



THE ENCYCLOPEDIA OF
grasses
for LIVABLE LANDSCAPES

Text and photography by **rick darke**

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Text and photography by
RICK DARKE

TIMBER PRESS

HALF TITLE PAGE Heavily flowered stalks of *Molinia caerulea* 'Strahlenquelle'.

FRONTISPIECE The author's Pennsylvania garden in late October.

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THIS BOOK IS DEDICATED
to family and friends
who've shared the pleasures
of grassy landscapes
at all hours and in all seasons.





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OPPOSITE A graceful patchwork of field
and forest at Gravetye Manor, West Sussex,
England.



Preface

MANY FRIENDS HAVE ASKED what first drew my eye to the grasses, and I've never had an easy answer. After working with them for more than a quarter century I can quickly point to their unique qualities of light and line, to their seasonal dynamics, and say that these are at the heart of the intrigue. But I know there's much more to the story. Though I think of myself as growing up amid the suburban forest, grasses have always been no further than a glance away. When did I first peer through the woods to an adjacent meadow? When did I first learn to listen to the grasses, to anticipate their presence in glades and other openings, or to seek the dramatic solitude of being immersed in a great grassy expanse? Perhaps the singular answer is that these common but uncommonly graceful plants have long belonged to what I've known as the emotional landscape. Add grasses' sensual qualities to their extraordinary diversity, durability, and versatility, and it becomes clear why grasses are being welcomed into all sorts of gardens in this age of change.

This book evolved from my 1999 Timber Press title, *The Color Encyclopedia of Ornamental Grasses*. As an encyclopedia this new book fully encompasses and greatly exceeds the previous one. It also differs in breadth and focus. The astounding growth in the popularity of grasses since 1999 has resulted in a huge increase in the diversity of plants readily available to gardeners, and the need for an encyclopedia that includes these developments was my primary motive. During the same period there has been a remarkable shift in the way gardeners think about grasses and the greater garden, and this provided the second motive. The previous title included the word "ornamental" to make clear that the topic was not lawn or turfgrass, and to emphasize that the book was oriented toward design. This book skips the "ornamental" tag in the belief that it's no longer necessary, but also to indicate that the new scope

The meadow at the Mount Cuba Center in northern Delaware in late October.

extends far beyond decorative designs and residential gardens to embrace contextual, conservation-based design of shared landscapes. The expanded palette includes grasses, sedges, rushes, restios, and cattails that are essential to the health and sustainability of today's parks, preserves, wetlands, highways, byways, and community open spaces. There's beauty to be seen in all these plants, and if our eye is equally attuned to genuine utility we'll envision the roles this expanded palette can play in the making of a continuously livable landscape.

When laying out *The Color Encyclopedia of Ornamental Grasses* both Timber Press and I had some concern that if the book was too photographic—too pretty—it might not be recognized as a serious reference but would instead be relegated to the coffee table category. The final count of approximately five hundred photos reflected these fears, which ultimately proved unfounded. Published in 2002, my next Timber Press book, *The American Woodland Garden: Capturing the Spirit of the Deciduous Forest*, included more than seven hundred photos, many of which were landscape views chosen for the dual purposes of illustrating composition and facilitating identification. Filled with more than a thousand photos, *The Encyclopedia of Grasses for Livable Landscapes* continues this photographic evolution, and it is my hope that it will serve as a conceptual match to the woodland book, while providing the essential encyclopedic reference on grasses.

This book is intended for all those intrigued by grasses: private gardeners, professional gardeners, landscape designers and architects, and anyone engaged in the use or stewardship of the public realm. Although North America is my home, I'm fortunate that my work affords first-hand study of a multitude of world landscapes and gar-

dens, and I've done my best to bring a balanced, cosmopolitan perspective to this book. It begins with a chapter discussing the opportunities and challenges of working with grasses in the contemporary ecological and cultural landscapes that comprise the Global Garden. Following long-established tradition, the broad term *grasses* is used in this book to include the true grasses (*Poaceae*) exclusive of bamboos, the sedges (*Cyperaceae*), the rushes (*Juncaceae*), the restios (*Restionaceae*), and the cattails (*Typhaceae*). Chapter two describes these families and their botanical characteristics of practical import. Chapter three illustrates and describes the unique aesthetics and appeal of grasses, and chapter four provides an illustrated discussion of the roles grasses can play in the design of landscapes large and small. Chapter five is devoted to propagation, growth, and maintenance of grasses and grasslands. Chapter six provides a practical overview of botanical names and nomenclature as they relate to grasses. The encyclopedic chapter seven makes up the remainder and majority of the book, providing an in-depth, alphabetical compendium of perennial grasses accompanied by an unprecedented photographic record showing them in diverse gardens and habitats, and in multiple settings and seasons.

I've always believed the camera to be among the most essential tools of gardeners, designers, and naturalists, and readers who agree may be interested to know that this book includes both film and digital photography. All my film images were taken with Kodachrome 64 using a manual Nikon FM2 camera. Digital images were taken using Sony model 717, 828, and R1 cameras ranging in capacity from five to ten megapixels.

Acknowledgments

SO MANY PEOPLE have directly contributed to my understanding of the grasses and to the making of this book. I thank you all and in particular Kurt Bluemel, Hans Simon, Wolfgang Oehme, Carol Bornstein, Herman Müssel, Anke Mattern, Ernst Pagels, Dick Lighty, Bill Frederick, Dale Hendricks, Masato Yokoi, Barry Yinger, Shigeto Tsukie, Paul van Meter, Dave Fross, John Hoffman, John Greenlee, Mary Barkworth, Tony Avent, Tony Reznicek, Rob Naczi, Gordon Collier, Isobel Gabites, David Hall, Lawrie Metcalf, Randy Baldwin, Neil Diboll, J. P. Wipff, Karl Partsch, Neil Lucas, W. D. Clayton, Karl Wienke, Roberto Burle Marx, Bernd Blossey, Dave Erhlinger, Jason Kubrock, Philip Smith, Bob Henrickson, Jim Locklear, John Swintosky, Pat Cullina, Sue Barton, Gary Schwetz, Galen Gates, Nichole O'Neill, Roy Diblik, Janet Rademacher, Dan Hinkley, Roger Raiche, Kathy Musial, Cole Burrell, Steve Schmidt, Adrian Bloom, Alan Bloom, Carl Schoenfeld, Greg Spiechert, Dan Heims, Mervyn Feese, Pauline Vollmer, Cassian Schmidt, David Hall, and Ximena Nazal.

I'm grateful for the many opportunities I've had to photograph in private and public gardens and landscapes, and these places are individually acknowledged in the photo captions. All black-and-white illustrations, unless credited otherwise, are adapted from USDA Miscellaneous Publication No. 200, the classic 1951 revision of the *Manual of the Grasses of the United States* by A. S. Hitchcock and Agnes Chase.

I also want to thank the following who contributed photographs to this book: Bluebird Nursery (for a blue *Sorghastrum nutans*), Cole Burrell (for *Sporobolus heterolepis* in autumn color), Dianna Jazwinski (for Knoll Gardens in morning frost), Joy Creek Nursery (for *Miscanthus sinensis* 'Gold Bar'), Alan Nations and Louisville Olmsted Parks Conservancy (for images of controlled burns at Summit Field), Ximena Nazal (for *Jarava caudata* in Chile), Nichole O'Neill (for miscanthus blight), Jaime Peñaloza (for *Jarava caudata* and *Nassella neesiana* in Chile), David Salman (for *Blepharoneuron tricholepis* in New Mexico), the Southern Weed Science Society (for a Ted Bodner photo of *Sorghastrum secundum*), Greg Vclavek (for *Calamagrostis canadensis* in Michigan), and Melinda Zoehrer (for *Hakonechloa macra* 'Aureola' in the Israelit Garden).

My brother, Jerry Darke, has for years been my mentor in all matters having to do with the digital technologies without which this book could not have been produced. My wife and garden partner, Melinda Zoehrer, compiled the bibliography and source list, and provided encouragement and inspired companionship on many of the thousands of miles of travel undertaken during this project.

Finally, I want to offer thanks to the people of Timber Press for the passion and professionalism they bring to enriching the literature of global landscapes and gardens.



CHAPTER ONE

Grasses & the Global Garden

SHIGETO TSUKIE FIRST TOOK MELINDA and me to Miyama-cho in 2001, and we returned two years later in better weather to catch the early winter light. I'd been curious to know what had become of this remote area in the mountains north of Kyoto since seeing Norman Carver's black-and-white photographs from the 1950s. Taken when Carver was a Fulbright scholar studying form and space in traditional Japanese architecture, his images of Kitamura (Kita village) record thatch-roofed houses and farm buildings clustered against the mountainside in a scene little changed over centuries. On previous trips to Japan I'd become familiar with miscanthus thatching from shrines, temples, and museum preservations of traditional structures, but I hoped to learn more about how miscanthus, as a local material, fit into active community life.

The road to Kitamura is now well-paved; however, I was delighted to find much of the village and its remarkable structures intact. The Japanese government has recognized the site as a national treasure and offers assistance to villagers maintaining the thatching tradition. Preservation efforts extend far beyond the roofs: Kitamura is one of only six rural districts in Japan that officially recognize the entire landscape in the preservation area, including homes, household gardens, rice fields, Shinto shrines, and the surrounding *Cryptomeria*-forested mountains.

We stayed in a thatch-roofed house during our second visit, and with Shigeto's help I asked the owner if he knew who in the village might be knowledgeable about miscanthus. He provided introduction to his neighbor Hiroyuki Shindo, a renowned indigo dye artist and former Kyoto University professor who heads the village *kaya* (thatching) association. Shindo welcomed us to his house and garden, and explained that, although *Miscanthus sinensis* (*susuki*) is typically used for village roofs, in the past *M. tinctorius* (*kari yasu*) had

Miscanthus sinensis harvested for roofing thatch in Kitamura, Miyama-cho, Japan, photographed just before twilight in December.



been valued for its great durability. Once fairly common in the local flora, this smaller species had become too scarce to provide adequate thatch. Shindo showed us plants in his garden grown from seed he'd collected from population on a local mountainside. The plants were shorter, strictly upright, and more refined than *M. sinensis*. Shindo's interest in these plants was not for thatching, but for dye (the specific epithet *tinctorius* literally means of dyes), and he showed us some homespun material he'd dyed bright yellow using the miscanthus.

We walked Kitamura's quiet streets and paths until dark, lingering among miscanthus recently harvested and neatly tied and stacked to dry. A few self-sown plants, uncut, stood casually in view of aging thatched roofs so green with moss that they were once again alive. By the time we departed, I'd developed a renewed appreciation for miscanthus.





Toward a Global Garden Ethic: Balancing Preservation and Sustainability

Preservation of local and regional landscapes, the relative merits of “native” vs. “exotic,” and true sustainability are intimately linked issues that must be reconciled in any thoughtful, ethical approach to grasses in the twenty-first century. Sounds complex, and it is, but we’re all engaged in this discussion every time we buy a plant, put spade to earth, or plan a garden. Because it is such an iconic “ornamental grass,” miscanthus provides a fine lens through which to view these issues.

Thinking back on my earliest gardening experiences, I recall that miscanthus was the first grass I grew. I was living in northern Delaware, and miscanthus thrived in the nearly impossible clay soil of my tiny urban garden. It was practical, undoubtedly beautiful, and seemed reasonably in sync with my local seasons. My garden’s ultimate mission was to reflect the plants, patterns, and processes that I knew and loved in surrounding woodlands and meadows, but I learned from experience that many local species that thrived in intact habitats quickly succumbed when subjected to my garden’s conditions, despite being watered and otherwise aided. Through observation, trial and error, I eventually developed a plant palette that served my purposes, but the



OPPOSITE TOP The care and artistry evident here suggest a deep appreciation of the visual pleasure of a utilitarian process. As a species we’ve lived close to grasses longer than we’ve produced written histories, so in many ways it is surprising, particularly in Western cultures, that grasses have only recently found their place among the things we find both useful and beautiful. BOTTOM Late afternoon light illuminates a self-sown miscanthus plant along a village path. The nearby roof, made of miscanthus thatch, supports a rich community of mosses. The distant mountains are clothed in Japanese cedar, *Cryptomeria japonica*.

ABOVE LEFT Resting on cedar shingles, a thatcher trims miscanthus stalks from a patch he’s making to one of Kitamura’s traditional roofs. The cedar shingles and miscanthus thatch are both local, renewable resources. ABOVE Dyed yellow from *Miscanthus tinctorius*, a bit of homespun material sits on a tatami mat (woven from native *Juncus* species) in Hiroyuki Shindo’s historic thatch-roofed house in Kitamura.

miscanthus made a lasting impression for its ability to sustain itself without supplemental irrigation, pesticides, or fertilizer.

When I first traveled to Japan in the 1980s for Longwood Gardens, I was delighted by advertisements inside Tokyo train cars featuring the twin symbols of autumn: Japanese maple (*momiji*) leaves and miscanthus (*susuki*) flowers. I had only to look out the window to see the real thing adorning much of the trackside landscape. The mission of that first trip was to bring back cultivated selections of Japanese plants, and I learned a lot about Japan's reverence for miscanthus from knowledgeable gardeners and nurserymen. The single discordant note came during a discussion with a young environmental biologist named Tanaka (whom I greatly admired) whose work was focused on subtropical Asia. He could understand his country's traditional fondness for miscanthus but was surprised that we were importing it to North America, because from his perspective, it was "such a weed." Tanaka wasn't concerned with the nuisance of weeding out errant *Miscanthus sinensis* seedlings from a residential garden: he knew of the potential for this extraordinarily vital species to disrupt the frequently fragile balance of other ecosystems.

More than two decades have passed since I rode those Tokyo trains, and miscanthus has since attracted an impressive array of promoters and critics. It has been lauded as a beautiful plant possessing the necessary genetic diversity to enrich gardens or to provide a sustainable option for greening toxified urban brownfields. It has been denigrated as an uncontrollable spoiler of native habitats and as an agent in the unfortunate homogenization of world landscapes. These conflicting viewpoints can be true or false: context is the ultimate arbiter. It's up to each of us to adopt a set of rules—an ethic—that guides us in our professional work and our personal gardening. A garden ethic constantly evolving from local observation and continuously reviewed in regional and world context is most likely to result in preserving what we love and sustaining what we need in this global garden we all tend.

READERS OF POETRY see the factory-village, and the railway, and fancy that the poetry of the landscape is broken up by these, for these works of art are not yet consecrated in their reading; but the poet sees them fall within the great Order not less than the bee-hive, or the spider's geometrical web. Nature adopts them very fast into her vital circles, and the gliding train of cars she loves like her own.

Ralph Waldo Emerson
"The Poet," 1844

The Nature of Nature: The Nature of Grasses

Emerson's wording is dated, but his message is modern. He's suggesting humanity's cultural landscapes are vital parts of one whole. Traditional ideas of nature are based upon a dichotomy: a "natural world" of untrammelled nature distinct from the "artificial world" of human invention. As appealing as the notion of an independently sublime, healing nature may be, the difficulty with the dichotomy is that it obscures the real role and responsibility of our species. Human influence is now so pervasive that it reaches virtually all parts of the globe. Recognizing this, the logical response is to take stock, identify goals, and behave like responsible managers.

I've been involved in more than one landscape project involving a degraded habitat during which someone has naively suggested that we simply "let nature take its course," as if some benign independent force would make things right without our effort. The challenge is to identify an appropriate level of human influence versus human control. Twentieth-century landscape architects with a regional focus frequently viewed nature as the source or authority for their designs, establishing ethics and strategies based upon the messages they "read" in the landscape. For Frank Lloyd Wright, the purpose of design was to improve upon nature, and his designs were often strong writings on the landscape. Jens Jensen believed in a gentler hand, going so far as to suggest in *Siftings* (1939), "Nature talks more finely and deeply when left alone." Jensen's designs did, of course, intervene, and he was perhaps at his best when acting as an observant editor.

I subscribe to Raymond Williams's (1980) definition of *nature*: "a singular name for the real multiplicity of things and living processes." If we adopt this inclusive approach, valuing living process and welcoming the inevitable changes resulting from such dynamics, then the whole world again fits within a redefinition of the garden as "the theater that intrigues" (Stilgoe 1998). Interested in dynamics and intrigue? Look to the grasses.

Miscanthus sinensis brightens the trackside landscape in this photograph taken through the front window of a moving train heading toward Takayama in the Japanese Alps. This is a perfect example of a native plant as opportunist. The miscanthus is an integral part of the local ecology, commonly growing along the sunny banks of the nearby river. If we recognize the river margin as the natural habitat of this grass, then what do we say about the miscanthus on the right-of-way, which is clearly an artificial habitat (resulting from deliberate human activity) if one makes such distinctions? The miscanthus is simply an adaptable plant taking advantage of suitable growing conditions. Is it an exotic here? Is it a harmful invasive? It's a weed from the perspective of railroad management. What would qualify as the native flora of a railroad right-of-way? If we're willing to update our definitions we can avoid such semantic entanglement and simply say that the miscanthus is a local plant growing in a local habitat. On this afternoon I was content to enjoy the whole scene as a continuous garden.



TOP Beauty or the Beast? This view west across the Hudson River at sundown over the Rose Garden balustrade on the Bard College campus has much to say about the changing nature of grasses in our modern landscape. Hudson River School painter Frederic Edwin Church made his home, Olana (1870–1871), upriver from this point, taking advantage of views across the river to the Catskill Mountains. *Phragmites* is absent from Church's period landscapes not because he painted at such grand scale, but because *Phragmites* in vast sweeps is a newcomer to the scene.

Unlike the *Miscanthus sinensis* moving about modern Japan, which is of Japanese origin, *Phragmites australis* in eastern North America is of mixed origin, including genotypes (genetically similar types) evolved in North America and other genotypes introduced inadvertently from exotic habitats. So variable in characteristics that it was once considered to represent two species (*P. communis* and *P. australis*), *P. australis* is a cosmopolitan grass occurring on every continent except Antarctica. Its presence in eastern North America is documented by herbarium records from the nineteenth and early twentieth centuries, qualifying it as “native” by common measure. The explosive growth of this species in the late twentieth century has been scientifically attributed (in particular by Bernd Blossey and Cornell University researchers) almost exclusively to introduced genotypes. In short, this single grass species may be “native” or “exotic” depending upon its genetic origin.

Controlling the exotic *Phragmites* is highly problematic. In small-scale and localized landscapes, mechanical and/or chemical methods can be effective, with lasting results. In larger, dynamic landscapes, such as regional river systems, mechanical methods are impractical and chemical methods ultimately prove futile, unless the regular application of toxic herbicides to regional waters is judged desirable. Until better management techniques are developed, the healthiest, most realistic approach is to accept scenes like this as genuine elements of the Hudson River Valley's twenty-first century landscape.





OPPOSITE BOTTOM At first glance I imagined I was looking at the planet, with continents spread across light blue oceans. In truth it is more like looking at the world dehydrated. The view is of the bottom of a derelict, empty steel swimming pool in what once was a very elegant private garden. Common cattail, *Typha latifolia*, which typically grows in deep soils in standing water, is clearly capable of surviving in a couple inches of leaf litter accumulating on an occasionally rainsoaked painted-metal surface. Such resilience and adaptability are the makings of the perfect weed in the wrong situation; however, those same traits may be the very answer for vegetating increasingly arid habitats and cultural landscapes.

ABOVE Hand-hewn granite retaining walls, built over a century ago by the Pennsylvania Railroad, still support elevated tracks along the Northeast Corridor, the busiest stretch of rail in the United States. The artwork is unsanctioned, and the entire ensemble, complete with an orderly fringe of switchgrass, *Panicum virgatum*, has for years been a highlight of my landscape experience on the way to the Philadelphia airport. No person planted the switchgrass. *Panicum* popula-

tions along the adjacent Delaware River provided the seed source, and this sturdy local plant found a niche between the ballast and the sheer edge. I'm fond of the way the tawny winter color of the grass picks up the black and ruddy browns in the stone and rails. I'm amused by the strict verticality of the switchgrass playing off the granite courses, and by the visual order of the grasses stepping down in unison with the stone. No mulch, no hose. A sustainably fine design.

Many grasslands that we take for granted as native are not. California still has a rich and diverse grass flora; however, the golden glow of the state's signature coastal landscapes is now primarily due to exotic grasses introduced for a multitude of human purposes. Native or not, it is difficult to deny the appeal of this mix of grasses and California oaks in Santa Barbara County in mid August.

Iconic Grasslands: Prairie to City

Gardens celebrating dominion over nature certainly had their day, and many of the results are enduringly dramatic, if admittedly high maintenance. Gardens celebrating regional ecologies, or increasingly, evoking lost landscapes, are more the current model. Grasses as a group are in no danger of extinction; however, few grasslands have survived intact past the twentieth century. The North American tallgrass prairie is perhaps the most iconic of great grasslands that have been reduced to remnants. Less than four percent of the original 400,000 square miles (1,035,995 square kilometers) has been left unplowed or undeveloped. Once a familiar home to North American Indian tribes, then a forbidding and often lethal realm for pioneers venturing west, the vast sea of grasses punctuated by perennial flowers has survived mostly as an emblem of sunlit wilderness. Some wonderful patches of prairie have been preserved, including Bluestem Prairie Preserve in Minnesota, Prairie State Park in Missouri, and Tallgrass Prairie National Preserve in Kansas, and others have been



rebuilt or restored; however, the newest iterations of the prairie are sprouting internationally in suburban and urban spaces.

The prairie, tallgrass and shortgrass, translates with relative ease to the city, not as a literal re-creation but as an abstraction. As with the original prairie, the urban prairie is built on a foundation of sturdy perennial grasses. This durable, drought-tolerant matrix is adaptable to a wide range of urban and suburban conditions and can cover large areas at relatively low cost, with floriferous perennial herbs contributing periodic interest throughout the seasons. In the process of abstraction, the prairie has become the “prairie.” This is more than a variation in national spellings (North America versus northern Europe). The “prairie” retains the grass/forb mix but employs species from globally diverse sunny habitats. Visually rich but lacking many of the ecological dynamics of authentic prairie systems, the “prairie” is a new type of garden, in sync with human habitat.



LEFT Tallgrass Prairie National Preserve in the Flint Hills of Kansas stretches over 10,000 acres (ca. 4000 ha) in the historic heart of the prairie. In this late-February view a path curving through big bluestem, *Andropogon gerardii*, and other tallgrass species directs the eye to a bur oak, *Quercus macrocarpa*, in a draw and to a distant schoolhouse built of local limestone in the 1880s.

ABOVE This isn't Kansas, and it isn't the tallgrass prairie, though it provides an approximation of what the prairie would have looked like ablaze. More than 30 feet (9 m) tall, flames are racing uncontrolled across *Phragmites australis* in the John Heinz National Wildlife Refuge at Tinicum one mile (1.6 km) from the Philadelphia airport. I took this photograph more than 100 yards (91 m) away from the fire, yet the heat was almost scorching.

Induced by lightning and by North American Indian peoples, fire was an integral part of prairie ecology, and without it the prairie as we know it would never have existed. Unless a powerful limiting factor is present, such as fire or deep water, grasslands in areas of moderate rainfall usually revert to forest.



THIS STRETCH OF State Route 91 in Dodge County, Nebraska, is classic Americana and appears entirely uncontrived.

BELOW The vernacular form of the grain storage facility in the distance combines with Indian grass, *Sorghastrum nutans*, and Maximilian sunflower, *Helianthus maximiliani* (in the foreground), to tell a story of the contemporary Nebraska landscape. In fact, the prairie grasses and wildflowers owe their existence in part to the deliberate stewardship of Nebraska's Department of Roads.

RIGHT Intermingling with nearby grasses, *Salvia azurea*, known as pitcher sage or blue sage, mirrors the color of the prairie sky.





LEFT Piet Oudolf's design for urban Chicago's Millennium Park is deeply textural, like its prairie progenitor. Frank Gehry's architecture fills in nicely in the absence of a grain silo. The composition of the plantings is unmistakably evocative of the prairie even though the actual species employed are a mix of North American and Eurasian origin.

BELOW A continuous sweep of switchgrass, *Panicum virgatum* 'Heavy Metal', in the redeveloping waterfront of Wilmington, Delaware, can be read as the prairie or, more locally, as a nod to similar scenes occurring in habitats along the state's coastal waters.





ABOVE Hans Simon's grassy planting on top of Herrenhausen's Rain Forest House in Hanover, Germany, is a visionary, ecologically inspired response to the challenge of greening the elevated urban habitat. His design is especially fitting for this building, which stands in place of the Great Palm House destroyed in the Second World War. The roof garden demonstrates strategies for dealing with one of the world's driest environments: the urban roof. Looking to European flora for models and materials, Simon's design introduces tough grasses and sedges, including *Sesleria rigida* (center) and *Carex humilis* (right foreground).

RIGHT Julie Messervy's design for Toronto's Music Garden reclaims and enlivens another urban waterfront that had once succumbed to industrial neglect. It includes both generous sweeps and intimate spaces, employing grasses and real stone to bring a bold dynamic within reach of new urban residential development. Here feather-reedgrass, *Calamagrostis xacutiflora* 'Karl Foerster' (foreground), and switchgrass, *Panicum virgatum* (background), create a gentle enclosure.





Grasses in Context: Style Fit to Place

More than two centuries ago, the French writer Chateaubriand suggested: “Ideas can be, and are, cosmopolitan, but not style, which has a soil, a sky, and a sun all its own.” I’ve always found these words illuminating when applied to garden style. It seems so sensible that of all art forms gardens should recognize local context and conditions, both environmental and cultural. As the garden palette of grasses continues to expand and develop, it is ever easier to employ grasses for this purpose.

Christchurch has long been celebrated as a Garden City and as the most English of New Zealand’s cities. Evolving sensibilities are bringing more of the South Island’s ecological legacy into Christchurch’s urban landscape, while holding on to history. Cutting diagonally across the city’s downtown grid, the Avon River’s once-eroded banks are now stable and lushly vegetated with New Zealand tussock sedge, *Carex secta*. Sponsored by Christchurch City Council programs for restoring waterways and national character, this design draws directly from the sedge’s typical habitat while simultaneously enhancing the formal character of the Gloucester Street Bridge and other classic architecture.

RIGHT Landscape architect Karl Wienke's design for his own water garden in Suhl, Germany, combines formal architectural elements with highly naturalistic planting arrangements. A diversity of moisture-loving sedges including *Carex siderosticha*, *C. muskingumensis*, *Schoenoplectus tabernaemontani*, *Cyperus longus*, and *Carex pendula* are positioned in appropriate moisture zones around the pond margin. The elegant result of this highly structured design could almost be mistaken for a naturally occurring aquatic habitat.

BELOW It would be easy to believe this exquisite textural composition is possible only by gathering plants from a multitude of far-away places, but in fact it draws only from the practicality, beauty, and diversity of the New Zealand flora. *Carex flagellifera* spills gracefully over the walls of this demonstration garden at the Taupo Native Plant Nursery on the North Island.



RIGHT Juxtaposition of tiger grass, *Thysanolaena latifolia*, and *Philodendron selloum* in the Martins Garden near Petrópolis, Brazil, boldly expresses the textural drama of the tropics. The late designer, artist, and landscape architect Roberto Burle Marx combined his extensive knowledge of tropical flora with his painter's eye to develop a style that became synonymous with his native Brazil.

BELOW Kirstenbosch National Botanical Garden in Cape Town, South Africa, is dedicated exclusively to the study and display of indigenous flora, which includes hundreds of species of restios—close relatives of grasses, sedges, and rushes. This focused environmental mission manages to create a myriad of compositions and associations that also qualify as stylishly fine design. In this view, restios *Elegia capensis* and *Thamnochortus insignis* mingle with the rare protea *Leucospermum formosanum* in the late-afternoon light. BELOW RIGHT Southern California has often been mistaken for a tropical paradise, but in fact it is a desert. Quail Botanical Gardens in Encinitas demonstrates a waterwise garden style that is eminently sensible for public and private landscapes. Moving to early July breezes, Peruvian feather grass, *Jarava ichu*, plays against the sculptural form of Shaw's agave, *Agave shawii*, and other southwestern North American desert species.



RIGHT Beth Chatto's gravel garden in Colchester, England, has not been artificially watered since its creation during the winter of 1991–92. Drought-tolerant grasses, including Mexican feather grass, *Nassella tenuissima*, and Mauritania vine reed, *Ampelodesmos mauritanicus*, evident in this view, contribute year-round interest. The water-conserving ethic is the basis for this garden's style, which makes use of an eclectic mix of plants from diverse but dry global habitats.

BELOW This winter morning view of the gravel garden at Knoll Gardens in Dorset demonstrates the drama possible in an unirrigated landscape even during England's dimmest season. The eclectic but regionally adapted mix of grasses includes *Pennisetum macrourum* (foreground) from South Africa, *Muhlenbergia rigens* (rear center) from California, and *Miscanthus nepalensis* (rear right) from Asia. Photo © Dianna Jazwinski.



Expanding the Palette

Although the garden palette of grasses, sedges, rushes, restios, and cattails is hugely expanded from even a few decades ago, it still represents a fraction of the potential. How do we recognize the garden grasses of the future, and how do we gather the material and information necessary for them to thrive in tomorrow's landscapes? There is no better place to begin than by closely observing the places in which we live.

Lecture travels in New Zealand in September (early spring) 2005 afforded the opportunity to visit again with Gordon Collier and his wife, Annette, two gardeners who know their country and its flora. We spent a day exploring Tongariro National Park in the North Island's volcanic central region and came upon scene after scene that was so richly composed I would have been happy to call any of them my garden. I was particularly interested in learning about *Gahnia*, a New Zealand sedge genus that was new to me and nearly unknown in cultivation. Gordon

and I confirmed the identity of the gracefully mounded plant at center and in the distance as mountain cutty grass, *G. procera*. Growing nearby we noted golden trailing *Podocarpus nivalis*, spiky, dark red-brown *Dracophyllum*, silvery *Celmisia incana*, southern beech *Nothofagus solanderi*, and many others at home in the same habitat. New Zealand gardeners and nursery professionals are now bringing *Gahnia* species into cultivation and recognizing them for the beauty they bring to the country's regional landscapes.

A PROJECT FOR THE Delaware Department of Transportation has given me the chance to look more closely at this small state's grasses. The purpose of the project, Enhancing Delaware Highways, is to celebrate the beauty and diversity of Delaware's flora in the design and management of its roadside landscapes. The southernmost of the state's three counties, Sussex, is on the outer coastal plain and is naturally sandy and droughty. While working with medians and dune edges near the town of Dewey, I noticed that naturally occurring coastal switchgrass, *Panicum amarum*, easily withstood the often challenging conditions, and that the local population included some strikingly blue foliage forms. Although this species is recognized for its value in dune stabilization it was not part of the garden palette at the time. I worked with Dale Hendricks and North Creek Nurseries to collect seed, run trials, and select a particularly blue plant to be introduced as a vegetatively propagated cultivar, 'Dewey Blue'. In a few years this plant has become available to gardeners and landscape architects working with similar droughty conditions. The name commemorates the place of origin, and the cultivar helps point to the appeal and utility of a species formerly ignored.

BELOW *Panicum amarum* 'Dewey Blue' in the author's Pennsylvania garden.





LEFT Karl Partsch's selection of tall moor grass, *Molinia caerulea* subsp. *arundinacea* 'Zuneigung', arches gracefully above red roses in the Sichtungsgarten (study garden) in Weihestephan, Germany. Partsch is a naturalist, not a nurseryman; however, he has a keen eye and the variations he's found on his treks through world habitats have many times enriched the diversity of garden grasses. He selected 'Zuneigung' for its form, which becomes increasingly relaxed and spreading as the flowering stems bend under the weight of maturing seeds.

ABOVE Production rows at Hoffman Nursery in Rougemont, North Carolina, represent two continents and one trend. *Muhlenbergia capillaris* (foreground) is an up-and-coming southeastern North American species, while *Miscanthus sinensis* (background) is a tried-and-true crop that hails from eastern Asia. In many parts of North America *Miscanthus* poses no threat to regional ecologies, due to naturally limiting factors such as aridity or cold. In the warm, moist Southeast, *M. sinensis* has demonstrated its potential for disrupting relatively intact habitats, and the future of prolific seeding types is uncertain. John Hoffman and his crew are taking progressive steps to identify and produce grasses such as *Muhlenbergia* and *Panicum*, which offer environmentally responsible alternatives for the Southeast.

Grasses at the Edge

The majority of the world's grasses and their close relatives the sedges, rushes, restios, and cattails are still at the very edge of our garden vision, yet they hold the promise of great beauty and utility for landscapes we have yet to discover, yet to recognize, yet to imagine. They are sure to play increasingly greater roles as we move toward a design ethic that embraces transitions through space and time, palette and purpose, meaning and motivation.

BELOW Corn meets the mountains in western Pennsylvania in October. Credible as art, it is merely agriculture.

RIGHT Salt hay, *Spartina patens*, and smooth cordgrass, *S. alterniflora*, define the edge of a saltmarsh in Orleans, on Cape Cod, Massachusetts, as the sun appears improbably through a driving snowstorm five

days before the new year. A path between the wooded bluff and the water has been worn by walkers, and its line is adjusted each season in response to the tides. Every year in August, sea lavender, *Limonium nashii*, blooms among the grasses' summer greens. This local landscape is revered and gently tended, which in my estimation makes it fit for inclusion in what we call "the garden."





CHAPTER TWO

Grass Families

OLD HERBALS USED THE WORD *grass*, variously spelled *gres*, *gyrs*, *gwrs*, to refer to almost any small green plant. We've since narrowed the meaning, and in today's common language grasses are plants with long, narrow leaves. This broad definition typically includes a number of related botanical families: the true grasses (in the grass family, *Poaceae*), sedges (sedge family, *Cyperaceae*), rushes (rush family, *Juncaceae*), restios (restio family, *Restionaceae*), and cattails (cattail family, *Typhaceae*). This book covers perennial plants belonging to these families, exclusive of bamboos and turfgrasses.

In addition to having narrow grasslike foliage, the above families all belong to a subgroup of flowering plants called monocotyledons (or monocots). The name of this subgroup refers to its members having one (mono) seed-leaf (cotyledon). The leaf veins of monocotyledons are typically parallel, and the leaf margins typically lack large teeth or notches, although some are very finely toothed or hairy. With the exception of the bamboos, which are true grasses, monocotyledons are herbaceous, meaning they don't develop woody tissues. In contrast, dicotyledons (dicots), the opposing subgroup of flowering plants, have two seed-leaves, leaf veins that are netted, and leaf margins that are frequently toothed or cut, and they may be either woody or herbaceous. The word *forb* is a useful term referring to broad-leaved herbaceous plants exclusive of grasses and their close relatives.

Although it's not difficult to develop a general sense of the differences between the botanical families of grasses, common names can often be contradictory and confusing. For example, panic grass, *Panicum virgatum*, is a true grass (*Poaceae*), but woolgrass, *Scirpus cyperinus*, and cottongrass, *Eriophorum virginiticum*, are sedges (*Cyperaceae*). Soft rush, *Juncus effusus*, and wood rush, *Luzula multiflora*, are true rushes (*Juncaceae*), but spike-rush, *Eleocharis acicu-*

Sunlit open spaces between the central mountains of New Zealand's South Island provide ideal habitat for *Cortaderia richardii*, here resplendent in the low winter light of late August (winter).

laris, and bulrush, *Schoenoplectus tabernaemontani*, are sedges (*Cyperaceae*). The gardener's term *ornamental grasses* is sometimes stretched to include all manner of narrow-leaved herbaceous plants including such things as *Acorus* (arum family, *Araceae*) and *Liriope* and *Ophiopogon* (lily family, *Liliaceae*); however, there's no logical limit to this approach.

It's not necessary to learn all the complex botanical family characteristics to appreciate grasses in the landscape or to use them effectively in design; however, a basic familiarity with family traits helps develop our eye for detail and makes identification easier. In addition to this, an understanding of grasses' ecological and human cultural context can greatly enrich our appreciation of them in gardens and regional habitats.

THE LARGE GENUS *Panicum*, which comprises the switchgrasses and panic grasses, embraces species adapted to a wide range of conditions, including extremes of moisture, heat, cold, and nutrient levels.

In late October, switchgrass, *Panicum virgatum*, shares a wet edge in the New Jersey Pine Barrens with water willow, *Decodon verticillatus*; red maple, *Acer rubrum*; highbush blueberry, *Vaccinium corymbosum*; and other moisture-tolerant species.

The Grass Family, *Poaceae*

The true grasses belong to the botanical family known either as the *Poaceae* or the *Gramineae*. Both names are correct. Modern botanical nomenclature uses the standard ending *-aceae* for plant families, and family names incorporate a selected genus from within the family. The name *Poaceae* is a combination of the grass genus *Poa* and the standard ending. *Gramineae* is an older, descriptive name that has been conserved as an alternate by international agreement among plant taxonomists. This book uses *Poaceae* for the grass family.



SIZE & DISTRIBUTION

True grasses, *Poaceae*, make up one of the largest families of flowering plants, comprising more than six hundred genera and approximately ten thousand species. It is surpassed in size only by the orchid family, *Orchidaceae*, which has a similar number of genera but nearly twice as many species, and by the aster family, *Asteraceae*, with more than nine hundred genera and nineteen thousand species. Size matters, but these numbers can be misleading, since grasses have by far the widest distribution of all flowering plant families. A truly cosmopolitan group, grasses grow on every continent and are part of all the major biomes of the terrestrial world. Grasses are found from mountaintops to seashores, from the Arctic Circle south through temperate and tropical zones to Antarctica.

Despite their vast distribution, most grasses are plants of sunny, open places. With the exception of bamboos, grasses are relatively scarce in dense forests. True pioneers, they are among the first species to colonize newly created habitats, and they often play important roles in the successional process of revegetation. Although grasses may thrive in moderate, fertile environments, they are often best adapted to survival in extreme conditions: heat, cold, drought, low fertility, and/or toxicity. Grasses produce their seeds in copious quantities, and the seeds are equipped with energy reserves that allow them to quickly



LEFT Coastal panic grass, *Panicum amarum*, and woolly false heather, *Hudsonia tomentosa*, are unfazed by the heat and exceptionally droughty conditions on coastal dunes in southern Delaware in late July.

ABOVE Growing in mid June under mixed pine and deciduous woodlands in Collin County, Texas, wild-oat, *Chasmanthium latifolium*, is one of relatively few grasses adapted to heavily shaded habitats.



BELOW Switchgrass, *Panicum virgatum*, finds refuge under power lines in southern New Jersey. No one planted the grass: it is self-sown. The utility company's management program eliminates woody plants that attempt to establish under the wires. The net effect is to produce the open, sunny habitat required by the grass. In past years, prior to the fire suppression that became humanly necessary due to increasing population, natural fires would have been the agents creating habitat for switchgrass.

RIGHT July harvest of winter wheat, *Triticum aestivum*, in Lancaster County, Pennsylvania. An annual grass, wheat is the most important food grain in the temperate zones. Of probably Middle Eastern origin, it has been grown for thousands of years, since the beginnings of agriculture. Nearly 500 million acres (ca. 200 million hectares) worldwide are devoted to wheat crops, primarily for flour production.



germinate and establish new plants. Grasses' extensive fibrous root systems are extraordinarily efficient. The low-growing points of grasses allow the plants to sustain continual damage to top growth by fires or grazing animals.

GRASSES & HUMAN CULTURE

Including the cereal grains wheat, corn (maize in Europe), rice, rye, oats, barley, millet, and sorghum plus sugarcane among its members, the grass family is the most important to human civilization, which owes its spread to the development of grass-based agriculture. Human culture around the world has been shaped by grasses and products made from them. Grasses are the source of many aromatic and culinary oils, and are employed in the making of sake, wine, beer, whiskey, and many other alcoholic beverages. They've also provided a myriad of construction materials. Simple homes have been built of grass sods and roofed with grass thatch. Bamboos are still commonly used for framing and scaffolding, and in the manufacture of furniture and fencing.

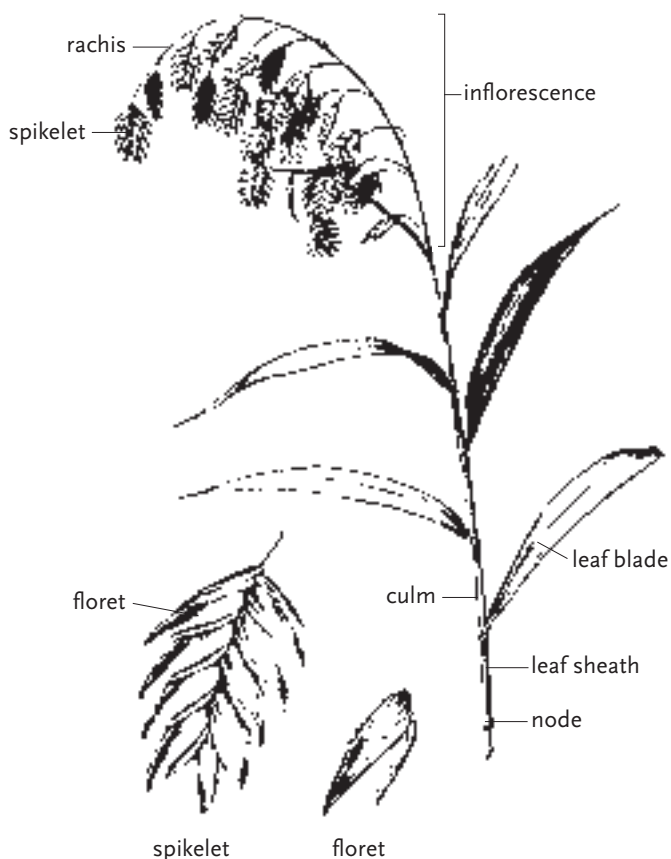


The reeds of wind instruments have traditionally been made from grasses. The highly manicured grassy lawn, though an ecological disaster by many estimates, is one of the most obvious of human cultural traditions involving grasses.

The destabilization of regional ecologies by human activity has been both good and bad for grasses. While humankind has virtually eliminated many grassland ecosystems including the North American tallgrass prairie, it has simultaneously created a huge amount of open, sunny habitat favorable to grasses. Though this has led to large-scale displacement and relocation of grasses, it has not been as destructive to them as it has been to less resilient groups. Modern circumstances, for example, favor grasses over orchids, which are often critically dependent upon long-evolved relatively stable habitats. The same physiological characteristics that make them fit for extreme conditions are responsible for grasses' opportunistic behavior in destabilized environments and disturbed habitats. The sunny, open ground and relative absence

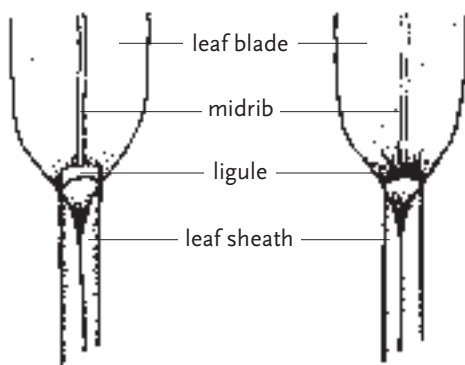
Harvested rice, *Oryza sativa*, in late October in central Japan. Rice is also an annual species, grown for its edible grain, for its use in making sake (rice wine), and for straw.





A culm (stem) of wild-oat, *Chasmanthium latifolium*, with terminal inflorescence.

Leaves are attached to the culm at nodes. Each leaf sheath surrounds the culm up to the point where the leaf blade diverges. The inflorescence is an open panicle with unusually large spikelets. Each spikelet contains multiple florets.



of competition often present in newly constructed gardens and other designed landscapes offer ideal habitat for colonizing grasses.

GRASS LIFE CYCLES

The grass family comprises both annuals and perennials. Many grass genera, such as *Panicum*, encompass both annual and perennial species. The majority of cereal crops including corn (maize), wheat, and rice are annuals, and as such complete their life cycle from seed to seed within one year or growing season. Perennial grasses typically flower and produce seed in a single season, although they may take longer; however, they continue to live for multiple years. Most grasses grown for ornament are perennials, although some perennials from warm climates behave as annuals when grown in colder environments.

ROOTS

A grass seedling typically produces an initial primary root that is short-lived. This root is soon supplanted by secondary roots, called adventitious roots, which arise from the lower portion of the stem. The secondary roots make up the bulk of the extensive, fibrous system characteristic of grasses. The highly efficient fibrous roots of grasses often extend to greater depths than the roots of other, larger plants. For example, the roots of big bluestem, *Andropogon gerardii*, have been observed growing 7 feet (2.1 m) into the earth, which exceeds the rooting depth of most mature trees.

STEMS

Although it's entirely acceptable to speak of grass stems, the botanical term for a grass stem is *culm*. Culms are made up of solid joints called nodes and separated by segments called internodes. Nodes are the points of attachment for leaves (see above left). The internodes are typically hollow, although those of a few grasses such as corn, *Zea mays*, and sugarcane, *Saccharum officinarum*, are solid and pithy. Grass culms are typically cylindrical and round in cross section. Though some grass species have culms which appear somewhat flattened in cross section, none are distinctly three-angled like the sedges. Grasses are herbaceous plants with the exception of bamboos, which develop woody character from cells impregnated with hardening substances lignin and silica. This is different from the true wood produced by trees and shrubs, which represents layered, secondary growth.

Grass leaves typically have ligules located at the juncture of the leaf sheath and leaf blade, on the side facing the culm. Ligules may consist of a thin membranaceous ridge (left) or a row of fine hairs (right). Drawing by R. Darke.

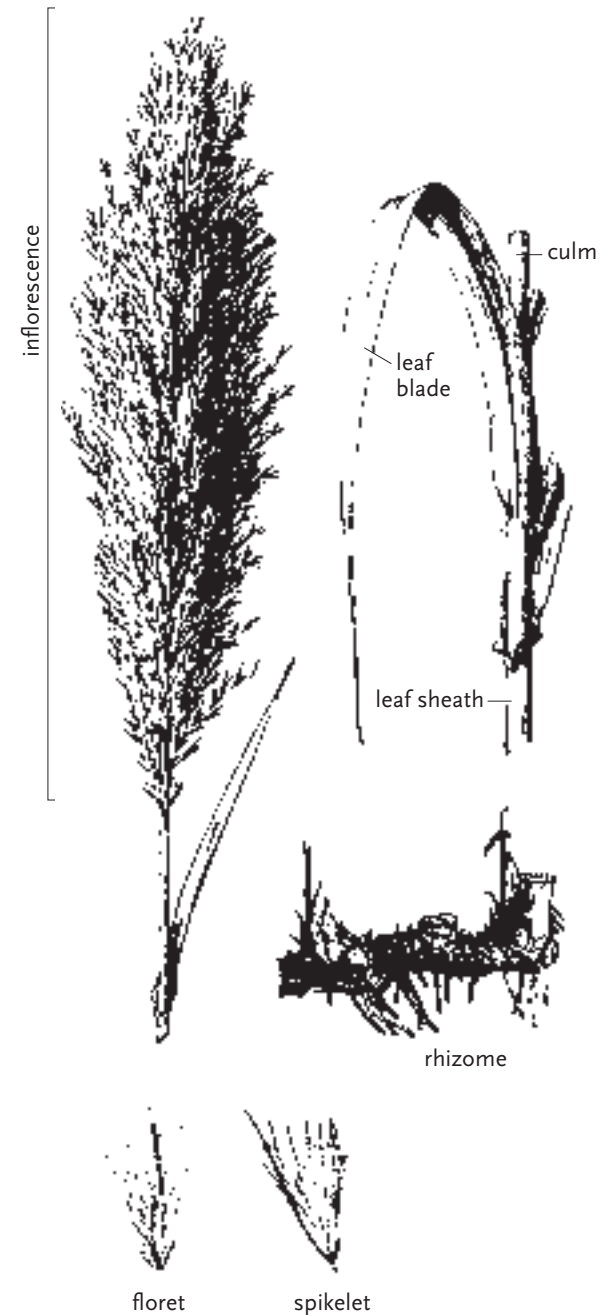
LEAVES

Grass leaves arise from alternate nodes, forming two ranks (rows) ascending the culm. They are typically comprised of three parts: the sheath, blade, and ligule (see page 38 bottom). A sheath originates at a node and surrounds the culm, typically with overlapping margins. The blade is the flattened part of the leaf, beginning at the top of the sheath and continuing away from the culm. Leaf blades of grasses are typically narrow, with numerous parallel veins and a single larger median vein called a midrib. The blade margins are usually smooth; however, some are edged with minute teeth and can cause serious cuts. The ligule is a thin membranous ridge or small row of hairs located at the juncture of the sheath and blade on the interior side, facing the culm. The function of the ligule is uncertain, though it may serve to prevent rain from entering the sheath. Characteristics of ligules vary considerably, including their relative prominence and the nature of hairs when present, and these features are often critical to the precise identification of closely related grass species.

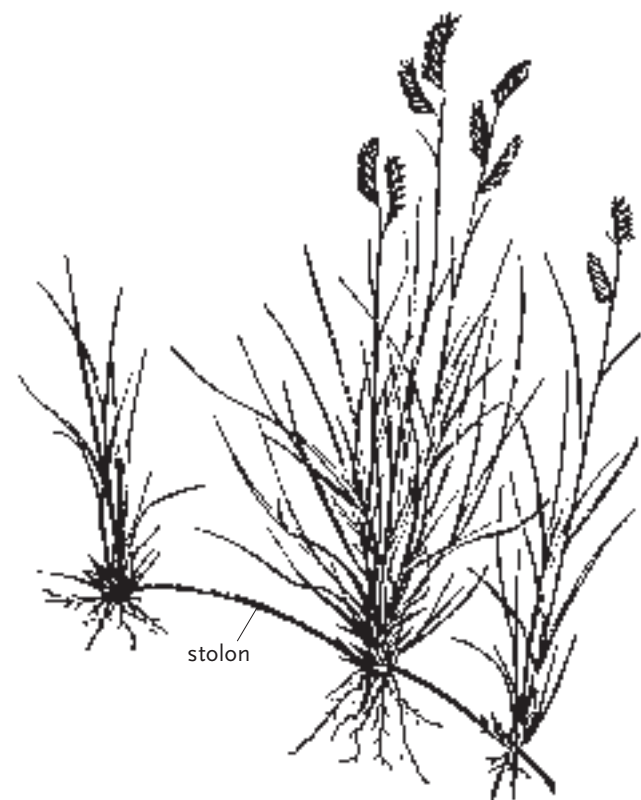
GROWTH

The active growing points (meristems) of most flowering plants are located at the tips of their stems and branches. Terminal growth of a stem or branch ceases if the meristem is destroyed, although growth may continue from a lateral meristem arising from a node. Grasses are unusual in having two types of meristems, one at the base of each leaf and another just above each node on the culm. These meristems allow grass stems and leaves to continue elongating even if their tips are grazed, cut, burned, or otherwise destroyed. The meristems at the nodes are also capable of one-sided growth, making it possible for grasses to right themselves after being trampled or flattened by storms.

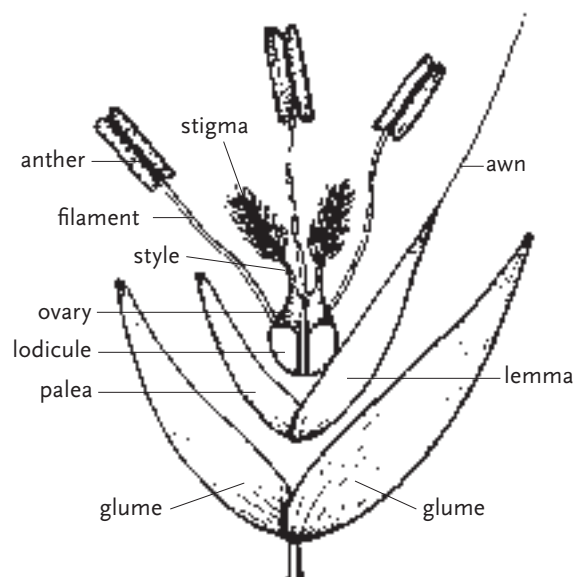
In addition to stem and leaf growth, grasses spread from their bases by various types of lateral shoots, which are often called tillers. These lateral shoots arise from the axils of the lowermost leaves. In many grasses, the lateral shoots grow vertically within the leaf sheaths, resulting in a tufted (cespitose, often spelled caespitose) habit of growth. These grasses are commonly referred to as clump-forming types. Other grasses have lateral shoots that do not elongate vertically but instead grow through the side of the leaf sheath. These lateral shoots are called rhizomes, which typically run below the soil surface, or stolons, which run at or above the soil surface. Grasses spreading by rhizomes and stolons are commonly called running types. The distinction between clump-forming and running types is not absolute. Some grasses are clump-forming for all practical purposes, yet they may in fact spread slowly by rhizomes or stolons. Giant reed, *Arundo donax*, is an example of a grass that spreads by rhizomes (right). Buffalo grass, *Buchloe dactyloides*, spreads by stolons (see page 40), as do most of the common turfgrasses.



Giant reed, *Arundo donax*, is a running grass which spreads by stout rhizomes. New vertical shoots (culms) are produced from nodes on the rhizomes. The inflorescence is a closed panicle.



Buffalo grass, *Buchloe dactyloides*, spreads by stolons which produce new plants at the nodes. This species is dioecious, having male and female inflorescences on separate plants. Plants shown here are male.



A grass spikelet containing a single floret, vertically expanded for purposes of illustration. Drawing by R. Darke.

FLOWERS & INFLORESCENCES

The individual flowers of grasses are so small that they are sometimes difficult to distinguish with the naked eye. The floral magnificence of grasses owes to their delicately complex flower clusters, called inflorescences, which may comprise hundreds or even thousands of individual flowers.

Grasses are wind-pollinated plants, not dependent upon the conspicuously colorful broad-petaled flowers that are so attractive to insects and many gardeners. The ecological and geographic prosperity of grasses proves the efficiency of this strategy. Grasses are among the most highly evolved plants on the planet, and their evolution has been characterized by the reduction of some floral features. Compared to most flowering plants, grasses have flower parts that are greatly reduced in size or sometimes lacking entirely. Though some physical features of grass flowers are readily visible, many of the finer details necessary for technical identification require the use of a hand lens or microscope. If you're ever offered the opportunity to view grass flowers through a good stereo dissecting microscope, accept the offer. There's an incredible world of beauty in the details.

Grass flowers do not have typical sepals or petals. In their place, each flower has two scalelike structures called lodicules (left). Each flower has one ovary enclosing a single ovule that develops into the seed. Together, the ripened ovary and seed are called a grain, or caryopsis. Each grain contains endosperm, an energy reserve in the form of starch, and the embryonic grass plant, known as the germ. Two short stalks called styles project from the top of the ovary. Each style ends in a feathery stigma adapted to receive wind-borne pollen grains. The grass flower also includes three stamens, each consisting of a threadlike stalk known as a filament, to which is attached a pollen-producing appendage called the anther.

Each individual grass flower is typically enclosed and protected by two bracts. The lower, outer bract is called the lemma, and the upper, inner bract is called the palea. The grass flower with the lemma and palea is called a floret.

A spikelet consists of one or more florets attached to a small central axis, together with two basal bracts called glumes. The glumes or the lemmas sometimes end in long bristlelike structures called awns. Additional hairs or bristles are often associated with spikelets and, together with the awns, these structures are primarily responsible for the dramatic translucent properties of grass inflorescences.

The basic pattern of spikelets consisting of two glumes and one to many florets is consistent among the grasses; however, variations in the size, shape, sexual complement, and number of parts, or the inclusion of additional structures, results in seemingly endless permutations that make the technical iden-

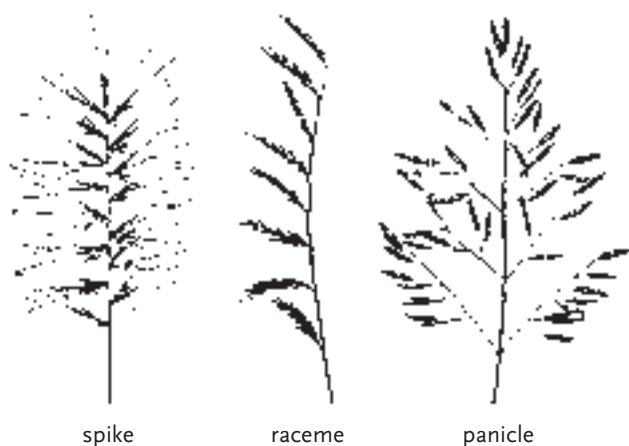


TOP LEFT Red anthers suspended from threadlike filaments and feathery pink stigmas are clearly visible in this inflorescence of big bluestem, *Andropogon gerardii*, in early September. RIGHT Suspended from the branches of an open panicle, the spikelets of wild-oat, *Chasmanthium latifolium*, are among the largest in the grass family. Each spikelet contains multiple florets.

ABOVE LEFT The individual flowers (florets) of grasses are often difficult to distin-

guish with the naked eye, partly because of their small size and partly because they are concealed within bracts associated with the spikelet. In this mid-September photo, bright yellow anthers of Indian grass, *Sorghastrum nutans*, are readily apparent. The feathery white stigmas are less obvious. The copper hues of the various stalks, bracts (including glumes, lemmas, paleas), and other appendages (including the long awns) combine with the yellow of the anthers for a relatively colorful ensemble. CENTER Awns

are bristlelike or needlelike appendages that extend from the glumes, or lemmas, of grass spikelets. Diverging almost horizontally, the conspicuous awns of purple three-awn, *Aristida purpurea*, catch the early April light in California. RIGHT The fringed awns of needle grass, *Stipa barbata*, are exceptional, reaching a length of 7 inches (18 cm) or more. Awns contribute significantly to the drama and luminous qualities of grass inflorescences, as evident in this late-July photo in England.



The three basic types of simple grass inflorescences.

tification of grasses relatively difficult. Full discussion of floral morphology is beyond the scope of this book; however, for interested readers several books on grass structure and identification are included in the bibliography.

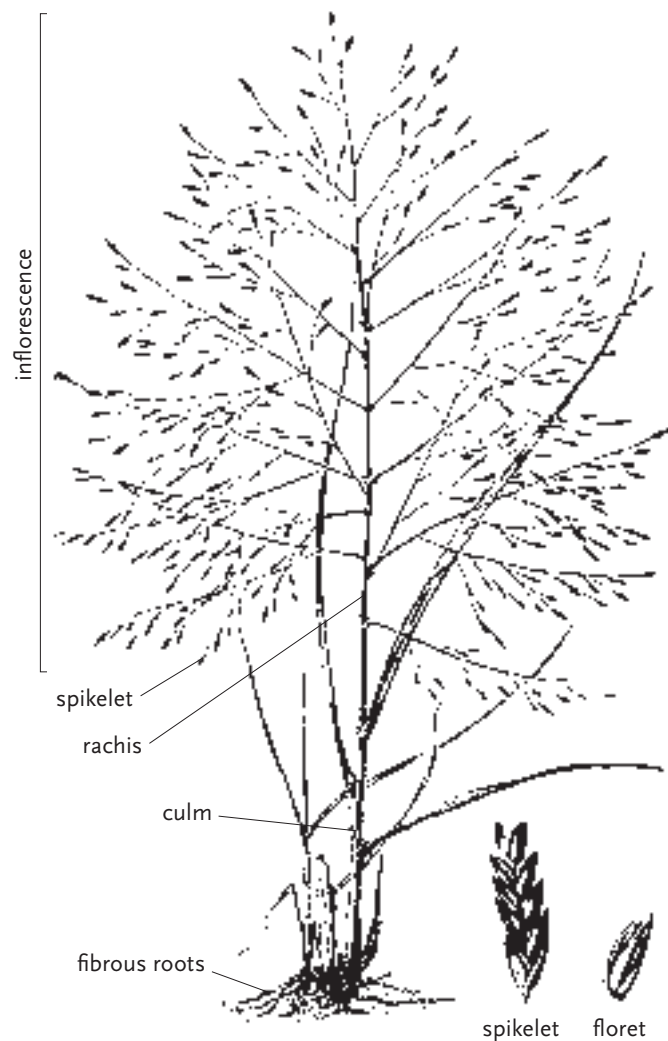
Though it is possible to distinguish the majority of cultivated grasses from one another without a thorough mastery of structural details, it is useful to be able to recognize a spikelet and to be aware of the variation in the structure and form of grass inflorescences. There are three basic types of simple inflorescences: spikes, racemes, and panicles (left). Common to all of these is a readily apparent main axis called a rachis. A simple spike has individual spikelets attached directly to the rachis. Wheat, *Triticum aestivum*, and bottle-brush grass, *Elymus hystrix*, are examples of simple spikes.

A simple raceme has individual spikelets attached to the rachis by short stalks. Semaphore grass, *Pleuropogon californicus*, an annual species, is one of relatively few examples of a simple raceme.

In a simple panicle, the spikelets are attached to the ends of stalks that branch, often repeatedly, from the rachis. The genus *Panicum* is characterized by this type of inflorescence, which is by far the most common among grasses. There are two general types of panicles: open and closed. The branching of open panicles is loose and airy, as in the examples of *Panicum*; purple lovegrass, *Eragrostis spectabilis* (left); and wild-oat, *Chasmanthium latifolium* (page 38). The branches of closed panicles are upright and held closely to the rachis, as with giant reed, *Arundo donax* (page 39).

The inflorescences of many grasses are actually combinations of one or more of the three simple types and are termed compound inflorescences. For example, the compound inflorescence of side-oats grama, *Bouteloua curtipendula*, is a raceme of spikes (page 43). *Miscanthus* inflorescences are panicles of racemes (page 44).

Although the inflorescences of most grass species consist of spikelets with bisexual florets (having both male and female reproductive parts), some, such as wild rice, *Zizania aquatica*, and *Tripsacum* species, have male and female spikelets located in different portions of the inflorescence. Less commonly, grass species are dioecious, meaning individual plants either have inflorescences of all female spikelets or inflorescences of all male spikelets. Pampas grass, *Cortaderia selloana*, and buffalo grass, *Buchloe dactyloides* (page 39), are examples of dioecious grasses.



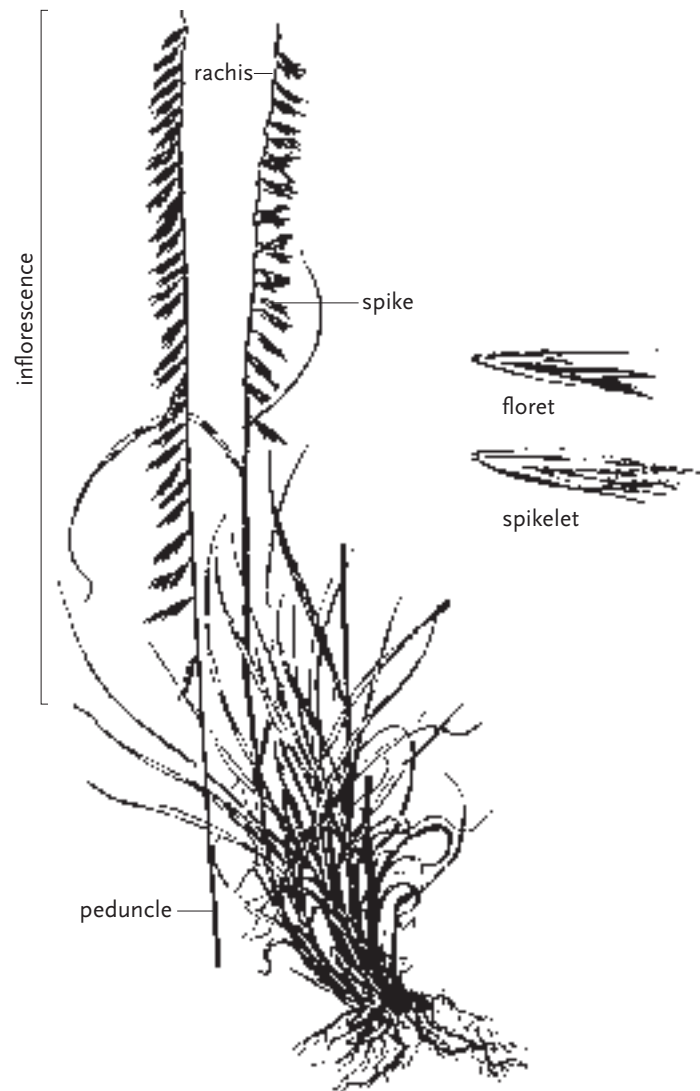
The panicle is the most common type of grass inflorescence. The inflorescence of purple lovegrass, *Eragrostis spectabilis*, is typical of an open panicle.

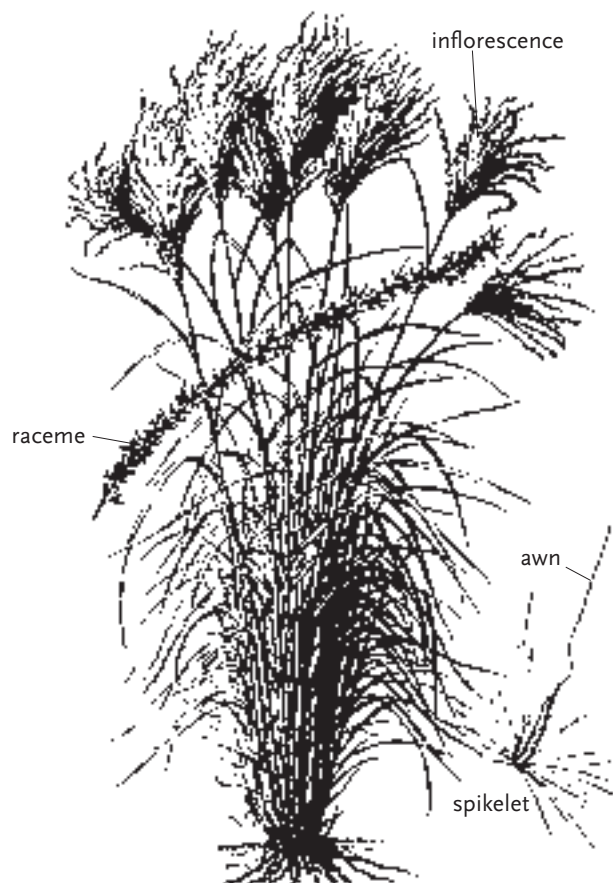


ABOVE An open panicle of switchgrass, *Panicum virgatum*, in mid September.

ABOVE RIGHT Inflorescences of side-oats grama, *Bouteloua curtipendula*, are dry and parchment-colored in late November in northern Delaware.

RIGHT The compound inflorescence of side-oats grama, *Bouteloua curtipendula*, is a one-sided raceme of spikes. Each spike contains multiple spikelets. The peduncle is a typically leafless extension of the culm, supporting the inflorescence.

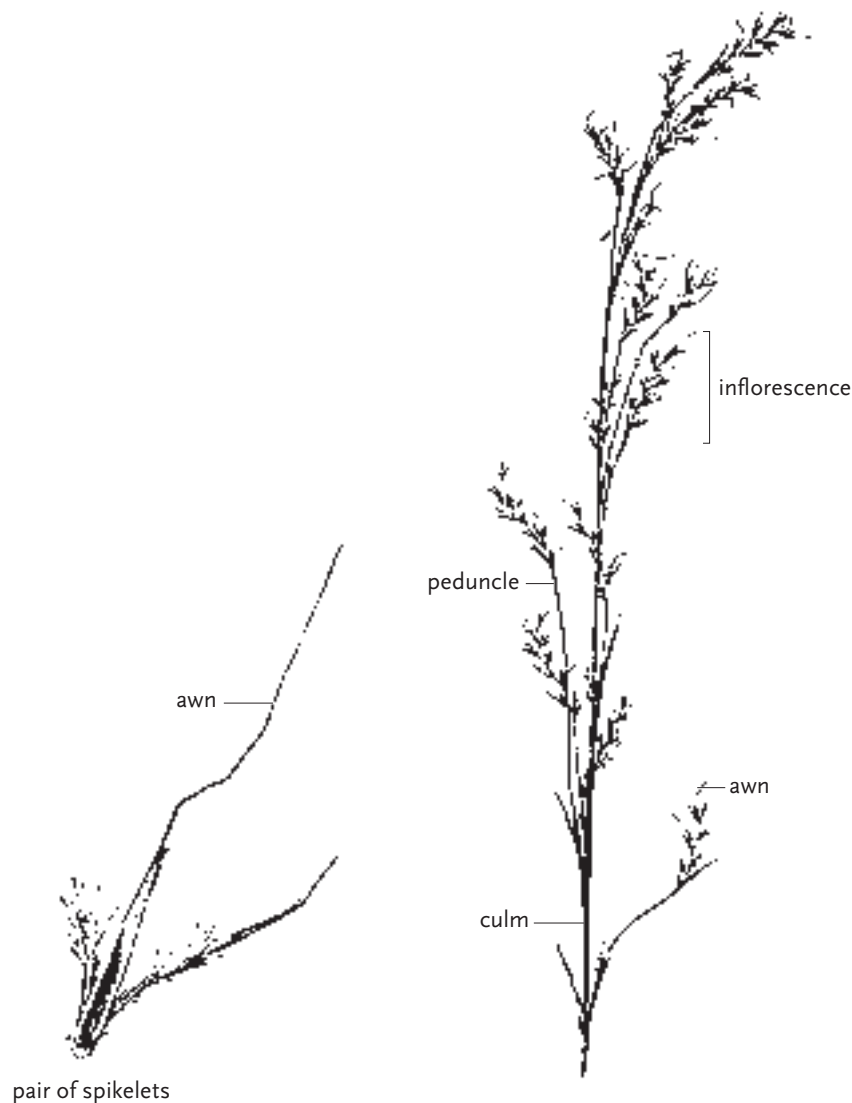




ABOVE The inflorescences of *Miscanthus sinensis* are compound panicles consisting of numerous pencil-thin racemes. Fine, translucent hairs extending from the base of each tiny spikelet are primarily responsible for the inflorescence's feathery appearance and extraordinary luminous qualities.

ABOVE RIGHT Compound inflorescences of *Miscanthus sinensis* are illuminated by the late-October sun in Maryland. RIGHT The stately inflorescences of wild rice, *Zizania aquatica*, have male spikelets in the lower portion and female spikelets above.





GRASSES IN THE GENUS *Tripsacum* also have male and female spikelets separated on the same inflorescence, with male spikelets in the upper portion.

TOP LEFT Dark red anthers extend from the upper, male spikelets of Florida gama grass, *Tripsacum floridanum*. CENTER Huge by grass standards, the bright red stigmas of eastern gama grass, *Tripsacum dactyloides*, extend from female spikelets located only in the lower portion of the inflorescence.

RIGHT Broom-sedge, *Andropogon virginicus*, is another example of lateral inflorescences arising from nodes. Unlike the racemose inflorescences of little bluestem, *Schizachyrium scoparium*, those of broom-sedge are not held out from the culm on extended peduncles but instead are tightly clustered at the nodes.

LEFT Although large terminal inflorescences are common among grasses, some species produce multiple lateral inflorescences along the length of the culm. Little bluestem, *Schizachyrium scoparium*, is an example of this, producing racemose inflorescences attached to separate peduncles arising from lateral nodes.

Almost lawnlike in appearance, Pennsylvania sedge, *Carex pensylvanica*, spreads over a wooded slope in northern Delaware in mid May. This highly adaptable running sedge occurs in a wide range of habitats, from moist woodlands with rich organic soils to sunny openings in sandy woodland environments.

The Sedge Family, *Cyperaceae*

Though the sedges are fewer in number than the grasses, they are a relatively large family of approximately 115 genera and thirty-six hundred species, nearly all of which are perennial. The family name *Cyperaceae* is derived from the genus *Cyperus*.

Like grasses, sedges are a cosmopolitan group, found in most parts of the world. They do not colonize quite as actively as grasses do, but they do play important roles in soil stabilization. Most sedges prefer sunny habitats with moderate to high moisture, although some sedges are adapted to hot, dry environments and others are at home in densely shaded forests.



RIGHT *Carex pensylvanica* becomes a carpet of gold in late October in the New Jersey Pine Barrens. It is covering the ground in open, sunny patches of a mixed pine-oak woods that burned the previous year. The soil is almost pure quartz sand: low in fertility and exceptionally dry in summer's heat. The sedge is a well-adapted component of this fire ecology, filling its niche among other fire-tolerant and drought-tolerant species including pitch pine, *Pinus rigida*; blackjack oak, *Quercus marilandica*; sweet fern, *Comptonia peregrina*; and numerous low blueberries, *Vaccinium*, and huckleberries, *Gaylussacia*.

BOTTOM Lined with birch and spruce, this rocky West Virginia mountain stream provides ideal habitat for two shade and moisture-loving species: plantain-leaved sedge, *Carex plantaginea*, and Fraser's sedge, *Cymophyllus fraserianus*, photographed in an early May rainstorm.



RIGHT Woolgrass, *Scirpus cyperinus*, generally prefers moist, sunny environments, as in this view of a former cranberry bog at Whitesbog in the New Jersey Pine Barrens, on the last day of December.

BELOW Tussock sedge, *Carex stricta*, is almost always found growing in standing freshwater habitats, though it will tolerate much drier conditions. It tends to grow in remote clumps in highly shaded environments, and often in tightly packed colonies in sunnier habitats. Shown here in mid May in a wooded wetland in New York State.



COMPARING SEDGES & GRASSES

Sedges can be distinguished from grasses by a few readily apparent vegetative characteristics. The popular saying “sedges have edges” is true and useful: unlike the cylindrical culms of grasses, sedge stems are triangular in cross section, and their leaves are three-ranked (arranged in three rows). Leaf blades of sedges are very grasslike; however, ligules are either entirely lacking or very much reduced. The leaf sheaths of sedges are closed (fused) around the stem, unlike the split, overlapping sheaths of grasses which can be easily pulled away from the culm. Whereas grass culms have hollow internodes, sedge stems lack nodes and are solidly filled with pith.

Like grasses, sedges have fibrous root systems. Though some sedges are tufted in their growth and remain as well-defined clumps, the majority spread by rhizomes or stolons, and many are capable of forming extensive mats.

BELOW Inflorescences of tufted sedge, *Carex elata*, have female spikes (white) and male spikes (light brown) attached to the same peduncle. RIGHT The woolly inflores-

cences of woolgrass, *Scirpus cyperinus*, owe their distinct appearance to tiny red-brown bristles associated with each of the myriad individual flowers.

BOTTOM LEFT The three-ranked leaf arrangement characteristic of sedges is exceptionally clear in this top-down view of three-way sedge, *Dulichium arundinaceum*. CENTER Gray's sedge, *Carex grayi*, is also called mace sedge due to the macelike appearance of the clustered utricle that make up the female portion of each inflorescence. RIGHT The conspicuously white terminal inflorescences of Fraser's sedge, *Cymophyllus fraserianus*, have female flowers at bottom and male at top. The branched stigmas of the female flowers and the light yellow anthers of the male flowers are readily apparent.



Also like grasses, sedges are wind-pollinated, and the individual flowers are typically inconspicuous and without recognizable sepals and petals. Flowers are often but not always grouped in spikelets. Sedge inflorescences are comprised of flowers or spikelets arranged in various spikes, umbels, or panicles; however, few are as visually dramatic as the inflorescences of grasses, in part because they lack the highly translucent awns and hairs of grasses. Some inflorescences are conspicuously attractive in their own unique ways. Reduced leaves or bracts are often present at the base of the sedge inflorescence, and while typically green, these may be bright white, as in the genus *Rhynchospora*. The inflorescences of black-flowered sedge, *Carex nudata*, are nearly black, and those of crimson-seeded sedge, *C. baccans*, turn deep red as seeds mature.

Unlike the majority of grasses, many sedges, including those in the large genus *Carex*, have male and female flowers grouped in separate spikes within the inflorescence of a single plant. The female flowers of *Carex* are commonly enclosed in a saclike structure called a perigynium or utricle, which may be enlarged and conspicuous as in Gray's sedge, *C. grayi*.

Sedges may lack colorful flowers, but their foliage is often richly hued. Sedges are often evergreen or semievergreen even in cold climates, and their leaf colors encompass a wide range of green, yellow-green, and blue. Many of the New Zealand *Carex* species are naturally brown or red.

SEDGES & HUMAN CULTURE

Especially when compared to grasses, sedges are unimportant as human food sources or as feed for domesticated animals. The relatively few edible sedges include Chinese water-chestnut, *Eleocharis dulcis*, and chufa or earth-almond, *Cyperus esculentus* var. *sativus*, which are cultivated for their tubers. Sedges more commonly provide raw materials for various products. The papyrus paper of classical antiquity was made from stems of Egyptian paper reed, or papyrus, *C. papyrus*. Many sedges, most notably bulrushes in the genus *Schoenoplectus*, have been employed in the construction of primitive dwellings, basketwork, mats, and chair seats. The fluffy heads of cottongrasses in the genus *Eriophorum* have been used for pillow stuffing, and the roots of galingale, *Cyperus longus*, provide aromatic oils used in perfumery.

The Rush Family, *Juncaceae*

Rushes are a small family of worldwide distribution, typically inhabiting wet or moist places in temperate and subarctic regions. Like grasses and sedges, rushes are wind-pollinated and their flowers are small and subtle in their coloration, but that's where the similarity ends. Though all their parts are relatively minute, rush flowers bear a close resemblance to those of more typical

monocots such as lilies. Rush flowers are most often bisexual, with six tepals (the term for nearly identical sepals and petals) arranged in two whorls, six stamens, and an ovary with three stigmas.

The family includes fewer than four hundred species in only eight genera. All rushes are herbaceous with the exception of the shrubby South African genus *Prionium*. The family name is derived from the genus *Juncus*, which is by far the most extensive in the family. *Luzula* is the other commonly encountered genus, and the two are quite distinct from one another.

Plants belonging to *Juncus* are called rushes, and their stems are typically erect, cylindrical, solid, and without nodes. Typical leaves are absent: the green (or blue-green) stems carry on the photosynthetic process and are usually evergreen. Flowers are clustered in branched inflorescences called cymes, which are usually attached directly to the stem, nearer the top. *Juncus* species typically flower in summer. They are usually found in wet sunny habitats, although some are adapted to sunny arid places.

Soft rush, *Juncus effusus*, grows in bands in full sun and shallow water near the margin of a former cranberry bog at Whitesbog in the New Jersey Pine Barrens. The pattern of the rush reflects the remains of subsurface grading and drainage that was engineered and constructed nearly a century ago.



Plants belonging to *Luzula* are called wood rushes, and these have leaves with enclosed sheaths and flat, grasslike blades. Wood rushes are typically evergreen, and their leaf margins are often fringed with fine hairs. The leaves form basal rosettes, with reduced leaves continuing up the generally erect stems. Inflorescences are terminal and often combine the characteristics of panicles, umbels, and heads. *Luzula* species are typically spring-flowering and, as the common name suggests, wood rushes prefer shady, woodland habitats, usually of moderate moisture.

The rush family is of minor economic importance as the source of various fibers and binding materials. The leaves of the South African palmiet, *Prionium palmitum*, are the source of a strong fiber called palmitite. Sea rush, *Juncus maritimus*, is the source of binding material known as juncio. Stems of the common or soft rush, *Juncus effusus*, which occurs throughout North America and Eurasia, are widely used to make baskets, chair seats, and various types of mats, including traditional Japanese tatami.

Green, leafless cylindrical stems of *Juncus effusus* are silhouetted in the smooth surface of New Jersey Pine Barrens waters. The orbicular leaves of fragrant waterlily, *Nymphaea odorata*, are dramatic in contrast.





FAR LEFT *Juncus effusus* offers the perfect perch for the calico pennant dragonfly, *Celithemis elisa*, at the margin of a northern Delaware pond. LEFT Common wood rush, *Luzula multiflora*, blooms in late April in a northern Delaware beech-oak forest. Yellow anthers and red-brown tepals are visible to the naked eye.

CENTER A mossy bank in deciduous forest in Virginia provides ideal habitat for wood rush, *Luzula acuminata*, and Christmas fern, *Polystichum acrostichoides*.

BOTTOM Tatami floor mats with decorative cloth edging fit precisely against a wooden channel for a sliding screen in a traditional Japanese structure. The durable outer covering (*tatami omote*) of the tatami is tightly woven from stems of *Juncus effusus*, soft rush or, as it is known in Japan, *igusa*.



Table Mountain is visible in the background in this early September (spring) view of broom-reed, or horsetail restio, *Elegia capensis*, growing at the Kirstenbosch National Botanical Garden in Cape Town, South Africa. This restio has green stems that are finely branched in whorls at the nodes, bearing a strong resemblance to horsetails, *Equisetum*, although the two are not related.



The Restio Family, *Restionaceae*

Restios include nearly five hundred perennial herbaceous species in as many as fifty-five genera, and these are almost entirely restricted to the Southern Hemisphere. Although they occur in Chile, Southeast Asia, Madagascar, and New Zealand, restios are best represented in the winter rainfall regions of Australia and South Africa, which together are home to nearly forty genera and four hundred species. Restios are an integral part of the fynbos flora of South Africa's Cape Floral Region, where they are commonly called Cape reeds. *Fynbos* literally means fine bush and refers to a vegetation type characterized by the presence of restios, heaths, and proteas. In this context restios largely take the place of true grasses, especially on the most nutrient-poor soils.

Like the true grasses, sedges, rushes, and cattails, restios are monocots, and they are most often rushlike in their appearance, although some have branched stems and bear a superficial resemblance to horsetails, *Equisetum*. The high silica content in the cells of many restios contributes to a shiny stiffness that is also horsetail-like. Like rushes in the genus *Juncus*, most restios lack normal leaves with flat leaf blades. When present, leaves are generally reduced to sheaths present at the nodes or are clustered at the base of stems. The leaf sheaths are often leathery and tan, gold, or cinnamon-brown in color, and can be rather striking in appearance. Photosynthesis is carried on by the mostly evergreen stems, which are most often cylindrical, although some are flattened, tetragonal, or oval in cross section. Unlike the stems of rushes, restio stems contain nodes and internodes, and the internodes may be solid, spongy, or hollow. Most restios are tufted and clump-forming, although some have slowly spreading rhizomes. The roots may be fleshy or thin and wiry.

Restios are wind-pollinated, and the individual flowers are small, green or brown in color, often with three to six tepals in two whorls, like true rushes. The flowers are typically grouped in spikelets which in turn comprise loose inflorescences, some of which can be of dramatic size. Most restios are dioecious, with male and female flowers on separate plants. Due to the unisexual nature of the flowers and associated bracts, male and female plants of the same species are often strikingly different in appearance from one another, making identification and classification of this family quite challenging.

The family name is derived from the genus *Restio*, which has as its root the Latin *restis*, meaning rope. The family is of no economic importance as a food source; however, a few species have been traditionally important as the source of thatching material. In South Africa, primitive homes as well as Cape-Dutch dwellings have long been thatched with dekriet, the common name for the thatching reed, *Thamnochortus insignis*. In addition to their use in thatching, some restios such as broom-reed, *Elegia capensis*, have been used for sweeping.

Restios are also the source of many unique stems and seedheads which are important to the international cut-flower trade.

Many restios have great ornamental appeal, sometimes rivaling the textures and graceful luminosity of the true grasses. Though few, if any, are winter hardy in colder temperate climates, they are well adapted to the heat and periodic drought typical of the world's Mediterranean regions, including California. Restios have seen a huge increase in their popularity as garden subjects since the 1980s attributable in large part to breakthrough research at the Kirstenbosch National Botanical Institute in Cape Town, South Africa. By closely observing the dynamics of the fynbos, which is a fire ecology, Kirstenbosch scientists determined that smoke from naturally occurring fires is a critical factor in breaking dormancy and stimulating seed germination of many restios. They have since developed a seed-priming method that employs fynbos-smoke-saturated water. This research has had a profound effect on the propagation and commercial availability of many restios. There are literally hundreds more to draw from.

Fynbos vegetation in the Hottentots Holland Mountains of South Africa's Cape Region comprises a number of restio family members including golden-curls, *Elegia equisetacea*, which are adapted to this low-nutrient environment subject to frequent fires.





ABOVE The leafless, cylindrical green stems and tightly clustered small brown flowers of Cape rush, *Chondropetalum tectorum*, are quite rushlike; however, this striking plant is one of nearly five hundred species in the restio family, *Restionaceae*. Photographed in late August (winter) in open, sunny, moist habitat on the Cape of Good Hope in South Africa. ABOVE RIGHT Conspicuous bracts of golden-curly, *Elegia equisetacea*, catch the afternoon sun in mid September (early spring) in Hottentots Holland Mountains.

RIGHT Locally known as dekriet, thatching reed, *Thamnochortus insignis*, is used to restore the roof of this historic Cape-Dutch dwelling in South Africa's Cape Region. If properly installed, this roof will last twenty years or more.



The Cattail Family, *Typhaceae*

The cattail family includes only one genus, *Typha*, and fifteen or fewer species, yet it is commonly represented in freshwater and slightly brackish habitats throughout the world's temperate and tropical regions. Various names known by the common names cattail, cat-tail, bulrush, bullrush, and reed-mace, all members of this family are herbaceous perennials. The species are variable and prone to introgressive hybridization, which has contributed to taxonomic disagreement about the precise number of *Typha* species.

Cattails prefer shallow water, growing from 2 to 8 feet (60–240 cm) in height at the margins of ponds, rivers, and lakes, and spreading by stout rhizomes to form large colonies in swamps and marshlands. They are very adaptable and can survive extremes of temperature and periods of drought. Although sometimes considered weeds in managed wetlands, cattails provide important nesting materials and cover for birds and are homes to numerous insects and amphibians. They are critical to healthy nutrient cycles in many marshy habitats and are increasingly valued for their role as filtering agents in polluted wetlands.

Cattails spread by thick rhizomes, often forming dense stands such as this colony of *Typha latifolia* in Wellfleet, Massachusetts, photographed on Christmas Day.





The flat, swordlike leaves are thick, slightly spongy, and nearly vertical, arising in two ranks from the base of the plant. Typically gray-green in summer, they often turn bright yellow or gold in autumn, then dry to tan or light brown and remain standing through winter.

Cattails bloom in mid to late summer, producing cylindrical inflorescences held erect on sturdy stems. The spikelike inflorescences are composed of male flowers in the upper portion and females below, sometimes with a sterile section in between. Cattails are wind-pollinated, and the individual flowers are subtly colored and minute, with greatly reduced parts. The male flowers are gold-colored at the time of pollen production, then they quickly dry and wither away to leave the central stalk exposed. The densely packed female spikes turn from green to cinnamon and rich, dark brown hues as the seeds mature. In temperate climates the fruiting spikes usually remain intact until

early winter and then begin separating, each dispersing more than one hundred thousand seeds attached to tiny hairs that float on the wind.

Cattails are of minor economic importance; however, the mature leaves have been used for thatching, matting, caning, and basketry. The thick rhizomes are high in starch and have been used as a human food source in times of famine. The floss from the seed spikes has been used as a substitute for down.



OPPOSITE TOP The narrow-leaved European cattail, *Typha laxmannii*, is one of the species having a sterile segment separating the female (lower) and male (upper) portions of the inflorescence. This feature is helpful in distinguishing various species. **BOTTOM** The inflorescence of *Typha latifolia* has the male section positioned directly above the female section, with no sterile segment in between. At the peak of pollen production in this June photo, male flowers appear gold.

ABOVE The late-October breeze helps disperse hairy seeds of *Typha latifolia* as red maples, *Acer rubrum*, reach the peak of their autumn color in a Delaware wetland.

LEFT The familiar brown spikes and sword-like foliage of common cattail, *Typha latifolia*, mingle with goldenrods and asters edging a pond at Winterthur Museum and Gardens in northern Delaware in mid September.



CHAPTER THREE

The Beauty of Grasses

OF LATE YEARS public taste has been turned to the advantageous effect of grasses in landscape gardening. Ferns had the credit of first winning attention from color to form, and grasses next stepped in to confirm the preference for grace and elegance over gaudy coloring.

Margaret Plues, *British Grasses*, 1867

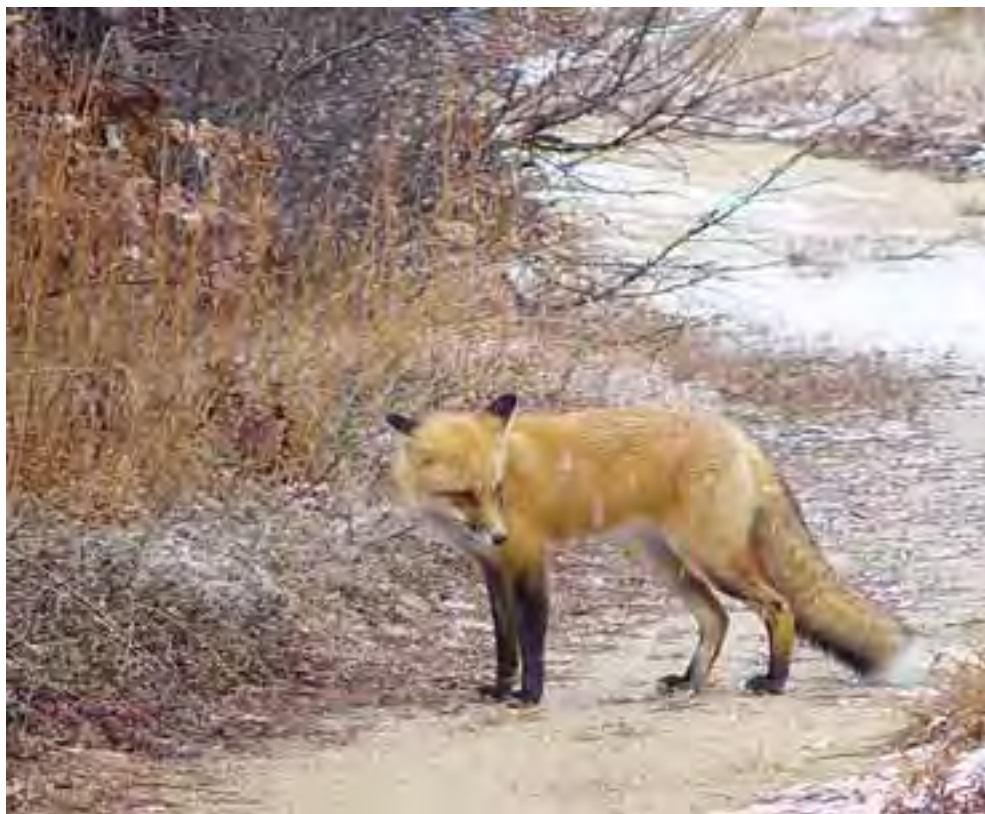
MARGARET PLUES MAY HAVE BEEN a bit premature with these words 140 years ago, but her thoughts are fitting now. Pioneers in both the ecological and visual senses, grasses have finally gained a firm foothold in the fields of horticulture, landscape design, and conservation.

The aesthetic appeal of grasses is indeed unique. Their colors, though often less saturated than those of traditional garden plants, are softly sophisticated and remarkably varied. Beyond color, grasses offer a wealth of beauty and interest derived from translucency, line, form, texture, scale, sound, movement, and seasonal dynamics. Some of these characteristics are readily apparent to the casual eye, and others are revealed through thoughtful observation. Developing an awareness of grasses' unique attributes is sure to enrich your experiences with them, in both the garden and the larger landscape.

Luminous grasses (*Miscanthus sinensis* 'Gracillimus') play against the absolute opacity of clipped yews in this late-November scene at Longwood Gardens in Pennsylvania. Color is almost unimportant to this composition, which relies on light, line, and form for its drama.

RIGHT This obliging red fox stood for my camera in a late-December snowstorm in North Truro on Cape Cod. Every color in its coat is reflected in the winter landscape: the near-black of wet twigs, the ivory and white of sand and snow, and the ruddy hues of oak leaves and dormant grasses (little bluestem, *Schizachyrium scoparium*). Too often we dismiss such scenes as colorless, yet this fox helps us see they are anything but that. Landscape historian John Stilgoe has written about the enduring rewards of developing “visual acuity”: the ability to see sharply both detail and context. Learning to discern and understand the color roles of grasses in seasonal landscapes is a fine example.

BELOW Switchgrass, *Panicum virgatum* ‘Dallas Blues’, and other grasses add their warm hues to a late-February day in the author’s Pennsylvania garden. The color balance of this winter composition is similar to that of surrounding fields and woodland edges, and helps reinforce the garden’s connection with them.





THE CAMERA CAN TEACH us a great deal about gardening and landscape design, especially because of its ability to record pattern and reveal process. Framed by the same white oak, *Quercus alba*, these three photos of broom-sedge, *Andropogon virginicus*; little bluestem, *Schizachyrium scoparium*; and Indian grass, *Sorghastrum nutans*, illustrate the seasonal cycle of local warm-season grasses in the eastern North American landscape.

TOP The summer landscape is still mostly green in August as blooming grasses add their gold and copper tones. CENTER By late October the grasses have finished flowering and set seed. Their foliage has become a rich mix of straw, salmon, and russet hues, complementing the gold and red colors lingering in the autumn foliage of deciduous trees. The oak's dark frame offers dramatic contrast. BOTTOM January snow cover reveals the grasses as now the most colorful aspect of a winter landscape that is otherwise a study in dark browns, grays, and charcoal. Welcoming such local colors, patterns, and processes into our aesthetic is a necessary step in the development of a locally grounded design and conservation ethic.



This Pennsylvania hayfield is a grand study in sunlight and shadow in late May, illustrating the luminous drama possible from even the simplest grasses.

Luminous Qualities

Few plants can match the luminous drama of the grasses. Their highly translucent flowers and foliage are set aglow by even the softest sunlight, and when strongly sidelit or backlit they present some of the most stunning displays encountered in any landscape. These radiant effects are in play year-round, but are perhaps most welcome in late autumn and winter when accentuated by the sun's low-angle rays. Luminous grasses bring vibrancy to the landscape at times when typical flowering plants are at low ebb.





LEFT Sweeps of *Miscanthus sinensis* and feather-reed grass, *Calamagrostis xacutiflora* 'Karl Foerster', at the Chicago Botanic Garden are illuminated by the early October sun.

BELOW LEFT Sidelit by the mid-September sun and backed by shadow, the finely detailed inflorescence of switchgrass, *Panicum virgatum* 'Prairie Wind', is incandescent in the author's Pennsylvania garden. BELOW *Miscanthus sinensis* 'Graziella' backlit by the mid-November sun in New York State. Fine hairs present in the inflorescences of many true grasses contribute to their luminous potential.







OPPOSITE Late-afternoon sun reveals the pattern of red tussock, *Chionochloa rubra*, on a mountain slope in New Zealand's Southern Alps at the end of August (winter). Although their clump pattern seems regular and contrived, these grasses are naturally occurring.

LEFT Spikelike inflorescences of Lindheimer's muhly, *Muhlenbergia lindheimeri*, are set off by late-October sunlight and the dark red foliage of sumac, *Rhus glabra* 'Laciniata', in the author's Pennsylvania garden.

BELOW LEFT Inflorescences of Indian grass, *Sorghastrum nutans*, appear flamelike when backlit by the early September sun in the author's Pennsylvania garden. BELOW Sunlit switchgrass, *Panicum virgatum*, in a Long Island meadow in late October demonstrates the radiant quality of grass foliage.



Sound and Movement

Grasses are the first to tell of each caressing summer breeze. Their lissome stalks and flowers flutter and bow, dancing before every spring gale, every autumn storm, every winter wind. Supple and sinuous, they paint portraits of the wind. As they move, they sing in tones ranging from a low whisper to a low rustle, to a staccato rattle. Their sound and movement add immeasurably to the vibrancy of any garden and to its resonance with the larger landscape. A window view on grasses dancing in the distance will often serve as a gentle beckoning to abandon indoors for out.

Mexican feather grass, *Nassella tenuissima*, soaks up the California sun at Seaside Gardens in Carpinteria, in early April. Literally soft and pliant as a feather, this graceful grass is almost constantly in motion.



LEFT Sunlit seed stalks of snow tussock, *Chionochloa flavescens*, flutter furiously in a powerful wind in August (winter) in New Zealand's Southern Alps.

BELOW Easily viewed from multiple windows, this storm-tossed sweep of *Miscanthus sinensis* 'Gracillimus' is a literal portrait of northern Delaware's winter winds.



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The Quality of Line

Grasses are among the most architectural of all herbaceous plants, largely due to their strength and quality of line. Both foliage and flowers contribute to the linear presence of grasses, which can be subtle or even monotonous in excess but is visually stunning in association with contrasting elements in the landscape: water, stone, sky, and the built environment. The lines of some grasses are strictly vertical, others are sharply ascendant, and still others follow gentle arcs.

The linear strength of feather-reed grass, *Calamagrostis xacutiflora* 'Karl Foerster', is both a match and a foil for a stone staircase at Chanticleer in Wayne, Pennsylvania, in late June.





TOP LEFT Graceful arcing lines are characteristic of cordgrass, *Spartina pectinata* 'Aureomarginata'.

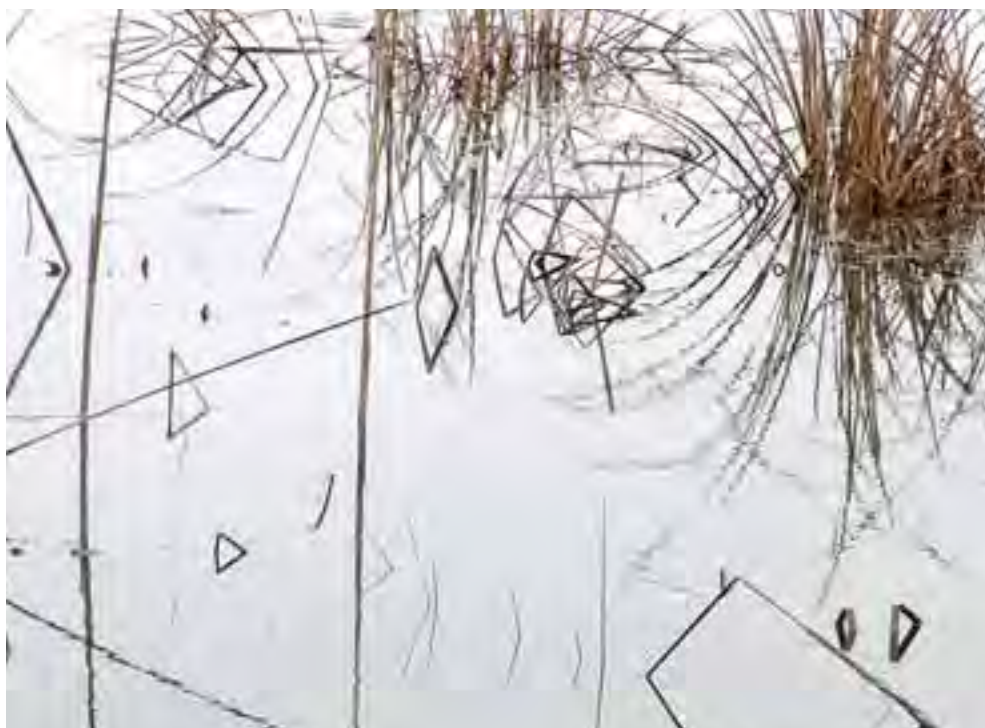
LEFT Though the lines of most grasses are parallel, some, such as those of this feather grass, *Stipa barbata*, in Beth Chatto's garden in Colchester, England, are complex and nearly free-form.

ABOVE The vertical lines of white bulrush, *Schoenoplectus tabernaemontani* 'Albescens', contrast with the water's surface and the masonry coping in this pool at the Chicago Botanic Garden in early June.



ABOVE Secondary lines created by reflection and shadow are part of the allure of grasses' linear character. An arcing stalk of bulrush, *Schoenoplectus tabernaemontani*, creates the illusion of a completed oval in this pond in Karl Wienke's garden in Suhl, Germany.

RIGHT Last season's cattails, *Typha latifolia*, are a study in linear abstraction as mirrored in a Texas swale in early April.





LEFT The linear drama of grasses plays through all seasons. Miscanthus shadows are etched on a snowbank in Newport, Rhode Island, in late January.

BELOW LEFT Reminiscent of artist Andy Goldsworthy's work, this is only the result of the tides working with salt marsh grasses (including *Spartina* species) along Robert's Cove on Cape Cod, Massachusetts, in late December. The defining lines of grasses often record the subtle stories of local landscapes. BELOW Crossing lines of *Panicum virgatum* 'Northwind' foliage and *Muhlenbergia lindheimeri* flowers create visual intrigue in early November in the author's Pennsylvania garden.



Form, Texture, and Scale

As with line, grasses are diverse in form, texture, and scale—characteristics which are of much greater importance when working with plants whose primary strength is not color. Grasses do come in practically all shapes and sizes, including tightly tufted mounds, gracefully spilling fountains, irregular cascades, and nearly vertical pillars. Their textures range from feather-fine to coarse-as-corn. The smallest grasses never exceed one foot (30 cm) in height, while others grow nearly 15 feet (4.6 m) tall in a single season. Many of these characteristics vary with climate and local growing conditions. A grass that is strictly upright when sited in droughty sand and full sun may be lax or pendant in moist shade and rich organic soil. The size and height of grasses can also vary tremendously with available light, moisture, and nutrients.

Aptly named fountain grass, *Pennisetum alopecuroides* retains a rounded, fountain-like form from foliage through flowering, as pictured at Ashland Hollow in Delaware in mid August.



RIGHT Moving the emphasis away from color profoundly changes the visual equation. In late July this south-facing border in the author's Pennsylvania garden is a study in texture and form. The upright stance, vertical lines, and relatively coarse texture of *Panicum virgatum* 'Northwind' (at left), a reliably upright cultivated variety of switchgrass, set it apart dramatically from aromatic aster, *Aster oblongifolius* (below it); thread-leaf bluestar, *Amsonia hubrichtii* (flanking it); and cutleaf smooth sumac, *Rhus glabra* 'Laciniata' (backing it). The form of 'Northwind' will change very little when it flowers: it will remain mostly columnar. Although Lindheimer's muhly, *Muhlenbergia lindheimeri* (at right), is slightly bluer than its companions, it stands out in the composition primarily because of its fine texture and rounded form. BELOW Three months later the same *Muhlenbergia lindheimeri* has morphed into a different form and is now upright-arching in flower. Many grasses change shape dramatically when they bloom.





ABOVE Giant miscanthus, *Miscanthus x giganteus*, towers over silver spike grass, *Achnatherum calamagrostis*, in an elegant composition at Great Dixter in Northiam, England, that is all about line, form, texture, and scale. Although both grasses have pendant lines, the miscanthus reads primarily as a vertical form. Its size and relative coarseness work well against the horizontal barn boards.

TOP RIGHT A slowly running grass, *Hakonechloa macra* 'Albovariegata' is shaped like tumbling waves in late May in the author's Pennsylvania garden. RIGHT Scale and texture can be independent of one another. Though many of the smallest grasses are relatively fine-textured, the largest grasses vary from fine to coarse. Diffuse and cloudlike in form, *Panicum virgatum* 'Cloud Nine' stands more than 6 feet (2 m) tall in late October in the author's Pennsylvania garden, yet its texture is exceptionally fine.





LEFT The grass collection at the Royal Botanic Gardens, Kew, in England is a wonderful place to study the diversity in form, texture, and scale encompassed by the grasses. In this late-August photo, low, ultra-fine-textured Mexican feather grass, *Nassella tenuissima*, skirts a border filled with multiple varieties of *Miscanthus sinensis*.

BELOW Tufted hair grass, *Deschampsia cespitosa* 'Goldtau', has the texture of soft clouds drifting through Piet Oudolf's borders at the Royal Horticultural Society's garden, Wisley, in Surrey, England, in mid July.



CHANGES IN FORM, TEXTURE, and scale of grasses over the growing season often result in similarly dramatic changes in the landscape itself, as demonstrated by two views of the same path at the Chicago Botanic Garden in Illinois.

RIGHT In early June *Miscanthus* 'Purpurascens' (left) and *M. sinensis* 'Ferne Osten' (right) are a low, soft green presence edging the path. BELOW Four months later, in early October, the grasses have tripled in height and are now luminous and upright, literally defining the path.



Color Diversity

The color diversity of grasses begins with green. Though green may be a single color, it can be infinitely variable in tint, shade, and saturation, and many such variations are found among the grasses. Grasses and their relatives include light greens and dark greens, soft greens and hard greens, gray-greens, yellow-greens, and, perhaps most frequently, blue-greens. Much of the blue we perceive in grasses is due to a thin waxy coating on green leaves and other parts that refracts sunlight to give the appearance of blue color. The “bloom”



LEFT Representing one of the innumerable green hues found among the grasses, *Sesleria argentea* is chartreuse in mid August in northern Germany.

BELOW LEFT The glaucous foliage of giant wild rye, *Leymus condensatus* ‘Canyon Prince’, appears especially blue in shadow and early morning June light in San Luis Obispo, California.

ABOVE This blue woodland sedge, *Carex flaccosperma*, has exceptionally glaucous foliage, making the green leaves appear blue in this early August view in the author’s Pennsylvania garden.



RIGHT Stunningly distinct from the green of a yucca and the light yellow of sempervivums, *Festuca glauca* 'Elijah Blue' is among the bluest of the blue fescues

BELOW RIGHT Blue oat grass, *Helictotrichon sempervirens*, is a steady, light blue year-round in many climates.

BELOW Grass foliage and flowers are often imbued with secondary colors, as with the red-purple segments on the otherwise light blue stems of little bluestem, *Schizachyrium scoparium* 'The Blues'.

OPPOSITE TOP LEFT Brown but not dead, *Carex flagellifera*, seen here in England in late July, is one of many New Zealand sedges with evergreen foliage that is anything but green. Colors of these sedges range from copper through cinnamon, orange, and red. RIGHT Orange sedge, *Carex testacea*, is true to name in early April in Southern California.

OPPOSITE BOTTOM LEFT Japanese blood grass, *Imperata cylindrica* 'Red Baron', is wine-red against a background of blue wheatgrass, *Elymus magellanicus*, in Southern California in mid August. RIGHT Purple millet, *Pennisetum glaucum* 'Purple Majesty', is one of a few dark purple pennisetums which are grown as annuals in cold climates.

on grapes is another example of this waxy or glaucous finish. Glaucous blues are dynamic: they vary with the quality of sunlight.

Beyond green, grass colors extend to red, orange, pink, and purple, with myriad variegated grasses adding real yellow, ivory, and white. Many of these colors shift dramatically with the seasons. Cool weather often induces pink or purple suffusions to white and blue. Autumn in temperate regions and dry periods in Mediterranean climates can transform the most mundane green to exuberant apricot and gold. Winter or dry dormancy augments the color spectrum with quieter but sublime hues ranging from fawn through chestnut and russet, and the dry, translucent parts of flowers and seedheads are often imbued with the varied tones of sunrises and sunsets.







TOP LEFT *Miscanthus sinensis* 'Morning Light' is among the most subtle of variegated grasses. Thin white-variegated edges on the narrow leaves result in an overall light green or gray-green appearance. RIGHT Boldly variegated leaf margins on broad-leaved sedge, *Carex siderosticha* 'Variegata', produce a two-tone effect.

ABOVE LEFT Giant reed, *Arundo donax* 'Variegata', is so strongly variegated it appears mostly white. RIGHT The leaves of Bowles' golden sedge, *Carex elata* 'Aurea', are yellow variegated with green edges.



ABOVE LEFT The banded variegation of zebra grass, *Miscanthus sinensis* 'Zebrinus', produces a color effect evocative of tropical foliage.

ABOVE In mid October in Pennsylvania, the autumn color of Indian grass, *Sorghastrum nutans*, rivals that of many trees and shrubs.

CENTER Variations in summer foliage color often correspond to variations in autumn and winter foliage colors. These seedlings of little bluestem, *Schizachyrium scoparium*, were various shades of blue and blue-green during the growing season. Here, in late September in Nebraska, the summer greens have turned copper and the summer blues are dark orange-red.

BOTTOM LEFT Light blue all summer long, the basal foliage of *Andropogon* 'Sanbi', a hybrid selection of *A. gerardii* and *A. hallii* marketed with the name Silver Sunrise™, is strongly tinted dark pink and purple in late October in North Carolina.



TOP LEFT The foliage of red switchgrass, *Panicum virgatum* 'Shenandoah', turns purple-red in early September in Delaware. RIGHT Blue hues sometimes carry through the inflorescences, as with coastal switchgrass, *Panicum amarum* 'Dewey Blue', photographed in early August in the author's Pennsylvania garden.

ABOVE The secondary colors in grass inflorescences are often strong enough to resonate with colors in the surrounding landscape. In mid October in southern Delaware, flowering stalks of split-beard bluestem, *Andropogon ternarius*, are silver, amber, green, and red. RIGHT The color impact of pink muhly grass, *Muhlenbergia capillaris*, is unusual among grasses. Clouds of vibrant purple-pink flowering stalks are eye-arresting in early July in North Carolina.



INFLORESCENCES OF FEATHER-reed grass, *Calamagrostis x acutiflora* 'Karl Foerster', undergo a startling shape and color transformation in a matter of weeks.

LEFT In June the flowering stalks are suffused with dark purple, which is accentuated by the purple smoke-bush, *Cotinus coggygria*, at Chanticleer in Wayne, Pennsylvania.

BELOW In late July the flowering stalks have constricted and turned a dark honey color, contrasting with a blue star sea-holly, *Eryngium*.



THE RELATIVELY SUBTLE HUES of grass flowers and seedheads are often important for the revealing contrast they offer with other colors in the landscape.

RIGHT The rich purple of a clematis is all the more effective when framed by the quiet tones of silver spike grass, *Achnatherum calamagrostis*, in mid August at the Royal Horticultural Society's garden, Wisley, in Surrey, England. CENTER Freshly opened in August at Wisley, the nearly white inflorescences of pampas grass, *Cortaderia selloana*, accentuate the dark purple-black flowers of *Salvia mexicana*. BOTTOM Wheat-colored spikelets of wild-oat, *Chasmanthium latifolium*, are set against the pumpkin-orange color of *Fothergilla gardenii* in early November in the author's Pennsylvania garden.



OPPOSITE TOP Dried to the color of light straw by mid November, the seed stalks of tall purple moor grass, *Molinia caerulea* subsp. *arundinacea* 'Skyracer', dramatize the rich red and green of hollies at Chanticleer in Wayne, Pennsylvania. BOTTOM The burgundy foliage of flowering dogwood, *Cornus florida*, reveals the delicate vertical stalks of bent-awn plume grass, *Saccharum contortum*, in the author's Pennsylvania garden in early November.







CHAPTER FOUR

Design with Grasses

THE CHARMING LANDSCAPE which I saw this morning is indubitably made up of some twenty or thirty farms. Miller owns this field, Locke that, and Manning the woodland beyond. But none of them owns the landscape. There is a property in the horizon which no man has but he whose eye can integrate all the parts, that is, the poet. This is the best part of these men's farms, yet to this their warranty-deeds give no title.

Ralph Waldo Emerson, *Nature*, 1836



FIND YOURSELF A PLACE TO SIT in William Robinson's *Wild Garden* at Gravetye Manor and while immersed in artful naturalism you'll find your eye drawn inexorably to the fields and forests that stretch to the horizon. *The Wild Garden*, first published in 1870, is perhaps the most enduringly relevant of all Robinson's books. In it he defines an ethic based upon naturalizing native and exotic plants adapted to local conditions, and upon an inclusive view of the potential scope of this activity, which he suggests may be suited to "fields, woods, copses, outer parts of pleasure grounds, and in neglected places in almost every kind of garden." Gravetye, in West Sussex, England, was Robinson's home and landscape laboratory from 1885 to 1935, and the place where he continued to refine his ideas.

ABOVE Heavily clothed in green vegetation and reminiscent of a hedgerow, a wall enclosing a garden space directly off the house at Gravetye frames the view to a graceful patchwork of field and forest.

OPPOSITE New Zealand wind grass, *Anemanthele lessoniana*, contributes to the informal dynamic of the Flower Garden at Gravetye Manor in England in late July.

In print throughout Robinson's lifetime, *The Wild Garden* began as a reaction to the static nature of nineteenth-century English gardens, many of which were dedicated to the geometric display of tender herbaceous plants. Robinson knew there was more beauty and practicality in a dynamic mix of hardy perennials, shrubs, and trees, and his approach in many ways fits modern values of diversity and sustainability. He eventually amassed more than 1000 acres (405 ha) surrounding Gravetye Manor, and his later years were primarily dedicated to managing woodlands, lakes, and meadows on this land. Robinson left Gravetye to the Forestry Commission, which has kept the estate relatively intact and, since 1958, has leased the manor house and immediate surrounding acres for operation as a country house hotel. The initial manager, Peter Herbert, deserves credit for restoring the gardens in keeping with Robinson's ideals, and his successors have continued the tradition. It is a rare place, surprisingly close to urban London, with a lot to say about how we might garden today.

The color of giant feather-grass, *Stipa gigantea*, part of a hardy mixed planting close to the Gravetye Manor house, matches the color of hayfields on the far slopes, inviting contemplation of the connected landscape.



If our gardens are to be part of a larger, livable landscape they must allow for creative expression while forging and retaining links to the larger ecology. They must be at once inspiring and conserving, high-spirited and low-maintenance, reflecting and sustaining the rhythms of our lives and homes while speaking to us eloquently of sun and season, community and place. Diverse, durable, and dynamic in nature, grasses are sympathetic to all these ideals, and they deserve further welcome into our deliberate designs.

Plants do make the garden; however, plants are not always the best place to begin when considering design. I prefer to begin with the design ethic, or narrative intent, and by asking questions. Is the purpose of the landscape to be decorative, or are there additional stories to be told? If so, are these stories immediately contextual (about local or regional place) or cosmopolitan (about a multitude of places), or are they a mixture of both? Is the design an independent exercise or should it recognize and tie into the surrounding ground? What are the limits on energy and resources necessary for sustained maintenance?

This chapter explores these questions through illustration and analysis of diverse landscapes—large and small, public and private—in which grasses play significant roles.

Grasses in Transition

Transition is an essential element of fine design and the experience of landscape. Transitions from place to place are easiest to understand and design for, but transition through time is more complex since it alters so many aspects of a landscape. The regular transition through seasons can be profoundly dramatic, but over longer periods of time a landscape may move more or less permanently from light to dark, wet to dry, or from field to forest. Because grasses are adaptable, quick to establish, and easily managed, they are natural choices for roles requiring transitional agents: plants that can bridge the ever-changing places in the evolving garden.

FIELD TO FOREST

In temperate climate landscapes, transition from sunlit meadow or field to shaded woods or forest is a common occurrence and often a long-term trend. Visually and experientially, the field is the counterpart to the forest. Open and bright, its mood and sense are dramatically distinct from the forest's enclosure and filtered light.



Deft watercolor strokes convey the light, color, and spatial drama of transition between field and forest in this illustration, titled “Color Note from Bare Woods on the Edge of a Meadow,” in Emily Vanderpoel’s 1903 book *Color Problems*, which was written for painters.

MY 1½ ACRE (0.6 ha) Pennsylvania garden would seem even more suburban if it wasn't located next to the nearly 5000-acre (ca. 2000-ha) White Clay Creek Preserve. The preserve was my motivation for living where I do, and although the property was mostly open lawn with a few specimen trees when I acquired it, my wife, Melinda, and I have worked steadily to reduce the lawn and re-tree the landscape. The goal is a garden more reflective of the local landscape, which is a mix of re-growth forests and open fields remnant from a long history of agriculture.

At the outset, the property seemed overwhelmingly exposed, and one of the first goals was to create a sense of enclosure in the rear garden, off the south-facing side of the house. An existing honeylocust tree provided a center point for a semicircular planting, reminiscent of a local hedgerow, designed to serve as a wall of the enclosure. I intended this green wall to eventually be built of living trees and shrubs, but since planting woody plants in small sizes is the healthiest approach, I planted seedling trees and shrubs and relied upon grasses to provide an immediate sense of enclosure. The grasses superbly served their purpose and years later were removed as light conditions changed and the woody plants matured to fill the role.



TOP By mid May, the foliage of feather-reed grass, *Calamagrostis xacutiflora* 'Karl Foerster', effectively creates the sense of a garden room around an existing honeylocust, *Gleditsia triacanthos*. The shrubs and trees interplanted with the grasses are too small to

BOTTOM Two years later the flowering grasses are tall and luminous in the late-August sun, while the woody plantings begin to have some presence. Beyond the grasses, an existing hemlock, *Tsuga canadensis*, is in decline due to an insect pest introduced to North America and is destined for removal.



LEFT A decade after the initial planting, the trees and shrubs now form the enclosure, which is regularly used as an outdoor reading and dining room. Although the feather-reed grass is somewhat shade-tolerant, it began to lose vigor as conditions became quite shaded between the woody plants and was removed as originally planned.

BELOW This is the south-facing view from the house or the garden room. The trees and shrubs which eventually superseded the feather-reed grass now frame the sweep of Indian grass beyond, which is sidelit or backlit almost all day long as the sun arcs across our landscape from east (left) to west (right).



RIGHT Grasses have a new place in this part of the garden. On the south side of the wooded wall, Indian grass, *Sorghastrum nutans*, flowers in mass in late summer in a space originally covered with mowed cool-season turfgrass. The Indian grass was established by repeatedly broadcasting seeds collected from plants growing along local roadsides.

BELOW Autumn foliage color was especially good in 2005, and though the garden grows increasingly wooded, the space on the south side is deliberately protected as sunny habitat for grasses, which now include both Indian grass and the slightly more shade-tolerant switchgrass, *Panicum virgatum*.



THE NORTH EDGE of the property directly abuts the public road and is partly screened by a diverse mix of deciduous trees and shrubs plus a few white pines, *Pinus strobus*, and red cedars, *Juniperus virginiana*. A turfed path wide enough to permit vehicular access to the rear of the property must be maintained between this screen planting and the house. Because of this, the south-facing edge of this planting will remain mostly sunny, providing ideal conditions for many grasses. This edge can be viewed from the front door and from the windows of multiple rooms in the house, so year-round interest is a primary design goal. The edge is planted with grasses mingled with woody shrubs and flowering forbs. Most species are of eastern North American origin, but some are from eastern Asia. The design ethic is that, native or not, all plants must be able to thrive without supplemental water or fertilizer, herbicides, or pesticides, and the entire ensemble must be in sync with the seasonal colors and rhythms of the regional landscape.

TWO HELICOPTER VIEWS illustrate the layout of the front garden and its relation to the house.

TOP The ridgeline of the house runs east to west (top to bottom) and the driveway is at the top of the photo. In early November, despite falling leaves, the public road (running diagonally, upper left) is still largely screened by mixed plantings. The south-facing edge includes many grasses.

BOTTOM The garden is mostly green in late May, in sync with the surrounding regional landscape.





ABOVE Mid July is typically a low ebb of flowering interest; however, since this design is intended to provide all-season interest, textural interplay is often paramount when flowers are absent. The sharply vertical form of switchgrass, *Panicum virgatum* 'Northwind', and the rounded basal foliage of Lindheimer's muhly grass, *Muhlenbergia lindheimeri*, are visually distinct from the textures of companion plants aromatic aster, *Aster oblongifolius*; threadleaf bluestar, *Amsonia hubrichtii*; Joe-pye-weed, *Eupatorium dubium*; and in the background, cutleaf smooth sumac, *Rhus glabra* 'Laciniata'; winged sumac, *Rhus copallina*; Korean spicebush, *Lindera glauca* var. *salicifolia*; and river birch, *Betula nigra*.





OPPOSITE BOTTOM Grown from locally collected seed, this Joe-pye-weed, *Eupatorium dubium*, might win in a butterfly contest with butterfly bush, *Buddleja*. It is early August and the 'Northwind' switchgrass (at right) continues to provide textural contrast with the swallowtail and bee-laden *Eupatorium*.

LEFT Switchgrass cultivars (*Panicum virgatum* 'Northwind', 'Cloud Nine', and 'Dallas Blues') and a couple of unnamed seedlings are blooming in mid September, in time to catch the increasingly low-angled sunlight of approaching autumn.

BELOW Texture still matters, but color interest is at peak in October-November, with warm hues of spicebush, sumac, and blue-star set off by the asters' purple-blue and the grasses' yellow and gold.





ABOVE *Panicum virgatum* 'Dallas Blues' erupts in volcanic fashion from *Aster oblongifolius* 'Raydon's Favorite'. RIGHT *Acer trifolium*, a trifoliolate maple from eastern Asia, is a ball of fire in late October, framing the front door view north to the grassy edge. Although the road is just beyond, the naturalism and diversity of these plantings give the impression of more wildness than is actually present in this section of suburbia. From the standpoint of suburban habitat, such dense plantings do actually provide important cover and sustenance for local fauna.

RIGHT December's colors are relatively muted but still of interest as tawny grasses remain standing through a chocolate carpet of asters, with spicebush holding on to its salmon-colored foliage in background.



THE POND GARDEN and meadow at the Mount Cuba Center, in Greenville, Delaware, provide an exquisite example of the grace and drama possible in a choreographed transition between field and forest. Dedicated to the study of the Piedmont flora, Mount Cuba has its extraordinarily flower-filled moments, yet the garden's visual play of green architecture and grassy elements is no less powerful.

Mount Cuba was once farmed, and its meadow is part of the land's agricultural legacy. Under the direction of the garden's founder, Pamela Copeland, and her professional staff, the meadow has undergone a transformation from a happenstantial "old field," sparsely vegetated with some of the local warm-season grasses, including little bluestem, *Schizachyrium scoparium*, and broom-sedge, *Andropogon virginicus*, to a deliberate meadow garden with these grasses plus Indian grass, *Sorghastrum nutans*, and a mix of flowering forbs. Flowering dogwoods, *Cornus florida*, both naturally seeded and planted are scattered over the meadow's expanse.

TOP This early May aerial photo explains the relationship between meadow and the lower pond garden, which is enveloped in woods (at right). A low, enclosed, shaded space under a soaring roof of nearly 100-foot (61-m) tall tulip-poplars, *Liriodendron tulipifera*; beeches, *Fagus grandifolia*; hickories; and oaks, the pond garden is the near opposite of the sun-filled, open-to-the-sky meadow. Both the pond and meadow are encircled by perimeter paths which meet at a clearing of the wooded edge separating the two.

BOTTOM Dogwoods are in full bloom in this late-April view from the lower pond to the meadow. The tree canopy is not yet fully leafed out, and the light differential between the pond and meadow spaces is still increasing. The meadow's warm-season grasses are just waking up to growth and are barely green.





ABOVE The grasses gain their stride over summer, and by early September they are full and luminous in the sunny meadow. Framed by the forest opening, the meadow's luminosity is accentuated by the pond garden's relatively low light.

RIGHT An overcast October day reveals the warming colors of the grasses, especially that of Indian grass at the higher elevations.





ABOVE LEFT By October's end the grasses' tawny tones are joined by the autumn red and bronze of dogwoods, and by the blue flowers of heart-leaved asters, *Aster cordifolius*, at the edge.
RIGHT The view from within one of the meadow dogwoods.

LEFT November is witness to the most dramatic transition in color and light values, as beeches add amber and gold to the composition and sunlight again fills both meadow and pond gardens.



ABOVE The meadow grasses are the most colorful elements in the winter landscape, as evident in this early March photo of a late snow cover.

RIGHT Imagine this image without the grasses: the delicate snow-tracing of dogwood branches would be lost against more forest, but is dramatically enhanced by the tawny tones of grasses.



GRASSY PATHS & PLACES

Pathways are often the most continuously changing elements in truly dynamic landscapes. Fundamental routes may remain the same, but new paths must evolve along with new or modified destinations. Paths are essentially utilitarian, but good design can transform them into some of the most enjoyable linear experiences within a landscape or garden. The ordered linearity, movement, and luminous dynamics of grasses make them superbly suited for wayfinding functions, and they can also contribute to spacemaking by providing quick and semipermanent enclosures.

This mid-July view looks back toward the house from the cabin space, through the newly opened path in the planted hedge-row. Eminently suited to the dry conditions caused by extensive tree roots, wild-oat, *Chasmanthium latifolium*, flanks the passage.



MOTIVATED BY THE DESIRE for a quiet place for conversation and contemplation in all weather but away from modern conveniences and inconveniences such as phones and messages, my wife and I built a tiny cabin at the far corner of

the garden. Equipped with wood stove and oil lamp but lacking electricity, it is a highly contrived but effective bit of rusticity that we can walk to and from. It sits between an authentic hedgerow and another

we've planted. The most sensible path from the house to the cabin is through the planted row, and I've used grasses to define this passage and to serve as a subtle cue to the diminishing formality ahead.



ABOVE Spikelets of wild-oat turn tawny by mid October, skirted by white wood aster, *Aster divaricatus*, and the reddening fall foliage of self-sown sassafras, *Sassafras albidum*.

RIGHT Sidelit by the early November sun, the grasses are like signs indicating the pass-through to the little cabin.





ABOVE Still standing sturdily in early January, the luminous grasses are visible from the main house, serving as an intriguing reminder that the garden is alive with interest and opportunity even during the coldest, most quiet of seasons.

LEFT A 2-foot (60-cm) snowfall fails to flatten the wild-oat, which continues to mark the passage through the planted hedgerow.

RIGHT Gardeners who live in areas with white-tailed deer know that deer will eat almost anything if they are hungry enough; however, grasses are among the few exceptions to this rule. Grasses can be of further use in reducing deer damage if they are employed as buffers for other more vulnerable plants. Deer tend to be habitual in their routes, and when presented with the choice of walking through high grasses or around them, they typically take the literal path of least resistance. The east edge of the cabin space adjoins a field which has been a deer path for many years. Dense barrier plantings of switchgrass, *Panicum virgatum*, have proved effective in dissuading the deer from nibbling on red cedars that help define the cabin space. The deer are now inclined to walk on by.

BELOW A simple path mown through high grasses can be one of the most intensely luminous experiences in any landscape. Photographed in late May, this path through a hayfield runs past our property across community open space, eventually connecting with the forested White Clay Creek Preserve.





MUCH MORE FORMAL than a mown path through a hayfield but no less luminous is this wild-oat-lined walkway down the center of the main parking lot at Longwood Gardens in Pennsylvania. Longwood has always sought to make the garden experience begin as visitors arrive and exit their vehicles. The wild-oat, *Chasmanthium latifolium*, is tough enough to withstand the shady, dry, seasonally hot conditions in the parking lot with a minimum of care.

ABOVE Wild-oat offers a radiant experience for Longwood Gardens visitors in early June.

RIGHT The durable grasses are still effective in December.





ABOVE Little bluestem, *Schizachyrium scoparium*, contributes a loose grace and sense of separation from the road to this public pathway in Sudbury, Massachusetts, in late September. This grass is also exceptionally drought-tolerant and well-suited to sunny urban conditions.

RIGHT Tussock sedge, *Carex stricta*, provides a softly guiding edge along a rough-hewn stone path in a private garden in New York State.



GRASSES ARE ESSENTIAL to the spatial organization of the Toronto Music Garden, designed by Julie Messervy in collaboration with Toronto's Parks and Recreation Department. Built on land reclaimed from industrial dereliction, this waterfront park is a landscape interpretation of Johann Sebastian Bach's First Suite for Unaccompanied Cello, with curving, swirling, undulating paths expressing the spirit of the Suite's various movements.

ABOVE Karl Foerster's feather-reed grass, *Calamagrostis xacutiflora* 'Karl Foerster' (foreground), is employed with *Miscanthus sinensis* and fountain grasses, *Pennisetum alopecuroides*, to enclose spaces within the park.

RIGHT Switchgrass, *Panicum virgatum*, is as effective as stone or masonry in defining the park's pathways.





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LIKE MANY PROJECTS in public gardens and parks, the Terrace Garden at the Delaware Center for Horticulture was completed in increments as funding became available. These three photographs illustrate the roles grasses have played over a seven-year period in the maturation of the garden.

TOP The initial phase of the Rodney Robinson Landscape Architects design for the Terrace Garden made extensive use of found objects and recycled materials to create the landscape's organizing hardscape, as shown in this 1997 photo. The granite pavers were unearthed during renovation of the property, which had once included a city street. The millstone was also discovered during excavation for the Center's buildings. The lampposts, installed in the garden as storied sculptural elements, were originally part of the lighting system for the adjacent Brandywine Park.

BOTTOM As an interim step, *Miscanthus sinensis* 'Morning Light' was planted in a half circle to create a near-instant garden room. The ground it was planted in was so compacted from the building construction process that a pickaxe was necessary to create planting holes for the grasses. The vigor of the miscanthus in this 1999 photo attests to its durable nature.





The miscanthus was eventually removed as additional funding allowed for the completion of the garden's plan, which includes other artifacts from the city's history recycled as garden benches and planters. The completed garden, shown here in August 2004, employs more than a dozen grasses, sedges, and rushes in its design.



RIGHT Drought-tolerant, long-lived *Festuca glauca* 'Siskiyou Blue' defines a casual pathway in a private garden in sunny San Luis Obispo, California, in early April.

BELOW Prairie dropseed, *Sporobolus heterolepis*, is a softening, unifying element in this path system at Chanticleer in Wayne, Pennsylvania.



SHADE STRATEGIES

Pathways through shaded spaces or spaces that are becoming shaded require a different palette of grasses. True grasses that will bloom in deep shade are limited in number, so as available light diminishes, look increasingly to sedges for design solutions.



LEFT California fescue, *Festuca californica*, is, like wild-oat, *Chasmanthium latifolium*, among the few true grasses (*Poaceae*) that will bloom significantly in shade as well as in sun. In this early April photo at the University of California Botanical Garden, Berkeley, California fescue begins flowering along a path shaded by big-leaf maple, *Acer macrophyllum*.

BELOW LEFT Eastern North American plume-grasses, including this giant plume-grass, *Saccharum giganteum*, will typically flower even in shade conditions. This September view is from a raised boardwalk in the Norfolk Botanical Garden's Virginia Native Plant Garden, which displays historic plant communities of tidewater and southeastern Virginia. RIGHT Softly textured masses of flowering tufted hair grass, *Deschampsia cespitosa*, flow from the edge of a pathway at the Chicago Botanic Garden in early June. Both *D. cespitosa* and crinkled hair grass, *D. flexuosa*, bloom well in light shade.





THE PATH FROM THE DRIVEWAY to the often-used rear door of the house where my wife and I live was in full sun when I began making the garden but is now increasingly, pleasingly enclosed and shaded by deciduous trees and shrubs. This walk relates to the rear garden, which in turn relates to the adjacent preserve, and because of this, the theme of this walk is mostly local in palette and pattern. Two years ago we removed an unnecessary egress from the bluestone walk, extending the woodland path border approximately 15 feet (4.5 m) into area formerly occupied by lawn. Local sedges are important elements in the new planting.

TOP As the garden has matured and its routes have evolved, this opening from the rear path became superfluous. Increasing shade and root competition were making it unsuited to turf, particularly the unwatered, unfertilized, unthatched, generally unpampered turf that is the only type we tolerate. In March of the following year, the turf was removed mechanically (without herbicides), soil from our garden compost was added to bring the area to level, and new plantings were installed.



BOTTOM By May the gap has been closed and the ground covered with a mix of local forbs, ferns, and sedges, including *Carex flaccosperma*, *C. laxiculmis*, *C. albicans*, and *C. appalachica*.



ABOVE This combination of woodland stonecrop, *Sedum ternatum*; Christmas fern, *Polystichum acrostichoides*; white wood aster, *Aster divaricatus*; and blue woodland sedge, *Carex flaccosperma*, has proved durably shade-tolerant and drought-tolerant.

RIGHT Blue woodland sedge is particularly blue by mid September, when it is enhanced by the flowering of the wood asters. The bamboo rail is a temporary device functioning as a “path closed” sign for the resident golden retriever.

TOP RIGHT Wild-oat, *Chasmanthium latifolium*, leans over the bluestone into the early September sun, providing a welcome display for anyone walking westward, which is the direction of any returning resident or guest. This common grass has been a fixture along the walk since it was first planted nearly fifteen years ago. It is an oft-repeated element in our garden, having proved itself completely adapted to our conditions and management. It self-sows gently, but is never a nuisance because we don’t irrigate the garden except in rare, extended droughts. Despite its native status in eastern North America, this tough grass can be quite an opportunist in naturally moist or artificially irrigated landscapes.





TOP LEFT The repetitive experience of necessary paths can be an extremely rewarding one for observant eyes. In late August, wild-oat nestles its kelly-green spikelets against the exfoliating bark of river birch, *Betula nigra* 'Heritage', along the walk. RIGHT By early October the wild-oat spikelets are translucent amber.

BOTTOM LEFT *Disarticulation* is the botanical term for the coming apart of grass spikelets. The spikelets of wild-oat begin disarticulating by late November; however, they and their shadows are no less intriguing. RIGHT Mid November brings high color to trees and shrubs bordering the walk, and as deciduous herbaceous plants in the ground layer recede, the evergreen foliage of *Carex flaccosperma* and the ferns becomes increasingly evident.

UNLIKE OUR REAR WALK which is regionally themed, the front walk is an eclectic mix of eastern North America, eastern Asia, and a little bit of eastern Europe. Situated on the north side of the house and consistently moist in the shadows, it requires a different plant palette.

RIGHT In early May the walk is a restful study in green. BOTTOM Limited sunlight returns to the walk in November as deciduous trees and shrubs turn color and drop their leaves. The foliage of the grasses and sedges eventually dries with dormancy, but typically remains evident and subtly attractive through winter.

BELOW The variegated creeping broad-leafed sedge, *Carex siderosticha* 'Variegata', represents a species found in mountain woods in Japan. It is well adapted to conditions along the walk and we also value it as a reminder of hikes in Japanese woodlands. The variegated foliage, well-developed in this late-May photo, brightens the shady front walk.





Though Bowles' golden sedge, *Carex elata* 'Aurea', is derived from a species native to wet habitats in northern and eastern Europe, it has persisted without irrigation for a decade in the moist shade provided by the north wall of the house. Its joyful yellow-green is especially vibrant in spring, as illustrated by this late-May photo, and gradually darkens over summer. To its right is a white-variegated Hakone grass, *Hakonechloa macra* 'Albovariegata', which was selected from a species native to wet, rocky cliffs in Japan's Hakone mountains. Its foliage starts the season green with thin yellow stripes that turn ivory white over the summer. Other companion plants include *Ajuga*, *Athyrium nipponicum*, *Bergenia*, *Ceratostigma*, *Rodgersia*, and *Pachysandra procumbens*.

The Mix and the Matrix

Grasses may be parts of the overall planting mix, or they may be, as they once were in many historic grasslands, the fundamental matrix into which everything else is set. In either case, the effective integration of grasses into designs for livable landscapes requires understanding of fundamental strategies for working with light, line, texture, form, color, sweep, scale, and available moisture.

WORKING WITH LIGHT

Capturing the inherent translucency and luminous potential of grasses requires an awareness of the direction, strength, and periodicity of sunlight in

the landscape. Backlighting and sidelighting are most dramatic, and even relatively shady places offer moments when sunstreams can work magic. For any of this to be effective, the positions of grasses must be matched both to the sun and to likely viewing patterns. For example, a path used most in morning light should have an easterly direction (in the Northern Hemisphere), or at least a section heading east, if it is to offer a glimpse of directly backlit grasses. A window facing south offers a potential view of grasses that are sidelit in morning and afternoon and backlit during midday. Luminous grasses are also most effective when positioned against opaque, dark-colored backgrounds. In many situations, shadows can serve the same background purpose.

Low-angled rays of the mid-November sun transform dry fountain grasses, *Pennisetum alopecuroides*, into a literal lightshow in the Blithewood Rose Garden on the Bard College Campus in Annandale-on-Hudson, New York. A few simple design features combine to create this effect. The view is almost unavoidable at sundown: as you crest the slope above the garden, the natural view is down to the sidelit walled garden. The translucent grasses are also positioned between two simple, dark-colored, opaque elements: the low evergreen hedge and the brick wall.



RIGHT The absolute opacity of a clipped yew in Beth Chatto's garden in Colchester, England, is the perfect foil for the radiant seedheads of giant feather grass, *Stipa gigantea*, in late July.

BELOW A continuous sweep of Mexican feather grass, *Nassella tenuissima*, is an inescapably glowing delight in this Southern California garden designed by Nancy Goslee Power.



WORKING WITH LINE

Quality of line is one of the grasses most-refined attributes, and as with use of the luminous quality of grasses, the use of line in design requires careful consideration of background, texture, sunlight, shadow, and contrast.

The graceful arching lines of this purple moor grass, *Molinia caerulea* 'Dauerstrahl', create the drama in this composition in a private garden by Hermann Müssel in Heigenhausen, Germany, in late August. Despite their common name, the purple moor grasses are mostly green, and the greatest

distinction between various cultivated varieties is in the line of their flowers and seed-heads. For example, 'Dauerstrahl' is typically arched, 'Strahlenquelle' is so lax its stems are sometimes nearly horizontal, and 'Moorhexe' is nearly vertical.





TWO VIEWS OF Peter's Pond at Longhouse Reserve in East Hampton, New York, illustrate the inspired use of the fine lines of *Miscanthus sinensis* to set off sculptural forms both linear and spherical.

TOP Color isn't entirely responsible for the drama in this combination of miscanthus and Dale Chihuly's glass sculpture. Despite the fact that both the grass and the sculpture are linear, the pendant curves of the grasses contrast effectively with the straight verticality of the glass rods.

BOTTOM The linearity of the grasses is completely distinct from that of Grace Knowlton's spheres, lotus leaves, and ripples on the surface of the pond.





THE DESIGN BY Oehme, van Sweden, and Associates for the gardens of the Great Basin at the Chicago Botanic Garden makes liberal use of Karl Foerster's feather-reed grass, *Calamagrostis xacutiflora* 'Karl Foerster', and for good reason: this widely adaptable, cold-hardy, noninvasive grass offers some of the most powerfully architectural linearity to be found among the grasses. At Chicago, it is especially effective in association with the graceful railings and bridges that connect to Evening Island.

ABOVE LEFT AND RIGHT The combined effects of grassy line and luminosity can rival the impact of any composition based on color. When evaluating the strength of composition, I often try to think in black and white, or as technology permits, to actually render the design in black and white. Compare these two images. Although the robin's-egg blue of the bridge and the tawny color of the grass are undoubtedly pleasing, this composition is still powerful with the color removed.

LEFT The lines of feather-reed grass are no less strong than the steel uprights of the railings.

WORKING WITH TEXTURE & FORM

Line, texture, and form are of course closely related, and perhaps the best feature of designs reliant upon these attributes is that their interest is generally of much longer duration than color-based designs. Although most grasses are linear in nature, their textures and forms run the gamut and provide limitless possibilities for durably effective compositions with other plants or with inorganic elements including stone, sculpture, and architecture.

RIGHT Forget the color. Here's another composition that would work in black and white. The vertical line and form of Karl Foerster's feather-reed grass, *Calamagrostis xacutiflora* 'Karl Foerster', are distinct from the horizontal ground line and the flat-topped flower clusters of orange butterfly-weed, *Asclepias tuberosa*. Photographed in late June at Chanticleer in Wayne, Pennsylvania.

BELOW LEFT This combination of blue fescue, *Festuca glauca* 'Elijah Blue', and lamb's-ear, *Stachys byzantina* 'Helene von Stein', illustrates the effectiveness of linear-lined, soft-textured grasses and broad-leaved, bold-textured companions. **RIGHT** The form and texture of weeping tussock grass, *Chionochloa flavicans*, are boldly complemented by the purple cabbage tree, *Cordyline australis* 'Purple Tower', in this late-August (winter) planting on South Island, New Zealand.





TOP LEFT Two architectural plants of complementary textures meet their match as Karl Foerster's feather-reed grass, *Calamagrostis xacutiflora* 'Karl Foerster', erupts from sea-holly, *Eryngium giganteum* 'Silver Ghost', in Piet Oudolf's borders at the Royal Horticultural Society's garden, Wisley, in Surrey, England, in mid July. BOTTOM In another example of Piet Oudolf's textural wizardry, yellow coneflower, *Echinacea paradoxa*, jumps out from a soft background of tufted hair grass, *Deschampsia cespitosa* 'Goldtau', also at Wisley in mid July.

BELOW Giant miscanthus, *Miscanthus x giganteus*, and *Ligularia dentata* wage a battle of bold textures on Friendship Island (Freundschaftsinsel) in Potsdam, Germany, in late August. This planting is part of the lovingly restored 15-acre (6-ha) park, which was originally laid out by Karl Foerster between 1938 and 1940 to display shrubs, perennials, ferns, and grasses.





OPPOSITE TOP LEFT In early April at the University of California Botanical Garden, Berkeley, an undetermined species of muhly grass, *Muhlenbergia*, is the textural opposite of various *Echinopsis* cactus species. RIGHT This Sea Garden planting at the entrance to the Ian Potter Foundation Children's Garden at the Royal Botanic Gardens, Melbourne, Australia, employs *Carex comans* 'Frosted Curls', *Asparagus densiflorus* 'Myersii', and *Muehlenbeckia complexa* trained on wire forms to create a textural fantasy sure to captivate young and old minds. Andrew Laidlaw designed the forms to resemble kelp, flowing with the current and pointing toward the main entrance gates.

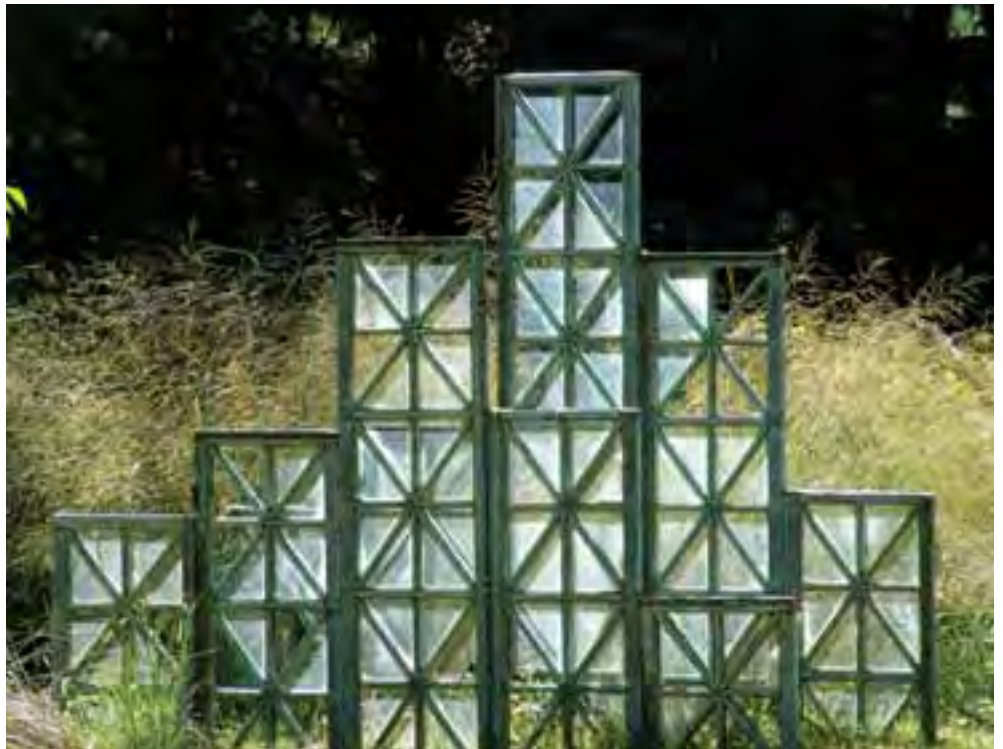
OPPOSITE BOTTOM LEFT The cascading form of silver spike grass, *Achnatherum calamagrostis* 'Lemperg', is a visually dynamic presence in late August between a paved walk and masonry pillars in this public space designed by Hans Simon in Marktheidenfeld, Germany. RIGHT Sculptural objects and artifacts can create textural drama with grasses while telling stories at the same time. Isobel Gabites's design of her garden in Otaki, New Zealand, nestles crucibles from old foundries with red tussock grass, *Chionochloa rubra*, and rengarenga lily, *Arthropodium cirrhatum*. Isobel sees a connection between the grass, which is prevalent on North Island, New Zealand's volcanic plateau, and the crucibles, which once spilled molten steel.

TOP RIGHT On a large scale, the form and texture of *Miscanthus sinensis* 'Gracillimus' humanize paved expanses and sharp-edged boulders in New York's Battery Park City in late June. BOTTOM Chairs handmade by the staff at Chanticleer in Wayne, Pennsylvania, are set off by the softly rounded forms of *Miscanthus sinensis* 'Morning Light' in mid September.





ABOVE The modest meadow area in my Pennsylvania garden is visible when looking south through a glass-walled room in the house, and on any clear day the grasses are illuminated from sunrise to sundown. Amid the grasses is a sculpture crafted from discarded sections of sash vents from the Longwood Gardens Main Conservatory that were replaced during restoration in the mid-1990s. The sash is constructed of old-growth cedar hand-sheathed in copper, with individual lights in groups of eight divided by cross muntins. I set the sash vertically, forming a ziggurat deliberately evoking the New York City skyscrapers I learned to love in my youth, and Melinda promptly named it Meadow Metropolis. This casual exercise has stood for a decade and along with the grasses functions as our sundial.





ABOVE The distinct line, form, texture, and luminous characteristics of the sash and *Panicum virgatum* 'Prairie Wind' combine for a good show in late September.

TWO PHOTOS TAKEN on the same day in late August illustrate the dramatic interplay of sunlight through switchgrasses, *Panicum virgatum*, and the remaining eighty-year-old acid-rain-etched glass in the Meadow Metropolis.

OPPOSITE BOTTOM 11:21 A.M.

LEFT 5:48 P.M.



There's very little luminous quality in a late 1930s Farmall F12 tractor, and that's the point here. The tractor provides the necessary opacity and framing for Indian grass, *Sorghastrum nutans*, and the turning leaves of cutleaf sumac, *Rhus glabra* 'Laciniata', in late October. After reading Leo Marx's *Machine in the Garden*, which ruminates on

America's contradictory passions for mythic wilderness and the convenience of machine technology, I resolved to put a machine in my garden. Forsaking a Buick, for practical reasons, I settled on a machine that functions as sculpture, or as a provocateur, asking questions such as, Was this part of Pennsylvania once farmed?

WORKING WITH COLOR

When casting for color, grasses are sometimes suited to play lead characters. More often they are best acting in support, and their nuanced performance of these roles is a credit to the entire ensemble. The gently varied greens of grass foliage are almost universally color-compatible and can be used alone for their restful effect or to provide a harmonizing background for more colorful flowering companions. Cool-blue grasses can serve similar purposes, or they may be used to reveal and enhance the foliage and flower colors of other plants. Yellow-leaved and red-leaved grasses, though few, can rival the color impact of flowering perennials and shrubs and may be treated as equals to flowers in color composition. This is also true of the many grasses that take on vivid autumn hues of gold, orange, red, and burgundy. Though not colorful in a technical sense, the white-variegated foliage of many cultivated grasses provides some of the boldest possible contrast with richly hued flowers and foliage. The silvery tones of grass flowers are essentially neutral and can add sparkle to a subtly colored planting or welcome respite in exceptionally color saturated compositions. The muted tones of dormant grasses superbly complement the winter colors of bark and lingering berries on trees and shrubs.

Primary and secondary colors in the foliage of little bluestem, *Schizachyrium scoparium* 'The Blues', complement the flowers of *Lobelia xgerardii* 'Vedrariensis' and *Perovskia atriplicifolia* 'Little Spire' in late August in Piet Oudolf's borders at the Royal Horticultural Society's garden, Wisley, in Surrey, England.



WE SO OFTEN PICTURE GARDENS only at their most exuberant moments; however, the quieter, season-to-season, day-in and day-out livability of our landscapes truly matters most. While photographing for this book, Melinda and I visited our friends Norio and Mitsuyo Ueda at their Tokyo home. We arrived on a dim, rainy day at the end of November, yet the garden was truly captivating. Themed in green and visible from the glass door of the guest bedroom, the small enclosed garden made it seem incredible that we were in fact in one of the most urban centers in the world.

The garden is in steady view from the Ueda's Tokyo town home guest room.





ABOVE Norio's design eschews lawn for a green mosaic that includes diminutive, narrow-leaved forms of *Miscanthus sinensis* along with multiple Japanese sedges.

LEFT Variegated *Carex oshimensis* 'Evergold' brightens the landscape even at the end of a rainy, late-November day.



RIGHT Light green globes of *Miscanthus sinensis* 'Variegatus' are a powerful presence among dark greens in late June at Ashland Hollow in northern Delaware.

BOTTOM RIGHT The intense, dark green of Cape rush, *Chondropetalum tectorum*, supports and accentuates the brightly colored flowers of *Leucospermum cordifolium* 'Yellow Bird', a pincushion protea originating, like the Cape rush, in South Africa. Photographed in late June at Leaning Pine Arboretum in San Luis Obispo, California.

ABOVE This color geometry relies only on the foliage of New Zealand natives *Festuca actae* (blue-green) and *Carex tenuiculmis* (bronze) at the Auckland Botanic Gardens in late August (winter).





MANY GRASSES UNDERGO remarkable color changes over the course of a growing year.

ABOVE In mid May, variegated Hakone grass, *Hakonechloa macra* 'Aureola', is a yellow-green highlight among Christmas fern, *Polystichum acrostichoides*; wild-ginger, *Asarum canadense*; threadleaf bluestar, *Amsornia hubrichtii*; and Korean spice viburnum, *Viburnum carlesii*, at the Delaware Center for Horticulture in Wilmington.

LEFT By mid November, the Hakone grass is amber, the bluestar is dark gold, the viburnum is burgundy, the ginger is going dormant, and the fern remains dark green.



FLOWERING BULBS ARE OFTEN ideal color companions for grasses, since the majority of bulbs flower when grasses are in leaf, and many grasses flower when bulbs are dormant. The mutual drought tolerance of many bulbs and grasses also suits them for combined planting. Two views of a slope at Longwood Gardens in Pennsylvania show the spring sequence of interplanted bulbs and grasses.

TOP Larger daffodils are at their peak in mid April. The foliage of cool-season grasses including blue moor grass, *Sesleria caerulea*, and Karl Foerster's feather-reed grass, *Calamagrostis x acutiflora* 'Karl Foerster', are already contributing to the composition, while warm-season grower prairie dropseed, *Sporobolus heterolepis*, is just breaking dormancy (lower left).

BOTTOM The flowering display of the bulbs is mostly finished by the first week of May, except for later types such as the triandrus hybrid miniature daffodil *Narcissus* 'Hawera', blooming between clumps of prairie dropseed (at bottom). The foliage of the larger daffodils, which would normally become increasingly unsightly as the bulbs go dormant, is already attractively cloaked by grasses.





ABOVE Later-blooming bulbs can be used to introduce flowering interest in the period before warm-season grasses bloom. In early June, flowering onion, *Allium christophii*, and poppies enliven a path at the Chicago Botanic Garden lined with switchgrass, *Panicum virgatum* 'Dallas Blues', and Russian sage, *Perovskia atriplicifolia*.

LEFT Detail of *Panicum virgatum* 'Dallas Blues' and *Allium christophii*.



TOP LEFT The sharp blue of *Elymus magelanicus* is an equal partner in Christopher Lloyd's exuberant color scheme at Great Dixter, in Northiam, England, in late July 2005.



TOP RIGHT My wife and I have enjoyed the color match of flowering purple muhly grass, *Muhlenbergia capillaris*, and the autumn foliage of flowering dogwood, *Cornus florida*, in our own Pennsylvania garden in early October.



RIGHT This early August color composition at North Creek Nurseries in Landenberg, Pennsylvania, would be less effective without the neutral band of side-oats grama, *Bouteloua curtipendula*, flowering between golden *Rudbeckia nitida* and purple *Vernonia noveboracensis*.

LEVELS OF FORMALITY & CONTROL

Despite their inherently casual nature, grasses have been welcomed into gardens at all levels of formality and control. At one end of the design spectrum they may be placed in set positions to reinforce immutable geometry, and at the other they are planted or sown and allowed to migrate toward the most hospitable niches.

Umbrella sedge, *Cyperus alternifolius*, skirts the brick pillars of the formal lily pond garden at El Encanto in Santa Barbara, California. This historic hotel has for decades maintained the charm of old-world Hollywood, with continuous gardens conjuring up the image of a lush tropical paradise.





TOP The walled Victorian Garden at Lauritzen Gardens in Omaha, Nebraska, is a modern iteration of a nineteenth-century design, with *Pennisetum setaceum* 'Rubrum' reinforcing the masonry's formal geometry and papyrus, *Cyperus papyrus*, displayed in a container at the center of the pool. An intriguing modern twist is the extensive use of architectural elements salvaged from historic Omaha buildings.

BOTTOM Though the masonry and yew hedges of the Sunk Garden at Great Dixter in Northiam, England, are of formal design, Christopher Lloyd's plantings, which make imaginative use of grasses, are highly informal. Visible in this late-July view are Karl Foerster's feather-reed grass, *Calamagrostis xacutiflora* 'Karl Foerster' (left foreground); *Miscanthus sinensis* (far center); and pale galingale, *Cyperus eragrostis*, a green sedge which is allowed to seed freely among carpets of the red-seeded *Acaena novae-zealandiae*.



SWEEP & SCALE

When the scale of a landscape allows, grasses in great sweeps and masses can be extraordinarily powerful elements in design; however, it is quite possible to miniaturize this effect with surprising success. Many years ago friends of mine planted a curving drift of feather-reed grass in their Pennsylvania garden, viewable from the kitchen window. Although the entire gesture was perhaps only 10 feet (3 m) wide, it evoked the prairie, or perhaps dune grasses on a remote beach.

Scale and levels of control are also closely related. In large landscapes, planting grasses from seed without precise order is often the most practical way of introducing the power of a grassy matrix with minimal effort and subsequent maintenance. When space is limited or the design more formal, deliberate positioning of grasses and routine management of the balance of grasses and companion plantings may be justified.

Colorful sweeps of *Tridens flavus* flank the long gravel drive in the Barton garden in Landenberg, Pennsylvania, in a fine example of achieving maximum results with a minimum of well-directed control. The purpletop is self-sown, establishing itself in the sunny edges of the drive as the Bartons reduced regular mowing and adopted a semiannual schedule that prevents woody regrowth but favors this purple-flowered perennial grass.





HANS SIMON'S "prairie" at the Berggarten in Hanover, Germany, makes extensive use of North American prairie species and is a deliberate reference to the historic prairie, yet it also integrates a number of European and Asian species that fit the "look" of a prairie and are adapted to the conditions in urban Hanover.

LEFT TOP Viewed from the roof of the Rain Garden in late August, Hans Simon's "prairie" garden inserts a great sweep of grasses and broad-leaved flowering companions to the Berggarten. Bordered and bisected by pathways, it is a wonderful respite from the vast formality of the adjacent Herrenhausen gardens. BOTTOM North American prairie grass species *Panicum virgatum* and *Sorghastrum nutans* mingle with flowering broad-leaved species of *Echinacea*, *Liatris*, *Ratibida*, *Aster*, and others, also of North American origin.

BELOW *Calamagrostis brachytricha* from Korea and *Sesleria autumnalis* from eastern Europe mix with North American *Helenium* and *Silphium* species at the Berggarten in a durably eclectic mix that is evocative of the prairie but is in no way a literal recreation. Though forbs were present in the historic North American prairie, they were rarely as prevalent as they are in plantings such as this one or others at the Royal Horticultural Society's garden, Wisley, in Surrey, England, or in Chicago's Millennium Park.





ABOVE Piet Oudolf's broad sweep of tufted hair grass, *Deschampsia cespitosa* 'Goldtau', at the Royal Horticultural Society's garden, Wisley, in Surrey, England, strongly evokes the wild abandon of native grasslands, yet it is in fact an element in highly ordered garden artistry. The durability of the pattern and balance of grasses and their companions here results from Piet's informed selection of long-lived, locally adapted plants. The mix is entirely eclectic.

RIGHT Dave Fross's sweep of purple three-awn, *Aristida purpurea*, in the Morgridge garden in San Luis Obispo, California, is simpler and much more rooted in place than the eclectic "prairie" garden. Purple three-awn is an essential and historic element in California's coastal grasslands, and is superbly suited for livable landscapes at all scales designed to be sustainable within the limits of the region's soil, sun, and rainfall.





SOMETIMES THE MOST SUBTLE gestures tell the surest story of grasses in the regional landscape. Purpletop, *Tridens flavus*, gets its name from the purple cover it puts on eastern old fields and meadows in late summer. Winterthur Museum, Gardens, and Library occupy nearly 2000 acres (ca. 800 ha) on the rolling piedmont of northern Delaware, and the natural landforms rival any garden artifice. Though Winterthur is renowned for its Robinsonian woodland gardens, it was once a working farm with dairy herds and a train station, and founder Henry Francis du Pont envisioned the peripheral grounds to be an essential part of the garden. This management ethic is still alive today and is evident in these late-summer photographs, when due to selective mowing, Winterthur's far hills and slopes are dusted purple by *T. flavus*.

TOP Clear blue skies, puffy white clouds, and hillsides of purpletop are quintessential components of a late-summer day in northern Delaware. Winterthur's carefully managed mowing is responsible for the thriving *Tridens flavus*, which is a locally native species adapted to sunny meadow conditions.



BOTTOM *Tridens flavus* highlights Winterthur's rolling landforms along the road to the historic railroad station where milk from Winterthur's dairy was once shipped.

LANDSCAPES WET & DRY

The extraordinary diversity of grasses and their relatives includes species suited for almost any conceivable moisture level. The most conserving approach to their use is of course to first take stock of available moisture and then select appropriately adapted species. Wetland species can contribute powerfully to both the visual appeal and stability of moist landscapes. Dryland species can be similarly soil-conserving, while eking out unusual beauty from landscapes that are literally or ethically beyond the reach of a watering hose.

The green architecture of narrow-leaved cattail, *Typha angustifolia*, complements an urban fountain in New York's Battery Park City. Even the most formal garden can point to fundamental ecological connections, and anyone intrigued by the beauty of this local species in this fountain habitat is more likely to notice the roles *T. angustifolia* plays in New York's Hudson River watershed environment.





LEFT Though masterful in its textural and color artistry, Beth Chatto's composition in which she positions *Carex elata* 'Aurea' at the edge of a natural pond in her garden in Colchester, England, also mimics the habitat preference of this European sedge species. Its companions, *Gunnera*, *Pontederia*, *Nymphaea*, and *Taxodium*, are from different parts of the world but share a habitat preference for wet edges.

BELOW The deft use of line and form in this design at the Auckland Botanic Gardens succeeds from a purely decorative standpoint; however, the display also illustrates the merits and habitat preference of New Zealand native rush, *Juncus kraussii*, which deserves greater attention in gardens and conserved landscapes.



RIGHT Although it is so authentic in detail as to appear as local habitat, this waterfall and pond garden on private property in New York State is almost entirely crafted. The garden's design intent is to embrace the beauty of eastern North American plants in habitat associations, such as this planting dominated by wet-edge species including tussock sedge, *Carex stricta*, and cinnamon fern, *Osmunda claytoniana*.

BELOW Tussock sedge, *Carex stricta*, and Joe-pye-weed, *Eupatorium fistulosum*, are natural companions along the edge of this rocky stream within the Edmund Niles Huyck Preserve and Biological Research Station in Rensselaerville, New York. Neither species was deliberately planted, but both come under Preserve management, which is dedicated to protecting the natural beauty, ecological health, and local ecological diversity of the Lake Myosotis watershed, including surrounding lands and waters.





DURING THE GARDENS of the Great Basin project, lake edges of the Chicago Botanic Garden were re-engineered and replanted with an appropriately adapted plant palette which contributes to the landscape's long-term health and beauty.

This approach is both beautifully and supremely more sustainable than the sterile steel-edged or turfgrass-edged eroding banks that have traditionally been common in many public parks and gardens.



OPPOSITE A diverse mix of grasses, sedges, and rushes, including *Panicum virgatum*, *Juncus effusus*, and *Schoenoplectus tabernaemontani*, holds the banks and helps filter the waters.

LEFT In early June, a lake edge is stabilized by the green tussock sedge, *Carex stricta*, at the wettest margin and by the blue-green growth of switchgrass cultivars *Panicum virgatum* 'Dallas Blues' and 'Cloud Nine'.

BELOW By early October, the flowering switchgrasses tumble gracefully over the sloping edge.





ABOVE Grasses offer myriad opportunities for attractively vegetating the most challenging, dry conditions without the need for supplemental irrigation. For those of us who believe the growth of sustainable gardens is a good thing and who also appreciate the global need for water conservation, grasses are essential tools. The suitability of grasses for dry conditions can often be easily observed by examining local habitats, both undisturbed and disturbed. For example, little bluestem, *Schizachyrium scoparium*, is a prairie species that ranges through some very dry natural habitats, and it also frequently establishes itself in droughty, low-nutrient conditions in built environments. This parking lot island planting of little bluestem at the Adkins Arboretum in Ridgely, Maryland, makes use of this local grass's adaptability.





OPPOSITE BOTTOM Sustainable dry gardens needn't be regional in theme or palette. Beth Chatto's gravel garden assembles a world mix that can thrive in the driest conditions on her site in Colchester, England, without irrigation, as typified by this late-July grouping of *Poa labillardieri*, a blue grass from Australia and New Zealand, with *Bergenia*, *Origanum*, and *Stachys*.

TOP LEFT *Nassella tenuissima* wends its way through wine cups, *Callirhoë involu-crata*; orange butterfly milkweed, *Asclepias tuberosa*; and lavenders on the Sun Steps at Chanticleer in Wayne, Pennsylvania. Though rainfall regularly exceeds 40 inches (102 cm) annually in this part of the state, water conservation is still a worthy goal. This rap-turous, unirrigated garden proves style and conservation needn't be mutually exclusive. RIGHT Purple three-awn, *Aristida purpurea*, mostly dormant in early April, covers the ground around prickly pear cactus, *Opuntia phaeacantha*, in an arid California native section of the University of California Botanical Garden, Berkeley.

LEFT Mexican feather grass, *Nassella tenuis-sima*, joins fountain grasses from arid Africa and a diverse mix of southwestern North American cacti and succulents in a water-wise garden at the San Luis Obispo County Office in California.

Covering the Ground

It's time for heavily irrigated cool-season turf to be replaced by better models of grass plantings to cover the ground. Though walkable turfgrasses are not generally within the scope of this book, there are many grasses and sedges, both running and clumping, that can cover ground with great beauty and utility. This group deserves mention here.



Although not walkable like a cool-season turfgrass lawn, *Sporobolus heterolepis* creates a highly attractive lawnlike effect at Chanticleer in Wayne, Pennsylvania, in mid June, without the constant watering and associated maintenance of traditional lawn.



Blue fescue, *Festuca glauca* 'Elijah Blue', attractively carpets a parking lot island at the Chicago Botanic Garden in early June. Though the clump-forming blue fescues in the *F. glauca* complex have one of the longest traditions of use as groundcovers, they are not ideal choices for the long term because they tend to die out at the center after

a few years and therefore require relatively frequent renewal. Good drainage, especially in winter, can lengthen the service life of such plantings, but ultimately it is worth considering different, longer-lived grasses if clump-forming species are to be used for groundcover.



PRAIRIE DROPSEED, *Sporobolus heterolepis*, is a good example of a clump-forming grass that is so long lived and durable as to be practical for semipermanent ground-cover use. A planting between the parking lot and the public road at the Delaware Center for Horticulture in Wilmington demonstrates this grass's effectiveness in covering a dry, nutrient-poor, unirrigated slope.

ABOVE In early June prairie dropseed is neat and lush. Originally established with individual plants, this planting benefits from the persistent health of the initial clumps and additional, self-sown plants that have come up in between.

RIGHT The same planting in mid November is mostly dormant but still attractive, especially as a color counterpart to the autumn foliage of deciduous shrubs including *Fothergilla gardenii*.



RIGHT Rosa Finsley's entry design for the Lone Star Ranch in eastern Texas employs buffalo grass, *Buchloe dactyloides*, as groundcover. This exceptionally heat-tolerant and drought-tolerant species hails from the Great Plains region of North America, and its stoloniferous growth creates a self-repairing groundcover that can withstand a considerable amount of foot traffic.

BELOW Autumn moor grass, *Sesleria autumnalis*, creates an attractively durable groundcover at the Ega Exhibition Park in Erfurt, Germany, in late August. Many *Sesleria* species, although clump-formers by nature, are drought-tolerant and long-lived, and make fine choices for long-term groundcover.





Taller clump-forming grasses with persistent basal foliage can also be practical groundcover choices, as illustrated by these late August (winter) photos of a slope at the Parliament Building in Wellington, New Zealand, planted with green-leaved tussock, *Chionochloa flavicans*.



OPPOSITE TOP LEFT Many sedges are suitable groundcovers, with various species suited to anything from sunny and dry to moist and shady. New Zealand orange sedge, *Carex testacea*, used here to flank steps in a private garden in Peka Peka, is so durable it is frequently used to cover traffic islands in New Zealand. RIGHT Variegated sedge, *Carex morrowii* 'Ice Dance', makes a bright, attractive groundcover at the Ega Exhibition Park in Erfurt, Germany, in late August. This cultivar is especially suited for groundcover use since it spreads steadily but manageably, filling in holes that may appear in a planting.

OPPOSITE BOTTOM Of European origin, greater wood rush, including the variegated selection *Luzula sylvatica* 'Marginata', is a vigorously durable option for low groundcover in both moist and shady conditions. This early May photo in the author's Pennsylvania garden shows a planting under a spreading apple tree that has remained full and attractive for more than a decade with no irrigation or care beyond an annual spring combing out of the oldest foliage.

RIGHT Clifford Miller's inspired use of Pennsylvania sedge, *Carex pennsylvanica*, in a Chicago-area garden originally designed by Jens Jensen demonstrates the suitability of this slow-spreading sedge for use as a low groundcover under the shade of deciduous woods.



BELOW Container-grown papyrus, *Cyperus papyrus*, growing at Chanticleer in Wayne, Pennsylvania, in late June illustrates the effectiveness of combining other plants in the same container to provide complementary color and textural interest.

BELOW RIGHT Blue wheatgrass, *Elymus magellanicus*, joins a host of other drought-tolerant plants in this container collection at Beth Chatto's garden in Colchester, England, in late July.

Grasses in Containers

With imagination, most grasses can be grown and displayed in pots and other decorative containers. Cultivating grasses in containers can eliminate the limitations imposed by stubborn soils, cold winters, or hot summers. Soil for plants grown in pots can be modified to suit the most particular species. Many grasses with multiple-season interest are sufficiently cold hardy to be left outdoors in containers over winter. Truly tender grasses can be grown indoors in warm seasons and held in cold frames or warm storage over winter, while alpine species can be moved to protection from summer heat and humidity. Drought-tolerant grasses can reduce the watering that is typically necessary for container-grown plants, although since grasses rather quickly produce vo-



luminous root systems, it is necessary to guard against their becoming pot-bound and constantly thirsty.

Massive grasses will require large planters if they are to attain anything close to full size, but this needn't be the goal. Many of the largest grasses look good as small specimens, and this is especially true for variegated-leaf cultivars.

The enduring foliage colors of grasses suggest myriad combinations with the variously hued clays and ceramic glazes found on antique and modern pots. Additional color and texture interplay is possible with containers fashioned from recycled objects and artifacts.

BELOW LEFT An adequately sized pot permits giant feather grass, *Stipa gigantea*, to reach flowering size at the Royal Horticultural Society's garden, Wisley, England, in mid July.

BELOW Photographed in early April, a container wall at the Ladybird Johnson Wildflower Center in Austin, Texas, provides a suitable year-round site for Mexican feather grass, *Nassella tenuissima*.



Why deny necessary infrastructure? Nearly all of us consume water from a faucet every day of our lives; however, if you ask people if they'd welcome a water tank in the "borrowed scenery" of their garden, most will say no. I prefer the approach taken at this Sancoa International corporate campus in southern New Jersey, which makes no attempt to hide or disguise the water tank, and instead integrates it visually into the landscape with a sweeping mass of switchgrass, *Panicum virgatum*, which is an immediately local native species. This view is from an outdoor cafeteria in mid September.

Collegial Landscapes: Grasses in the Public Realm

Looking beyond the proverbial garden border, what further roles may grasses play in our shared spaces: our parks, public gardens, corporate and college campuses, community open space, streetscapes, highways, byways, greenfields, and brownfields? Livable landscapes most often result from a collegial approach to their design and evolution, in which both authority and responsibility are shared among colleagues dedicated to continuous observation and the exploration of possibilities. This next section considers the roles and potential of grasses in a few selected landscapes created in this spirit.



WHEN THINKING ABOUT GRASSES and our modern shared landscape, there's perhaps no better place to begin than the parking lot. If parking lots are here to stay, then we might as well treat them as gardens. Grasses offer myriad solutions to the typical challenges of parking lot landscapes, since they can withstand compacted, nutrient-poor, droughty soils, winter winds, and summer heat intensified by reflection from paved surfaces.

TOP A parking lot on the Bard College campus in Annandale-on-Hudson, New York, demonstrates the appealing practicality of a mixed planting of local and exotic species that includes *Miscanthus sinensis*, *Schizachyrium scoparium*, *Panicum virgatum*, and *Pennisetum* species. Although the *Miscanthus* and *Pennisetum* species are not native New Yorkers, the growing season in this part of the Hudson River valley is too short for either to produce viable seed that might pose a risk of invasive behavior in local habitats.

BOTTOM Another view of the same parking lot at Bard College.





Designed by Joe Karr and Associates, the landscape of the Lucent Technologies corporate campus in Lisle-Naperville, Illinois, evokes the Chicago region's once-vast tallgrass prairie. Nearer the building entrance and parking lots, *Calamagrostis xacutiflora* 'Karl Foerster' is planted in a prairie abstraction. Extended plantings of tallgrass species including Indian grass, *Sorghastrum nutans*; switchgrass *Panicum virgatum*; and big bluestem, *Andropogon gerardii*, stretch over multiple acres to the roadside periphery of the site.





IROQUOIS PARK IS ONE of eighteen parks and six parkways developed by Frederick Law Olmsted and his successor firm for the city of Louisville, Kentucky. The park rises to a savanna-like plateau that historically included chestnut oaks, post oak, white oak, and warm-season grasses. Known as Summit Field today, the plateau was once called Burnt Knob, a name which offers anecdotal evidence of fires, set by lighting or humans, which may have contributed to the open, grassy conditions. For years Summit Field was maintained in mowed cool-season turf, but in 1996 a joint effort of the Louisville Olmsted Parks Conservancy and the city's Metro Parks

department returned the site to its historic grass cover, seeding the area with a mix of big bluestem, *Andropogon gerardii*; switchgrass, *Panicum virgatum*; and Indian grass, *Sorghastrum nutans*. The restored landscape is richer in visual appeal and habitat value, better serving Louisville citizens and other members of the resident fauna.

ABOVE In mid January, white oaks frame warm-season grasses covering Summit Field.

RIGHT Management of Summit Field includes periodic controlled burns conducted in spring by Metro Parks and the Louisville Olmsted Parks Conservancy. Photo © Alan Nations.





SOUTHERN CALIFORNIA native grasses are featured in Tom Bostrom's design of Cluff Vista Park in Ojai, California. The triangular site, formerly occupied by an abandoned gasoline station, was transformed into a showcase for the Ojai Valley's plants and landscapes through the joint efforts and contributions of the Ojai Valley Land Conservancy, the city of Ojai, and hundreds of private community members. The park is organized by garden areas featuring different plant associations, including a riparian garden, woodland garden, chaparral garden, and deergrass meadow.

LEFT Drought-tolerant California grasses *Leymus condensatus* 'Canyon Prince' and *Muhlenbergia rigens* edge the arbor walkway in late June.

BELOW LEFT The deergrass meadow of *Muhlenbergia rigens* extends along Ojai Avenue. RIGHT Wild rye, *Leymus condensatus* 'Canyon Prince', contributes blue-gray foliage interest year-round.





THE 4-ACRE (1.6-ha) rooftop garden at the Conference Center of the Church of Jesus Christ of Latter Day Saints in Salt Lake City, Utah, presents trees, wildflowers, and grasses native to the surrounding Wasatch mountains and foothills. The Conference Center landscape design by the Olin Partnership treats the building as landform, grouping plants in associations that reflect their natural occurrence at different elevations.

LEFT Bristlecone pines, *Pinus aristata*; wildflowers; and various grasses including basin wild rye, *Leymus cinereus*; side-oats grama, *Bouteloua curtipendula*; little bluestem, *Schizachyrium scoparium*; and Indian rice grass, *Achnatherum hymenoides*, allow close contemplation of the Wasatch Mountain flora while the mountains themselves fill the distant view, in mid August. BELOW LEFT Basin wild rye, *Leymus cinereus*, is a featured grass on the rooftop garden.

BELOW Long buried, this natural creek was uncovered during the redesign of the Conference Center site. It now brings an authentic remnant of wild Utah to the Salt Lake City streetscape, as switchgrass, *Panicum virgatum*, leans gracefully over local boulders. The planting uses a mix of Utah species and exotic species, all of which are locally adapted and drought-tolerant.





THE FUTURISTIC ARCHITECTURE of the Rain Forest House in Hanover, Germany, is matched by the forward-thinking exterior plantings and roof garden designed and executed by Hans Simon, who used his extensive knowledge of grasses and other plants from dry, challenging habitats to construct a planting palette suited to roof conditions.

Pampas grass, *Cortaderia selloana* 'Patagonia', makes the transition from wall plantings to the Rain Forest House roof.



ABOVE LEFT Simon made his own selection, named 'Hexe', from the low sedge, *Carex humilis*, which is a Eurasian species occurring naturally in habitats that are open, sunny, dry, and typically alkaline—conditions that match those often encountered on rooftops. In late August, the view from the roof shows continuous clumps of 'Hexe' thriving without regular irrigation. RIGHT Carpathian moor grass, *Sesleria rigida* (left foreground), and hair fescue, *Festuca filiformis* (center and right foreground), are other European species naturally adapted to dry, nutrient-poor conditions on the roof. Visible also in the photo are seedheads of the small yellow onion, *Allium flavum* (at far right), an equally well-adapted species that provided flowering interest earlier in the season.

RIGHT Precise rows of hair fescue, *Festuca filiformis*, and other heat- and drought-tolerant perennials grow in gravel within ruin walls at the Landschaftspark in northern Duisburg, Germany. Located in the heart of the heavily industrialized Ruhr Valley, this derelict steel mill complex has been recast as a public park. The ordered planting, which is formal in design yet durably sustainable, offers intriguing visual contrast with the successional flora that is gradually re-greening most of the 495-acre (200-ha) site.





GRASSES HAVE BEEN and will continue to be essential elements in the flora of the High Line, which is providing a fresh look at the likely origin, evolution, and form of many of our future parks and public gardens. The elevated High Line was originally built between 1929 and 1934 to separate freight railroad lines on New York City's West Side from the increasing pedestrian and vehicular traffic at grade along 10th Avenue. Railroad activity on the High Line ceased in the 1980s, and since that time a cosmopolitan flora including locally native grasses has established itself on the site which, though truncated, still extends for 1½ miles (2 km), or twenty-two city blocks, and covers nearly 7 acres (ca. 3 ha) of open space 18 to 30 feet (5.5–9 m) above street level. The not-for-profit group Friends of the High Line successfully promoted a vision of this space as continuous park, and at the time of this writing the High Line is well on its way to becoming one of Manhattan's most exhilarating linear landscapes. The project has enjoyed enormous and diverse support, developed in part by the Friends's use of Joel Sternberg's photos of the spontaneous flora of the High Line, which have resonated with innumerable New Yorkers yearning for a bit of open space free of total control.



ABOVE A study tour organized by Friends of the High Line in September 2002 reveals an elevated garden of sorts, unlike any other in New York. Offering intimacy within immensity, this unique open space is defined at points by iconic architecture such as the Empire State Building (at distant left), or by smokestacks, apartment buildings, rail yards, or the Hudson River itself.

LEFT In a curious update on the prairie, grasses make up the matrix covering much

of the High Line. Richard Stalter (2004) listed more than twenty species of grasses, native and nonnative, thriving on the High Line with virtually no irrigation other than what falls from the sky or condenses from the very atmosphere of New York City. The list includes little bluestem, *Schizachyrium scoparium*; purpletop, *Tridens flavus*; sheep's fescue, *Festuca ovina*; and purple lovegrass, *Eragrostis spectabilis*. Flowering companions in this mid-May photo include chives and dwarf bearded iris.



ABOVE AND TOP RIGHT The resilience and adaptability of little bluestem, *Schizachyrium scoparium*, are evident in these late-April images of last season's dormant stalks standing while new growth begins between the tracks. The continued presence of this humble grass in the reconstructed High Line will offer a subtle recollection of the rails.

CENTER It's fair to say that the High Line isn't so much a disturbed habitat as a created habitat, and the spatial patterns of its flora are evidence of the microclimates that exist even in such a challenging environment, where the depth of growing medium

is often a matter of a few inches. Along with grasses, European *Potentilla* and *Linaria* species are prevalent in this section. Stalter's study (2004) found regionally native species comprising slightly more than half of the High Line's flora.

RIGHT A relatively innocuous exotic species introduced from Europe, flannel plant, *Verbascum thapsus*, is tough enough to grow unaided in gravel originally placed on the High Line as ballast for the tracks. The nature of the High Line's evolved flora is, in its tenacity, an optimistic statement about the potential livability of former industrial corridors.





GANTRY PLAZA STATE PARK In Long Island City, New York, is a mature example of the use of grasses and sedges in a highly contextual design. This urban waterfront park, designed by Thomas Balsley Associates with Sowinski Sullivan Architects and Lee Weintraub, offers spectacular views of the Manhattan skyline from

a site originally built to dispatch railroad cars on barges across the East River. The design is centered around historic former Long Island railroad gantries, which were capable of raising or lowering tracks to meet barges floating on the tidal system that comprises the East River.

The lighted top of the Chrysler Building is evident in this late-January night view of the Manhattan skyline from Gantry Plaza State Park. Locally native switchgrass, *Panicum virgatum*, is nestled between granite blocks and rail remnants that reflect the site's history.



ABOVE Switchgrass, *Panicum virgatum*, and woolgrass, *Scirpus cyperinus*, are visible in this daytime view.

RIGHT Known as wild-oat or river-oat, *Chasmanthium latifolium* is an appropriate choice for the often droughty conditions of the site.

FAR RIGHT Woolgrass, *Scirpus cyperinus*, which occurs naturally at sunny wet and dry edges, is another durably authentic component of the planting.





GRASSES HAVE LONG BEEN present in the “accidental landscapes” that line our highways and byways. A growing worldwide movement is now recognizing their beauty and utility, and designing them into the landscapes that accompany our necessary journeys. For a number of years I’ve enjoyed working with colleagues Sue Barton, Gary Schwetz, and the Delaware Department of Transportation on a project titled “Enhancing Delaware Highways.” Our goal has been to research, develop, and define a management strategy for Delaware’s thousands of acres of roadside rights-of-way that would increase

operational safety and efficiency while celebrating, conserving, and enhancing the regional vegetation bordering the state’s roads. Although Delaware is a small state, its roads run from the northernmost county, comprised of upland hills with rich organic soils, to the southernmost county which is characterized by sterile quartz sands, especially toward the Atlantic Ocean coast. Over many years of studies, regionally native grasses have proved to be among the most cost-efficient and longest-lived elements in the project’s designed and managed roadside landscapes.

Over much of North America, regularly mowed cool-season turf has been the model for roadside medians and edges, despite the intensive maintenance involved and the accompanying risk of operating heavy machinery on often irregular surfaces amid fast-moving traffic. The Enhancing Delaware Highways project has begun reversing this tradition by revegetating with durable warm-season native grasses that can be indefinitely maintained by mowing only once or twice annually. This early August photo shows Delaware’s Route 1 artery after the medians were seeded to switchgrass, *Panicum virgatum*.



ABOVE A seeded mix of Indian grass, *Sorghastrum nutans*, and switchgrass, *Panicum virgatum*, is luminous in a Delaware highway infield in the mid-November light. Public feedback has indicated that the tall-grass infield is perceived as attractive as long as a regularly mowed edge is retained as proof that the roadside landscape is in fact being maintained.

RIGHT Established from seed, Indian grass, *Sorghastrum nutans*, blooms in early August along a northern Delaware roadside. The color and movement of such grasses contribute subtly but surely to the regional sense and pride of place which are among the project's goals.





ABOVE LEFT In high visibility areas, such as this location at the junction of interstate highways 95 and 495 entering Delaware, grasses have been planted in more formally defined patterns. This late-October photo shows switchgrass, *Panicum virgatum*, mixed with redbud trees, *Cercis canadensis*, and fronted by lower sweeps of bluestars *Amsonia tabernaemontani* and *A. hubrichtii*.

ABOVE *Panicum virgatum* 'Shenandoah', selected for its burgundy late-season color evident in this September photo, fills a narrow median in a northern Delaware suburb.

LEFT Grand gestures are often necessary to make an impression on viewers traveling at highway speeds. This late-September view shows a great arc of *Panicum virgatum* 'Northwind' enclosing a yellow ocean of *Solidago rugosa* 'Fireworks'.



ABOVE Warm-season grasses *Panicum virgatum* and *Sorghastrum nutans* were deliberately seeded onto this site in the sunny space between existing red cedars and groundsel-bush, *Baccharis halimifolia*. This local shrub makes a fine late-season companion to the grasses, since its white seedheads remain attractive for more than a month in the autumn landscape.

RIGHT Seedheads of *Baccharis halimifolia* in mid October.





ABOVE LEFT This naturally occurring sweep of split bluestem, *Andropogon ternarius*, along Delaware's Route 1 corridor has been maintained and enhanced by semiannual mowing that allows the grass to continually self-sow. ABOVE The Enhancing Delaware Highways ethic is to identify, conserve, and enhance existing habitat associations whenever practical, as in this roadside population of bushy beardgrass, *Andropogon glomeratus*, fronting a moist woodland edge comprised mostly of sour gum, *Nyssa sylvatica*, and sweet pepperbush, *Clethra alnifolia*.

LEFT Both field and forest are components of many roadside landscapes. Appearing uncontrived, a slope bordering an exit ramp is the result of judicious "editing" of existing vegetation. The trees, shrubs, and grasses are almost entirely local native species that established themselves following the initial roadcut for the exit ramp many years ago. The site's soil is thin and rocky, and conditions are dry, especially on the upper portions. In the editing process, seedlings of red maple, *Acer rubrum*, and sweetgum, *Liquidambar styraciflua*, were selectively removed, leaving more clearly defined clusters of trees with expanses of Indian grass, *Sorghastrum nutans*, and red cedar, *Juniperus virginiana*, in between. The resulting landscape is more ordered and therefore more visually coherent to passing motorists, yet the complement of regional ecotypes is effectively maintained.



LEFT An aerial view in early November shows the previously mentioned exit ramp slope (at left middle), along with a grassy infield that is part of the same cloverleaf interchange. For many years the infield was maintained in regularly mowed cool-season turf. As an experiment, the infield was put on a once-annual mowing regimen, with no new planting. Four years later, self-sown native warm-season grasses *Schizachyrium scoparium* and *Andropogon virginicus* are well on their way to dominating the site. Sunny, low-nutrient conditions often prove favorable to the natural regrowth of such grasses, especially if populations on nearby landscapes provide a source of wind-disseminated seed.

BELOW LEFT This late-October aerial view of State Route 1 in Delaware's southernmost, sandiest county demonstrates the results of switching to once-annual mowing of the central median. A diverse mix of local grass, forb, and shrub species has established itself by the end of the second growing season.



BELOW A ground view of the same median shows a seaside goldenrod, *Solidago sempervirens*, blooming with *Panicum virgatum* in mid October. Coastal switchgrass, *P. amarum*, and multiple Joe-pye-weeds, *Eupatorium* species, are also present in the median.





ABOVE Photographed in late August, Hans Simon's planting of a traffic circle in Marktheidenfeld, Germany, relies on an eclectic mix of durable species to provide unirrigated multiseason interest.

FAR LEFT Native to the Atlas mountains of Morocco, *Festuca mairei* is a relatively large fescue grass that is well-suited to sunny, dry conditions.

LEFT The island planting also includes *Eragrostis chloromelas*, an exceptionally drought-tolerant blue lovegrass from southern Africa which produces a profusion of fine inflorescences in summer.

RIGHT Although barely discernable amid similarly colored swamp milkweed, *Asclepias incarnata*, red-top panic grass, *Panicum rigidulum*, makes up a significant portion of this plant association in a wet swale beside U.S. Route 301 in Maryland, the Eastern Shoreway. Other companions include blue vervain, *Verbena hastata*, and goldenrods, *Solidago* species. With a mission similar to that of the Enhancing Delaware Highways project, Maryland's State Highway Administration and the Adkins Arboretum are working together to conserve and enhance the Maryland flora along the state's roadside rights-of-way.

BOTTOM The use of grasses and sedges in the restoration and enhancement of regional landscapes extends far beyond the roadside, as evidenced by this dune stabilization project in Wellington, New Zealand. The bright orange foliage belongs to pingao, *Desmoschoenus spiralis*, a New Zealand native sedge that is a natural component of dune vegetation. Many New Zealand dune systems were damaged by poor farming practices, and early twentieth-century attempts to stabilize them typically made use of the exotic marram grass, *Ammophila arenaria*, which is native to Europe and Africa. In addition to its beautiful color, *Desmoschoenus* is preferable because it creates smooth, stable fore dunes as opposed to the steep, blowout-prone dunes formed by *Ammophila*.





THOUGH MUCH OF MY understanding of grasses and their potential in managed landscapes has come from the close and repeated observation of regional habitats, I owe a considerable debt to the many public gardens worldwide that identify and display the diversity of grasses. In all the years I've studied grasses, one place that has expanded my knowledge and provided inspiration with each visit is the Santa Barbara Botanic Garden in Southern California (SBBG), and it is a superb example of a public institution with an inspired, regional focus. SBBG isn't all

about grasses—in my opinion, no great garden is—but it does integrate grasses throughout its acres, often in association with California species that might be natural companions in native habitats, and typically in association with plants and other landscape elements that deserve repetition in any garden seeking to represent the regional beauty of Southern California.

SBBG owes its grassy subtext in many ways to the influence of Carol Bornstein, who has been a consistent voice for the merits of California grasses. Carol came to California from Detroit, Michigan, in the

early 1980s and found that her Midwestern awareness of grasses (Michigan is one of the original Prairie states) pointed toward an exploration of California's grasses as a way of developing a point of reference in her newly adopted flora. She envisioned the grasses as a group that could help extend the garden's interest throughout the year.

As we all grow in our awareness of grasses' beauty and utility, I hope there will be more places like SBBG that offer inspired regional examples of grasses in livable landscapes.



OPPOSITE Viewed in early April from a bench under a coast live oak, *Quercus agrifolia*, the meadow at the Santa Barbara Botanic Garden is ablaze with California poppies, *Eschscholzia californica*, flowering within a matrix of native grasses.

ABOVE Narrow spikes of deergrass, *Muhlenbergia rigens*, are backed by California poppies in early April. ABOVE RIGHT Poppies are nestled among the new blue foliage of wild rye, *Leymus condensatus* 'Canyon Prince', also in early April. RIGHT Translucent inflorescences of purple needle grass, *Nassella pulchra*, glow against the shadow of a monumental boulder at the edge of the meadow in early April.





ABOVE Grasses provide continuing interest in the meadow landscape long after the poppies have faded. Blue hues of wild rye meet the mountain colors during a late afternoon at the end of June.

RIGHT The rounded form of spiny rush, *Juncus acutus* subsp. *leopoldii*, contrasts with local boulders near the garden entrance in late June.





TOP LEFT *Leymus condensatus* 'Canyon Prince' blooms in the meadow in late June.

LEFT Deergrass, *Muhlenbergia rigens*, is backed by the red berries of Nevin's barberry, *Mahonia nevinii*, in late June.

TOP The desert landscape at the Santa Barbara Botanic Garden features Shaw's agave, *Agave shawii* (foreground), with desert needle grass, *Achnatherum speciosum* (beyond).

ABOVE In silhouette, an extended branch of palo verde, *Cercidium floridum*, frames drying flower stalks of purple three-awn, *Aristida purpurea*, in late afternoon.



CHAPTER FIVE

Cultivation & Maintenance

GRASSES ARE EASY TO GROW. Individual species are often tolerant of a wide range of climatic and cultural conditions, and the great diversity of grasses means there are species and cultivated varieties suited for almost any purpose and place. Properly selected and used, grasses and their relatives can contribute more beauty and sustained interest with less maintenance than almost any other group of herbaceous landscape plants. This chapter offers general concepts, techniques, and recommendations for cultivating and maintaining grasses. Additional comments and recommendations specific to individual grasses appear in the encyclopedia entries in chapter seven.

Fitting Plants to Purpose and Place

When selecting grasses for gardens and other managed landscapes, aesthetic considerations are ultimately a matter of personal choice; however, there are practical and environmental points worth considering that are independent of style and taste. Traditional gardening often attempts to fit place to plants, using horticultural techniques to alter growing conditions so that otherwise minimally adapted plants may survive. In some cases these techniques can successfully alter the local or micro-habitat more or less permanently, allowing the chosen plants to thrive without the continual input of additional resources. In many cases, fitting place to plants results in a permanent dependency upon supplemental irrigation and often necessitates the continual renewal, support, or wholesale replacement of the plants themselves. A more environmentally friendly approach is to fit plants to place: Know your climate and local conditions, and choose plants that are appropriately adapted. If low maintenance is one of the purposes of your planting, this approach will be more rewarding.

Fitting plants to place, Dave Fross's planting of deergrass, *Muhlenbergia rigens*, with *Fremontodendron californicum* and *Ceanothus obispoensis* among serpentine rocks on dry sloping ground at Leaning Pine Arboretum in San Luis Obispo, California, succeeds on multiple counts. Sustainable without irrigation, it provides multiseason interest while providing an authentic model of a local serpentine plant association.

The Importance of Provenance

Provenance literally means derivation or place of origin. In an ecological context the term is an important one because it goes beyond the broad meaning of the word *native* and refers to the origin of the specific plants in question. For example, switchgrass, *Panicum virgatum*, is a wide-ranging species that naturally occurs in prairies and on open ground, woods, and freshwater and brackish marshes from eastern Canada through most of the United States except for California and the Pacific Northwest south to Mexico and Central America. This is the native range of the species, and it is correct to say that *P. virgatum* is native to these places. Like most wide-ranging species, *P. virgatum* is highly variable in its genetic makeup, and it is obvious to any casual observer that plants from different parts of the range are often quite unique from one another in a number of characteristics. The term *provenance* refers to this unique origin. For example, plants of *P. virgatum* originating from the sandy outer coastal plain of New Jersey are of different provenance than plants originating from interior East Texas.

Provenance can be of profound importance to the suitability and fitness of plants for garden and landscape purposes. For example, Indian grass, *Sorghastrum nutans*, has a native range over much of central and eastern North Amer-

Provenance matters. These switchgrasses, *Panicum virgatum*, growing unplanted along a road outside Dallas represent the local population of this species. The dry, sunny Texas provenance of these particular plants makes it likely that they possess more genetically inherent heat tolerance than cool northern representatives of *P. virgatum*.



ica. There's a much higher incidence of glaucous-blue foliage among plants of central (prairie) provenance than among plants of eastern provenance, which are typically green-leaved. In addition to the obvious difference in foliage color, Indian grasses of prairie provenance are typically taller and more lax-stemmed than plants of eastern provenance. Planting plants of prairie provenance in an eastern landscape is likely to result in attractively blue-leaved plants that unattractively flop on the ground.

Characteristics associated with provenance can sometimes be overcome with individual selection. For example, I selected an upright-growing glaucous-blue individual from a multitude of seedling plants of prairie provenance and introduced it as *Sorghastrum nutans* 'Sioux Blue', a cultivated variety (cultivar) which must be vegetatively propagated if it is to retain its especially blue color and upright character. Vegetative (clonal) cultivars often reflect characteristics associated with their original provenance. *Panicum virgatum* 'Cloud Nine', originally of northeastern North American provenance, is green and relatively thin-leaved, while 'Dallas Blues', selected from plants of Texas provenance, is glaucous blue with thick, coarse foliage.

Heat tolerance and cold hardiness are among other characteristics of practical import that often vary with provenance. For example, the documented native range of purple muhly grass, *Muhlenbergia capillaris*, extends from New England to the Gulf coast. Individual plants are more likely to survive winters in New Jersey if they are of more northern provenance.

In addition to readily visible characters, provenance entails a huge number of variables that are obscure but of paramount importance to the relative balance of regional and local ecologies, and for this reason it is best to seek plants of local provenance when introducing grasses into otherwise intact habitats. The commercial availability of grasses of known provenance is increasing along with awareness of these issues.

Cool-season and Warm-season Grasses

Flowering plants in general, including grasses, can be grouped into two broad categories: cool-season species and warm-season species. Scientifically speaking, cool-season grasses are included in C₃ plants, and warm-season grasses are in with C₄ plants. Both C₃ and C₄ plants use light energy to make sugar from water and carbon dioxide, and this sugar is used to fuel growth. The designations C₃ and C₄ refer to molecular compounds produced during photosynthesis. C₃ plants fix carbon dioxide in a three-carbon compound that is then transformed into glucose (sugar). C₄ plants do this too, but first they create a four-carbon intermediary compound. The C₄ process is ultimately the most efficient, accounting for the sometimes phenomenal growth capacity of C₄ plants; however, it requires relatively high temperatures, hence the warm-

Seedlings of *Gahnia setifolia*, a New Zealand native sedge, are labeled by the provenance at Taupo Native Plant Nursery on the North Island. The forty-year-old nursery originated as part of the Department of Conservation and continues as a successful commercial business specializing in New Zealand native plants of documented origin, producing nearly two million plants annually.



season designation. C₃ plants are less efficient overall than C₄ plants but excel at lower temperatures.

One additional physiological difference affecting relative heat tolerance and moisture efficiency is that cool-season grasses open their pores to take in carbon dioxide during the day, which exposes them to warm drying winds and subsequent moisture loss. Warm-season grasses can take in carbon dioxide at night, opening their pores when temperatures are cooler and moisture loss is lessened.

Optimum growth of cool-season grasses occurs under relatively moist conditions when soil temperatures are between 50° and 65°F (10° and 18°C) and air temperatures are between 60° and 75°F (16° and 24°C). In a cold-temperate climate, this means cool-season grasses often have two periods of growth. A typical cool-season grass begins growth in late winter, develops significant foliage by early spring, and produces flowers anytime from late winter to early summer. As summer progresses, decreasing rainfall and increasing temperatures work against photosynthetic efficiency and cause physiological stress which results in partial or complete summer dormancy. Cool-season grasses resume growth when autumn brings increased moisture and lower temperatures.

Cool-season grasses may be divided or transplanted in winter or early spring, and again in late summer and autumn. They should not be moved or divided as they approach or are in their summer dormant state, however partial it may be, since the additional stress may prove fatal. Heat stress can be relieved to some extent by providing summer shade, and supplemental irrigation during summer droughts will also reduce stress. Summer watering can keep some species from going dormant, although this is not the most waterwise approach to gardening. In mild, cool climates, cool-season grasses may be evergreen or semievergreen. Cool-season grasses include most *Achnatherum*, *Calamagrostis*, *Fescue*, *Helictotrichon*, *Koeleria*, *Melica*, *Milium*, *Poa*, and *Stipa* species as well as the common bluegrasses, fescues, and ryegrasses so often used as lawn grasses and the cereal grasses wheat and rice.

Warm-season grasses like it hot. They achieve optimum growth when soil temperatures range between 70° and 90°F (21° and 32°C) and in air temperatures of 80° to 95°F (26° to 35°C), and are much less susceptible to drought stress. In cold-temperate climates, warm-season growers typically break winter dormancy quite late in spring, and are very slow-growing until real summer heat arrives. They revel in the intense summer sun, growing steadily larger and gathering energy for flowering at summer's end. Their processes shut down with the onset of cold weather, and they remain dormant through winter. During this shut-down many warm-season grasses take on beautiful autumn colors.

Warm-season grasses are best divided or transplanted when they are in active growth but long before they begin blooming. In cold-temperate climates,



late spring into early summer are ideal times, although summer division and transplanting are practical if moisture is sufficiently high. It can be risky to divide or transplant warm-season grasses in late fall since much of the plants' stored energy has often just been spent on flower and seed production. In cold climates, late fall divisions and transplants will make very little root growth before winter dormancy begins, and plants may succumb to the stress of winter cold and the often oxygen-deprived conditions of frozen soils. Small transplants and plugs run a high risk of popping out of the ground due to frost-heaving. Fall transplanting of warm-season grasses will be most successful in mild climates and least successful in climates where winter low temperatures are nearer to the grasses' normal limits of cold hardiness

Warm-season grass genera include *Arundo*, *Blepharoneuron*, *Bothriochloa*, *Cortaderia*, *Eragrostis*, *Imperata*, *Melinis*, *Miscanthus*, *Muhlenbergia*, *Pennisetum*, *Setaria*, *Tridens*, *Tripsacum*, *Saccharum*, and *Uniola*, as well as the majority of North American prairie genera including *Andropogon*, *Bouteloua*, *Panicum*, *Schizachyrium*, *Sorghastrum*, *Spartina*, and *Sporobolus*. Corn (maize), sorghum, millet, and sugarcane are other examples of warm-season grasses.

Hardiness

The hardiness zones indicated in chapter seven and elsewhere in this volume refer to the U.S. Department of Agriculture (USDA) Hardiness Zone map published in 1990 and reproduced at the back of this book. These zones are based on annual average minimum temperatures recorded in the United States and must be interpreted cautiously. Though such zones are useful measures, they



CALIFORNIA MELIC, *Melica californica*, is a cool-season grass, flowering in spring when the weather is cool and moisture is abundant, then going dormant with the arrival of summer heat and dryness. These two photos capture different angles of the same planting at Leaning Pine Arboretum in San Luis Obispo, California.

TOP LEFT *Melica californica* in late June.
RIGHT *Melica californica* in early April.

BOTTOM RIGHT Indian grass, *Sorghastrum nutans*, is a classic warm-season grass, shown here in peak bloom on 26 August, in the full heat of summer in eastern Pennsylvania. Indian grass begins growth late in spring.

tend to reinforce the notion that hardiness is limited solely by plants' ability to survive cold. In many garden situations, other factors such as sustained heat, poorly drained or aerated soils, or extremes of acidity or alkalinity may actually be more determining of plants' long-term hardiness in a given location.

When plants are introduced from distant parts of the world they are typically subjected to climatic patterns that differ from their own, even though the average minimum low temperatures may be similar. For example, temperatures in Japan rise fairly steadily from winter through spring. Spring warming in eastern North America is usually interrupted by brief, late periods of freezing cold. Similarly, the eastern North American autumn is much more uneven in its cooling than is Japan's. Unaccustomed to these patterns, Japanese species in North American gardens are sometimes adversely affected.

The winter hardiness of cool-season growers may ultimately be dependent upon the extent of their exposure to high temperatures during summer days and nights. Cool-season species that are tolerant of extreme low temperatures in their original climate sometimes succumb during relatively mild winters in a foreign garden because they enter winter weakened by excessive summer heat or drought. Conversely, the winter cold hardiness of warm-season species can be seriously reduced if summer temperatures and sunlight intensity are not high enough to adequately drive their metabolisms. This partly explains why plants may prove hardy through winters in a truly cold place and succumb during a milder winter in a different climate. For example, the striped giant reed, *Arundo donax* 'Variegata', is winter hardy only in warmer parts of England, yet is hardy in the U.S. mid Atlantic region, which is much colder in winter but much hotter in summer.

Snowfall also dramatically influences grasses' winter survival. A steady cover of snow often protects soil temperatures from dipping significantly below freezing during periods when air temperatures may drop to lethal lows. This important variable is not reflected in the hardiness zone map.

Never underestimate the importance of microclimate. Any garden or landscape is likely to include special niches with growing conditions that are effectively different from the regional climate. Sheltered corners, planting beds adjacent to warm walls of a dwelling, interior courtyards, or even roof gardens can afford the opportunity to enjoy grasses that might not normally be considered hardy.

Of necessity, the hardiness zones listed in books and nursery catalogs are often educated guesses rather than documented fact. Despite considerable research in recent years there is still much to be done on heat and cold hardiness of grasses, and this is especially true for grasses grown outside their usual limits of distribution.

Sunlight

The majority of true grasses (*Poaceae*), cattails, and most restios thrive in sunny situations, and wood rushes and many sedges prefer shade; however, there are many exceptions. Individual preferences of various species and cultivars are included in the encyclopedia entries in chapter seven.

The amount of sun required or tolerated for optimum growth is not easily quantified. The intensity of full sun varies dramatically in different parts of the world. Full sun in Devon, England, is more like partial shade in Southern California. Full sun at high mountain elevations, which are often cloaked in clouds, may equate to shade in a valley bottom. Available moisture and relative fertility of the soil or growing medium can also strongly influence the ideal amount of sunlight. For example, a particular grass may grow largest and flower most fully in direct, all-day sun if the roots are constantly moist, yet the same grass may require partial shade for mere survival in an extremely dry environment. Despite these qualifications, it is reasonable to say that most sun-loving grasses will achieve adequate growth and flowering if provided approximately five hours of direct sunlight daily during the growing season. They will be stronger and more upright with more sun and smaller and more lax in less.

In addition to the intensity of sun, the seasonal duration of sunlight and the number of daylight hours also affect growth and flowering. Some grasses require longer growing seasons than others to complete their flowering and fruiting cycles. Most temperate grasses and sedges also have what is known as a dual-daylight requirement for flowering. For some species this means they must be exposed to short days followed by longer days. For others, long days followed by shorter days trigger flowering.

Species that prefer shade generally prefer deciduous or variable shade: very few thrive in the constant dimness of evergreen forest interiors. For evergreen species of grasses and their relatives, the sunlight they receive in winter is often necessary to their survival, though too much winter sun can prove desiccating and injurious.

Moisture

Although standing with hose in hand still seems to be a popular form of therapy, there are better ways to relax in the garden. The ability to thrive without constant watering and, in many cases, without any supplemental irrigation at all is part of the appeal and beautiful utility of grasses. Other than the watering of new transplants, which cannot be avoided, gardeners can do much to free themselves from the waste and tedium of watering by properly selecting and siting grasses.

Moisture requirements and tolerance can vary dramatically even between species in the same genus. In this mid-October view in a West Virginia deciduous woodlands, silver sedge, *Carex platyphylla*, grows naturally in thin, rocky, alkaline soil that is periodically bone dry.





Tussock sedge, *Carex stricta*, naturally occurs in wet habitats such as this red maple swamp in northern Delaware, photographed in early April, but it is a very adaptable species and can survive in soils that are barely moist.

The available moisture typically present in a plant's native habitat is a good rule of thumb for gauging needed moisture in a designed or managed landscape, and the least costly and least disruptive approach is to try to match plants to similar existing conditions. Often the available moisture on a constructed or highly modified landscape is less than that of many natural habitats. In this case it is more water-conserving to consider species adapted to dry environments than to introduce artificial irrigation. In other landscape situations, the challenge may be too much moisture, and again, appropriate selection of grasses can often provide the solution. Many species of true grasses, sedges, cattails, and restios are naturally adapted to moist or even partly inundated conditions, and these can contribute significantly to the multiseason beauty and habitat diversity of moist places and wetlands in and beyond the individual garden.

Soils and Fertility

One of the reasons grasses are being welcomed into all sorts of private and public landscapes is that they often thrive in difficult soils in which little else will grow. While many grasses appreciate a well-drained reasonably fertile loam, the most adaptable sorts are undaunted by either poorly drained heavy clays or dry infertile sands. As a group, grasses are also largely indifferent to normal variations in acidity and alkalinity, and many, including desert species and coastal species that have evolved in brackish conditions or near ocean spray, are significantly salt-tolerant. Species such as *Carex humilis* that have evolved in dry, alkaline soil conditions are naturally adapted to similar conditions that may be found on rooftops, between paving, walls, and other masonry structures.

Soil variations can, however, make a real difference in the health and manageability of certain species. For example, the blue fescues generally require sharp drainage if they are to survive cold, wet winters in good condition. Running grasses such as blue lyme grass, *Leymus arenarius*, or giant reed, *Arundo donax*, may be manageable in dense clays or sterile sand but too aggressive in rich friable loam. Some specialized species such as Fraser's sedge, *Cymophyllus fraserianus*, require well-aerated soils high in organic matter for long-term survival.

Except when grown on the most sterile soils and sands—and even then, only if they are not evolved from such conditions—grasses generally do not benefit from supplemental fertilization. Adding concentrated chemical fertilizers to average soils can actually hurt performance. Excess fertility results in overlush growth and is likely to cause plants to lose their shape and flop unmanageably. This is especially true in nutrient-efficient genera such as *Andropogon*, *Schizachyrium*, and *Sorghastrum*. Staking large grasses to hold them upright is tedious in small gardens and impossibly impractical in large landscapes, and is unnecessary if fertility and moisture levels are maintained at

appropriate levels. Running grasses that are easily managed in average soils can become aggressive nuisances in overrich soils. Grasses such as broom-sedge, *Andropogon virginicus*, that are specially adapted to infertile soils may lose their competitive edge and be overgrown by other plants if nutrient levels are raised significantly. Especially in cold-temperate regions, many invasive nongrass species thrive on elevated fertility. Taking advantage of the inherent ability of grasses to grow in infertile soils is one strategy for minimizing the need to control invasive nongrasses.

Growth Habits: Runners and Clumpers

Though all grasses increase in width or spread to some degree by lateral shoots, for practical purposes they can be categorized as either runners or clumpers. Running grasses spread rather rapidly by rhizomes (horizontal underground stems), in which case they may also be called rhizomatous grasses, or by stolons (horizontal aboveground stems), in which case they may be called stoloniferous.

A single genus may include both running and clumping species. For example, *Miscanthus sinensis* is clump-forming, while *M. sacchariflorus* is a strong runner. *Pennisetum alopecuroides* forms tight clumps, but *P. incomptum* spreads rapidly and extensively. The majority of running landscape grasses are rhizomatous. Stoloniferous growth is more common among turfgrasses.

Appropriately utilized, running grasses can minimize maintenance. Their ability to knit together and cover large areas often makes them the best choice for groundcover use and soil stabilization. Running grasses can fill gaps that may appear in a planting due to physical damage or disease, and many produce such dense growth that they effectively prevent weeds from establishing. In difficult sites such as dry urban traffic islands, durable running grasses are often the most practical choice. Some running species such as cordgrass, *Spartina pectinata*, and manna grass, *Glyceria maxima*, are adapted to moist or wet soils, and are suited for vegetating and stabilizing margins of ponds and storm water catchments or streambanks.

Planted in the wrong situation, running grasses can be seriously disruptive, overpowering less vigorous neighbors and turning once-diverse landscapes into monocultures. Before planting a strongly running grass, carefully consider whether adjacent plantings and hardscapes will be sturdy enough to contain its spread, and whether resources are available to control any unplanned advances into unwanted areas.

The growth rate of running species varies radically with climate and cultural conditions. For example, a warm-season spreader such as giant reed, *Arundo donax*, may be unmanageable in a small garden in sunny South Carolina; however, the relatively short, cool season of a Connecticut garden may slow it to the point that it behaves nearly like a clumping grass.

Clumping grasses essentially remain in place. They may slowly increase in girth, but new shoots will not appear at significant distances from the clump. Grasses that produce tight clumps may also be referred to as tufted, cespitose, or bunchgrasses. Though clump-forming grasses may take years to reach mature size, the ultimate space they'll occupy is predictable, and for this reason they are sometimes easier to plan for than running types. Because they don't readily fill gaps, clump-formers used as groundcovers should be selected from species or cultivars of proven durability under local conditions.

Some grasses don't fit neatly into either the running or clumping categories. The growth habit of Hakone grass, *Hakonechloa macra*, has been variously described as clumping or spreading. This species does increase by rhizomes and is capable of appreciable spread if cultural conditions are ideal, yet its rate of increase is often so modest that it is a clump-former in the practical sense. Switchgrass, *Panicum virgatum*, is another species that is somewhere between strictly clump-forming and running. Its rhizomes occasionally stray noticeably from the clump, yet for practical purposes it is a clumping grass.

Weediness and Ecological Invasiveness

There is a profound difference between plants which are weedy nuisances in gardens or other controlled landscapes and plants which have the potential to proliferate beyond human control, disrupting the balance of regional habitats or ecologies. Unfortunately, the word *invasive* is often used without qualification to describe both types of behavior. The subject is important enough to warrant greater precision. Both types of behavior—weediness and ecological invasiveness—are undesirable; however, ecological invasiveness can have far-reaching destructive impact in addition to being hugely costly to reverse or control. Guided by global perspective, realistic, preventative strategies must be developed with knowledge of local and regional conditions.

A weed in the simplest definition is a plant out of place. Grasses occasionally become weeds in gardens and other designed or highly managed landscapes by running aggressively or by self-sowing. Running species that have exceeded their limits can present a minor task easily accomplished with hand tools, or a major effort requiring power machinery and/or chemical herbicides. There are purposes for which even the most aggressively running species may be appropriate, such as contained spaces within sturdy masonry patios, terraces, and traffic islands, but it is important to gauge the potential for uncontrolled spreading prior to planting.

Though annual grasses have a well-earned reputation for weedy self-sowing, most perennial grasses in this book are well behaved if appropriately selected and sited. In the garden, there are a few simple ways to minimize maintenance resulting from self-sown grasses. Removing the inflorescences

of grasses before seeds ripen is the surest way of eliminating self-sowing, but this method robs the landscape of considerable beauty.

One way to avoid unwanted seedlings is to select species or cultivars that are not likely to produce fertile seed in your region or climate. For example, Karl Foerster's feather-reed grass, *Calamagrostis × acutiflora* 'Karl Foerster', is essentially seed-sterile and can be planted without any real risk of self-sowing. Cultivars of *Miscanthus sinensis* vary greatly in the length of growing season required for the production of fertile seed. Choosing long-season cultivars for use in regions with short seasons can eliminate the possibility of self-sowing.

Another way to reduce self-sowing is to avoid excessive irrigation. Gravel or stone mulches will both reduce the amount of self-seeding and make it easier to spot and remove seedlings if they occur.

The potential of cultivated grasses to become ecologically invasive, disrupting local or regional ecosystems, is a serious, complicated issue. The capacity for invasiveness in any given grass species varies significantly with the unique genetic makeup of different ecotypes and is always a matter of how the inherent reproductive characteristics of the grass fit with available growing niches. All ecosystems are constantly in flux, with stability always relative. At their worst, ecologically invasive species, including grasses, rapidly disrupt this relative balance by displacing integral elements and causing changes in conditions leading to reduced diversity. Human activity is responsible for the majority of ecological imbalances that are increasingly evident, both by the relocation of species and by the disturbance or wholesale modification of regional environments.

The argument against plant introduction and dissemination is often framed by the broadly opposing terms *native* and *exotic*, but this is too superficial. The term *native* is often so imprecisely used as to be meaningless, and in any case, introducing a species from as little as 50 miles (80 km) away can result in hab-

BELOW LEFT Uncontained by masonry or other suitable barriers to its aggressive growth, spreading fountain grass, *Pennisetum incomptum*, moves beyond the border and across the lawn in this late-August view of a Delaware public landscape.

BELOW Excessive overhead watering encourages wild-oat, *Chasmanthium latifolium*, to self-sow into constantly moist organic mulch in this early June view in a Pennsylvania public garden.



BELOW RIGHT Introduced from its native habitat in the mountains of Chile, Ecuador, and Peru, purple pampas grass, *Cortaderia jubata*, has naturalized extensively in California's coastal mountains, displacing many local species that would otherwise occupy the same niche.

BELOW Ravenna grass, *Saccharum ravennae*, grows in a neat line parallel to active railroad tracks in Wilmington, Delaware. This exotic species has been cultivated in the United States for over a century, but it has so far proved capable of naturalizing only in greatly disturbed niches, such as here in the highly modified habitat created and maintained by human industrial activity.

itat disruption. There is no one rule to go by; however, it is always advisable to be informed about local conditions and dynamics before introducing fertile grass species to designed landscapes adjacent to vulnerable local habitats.

Remember that ecologically invasive behavior is a combination of the right plant in the wrong conditions. Purple pampas grass, *Cortaderia jubata*, is a balanced element in the mountains of Chile, Ecuador, and Peru, where it evolved, but it has proved too well adapted to coastal mountains in California, where it is aggressively out of balance. In some cases, exotic grasses have become naturalized, but their spread has been naturally limited to habitats created and maintained by human disturbance.

There are also numerous examples of cultivated grasses that have becoming seriously disruptive in certain parts of the world, yet these same species are completely innocuous elsewhere. For example, giant reed, *Arundo donax*, has widely escaped and established itself in warm, moist habitats in Southern California; however, in the cold northeastern United States it rarely flowers, never sets seed, and consequently poses little if any threat there. *Miscanthus sinensis* has proved itself to be a destructive force in moist bottomlands in the warm U.S. Southeast, yet it is completely benign in arid California where it will not even survive unless artificially irrigated.

Sometimes the term *species* is not specific enough to distinguish between plants prone to balance or imbalance. One of the most semantically perplexing examples involves common reed, *Phragmites australis*. This cosmopolitan species is native to North America's mid Atlantic region and was once a relatively stable element in the regional ecology. European ecotypes of the same species, introduced inadvertently through human activity, have proved so



fit for modern mid Atlantic conditions that this grass has spread over tens of thousands of acres. Using the accepted concept of species combined with native/exotic terminology, we can identify this invasive grass as an exotic form of a native species.

Ethically responsible individual gardeners and public landscape professionals will seek rational ways to enjoy grasses and other introduced plants, while respecting the fragile balance of regional ecologies. Further details concerning specific grasses are included in the encyclopedia entries in chapter seven.

Pests and Diseases

Grasses are among the most pest-free and disease-free of all landscape plants. With appropriate selection, siting, and general cultural conditions that minimize stress, they will be nearly trouble-free.

Some grasses are susceptible to foliar rust diseases caused by fungi. Rusts produce orange or brownish discoloration on leaves and are most likely to be a problem during warm, humid seasons, especially on cool-season grasses. Rusts can be minimized or eliminated entirely by positioning susceptible grasses to maximize air movement around and through them, especially in warm periods. Rust diseases on grasses in the landscape are often temporary and usually tolerable. They can be most troublesome on grasses being propagated under greenhouse conditions, in which case chemical control with wettable sulfur or commercial fungicides may be advisable.

Miscanthus mealybug can be a serious pest but is restricted to *Miscanthus* species and cultivated varieties. The mealybug, *Miscanthicoccus miscanthi*, is an Asian native, first found in North America in the late 1980s and since dispersed across much of the United States inadvertently by the sale and exchange of infested plants. The mealybug is usually not noticed until the population on an individual grass plant increases to high levels, at which time superficial symptoms become apparent. Up to $\frac{3}{16}$ inch (4 mm) long, the mealybug lives in the tight space between the stem and the enclosing leaf sheath. Colonies are usually established first toward the base (crown) of the plant and spread upward as their numbers increase. The mealybugs themselves are difficult to see until they reach mature adult size. The best way to confirm their presence is to pull a lower leaf sheath away from the stem of an infested plant and look for the white-powdery wax and syrupy honeydew that is produced by and obscures the mealybugs.

A general stunting of growth and an uncharacteristic twisting in the flower heads of grasses are usually the first superficial symptoms of miscanthus mealybug. The stem and sheath tissue often turn dark red in areas where the mealybugs are feeding, especially in late season. Severely infested plants are not killed but are reduced to unsightly, misshapen masses with white powder covering the stems, especially in the lower portion. Affected plants often fail

BELOW Foliar rust on the underside of a leaf of *Molinia caerulea* subsp. *arundinacea* in mid August in England.

BOTTOM Miscanthus mealybugs live between the stem and the enclosing leaf sheath, and cause condensed and distorted growth.





TOP Miscanthus blight is a fungal disease that causes reddish brown spots or streaks on leaves and leaf sheaths. Photo by Nichole O'Neill.

ABOVE The roots of this clump of *Panicum amarum* have been eaten away just below the surface by voles. The grass survived after being divided and replanted.

to bloom or the flower stalks may be stunted, causing the inflorescences to open down among the foliage.

No natural predators that might serve as control agents have been found. Topical sprays are ineffective at eradicating the miscanthus mealybug, since they do not adequately penetrate the protected crevices between sheath and stem. Mealybugs can overwinter deep in the crown, so removing top growth only is not effective. A highly toxic but effective control is to lift and divide plants and drench material with an organophosphate insecticide, but this is safe only under professionally controlled conditions and is not appropriate for private residential gardeners. The most environmentally sound approach is to discard and incinerate infested plants, and to inspect any new *Miscanthus* acquisitions carefully.

Miscanthus blight is a foliar disease caused by *Stagonospora* and *Leptosphaeria* fungi that sometimes affects *Miscanthus* species. On mature plants, the blight is characterized by reddish brown spots or oval streaks on leaves and leaf sheaths. New leaf margins, tips, and older leaves become discolored and die. The disease can kill young seedlings and newly rooted cuttings. Fungicides can provide effective control.

Deer rarely bother grasses. In fact, they tend to avoid large grasses with sharp-edged leaves, and these can be used effectively to screen and protect other more vulnerable plants and areas.

Rabbits and gophers can be considerable nuisances, devouring and disfiguring or occasionally killing plants. Wire mesh coverings can be used to protect smaller numbers of plants, but this solution is often more unsightly than the problem. It is frequently necessary to protect grasses and sedges only when they are young and their new growth is particularly edible.

Voles sometimes attack grasses from below, eating their roots. In cold climates, vole damage tends to be worst in years with heavy snowfall. The typically random damage voles cause is usually tolerable; however, if a vole population builds to high levels in an extensive groundcover or a grassy meadow landscape, use of toxins and or traps may be the only effective option.

Acquiring Grasses

A quick Web search for “grass nursery” will demonstrate the phenomenal growth in recent years among nurseries producing grasses of all sorts and sizes. Commercial nurseries are now almost exclusively devoted to the container production of grasses, an efficient system offering convenient handling for both producer and consumer. Partly because of this, an impressive array of grasses is now commonly available at retail nurseries, garden centers, and mail-order establishments. Less-common grasses and large quantities of

grasses are offered by specialty grass nurseries, often only by wholesale firms catering to professionals.

Whether obtained from a local retail garden center or from a mail-order nursery, container-grown grasses are often best purchased in spring, even though spring buying means acquiring plants long before they've reached peak attractiveness. This is especially true for deciduous grasses, which may be just putting on new growth following dormancy. It is never ideal to purchase grasses when they are in full flower since their energy resources are relatively depleted. Nurseries are increasingly offering container grasses in larger sizes intended for immediate impact. This is usually a very viable option; however, it is important to ensure that the plants are not pot bound. The rapid-growing roots of grasses can quickly become congested and compacted in containers, and such plants may be difficult to establish in the landscape. Sufficiently cold-hardy plants grown in containers large enough for healthy root growth may also be acquired and planted in autumn.

Grass plugs (very small grass plants produced in flats) are usually only available to wholesale buyers. Plugs are often transplanted to larger pots and grown to normal retail size; however, they are frequently the most cost-efficient method of establishing large plantings that cannot be done by seeding.

Seed is often the least expensive way to acquire grasses and is sometimes the only way to obtain certain species. Many nurseries offer seed by mail-order. Collecting your own seed, legally and with appropriate permission, can be the best way to procure grasses of local provenance. For gardeners with a keen eye, starting grasses from seed affords the opportunity to watch for interesting variation and to make new selections. If your interest is in cultivated varieties, keep in mind that while some may be suitable for seed propagation, the majority are clonal cultivars that must be reproduced vegetatively to retain their distinguishing characteristics.



BOTTOM LEFT Production of landscape-sized container grasses at Pleasant Run Nursery in Allentown, New Jersey. **BOTTOM** Container production of grasses and sedges at Native Sons, a wholesale nursery in Arroyo Grande, California, specializing in grasses and other plants suited to the state's Mediterranean-type climate.

BELOW Plugs of split-beard bluestem, *Andropogon ternarius*, produced by North Creek Nurseries in Landenberg, Pennsylvania.





LEFT Switchgrass, *Panicum virgatum* 'Cloud Nine', was planted in spring in one-gallon (ca. 4-liter) size in this highway median planting in southern Delaware. A light layer of organic mulch combined with spot applications of broad-leaved herbicide was used to control weeds until the grasses provided complete cover.

RIGHT The same planting in September of the following year.



Planting, Mulching, and Weeding

For the most part, planting grasses is just like planting other garden perennials. The root systems of container-grown plants should be loosened up before planting, and grasses should be thoroughly watered when planted and until they become established. To get the most from the water-conserving nature of grasses, it is best to plant young plants that will most quickly grow beyond the need for supplemental irrigation.

Grasses are sensitive to soil level, especially when young. Ideally, the crown of the grass should sit just at or, if mulch will be used, slightly above the soil surface. Planting too low can cause grasses to rot, and planting too high can cause them to dry out and die. In cold-temperate climates, small container-grown plants and plugs of warm-season grasses should be planted in spring or early summer so that their roots can grow sufficiently to prevent frost heaving during their first winter.

Many grasses can be readily established from seed, and this is often the only practical method for the largest landscapes. Seed may be broadcast dry, hydro-seeded, or planted with a commercial drill-seeder. Cool-season grasses will germinate quickly in spring or autumn. Warm-season grasses seeded in fall may be washed away by rains before they have a chance to germinate, so spring planting is usually preferable. Warm-season grasses including many tallgrass prairie species require cold treatment for germination.

In native habitats, grasses are often observed germinating and growing in exposed soils; however, in gardens and other designed landscapes some type of mulch is usually desirable to help control weeds and conserve moisture.



Although organic mulches such as shredded bark or licorice root are popular choices, it is important not to allow mulch to build up around the crowns of many grasses since this can promote fungal diseases. Organic mulching is most helpful to moisture-loving species including many of the sedges and wood rushes. Many grasses, especially desert and arid-region species, do as well or better when inorganic mulches such as gravel or stone are used, since these conserve moisture and can keep the soil surface cooler than dark-colored mulches.

Young grass plants can be difficult to tell apart. Until you learn to recognize grasses reliably from their vegetative characters, it is best to label plants or to make planting charts to record identities.

Keeping grass plantings free of weeds can be uniquely perplexing since the weeds are often unwanted grasses that can be difficult to distinguish from small plants of desired species. This is especially true when grasses are not in flower. Be diligent about removing weedy grasses at least until newly planted grasses are large enough to identify. When attempting to distinguish weed grasses on the basis of vegetative characters, look for differences in their ligules, leaf color, width, and general roughness, smoothness, or hairiness.

Unwanted seedlings of other grasses will sometimes germinate inside a mature clump. These should be pulled out by hand as soon as they are noticed. It is easiest to do this when the soil is wet. If neglected for too long, weed seedlings can be impossible to remove unless the entire plant is lifted and divided. Broad-leaved herbicides may be used around grasses; however, herbicides intended for weed grasses are often effective at eradicating ornamental species.

LEFT A tractor-drawn Trux drill seeder was used for this multi-acre planting of Indian grass, *Sorghastrum nutans*, in northern Delaware. Shown in mid August, these seedlings germinated in spring.

RIGHT *Nassella trichotoma* at the Royal Horticultural Society's garden, Wisley, grows in light brown gravel mulch which is topped with a covering of larger stones in the adjacent planting of *Agapanthus*.

THREE PHOTOGRAPHS SHOW the same planting of prairie dropseed, *Sporobolus heterolepis*, in the author's Pennsylvania garden from snowy mid winter through mid spring.

TOP Even smaller grasses such as this prairie dropseed contribute winter interest if left standing. BOTTOM Hand pruners are used to cut back old growth in late March. RIGHT New growth is a soft bright green in late April.



Cutting Back and Burning

Most grasses require little maintenance other than being cut back once yearly, and even this is done more for neatness than for the needs of the grass. The general rule in cold-temperate climates is to cut back grasses in late winter or early spring before new growth begins. Grasses left standing through the cold season do much to keep the landscape alive and dynamic. They respond to winter winds; glow in the winter sun; provide exquisite frameworks for frosts, ice, and snow; and provide important shelter for wildlife.

Smaller grasses and small numbers of larger grasses may be easily trimmed back with hand pruners or shears. Gloves should always be worn to protect against cuts. Some grasses such as miscanthus have sharp leaf margins that can cause cuts to unprotected hands and face. Electric hedge shears can make quick work of cutting back both large grasses and groundcover plantings of smaller species. Power string trimmers and blade trimmers are quick but cause messy shattering that may require tedious clean-up.

Many evergreen grasses and sedges do not need to be cut back yearly and may grow attractively for a number of years with just minor grooming. Old growth or discolored foliage is often easily removed by gently combing plants by hand.

Though grasses in natural habitats grow without anyone to cut them back, fires have frequently served as renewing forces. The benefit of controlled burning of prairie restorations and large grassy meadow plantings is well established. The crowns and deep root systems of grasses are undamaged by fire, unlike many weedy herbaceous and woody species, and the nutrients returned to the soil by burning are often beneficial to grasses. Burning grasses, however, is a potentially dangerous activity best undertaken by professionals with organized safety support. Parks, conservation agencies, and public gardens that practice controlled burning typically have fire departments on site.





TOP LEFT Hand shears are used to cut back coastal switchgrass, *Panicum amarum*, to approximately 5 inches (13 cm) in early spring. RIGHT Evergreen and semievergreen sedges do not require annual cutting back, and some species may be damaged by it. If plants require grooming, it's often best to use fingers to gently comb out old foliage, as is being done here with *Carex appalachica* and *C. albicans*.

ABOVE LEFT The Louisville (Kentucky) Fire Department is close at hand for this controlled burn of Iroquois Park's Summit Field grasses by the Louisville Olmsted Parks Conservancy and Metro Parks. Photo © Alan Nations. RIGHT Cut flowers and foliage of grasses, both fresh and dry, can be enjoyed indoors at almost any time of year. Cut from the author's garden, this late-October dining room table arrangement features wild-oat, *Chasmanthium latifolium*, with cut-leaf sumac, threadleaf bluestar, and heart-leaved aster

TOP Enhancing Delaware Highways team member Gary Schwetz collects seed from a Delaware population of Indian grass, *Sorghastrum nutans*, to be used to extend a naturally occurring population of this grass on a roadside landscape. Propagation by seed of known origin is one way of continuing local genetic diversity.

BOTTOM This older clump of miscanthus is dead in the center and is ripe for renewal by divisions taken from the outer ring of healthy tissue. BOTTOM RIGHT Smaller grasses such as this tufted hair grass, *Deschampsia cespitosa*, can be lifted and then divided with a knife. The fibrous root systems of grasses can be exposed for brief periods but should never be allowed to dry out.



Small-scale controlled burning of grasses in residential gardens may be practical if necessary precautions are taken and local burning ordinances permit such activity. Many grasses, especially miscanthus, burn with surprising intensity. Choose a calm day in late winter or early spring, and keep a watering hose within reach. Ensure that children and pets are at a safe distance, and check grasses for active bird nests and beneficial insect egg cases. Do not attempt to burn grasses if they are close to shrubs or trees, especially conifers. I once photographed 60-foot (18-m) tall spruces in a private garden that had been reduced to brown needles and smoldering cinders by the uncontrolled burning of grasses at their feet.

Propagating, Dividing, and Transplanting

One approach to propagating perennial grasses is to sow seeds in pots or flats in a cold frame or greenhouse and then transplant young seedlings into the landscape. In cold-temperate climates, the majority may be sown in late winter or early spring and planted out after they reach a few inches in height, once the danger of killing frosts is past. Germination rates vary widely. Some grasses will germinate in a few days, others will take weeks or months, and certain species require periods of cold before they will become capable of germination. Seed propagation is a useful way of ensuring genetic diversity in plantings.

Division is the usual means of vegetatively propagating grasses and is typically done when they are in active growth, although many grasses including warm-season North American prairie species will tolerate dormant division. Some grasses may also be rooted from stem cuttings or produced by tissue culturing.



Relatively few ornamental grasses have been patented or trademarked; however, these practices are increasing. Patented grasses may not legally be propagated for sale unless licensed by the patent holder. Trademarks (usually indicated by ™ or ®) do not exclude others from propagating plants, but restrict the commercial use of the trademark to the legal holder of the mark or others licensed by the holder.

As grasses age, their clumps tend to die in the center, and this often results in plants that are weak and floppy. Such plants can usually be renewed by division and transplanting. For small and medium-sized grasses, it is best to lift clumps from the ground with a strong trowel or sharp spade and then use a knife to divide them. Discard dead material from the center, and replant healthy live divisions from the outside of the clump. Divisions should be thoroughly watered immediately following replanting. Running grasses can also be divided if care is taken to secure sufficient roots with each division.

A sharp sturdy spade, not a shovel, is absolutely essential for dividing and managing large grasses. Mature specimens are often too big and heavy to be lifted in one piece, and must be sectioned in the ground with a spade before they can be lifted. Unless you are working around buried electrical lines, the best type of spade is one constructed entirely of modern steel alloys, which are light but exceptionally strong. Some manufacturers offer spades with cushioning rubber footpads at the top of the blade. This type of tool is comfortable to use when cutting into the roots of grasses and is strong enough to be used to lever heavy divisions out of the ground.

A strong but light alloy spade with rubber cushions is used to make two divisions from a healthy clump of coastal switchgrass, *Panicum amarum*, in early spring. With larger grasses, it is often easiest to use the spade to divide the plant while in the ground and then lift each division.





CHAPTER SIX

Grass Names & Nomenclature

ANYWHERE IN THE WORLD, most grasses have at least two names: a common, or vernacular name, and a botanical name. Vernacular names are common names expressed in local language. For example, susuki is the Japanese vernacular name for the grass most English-speaking people commonly call miscanthus. Uncontrolled by governing bodies, common and vernacular names of grasses are constantly in flux, evolving with human culture, and for this reason they are both appealing and confusing. Often, they are quite local or regional in nature. A particular common name may have a very precise meaning locally but be ambiguous in larger context. The level of precision of vernacular names varies considerably. In Japanese vernacular, the name susuki is directly equivalent to the botanical name *Miscanthus sinensis* and ogi is equivalent to *M. sacchariflorus*. Japanese vernacular is so specific and precise that hachijo susuki is commonly used to distinguish the botanical variety *M. sinensis* var. *condensatus*. Although English-language vernacular names for these plants do exist, their use is neither common nor consistent, and English speakers are likely to refer to all three as miscanthus, or to rely on the universal precision of the botanical names, which is precisely why they exist.

The encyclopedia entries in chapter seven include English-language common names both current and historical in approximate order by popular usage (a necessarily subjective judgment on my part), plus occasional transliterations of vernacular names from grasses' countries of origin.

Hachijo susuki is the Japanese vernacular name for *Miscanthus sinensis* var. *condensatus*, shown in this late-October view in native habitat between Mount Hakone and Mount Fuji, which is just visible through distant clouds.

Botanical Names

The system of botanical names has evolved for the purpose of providing a precise, standard method of communication about plants that is independent of language and regional culture. Botanical names refer to living things in the plant kingdom and are a subset of scientific names, which include the zoological names of animals.

Botanical names are Latinized names deliberately removed from the flux of any modern, living language. Though they are sometimes referred to as Latin names, this is imprecise since they are often derived from other languages such as Greek. Botanical nomenclature as we know it dates to 1 May 1753, when Swedish naturalist Carolus Linnaeus (who Latinized his given name, Carl von Linné) published a system of two-part names in his *Species Plantarum*. The Linnaean system is in universal use by the scientific community, so a basic familiarity with it is usually necessary when discussing the great diversity of grasses.

The botanical names of plants are governed by the *International Code of Botanical Nomenclature* (ICBN), often referred to as the Code when the context is clear. The Code is constructed and periodically updated at the International Botanical Congress (IBC), a meeting comprised of botanists from all over the world.

The Code regulates various nomenclatural terms used to organize the plant kingdom into progressively narrower categories. The principal terms, in descending rank, are division, class, order, family, genus (plural: genera), and species (plural: species). A group of plants at any rank is called a taxon (plural: taxa). The grass family, *Poaceae*, is a taxon, as is the species *Panicum virgatum*. Taxonomy is the study of the classification of taxa. When inserted in text, botanical names of taxa are usually set off by a typographic device such as italic font or underlining.

A *family* is a group of genera whose members resemble one another in several respects. A *genus* is made up of closely related and similar plant species. The generic name is always capitalized, as in *Carex*. A *species* is an assemblage of plants that are similar in several characteristics. Cross-fertilization between plants of the same species produces seedlings that retain the distinguishing characteristics of the species. When referring to a single, unknown or unspecified species in a genus, it is correct to use the abbreviation sp. following the genus name, as in *Carex* sp. The abbreviation is not italicized. When multiple species of the same genus are referred to, the abbreviation spp. is used, as in *Carex* spp.

The Code dictates that each plant species must have a binomial (two-word) name consisting of the genus followed by the *specific epithet* (species designa-

tion), which is not normally capitalized. These two parts together make up the species name of a plant. In the case of *Carex laxiculmis*, *Carex* is the genus, *laxiculmis* is the specific epithet, and *Carex laxiculmis* is the full name of the species.

When referring to multiple species of a single genus, it is acceptable to spell out the genus name of the first species and use only the first letter of the genus, followed by a period and the specific epithet, for subsequent species. For example, it is correct to say that cultivated miscanthus species include *Miscanthus sinensis*, *M. oligostachyus*, and *M. sacchariflorus*.

Hybrids between different species occur infrequently in regional ecosystems but are commonly produced through horticultural techniques. There are relatively few hybrids among ornamental grasses, but one widely known is *Calamagrostis ×acutiflora*, a cross between *C. epigejos* and *C. arundinacea*. The multiplication symbol (×) is used to indicate the hybrid nature of a plant. Current rules of nomenclature dictate that the multiplication sign directly precede the first letter of the epithet.

Not to be confused with cultivated variety (see “Names of Cultivated Plants”), a *botanical variety* (abbreviated var.) is a nomenclatural rank below species. A variety differs from individual plants of the same species in one or a very few characteristics. For example, the flowers may be different in color or the leaves different in shape. Varietal names are never capitalized and are always italicized or underlined, as in the example *Carex morrowii* var. *temnolepis*.

The Code allows the formation of intermediate nomenclatural ranks by adding the prefix *sub-* to various taxa. Examples include subfamily, subgenus, and subspecies (abbreviated subsp. or, alternately, ssp.). An example of a grass with defined subspecies is *Molinia caerulea*. The typical subspecies is *M. caerulea* subsp. *caerulea*. Note that the name of this first subspecies is a repeat of the specific epithet. This is always the case, according to nomenclatural code. The second subspecies is *M. caerulea* subsp. *arundinacea*. If no subspecies name is given, it is understood that the name refers to the typical (first) subspecies. For example, *M. caerulea* is understood to mean *M. caerulea* subsp. *caerulea*.

Author Citations and Name Changes

The Code requires botanists to adhere to a number of precise requirements when authoring names of plants. When a plant is named for the first time, a specimen must be collected, pressed, dried, and preserved in an herbarium along with a proper description of the plant. The new plant name must be properly published along with the description, a reference to the location of the specimen, and the name of the author. In this way, the author’s name provides a direct link back to the plant, should confusion arise. This system of

authorship is applicable to the various nomenclatural ranks including family, genus, and specific epithet.

All valid botanical names of plants have authors, and in scientific publications and professional references the author's name, typically in standard abbreviation, is cited following the botanical name. For example, *Carex* L. is Linnaeus's name for the genus of sedges. The policy of Timber Press is to spell author names in full, for example: *Carex* Linnaeus. Though author citations are often unnecessary or impractical in popular texts and magazines, they can be of critical importance when communicating unambiguously about a complex group of plants such as the grasses.

Growing 6 feet (2 m) tall in late August in southern Germany, *Molinia caerulea* subsp. *arundinacea* 'Windspiel' is a cultivated variety of purple moor grass representing the taller of two subspecies.

The Code is founded on the principle of priority, meaning that the earliest validly published name has precedence. Authors are obliged to determine that the plant they have found has not already been named, a task which is easier today than it was in Linnaeus's time. Occasionally and inadvertently, mul-



tiple names have been assigned to the same plant by different authors. When such errors are discovered, the rule of priority requires that the earliest validly published name be preserved as the correct one, and that the later names be consigned to synonymy. For example, the name *Andropogon elliottii* Chapman was found to be a later published name for *A. gyrans* Ashe, which is now given priority. Unfortunately, a botanical name may be in wide use for many years before it is found to be a later synonym.

Confusion also arises when the same name is, in error, applied to different plants by different authors. For example, the name *Carex stricta* was assigned by the botanist Jean Baptiste Lamarck to the North American native tussock sedge. Another botanist, Samuel Goodenough, later published the name *C. stricta* to describe a European sedge species. In this case, the authors' names are necessary to confirm the identity of the species in question: *C. stricta* Lamarck is a different plant than *C. stricta* Goodenough. Nomenclatural priority preserves *C. stricta* Lamarck for the American species. *Carex stricta* Goodenough was determined to be a synonym of *C. elata* Allioni, which now has precedence. The author citation of *C. stricta* Goodenough, non Lamarck, makes clear that the plant in question is Goodenough's European species, not Lamarck's North American species. Without the author citation, *C. stricta* is ambiguous.

Name changes can also result from re-classification. Modern systems of plant classification aim to express the genetic relationships and evolutionary pathways of plants. In the past, information used to classify plants was often dependent on relatively unsophisticated tools and superficial observations. Modern technology now makes it possible to determine chromosome counts and minute differences in the chemical makeup of plants, and this information often reveals new or different plant relationships. This results in reclassification, which often results in name changes. For example, new data or newly interpreted data may reveal that a species formerly included in one genus really belongs in another. Botanist Harris O. Yates determined that the grass known as *Uniola latifolia* Michaux was sufficiently distinct to be reclassified in the genus *Chasmanthium*. The rules of nomenclature require that the specific epithet (*latifolium*) be re-used as part of the new combination *C. latifolium* (Michaux) Yates. Note that the original author's name is retained in parentheses followed by the transferring author.

Changes in long-established names are usually inconvenient but necessary steps in the maintenance of a rational system. Because obsolete names survive in printed literature, it often takes quite a while before name changes are fully communicated and adopted. This is becoming less problematic with the advent of online taxonomic databases.

The Code does not determine how data concerning the classification of plants must be interpreted, it merely sets forth rules and procedures for the

Swaying-rush, *Schoenoplectus subterminalis* (Torrey) Soják, adds its unique patterns to dark Pine Barrens waters in mid September. Despite the well-used common name, this plant is botanically a sedge, not a rush. Originally named by John Torrey and classified in the genus *Scirpus*, as *Scirpus subterminalis* Torrey, it is now accepted as belonging in the genus *Schoenoplectus*.

construction of the names themselves. For this reason, there is sometimes no absolute answer to the question “What is the correct name of this grass?” Since living organisms do not always fit into rigidly defined categories, classifying botanists often disagree as to how broadly the various nomenclatural ranks should be interpreted. For example, a particular group of grasses that appears to constitute a subspecies to one botanist might be judged a species by another. The purple moor grasses, *Molinia caerulea* (Linnaeus) Moench, are an example of this situation. Most botanists see the differences between the shorter and taller purple moor grasses as warranting recognition only as subspecies, in which case the shorter plants are named *M. caerulea* subsp. *caerulea* (Linnaeus) Moench, and the taller plants *M. caerulea* subsp. *arundinacea* (Schrank) H. Paul. Other botanists consider the taller plants worthy of recognition as a species, *M. arundinacea* Schrank. Botanists inclined to nomencla-



tural recognition of the differences between plants are informally referred to as splitters. Those inclined to broader definitions of taxa are called lumpers.

This book follows scientifically accepted botanical nomenclature for grasses. The names have been compiled from the most recent world floras, journal articles, and checklists available, including online databases cited in the bibliography. Synonyms are included in individual encyclopedia entries in chapter seven, and the index provides cross-references to current names. The overall approach is of informed conservation. Name changes and reclassifications have been adopted only when there is genuine evidence of their merits and likely durability. In situations where no definitive nomenclature or classification is available, the encyclopedia entries offer explanations of different viewpoints.

Names of Cultivated Plants

Horticulturists are often concerned with differences between plants that are not adequately distinguished by the preceding botanical ranks. The term *cultivar*, derived from cultivated variety, was coined to serve this purpose. The naming of cultivars is governed by the *International Code of Nomenclature for Cultivated Plants* (ICNCP), which supplements the *International Code of Botanical Nomenclature* (ICBN).

A cultivar is a group of plants under cultivation selected for one or more distinct characteristics which are uniform, stable, and capable of being retained through appropriate means of propagation. Cultivars may arise by selection from variant individuals in the wild or in cultivation, or through deliberate or accidental hybridization.

Cultivar names are always capitalized. Unlike botanical names, cultivar names are never italicized or underlined; however, they should be enclosed in single quotation marks. Cultivar names are always placed at the end of the botanical name, as in *Panicum amarum* 'Dewey Blue'. Especially in popular writing, it is acceptable to drop author citations from botanical names when cultivar names follow. Also, in popular use, it is allowable to drop the species epithet from the botanical name of a cultivar if there is no likelihood of confusion. For example, *P. amarum* 'Dewey Blue' may be abbreviated to *P.* 'Dewey Blue' since the cultivar name 'Dewey Blue' has only been assigned to the species *P. amarum*. If the species of a cultivar is not known or in doubt, the cultivar name follows the genus, as in *Miscanthus* 'Purpurascens'.

The use of cultivar names is a relatively recent convention. The first edition of the ICNCP appeared in 1953. Many early cultivar names originated as Latinized names coined in an era when the distinction between horticultural nomenclature and botanical nomenclature was unclear. 'Gracillimus' is such a

name, as are 'Aurea', 'Variegata', and 'Rubra'. Beginning in 1959, ICNCP rules require that all cultivar names must be from words in a modern language; they may not be Latinized. For example, 'Morning Light' is an acceptable cultivar name whereas 'Gracillimus Variegatus' is not. Beginning in 1995, ICNCP rules do not condone the use of translations of cultivar names. For example, the German miscanthus cultivar name 'Silberfeder' should not be translated to 'Silver Feather', its English equivalent. Despite the ICNCP, this practice persists in commerce and for this reason, commercial translations are often provided in parentheses following the ICNCP-approved names in the encyclopedia entries in chapter seven.

The ICNCP also includes a rule of priority requiring that the earliest, valid cultivar name be preserved as the correct one. For example, the earliest established cultivar name for Bowles' golden sedge is *Carex elata* 'Aurea'. The name 'Bowles Golden' is a later name not acceptable as a cultivar but appropriate as part of the common name: Bowles' golden sedge.

Panicum amarum 'Dewey Blue' at Chanticleer in Wayne, Pennsylvania, in late June.



Contrary to popular misconception, cultivars are not, by definition, comprised of genetically identical plants (clones). They may be, in which case they are best referred to as clonal cultivars. An example is *Panicum virgatum* 'Shenandoah'. This clonal cultivar must be vegetatively propagated if new plants are to retain all distinguishing characteristics, which include relatively short stature and deep red-suffused late-season foliage.

Seed cultivars are not as precisely defined as clonal cultivars, sometimes having only one distinguishing characteristic, and are intended for propagation by seed. Some very loosely defined seed cultivars are maintained by selecting seedlings that match the cultivar description and by rejecting uncharacteristic seedlings. The historic cultivar *Miscanthus sinensis* 'Gracillimus' is often maintained by seed. It has been grown in Western gardens for over a century, defined by its narrow leaves, rounded form, and late-season reddish inflorescences. Most seedlings of 'Gracillimus' (unless pollinated by other cultivars) are reasonably uniform in these characteristics, even though they are not genetically identical. Over decades, some nurseries have grown 'Gracillimus' from seed, rejecting occasional variants, and other nurseries have produced genetically uniform new plants by vegetative division. Plants of *M. sinensis* 'Gracillimus' obtained from ten different sources will look essentially alike, but minor variations will be apparent to keen eyes.



CHAPTER SEVEN

Encyclopedia of Grasses, Sedges, Rushes, Restios & Cattails

ENTRIES FOR INDIVIDUAL GENERA and species are in alphabetical order by botanical name, followed immediately by the author citation(s). Genus entries begin with the common and botanical names of the corresponding plant family, followed by the common name(s) of the genus, if any, followed by the description. Species entries begin with the accepted botanical name and author citation(s) followed by synonyms, if any, in brackets [], followed by the common name. Multiple common names are in order of popular North American usage. If a genus or species appears to be missing, the name may have been changed. Use the index to find a cross-reference to the accepted name. Cultivar names are in bolder type enclosed by single quotation marks. Synonyms for cultivars, if any, follow the accepted name and are enclosed in single quotes in parentheses. Transliterations of vernacular cultivar names are also enclosed in parentheses but not in single quotes. All cultivars should be assumed to require vegetative propagation unless noted. Hardiness zones listed for species refer to the USDA and European hardiness zone maps reproduced at the back of this book. Hardiness of cultivars is the same as the species unless specifically noted. For a full discussion of botanical and cultivated names see chapter six, “Grass Names and Nomenclature.”

Silver spike grass, *Achnatherum calamagrostis*, is to the right of the boulder in this mid-July view of the grass border at the Royal Horticultural Society’s garden, Wisley, in Surrey, England.

Achnatherum P. BeauvoisGrass family, *Poaceae*

Needle grass, spike grass

Densely tufted, clump-forming species from central and southern Europe, eastern Asia, and western North America, the majority split from the genus *Stipa*. The common names refer to the presence of numerous needlelike awns on the florets, a characteristic *Achnatherum* shares with *Stipa*, and one which contributes to the feathery, luminescent qualities of the inflorescences. All are cool-season growers, freely flowering from early spring into summer in regions with strong sun but cool nights and low humidity. The dry inflorescences are persistent and often remain attractive for months.

Achnatherum calamagrostis (Linnaeus) P. Beauvois[*Stipa calamagrostis* (Linnaeus) Wahlenberg]

Silver spike grass, silver spear grass

Native to high-elevation clearings in mountainous regions of central and southern Europe. One of the most graceful, free-flowering mid-sized ornamental grasses if provided plenty of sunlight, low humidity, and cool summer nights. Clump-forming and densely tufted, increasing slowly in girth. Produces a fountain of refined, medium-green foliage topped in June by full but equally fine-textured silver-green inflorescences. Typically 2 to 3 feet (60–90 cm) tall in bloom. The flowers turn beautifully tawny by late July or August and remain attractive entirely through winter in milder climates. The foliage is semievergreen in mild climates and deciduous in cold regions. Prefers full sun. Will grow in light shade although stems will be more lax. Prefers well-drained, average to low-nutrient soils. Growth is weak and floppy in rich soils. It is remarkably drought-tolerant and deserves more attention in Mediterranean and steppe climates. The rounded form and loosely spilling flowering stems evoke cascading water. This grass is effective singly or in drifts and sweeps. Grow from seed, or divide in spring. Zone 5.

‘Allgäu’. An early Karl Partsch selection from the Allgäu region of southern Germany.

‘Lempert’. A compact selection by Hans Simon.

‘Zukunftsmusik’ (future music). Karl Partsch’s improvement on ‘Allgäu’, selected from plants growing in a rocky gorge exposed to snow melt from the mountains. More tolerant of moist conditions.

Achnatherum coronatum (Thurber) Barkworth[*Stipa coronata* Thurber]

Giant needle grass

Occurs naturally in full sun on dry, gravelly, rocky, often sloping ground in chaparral at elevations up to 5000 feet



TOP Silver spike grass, *Achnatherum calamagrostis*, in late August at the Westpark in Munich, Germany. ABOVE Light rain falls in late August on a drift

of *Achnatherum calamagrostis* ‘Lempert’ in this community park planting by Hans Simon in Marktheidenfeld, Germany.



(1500 m) in southwestern California and adjacent Mexico. Flowers in spring on strictly upright culms 3 to 6 feet (90–180 cm) tall. The seedheads remain upright and standing for months. Tufted, with leaves mostly basal. Attractive and well suited to sunny, dry sites. Propagate by seed. Zone 7.

Achnatherum extremiorientale (Hara) Keng

[*Achnatherum pekinense* (Hance) Ohwi, *Stipa extremiorientalis* Hara, *S. sibirica* (Linnaeus) Lamarck]

Eastern needle grass

This native of Japan, China, Korea, and Siberia is not a desert species. It grows to 5 feet (1.5 m) tall at the edges of woods and grassy slopes in mountains, flowering in mid to late summer. It is a slight, airy plant, with open inflorescences. Leaves deep green, to 5/8 inch (15 mm) wide. Grows best in fertile soils with regular moisture, in sun or light shade. Propagate by seed or division. Zone 5.

Achnatherum hymenoides (Roemer & Schultes) Barkworth

[*Oryzopsis hymenoides* (Roemer & Schultes) Ricker]

Indian rice grass, sand grass, silky grass

This widespread western North American species occurs on well-drained or sandy soils in desert shrublands, sagebrush, and pinyon/juniper woodlands from British Columbia and the Great Plains region south to Texas and west to northern Mexico. Rice grass was an important food grain for southwest North American Indian tribes prior to their cultivation of corn. This delicate, airy grass has suffered from severe habitat destruction due to overgrazing, since it is extremely



TOP LEFT Its seeds maturing in early July, giant needle grass, *Achnatherum coronatum*, grows with *Yucca whipplei* at the edge of a burned area in Cleveland National Forest in Southern California. CENTER Eastern needle grass, *Achnatherum extremiorientale*, blooms in August in Herman Müssel's garden in Hei-

genhausen, Germany, with *A. calamagrostis* (in background). RIGHT The Southern California sun illuminates dry seedheads of Indian rice grass, *Achnatherum hymenoides*, in mid June.

ABOVE Indian rice grass, *Achnatherum hymenoides*, in northern New Mexico in late February.



palatable to livestock. Fine-textured and up to 2 feet (60 cm) tall, Indian rice grass is a cool-season grower, producing attractive, open flower panicles in early spring and going dormant for summer. Grows well in extremely dry situations and will succumb to excess moisture. The delicate seedheads persist though winter and move readily in the wind. Propagate by seed. Zone 5.

Achnatherum robustum (Vasey) Barkworth

[*Stipa robusta* (Vasey) Scribner]

Sleepy grass

Native to dry plains, hills, and open woods from South Dakota and Wyoming south to Texas, Arizona, and northern Mexico, this drought-tolerant species is upright to 5 feet (1.5 m) tall, flowering after winter rains. The common name refers to the effect on grazing livestock, especially horses. Readily grown from seed. Zone 4.

Achnatherum speciosum (Trinius & Ruprecht) Barkworth

[*Stipa speciosa* Trinius & Ruprecht]

Desert needle grass

Native to desert communities from California to Colorado south to Mexico and South America, this long-lived, exceptionally drought-tolerant grass can survive on only 5 to 10 inches (13–25 cm) annual rainfall. The extremely fine, gray-green foliage forms a rounded basal tuft that turns to rich tans and light browns with summer drought, remaining attractive through winter. Blooms in spring following rains, and flowers remain fluffy into summer. A naturally fine companion to bold-textured cacti and other desert, succulent species. Propagate by seed. Zone 5.

Achnatherum splendens (Trinius) Nevski

[*Stipa splendens* Trinius, *Lasiagrostis splendens* (Trinius)

Kunth]

Chee grass

Native to steppes and semidesert sands, gravels, stony slopes, and alkaline areas in central Asia and Siberia, sometimes forming the basis of large vegetation groups known as chee grass associations. This stately grass can reach 8 feet (2.4 m) tall in flower. A June to July bloomer, it produces open, feathery, purplish-pink panicles held high on slender stalks above a large basal mound of green or slightly gray-green

TOP LEFT Desert needle grass, *Achnatherum speciosum*, in early April at the Santa Barbara Botanic Garden in California.

LEFT Desert needle grass, *Achnatherum speciosum*, in mid June at the Santa Barbara Botanic Garden in California.



narrow foliage. The inflorescences fade to tan color but remain intact and attractive. Prefers full sun, cool night temperatures, and relatively low humidity. As its native habitat suggests, this species can thrive on alkaline or gravelly soils under cultivation. Semievergreen in milder climates. Best propagated by seed. Zone 7.

Alopecurus Linnaeus

Grass family, *Poaceae*

Foxtail

The genus name is derived from the Greek *alopex*, fox, and *oura*, tail, referring to the soft, cylindrical inflorescences. Comprises approximately 36 annual and perennial species native to north-temperate regions and temperate South America. Most are meadow and pasture species of little significance in designed landscapes; however, the following two are valued for their colorful foliage.

Alopecurus borealis Trinius

[*Alopecurus alpinus* Small, non Villars, *A. alpinus* var. *glaucus* (Lessing) Krylov, *A. glaucus* Lessing]

Boreal foxtail, alpine foxtail, mountain meadow foxtail, blue foxtail

This very gray-blue grass has a circumpolar distribution in high arctic environments, growing in wet meadows and along streams, lake shores, and river terraces as a primary colonizer of disturbed sites. A cool-season grower, it flowers in late winter or early spring. The flowers, like most meadow



TOP LEFT Flowers of chee grass, *Achnatherum splendens*, are pink-purple in this mid-July view in Beth Chatto's gravel garden in Colchester, England. LEFT Past flowering in this late-August view, *Achnatherum splen-*

dens is still a strong presence at the Berggarten in Hanover, Germany.

BELOW Boreal foxtail, *Alopecurus borealis*, in July in England.



foxtails, are insignificant at best. The foliage, up to 8 inches (20 cm) tall, is quite attractive. Mostly clump-forming, spreading very slowly by rhizomes. Does best on low-nutrient soils in cooler climates. The cultivar name 'Glaucus' is unnecessary as the typical form of this grass is glaucous. Zone 3.

Alopecurus pratensis Linnaeus

Meadow foxtail, common foxtail grass

This Eurasian meadow species has naturalized over much of northern North America. It forms dense tufts to 3 feet (90 cm) tall in flower. Mostly clump-forming, spreading very slowly by rhizomes. A cool-season grower, meadow-foxtail is semievergreen in mild, moist temperate climates. The typical form of the species has solid green leaves and is rarely cultivated. Zone 4.

'Variegatus' ('Aureovariegatus', 'Aureus'). Golden meadow foxtail, variegated foxtail, gold-variegated foxtail. Among the most colorful of all yellow-leaved grasses. Shorter-growing than the species, with a flowering height of only 18 inches (45 cm). The narrow leaves vary from bright green with vivid yellow longitudinal stripes to nearly solid yellow, producing an overall golden effect, especially when backlit or sidelit. Yellow color is most intense when plants are grown in full sun, although half-shaded plantings will still be a pleasing char- treuse. Flowers appear in late April or May and are insignificant at best. For a neater appearance, it is best to cut plants back to about 5 inches (13 cm) when flowering begins. This helps retain foliage color in summer, when this cool-season grower tends to go lax and semidormant, especially in warm, humid climates. If uncut, the flowers and foliage become unsightly by July or August. Colorful, new growth resumes with the subsiding of summer's heat, and plants remain attractive until temperatures drop to freezing. A reliable performer of easy culture, tolerant of a wide range of soil types and moisture conditions. Propagate by division in spring or fall.

Ammophila Host

Grass family, *Poaceae*

Beach grass, dune grass

Name derived from the Greek *ammos*, sand, and *philos*, loving, referring to the typical habitat. Comprises two north-temperate species, both coarse, strongly rhizomatous warm-season grasses. One is native to coastal Europe and northern Africa, the other to eastern coastal North America. Both are critical, stabilizing elements in the ecologies of coastal dunes. New shoots produced from the rhizomes allow these grasses to survive burial by shifting dune sands. Both species are salt-tolerant. Selected forms are usually propagated by division, and planted 1 foot (30 cm) deep. Neither species withstands regular foot traffic.



TOP Golden meadow foxtail, *Alopecurus pratensis* 'Variegatus', provides color accent along this walk in Terry Welch's garden in

Woodinville, Washington, in mid May. BOTTOM *Alopecurus pratensis* 'Variegatus' in mid May in a full sun setting in Pennsylvania.

Ammophila arenaria (Linnaeus) Link

European dune grass, European beach grass
Native to coastal Europe and northern Africa. The species epithet means of the sand. This adaptable, aggressively running species has been planted far beyond its natural range for erosion control in dunes and other sandy soils. Such plantings have displaced American dune grass populations on the West Coast of North America and pingao sedges (*Desmoschoenus spiralis*) that normally occupy the same habitat niche in New Zealand. Although also introduced to the eastern coast of North America, *Ammophila arenaria* has not proved as persistent there as the local native, *A. breviligulata*. Zone 5.

Ammophila breviligulata Fernald

American dune grass, American beach grass
Native to eastern coastal North America, and essential to the character and ecology of sandy beaches and dunes. It has proved better-adapted in its native region than the introduced European species. Cultivars based on provenance are available for different regions. Most readily established by divisions planted from mid October to mid April, except when ground is frozen. Summer planting is not recommended. Zone 5.

‘Cape’. Selected from a naturally occurring population on Cape Cod, Massachusetts. Best suited for locations from the Mid Atlantic States north to Maine.

‘Hatteras’. Selected for superior performance in warmer, southern coastal locations.

Ampelodesmos Link

Grass family, *Poaceae*

Vine reed

Comprises a single large, tussock-forming species native to coastal areas of northwestern Africa and the Mediterranean Basin eastward to western Greece.

Ampelodesmos mauritanicus (Poiret) T. Durand & Schinz

Vine reed, Mauritania vine reed, rope grass

Growing nearly 10 feet (3 m) tall in flower, this majestic tussock-forming grass is on the same scale as the larger pampas grasses, *Cortaderia selloana*, but unlike pampas grass it is uncommonly cultivated. Vine reed is fire-tolerant and sometimes occurs in large prairielike populations. The generic and common names refer to the early use of this plant to tie

LEFT European dune grass, *Ammophila arenaria*, in mid December, planted for stabilization along the northern California coast. RIGHT Plantings of American dune grass, *Ammo-*

phila breviligulata, augment the naturally occurring population along the New Jersey coast, growing with seaside goldenrod, *Solidago sempervirens*, in mid July.





LEFT Vine reed, *Ampelodesmos mauritanicus*, in late July at the Royal Botanic Gardens, Kew, in

England. ABOVE *Ampelodesmos mauritanicus*, flower detail, in late July at Kew.

grapevines. Flowers are produced from mid to late summer in a great arc above the dark green evergreen basal foliage, remaining attractive through winter. Prefers full sun and well-drained soil. Propagate by seed. This unusual grass has proved durable, drought-tolerant, and noninvasive in English gardens including the Royal Botanic Gardens, Kew, outside London, and Beth Chatto's gravel garden in Colchester. Zone 8, possibly Zone 7.

Andropogon Linnaeus

Grass family, *Poaceae*

Beardgrass

The genus is derived from the Greek *aner*, man, and *pogon*, beard, referring to the silky hairs associated with the spikelets. A large, cosmopolitan genus comprising more than 120 species of annual and mostly perennial grasses of tropical and temperate regions. Many species are from xeric habitats and are tolerant of very dry growing conditions. Approximately 13 species are clump-forming warm-season perennials native to temperate North America, and these are the most commonly cultivated. Most in this group flower in late summer and enliven autumn and winter landscapes with rich, long-lasting orange, red, and copper colors. Some species have glaucous-blue summer foliage, and these often are suffused with red and purple tones in autumn. All are deciduous and are best cut back in late winter or early spring. All species are best propagated by seed, or by division in late winter through spring. This genus is very closely related to

Schizachyrium: little bluestem, *S. scoparium*, was formerly classified as *Andropogon scoparius*.

Andropogon gerardii Vitman

Big bluestem, turkey foot

Occurs naturally in prairies, meadows, sunny riverbanks, and sunlit open woods across much of North America south to central Mexico, often on dry soil. Reaching 5 to 8 feet (1.5–2.4 m) in height, big bluestem is the tallest North American representative of the genus and was once the dominant component of the tallgrass prairie. Prairie ecologist and nurseryman Neil Diboll refers to this regal species as the “monarch of the prairie grasses.” Upright and strictly clump-forming, leaves to $\frac{3}{8}$ inch (9 mm) wide, typically green or slightly blue-green in summer, reliably turning rich orange and copper-red in autumn, often with deep burgundy tints with the onset of frosts and freezing temperatures. Three-branched terminal inflorescences that vaguely resemble turkey's feet appear in late August or early September, opening with noticeably bright red pollen sacs.

The main appeal of this grass is in its lush summer foliage and fall and winter color, which is effective when planted singly or in mass. In the garden, the size and upright stature can be quite dramatic. Ideal for deciduous screening, naturalizing, and for meadow gardens and prairie restorations. Birds and mammals use big bluestem for nesting and cover in summer and winter. Plants that don't lodge with winter snows also provide spring nesting habitat.



TOP LEFT Red color of newly opened flowers is apparent in this late-August view of *Andropogon gerardii* at the University of Hamburg Botanical Garden in Germany. RIGHT Flowering plants of *Andropogon gerardii* stand tall and upright at the Ega Exhibition Park in Erfurt,

Germany, in late August. The green foliage color is typical for the species.

ABOVE LEFT AND CENTER *Andropogon gerardii* flowers arch gracefully by mid October in Illinois, as the foliage turns orange and copper-red, the

typical autumn color of green-leaved plants.

RIGHT *Andropogon gerardii* 'Sentinel' is both upright and very blue in the author's eastern Pennsylvania garden in early August.

This sturdy, long-lived grass is adapted to a wide range of soil and moisture conditions, but requires full sun. Will be lax-stemmed and unkempt if shaded or grown in excessively fertile conditions. Most recently introduced, vegetatively propagated cultivated varieties have been selected for upright stature and/or for glaucous foliage. The only trade-off with bluish plants is that they lack the warmer orange-red autumn color of the green-leaved types. Many seed-propagated varieties have been developed for soil conservation and forage use. These are typically bred from seed of naturally occurring populations with the aim of producing regionally adapted cultivars. Best propagated by seed sown very early in spring. The relatively slow rate of big bluestem seedlings is sometimes aided by high mowing (above the grass seedlings) to control weeds early in the season. Divide in late winter or in spring. Big bluestem sometimes hybridizes with sand bluestem, *Andropogon hallii*. Zone 3.

‘**Bison**’. A seed cultivar of North Dakota origin with good red-orange autumn color.

‘**Lord Snowden’s Big Blue**’. With thick stems and chalky sky-blue color throughout, this very upright cultivar is so distinct that it is a testament to how much variation is possible within a single species. Bluestem Nursery owner John Snowden obtained the original stock from active railroad tracks in Crowley, Texas, and provided material to California grass guru John Greenlee, who named it for Snowden. Suffused red-purple in autumn.

‘**Niagara**’. A seed cultivar of New York origin with good red-orange autumn color.

‘**Pawnee**’. A seed cultivar of central Nebraska origin with good red-orange autumn color.

‘**Roundtree**’. Released by the USDA Soil Conservation Service, this seed cultivar originated from a native population growing in Monona County, Iowa. Selected for seedling growth rate, leaf rust resistance, superior forage production, and resistance to lodging.

‘**Sentinel**’. An upright, glaucous blue-green selection by Norm Hooven of the now-closed Limerock nursery in Pennsylvania. Suffused red-purple in autumn.

Andropogon glomeratus (Walter) Britton, Sterns & Poggenberg

[*Andropogon virginicus* var. *abbreviatus* (Hackel) Fernald]
Bushy beardgrass

This species is distinct from others in this book in its preference for relatively wet conditions, growing naturally in bogs, marshes, swamps, swales, and other low, moist ground. The typical variety of this species, *Andropogon glomeratus* var. *glomeratus*, occurs along the coastal plain of eastern North America from Massachusetts to Florida. Generally 2 to 3 feet



TOP Bushy beardgrass, *Andropogon glomeratus*, grows on a hummock in the New Jersey Pine Barrens along with white cedars, *Chamaecyparis thyoides*, backlit by the mid-October sun and reflected in the dark waters.

ABOVE LEFT *Andropogon glomeratus* blooms 5 feet (1.5 m) tall in a wet swale in mid September in Colin County, Texas. Pecan trees, *Carya illinoensis*, and Maxi-

milian sunflowers, *Helianthus maximiliani*, share the habitat.

ABOVE RIGHT Bushy seed-heads of *Andropogon glomeratus* are cinnamon-colored against the autumn color of woody shrubs at the edge of New Jersey Pine Barrens waters in late October. Typical of plants in the northern range of this species, these grasses are only 2 feet (60 cm) tall.

(60–90 cm) tall. Leaves are green in summer, turning copper-orange in autumn. Produced in September, the flowers are enclosed in densely clustered bushy bracts at the top of stiffly upright stems. The dry seed stalks remain mostly intact through winter and make attractive cut material. Grows in garden soils of average moisture but is not as drought-tolerant as most *Andropogon* species. Prefers full sun to very light shade. Propagate by seed sown in early spring, or divide in late winter or spring. Zone 5.

Andropogon glomeratus* var. *scabriglumis C. S. Campbell

Southwestern bushy beardgrass

This variety occurs on moist sites from New Mexico and Southern California south into Mexico. It grows taller than the typical variety, often reaching a height of 4 to 5 feet (1.2–1.5 m), and is not quite as cold hardy. Zone 6.

Andropogon gyrans Ashe

[*Andropogon elliotii* Chapman]

Elliott's broom-sedge, Elliott's beardgrass

Found on dry or moist fields and open woods in the eastern North America, often growing with broom-sedge, *Andropogon virginicus*, from which it differs in having the inflorescences clustered at the upper portion of the stem, surrounded by broad, showy sheaths. Green in summer, the culms and sheaths turn vivid orange in late autumn and winter, and are quite striking. The sturdy stems remain standing through repeated snows, providing habitat for spring-nesting birds. Strictly clump-forming, 2 to 3 feet (60–90 cm) tall. Prefers full sun and average to low-nutrient soils. Drought-tolerant. Propagate by seed sown early in spring, or by division in late winter or spring. Zone 5.

Andropogon hallii Hackel

[*Andropogon gerardii* var. *paucipilus* (Nash) Fernald]

Sand bluestem, Hall's bluestem

Very similar in stature to big bluestem, *Andropogon gerardii*, but occurring naturally on sandhills and other dry sandy sites, from North Dakota and Montana to Texas, Wyoming, Utah, and Arizona. Sand bluestem is slightly more rhizomatous than big bluestem and is more inclined to glaucous foliage. Grows to 6 feet (1.8 m) tall. Because the two species hybridize readily and often naturally intergrade, they are sometimes lumped together and commonly referred to as big bluestem. Sand bluestem is quite distinct for landscape purposes and is much better suited to very dry sites. Some very attractive glaucous-blue hybrids between sand bluestem and big bluestem are proving very useful and attractive. Zone 3.

'Champ'. This hybrid of *Andropogon gerardii* and *A. hallii* was developed by Lawrence Newell at the University of



TOP Persisting from the previous season, *Andropogon glomeratus* var. *scabriglumis* stands more than 4 feet (1.2 m) tall in late February in the meadow at the Santa Barbara Botanic Garden in California.

ABOVE LEFT Elliott's broom-sedge, *Andropogon gyrans*, is lit

by the early January sun in the managed meadow at Longwood Gardens in Pennsylvania.

ABOVE RIGHT Well adapted to Colorado's low rainfall, sand bluestem, *Andropogon hallii*, blooms in late August at the Denver Botanic Gardens.



Nebraska and selected for its adaptability to a variety of soil types. It is a seed cultivar maintained by controlled crosses.

'Sanbi'. An upright, strongly glaucous hybrid of *Andropogon gerardii* and *A. hallii* developed by Nebraska's Great Plants for the Great Plains program and intended for vegetative propagation. It is marketed with the name Silver Sunrise™.

Andropogon ternarius Michaux

Split-beard broomsedge, split bluestem
Occurs on sandy soils along the coastal plain of eastern North America from Delaware to Florida and Texas and on clay soils from Georgia to Missouri. Typically grows 2 to 3 feet (60–90 cm) tall. Similar enough in foliage to both *Andropogon virginicus* and *Schizachyrium scoparium* that it might be mistaken for either, split-beard broomsedge is quite distinct when the flowers appear in late summer, held out from the stems on conspicuous slender stalks. The inflorescences are very silvery when dry and especially attractive backlit. The foliage is often slightly glaucous blue-green, turning shades of purple-bronze, copper, and red in fall. Requires full sun. Very drought tolerant. Propagate by seed sown in early spring, or by division in late winter or spring. Zone 6.

Andropogon virginicus Linnaeus

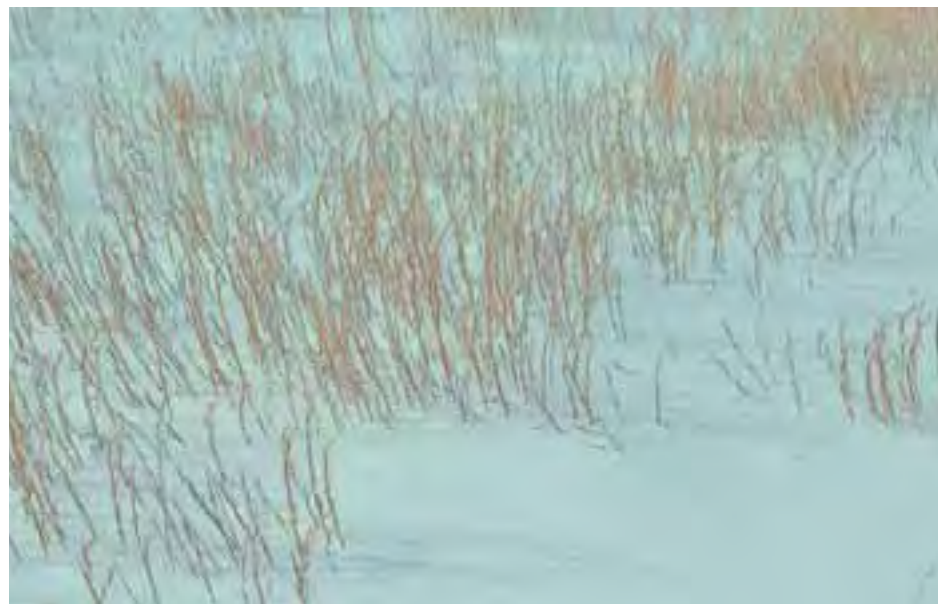
Broom-sedge, beardgrass
This wide-ranging, variable species occurs over much of North America on open ground, old fields, and sterile hills, on dense or sandy soils, with a continuing distribution into northern South America. An adaptable and often aggres-

sive colonizer, it has naturalized beyond its range, in California, Hawaii, Japan, and Australia. Upright, strictly clump-forming, typically 2 to 3 feet (60–90 cm) tall in flower in cold-temperate regions. Stems and leaves are bright green in summer, suffused dark red-purple when flowers first appear in September, turning bright orange in late fall. The color persists through winter and into the following spring, and is intensified when plants are wet by rain. Inflorescences attractively silver when backlit. Often overlooked in summer, broom-sedge is well-known for the tawny-orange winter color of many old fields and pastures. It requires nearly full sun and is longest lived on infertile soils. Extremely drought tolerant, and suited for managed meadows and natural areas in parks, roadsides, and other large-scale landscapes. Propagate by seed sown in early spring, or by division in late winter or spring. Zone 3.

is also common among plants of *A. hallii*.

CENTER RIGHT Backlit stalks of split-beard broomsedge, *Andropogon ternarius*, are dramatic against the autumn foliage of trees and shrubs in open, sandy habitat in southern Delaware in late October. RIGHT The distinctive flowers and seedheads of *Andropogon ternarius* are held on long slender stalks.

FAR LEFT *Andropogon* 'Sanbi', a hybrid of *A. gerardii* and *A. hallii* marketed under the name Silver Sunrise™, is clearly the most upright, at the end of this research trial row at the University of Nebraska, Lincoln, in early August. CENTER LEFT Light yellow stem sections of *Andropogon* 'Sanbi' stand out noticeably from the bluish foliage in late July in the author's Pennsylvania garden. This characteristic



Andropogon virginicus* var. *glaucus Hackel

[*Andropogon capillipes* Nash]

Blue beardgrass, chalky bluestem

This primarily coastal plain variety grows mostly on sandy soils from Texas and Florida north to southern New Jersey, and is distinguished most readily by its strongly glaucous-blue summer foliage. Many botanists feel it deserves recognition as a separate species, *Andropogon capillipes*; however, intermediate forms make it difficult to draw a clear line, and the consensus has shifted in recent years toward recognizing *A. virginicus* as an inclusive, variable species. Upright in stature, usually 2 to 3 feet (60–90 cm) tall, blue beardgrass blooms from mid September to early October. Prefers full sun and does best on soils of low to average fertility. Very drought tolerant. Plants of southern provenance are not as cold hardy as *A. virginicus*, but much more heat-tolerant, unfazed by summers in places like Georgia or Florida. Zone 7.

‘Silver Beauty’. Leaves silvery blue-green in summer, suffused with red and purple in autumn.

‘Valdosta Blue’. Leaves blue-green in summer, with purplish tones in autumn. Selected and introduced by Bob McCartney of Woodlanders Nursery, from a native population growing near Valdosta, Georgia.

Anemanthele Veldkamp

Grass family, *Poaceae*

New Zealand wind grass

Split from *Stipa*, this genus is monotypic, meaning it comprises only one species, and endemic to New Zealand, meaning it occurs nowhere else in the world.



TOP LEFT Broom-sedge, *Andropogon virginicus*, grows in full sun on a hillside in Chester County, Pennsylvania, in late October, complementing the autumn color of oak trees (in the background). CENTER *Andropogon virginicus* gets the name beardgrass from silky hairs associated with the flower spikelets and seed clusters that are apparent in this early November photo.

RIGHT *Andropogon virginicus* is still standing through a late snow in mid March in northern Delaware, as the winter sun-bleached stalks cast fine shadow lines across the surface.

ABOVE *Andropogon virginicus* var. *glaucus* ‘Silver Beauty’ in mid September at the Norfolk Botanical Garden in Virginia.

Anemanthele lessoniana (Steudel) Veldkamp

[*Stipa arundinacea* (Hooker f.) Bentham, *Oryzopsis lessoniana* (Steudel) Veldkamp]

New Zealand wind grass, gossamer grass, pheasant's-tail grass

This exceptionally graceful grass grows on New Zealand's North and South Islands, from sea level to mountains in forests, forest margins, and scrub. It is tightly tufted, forming a fine-textured, rounded mound up to 2½ feet (75 cm) tall. The delicate stems move with the slightest breeze, hence the common name. When grown in shade, the foliage is deep green, but in sun it becomes gold or amber. A profusion of flowering stems is produced in early summer, arching above the foliage and eventually drooping to the ground under the weight of the maturing seeds. The finely branched inflorescences are strongly red or pink-tinted at first and remain colorful for a few weeks. They are especially captivating when glistening with morning dew. Self-sows readily in cultivated settings but has not proved ecologically invasive. Although naturally a woodland species and quite shade-tolerant, wind grass is surprisingly drought-tolerant and durable in full sun. Long popular in its home country and in England, it is proving adaptable to cultivation in California and into the Pacific Northwest when provided well-drained soils. Most easily grown from seed. It can be divided but the dense crown of older plants makes this a tedious undertaking. Zone 8.

'Autumn Tints'. Leaves flushed deep red-orange in late summer.

'Gold Hue'. Leaves flushed golden yellow in late summer.

***Aristida*** Linnaeus

Grass family, *Poaceae*

Three-awn

Comprises nearly 300 species of warm-season bunchgrasses occurring in mostly dry habitats throughout the world, including savannahs, sandy and open rocky woodlands, dry grasslands, and deserts. A few species are noxious weeds. The name is derived from the Latin *arista*, bristle, referring to the stout awns present in most species.

Aristida purpurea Nuttall

Purple three-awn

A beautiful component of dry grasslands. Erect-growing, to 2 feet (60 cm) tall, *Aristida purpurea* is a very variable species that is often segregated into numerous intergrading botanical varieties. It occurs on both sandy and clay soils, on slopes and mesas, dry hills and plains, from Arkansas and Kansas to Utah and Texas, Southern California, and into northern Mexico. Attractive year-round, purple three-awn is uniquely colorful when flowering. The inflorescences are strongly red-purple at first, bleaching in the sun to a light straw color. Flowering typically occurs in spring following winter rains, but additional wet periods or supplemental irrigation in a cultivated setting will spark more growth and flowers. Foliage color is a rich green. Prefers full sun. Very drought tolerant. Self-sows manageably unless irrigated, when it can become a minor nuisance. Easily propagated by seed. Zone 6.

LEFT In early April, New Zealand wind grass, *Anemanthele lessoniana*, adds its rich green color to a shaded section of Dave Fross's garden in San Luis Obispo, California. Although this grass is typically grown in sun,

the shaded conditions here more closely resemble those of its native habitat. BELOW Flowering in late July, *Anemanthele lessoniana* resembles a pink fountain in Beth Chatto's garden in Colchester, England.





ABOVE Purple three-awn, *Aristida purpurea*, blooms deep purple-red in response to spring moisture in California. TOP RIGHT The red flowers have turned tawny, but this sweep of *Aristida purpurea* designed by Dave Fross is still dramatic

under a coast live oak, *Quercus agrifolia*, in San Luis Obispo, California, in April.



RIGHT Pineland three-awn, *Aristida stricta*, in late October at the University of North Carolina Botanical Garden in Chapel Hill.

Aristida stricta Michaux

Pineland three-awn, wire grass

Pineland three-awn grows 2 to 4 feet (60–120 cm) tall on sandy soils and in pinelands from North Carolina to Florida and Mississippi. This slight grass is an integral part of the longleaf pine (*Pinus palustris*) forest ecosystem that once occupied a major part of the southeastern United States. Dominated by longleaf pine and pineland three-awn along with scattered oaks, this forest system is adapted to fire and dependent upon it. Fire stimulates growth and seed production of the grass, and fire suppression by humans results in eventual succession to hardwood forests and the loss of both grass and pines. Efforts to conserve and restore remaining longleaf pine forests include re-establishing the grass and introducing controlled burns. Propagated by seed. Zone 7.



Arrhenatherum P. BeauvoisGrass family, *Poaceae*

Oat-grass

From the Greek *arren*, male, and *ather*, awn, referring to the bristled male florets. Comprises four perennial species in Europe, Africa, and Asia. Tall oat grass, *Arrhenatherum elatius* (Linnaeus) J. Presl & C. Presl, is of European origin but is a cosmopolitan weed. Only the following subspecies is deliberately cultivated in gardens.

Arrhenatherum elatius* subsp. *bulbosum (Willdenow)

Schübler & G. Martens

[*Arrhenatherum bulbosum* (Willdenow) C. Presl]

Tuber oat-grass

Distinct in producing conspicuous bulbous storage organs at the base of the stems, which root easily to form new plants. Only the following variegated selection is cultivated.

'*Variegatum*'. Striped tuber oat-grass. Clear white longitudinal stripes predominate over the dark green of the leaves, so that this plant appears nearly all white from a few feet away. This cool-season grower does well in climates with dry summers and cool nights, where it produces a neat mound under 1 foot (30 cm) tall. Flowers are produced in late summer on growth up to 2½ feet (75 cm) tall, but plants are more attractive if cut back at this stage. In hot, humid areas where night temperatures remain high, striped tuber oat-grass is often afflicted by foliar rust diseases, becoming very unattractive before going completely dormant. Partial shade minimizes summer stress and does not affect intensity of variegation. New foliage appears in fall, and the plants are again attractive going into winter. Requires frequent division, best in spring or fall. Zone 4.

***Arundo*** LinnaeusGrass family, *Poaceae*

Reed

Name derived from the Latin *arundo*, reed. Comprises three species, all rhizomatous, warm-season growers originally from moist habitats from the Mediterranean to eastern Asia, with one species, *Arundo donax*, widely naturalized elsewhere.

Arundo donax Linnaeus

Giant reed

Historically a source of reeds for wind instruments. This Mediterranean native grows larger and taller than any other grass hardy in cool-temperate regions, excepting the bamboos. It can attain 14 feet (4.2 m) in height in a single season even in cold areas where it dies to the ground each winter. It remains evergreen in warm climates and can grow to 18 feet (5.5 m). Stems are upright with coarse, gray-green leaves to 3 inches (8 cm) wide. Spreads strongly by thick rhizomes. Foot-tall (30-cm) inflorescences top the culms in summer or in early autumn in regions with shorter growing seasons, opening with a pink cast and drying to silver.

Giant reed requires a long warm season for flower production, but is often grown for the bold stems and leaves alone. E. A. Bowles called it "the king of grasses for foliage effect." The foliage quickly browns if exposed to freezing temperatures, becoming tattered by winter winds at which time the plants are best cut to the ground. Striking as a specimen or screen planting.

Best in full sun but will tolerate light shade. Not particular as to soils or fertility. Drought-tolerant, yet will also tolerate periodic standing water. Sets fertile seed only in warm

climates such as Southern California, and there it has proved biologically invasive in moist habitats. Old, established specimens require considerable effort to divide, transplant, or remove due to sheer weight and size. Fortunately, the rhizomes are relatively soft, and a sharp spade will easily cut through them. Easily rooted from rhizome pieces. Best divided in spring. Zone 6.

'Golden Chain'. Leaves yellow with green stripes at center. Shorter-growing and less inclined to flower. Also less cold hardy than the species. Zone 7, possibly colder.

'Macrophylla'. An old standard, with leaves broader and more glaucous than typical.

'Variegata' ('Versicolor'). Striped giant reed. Leaves and stems striped cream-white. Variegation is brightest white in

spring, often fading to yellow-green by the end of a warm growing season. Shorter-growing and less inclined to flower. Slightly less cold hardy than the species. Zone 6.

Arundo formosana Hackel

Taiwan grass

Native to temperate eastern Asia. Smaller in all parts than *Arundo donax*, growing to 8 feet (2.4 m) with leaves ½ inch (12 mm) wide. Rhizomes are shorter and plants more clump-forming than *A. donax*. Blooms in late summer or autumn, with flowers opening pink, turning buff. Evergreen in milder climates.

'Green Fountain'. More rounded form than typical. Cutting-propagated from plants introduced from China by Jim Waddick.

'Oriental Gold'. This patented cultivar was discovered by Greg Speichert of Crystal Palace Perennials, originating as a sport on a green-leaved plant. Bright yellow and green-striped foliage is topped by light pink flowers in fall. Grows 4 to 8 feet (1.2–2.4 m) tall. Zone 6.



OPPOSITE LEFT *Arrhenatherum elatius* subsp. *bulbosum* 'Variegatum' in late May with *Brunnera macrophylla* 'Lang-trees'. CENTER *Arundo donax* blooms 14 feet (4.2 m) tall in late October at Longwood Gardens in Pennsylvania. RIGHT *Arundo donax* 'Golden Chain' in late October in North Carolina.

LEFT *Arundo donax* flowers begin opening in late September at Longwood. BELOW LEFT *Arundo donax* 'Variegata' at Chanticleer in Wayne, Pennsylvania, in mid June. BELOW *Arundo formosana* 'Oriental Gold' at Seaside Gardens in Carpinteria, California, in early April.



Arundo plinii Turra[*Arundo pliniana* Turra]

Smaller and more reedlike than *Arundo donax*, growing 5 to 7 feet (1.5–2.1 m) tall. Spreads vigorously by long rhizomes. Foliage gray-green, evergreen in milder climates. Needs a long growing season to produce flowers. Zone 6.

Austrostipa S. W. L. Jacobs & J. EverettGrass family, *Poaceae*

Australian feathergrass

Recently segregated from *Stipa* and comprising approximately 70 perennial species native to Australia and New Zealand.

Austrostipa elegantissima (Labillardière) S. W. L. Jacobs & J. Everett[*Stipa elegantissima* Labillardière]

Australian feathergrass, feather speargrass

Native to temperate Australia. Clump-forming, to 3 feet (90



cm) tall. The airy flower panicles are produced from spring through fall in response to rains. The inflorescences accumulate over the season, drying to silver. Propagate by seed. Zone 8.

Austrostipa ramosissima (Trinius) S. W. L. Jacobs & J. Everett[*Stipa ramosissima* (Trinius) Trinius]

Australian plume grass, pillar of smoke

Grows to 8 feet (2.4 m) in moist, well-drained gullies near forest or woods edges in its native Australia, flowering most of the year in response to rains. The name “pillar of smoke” is apt. Upright and clump-forming, this grass blooms nearly continuously in a sunny, moist location, producing a dense, towering mass of fine-textured inflorescences. Readily propagated by seed. Zone 8.

LEFT *Arundo plinii* flowering 6 feet (1.8 m) tall in early November at Longwood Gardens in Pennsylvania.

BELOW *Austrostipa ramosissima* with yellow monkey flower, *Mimulus guttatus*, in late June at Leaning Pine Arboretum in San Luis Obispo, California.

BELOW LEFT New flowers of *Austrostipa ramosissima* are airy and light green at Leaning Pine Arboretum.



Austrostipa stipoides (Hooker f.) S. W. L. Jacobs & J. Everett

A rare species that occurs on coastal sands, rocks, and mud flats in Australia and New Zealand. Forms a dense tuft to 3 feet (90 cm) tall.

Baumea Gaudichaud

Sedge family, *Cyperaceae*

Twig-rush

Split from the genus *Cladium* and comprising approximately 30 perennial aquatic marginal species of Australasian distribution.

Baumea rubiginosa (Sprengel) Böckeler

[*Cladium rubiginosum* (Sprengel) Domin]

Soft twig-rush

Grows in swampy places and lake margins from sea level to low mountains in New Zealand, Australia, New Guinea, New Caledonia, and Southeast Asia. This perennial rushlike sedge spreads by rhizomes to form colonies, but can be easily managed as small clumps in water gardens. Stems evergreen, typically solid dark green, elliptical in cross section, nearly

vertical, to 15 inches (38 cm) tall. Prefers a wet or at least constantly moist site in full sun. Zone 7.

‘*Variegata*’. Striped twig-rush. Stems striped yellow along one edge.

Blepharoneuron Nash

Grass family, *Poaceae*

Name from the Greek *blepharis*, eyelash, and *neuron*, nerve, referring to the nerves of the lemmas. A genus of only two warm-season species native to the desert southwestern United States.

Blepharoneuron tricholepis (Torrey) Nash

Mountain mist grass

Native to the “four corner” states of Arizona, New Mexico, Colorado, and Utah and extending into Mexico, this species typically occurs on steep, rocky south- and west-facing slopes at low to mid elevations in the foothills and moun-

LEFT *Austrostipa stipoides* in late August (winter) at the Auckland Botanic Gardens in New Zealand.

RIGHT Striped twig-rush, *Baumea rubiginosa* ‘*Variegata*’.





tains. Grows 1 to 2 feet (30–60 cm) tall when blooming in mid to late summer. The delicate, finely branched inflorescences catch the sunlight and the morning dew, and do genuinely produce misty effects. Relatively unknown in gardens and designed landscapes, this grass is another fine example of looking more closely at existing regional vegetation. New Mexico nurseryman David Salman long admired this grass during hikes in the mountains and decided to try growing it. He obtained seed from the Pecos wilderness in Santa Fe National Forest and offered plants in the High Country Gardens catalog in 2004, contributing to the regional beauty, diversity, and water-conserving palette of grasses available for desert and steppe climates. Zone 4.

Bothriochloa Kuntze

Grass family, *Poaceae*

Approximately 35 species of perennial, warm-season growers of wide distribution in open habitats in warm-temperate and tropical regions, sometimes cultivated for forage. Very closely related to *Andropogon*.

Bothriochloa barbinodis (Lagasca) Herter

[*Andropogon barbinodis* Lagasca]

Silver beardgrass, cane bluestem

Native on dry slopes and gravelly places in Oklahoma, New Mexico, Texas, and California, south into Mexico. Strictly clump-forming, upright, to 2 to 4 feet (60–120 cm) tall. Softly silky inflorescences are produced anytime from May to October, held above the foliage on slender stalks. They are slender and silver at first, becoming more feathery and translucent at maturity and after drying, and can be very dramatic when backlit. Stems are lax after flowering. Very drought tolerant, but will remain semievergreen in more moist locations. Well suited to drifts and sweeps in meadow gardens. Propagate by seed. Zone 7.

Bothriochloa ischaemum (Linnaeus) Keng

[*Andropogon ischaemum* Linnaeus]

Yellow bluestem

Originally from sunny, dry habitats in Europe but now widely distributed in Eurasia and northern Africa. The stems of this upright, clump-forming perennial are green with strong secondary yellow tones. Grows to 2½ feet (75 cm) tall when flowering in mid summer. Inflorescences open red, then dry to silver. Readily propagated by seed. Zone 6.

Bouteloua Lagasca

Grass family, *Poaceae*

Gramma, grama grass

Named for Spanish botanist brothers Claudio and Esteban Boutelou. Comprises nearly 40 annual and perennial species native to dry hills, plains, and other open grasslands in the Americas, from Canada to Argentina. Many species are from the southwestern United States, and the following two perennial, warm-season growers were important components of the historic North American shortgrass prairie. Also known as the Great Plains, this area is warmer and drier than the tallgrass prairie region. Grama grasses are important forage species.

Bouteloua curtipendula (Michaux) Torrey

Side-oats grama

Native to dry, often rocky or gravelly habitats in North America from Ontario to Southern California and south to Argentina. The common name refers to the oatlike spikelets, which are attached along one side of the inflorescences. The flowering stalks ascend vertically or arch above the basal mound of gray-green foliage, to a height of 3 feet (90 cm). Begins blooming in early summer and often flowers continuously until late summer if moisture is sufficient. Spikelets are purplish at first, bleaching to straw color as they age. Autumn

OPPOSITE Mountain mist grass, *Blepharoneuron tricholepis*, blooms in mid summer in a New Mexico garden. Photo © David Salman.

RIGHT New flowers of *Bothriochloa barbinodis* are silver against the blue-gray mountain background in late June in the meadow at the Santa Barbara Botanic Garden in California.

BELOW RIGHT Backlit *Bothriochloa barbinodis* brightens a path at Leaning Pine Arboretum in San Luis Obispo, California, in late June.

BELOW *Bothriochloa ischaemum* blooming in late August at the Royal Botanic Gardens, Kew, in England.





foliage colors include bronze-purple, orange, and red. Prefers full sun but will grow in light shade. Tolerant of a range of soils and of extended dry periods. Single plants are subtly attractive, and broad drifts can be quite dramatic. A fine addition to a meadow garden but will be overwhelmed by other grasses in moist settings. Propagate by seed sown in early spring, or by division. Zone 4.

Bouteloua gracilis (Humboldt, Bonpland & Kunth) Griffiths
[*Bouteloua oligostachya* Torrey ex A. Gray]

Blue grama, mosquito grass

Native to dry plains from Wisconsin to Manitoba south to Southern California and Texas. Usually only 8 to 15 inches (20–38 cm) tall in full flower, this diminutive grass blooms from June through September. The curious flowers are suspended horizontally like tiny brushes from the tip of each flowering stem, strongly red-tinted at first, bleaching to straw color and often curling as they dry. Prefers full sun. Can also be planted densely to create a low, casual no-mow ground-





cover or mowed occasionally to 2 or 3 inches (5–8 cm) to provide a water-conserving lawn that will tolerate a considerable amount of foot traffic. Semievergreen in mild climates, winter dormant in cold climates. Easily propagated by seed. Zone 3.

Brachypodium P. Beauvois

Grass family, *Poaceae*

Approximately 18 mostly Eurasian annual and perennial species. The following two European species have the potential to be biologically invasive in some parts of the world, but in others they are manageable and useful in difficult growing conditions.

Brachypodium pinnatum (Linnaeus) P. Beauvois

Heath false-brome, chalk false-brome

Of European origin, occurring naturally in shaded and open habitats including forest edges, open woods, and grasslands. Grows mostly upright, 1 to 4 feet (30–120 cm) tall. Tolerates dry shade and can withstand moisture competition from tree roots. Easily grown from seed. Zone 4.

Brachypodium sylvaticum (Hudson) P. Beauvois

Slender false-brome

This European species is native to woodlands and other shady places, growing as far north as Norway. Clump-forming and mostly upright, 1 to 3 feet (30–90 cm) tall. It self-sows readily and has naturalized widely, including in parts of the U.S. Pacific Northwest, where it has become a noxious weed. In dry, shady European gardens it is quite manageable and one of the few grasses that will tolerate difficult low-light conditions. Zone 3.



OPPOSITE FAR LEFT *Bouteloua curtipendula* blooms in light shade in early September at the Delaware Center for Horticulture in Wilmington.

OPPOSITE TOP RIGHT Spikelets of *Bouteloua curtipendula* are arranged along one side of the inflorescences. CENTER Inflorescences of *Bouteloua gracilis* appear to be swarming above the foliage in mid-August in northern Germany. BOTTOM *Bouteloua gracilis* makes an attractive, water-conserving lawn at the Denver Botanic Gardens in Colorado.

ABOVE LEFT *Bouteloua gracilis* grows naturally on a dry slope at Bandelier National Monument in New Mexico, its inflorescences dry and characteristically curled in mid February.

ABOVE RIGHT *Brachypodium pinnatum* at the Royal Botanic Gardens, Kew, in late August.

ABOVE *Brachypodium sylvaticum* grows in very dry shade under a large tree in the Cloister garden in Weihenstephan, Germany, in late August.

Briza LinnaeusGrass family, *Poaceae*

Quaking grass

Comprises 20 annual and perennial species native to grasslands in temperate Eurasia and South America, and widely introduced elsewhere primarily for their ornamental flower spikelets. *Briza media* is perennial. Two annual species are also cultivated in gardens: *B. maxima* Linnaeus, greater quaking grass, a Mediterranean native with larger spikelets, and *B. minor* Linnaeus, lesser quaking grass, a Eurasian native with smaller spikelets.

Briza media Linnaeus

Common quaking grass, rattle grass, pearl grass, shivering grass, trembling grass, cow quakes, didder, totter, dillies, doddering dickies

The plethora of vernacular names speaks of the broad ability of this grass to entertain and amuse. This cool-season Eurasian native is common nearly throughout the British Isles on a variety of grassland soils from light to heavy, dry to damp, and acidic to calcareous. Diffusely branched inflorescences to 2½ feet (75 cm) tall are produced in late spring, tipped with pendant spikelets resembling puffy oats. They rattle and rustle delightfully in spring and summer breezes

and make superb cut flowers. Opening green with tints of red-purple, they bleach to light straw color by mid summer. Clump-forming, producing a dense tuft of soft, deep green foliage that is semievergreen even in cold climates. No appreciable fall color. Reliable and easy to grow in full sun or light shade. Tolerant of poorly drained, heavy soils and also somewhat drought-tolerant. By late summer the flowering stalks are in disarray and are best cut back. Shearing foliage lightly at this time encourages new growth that will remain attractive into winter. Durable and long-lived. Sweeps and masses planted for flowers also double as groundcovers. Zone 4.

'Russells'. Striped quaking grass. A strong grower with neatly white-variegated leaves. Zone 4.

Bromus LinnaeusGrass family, *Poaceae*

Brome, brome grass, chess

From the Greek *bromos*, oat. Approximately 150 annual and perennial species widely distributed mostly in north-temperate regions.

Bromus inermis Leysser

Smooth brome, smooth brome grass

Native to Europe, Siberia, Mongolia, and Manchuria, this



LEFT The drying flowers of *Briza media* are still neatly attractive in July at Longwood Gardens in Pennsylvania. The basal foliage remains appealing year-round in cool mild climates.

ABOVE LEFT Spikelets of *Briza media* are green with red-purple tints in early June in Chicago. RIGHT *Briza media* 'Russells' at Knoll Gardens near Wimborne, England, in mid August.

perennial, cool-season grower is mostly clump-forming but does spread by creeping rhizomes. Widely valued as a hay and pasture grass, it has been introduced to the western United States and is now naturalized in many places. Though highly valued for forage, it is of landscape importance only for the following variegated cultivar. Zone 3.

'Skinner's Gold'. Striped brome. The yellow and green-striped leaves of this cultivar are among the most vibrantly colored of all grasses during cool parts of the year. The color dulls and growth becomes lax and unkempt in summer heat and humidity. Grows to 3 feet (90 cm) tall in bloom. Flowers from spring through summer with adequate moisture, though flowering interest is minimal and secondary to the foliage color. Not particular to soil type. Prefers full sun or very light shade in warmer climates. Zone 4.

Bromus riparius Rehmann

Meadow brome, meadow brome grass

This species is also a perennial, cool-season Eurasian native, typically growing in sunny, often moist meadow habitats. Tightly clump-forming, it produces a dense basal tuft of blue-green foliage that is overtopped by delicate inflorescences in late spring and early summer. Usually grown for forage, but drought-tolerant and attractive enough for gardens. Zone 3.



Buchloe Engelmann

Grass family, *Poaceae*

Buffalo grass

The genus name is contracted from *boubalos*, buffalo, and *chloe*, grass. Comprises only one North American species native to dry plains.

Buchloe dactyloides (Nuttall) Engelmann

Buffalo grass

The sod houses of early North American settlers were mostly made of buffalo grass sod. This warm-season grower was once dominant over dry upland areas of the Great Plains, which is known colloquially as shortgrass country or the shortgrass prairie. Buffalo grass ranges naturally from Minnesota to Montana south to Iowa, Texas, western Louisiana, Arizona, and northern Mexico, and is still a very important grazing grass in this region. Strongly stoloniferous, it forms a low, dense gray-green turf that can stand considerable foot traffic. It is extraordinarily drought-tolerant and is continu-

LEFT *Bromus inermis* 'Skinner's Gold' in late July at Merriments Gardens in East Sussex, England.

RIGHT *Bromus riparius* at the Royal Botanic Gardens, Kew, in late August.





ally gaining in popularity as a water-conserving lawn substitute in dry regions. Grows 4 to 8 inches (10–20 cm), and can be left unmowed or mowed occasionally. Deciduous, turning light brown in winter but returning to green earlier in spring than Saint Augustine grass (*Stenotaphrum secundatum*) or Bermuda grass (*Cynodon dactylon*). Its texture is much finer and more pleasant for barefoot strolling. The species is dioecious, with separate male and female plants.

Selections developed for lawn use are often vegetatively propagated female clones which grow lower, are more uniform, and are pollen-free. Usually purchased as sod, these include '609', 'Prairie', and 'Stampede'. Recommended seed varieties include 'Cody' and 'Tatanka'. Seeding is best done in early spring.

Prefers full sun and will grow on heavy, compacted soils. Not salt-tolerant. Will go dormant in extended summer drought. Supplemental moisture will keep it green but too much water will be injurious. Zone 4.

LEFT Male plants of *Buchloe dactyloides* are 8 inches (20 cm) tall in late August in Hans Simon's "prairie" garden at the Berggarten in Hanover, Germany.

BELOW Buffalo grass, *Buchloe dactyloides*, forms a neat lawn at the Ladybird Johnson Wildflower Center in Austin, Texas, in early April.



Calamagrostis Adanson

Grass family, *Poaceae*

Reed grass

Name from Greek *kalamos*, reed, and *agrostis*, a kind of grass. Comprises approximately 230 perennial species both clump-forming and running, occurring in diverse habitats in north-temperate regions including woodlands, meadows, and marshes, in wet-to-average moisture conditions and in both shade and sun. Many produce upright, feathery inflorescences that are spectacular when sunlit. Though the Eurasian species are most often cultivated, the western North American species deserve more attention.

Calamagrostis *x* *acutiflora* (Schrader) De Candolle

Feather-reed grass

This hybrid of *Calamagrostis epigejos* and *C. arundinacea* occurs naturally but infrequently in Europe. Both parents self-sow prolifically; however, the hybrid rarely produces fertile seeds and that is a great part of its appeal for garden and landscape use. Like both parents, the hybrid is a cool-season grower, typically flowering in very late spring or early summer. Its form is even more upright than either parent and it is a tight clump-former. For many years, a plant representing this cross was known as *C. epigejos* 'Hortorum' and was propagated by division. The renowned German nurseryman Karl Foerster first recognized the hybrid nature and called the plant *C. xacutiflora* 'Stricta'. Though in popular use for many years, the Latinized cultivar name 'Stricta' doesn't fit nomenclatural rules. The name 'Karl Foerster' has since been applied and is correct for Karl Foerster's feather-reed grass. Other variegated selections have since been made. Zone 4.

'Avalanche'. Variegated feather-reed grass. The center me-

dians are white in this introduction by nurseryman Steve Schmidt of Oregon. Zone 4.

'Eldorado'. Gold variegated feather-reed grass. The center medians are bright yellow-green. Plant patent applied for (PPAF). Zone 5.

'Karl Foerster' ('Stricta'). Karl Foerster's feather-reed grass. Beautiful, versatile, and nearly care-free, this is understandably one of the most popular garden grasses worldwide. The deep green, lustrous foliage of this cool-season grower is effective by late winter or early spring, and lasts well into the following winter, especially in milder climates. Clump-forming and strictly upright, producing vertical inflorescences up to 6 feet (1.8 m) that are loosely feathered and subtly purplish when they first appear in mid June. By August they become narrow vertical plumes of a delicate buff color, remaining upright and attractive through most of winter. This limber grass is one of the best for introducing motion to the garden; it moves gracefully with even a barely perceptible breeze. It always regains its upright posture even after heavy rains and never needs staking. Effective when planted singly as a specimen or vertical accent, or in sweeps and masses. Makes a fine deciduous screen due to fast growth, reliability, and multiseason duration. Virtual sterility recommends it for large-scale residential or commercial use without fear of compromising adjacent natural areas. No appreciable fall foli-

LEFT *Calamagrostis xacutiflora* 'Karl Foerster' paints a portrait of the wind in mid June at Chanticleer in Wayne, Pennsylvania. CENTER Dry flowers of *Calamagrostis xacutiflora* 'Karl Foer-

ster' flicker like candles in the September sun. RIGHT *Calamagrostis xacutiflora* 'Overdam' at Merriments Gardens in East Sussex, England, in late July.





age color. Grows best in full sun on well-drained fertile soils with adequate moisture, but will tolerate heavy clays and light shade. A true cool-season grower, it suffers in extended summer heat, and sometimes is susceptible to disfiguring foliar rust diseases in hot, wet summers, especially if air circulation is poor. Best cut back to about 5 inches (13 cm) in late winter. Divide or transplant in spring or fall. Plants displayed in containers will often survive winters without protection.

'Overdam'. Variegated feather-reed grass. Similar to 'Karl Foerster' except the leaves are longitudinally striped cream-white especially at the edges, and both foliage and flowers are less robust. The variegation is most pronounced in climates similar to that of northern Europe, with relatively low humidity and cool summer nights. This cultivar really suffers in hot, humid weather. Zone 4.

Calamagrostis arundinacea (Linnaeus) Roth

Feather-reed grass

This Eurasian native occurs naturally in forest gaps and lightly shaded habitats. It self-sows readily and is often a pioneer species in disturbed woodlands and edge habitats. An upright clump-former, it is best known as one of the parents of the cultivated hybrid *Calamagrostis* × *acutiflora*. Tolerates sun or shade, moist or dry conditions. Zone 5.

Calamagrostis brachytricha Steudel

[*Calamagrostis arundinacea* var. *brachytricha* (Steudel) Hackel]

Korean feather-reed grass, diamond grass

Distinct from the commonly cultivated European species, this Asian native typically flowers in late August or September. It occurs naturally in moist deciduous woodlands and wood edges. Most or all of the material in cultivation in Western gardens was introduced from Korea by Richard Lighty of Pennsylvania while on a plant-hunting trip for Longwood Gardens in September 1966. Lighty collected divisions of a plant growing at 2850 feet (850 m) elevation along a small streambank on Tok Yu Mountain in central South Korea. This clump-forming, shade-tolerant grass grows to 4 feet (1.2 m) tall in flower. It is most upright and heavily flowered in sun, and tends to be somewhat lax in shade. To ½ inch (12 mm) wide and glossy green, the leaves are wider and the foliage more coarse-textured than *Calamagrostis* × *acutiflora*. The inflorescences open with a strong purple-red tint, remaining open and feathery even when dry. Fall foliage color is an undistinguished yellow, and plants are completely dormant in winter. Easily grown on a range of soils in partial shade or in full sun if provided with sufficient moisture. Self-sows in moist, shady situations to a minor extent but is easily



OPPOSITE A sweep of *Calamagrostis xacutiflora* 'Karl Foerster' at Red Butte Garden in Salt Lake City, Utah, catches the late afternoon light in mid August.

ABOVE TOP New flowers of *Calamagrostis brachytricha* are strongly tinted pink-purple in late August at the Berggarten in

Hanover, Germany. ABOVE Luminous inflorescences of *Calamagrostis brachytricha* catch the early September sun in northern Delaware.

ABOVE RIGHT *Calamagrostis canadensis* catches the mid-July sun in Washtenaw County, Michigan. Photo © Greg Vaclavek.



managed. Best propagated by seed. Can be divided in spring. Zone 4.

Calamagrostis canadensis (Michaux) P. Beauvois

Bluejoint, bluejoint reedgrass

This sod-forming grass is the most common and widespread of the North American *Calamagrostis* species. It is native to marshes, wet places, open woods, and meadows from Greenland to Alaska and south in the United States to California, New Mexico, Missouri, Kansas, West Virginia, and North Carolina. Bluejoint spreads by rhizomes and often forms large, long-persistent colonies. Reaches 3 to 5 feet (90–150 cm) tall when flowering in early summer. Prefers full sun but will tolerate light shade. Grows best in moist to wet conditions. Self-sows readily. Divide in spring or fall. Zone 3.

Calamagrostis epigejos (Linnaeus) Roth

Feather-reed grass, wood small-reed, bush grass
Though upright in stance, this Eurasian native spreads strongly by rhizomes and often forms large clumps or masses. One of the parents of the cultivated hybrid *Calamagrostis × acutiflora*, it is a common pioneer species in disturbed woodlands and open waste places in northern Europe. Tolerates sun or shade, moist or dry conditions. Self-sows readily. Propagate by seed or division. Zone 5.

Calamagrostis foliosa Kearney

Mendocino reed grass, Cape Mendocino reedgrass, leafy reedgrass

The low, mounded form of this cool-season California native is unique among North American *Calamagrostis* species. Occurs naturally on coastal bluffs, cliffs, scrub, and other open rocky places in the northern California counties of Mendocino, Humboldt, and Del Norte, growing 10 to 15 inches (25–38 cm) tall when blooming in spring. Clump-forming, with glaucous foliage that often appears quite gray-blue and generally persists year-round. Prefers light shade but will grow in full sun if moisture is adequate. Additional moisture will extend the flowering period into summer. Tolerates a moderate amount of salt spray. Propagate by seed or division. Zone 8, possibly colder.

Calamagrostis nutkaensis (C. Presl) Steudel

Pacific reed grass

Native along North America's Pacific Coast in moist habitats from Alaska to Central California. Tufted and clump-forming to 3 to 5 feet (90–150 cm) tall when flowering. Feathery inflorescences open purplish in spring, drying to straw color. The foliage is relatively coarse and medium green, and in mild climates is semievergreen. Does well in full sun on moist soil but is better adapted to shaded conditions in drier conditions. Somewhat salt-tolerant. Propagate by seed or division. Zone 7.

TOP *Calamagrostis epigejos* runs over disturbed ground in northern Germany in late August.

CENTER Pink-tinted inflorescences emerge above the glaucous foliage of *Calamagrostis foliosa* in early April at the Santa

Barbara Botanic Garden in California. BOTTOM By mid June the inflorescences of *Calamagrostis foliosa* are dry and luminous, appearing much like a fountain fireworks rising from this neatly mounded grass.





TOP LEFT *Calamagrostis nutkaensis* blooms in mid June in a sunny location at the Santa Barbara Botanic Garden in California. LEFT *Calamagrostis nutkaensis* flowers in mid June in

the shade of large oaks at the Santa Barbara Botanic Garden.

ABOVE *Calamagrostis ophitidis* in mid August at the University of California Botanical Garden, Berkeley.

Calamagrostis ophitidis (J. Howell) Nygren

Serpentine reed grass

This uncommon species occurs on well-drained, rocky serpentine soils at mid to high elevations in northern California. Tufted and strictly clump-forming to 3 feet (90 cm) tall in flower. Forms a dense tuft of basal foliage from which strictly upright flowering stalks emerge in spring. New foliage is green in late winter and spring, and is increasingly suffused with warm tones as summer progresses. Requires sharp drainage. Propagate by seed or division. Zone 8.

Carex LinnaeusSedge family, *Cyperaceae*

Sedge

In the broad sense, *sedge* refers to any of the nearly 4000 species in the sedge family, but in the usual, narrower sense, the word refers to any of the more than 1000 species comprising the huge genus *Carex*. The species are often intergrading and highly variable, resulting in frequently confused identifications and an unusually unstable nomenclature. The majority of cultivated *Carex* species originate from moist or wet habitats in the world's temperate regions, and most are evergreen or semievergreen, but they are so diverse in habit, size, form, color, and flowers that it is difficult to make general statements about them. Flowers are often visually insignificant; however, some are quite showy. Foliage colors match or exceed the diversity found in grasses, including myriad greens, blues, yellows, browns, and oranges as well as bold variegations. The New Zealand sedges alone include a remarkable array of colors from medium green to light green or nearly white, orange to dark red, and bronze-green to copper, metallic tan, or root beer brown. The latter are sometimes humorously referred to as the "dead sedges" for obvious reasons, but are distinctively attractive unless displayed against mulch. Many sedges are clump-formers but others are aggressive runners. Although most *Carex* species do best in organic soils with plentiful moisture, others are naturally adapted to sunny, dry, alkaline conditions. Together they offer a multitude of choices for vegetating gardens and managed landscapes of all types.

Carex alba Scopoli

White sedge

This fine-textured green-leaved species is a good example of one of the many durable, useful sedges that are often overlooked because they are not variegated or otherwise colorful. Occurring in limestone regions on dry, often stony or sandy soils from southern Europe through the Caucasus and into Manchuria and Siberia, white sedge is adapted to harsh conditions and can keep the ground attractively covered in many difficult situations. Grows 4 to 12 inches (10–30 cm) tall and spreads by rhizomes, in sun or partial shade. Zone 5.

Carex albicans Willdenow ex Sprengel

Whitening sedge

It would be easy to mistake this clump-forming eastern North American native sedge for a grass: its leaves are so slender and the plant is so low. The foliage is only 4 to 8 inches (10 to 20 cm) tall, with spring flowers an inch or two above that. Durable, shade-tolerant, and semievergreen, it is an attractive presence in woodland landscapes. The typical variety, *Carex*



TOP *Carex alba* carpets the corner of shaded walkways at the Berggarten in Hanover, Germany, in late August, growing across from North American

native white wood aster, *Aster divaricatus*. ABOVE *Carex alba* in late August at the Berggarten.



albicans var. *albicans*, grows mostly in upland, often calcareous deciduous woods from Massachusetts to South Carolina and west to Michigan, Wisconsin, Nebraska, and Oklahoma. *Carex albicans* var. *emmonsii* (Dewey) Rettig is more common on acidic soils along the coastal plain, but ranges inland to Indiana and Illinois. Both can be propagated by seed, or by division in spring. Tolerant of dry shade. Zone 4.

Carex albula Allan

Blonde sedge

The leaves of this South Island New Zealand native are light buff to near-white. Strictly clump-forming, it produces a neat mound of fine-textured foliage 10 to 18 inches (25–45 cm) tall. Inflorescences are produced on stalks that are shorter than the leaves, so they are never very noticeable. This distinct species is often confused in commerce with *Carex comans* ‘Frosted Curls’; however, the cultivar is lower-growing, more sprawling, and never quite as white as true *C. albula*. Easily grown from seed or may be divided in spring. Zone 7.

Carex appalachica J. Webber & P. W. Ball

Appalachian sedge

Though its natural range extends from Maine and Quebec to Ohio and south in uplands to North Carolina and Tennessee, this fine-textured clump-forming species is never common, and has been listed in some regions as threatened or endan-



TOP LEFT *Carex albicans* blooms 6 inches (15 cm) tall in mid April in deciduous woods in eastern Pennsylvania, as its new foliage adds a cheerful bright green to the awakening landscape.

ABOVE Only 4 inches (10 cm) tall, *Carex albicans* (center) is similar in texture to *C. appalachica* (young plant at left) but

contrasts dramatically with *C. flaccosperma* (at right) in the author's Pennsylvania garden in mid November.

TOP RIGHT *Carex albula* in early April at Berkeley Horticultural Nursery in Berkeley, California.

gered. It is superficially similar to the common *Carex radiata* from which it can be distinguished only by small differences in floral morphological detail; however, *C. radiata* tends toward more moist environments. *Carex appalachica* grows naturally in average to dry woods, often in heavily shaded conditions and this combined with its clumping nature make it a useful plant for woodland landscapes and a distinct alternative to the running species *C. pensylvanica*. Propagate by seed, or by division in spring. Zone 4.

Carex baccans Nees ex Wright

Crimson-seeded sedge

An unusual sedge known for its bright red seeds. A lax, coarse-textured plant, with medium-green leaves ½ inch (12 mm) wide topped in summer by flowering stems to 3 feet (90 cm) tall. Seeds begin green, maturing to red by late autumn and remaining colorful during winter in mild climates. Prefers partial shade, fertile soil, with plenty of moisture. Well adapted to streamside locations. Propagate by seed or division in spring. Zone 8.

Carex baltzellii Chapman ex Dewey

Baltzell's sedge

This relatively rare forest native typically occurs on sloping sandy loam in Alabama, Florida, Georgia, and Mississippi. Little known in cultivation, it has attractive glaucous blue-green foliage and heat and shade tolerance that make it a promising choice for dry woodland gardens in the southeastern United States and other warm-temperate regions. To 8 inches (20 cm) tall, with leaves ¼ inch (6 mm) wide. Zone 8.

***Carex* 'Beatlemania'**

Fab Four sedge

This mop-headed sedge originated as a sport of *Carex* 'The Beatles' and is identical to it except that the leaf margins are green-gold variegated. Grows 6 inches (15 cm) tall. Although frequently sold as *C. caryophyllea*, it is probably a hybrid of *C. digitata* and *C. ornithopoda*. Zone 4.

Carex berggrenii Petrie

Nutbrown sedge

Native to New Zealand's South Island, typically growing in moist to wet ground in bogs, river flats, and lake margins. The lowest growing of the cultivated New Zealand sedges, this species rarely exceeds 4 inches (10 cm) in height. The leaves are flat and bronze or red-brown in color. Spreads slowly by rhizomes to form patches. Prefers full sun but requires moist conditions. Propagate by seed or division. Zone 5.



TOP *Carex baccans* in early February at the University of California Botanical Garden, Berkeley. ABOVE Ripening seeds of *Carex baccans*.

OPPOSITE TOP *Carex brunnea* 'Jenneke' in late August at the Royal Horticultural Society Garden, Wisley, in Surrey, England. BOTTOM *Carex buchananii* in early September (spring) at Heronswood Gardens on Australia's Mornington Peninsula.



Carex brunnea Thunberg

This tussock-forming species has a wide distribution, occurring in China, Japan, Taiwan, India, Indonesia, the Philippines, Australia, and New Caledonia. The evergreen foliage is typically solid green, growing to 2½ feet (75 cm) tall. The specific epithet means brown, referring to the color of the flower spikes; however, this sedge is cultivated almost exclusively for the strikingly variegated selections. Prefers moist, well-drained soil, in sun or partial shade.

‘Jenneke’. Leaves bright green-yellow with dark green edges. To 15 inches (43 cm) tall. Zone 8.

‘Variegata’. Leaves green with cream-white edges. Zone 8.

Carex buchananii Berggren

Leatherleaf sedge

One of the best-known and most popular of the New Zealand species, tufted and erect in growth, especially when young. The narrow foliage is copper-bronze to cinnamon-colored, to 2 feet (60 cm) tall, often curled at the tips. Grows best in full sun and is quite drought-tolerant. This and the other bronze-leaved New Zealand sedges truly require a contrasting background if they are to be effective in the garden. Viewed against brown mulch or soil, they look dead. Gravel or pebble mulches or silver-leaved groundcovers best bring out their unique foliage colors. Good drainage is essential for winter hardiness in colder zones. Propagate by seed, or by division in spring. Zone 7.

Carex caryophyllea Latourrette

Spring sedge

A European native, occurring in calcareous grasslands and on acidic mountain soils. Leaves typically dark green, recurving, up to 12 inches (30 cm). Zone 7. The cultivars ‘Beatlemania’ and ‘The Beatles’, often offered under this species, are probably hybrids of *Carex digitata* and *C. ornithopoda*.

Carex castanea Wahl

Chestnut sedge

Native to swamps, bogs, wet meadows, and margins of coniferous woods from Newfoundland to Ontario and south to Connecticut, Michigan, and Minnesota. Forming a neat, low mound of foliage less than 6 inches (15 cm) tall and 1 foot (30 cm) or more wide, this hardy clump-former is a durable addition to the woodland garden. New leaves are bright green, maturing to glossy dark green. Foliage is essentially evergreen. Flowering stems, produced in spring, are fine-textured and do not detract from the neat appearance of the foliage. Prefers moist organic soil but is





fairly drought tolerant once established. Grows best in light shade. Propagate by seed, or by division in spring. Zone 3.

Carex ciliatomarginata Nakai

[*Carex siderosticha* var. *pilosa* Léveillé]

Smaller creeping broad-leaved sedge, Ke tagane-so. Very similar to *Carex siderosticha* but with leaf blades smaller and long ciliate (finely hairy) on the lower margins. Native to dry, shaded grassy places in the mountains of Japan, and also in China and Korea. Creeps slowly by rhizomes to form a dense mat. Prefers fertile soil of average moisture, but will tolerate considerable dryness. Will grow in sun with adequate water, but is tolerant of considerable shade. Easily propagated by division, or by seed. Zone 5.

‘Shima Nishiki’ (island brocade). Leaves mostly green at center with bright yellow margins. To 4 inches (10 cm) tall. Zone 5.

‘Treasure Island’. Leaves mostly green at center with longitudinal white stripes especially at the margins. To 4 inches (10 cm) tall. Plant patent applied for (PPAF). Zone 5.

Carex comans Berggren

New Zealand hairy sedge, mop-headed sedge. Native to New Zealand’s North and South Islands, except for the extreme wet south end of the South Island which is known as Fiordland. Grows in damp open places and in openings in the forest. This densely tufted clump-forming species produces a mop of fine foliage 12 to 16 inches (30–40 cm) tall, but the flowering stems often extend in fruiting stage, sprawling over the ground 3 feet (90 cm) or more from the center. The foliage varies from bronze to red-bronze to pale green and is often distinctively curled although less so than *Carex buchananii*. Grows best in sun but will toler-



TOP LEFT *Carex castanea* blooms in early May in the author’s Pennsylvania garden. The bright color of the new leaves will mature to dark green by late spring.

TOP RIGHT The typical green form of *Carex ciliatomarginata* (right foreground) grows under the shade of Japanese cedar, *Cryptomeria japonica*; along with Christmas fern, *Polystichum acrostichoides* (upper left and center); and broad-leaved *Tellima grandiflora* (left center) in the author’s Pennsylvania garden in early November. CENTER *Carex ciliatomarginata* ‘Shima Nishiki’ in hanging planters at



Terra Nova Nurseries in Oregon in mid May. BOTTOM *Carex ciliatomarginata* ‘Treasure Island’ in May.



ate light shade. Also withstands considerable drought once established. Requires well-drained conditions for long life. Propagate by seed, or by division to retain foliage character and color. Zone 7.

'Bronze'. Leaves rich bronze with pink tints, although this name is something of a catchall for bronze forms, which often come more-or-less true from seed.

'Frosted Curls'. Leaves very pale green, even paler toward the ends. Plants truly representing this clonal cultivar were discovered at Cape Egmont in New Zealand by nurseryman Terry Hatch and introduced to cultivation through his Joy Plants nursery in 1975. Since then many seedlings and wild-collected pale green forms have been introduced to commerce, often sold as 'Frosted Curls' or 'Frosty Curls'. The name is also sometimes used for plants of *Carex albula* although these lack the characteristic curling of *C. comans*.

'Milk Chocolate'. Leaves rich brown. Of uncertain species origin, but likely belonging here.



ABOVE LEFT *Carex comans* 'Frosted Curls' (foreground) with *C. buchananii* (behind) and other plants in late August in California. ABOVE A rich bronze seedling of *Carex comans* in mid July at Adrian Bloom's garden in Bressingham, England. LEFT Curled leaf tips on *Carex comans* 'Frosted Curls' are characteristic of the species.

Carex conica Boott

Hime-kan-suge

Common in open woods on hillsides and low mountains in Japan, also native to southern Korea. Densely tufted, forming a neat mound of narrow, glossy green foliage. Leaves $\frac{3}{16}$ inch (4 mm) wide. Only the following variegated selection is commonly cultivated.

'Snowline' ('Variegata', 'Marginata'). Leaves deep green with crisp white margins. Long-lived but slow to increase in size. Provided good soil and adequate moisture, this durable sedge can grow to 15 inches (38 cm) tall by 24 inches (60 cm) wide. Planted closely, it makes a fine groundcover. Best in light shade in climates with strong summer sun. Fully evergreen in mild climates. Zone 5.

Carex crinita Lamarck

Fringed sedge

Native to wet woods and swales in eastern North America. A large species, clump-forming and upright-arching in habit, to 4 feet (1.2 m) tall. Produced in early summer, the long-pendant inflorescences last into autumn. An architectural plant that moves gracefully with woodland breezes. Attains greatest size in a moist or wet shady site, but can be grown on soils of average moisture in partial sun or shade. Propagate by seed, or by division in spring. Zone 5.

Carex digitalis Willdenow

Finger sedge, slender woodland sedge

Native to dry woods from Maine to Florida and west to Wisconsin, Illinois, Missouri, and eastern Texas. This widely distributed clump-forming species is very adaptable, growing in sun or shade, and in moist or dry conditions. It forms a neat mound of dark green foliage up to 8 inches (20 cm) high, topped by subtly attractive flowering stems in early spring. Often occurs with and sometimes hybridizes with *Carex laxiculmis*. An easy, durable sedge for woodland or woods-edge landscapes. Readily propagated by seed, or by division in spring. Zone 4.

TOP *Carex conica* 'Snowline' covers shaded ground at the Berggarten in Hanover, Germany, in late August.

CENTER Fringed sedge, *Carex crinita*, blooms in mid June in a moist deciduous woodland in northern Delaware.

RIGHT *Carex digitalis* grows in moss under the deciduous forest canopy at the Mount Cuba Center in northern Delaware in early October.



Carex digitata Linnaeus

Fingered sedge

This narrow-leaved, low-growing woodland species is widespread in Europe and ranges eastward to Siberia. It is durable and long-lived, forming dense tussocks up to 8 inches (20 cm) in diameter. Although this species is not commonly cultivated, *Carex* 'Beatlemania' and *C.* 'The Beatles' are likely hybrids between *C. digitata* and *C. ornithopoda*. Zone 4.

Carex dipsacea Berggren

Another New Zealand native, occurring in moist habitats on both North and South Islands. Densely tufted, 1 to 2 feet (30–60 cm) tall. Upright in habit, similar to *Carex testacea*, but with leaves typically light green or reddish. Zone 7.

Carex divulsa Stokes

[*Carex tumulicola* hort.]

Berkeley sedge, grassland sedge, gray sedge

Naturally occurring in dry, typically calcareous, open habitats, this widespread European species forms dense, spreading clumps and is a real workhorse in the garden. It has been grown for years in California and other parts of the southwestern United States as *Carex tumulicola*, a similar-looking California species. The true identity of material in cultivation was determined in 2005 by University of Michigan sedge specialist Tony Reznicek. Evergreen, with deep solid green foliage forming an exceptionally dense, slowly spreading clump 12 to 18 inches (30–45 cm) tall. Grows in dry, shaded sites or in full sun with average moisture. Drought-tolerant once established, but will also tolerate moist to occasionally wet conditions. Self-sows into areas where moisture is plentiful, but is very contained in dry sites. Propagate by seed or division. Zone 4.

Carex dolichostachya Hayata

Miyama kan suge

Native to mountain woods in Japan and Taiwan. The Japanese vernacular name refers to Miyama-cho, a mountainous area north of Kyoto. Mostly clump-forming, although creeping forms occur. Typically green-leaved, 10 to 18 inches (25–45 cm) tall. Fine-textured and shade-tolerant. Represented in cultivation mostly by the variegated form. Zone 5.

'Kaga Nishiki' ('Gold Fountains' is a commercial synonym). Kaga brocade sedge. A distinct selection from Kenji Watanabe's Gotemba Nursery in Japan, introduced to the United States by Barry Yinger. In Japanese, Kaga is the old name for the Ishikawa Prefecture and *nishiki* means brocade, a fitting description of the lacy beauty of this finely gold-variegated sedge. Leaves to $\frac{3}{16}$ inch (4 mm) wide, medium green



TOP Berkeley sedge, *Carex divulsa*, in dry shade at Leaning Pine Arboretum in San Luis Obispo, California, in early April.

ABOVE *Carex dolichostachya* 'Kaga Nishiki' in partial shade in late June at the Delaware Center for Horticulture in Wilmington.

in the center and gold at the edges, forming a symmetrical fountainlike mound, eventually to 2 feet (60 cm) in diameter. Long-lived and durable, suited for accent or groundcover sweeps. Fully evergreen into Zone 6. Prefers fertile organic soils and light shade or full sun with adequate moisture. Fairly drought tolerant in shade once established. Propagate by division in spring. Zone 5.

Carex eburnea Boott

Ivory sedge

Native from Newfoundland to British Columbia south to Virginia, Missouri, Nebraska, and Texas mountains, in dry sand or especially on limestone bluffs and ledges. Very fine, almost needlelike foliage, in neat symmetrical clumps 6 to 8 inches (15–20 cm) tall and soft green in color. Blooms in late spring. Slowly rhizomatous. Prefers sharply drained alkaline soil. Very drought tolerant and surprisingly heat-tolerant. Zone 4.

Carex elata Allioni

[*Carex stricta* Goodenough, non Lamarck]

European tussock sedge, tufted sedge

Native to swamps, mires, fens, lake edges, and riverbanks in northern and eastern Europe. Forms dense tussocks, sometimes in extensive stands. Analogous in form and habitat to the North American *Carex stricta* Lamarck. Although handsome, the green-leaved species is not often cultivated. The variegated forms are among the most brightly colored of all sedges. Zone 5.



'Aurea' ('Bowles Golden'). Bowles' golden sedge. E. A. Bowles described his discovery as "a very beautiful sedge, with golden-striped leaves, another of my finds in the Norfolk Broads." Both gardener and amateur naturalist, Bowles saw value in the diversity of local plant communities. This graceful plant grows upright to 2½ feet (75 cm). The leaves are up to 5/16 inch (8 mm) wide, mostly yellow with faint, random longitudinal green stripes. Yellow color is most intense in full sun. Foliage looks good through the growing season on plants at waterside, or even shallowly submerged. Burns if too dry, losing much appeal by late summer. Shady siting is necessary in drier soils, in which case leaves will be rich lime-yellow in color. Suffers in truly hot climates. Vertical inflorescences in early May are subtly attractive, soon disappearing amid developing foliage. Propagate by division in spring. Zone 5.

'Knightshayes'. Similar to 'Aurea' but leaves absolutely yellow. Named for the famed British Garden. Zone 5.

Carex firma Host

This tiny alpine species is native to high mountain grasslands in central Europe. Leaves blue-green, tufted, less than 4 inches (10 cm) tall. Sometimes grown in rock gardens, but



OPPOSITE TOP *Carex elata* 'Aurea' in Beth Chatto's garden in Colchester, England, in late July. BOTTOM *Carex elata* 'Aurea' flanks stone steps in the Israelit garden in Portland, Oregon, in late July, with

Hakonechloa macra 'Aureola' planted just below it. Photo by Melinda Zoehrer.

ABOVE *Carex flacca* at the Royal Horticultural Society's garden, Wisley, England, in late August.

most material in cultivation belongs to the following cultivar. Zone 6.

'Variegata'. Leaves striped cream-yellow. Zone 7.

Carex flacca Schreber

[*Carex glauca* Scopoli]

Glaucous sedge, carnation-grass

This European and northern African native occurs naturally in calcareous grasslands, on sand dunes, and in estuary marshes. It is naturalized in parts of eastern North America. A very variable species growing 6 to 24 inches (15–60 cm) tall, with leaves to 3/16 inch (4 mm) wide, sometimes green above and glaucous blue below, sometimes glaucous blue on both sides, resulting in an attractive bluish overall appearance. The foliage is similar in color to carnation leaves, hence the common name. Many different forms are in cultivation, some intensely blue and short growing, others more green or taller. Sun and dry conditions intensify the chalky-blue color and result in tighter, lower growth. Flowers, appearing in late spring on culms up to 12 inches (30 cm) tall, are relatively insignificant, although there is a noticeable purple-black color to the male and female spikes. Strongly rhizomatous, this species spreads slowly but steadily to form dense, fine-textured masses and is very useful as a groundcover in full sun to partial shade. Very drought tolerant. Adaptable to a wide range of soils including alkaline types and can also withstand some salinity. Most plants sold in the United States as *Carex nigra* are actually *C. flacca*. The individual florets of *C. flacca* have three stigmas; florets of *C. nigra* have two stigmas. Zone 4.

'Bias'. Leaves cream-white variegated on one side.

Carex flaccosperma Dewey

Thinfruit sedge

This clump-forming eastern North American woodland species has two intergrading varieties. The typical variety, *Carex flaccosperma* var. *flaccosperma*, is more southern in distribution, growing in rich, sometimes calcareous wood, bottomlands, and swamps from Florida and Texas north to Virginia, Tennessee, and Missouri. It forms a neat mound of evergreen foliage 8 to 10 inches (20 to 25 cm) tall. The leaves, typically green, are up to 5/8 inch (15 mm) wide.

The more northern *Carex flaccosperma* var. *glaucodea* (Tuckerman) Kükenthal grows in calcareous woods and meadows from Alabama and Louisiana north to Ontario and west to Illinois and Missouri. The foliage of this variety is strongly glaucous, resulting in the plants having an overall blue-green or gray-green appearance. "Glaucous woodland sedge" would be an appropriate common name. This variety is so distinct both morphologically and genetically that there is



growing consensus for classifying it as a separate species: *C. glaucoidea* Tuckerman.

Both varieties are long-lived, adaptable plants for gardens and other designed or managed landscapes. Although adapted to moist soils and considerable deciduous shade, they are quite drought-tolerant once established and will grow in sun on moist ground. Flowers are produced in May on stalks rising above the foliage. These become lax and create an often-tangled mass as the seeds mature; shearing them back at this time will improve neatness if desired. The foliage remains evergreen through all but the coldest winters; however, plants will tolerate annual cutting back if necessary to remove winter-desiccated growth. Propagate by seed, or by division in spring. Zone 4.

ABOVE A sweep of *Carex flaccosperma* var. *glaucoidea* in the Barton garden in Pennsylvania combines with drifts of local asters and ferns under a deciduous

canopy in mid August. RIGHT Glaucous woodland sedge, *Carex flaccosperma* var. *glaucoidea*, in the author's Pennsylvania garden in early August.





Carex flagellifera Colenso

Mop-headed sedge

Native to damp habitats on New Zealand's North, South, and Stewart Islands. Similar to *Carex testacea* and *C. comans*. Foliage color varies from metallic green to rich copper-bronze or red-bronze to dull gray-bronze. Typically grows 10 to 16 inches (25–40 cm) tall; however, the flowering stems are capable of elongating horizontally 3 to 6 feet (90–180 cm) from the center of the clump in fruiting stage.

'Bronze Delight'. Leaves warm bronze.

'Coca Cola'. Leaves cola-colored.

'Nelson'. Leaves green-bronze.

'Toffee Twist'. Leaves a light toffee brown.



TOP LEFT *Carex flagellifera* in mid July at Merriments Gardens in East Sussex, England. TOP RIGHT *Carex flagellifera* 'Coca Cola' at the Royal Horticultural Society's garden, Wisley, in Surrey, England, in late August.

RIGHT *Carex flagellifera* 'Toffee Twist' in early April at Berkeley Horticultural Nursery in Berkeley, California.

Carex grayi Carey

Gray's sedge, mace sedge

Named for eminent American botanist Asa Gray (1810–1888), this clump-forming North American grows in calcareous meadows and alluvial woodlands from Quebec to Iowa and south to Georgia, Mississippi, and Missouri. To 3 feet (90 cm) tall, leafy, medium green. Blooms in May, producing conspicuous and attractive light-green seedheads shaped like maces, $\frac{3}{4}$ to $1\frac{1}{2}$ inches (2–4 cm) in diameter at maturity. Will grow in shade to partial sun if provided adequate moisture. Propagate by seed, or by division in spring.

'Morning Star'. Seedheads larger than average, to 1 inch (25 mm) wide.

Carex hachijoensis Akiyama

Hachijo kan suge

This green-leaved Japanese sedge is native to Hachijo Island off Japan's main island of Honshu. Similar to the more densely tufted *Carex oshimensis* but not as cold hardy. The popular variegated cultivar 'Evergold' is sometimes listed here but is a selection of *C. oshimensis*. Zone 7.

Carex humilis Leysser

Low sedge

Native to hot, dry, open places including chalk grasslands and scrub woodlands, typically on nutrient-poor, often calcareous soils in Europe including the British Isles, sometimes occurring with *Carex flacca*, where soils are slightly richer. Green-leaved and fine-textured, it grows 8 to 24 inches (20 to 60 cm) tall, blooming in early spring. Rhizomes slowly extend laterally, forming new clumps. The flowers are relatively insignificant. Naturally adapted to heat, drought, and thin, poor soils, it is proving well suited for use on roof gardens and other similarly challenging urban sites. Plants in sun are typically light green in color. Shade-grown plants are deep green. Propagate by seed, or by division in spring. Zone 6, possibly colder.

'Hexe' (witch). A selection by Hans Simon of Germany. The name refers to the "witches" rings (circular growth patterns) sometimes evident in old populations of this sedge growing in habitat.

TOP *Carex grayi* grows in shade amid *Jeffersonia diphylla*, *Geranium maculatum*, and *Trillium* species at Cole Burrell's Bird Hill garden in Virginia in early May.

CENTER *Carex humilis* 'Hexe' in full sun on the Berggarten roof

garden in Hanover, Germany, in late August.

BOTTOM *Carex humilis* 'Velbeit' in partial shade at Garden Treasure Nursery on Long Island, New York, in mid July.



'Velbeit'. Superficially similar to the typical form, but has proved well adapted to coastal gardens in the northeastern United States.

Carex intumescens Rudge

Mace sedge

Very similar to Gray's sedge, *Carex grayi*, but with green, macelike seedheads that are not quite as large. Grows naturally in moist or wet woodlands from Newfoundland south to Texas. Blooms in June, to 2 feet (60 cm) tall, somewhat lax in habit, becoming more so by late summer. Very shade-tolerant. Prefers average to moist soil. Fully deciduous in winter. Propagate by seed or division. Zone 4.

Carex laxiculmis Schweinfurth

Glaucous woodland sedge, spreading sedge

Native to rich woods and glades from Maine to southern Ontario and Wisconsin south to Long Island, Tennessee, and Missouri. Clump-forming, producing a neat mound of evergreen foliage 6 to 8 inches (15–20 cm) tall. The glaucous blue-green leaves, are up to ½ inch (12 mm) wide. Superficially similar to *Carex flaccosperma* but with slightly narrower, typically more glaucous leaves, and with slender flowering and fruiting stems that never distract from the neat appearance of the foliage. Often occurs with and hybridizes with *C. digitalis*. Adaptable to a range of soil types. Prefers light shade but will grow in sun with adequate moisture. Drought-tolerant, surprisingly heat-tolerant, and a natural choice of dry shade situations. Propagate by seed, or by division in spring. Zone 4.

'Hobbs'. A blue-green selection from a Pennsylvania population, introduced by Head Ornamentals of South Carolina and marketed with the name Bunny Blue™. It has proved adapted to summer heat into Zone 9 in Florida.

Carex lupulina Muhlenberg ex Willdenow

Hop sedge

Native to wet woods and swamps, from Nova Scotia to Minnesota south to Florida and Texas. Deciduous, clump-forming, with upright stems to 30 inches (75 cm) tall and medium-green leaves to ½ inch (12 mm) wide. Flowers abun-

TOP *Carex intumescens* blooms in mid May in moist deciduous northern Delaware woods.

CENTER *Carex laxiculmis* along a bluestone walk in the author's Pennsylvania garden in mid October.

BOTTOM *Carex laxiculmis* 'Hobbs' amid falling leaves of pawpaw, *Asimina triloba*, in mid November in a shaded woodland section of the author's Pennsylvania garden.





dantly in late spring to early summer. The female spikes are up to 1¼ inches (32 mm) long and hoplike in appearance. Larger-flowered but lesser known than Gray's sedge, *Carex grayi*, this species is well suited to moist or wet woodland landscapes. Adapted to periodic standing water. Readily propagated by seed, or by division in spring. Zone 4.

Carex montana Linnaeus

Mountain sedge

Native to subalpine, rocky mountain habitats in Europe. Evergreen and fine-textured, growing 10 to 20 inches (25 to 50 cm) tall. Rhizomes slowly extend laterally, forming new clumps. Tolerates alkaline conditions. Propagate by division in spring, or by seed. Zone 4.

Carex morrowii Boott

[*Carex fortunei* hort.]

Kan sedge

Native to low mountain woodlands in central and southern Japan. Clump-forming or slowly spreading by rhizomes, with glossy evergreen leaves. Easily grown and adaptable to a wide range of conditions, this species is most commonly represented in cultivation by variegated forms, some of which were introduced to Western gardens as early as the mid-1800s. The majority of these belong to the typical variety, *Carex morrowii* var. *morrowii*, and have firm, leathery leaves to ½ inch (12 mm) wide. Grows 6 to 12 inches (15 to 30 cm) tall, in sun or light shade. Durable and well suited for use as groundcovers, especially the more rhizomatous forms. Zone 5.

'Gilt'. Leaf margins cream-white. Introduced from Japan and named by Hans Simon of Germany.

'Gold Band'. Leaf margins cream-yellow.

'Ice Dance'. Leaf margins cream-white. Strongly rhizomatous but not so fast as to be a nuisance. A superb, self-repairing groundcover selection introduced from Japan by Barry Yinger of Pennsylvania.

'Variegata'. This name is a catchall for numerous, otherwise unnamed variegated selections. Plants sold by this name may have crisply distinct white leaf margins or the variegation may be barely discernable.

TOP *Carex lupulina* in mid June in shaded moist woodlands in northern Delaware. CENTER *Carex montana* grows among calcareous rocks at the Sichtungsgarten in Weihenstephan,

Germany, in late August. BOTTOM This plant represents the most pronounced white-margined variegation to be found among plants sold as *Carex morrowii* 'Variegata'.



Carex morrowii* var. *temnolepis (Franchet) Ohwi

[*Carex temnolepis* Franchet]

Hosoba kan suge

This botanical variety is so different from the typical that it is difficult for casual observers to believe it belongs in same species. In fact, nineteenth-century botanist Adrien Franchet originally thought it to be a distinct species. Native to mountain woods on Japan's main island, Honshu, this exceptionally fine-textured sedge has threadlike leaves just over 1/8 inch (3 mm) wide. Grows in sun with adequate moisture, or

TOP Very subtly variegated plants of *Carex morrowii* 'Variegata' cover the shaded corner of two paths in the Friendship Island garden in Potsdam, Germany, in late August, backed by a clump of *Carex grayi*, *Epimedium* species, and ferns. ABOVE

LEFT *Carex morrowii* 'Ice Dance' with *Alchemilla mollis* at the Ega Exhibition Park in Erfurt, Germany, in late August. ABOVE RIGHT *Carex morrowii* var. *temnolepis* 'Silk Tassel' in mid July at Tony Avent's Juniper Level Botanic Garden in North Carolina.

in wet or dry shade. Clump-forming, to 1 foot (30 cm) tall. Propagate by seed, or by division in spring. Zone 5.

'Silk Tassel'. Leaves glossy, with white-variegated median and dark green margins. The variegation is subtle, producing an overall light green or gray-green appearance. Plants sometimes revert to solid green. Introduced and named by Barry Yinger, from a 1976 trip to Japan. Zone 5.

Carex muskingumensis Schweinfurth

Palm sedge

Native to low woods and wet meadows in north-central North America. Narrow, tapering solid green leaves radiate from lax stems growing to 2 feet (60 cm) tall. Spreads strongly by rhizomes, often forming large masses. Terminal inflorescences, produced in late spring, open green and turn light brown. Although naturally occurring in moist habitats, this species is surprisingly drought-tolerant and will grow on soils of average moisture in light shade or sun. Durable, long-lived, and suited for groundcover use. Propagate by seed, or by division in spring. Zone 4.

'Ice Fountains'. Leaf medians bright white, margins dark green. A distinct introduction from Dan Heims of Terra Nova Nurseries in Oregon.

'Little Midge'. A true miniature version, smaller in all parts and growing only 6 to 8 inches (15–20 cm) tall, with leaves 1/8 inch (3 mm) wide. Introduced by Limerock Nursery of Pennsylvania.

'Little Midge Variegated'. Leaves with cream-white margins. Originated as a sport at Hoffman Nursery in Rougemont, North Carolina.

'Oehme'. Leaves with pronounced yellow margins. Originated as a sport in Wolfgang Oehme's Maryland garden and named by Tony Avent of Plant Delights Nursery.

'Silberstreif' (silver stripe). Leaves green and white-variegated, slightly smaller-growing. Introduced in Germany by Eckhard Schimana.

'Wachtposten' (sentry tower). Green-leaved and slightly more erect-stemmed than typical.

Carex nigra (Linnaeus) Reichard

Black-flowering sedge

This extremely variable species occurs in bogs, marshes, and along waterways in Europe and to eastern coastal North America. Grows 1 to 2½ feet (30–75 cm) tall, spread-

TOP Flowering in early June, *Carex muskingumensis* is interwoven with *Polygonum amplexicaule* on dry ground at the Chicago Botanic Garden in Illinois. CENTER *Carex muskingumensis* 'Oehme'

in the courtyard at the Delaware Center for Horticulture in Wilmington in mid August. BOTTOM *Carex muskingumensis* 'Ice Fountains' at Terra Nova Nurseries in Oregon.



ing by rhizomes and sometimes forming dense tussocks. Leaves often glaucous, to $\frac{3}{16}$ inch (4 mm) wide. Blooms in late spring, the female flowers blackish, interesting but not showy. Though this species is worthy of cultivation, most plants sold by this name are actually *Carex flacca*, having florets with three stigmas instead of the two stigmas characteristic of *C. nigra*. Zone 5.

'*Variegata*'. Leaves with marginal light yellow variegation. Grows to 12 inches (30 cm) tall, spreading. Small blackish flowers in late spring. Stigmas two. Full sun or light shade.

Carex nudata W. Boott

California black-flowering sedge

This northern California native grows along wet, sandy or rocky streambeds below the high-water mark. Densely tufted, forming raised tussocks reminiscent of the eastern North American *Carex stricta*. Flowers truly black when opening in late winter or early spring, conspicuous and attractive, held on arching stems above the foliage, to 2 feet (60 cm). Grows best in sun with moisture. Propagate by seed, or by division in spring. Zone 7.

Carex ornithopoda Willdenow

Bird's-foot sedge

This small European species grows in open, subalpine often calcareous grassland habitats. Reaching only 4 to 8 inches (10–20 cm) tall with solid green leaves, it spreads by rhizomes that form new clumps. Will grow in sun or light shade. Fairly drought tolerant once established. Zone 7.

'*Variegata*'. Leaves white-variegated at center, with green margins. Smaller than *Carex oshimensis* 'Evergold', but similar enough that it is often confused with it in commerce.

Carex oshimensis Nakai

Oshima kan suge

This clump-forming Japanese native is common in dry woods and rocky slopes throughout Honshu, the main Japanese island. Densely tufted, it forms a thick, spilling tussock of fine-textured evergreen foliage to 16 inches (40 cm) high. Leaves are solid glossy green, up to $\frac{5}{16}$ inch (8 mm) wide. Durable and adaptable, it will grow in sun or shade and is

TOP California black-flowering sedge, *Carex nudata*, in March in a Longwood Gardens conservatory garden designed by Ron Lutsko. CENTER The typical green-leaved form of *Carex ornithopoda* in late August at the Berggarten in Hanover, Germany. BOTTOM LEFT The

typical, green form of *Carex oshimensis* grows beneath *Betula jacquemontii* in mid August at the Berggarten in Hanover, Germany. BOTTOM RIGHT *Carex oshimensis* 'Evergold' displayed in a container along a street in Takayama, Japan, in mid December.





quite drought-tolerant. Represented in cultivation mostly by the variegated forms. Propagate by seed, or by division in spring. Zone 5.

'Evergold' (also sold as 'Aureo-variegata', 'Old Gold', 'Everbrite', and 'Variegata'). One of the most elegant and widely grown of the variegated sedges. Leaves dark green at the margins, with a broad median stripe that is cream-white to cream-yellow. Flowers, produced in early spring, are ornamentally insignificant. Sections of the clumps occasionally revert to solid green or to less regular variegation, and plants in commerce sometimes include such variations. Also, 'Evergold' is often listed incorrectly as belonging to *Carex hachijensis* or *C. morrowii*. Performs well in a broad range of cultural conditions, but suffers in extreme heat. Zone 6.

'Gold Strike'. Leaves uniformly cream-yellow at center with dark green margins. Introduced by Kurt Bluemel.

Carex pallescens Linnaeus

Pale sedge

Native to Europe, Asia, and North America, usually in open woods and at woods edges. Shortly rhizomatous, with narrow leaves up to 2 feet (60 cm) tall. Zone 5.

'Wood's Edge'. Leaves with creamy marginal variegation.

Carex pansa Bailey

California meadow sedge

Native to coastal sands and other sandy open habitats in California, Oregon, Washington, and British Columbia. Spreads by strong rhizomes to form large mats, and is useful for stabilization and as a water-conserving alternative to cool-season turfgrass lawns. Narrow green foliage is somewhat tousled, 6 to 8 inches (15–20 cm) high if unmowed. Drought-tolerant although it will go dormant in summer in hot, dry regions without supplemental irrigation. Prefers full sun but will tolerate light shade. Best established by plug planting. Zone 6.

Carex pendula Hudson

A wide-ranging species, native to Europe, Asia, and North Africa. Typically occurs in moist environments and at woodland edges. Clump-forming, with gracefully arching stems to 6 feet (1.8 m) tall, from which hang delicate, cylindrical male and female flower spikes. It self-sows freely and is frequently encountered, invited, in British gardens. Although most texts suggest relegating it to the wilder parts of the garden, it is sometimes the perfect, architectural counterpoint to a stone

TOP *Carex oshimensis* 'Evergold' with *Helleborus foetidus* in early December in the author's Pennsylvania garden. CENTER The variegated pattern on *Carex*

oshimensis 'Gold Strike' is pronounced and uniform. BOTTOM *Carex pansa* unmowed at the Santa Barbara Botanic Garden in California in mid July.



wall or the spare courtyard of a stately home, where it will be content to grow between cracks in the pavers. Shade-tolerant and drought-tolerant. Easily propagated by seed or division. Zone 7.

‘Moonraker’. This strikingly cream-yellow variegated cultivar was pulled out of a hedgerow in Wiltshire, England, by a farmer’s tractor. The variegation is most pronounced in the early, cooler part of the growing season. Slow to propagate by division.

Carex pensylvanica Lamarck

Pennsylvania sedge

This highly variable species is widely distributed, growing in woods, woodland openings, and thickets, on upland organic soils and sandy soils in average to dry conditions, over much of eastern North America. Slender and upright to 8 inches (20 cm) tall, spreading by rhizomes and often creating an almost lawnlike cover. Tolerant of almost full sun if growing in moist soil. Highly shade-tolerant and drought-tolerant. Semievergreen in milder climates, winter dormant in cold regions, sometimes turning amber or gold at the end of autumn. Useful as a no-mow lawn substitute in shaded spaces, but will withstand only minor foot traffic. Tolerates periodic mowing. Easily grown from seed, although lawn plantings

TOP LEFT *Carex pendula* grows in a small space between the paving in the entry courtyard at Little Thakeham, in Storrington, England, in early July. TOP RIGHT *Carex pendula* at Red Butte Garden in Salt Lake City, Utah, in mid August. CENTER *Carex pensylvanica* blooms 6 inches (15 cm) tall in the author’s Pennsylvania garden in

mid April. Light yellow anthers of the male flowers are visible in the upper portion of each inflorescence. Translucent-white stigmas of the female flowers are positioned below. BOTTOM *Carex pensylvanica* appears quite lawnlike in this parking lot island at the Chicago Botanic Garden in early June.



are best established from plugs. Plants of local or regional provenance may prove more seasonally adapted than material from distant regions. Closer study and selection is warranted. Zone 4.

'Hilltop'. A low-growing selection of Maryland provenance.

Carex petriei Cheesman

Compact New Zealand sedge

Native to moist habitats on New Zealand's North and South Islands. Grows only 8 to 12 inches (20–30 cm) tall with leaves copper-brown to red-bronze, often curling or twisting at tips. Typically upright in form, like a small *Carex buchananii*, but sometimes more lax and spreading. Easily grown from seed which, as with so many of the New Zealand species, produces numerous leaf color variations. Prefers moisture and sharp drainage. Zone 7.

Carex phyllocephala T. Koyama

Chinese palm sedge, Tenjiku suge

An unusually architectural Chinese native with evergreen leaves arranged in whorls clustered toward the top of the 2-foot (60-cm) tall canelike stems. The typical form has solid green leaves and is rarely cultivated in gardens. The species was originally introduced to Japan for medicinal purposes and is best known for the variegated sport now called 'Sparkler'. Grows best in rich organic soil with adequate moisture. Solid green plants are slightly more cold hardy, often surviving winters in Zone 7.

'Sparkler'. Furi Tenjiku suge. *Furi* means variegated in Japanese. This unique variegated variety was introduced from Japan and named by Barry Yinger. Each stem truly resembles a sparkler throwing off bright white sparks from the tip. Clustered near the top of the stems in a palmlike manner, the leaves have broad white margins and dark green medians, creating an overall white effect. Though perennial in

mild climates, it is well suited to container display in colder regions. Grows well in partial shade, or in full sun with plenty of moisture. Zone 8.

Carex pilulifera Linnaeus

Pill sedge

A small Eurasian native occurring mostly on acidic soils in upland areas but also found on sandy soils. Clump-forming, 4 to 12 inches (10–30 cm) tall. Evergreen leaves typically solid green. Prefers sunny, acidic conditions. Alkaline soils will cause chlorosis. Drought-tolerant. Zone 7.

'Tinney's Princess'. Leaves cream-white at center with dark green margins. Found and introduced by Gerald Mundy from a plant on his estate near Salisbury, England. To 10 inches (25 cm) tall. Zone 7.

Carex plantaginea Lamarck

Plantain-leaved sedge, broad-leaved sedge

Native to rich moist deciduous woodlands in eastern North America, often along streamsides or near seeps. Clump-forming, with unusually broad leaves to 1½ inches (3 cm) wide, shiny green, with prominent parallel veins that result in a pleated look. The basal leaves overwinter, so the plant is effectively evergreen. A delightful bold-textured companion to ferns and woodland wildflowers in native habitats and in the garden. Requires regular moisture and partial shade for best growth. Too much sun will cause the leaves to yellow, no matter how much moisture is provided. Propagate by seed, or by division in spring. Zone 5.

'Mountain Yodel'. An especially vigorous, durable selection by Kurt Bluemel, from a North Carolina mountain population.

LEFT Container-grown *Carex phyllocephala* 'Sparkler' in late September in Pennsylvania.

RIGHT *Carex pilulifera* 'Tinney's Princess'.



Carex platyphylla Carey

Silver sedge, broad leaf sedge

Occurs on rocky slopes and streambanks in rich deciduous woodlands from Maine and southern Quebec south to the North Carolina mountains and west to Wisconsin and Missouri. Clump-forming and boldly textured, with leaves typically 1 inch (25 mm) wide. The glaucous foliage is sometimes nearly silver in appearance. Forms a loose, low tuft of leaves, usually less than 5 inches (13 cm) in height. Produces new leaves each spring which remain attractive through most or all of winter. Upright flowering stalks are produced in early spring. Grows fullest on moist organic soil but will tolerate poorly drained, periodically droughty soil. Tolerates alkaline conditions. Grows well in deciduous shade or in partly sunny sites. Readily propagated by seed, or by division in spring. Zone 4.



TOP LEFT New leaves are bright green on *Carex plantaginea* growing beside a West Virginia mountain stream in early May. BOTTOM *Carex plantaginea* in late August in a guesthouse courtyard garden by Karl Wienke in Suhl, Germany.

TOP RIGHT *Carex platyphylla* in early September in the author's Pennsylvania garden. BOTTOM In mid June, *Carex platyphylla* is displayed in a container along with other eastern North American woodland species in the entrance courtyard of Peirce's Woods at Longwood Gardens in Pennsylvania.



Carex praegracilis W. Boott

Western meadow sedge

Very similar to *Carex pansa* and often confused with it in commerce, this strongly rhizomatous, widespread western North American species occurs in a variety of habitats both moist and dry, including meadows, prairies, and edges of waterways. It often grows naturally on alkaline soils and is salt-tolerant in cultivated settings such as roadsides. Solid green and fine-textured, it grows to 12 inches (30 cm) if unmowed and can form an extensive carpet. Useful as an alternative lawn, either unmowed or mowed or cut with a string trimmer and maintained as low as 4 inches (10 cm). Withstands considerable foot traffic. Evergreen in mild moist conditions. Summer dormant in hot, dry conditions. This durable, adaptable species has been rapidly spreading from its original western distribution and is now found as far east as Pennsylvania. Prefers full sun but will tolerate light shade. Best established by plug planting. Zone 5.

'Laguna Mountain'. A dark green compact selection from the Laguna Mountain area in San Diego County, California. Zone 6.

Carex radiata (Wahlenberg) Small

[*Carex rosea* var. *radiata* (Wahlenberg) Dewey]

Eastern star sedge

This clump-forming eastern North American species typically occurs in deciduous forest habitats that are often moist to wet. Grows 8 to 12 inches (20–30 cm) tall with narrow green leaves. Well adapted to moist shade. Propagate by seed, or by division in spring. Zone 4.

Carex remota Linnaeus

Remote sedge

A fine-textured evergreen clump-former native to damp shady habitats in Europe including the British Isles. Forms dense tussocks of bright green leaves 10 to 12 inches (25–30 cm) tall. Grows best in light shade or in sun on moist soils or at water's edge. Propagate by seed, or by division in spring. Zone 6.

Carex riparia Curtis

Greater pond sedge

Widespread throughout the Northern Hemisphere, often forming large stands around ponds and by slow-moving riv-



TOP *Carex praegracilis* unmowed, in early April at the Santa Barbara Botanic Garden

in California. BOTTOM *Carex remota* in late August in Karl Wienke's garden in Suhl, Germany.

ers and other wet places. Spreads aggressively by rhizomes. Typically green-leaved. Stems to 4 feet (1.2 m) tall. Zone 5.

'*Variegata*'. Variegated pond sedge. Long arching leaves are boldly striped white. Occasional all-white leaves are produced in spring. Full sun, in moist or wet sites. Can be an invasive runner. Zone 6.

Carex rosea Schkuhr ex Willdenow

[*Carex convoluta* Mackenzie]

Rosy sedge

This fine-textured clump-former is native to deciduous and mixed forests over much of eastern North America, often in dry conditions. Grows 8 to 12 inches (20–30 cm) tall with green leaves that are slightly wider than *Carex radiata* or *C. apalachica*. Well adapted to dry shade. Propagate by seed, or by division in spring. Zone 4.

Carex secta Boott

New Zealand tussock sedge

This large species is native to New Zealand's North, South, and Stewart Islands, growing in swamps and along the margins of ponds and waterways. It is the analog to *Carex stricta* in North America, but even larger in ultimate size. Young plants appear as a fountain of fine-textured green foliage. Older plants form thick trunks up to 4 feet (1.2 m) tall. Though unquestionably handsome, this species has long been overlooked and underappreciated because it is so widespread and abundant. In recent years it has attracted attention for its utility in stabilizing streambanks and for its value in providing sheltering habitat for waterfowl. Prefers wet sites in full sun but will tolerate light shade and moist soil. Best propagated by seed. Zone 8, possibly colder.

Carex siderosticha Hance

Creeping broad-leaved sedge, Tagane-so

Native to mountain woods in Japan, also Korea, Manchuria, China. Slowly creeping by rhizomes, forming a dense mass of bold-textured foliage. Leaves 1¼ inches (32 mm) wide, solid green, to 8 inches (20 cm) tall. Deciduous, going fully dormant in cold winters. Prefers partial shade and average to moist organic soil. A long-lived, durable sedge for woodland gardens. Propagate by seed, or by division in spring. Zone 5.

'*Banana Boat*'. Leaves yellow-green at center with darker green margins. Dan Heims of Terra Nova Nurseries coined



TOP *Carex riparia* 'Variegata' in late July in England. BOTTOM Mature plants of *Carex secta* with well-developed trunks flank a

fountain at the Christchurch Botanic Gardens in New Zealand in late August (winter).



this name for an unnamed Japanese variety he introduced to the United States. Although the variegation is fairly stable in the garden, it is unfortunately not stable in tissue culture. Zone 6.

'Lemon Zest'. Another Terra Nova Nurseries introduction, with solid green-yellow leaves. Zone 6.

'Variegata'. Striped broad-leaved sedge. Leaves green with clear white stripes, especially toward the margins. The variegation on new leaves is often attractively pink-tinted during cool spring periods. Zone 6.

***Carex* 'Silver Sceptre'**

Silver sceptre sedge

Typically only 8 to 10 inches (20–25 cm) tall, this low, neatly variegated sedge is one of the very best for groundcover purposes. It spreads by rhizomes, forming a dense carpet of connected clumps that is largely impervious to weeds. Up to $\frac{5}{16}$ inch (8 mm) wide, the relatively soft leaves have broad cream-white margins. This sedge was originally introduced as a selection of *Carex morrowii*, but certainly does not belong to this species which has hairless, mostly two-toothed perigynia. The perigynia of *C.* 'Silver Sceptre' are hairy and toothless, more closely resembling those of *C. oshimensis*. This plant probably originated as a mutation in the garden of Masato Yokoi of Japan. Yokoi provided material to Roger Grounds of England, who named it 'Silver Sceptre'.

***Carex socialis* Mohlenbrock & Schwegman**

Low woodland sedge, social sedge

This fine-textured running species typically occurs on alluvial floodplain woods and other moist bottomlands from Texas to Georgia north to North Carolina, Kentucky, and Illinois, and is capable of withstanding periodic inundation. Grows 8 to 10 inches (20–25 cm) tall, spreading by rhizomes and often creating a nearly continuous cover. A useful alternative to *Carex pensylvanica* for more moist locations. Tolerates shade or will grow in sun with adequate moisture. Propagate by seed, or by division in spring. Zone 5.

***Carex solandri* Boott**

New Zealand forest sedge

Native to moist forests on New Zealand's North and South Islands. Distinct from most cultivated New Zealand sedges in

TOP *Carex siderosticha* with *Adiantum venustum* in late August in a very shady section of Hermann Müssel's garden in Heigenhausen, Germany. CENTER This Japanese selection of *Carex siderosticha* has been sold in the

United States as 'Banana Boat'. Photographed in Cole Burrell's Virginia garden in early May. BOTTOM *Carex siderosticha* 'Variegata' in Barry Yinger's Pennsylvania garden in mid June.



having green leaves. Grows 18 to 24 inches (45–60 cm) tall. Prefers moist shade but will grow in partial sun and average moisture once established. Zone 7.

Carex spissa Bailey

San Diego sedge

Native along watercourses and in wet seeps, sometimes in serpentine regions, at lower elevations in Southern California, New Mexico, and Mexico. A distinct and dramatic sedge with thick, evergreen gray-blue leaves, growing upright to 5 feet (1.5 m) tall. Increases slowly by rhizomes to form large clumps but is never invasive. Light brown terminal inflorescences are produced in spring. Accumulated discolored or dead foliage from past seasons is best removed by raking. This sedge does not recover easily from being cut back. Grows best with plentiful moisture but is surprisingly drought-tolerant once established. Propagate by seed or division. Zone 7.



Carex stricta Lamarck

Tussock sedge

Native to bogs, marshes, wet swales, and creeksides in northeastern North America. Similar in form and preferred habitat to the European *Carex elata*. Develops dense tussocks raised



TOP LEFT *Carex* 'Silver Sceptre' with *Polygonum amplexicaule* 'Firetail' (foreground) and *Sedum* 'Autumn Joy' (background) at the Ega Exhibition Park in Erfurt, Germany, in late August.

TOP RIGHT *Carex spissa* blooms in early April at Leaning Pine Arboretum in San Luis Obispo, California. CENTER *Carex stricta* blooms in May in a wet woodland opening in New York State. BOTTOM *Carex stricta* tussocks in mid April in western Massachusetts.

above the water's surface, each with an accumulation of old leaves surrounding the base. Spreads by underground rhizomes to form new tussocks, sometimes creating large stands. Rich green and fine-textured, striking in contrast with skunk cabbage, *Symplocarpus foetidus*; cinnamon fern, *Osmunda cinnamomea*; and other eastern natives of wet woods and woods edges. Will survive dry periods and will grow away from water if soil is moist. Propagate by seed, or by division in spring. Zone 4.

Carex subfusca W. Boott

Mountain sedge

Occurs along watercourses and seasonally moist mountain meadows from Washington south through California into Mexico, and eastward into Idaho, Utah, and New Mexico. Spreads rapidly by rhizomes to form a thick cover of fine-textured foliage 12 to 18 inches (30–45 cm) tall. Grows in sun or shade. Dormant in hot, dry summer period or will remain green if moisture is plentiful. Propagate by seed, or by division in early spring. Zone 5.

Carex tahoata Hamlin

This New Zealand native is restricted to the central North Island. It is very similar to *Carex dipsacea*, but is shorter, with more slender leaves. Zone 7.

'**Taupo Bronze Warrior**'. Leaves rich chestnut bronze. Introduced by Taupo Native Plant Nursery on New Zealand's North Island.

Carex tenuiculmis (Petrie) Heenan & de Lange

[*Carex secta* var. *tenuiculmis* Petrie]

This South Island New Zealand native is represented in cultivation by plants that are rich warm bronze in color. Mostly upright-arching in form, especially when young. Best in full sun with adequate moisture. Zone 6.

Carex testacea Solander ex Boott

Orange New Zealand sedge

A common species on New Zealand's North and South Islands, growing in grasslands and forests and on dunes. Densely tufted, to 2 feet (60 cm) tall with upright-arching fine-textured foliage. The color varies from green to golden brown and orange, but the most commonly cultivated forms

TOP *Carex subfusca* carpets moist ground around a stone in the meadow at the Santa Barbara Botanic Garden in California. CENTER *Carex tenuicul-*

mis in Southern California in early April. BOTTOM *Carex testacea* in Christchurch, New Zealand, in late August (winter).



are intensely orange, especially when grown in full sun. The color persists almost year-round. This is one of the hardiest, most drought-tolerant New Zealand sedges, and because of this it is commonly planted in challenging urban sites and is ideal for growing as a container specimen. The fruiting stems can elongate greatly, becoming a nuisance unless trimmed, which is easily done except in very large plantings. Propagate by seed or division. Zone 6.

Carex texensis (Torrey) Bailey

Texas sedge, catlin sedge

Occurs mostly on rocky or sandy ground in open, often dry woodlands and meadows over much of the eastern United States west to Illinois, Missouri, Oklahoma, and Texas. It has been introduced eastward to New Jersey and westward to California. This low-growing clump-former is long-lived and durable enough to be used as a water-conserving lawn alternative. Foliage is dark green and fine-textured, to 5 inches (13 cm) high. Spring flowers are subtle and visually insignificant. Can be grown from seed, although lawn plantings are best established by planting plugs approximately 6 inches (15 cm) apart. Will tolerate periodic mowing and a moderate amount of foot traffic. Grows in sun or partial shade, in moist or dry conditions. Zone 5.

***Carex* 'The Beatles'**

A likely hybrid between *Carex digitata* and *C. ornithopoda*. Makes a deep green mop of narrow foliage 6 inches (15 cm) tall, spreading slowly. A useful low groundcover, evergreen in milder climates. Requires moisture. Zone 4.

Carex trifida Cavanilles

New Zealand blue-green sedge, tataki grass

Native in New Zealand, on coastal cliffs or rock outcrops and occasionally in swamps, as well as in Chile and the Falkland Islands. Distinct from most other New Zealand native sedges, with rather wide, glaucous blue-green leaves and a stout habit. Grows 18 to 30 inches (45–75 cm) tall. The flowering stems are upright and topped with attractive brown inflorescences. Blue foliage color is most pronounced when plants are grown in sun, although this sedge will tolerate light shade. Drought-tolerant. Propagate by seed or division. Zone 8, possibly colder.

TOP *Carex texensis* in early April at the Ladybird Johnson Wildflower Center in Austin, Texas.

BOTTOM *Carex trifida* in late August (winter) at the Auckland Botanic Gardens in New Zealand.

Carex tumulicola Mackenzie

Foot-hill sedge

This slowly spreading species is native to grasslands and forest openings in British Columbia, Washington, Oregon, and California. Grows 1 to 2 feet (30–60 cm) tall, with narrow green leaves. Will tolerate sun or shade and moisture levels from moist to dry. This species is confused in commerce with the European Berkeley sedge, *Carex divulsa*. For many years, the majority of plants sold as *C. tumulicola* have actually represented *C. divulsa*. Zone 7.





Chasmanthium Link

Grass family, *Poaceae*

Wild-oat, wood-oat

Comprises five perennial, warm-season species native only to North America, primarily distributed in the central and southeastern United States and northern Mexico. This genus was formerly included in *Uniola*, sea-oat; however, *Chasmanthium* species are inland grasses that have nothing to do with the sea, and any nursery listings retaining the common name sea-oat are in error. All the species occur primarily in woodland habitats, typically along streams and rivers.

Chasmanthium latifolium (Michaux) Yates

[*Uniola latifolia* Michaux]

Wild-oat, wood-oat, river-oat, Indian wood-oat

This species has the largest spikelets and is the only one with pendant panicle branches and spikelets. It grows on banks of rivers and streams, on floodplains, and in low, rich deciduous woodlands from New Jersey south to Florida and Texas and west to Kansas. Clump-forming and upright to 4 feet (1.2 m) tall when flowering in mid to late summer. Plants growing in sun are lighter green and strictly upright. Plants in shade tend to be dark green and more lax-stemmed. The nodding spikelets are light green at first, progressing through yellow-green, then red-bronze, then salmon-buff, remaining attractive through winters in cold regions. Foliage reliably turns vibrant amber-gold in autumn. Prefers light shade but will grow in full sun with adequate moisture. Very drought tolerant, and tolerant of poorly drained clay soils. Self-sows readily in moist environments or irrigated gardens. Seedlings are minimal in dry conditions. Essentially clump-forming, but increases slowly in width by short rhizomes and is durable enough to be used as a tall groundcover in sun or shade. Best cut back annually in late winter. Excellent for cut material any time from mid summer into winter. Propagate by seed, or by division in spring or fall. Zone 5.



Chasmanthium laxum (Linnaeus) Yates

Slender wild-oat, slender wood-oat

Occurs in deciduous and piney woodlands, swamps, and meadows, often on the coastal plain and on sandy soils



TOP Golden spikelets of wild-oat, *Chasmanthium latifolium*, catch the mid-October sunlight in the author's Pennsylvania garden, backed by the light blue flowers of *Aster cordifolius*. CENTER *Chasmanthium latifolium*

grows in large masses in full sun along northern Delaware's Wilmington Waterfront in mid August. BOTTOM *Chasmanthium laxum* in early October at Hoffman Nursery in Rougemont, North Carolina.

throughout most of southeastern North America. Clump-forming and upright, to 5 feet (1.5 m) tall when flowering in mid summer. The spikelets are much smaller than those of *Chasmanthium latifolium* typically no more than $\frac{3}{8}$ inch (9 mm) long, and are arranged closely along the central axis of the inflorescence. Foliage is clustered toward the lower portion of the plant. The upper portions of the stems, including the inflorescences, are leafless. Prefers shade but will grow in partial sun with adequate moisture. Drought-tolerant. Propagate by seed, or by division in spring or fall. Zone 6.

Chasmanthium sessiliflorum (Poirlet) Yates

Longleaf wild-oat, longleaf wood-oat

Very similar to *Chasmanthium laxum* in most characteristics but slightly shorter, to 4 feet (1.2 m) tall, and less common in pine woods. Propagate by seed, or by division in spring or fall. Zone 6.

Chionochloa Zotov

Grass family, *Poaceae*

Snow tussock, snow grass

This Australasian genus is comprised of 24 species, with 22 of those endemic to New Zealand. Closely related to *Cortaderia*. Includes large tussock-forming species growing to 7 feet (2.1 m) tall in flower and smaller, tufted, and slowly spreading species under 4 feet (1.2 m) tall. All are perennial and evergreen. As a group, they are essential to and emblematic of New Zealand's great tussock grasslands. Some have conspicuous inflorescences held high above the foliage. Others flower with the leaves and are dramatic mostly for their rounded form, texture, and size. They are found in a wide range of habitats from coastal forests and cliffs to subalpine mountain streamsides. Most can be grown from seed. Division is pos-

sible but difficult due to the large size and density of mature clumps.

Chionochloa conspicua (Forster f.) Zotov

Plumed tussock grass, toetoe hunangamoho

Endemic to New Zealand, found throughout the South Island in lowland and subalpine forests and clearings, especially near streams, and also occurs in North Island mountains. Produces large inflorescences to 7 feet (2.1 m) tall, reminiscent of the New Zealand *Cortaderia* species, which are known generically as toetoe, but more open and airy. Summer-blooming. Zone 8.

Chionochloa flavescens (Hooker f.) Zotov

[*Danthonia flavescens* Hooker f.]

Broad-leafed snow tussock

Occurs on New Zealand's North and South Islands, typically in mountainous regions, often near water. Grows to 4 feet (1.2 m) tall, forming a dense tussock of deep green foliage with leaves to $\frac{1}{2}$ inch (12 mm) wide. Blooms in summer, with open, airy inflorescences held above the foliage and moving freely with the wind. Grows best on average to moist soil. Zone 8.

Chionochloa flavicans Zotov

This graceful tussock-forming species is confined to New Zealand's North Island, where it occurs on cliffs and rocky outcrops at lower and middle elevations. Typically 3 feet (90 cm) tall with dark, glossy green leaves and attractively nodding inflorescences held above the foliage. This species is most common in cultivation and is adapted to a wide range of soil types and moisture conditions. Durable and long-lived, it is effective singly or massed as a groundcover. Very drought

FAR RIGHT *Chionochloa flavescens* remains semievergreen, and last season's inflorescences are still visible on plants growing along a high mountain stream in central South Island, New Zealand, in late August (winter).

RIGHT Green, leathery foliage of broad-leafed snow tussock, *Chionochloa flavescens*.





tolerant once established. Will grow in sun or light shade. Propagate by seed or division. Zone 8.

Chionochloa rubra Zotov

Red tussock grass

Widely distributed through New Zealand's North, South, and Stewart Islands, in lowland and low alpine areas in the volcanic mountain regions. Common on the mineral belts of South Island and also on poorly drained peaty valley floors or rolling slopes mostly below the tree line. Often occurs in great drifts characteristic of the classic New Zealand tussock grasslands. The inflorescences are not clearly distinguished from the foliage, and the appeal of this species is primarily in its graceful form, fine texture, and color, which ranges from a light brassy copper to a rich copper-red. Grows 3 to 4 feet (90–120 cm) tall. Best propagated by seed. Prefers sun. Very drought tolerant. Zone 8.



TOP LEFT *Chionochloa flavicans* in late August (winter) in Wellington, New Zealand. CENTER *Chionochloa flavicans* serves as a groundcover on an urban slope in Wellington, New Zealand, in late August (winter). The foliage often retains its rich green over winter. BOTTOM *Chionochloa rubra* in early September (spring) at the Army Museum Waiouru on New Zealand's North Island, near Tongariro National Park.

TOP RIGHT The graceful form and fine texture of *Chionochloa rubra* is complemented by a wind-sheared shrub near Arthur's Pass in New Zealand's Southern Alps at the end of August (winter).

OPPOSITE TOP Red tussock grass, *Chionochloa rubra*, in New Zealand's Southern Alps at the end of August (winter). BOTTOM *Chondropetalum tectorum* in late June at Leaning Pine Arboretum in San Luis Obispo, California.



Chondropetalum Rottbøll

Restio family, *Restionaceae*

Comprises approximately 15 rushlike, dioecious species native to the Cape Floral region, in South Africa, forming tussocks to 6 feet (1.8 m) tall. They are part of the fynbos plant community, which is characterized by natural burning, and are generally found on low-nutrient soils. The green, mostly leafless stems are sometimes used for roof thatching. These species are cool-season growers, most active in spring and autumn, but having a strong evergreen presence. Research at the Kirstenbosch National Botanical Garden in Cape Town has revealed that smoke treatment of restio seeds significantly increases germination rates, and because of this these unique plants are becoming more readily available commercially.

Chondropetalum tectorum (Linnaeus f.) Rafinesque

Cape-reed, Cape rush

Occurs in marshes and seeps in South Africa from Clanwilliam to the Cape of Good Hope and east to Port Elizabeth. Forms an erect tussock to 4 feet (1.2) tall, increasing slowly



in width by rhizomes. Stems rich, dark green, unbranched, and bare of recognizable leaves, giving the appearance of a huge *Juncus effusus*, but more relaxed. The stems radiate in an arc, sometimes touching the ground when laden with flowers or seeds. Male and female flowers occur on separate plants and are similar in appearance, dark brown, and clustered at the tips of stems. A truly sculptural plant, eye-catching when moving in the wind or when lit by the sun. Propagate by seed. Difficult to divide, as the roots do not like to be disturbed. Resents high fertility. An excellent seasonal container subject in areas beyond its winter cold hardiness. Prefers full sun but will tolerate light shade although growth will be somewhat lax. Zone 8.

Cortaderia Stapf

Grass family, *Poaceae*

Pampas grass, toetoe

The genus name is derived from *cortadera*, the Argentine name for this grass, having the same root as the Spanish word *cortar*, to cut. The leaves of many *Cortaderia* species are sharp-edged and can cause serious cuts. Though most commonly known in cultivation for the South American pampas grass, *C. selloana*, this genus comprises 24 or 25 species native to South America and New Zealand. Pampas grass refers to the South American species and toetoe to the New Zealand species. All are closely related to *Chionochloa*. They are relatively large, perennial, tussock-forming grasses, producing plumelike inflorescences held high above the foliage. Flowers are either bisexual or unisexual, and the species are either monoecious or dioecious. Among dioecious plants, females produce the most impressive plumes. Foliage is evergreen, and over years the tussocks tend to accumulate a large amount of old, dead growth.

The tussocks are best cut back occasionally, with gloved hands and sturdy hand shears or power shears. In native habitats fire typically serves to clean and renew plants; however, burning such large grasses in residential garden settings requires extreme caution since they are highly flammable.

More recent introductions from South America have extended the range of winter hardiness into Zone 6; however, most *Cortaderia* species require more warmth. They are suitable for display in large containers. Plants sold as hardy pampas grass may be *Saccharum ravennae*, so it is best to check with suppliers.

All the species may be grown from seed, though division or tissue culture is necessary to retain distinct characteristics of cultivars. Both *Cortaderia selloana* and *C. jubata* have become naturalized in western North America, especially on disturbed open ground.

Cortaderia fulvida (Buchanan) Zotov

Tussock grass, kakaho

Native to New Zealand, especially on the North Island, from sea level to subalpine regions, occurring in open places, along streamsides, and at the margins of forests, sometimes in huge masses. Blooms mid summer. Inflorescences tawny, to 6½ feet (2 m). Well suited to waterside situations in the garden. Zone 8.

Cortaderia jubata (Lemoine) Stapf

Purple pampas grass, Andes pampas grass

Native to the mountains of Ecuador, Peru, and Chile. Earlier blooming than *Cortaderia selloana* with inflorescences rosy lavender upon opening, drying to dull grayish tan. To 9 feet (2.7 m) in flower. Well adapted to dry conditions, this species has become widely naturalized on disturbed open ground along the West Coast of North America, and is considered a serious pest. Female plants produce copious quantities of fertile seeds through apomixis (seed production without sexual cross-fertilization), which contributes to their spread. Zone 8.

Cortaderia richardii (Endlicher) Zotov

Toetoe, tussock grass, plumed tussock

Native to moist, open places in New Zealand. Although the plumes are not as large and full, this species rivals the majesty of pampas grass, *Cortaderia selloana*. It grows to 10 feet (3 m) height in bloom, with the inflorescences often gently nodding atop a multitude of stalks ascending at different angles from the center of the clump. Plumes nearly white or with a slight brassy tint, often slightly one-sided. Blooms mid to late summer. A versatile grass for streamside, pondside, or soils of average moisture. Not as drought-tolerant as the South American species. Zone 8.

Cortaderia selloana (Schultes & Schultes f.) Ascherson & Gräbner

[*Cortaderia argentea* (Nees) Stapf]

Pampas grass

The quintessential ornamental grass of the Victorian era, when ostrich feathers and pampas grass plumes were the epitome of style. Native to the pampas of Brazil, Argentina, and Chile, where it typically occurs in extensive populations. The word *pampas* is derived from a South American Guaraní tribal word meaning level plain, and the pampas regions of South America are grassland biomes covering flat, fertile plains located between the Atlantic Ocean and the Andes Mountains. The climate of the pampas is warm and humid, with a nearly constant wind and sometimes searing, hot summer temperatures.



TOP LEFT *Cortaderia fulvida* in late July at Nymans Garden in West Sussex, England. TOP RIGHT *Cortaderia richardii* in moist, sunny native habitat in the central South Island, New Zealand, in late August (winter). The plumes have lasted entirely through the winter.

ABOVE *Cortaderia richardii* in Alan Bloom's garden in Bressingham, England, in mid July. RIGHT *Cortaderia selloana* in late August at the Royal Botanic Gardens, Kew, in Surrey, England.

Adapted to these rather extreme conditions, *Cortaderia selloana* is capable of growing in a wide range of conditions in cultivation and sometimes beyond cultivation. It has naturalized along the West Coast of North America, where it is considered a serious pest. In many areas where it is grown, including England, it has no invasive potential, once again illustrating the often regional or localized nature of weedy behavior. The standard form of the species has long been popular in the southeastern United States, where it has become a beautiful cliché.

Dramatic as the plumes are, many variegated cultivars of pampas grass are worth growing for foliage alone, either planted in the landscape or set out seasonally in pots. Plants can be maintained indefinitely in cold areas by overwintering in a cold frame or cool greenhouse. Container growing generally limits size and discourages flowering, which is desirable in areas where the species is potentially invasive. The species and its cultivars are typically cold hardy to Zone 8; however, some recent introductions are much more cold-tolerant.

'Albolineata' ('Silver Stripe'). White-striped pampas grass. Leaves longitudinally white-striped. Plumes white, of modest size. Zone 8.

'Andes Silver'. Silver plumes 7 feet (2.1 m) tall. A cold-hardier introduction by Kurt Bluemel. Zone 6.

'Aureolineata' ('Gold Band'). Golden-variegated pampas grass. Leaves longitudinally yellow striped, mostly near the margins but some blades nearly all-yellow. Plumes white, modest-sized. Zone 8.

'Bertini'. Compact-growing, less than 4 feet (1.2 m) tall in flower. Plumes white.

'Monstrosa'. A huge green-leaved selection, with immense white plumes.

'Monvin'. Yellow-striped leaves. Introduced and patented by Monrovia Nursery of California, and marketed with the name Sun Stripe™.

'Patagonia'. Silver plumes to 7 feet (2.1 m) tall. Leaves bluish gray-green. A cold-hardier introduction by Kurt Bluemel. Zone 6.

'Pink Feather'. Large plumes with pink blush. Zone 8.

'Pumila'. Compact pampas grass. White medium-sized, somewhat narrow plumes in late summer. Grows 5 to 7 feet (1.5–2.1 m) tall in flower. A fine choice for gardens of moderate size. Leaves gray-green. Among the most cold hardy of the true pampas grasses. Zone 6.

'Rendatleri'. Plumes large, purplish-pink. To 9 feet (2.7 m) tall in flower. Zone 8.

'Rosea'. Plumes mostly silver-white with a pink blush. To 8 feet (2.4 m) tall in flower. Zone 8.

'Silver Comet'. White-striped pampas grass. An improvement over 'Albolineata' with more pronounced white variegation. Plumes white, medium-sized. To 8 feet (2.4 m) tall in flower. Zone 8.

'Splendid Star'. Leaves longitudinally yellow-striped. Originated as a sport of 'Pumila' and shares traits of small stature and increased cold hardiness. Grows only 5 feet (1.5 m) tall in flower. Introduced by Bert Verhoef of Hazerswoude nursery in the Netherlands. Zone 7.

'Sunningdale Silver'. Widely acclaimed as the best of the larger types for the grandeur and quality of its silvery plumes. Can grow to more than 10 feet (3 m) tall. Zone 8.

'White Feather'. Plumes large, white. Zone 8.





OPPOSITE TOP *Cortaderia selloana* 'Albolineata' in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England. BOTTOM *Cortaderia selloana* 'Patagonia' at the Berggarten in Hanover, Germany, in late August.

TOP LEFT *Cortaderia selloana* 'Silver Comet' in mid July at Alan Bloom's garden in Bressingham, England. ABOVE *Cortaderia selloana* 'Aureolineata' in mid October at Descanso Gardens in Southern California.

TOP RIGHT *Cortaderia selloana* 'Pumila' at Kurt Bluemel's nursery in Fallston, Maryland, in mid October. CENTER *Cortaderia selloana* 'Splendid Star' foliage in England in mid July. BOTTOM *Cortaderia selloana* 'Aureolineata', foliage detail, in mid August.





Cortaderia toetoe Zotov

Toetoe

Native to low, open, moist areas on New Zealand's North Island only, growing up to 12 feet (3.7 m) tall in flower. A relatively newly recognized species, first published in 1963. It is similar enough to *Cortaderia richardii* (Endlicher) Zotov that the two could be mistaken for one another. Adding to the confusion, the common name "toetoe" is used generally to refer to any of the New Zealand *Cortaderia* species.

Ctenium Panzer

Grass family, *Poaceae*

Name from the Greek *ktenos*, comb, referring to the comblike inflorescences. Comprises approximately 20 species, mostly native to savannahs in tropical Africa and the Americas, with two species native to southeastern North America.

Ctenium aromaticum (Walter) Wood

Toothache grass

Native to savannahs, bogs, and wet to moist pine woods from Louisiana to Florida and north on the coastal plain to Virginia. Leaves mostly basal, the slender flowering stems to 4 feet (1.2 m) tall, each ending in a comblike, slightly curved inflorescence to 6 inches (15 cm) long. All parts of the plants have a citruslike fragrance when crushed. This grass also has mild analgesic properties that have been traced to the presence of isobutylamides, and has been traditionally used to treat toothaches. A curious and delicately graceful grass suited to informal landscapes and deserving conservation in native habitats. Blooms mid to late summer, the inflorescences lasting into winter. Grows best in full sun and moist conditions. Propagate by seed, or by division in spring. Zone 7.



TOP LEFT *Cortaderia toetoe* grows with *Cordyline indivisa* in low, moist habitat in Tongariro National Park on New Zealand's North Island.

BOTTOM LEFT Toothache grass, *Ctenium aromaticum*, in late June at the University of North Carolina Botanical Garden in Chapel Hill. BELOW *Ctenium aromaticum*, inflorescence detail, in late June.



Ctenium floridanum (Hitchcock) Hitchcock

Florida orangegrass, Florida lemongrass
Grows in wet and dry pine woods and occasionally in pine-oak upland woods in Georgia and Florida. Similar to *Ctenium aromaticum*, but with creeping rhizomes. Zone 8.

Cymbopogon Sprengel

Grass family, *Poaceae*

Comprises approximately 55 clump-forming, mostly perennial species native to tropics and subtropics in Africa, Asia, and Australia. Most are strongly aromatic, including citronella, *Cymbopogon nardus*, and oils from these grasses are used for various purposes, such as cooking, perfumes, herbal remedies, and insect repellents.

Cymbopogon citratus (De Candolle ex Nees) Stapf

Lemon grass

Native to southern India and Sri Lanka. The oil from this species is strongly lemon-scented, and the leaves are widely used for flavoring in Southeast Asian cuisine. The plant is also quite handsome, with broad flat leaf blades that bend gracefully toward the tips. Clump-forming and upright. Grows 2 to 3 feet (60–90 cm) tall over the course of a summer. Though too tender to survive winter in most temperate regions, it can be held over in a cold frame, greenhouse, or sunny window and planted out for the summer and autumn in the ground, or in a decorative pot. It's delightful to savor the scent of a crushed leaf while strolling through the garden on a summer evening. Best in full sun with adequate moisture. Adaptable to a range of soils. Zone 9.

Cymophyllus Mackenzie

Fraser's sedge

Name from the Greek *cyma*, a wave, and *phyllon*, leaf, referring to the minutely undulate margins of the leaves. Comprises a single eastern North American species. Formerly included in *Carex*.

Cymophyllus fraserianus (Ker-Gawler) Kartesz & Gandhi

[*Carex fraserianus* Ker-Gawler, *C. fraseri* Andrews, *Cymophyllus fraseri* (Andrews) Mackenzie]

Fraser's sedge

Named for its discoverer, John Fraser (1750–1811), this unique North American native is rare in the wild and still uncommon in cultivation. It occurs in rich upland woods, often on sloping ground, and along streambanks in eastern Tennessee and northwestern South Carolina, north into Virginia, West Virginia, and extreme south-central Pennsylvania. The plant is clump-forming, with broad, flat evergreen basal leaves. Suspended above the foliage in May and June, the inflorescences are bright white, to 15 inches (38 cm) in



TOP LEFT Lemon grass, *Cymbopogon citratus*, in late August at Longwood Gardens in Pennsylvania.

ABOVE Though rare, *Cymophyllus fraserianus* is often locally abundant where it does occur. Photographed in early May, this slope under mixed deciduous and coniferous forest in the Smoky Mountains of North Carolina is typical of the species's

preferred habitat. The soil is moist but well-drained and rich in organic matter.

TOP RIGHT *Cymophyllus fraserianus* blooming in early May in North Carolina. Male flowers with light yellow anthers extended on thin white filaments are clustered nearest the tip above the female flowers, which have small but visible three-part stigmas.

height. Male flowers have conspicuous threadlike anthers and are clustered at the top of each inflorescence above the females. New leaves develop after flowering, eventually growing to 20 inches (50 cm) long by $\frac{3}{4}$ inch (2 cm) wide, deep green and glossy, persisting through winter. The leaves are unusual in having no midrib. A distinctly attractive sedge worth growing for foliage or flowers. Requires partial shade, well-drained soil with plenty of organic matter, and steady moisture for best growth. Does well on shaded slopes. Tolerant of dense deciduous shade and light coniferous shade. Propagate by division, or by seeds sown in spring immediately as they come loose from the seedhead. Zone 6.

Cyperus Linnaeus

Sedge family, *Cyperaceae*

Umbrella sedge, umbrella plant, galingale

This is the second largest genus in the sedge family, after *Carex*, comprising approximately 600 mostly perennial species native to wet tropical, subtropical, and temperate habitats. Diverse in size and appearance, the genus includes the famous Egyptian paper reed or classical papyrus, *Cyperus papyrus*, and the infamous yellow nutsedge, *C. esculentus*, a pernicious weed in temperate gardens. Chufa, *C. esculentus* var. *sativus*, is grown for its edible tubers, which have a sweet nutty flavor after roasting.

Many of the most commonly cultivated species are tropicals requiring winter protection in a greenhouse, with minimum temperatures of 50°F (10°C). These are often called umbrella sedges or umbrella plants because of the leaflike bracts that spiral outward and downward from the top of the stem, like the ribs of umbrellas. Some species have well-developed basal leaves, others have leaves reduced to bracts that closely sheath the stems.

All umbrella sedges prefer constantly moist soils, and many grow best in shallow water. They make excellent year-round indoor plants if provided sufficient sunlight. They may also be grown in a pot with the base standing in a tray of water, and can be set out during warm seasons as marginals

in water gardens. Their fine texture contrasts naturally with the broad, bold leaves of waterlilies and other broad-leaved aquatics and marginals. All are best in full sun but some will tolerate light shade. Many variegated selections are available.

The *Cyperus* species cultivated ornamentally are mostly clump-forming, but some run and a few are aggressive self-sowers. Propagate by division in spring, by seed, or by upper stem cuttings rooted in water. The names and identifications of *Cyperus* species in cultivation have seen considerable change in recent years, and there is still much confusion among names of plants offered commercially. Most notably, all or nearly all plants cultivated as *C. alternifolius* truly represent *C. involucratus*.

Cyperus albostriatus Schrader

[*Cyperus diffusus* hort., non Vahl, *C. elegans* hort., non Linnaeus]

Broad-leaved umbrella plant, broad-leaved umbrella sedge. Native to southern Africa. Distinct from the other umbrella sedges in having well-developed basal leaves and leafy, broad inflorescence bracts, to 6 inches (15 cm) long and 1 inch (2.5 cm) wide, with prominent longitudinal veins. The leaves are typically dark green. Unlike many cultivated umbrella sedges, this species prefers not be submersed in water and does well planted in the ground in moist soil. Spreads slowly and can be used as a groundcover in warmer climates. Tolerates shade better than most and is well adapted to cultivation as a house plant. Zone 8.

'Nanus'. Compact and solid green. Typically to 12 inches (30 cm) tall.

LEFT The typical solid green form of *Cyperus albostriatus*. CENTER The compact, dark green and white-striped form of *Cyperus albostriatus* 'Variegatus' in Roger Raiche's garden in Berkeley, California, in mid

August. This form is also amenable to use as a groundcover in warm regions. RIGHT The light green form of *Cyperus albostriatus* 'Variegatus' growing in moist soil under glass at the New York Botanical Garden in late May.



'*Variegatus*'. This name is a catchall for variegated forms in cultivation. Two distinct plants are most often encountered. One is compact, growing only 12 to 18 inches (30–45 cm) tall, with dark green leaves and white stripes. The other has leaves and bracts almost entirely greenish white. Zone 8.

Cyperus alternifolius Linnaeus

Umbrella sedge, umbrella plant

This species is endemic to Madagascar and is not common in cultivation. Most or all of the plants cultivated under this name are actually *Cyperus involucreatus* (which see).

Cyperus eragrostis Lamarck

[*Cyperus vegetus* Willdenow]

Pale galingale

This South American perennial species is widely introduced and naturalized elsewhere, including southwestern North America and Europe. The entire plant is pale yellow-green, growing to 24 inches (60 cm) tall. Not an aquatic species, but instead prefers average to moist soil. Flowers in mid summer. An enthusiastic self-sower, popular in British gardens and there often allowed to find niches in informal areas. Propagate by seed or division. Zone 6.

Cyperus giganteus Rottbøll ex Kunth

Mexican papyrus

Native to Mexico, Central and South America, and the West Indies, and introduced and naturalized elsewhere including Texas and Louisiana. Despite the specific epithet, this plant is not a giant and is typically smaller than the classic papyrus, *Cyperus papyrus*. It is relatively new to cultivation, being first introduced in the Southern California nursery trade as *C. papyrus* 'Mexico', which is incorrect. Reaches 6 to 9 feet (1.8–2.7 m) tall and grows best with roots slightly submerged. The inflorescences are open and ball-like, and can be nearly 16 inches (40 cm) in diameter. The bracts of the inflorescence are flat and leafy, unlike the cylindrical, tubelike bracts of *C. papyrus*. Propagate by seed or division. Zone 8.

Cyperus haspan Linnaeus

Most material in cultivation under this name is actually *Cyperus prolifer*. *Cyperus haspan* is native to North America from coastal Virginia south to Florida and west to Texas, and also to Mexico, Central and South America, Africa, and Australasia. A relatively slight plant, with inflorescences open with ascending branches. Not globelike in overall shape. Typically



TOP RIGHT Pale galingale, *Cyperus eragrostis*, shares space with equally rambunctious *Acaena novae-zelandiae* in the

Sunk Garden at Great Dixter in Northiam, England. BOTTOM *Cyperus giganteus* at Longwood Gardens in late September.

grows to 2 feet (60 cm) tall in swales and other moist to wet habitats. Zone 7.

Cyperus involucratus Rottbøll

[*Cyperus flabelliformis* Rottbøll]

Umbrella plant, umbrella sedge, umbrella-palm

Native to eastern Africa and widely introduced and naturalized elsewhere, this is the most commonly cultivated *Cyperus* species. It has long been a favorite for use as a house plant or in pond gardens around the world. Basal leaves are lacking. The slender leafless stems grow to 3 feet (90 cm) tall, each topped by an umbrella-like spiral of up to 25 dark green bracts. The bracts are flat and narrowly leaflike, up to 5/8 inch (15 mm) wide and 4 to 12 inches (10–30 cm) long. It is one of the easiest to grow, which accounts for its popularity. Prefers moist soil or submersion in water. Will grow in full sun or partial shade. Propagate by seed, division, or rooted cuttings prepared from the stem-tops. Zone 8 or slightly colder with winter protection.

‘*Gracilis*’. Smaller than the species, typically less than 2 feet (60 cm) tall.

‘*Variiegatus*’. Bracts neatly striped cream-white. Sometimes reverts to green.



Cyperus longus Linnaeus

Galingale

Native to coastal marshes and wet margins in Europe including the British Isles, Asia, and North Africa. Grows upright, 3 to 4 feet (90–120 cm) tall, with narrow dark green, pendant foliage. The inflorescences are open, with lax branches. A highly architectural plant, effective at pool or pondside. Spreads with moderate speed by rhizomes. Will grow in moist soil or partly submerged at margins of water. Propagate by seed or division. Zone 7.



Cyperus papyrus Linnaeus

Papyrus, Egyptian paper reed

This is the classic papyrus of ancient Egypt, which grew along the Nile and was used in making papyrus paper. Egyptians cut the stems vertically into thin strips, laid them parallel to each other, and added another layer at right angles. The resulting mat was pressed and dried in the sun. This species is also believed to be the bulrush referred to in the Bible. It is a truly majestic plant, capable of growing 15 feet (4.5 m) tall. Basal leaves are lacking. The stout green leafless stems are topped by globelike umbellate inflorescences 10 to 16 inches (25–40 cm) wide. The bracts of the inflorescences are tube-like and cylindrical, not at all leaflike. Inflorescences are produced from mid summer into autumn, and are especially luminous when the sun catches them. Spreads by stout rhizomes but can be maintained as a clump. Prefers full sun and





OPPOSITE TOP *Cyperus involucratus* in the waterlily pools at Longwood Gardens in late September. CENTER *Cyperus involucratus* growing in moist ground at El Encanto in Santa Barbara, California, in late June. BOTTOM *Cyperus involucratus* 'Variegatus'

in late May inside the conservatory at the New York Botanical Garden.

TOP LEFT *Cyperus longus* in late August in Karl Wienke's garden in Suhl, Germany. BOTTOM *Cyperus longus* flowers in late August in Germany.

TOP RIGHT *Cyperus papyrus* towers more than 10 feet (3 m) tall, growing in water at Quail Botanical Gardens in Encinitas, California, in early July. ABOVE CENTER RIGHT A small plant of *Cyperus papyrus* is less than 4 feet (1.2 m) tall at the corner

of a pool at the Royal Horticultural Society's garden, Wisley, in Surrey, England, in late August. RIGHT *Cyperus papyrus* 'King Tut' in the waterlily pools at Longwood Gardens in late September.



submersion in water for most luxuriant growth. Propagates easily by seed or division. Zone 9.

'King Tut'. This name was coined by Greg Speichert to distinguish a very compact form originally introduced to the United States from Japan as *Cyperus papyrus* var. *percamentus*, which is not a valid botanical name. The plant is a genuine miniature, typically only 2 feet (60 cm) tall. It resulted from seed trials in Japan intended to develop a shade-tolerant papyrus that could be grown as a house plant, and in fact the plant is remarkably shade-tolerant and does not need to be submerged: it will grow in soil that is constantly moist. Unfortunately, the name 'King Tut' is now sometimes used to market standard-sized papyrus, so care must be taken to determine that plants are in fact compact. Zone 9.

Cyperus prolifer Lamarck

[*Cyperus isocladius* Kunth, *C. prolifer* var. *isocladius* (Kunth) Kükenthal]

Miniature papyrus, dwarf papyrus

Native to edges of swamps and streams in eastern and southern Africa, Madagascar, and the Mascarene Islands. Resembles *Cyperus papyrus* in miniature. Stems slender, growing 2 to 3 feet (60–90 cm) tall. The umbellate inflorescences are quite small, typically less than 4 inches (10 cm) across. Plants in cultivation frequently produce sterile umbels, lacking spikelets at the ends of the rays. Spreads by rhizomes but easily managed as a clump. Prefers full sun or very light shade, and wet or constantly moist soil. Zone 9.

Dactylis Linnaeus

Grass family, *Poaceae*

From the Greek *daktylos*, finger, referring to the fingerlike branches of the inflorescence. Comprises a single variable species native to moist and dry sunny habitats including meadows and open woodlands in temperate Eurasia.

Dactylis glomerata Linnaeus

Orchard grass, cocksfoot

This Eurasian species is now distributed through most of the world's cool-temperate regions, often introduced for forage. It is widely naturalized in North America, where it is called orchard grass, and in England, where it is known as cocksfoot. A familiar presence in sunny fields, roadsides, and other

TOP *Cyperus papyrus* 'King Tut' is displayed in a pot on the steps of the Scott Arboretum office on the campus of Swarthmore College in Pennsylvania in early August. CENTER *Cyperus prolifer*

in the waterlily pools at Longwood Gardens in late September. BOTTOM *Dactylis glomerata* 'Variegata' in late August in Germany.

disturbed sites, it grows to 4 feet (1.2 m) tall and is typically green-leaved. Zone 4.

‘*Variegata*’. Variegated orchard grass, variegated cocksfoot. Leaves conspicuously striped white, giving an overall light green or white appearance. This cool-season grower is best in spring and autumn. It often looks ragged in the heat of mid summer, and is best cut back to allow a flush of new, clean growth for autumn. Less vigorous than the species, this cultivar rarely tops 2 feet (60 cm) and doesn’t flower as heavily. Self-sown seedlings are usually green-leaved. Grows easily in a range of soils with average moisture in sun or light shade. Propagate by spring, or by division in fall. Zone 5.

Deschampsia P. Beauvois

Grass family, *Poaceae*

Hair grass, tussock grass

Comprises 40 annual and perennial species widely distributed in north- and south-temperate regions and in upper elevations in the tropics, growing in open and shaded habitats including meadows, glades, woodland openings, and mixed deciduous and coniferous forests.

Deschampsia cespitosa (Linnaeus) P. Beauvois

[*Aira cespitosa* Linnaeus]

Tufted hair grass, tussock grass

This variable species is native to cool-temperate parts of North America, Europe, and eastern Asia. A cool-season grower, it occurs in moist habitats including bogs, meadows, and damp open woodlands. In the southern extremes of its range it is found mostly in higher, cooler mountain habitats. Strictly clump-forming, it produces a neatly rounded tuft of narrow, typically dark green foliage which is topped by a cloudlike mass of finely branched inflorescences in early summer. The common name “hair grass” refers to the fine texture of the inflorescences, which are translucent and luminous when sidelit or backlit by the sun. Grows to 4 feet (1.4 m) tall in flower. The inflorescences typically open light green and dry to light buff, remaining attractive into autumn. Many cultivated varieties open yellow-green, and some are more compact and shorter than typical. Long-lived and of easy culture in sun or shade, though flowering is most profuse in full sun. Semievergreen in milder climates, the basal foliage looks good much of the year and this durable clump-former is suitable for groundcover masses. Readily propagated by seed, or by division in spring or fall. Zone 4.

‘*Bronzeschleier*’ (bronze veil). Inflorescences open green-bronze. Grows 2 to 3 feet (60–90 cm) tall in flower.

‘*Goldgehänge*’ (gold pendant). Inflorescences open green-yellow with slightly pendulous form. Grows 2 to 3 feet (60–90 cm) tall in flower.



TOP Rounded clumps of *Deschampsia cespitosa* are characteristically dark green in early April in Southern California.

BOTTOM *Deschampsia cespitosa* begins blooming in early June at the Chicago Botanic Garden.



LEFT Cloudlike and fine-textured inflorescences of *Deschampsia cespitosa* 'Goldtau' have turned tawny by mid July next to pink *Diascia* 'Rupert Lambert' at the Royal Horticultural Society's garden, Wisley, in Surrey, England. ABOVE *Deschampsia cespitosa* 'Vivipara', inflorescence detail, in late August.

'Goldschleier' (gold veil). Inflorescences open green-yellow. Grows 1 to 2 feet (30–60 cm) tall in flower.

'Goldstaub' (gold dust). Inflorescences open yellow-green. Grows 1 to 2 feet (30–60 cm) tall in flower.

'Goldtau' (gold dew). Inflorescences finer textured than many, opening yellow-green. Grows 1 to 2 feet (30–60 cm) tall in flower.

'Northern Lights'. Leaves with cream-white longitudinal stripes, sometimes pink-suffused in cool seasons. More compact than standard green-leaved forms. Originated as a seedling at Bluebird Nursery in Nebraska and named by Steve Schmidt. Grows 1 to 1½ feet (30–45 cm) tall in flower.

'Schottland'. Of Scottish origin, as the German cultivar name implies. Typical of the species, but uniform, with dark solid green foliage. Inflorescences open light green. Grows 2 to 3½ feet (60–105 cm) tall in flower.

'Tardiflora'. Slightly later blooming, inflorescences open light green. Grows 2 to 3 feet (60–90 cm) tall in flower.

'Taurträger' (dew carrier). Inflorescences slender, opening light green. Grows 1 to 2 feet (30–60 cm) tall in flower.

'Vivipara' ('Fairy's Joke'). Viviparous plants are produced within the inflorescences, which are pendulous from the extra weight. Grows 2 to 3 feet (60–90 cm) tall in flower.

Deschampsia flexuosa (Linnaeus) Trinius

[*Aira flexuosa* Linnaeus]

Hair grass, crinkled hair grass, common hair grass (North America)

Smaller, lower, and finer textured than *Deschampsia cespitosa*, this species is also a clump-forming cool-season grower native to cool-temperate North America and Eurasia, mostly in drier habitats in sun or woodland openings. In many regions it is an important, locally native pasture grass. Densely tufted, with very fine-textured, typically medium-green foliage less than 8 inches (20 cm) tall. Grows to 2 feet (60 cm) tall when flowering in early to mid summer. Of easy culture on a wide variety of soils including sand. Blooms well in sun or partial shade and is superbly adapted to dry shade. Propagate by seed, or by division in spring or fall. Zone 4.

'Aurea' ('Tatra Gold', 'Hohe Tatra'). Foliage yellow-green,



TOP LEFT *Deschampsia flexuosa* grows in drifts over a rock face along the Blue Ridge Parkway in Virginia in late July. RIGHT *Deschampsia flexuosa* blooms in cloudlike drifts beside a walking trail passing through a woodland opening in the Smoky Mountains of North Carolina in mid July.

ABOVE The fine-textured foliage and flowers of *Deschampsia flexuosa* contrast with a dark granite outcrop, wet with rain, in the Smoky Mountains of North Carolina in mid July. RIGHT *Deschampsia flexuosa* 'Aurea' begins blooming in mid May in Linda Cochran's garden, Froggy Bottom, near Seattle, Washington.

especially in spring. Color is more pronounced and longer-lasting in cooler climates. Comes true from seed.

'Mückenschwarm' (cloud of flies). Inflorescences with a profusion of dark green spikelets.

Desmoschoenus J. D. Hooker

Sedge family, *Cyperaceae*

A monotypic genus comprising one species endemic to New Zealand.

Desmoschoenus spiralis (A. Richard) J. D. Hooker

Pingao, pikao golden sand sedge

Native to New Zealand and originally an important stabilizing element of coastal dune systems. Once common, it has been in decline as a result of competition from the introduced dune grass or marram grass, *Ammophila arenaria*, but is making a comeback due to restoration efforts. Perennial, growing 2 to 3 feet (60 to 90 cm) tall with coarse yellow-green leaves borne on thick ropelike rhizomes. Its habit of growth promotes smooth, stable fore dunes, as opposed to the easily eroded steep dunes that result from *Ammophila arenaria*. Pingao is important to Maori culture and has been em-

BELOW Pingao, *Desmoschoenus spiralis*, helps maintain gradually sloping fore dunes in Wellington, New Zealand, in late August (winter).

RIGHT *Dichanthelium clandestinum* in light shade in late July at the Royal Horticultural Society's garden, Wisley, in Surrey, England.

ployed in the weaving of tough fabrics for use in clothing and shelter. The foliage turns bright orange when growing in full sun with periodic drought stress. Blooms in spring and early summer, eventually producing dark brown seed clusters. Propagate by fresh seed or cuttings. Zone 8.

Dichanthelium (Hitchcock & Chase) Gould

Grass family, *Poaceae*

Originally included in *Panicum* and now generally recognized as a distinct genus comprising approximately 72 species, about half of which are native to North America. All are perennials, and some are strongly rhizomatous spreaders.

Dichanthelium clandestinum (Linnaeus) Gould

[*Panicum clandestinum* Linnaeus]

Deer-tongue grass, deer-tongue panic grass

Native to moist, sometimes sandy ground over much of the eastern United States, growing in meadows, thickets, and open woodlands, and on streambanks. The common name refers to the shape of the leaves, which are relatively wide, up to 1¼ inches (31 mm), and short, to 7 inches (18 cm) long. Forms dense clumps to 30 inches (75 cm) tall, but can also spread aggressively by rhizomes, creating large masses. Summer foliage color is a bright green, turning yellow-brown with the coming of autumn frosts and providing subtly attractive accompaniment to the whites, purples, and yellows of late-flowering asters and goldenrods. In addition to spreading vegetatively, it also self-seeds prolifically and is



difficult to manage in small landscapes in warmer climates. Its spread and seeding are checked in regions with cooler, shorter seasons such as the British Isles and northern continental Europe. Inflorescences are visually insignificant. Of easy culture in sun or partial shade. Drought-tolerant. Propagate by seed, or by division in spring. Zone 4.

Dulichium Persoon

Sedge family, *Cyperaceae*

Three-way sedge

Includes only one species native to wet habitats in North America.

Dulichium arundinaceum (Linnaeus) Britton

Three-way sedge

Occurs in open wet places including bogs, swamps, lake and pond margins, and streambanks, typically growing in standing water, from Newfoundland to Minnesota south to Florida and Texas, and also from British Columbia to California and Montana. The bright green leaves are arranged in three distinct ranks which are evident when viewing the plant from above, hence the common name. The stems are upright, 2 to 3 feet (60–90 cm) tall, with narrow leaves, giving a somewhat bamboolike appearance. Mid-summer flowers are visually insignificant. Spreads by rhizomes and often forms extensive colonies that read as bright green ribbons at water's edge. A fine-textured companion to broad-leaved waterlilies including *Nymphaea* and *Nuphar* species, with which it often

occurs. Of easy culture in sun or light shade if provided constantly wet or moist soil. Can be grown in a large pot or tub and is a fine addition to water gardens. Propagate by seed, or by division in spring. Zone 5.

Elegia Linnaeus

Restio family, *Restionaceae*

Broom-reed

Comprises approximately 32 dioecious perennial species native to the Cape Region of South Africa. Some have been traditionally used for thatching or in the making of brooms. They are members of the fynbos plant community, which is adapted to frequent natural fires. All are wind-pollinated and typically grow in open habitats on the Cape where the wind is almost always blowing. Growth is most active following rains, but all have a strong evergreen presence. Research at the Kirstenbosch National Botanical Garden in Cape Town has revealed that smoke treatment of the seeds significantly increases germination rates. Broom-reeds lack normally developed leaves with broad blades. Photosynthesis takes place

LEFT *Dulichium arundinaceum* mingles with fragrant waterlily, *Nymphaea odorata*, in native habitat in the New Jersey Pine Barrens in late August. RIGHT *Dulichium arundinaceum* creates a bright green stripe across the

far edge in naturally dark water in the New Jersey Pine Barrens as a fragrant azalea, *Rhododendron viscosum*, flowers in its midst and bold-textured waterlilies venture beyond it into deeper water.



in the green stems, bracts, and branches. Some species have simple unbranched stems, and others are finely branched and resemble horsetails, *Equisetum* species. The curling bracts associated with the terminal inflorescences of some species are golden amber and persistent, and these species are often called golden-curly. Amenable to culture in other regions with Mediterranean-type climates such as California, and also in southern England. They also make fine conservatory specimens and can be held over winter under glass and set out for summer in climates otherwise too cold.

Elegia capensis (Burman f.) Schelpe

Broom-reed, horsetail restio, besemriet, fonteinriet
Occurs along streamsides and low mountain seeps in South Africa from Clanwilliam to the Cape of Good Hope and east to Port Elizabeth. Traditionally used in South Africa for sweeping, hence the name broom-reed. Clump-forming, to nearly 7 feet (2.1 m) tall, bearing an uncanny resemblance to a giant horsetail, with dense whorls of threadlike branches spaced along the vertical stems. Brown male and female flowers on separate plants, at the tops of stems. Conspicuous papery leaf bracts, held closely to the stems, are a striking feature of this species. Prefers full sun and moist soil of average to low fertility. Best planted at the beginning of the rainy season in Mediterranean climates. An excellent seasonal container subject in areas beyond its winter cold hardi-

BOTTOM *Elegia capensis* at Kirstenbosch National Botanical Garden in Cape Town, South Africa, in early September (spring). **BELOW LEFT** *Elegia capensis*, flower and stem detail, in early

September (spring) at Kirstenbosch. **BELOW RIGHT** *Elegia capensis*, stem and bract detail, in early September (spring) at Kirstenbosch.





ness. Best propagated by seed. The roots do not like to be disturbed, so division is difficult. Zone 8.

Elegia equisetacea Masters

Golden curls

A widespread species occurring from the Cederberg Mountains of the Western Cape east to Port Elizabeth. Grows erect to 4 feet (1.2 m), with stems generally unbranched though new stems on young plants are often branched in whorls reminiscent of *Elegia capensis*. Prefers full sun and well-drained soil. Zone 8.

Elegia fenestrata Pillans

Native from the Cape Peninsula to Bredasdorp. Grows erect with unbranched stems, to 2½ feet (75 cm) tall. Prefers full sun. Will grow in average to dry soil. Zone 8.

Elegia juncea Linnaeus

Golden curls

Frequent in drier habitats from Tulbagh to the Cape Peninsula and east in the Swartberg Mountains. Grows erect, 12 to 30 inches (30–75 cm) tall, increasing in width slowly by rhizomes. Prefers full sun. Very drought tolerant. Zone 8.



TOP LEFT *Elegia equisetacea* in mid September (spring) in the Hottentots Holland Mountains of South Africa's Cape Region. RIGHT *Elegia fenestrata* in late June at Leaning Pine Arboretum in San Luis Obispo, California.

ABOVE *Elegia juncea* in dry, rocky habitat in the Swartberg Mountains of South Africa in mid September (spring).

Eleocharis R. BrownSedge family, *Cyperaceae*

Spike-rush

Name from the Greek *helos*, marsh, and *charis*, grace. Approximately 200 species of worldwide distribution in wet soil or shallow water, many creeping by rhizomes to form extensive, dense mats. The leaves are reduced to bladeless sheaths and the stems slender and unbranched, each topped by a terminal spikelet. The unobtrusive simplicity of the spike-rushes is often overlooked, yet they are often a graceful, fine-textured presence in wet habitats. They deserve more attention in conserved landscapes and in gardens. Many look alike and can be very difficult to tell apart.

Eleocharis acicularis (Linnaeus) Roemer & Schultes

Slender spike-rush, needle spike-rush, hair grass

The specific epithet means needle-shaped, referring to the very slender stems and spikelets. This widespread perennial species occurs on wet soil, in meadows, at lake and pond margins, vernal pools, and often in disturbed damp places, in Arctic regions, across much of North America south through Central America and into South America, and in Eurasia. Spreads by rhizomes to form dense mats. Stems fine and almost hairlike, to 12 inches (30 cm) tall, upright or lax. A graceful addition to marginal areas in water gardens. Can also be grown in indoor aquaria. Of easy culture in sun and moist soil or shallow water. Does best in slightly acidic conditions. Propagate by division in spring or by seed. Zone 4.

**Eleocharis dulcis** (Burman f.) Trinius ex Henschel

Chinese water-chestnut, mai-tai

Though simple and attractive, this widespread native of Asia and western Africa is most often grown for the edible tubers. Jointed cylindrical green stems are up to $\frac{3}{16}$ inch (4 mm) in diameter and to 4 feet (1.2 m) tall. The terminal spikelet is up to 2 inches (5 cm) long or sometimes absent. Spreads by elongated stolons that terminate in rounded tubers up to 1½ inches (4 cm) in diameter. Eaten fresh or cooked, the tubers are the familiar white crunchy vegetable common in Chinese foods. Of easy culture in full sun and shallow water. Propagate by offsets from tubers. Zone 9.

Elymus LinnaeusGrass family, *Poaceae*

Wild rye, wheatgrass

A cosmopolitan genus comprising up to 150 perennial species, clump-forming or spreading by rhizomes or stolons, native throughout temperate latitudes of the Northern and Southern Hemispheres, in a variety of habitats including meadows, prairies, woodlands, steppes, and dunes. Most are pronounced cool-season growers. The genus is closely related to *Leymus*, in which a number of species formerly included in *Elymus* have been reclassified, including the blue lyme grasses *E. arenarius* and *E. racemosus*.

LEFT *Eleocharis acicularis* in shallow water in coastal Maine in early August.

RIGHT *Elymus canadensis* in late June at Longwood Gardens in Pennsylvania.



Elymus canadensis Linnaeus

Canada wild rye

Native over much of North America, growing along riverbanks, in prairies, open ground, and often dry sandy soil. This cool-season grower is a common counterpart to warm-season species in bluestem-dominated tallgrass prairies and savannahs. Clump-forming, 3 to 6 feet (90–180 cm) tall. Flowers in early summer, with nodding inflorescences reminiscent of cultivated rye. These typically remaining intact and attractive into winter. The foliage is coarse-textured, usually green but sometimes glaucous blue-green. The blue color is never as strong as that of its relatives *Leymus arenarius* or *L. racemosus*. This fast-growing but somewhat short-lived prairie grass is often included in seed mixes to serve as a nurse crop for slower-growing prairie grasses and forbs. Of easy culture in sun or light shade on almost any soil, moist or dry. Easily propagated by seed, or by division in spring or fall. Self-sows, which is desirable in meadows or prairie restorations but may be a nuisance in small gardens. Zone 3.

Elymus glaucus Buckley

Blue wild rye

Native to moist and dry, open thickets across much of northern North America. Clump-forming and densely tufted. Leaves typically glaucous. This species is not often cultivated; however, the name *Elymus glaucus* hort. is still commonly used in nursery catalogs and garden books to refer to *Leymus arenarius*, a strongly rhizomatous species with strongly glaucous, blue-gray foliage. Zone 5.

Elymus hystrix Linnaeus[*Hystrix patula* Moench]

Bottle-brush grass

Though this cool-season grass has been known for many years as *Hystrix patula*, the current consensus is that it is not sufficiently distinct from other *Elymus* species to warrant classifying it in a distinct genus, *Hystrix* Moench. One of the strongest arguments for inclusion in *Elymus* is that bottle-brush grass occasionally hybridizes in native habitats with the wild ryes, particularly with *E. virginicus*. Bottle-brush grass is native to moist or dry, often rocky woods in eastern North America, from Nova Scotia and Quebec to North Dakota and south to Virginia and Oklahoma. Clump-forming and upright, to 4 feet (1.2 m) tall. Bottlebrush-like inflorescences, up to 6 inches (15 cm) long, first appear in mid June and are produced intermittently through August if rains continue. Opening green, bleaching to light buff, they remain attractive into autumn, when the deciduous forest is at its color peak. The seedheads are often cut for dried arrangements. One of relatively few true grasses adapted to dry shaded conditions, it responds to moist fertile soils with fuller



TOP LEFT *Elymus hystrix* begins to bloom in early June in Missouri. The long-awned inflorescence resembles a bottlebrush. It apparently reminded botanist Carl Linnaeus of porcupines, since he selected the specific epithet. The porcupine is in the animal genus *Hystrix*.

TOP RIGHT *Elymus hystrix* grows with *Rhus aromatica* in dry, rocky oak-hickory woods in West Virginia in mid October.

BOTTOM *Elymus hystrix* blooms with *Campanula americana* in native habitat along Virginia's Blue Ridge Parkway in July.



growth and flowering. Hot, dry sunny conditions in summer may cause dormancy. This subtle woodland native is best in informal settings. Self-sows manageably. Best propagated by seed. Zone 3.

Elymus magellanicus (Desvaux) Á. Löve

[*Agropyron magellanicum* Desvaux, *A. pubiflorum* (Steudel) L. Parodi]

Magellan wheatgrass, blue wheatgrass

Native to sunny habitats at high elevations in South America. The glaucous foliage of this tightly tufted clump-former is almost electric-blue. It is semievergreen in mild climates but is a pronounced cool-season grower that quickly suffers or goes dormant when exposed to hot, humid summer conditions, especially if night temperatures remain high. In southern England it is prone to foliar rust disease. Sharply drained soil and a siting with plenty of air circulation promote best growth. Does well in cool coastal areas and is a superb container subject. Propagated best by seed, or by division in early spring. Zone 6.

'Blue Tango'. A Kurt Bluemel introduction from material collected in South America.

Elymus solandri (Steudel) Connor

[*Triticum solandri* Steudel]

Native to sunny, open habitats from sea level to upper elevations in the mountains of New Zealand's North and South





Islands. Occurs on rocky coastal sites, riverbeds, and glacial moraines, and in interior tussock grasslands. Lax-stemmed and typically less than 18 inches (45 cm) tall, often stoloniferous and spreading. The foliage is strongly glaucous with a deep blue-green color. Prefers sun but is adaptable to a wide range of soil and moisture conditions. Propagate by seed or division. Zone 7.

Elymus virginicus Linnaeus

Virginia wild rye

A variable, cool-season, clump-forming species native to rich thickets, alluvial soils, shores, and sometimes alkaline areas over much of eastern North America. Coarse-textured and similar to *Elymus canadensis*, but foliage is rarely glaucous and awns are shorter and less conspicuous. Tends toward more shaded and damp habitats than *E. canadensis*; however, the two are sometimes found side by side and occasionally hybridize. Easily grown from seed, or by division in spring or fall. Will grow in sun or partial shade. Self-sows. Zone 3.

Elytrigia Desvaux

Grass family, *Poaceae*

Wheatgrass

Comprises 80 perennial species, some clump-forming and others strongly rhizomatous, native to diverse habitats mostly in the Northern Hemisphere, often growing in dry, alkaline or sandy, salty conditions. A few, including quack grass, *Elytrigia repens*, are noxious weeds. Closely related to *Elymus*.

Elytrigia elongata (Host) Nevski

[*Agropyron elongatum* (Host) P. Beauvois, *Elymus elongatus* (Host) Runemark, *Thinopyrum ponticum* (Podpěra) Z.-W. Liu & R.-C. Wang]

Tall wheatgrass

Native to the Mediterranean basin, this drought-tolerant and salt-tolerant clump-forming species has been introduced far beyond its original range for forage and soil stabilization, and is naturalized in many places including parts of the desert southwestern United States. Strictly upright but supple

OPPOSITE FAR LEFT In mid July, drying seedheads of *Elymus hystrix* mix with blooming *Veronicastrum virginicum* and *Phlox paniculata* 'David' at the Scott Arboretum of Swarthmore College in Pennsylvania.

OPPOSITE RIGHT TOP *Elymus magellanicus* grows in sun on a well-drained site and fine gravel mulch at the Royal Horticultural Society's garden, Wisley, in Surrey, England, in late August. CENTER The steely blue foliage of *Elymus magellanicus* easily competes with the intense red of salvia in July at Great Dixter in Northiam, England. BOTTOM Foliage of *Elymus solandri* is still mostly evergreen in August (late winter) in New Zealand.

LEFT *Elymus virginicus* is continuous through a moist woodland in Texas in mid November.

enough to bend with the wind, it grows to 5 feet (1.5 m) tall with glaucous gray-blue stems and foliage. Blooms in early summer. A rambunctious self-sower that will require regular effort to control in some regions. Of easy culture in full sun on a wide range of soils and in various moisture conditions. Propagate by seed, or by division in spring. Zone 3.

'Jose Select'. A nearly vertical selection by David Salman of High Country Gardens in New Mexico. Originated as a seedling in a cover crop of 'Jose', an early seed cultivar introduced as a range grass by the USDA-NRCS (Natural Resources Conservation Service) Plant Material Center in Los Lunas, New Mexico, originally under the name *Thinopyrum ponticum* 'San Jose'.



Eragrostis Wolf

Grass family, *Poaceae*

Lovegrass

A huge genus comprising nearly 350 annual and perennial species native to tropical, subtropical, and temperate regions around the world. Though the common name is well established, the origin of the genus name is uncertain. It may have been derived from *eros*, love, and *Agrostis*, a Greek name for a type of herb, or from the Greek words *er*, early, and *agrostis*, wild, referring to the fact that many species are early colonizers of disturbed ground. The following perennial species are warm-season growers.

Eragrostis chloromelas Steudel

[*Eragrostis curvula* var. *conferta* Nees]

Boer lovegrass

Though plants are sometimes cultivated under this name, this species is now included within *Eragrostis curvula* by most classifying botanists. It differs from typical in having glaucous foliage and somewhat less cold hardiness, and perhaps is best considered a strain. It is apomictic and comes true from seed. Prefers full sun but adaptable to a wide range of soils. Extremely drought tolerant. Zone 7.

TOP LEFT Rocketing from a ground-covering sweep of butterfly milkweed, *Asclepias tuberosa*, *Elytrigia elongata* 'Jose Select' bends to an early summer breeze at Chanticleer in Wayne, Pennsylvania, in late June. BOTTOM *Elytrigia elongata* in mid August near Salt Lake City, Utah.

BELOW Misidentified as *Eragrostis elliottii* in the United States and commonly available commercially by that name, this

plant is certainly of African origin. It most likely represents a glaucous strain of *E. chloromelas* or possibly of *E. robusta*, two species that are often included in a broad interpretation of *E. curvula*. It is also very similar to *E. trichophora* Cosson & Durieu, a glaucous-leaved southern African species that has been introduced to North America by the USDA Natural Resources Conservation Service. Photographed in mid July in North Carolina.



Eragrostis curvula (Schrader) Nees

Weeping lovegrass, African lovegrass
Native to southern Africa but widely introduced elsewhere, including the southeastern United States, for soil stabilization, forage, and as an ornamental. It is cold hardy far beyond what might be expected, given its origin. Clump-forming and densely tufted, it forms a neat, rounded mound of fine-textured medium-green foliage overtopped in mid to late summer by arching flowering stalks, to 4 feet (1.2m) tall. The foliage and flowers are lax, with an overall weeping or fountainlike appearance. A well-behaved plant in cooler climates such as northern Europe, but an aggressive self-sower and naturalizer in warmer regions. It has long been used in the United States for erosion control on roadside rights of way and has widely escaped beyond these plantings. Prefers full sun but will grow in light shade. Propagate by seed, or by division in spring. Zone 6.

'Totnes Burgundy'. A truly distinct selection with foliage strongly red-colored from mid summer to autumn. Introduced by the Suttons of Desirable Plants nursery in Totnes, Devon, England.

Eragrostis elliottii S. Watson

Most plants cultivated for ornament in the United States as *Eragrostis elliottii* do not belong to this species. The inflorescences of true *E. elliottii* begin branching at the base and continue a pattern of diffuse branching to their tips. The overall form and size are much like those of purple lovegrass, *E. spectabilis*. The misidentified material, which has inflorescences held high on stalks that are only branched in the upper portion, is almost certainly of southern African origin, possibly *E. chloromelas* Steudel or *E. robusta* Stent, two species which are included in *E. curvula* by most taxonomists today.

Relatively uncommon in cultivation, true *Eragrostis elliottii* is native to sandy pinelands and live oak woodlands, mostly on the coastal plain, in the southeastern United States and continuing south to Central and South America. Clump-forming, growing 8 to 30 inches (20–75 cm) tall when blooming in summer, with glaucous blue-green foliage. Propagate by seed, or by division in spring. Zone 8, likely colder.

'Tallahassee Sunset'. A particularly glaucous selection by John Greenlee, picked from seedlings of Florida provenance grown by The Natives nursery in Davenport, Florida. The foliage is plum-colored in winter.

BELOW *Eragrostis curvula* in full sun in late June in the African section of Leaning Pine Arboretum in San Luis Obispo, California.

TOP RIGHT *Eragrostis curvula* in partial shade in Ojai, California, in late June. BOTTOM *Eragrostis curvula* 'Totnes Burgundy' in mid July at the Royal Horticultural Society's garden, Wisley, in Surrey, England.



Eragrostis spectabilis (Pursh) Steudel

Purple lovegrass, tumble grass
Native on sandy to clay-loam soils from southern Canada through much of the eastern United States and south through Mexico and into Central America. Clump-forming and relatively low-growing, typically under 18 inches (45 cm) tall when blooming in late summer. Medium-green foliage is coarse-textured and mostly basal. The inflorescences are diffuse and branched from the base. An enthusiastic self-sower, this adaptable grass sometimes grows in drifts or masses, covering the ground with low clouds of red-purple or pink flowers. Though perennial, it is relatively short-lived. It does best on open soil in full sun. Very drought tolerant. Easily propagated by seed, or can be divided in spring. Zone 5.

Eragrostis trichodes (Nuttall) A. Wood

Sand lovegrass
Endemic to the contiguous United States, occurring mostly in open or lightly shaded sandy habitats including prairies and open woods, from Illinois to Nebraska and south in Arkansas



and Texas. Much taller than *Eragrostis spectabilis*, growing upright with leafy flowering stems to 4 feet (1.2 m) tall. Blooms in July and early August, with lightly pink-tinted inflorescences. Of easy cultivation in full sun on almost any well-drained soil. Very drought tolerant. Self-sows manageably. Propagate by seed, or by division in spring. Zone 5.

'Bend'. Attractively lax-stemmed, bending under the weight of its flowers in late season. Selected by Richard Lighty of Pennsylvania.

Eragrostis trichophora Cosson & Durieu

Hairy lovegrass, Atherstone lovegrass
Native to moist, often disturbed places in southern Africa. Leaves glaucous gray-blue. Blooms in summer, with finely branched inflorescences held high above the basal foliage, to 3 feet (90 cm) in height. Drought-tolerant. Self-sows prolifically. Introduced to North America by the USDA Natural Resources Conservation Service as Atherstone lovegrass for soil stabilization and range improvement and possibly naturalized. Zone 7.



TOP LEFT *Eragrostis spectabilis* in southeastern Pennsylvania at the end of August. ABOVE *Eragrostis spectabilis* in early September at the Delaware Center for Horticulture in Wilmington.

BOTTOM LEFT *Eragrostis trichodes* 'Bend' in the early stage of blooming in mid July in North Carolina. The inflorescences will expand and become much more airy and diffuse.

Eriophorum LinnaeusSedge family, *Cyperaceae*

Cottongrass

From *erion*, wool, and *phoros*, bearing, referring to the woolly flower heads. Comprises approximately 25 perennial species occurring throughout cool-temperate, alpine, and arctic zones, mostly in the Northern Hemisphere, usually in full sun and often in acidic swamps and bogs. Some are clump-forming, others spread by rhizomes. They are distinct among sedges in having numerous fine bristles extending beyond the flower spikelets to form dense tufts resembling balls of cotton. The color of the bristles varies from tawny and dull to nearly pure white. A high mountain bog filled with thousands of cottongrasses is a spectacular sight in late autumn, as deciduous trees and shrubs add their color to the landscape. Though they are superb cut flowers, they should never be picked from wild populations. All require full sun, cool summer conditions, plenty of moisture, and acidic conditions for best growth. Propagate by seed, or by division in spring.

Eriophorum angustifolium Honckeny

Cottongrass, common cottongrass

Native to bogs in Greenland and across North America to Alaska south to New York, Michigan, Iowa, and Washington. Also common throughout the British Isles and Eurasia. Up to 3 feet (90 cm) tall, spreading by long rhizomes. Bristles white. Zone 3.

Eriophorum gracile Koch

Slender cottongrass

Native to swamps and bogs from Newfoundland to British Columbia south to Pennsylvania, Indiana, Colorado, and northern California. Also native to Eurasia. Usually under 2 feet (60 cm) tall, spreading by long rhizomes. Bristles white. Zone 4.

Eriophorum latifolium Hoppe

Broad-leaved cottongrass

Native to wet places scattered throughout the British Isles, though less common than *Eriophorum angustifolium*. Also native to Eurasia. Typically only 12 to 18 inches (30–45 cm) tall, with short rhizomes. Bristles white. Zone 4.

Eriophorum vaginatum Linnaeus[*Eriophorum spissum* Fernald]

Hare's tail cottongrass, tussock cottongrass

Native in moorland bogs and other damp, peaty places in the British Isles, also in Europe and across northern North America. Clump-forming and densely tufted, forming broad tussocks. Bristles white. Zone 4.

Eriophorum virginicum Linnaeus

Virginia cottongrass, tawny cottongrass

This North American endemic is abundantly native in swamps, bogs, and wet meadows, from Newfoundland and Quebec to Manitoba and Minnesota south to Florida and Kentucky. To 3 feet (90 cm) tall, spreading by long rhizomes to form extensive colonies. Bristles white or tawny. Tolerates warm, humid summer conditions better than species that only occur in cool climates. Zone 3.

TOP *Eriophorum virginicum* covers countless acres of native habitat as the deciduous forest colors in mid October at Cranberry Glades Botanical Area, the most extensive acidic

bog in West Virginia. BOTTOM *Eriophorum virginicum* catches the late afternoon light in acidic habitat at Dolly Sods in the West Virginia mountains.



Festuca LinnaeusGrass family, *Poaceae*

Fescue

This large genus includes more than 350 perennial species of cosmopolitan distribution in temperate zones. Many are plants of mountains, plains, and meadows. The majority grow in full sun on average or slightly dry well-drained soils. Some are tufted and clump-forming, others are strong spreaders, creeping by rhizomes. They vary in size from 6 inches (15 cm) to 3 feet (90 cm) in height. All are cool-season growers, and many are poorly adapted to hot, humid summer periods. Fescues are cultivated for soil stabilization and conservation, as turfgrasses, and as ornamentals. They include the popular blue fescues, which are often sold and incorrectly referred to as "*Festuca ovina glauca*" but correctly belong to a complex primarily involving *Festuca glauca* Villars and likely hybrids with it. Some species, such as Atlas fescue, *F. mairei*, are durable long-lived plants, but clumps of many of the smaller, glaucous-leaved plants begin to die out in the center after a few years, and require regular division and replanting to retain a neat, healthy appearance. Most fescues are easily grown from seed; however, the clonal cultivars must be propagated by division to continue their distinct color and character.

Festuca actae Connor

Endemic to the Banks Peninsula of New Zealand's South Island, growing on bluffs and rock outcrops from sea level to low mountains. Foliage is blue-green, less than 1 foot (30 cm) tall. Closely related to *Festuca novae-zelandiae*, but leaves more slender. Propagate by seed or division. Zone 6, possibly colder.

Festuca amethystina Linnaeus

Large blue fescue

Native to central Europe. Tufted and clump-forming, to 2 feet (60 cm) tall in flower. Leaves rolled and threadlike, the foliage texture extremely fine, color varying from blue-green to intensely glaucous gray-blue. Blooms in late spring or early summer, with inflorescences held well above the foliage on slender stalks. Of similar garden use to the common blue fescue, *Festuca glauca*, but slightly larger in size. Zone 4.

'Aprilgrün' (April green). New foliage bright green.

'Bronzeglanz' (bronze gleam). Foliage with slight bronze tint.

TOP *Festuca actae* at the Auckland Botanic Gardens in New Zealand, in late August (winter).
CENTER *Festuca amethystina* 'Superba' in early June at Long-

wood Gardens in Pennsylvania.
BOTTOM Flower stalks of *Festuca amethystina* 'Superba' are vivid pink-purple at the beginning of June in Pennsylvania.





'Klose'. Shorter than typical, with olive-colored foliage. Named for German nurseryman Heinz Klose.

'Superba'. Foliage strongly glaucous with a silver-blue appearance. Distinctly attractive for the pink-amethyst color of the stalks supporting the inflorescences, which is vivid for nearly three weeks from when flowering commences in late spring or early summer.

Festuca californica Vasey

California fescue

Native to dry, open ground, chaparral, thickets, and open forests to approximately 5000 feet (1500 m) elevation in Oregon and in California west of the Sierra Nevada, occasionally on serpentine soils. Often grows on north-facing slopes. A distinct and elegant mid-sized grass with slightly flat, blue-green or glaucous blue-gray leaves forming a loose mound 2 to 3 feet (60–90 cm) high, topped by airy flower panicles anytime from April through June. A cool-season grower, fully evergreen in milder climates. Long-lived and durable. Easily grown on a variety of soils in sun or light shade. Fairly drought tolerant but grows more lushly with average moisture. Old foliage may be removed by occasionally cutting back a plant, or by using fingers or a stiff rake. Propagate by seed, or by division during moist times of the year. Zone 7.

'Blue Fountain'. Foliage bright gray-blue. A selection by Nevin Smith from a population in Santa Clara County, California.

'Horse Mountain Gray'. Foliage gray-green, leaves wider than average. Selected by Sally Casey from a population in Humboldt County, California.



TOP LEFT *Festuca amethystina* 'Superba' is past its purple stage but is a strong blue presence tall in late June at Wave Hill in Bronx, New York.

TOP RIGHT *Festuca californica* blooms on the first day of April

at Leaning Pine Arboretum in San Luis Obispo, California.
BOTTOM *Festuca californica* grows under the open branches of *Arctostaphylos manzanita* in February at the University of California Botanical Garden, Berkeley.



'Mayacamas Blue'. Foliage blue-gray. Selected by Roger Raiche of the University of California Botanical Garden, Berkeley, from a population in the Mayacamas mountain range in Lake County, California.

'Salmon Creek'. Foliage blue-gray.

'Serpentine Blue'. A strong bloomer with intensely blue-gray foliage. Introduced by Roger Raiche from a population growing on serpentine soil in Marin County, California. Especially heat-tolerant.

Festuca cinerea Villars

In 1787, French physician and botanist Dominique Villars published this species and *Festuca glauca* Villars. Modern taxonomic science has determined that *F. cinerea* is a hexaploid and *F. glauca* a tetraploid. They are otherwise nearly indistinguishable, and *F. cinerea* is included in *F. glauca* Villars in this book.

Festuca coxii (Petrie) Hackel

Blue-green tussock fescue

This New Zealand endemic occurs only in rocky, sandy coastal habitats of the Chatham Islands. Clump-forming, typically less than 1 foot (30 cm) tall, with lax glaucous fo-



LEFT *Festuca californica* 'Serpentine Blue' is still colorful in December in the California section of the University of California Botanical Garden, Berkeley.

ABOVE *Festuca coxii* in early September (spring) at the Taupo Native Plant Nursery on New Zealand's North Island.

liage that is often very gray-blue in appearance. Only moderately drought-tolerant but will grow in very light shade. Propagate by seed or division. Zone 6, possibly colder.

Festuca filiformis Pourret

[*Festuca tenuifolia* Sibthorp, *F. ovina* subsp. *tenuifolia* (Sibthorp) Dumortier]

Hair fescue, fine-leaved sheep's fescue

This European native typically occurs in sandy, often acidic soils. Densely tufted and mostly clump-forming, with almost threadlike green leaves forming a neat mound of the finest-textured foliage to 6 inches (15 cm) tall, topped in June by upright flowering stalks to 16 inches (40 cm) tall. Prefers full sun or light shade and sharp drainage. Very drought tolerant and suitable for groundcover use on roof gardens and other challenging sites defined by masonry or paving. Propagate by seed or division. Zone 4.

Festuca gautieri (Hackel) K. Richter

[*Festuca scoparia* A. Kerner ex Nyman]

Bearskin fescue

It's no wonder how this grass got its common name. It spreads slowly but steadily by short rhizomes and can over



time create a thick mat of dense, fine-textured foliage that looks very much like a bearskin rug except for its rich green color. Native to France and Spain. Foliage 3 to 5 inches (8 to 13 cm) high is topped by slender upright-flowering stalks in late spring. Propagate by seed, or by division in early spring or autumn. Zone 4.

'Pic Carlit'. A true miniature, barely 3 inches (8 cm) tall.

Festuca glauca Villars, non Lamarck

[*Festuca ovina* var. *glauca* (Lamarck) Hackel, *F. cinerea* Villars, *F. cinerea* var. *glauca* (Villars) Stohr]

Blue fescue, common blue fescue

Originally native to southern France, this species is the origin of most of the common blue fescues popular in gardens, and is the simplest, most correct name to use in referring to them. The common blue fescues belong to a complex of *Festuca* species that intergrade and hybridize. In many cases, it is impossible to trace the specific origins or to guess at parentage of garden cultivars unless chromosome counts are available, and in most cases they are not.



TOP LEFT *Festuca filiformis* flower stalks remain upright and attractive in the Berggarten in Hanover, Germany, in late August. BOTTOM *Festuca filiformis* covers a large section of the roof of the Rain Garden house at the

Berggarten in Hanover, Germany, in late August.

ABOVE *Festuca gautieri* in the Friendship Island garden in Potsdam, Germany, in late August.

Clump-forming and densely tufted, with narrow, glaucous foliage forming a neat mound 6 to 10 inches (15–25 cm) tall, topped by upright or upright-arching flowering stems up to 16 inches (40 cm) tall in late spring or very early summer. Blue or green upon opening, the inflorescences quickly fade to light straw color. They often become disheveled and unsightly by mid to late summer and are best cut back.

Pronounced cool-season growers, common blue fescues typically remain evergreen and attractive through winter but may go partly dormant or become diseased if exposed to excess summer heat and humidity. Well-drained soil and good air movement will contribute to healthy growth. Drought-tolerant. Best in full sun but tolerant of light shade. Though frequently used as groundcovers, blue fescues usually require division and re-setting every few years, especially in warmer, more humid climates.

A plethora of foliage color forms have been selected and named, and many of these are quite distinct. Plants sold as generic blue fescue may be quite variable in color and size. Following are some of the more widely grown, distinct varieties. Most are cold hardy to Zone 4.

‘Azurit’. Foliage silver-blue.

‘Blaufink’ (blue finch). Foliage soft blue.

‘Blaufuchs’ (blue fox). Foliage green-blue.

‘Blauglut’ (blue glow). Foliage intense blue.

‘Blausilber’ (blue silver). Foliage intensely glaucous and nearly silver in appearance.

‘Blue Note’. Foliage blue-green.

‘Boulder Blue’. The intensely blue foliage color rivals ‘Elijah Blue’. Relatively new to commerce, this decades-old selection originated in Ted Kuettel’s nursery in Colorado and was noticed and named by Steve Schmidt. It has proved well adapted to steppe climate conditions.

‘Däumling’ (‘Tom Thumb’). Only 4 inches (10 cm) tall.

‘Elijah Blue’. If in doubt, choose this one. More silver-blue than ‘Boulder Blue’, it has proved to be one of the most durable of the common blue fescues. Discovered and named by Lois Woodhill of The Plantage Nursery on Long Island, New York.

‘Frühlingsblau’ (spring blue). Foliage light blue.

‘Golden Toupee’. Not blue at all, but with new foliage bright, light yellow, turning yellow-green as the season progresses. The yellow color is most pronounced and longest-lasting in cooler, milder climates such as England or the U.S. Pacific Northwest. Somewhat compact, with soft but needle-like leaves.

‘Meerblau’ (sea blue). Foliage silver-blue.

‘Seeigel’ (sea urchin). Compact habit, with silver-blue foliage.

‘Silberreiher’ (silver egret). Foliage silver-blue.

‘Siskiyou Blue’. Though long offered commercially as *Festuca idahoensis*, a California species, this very silver-blue selection has been determined to belong to the common blue fescue group. No matter whether it’s a California native or not, it is a superb selection.

‘Solling’. Foliage silver-blue. Rarely blooms.





OPPOSITE TOP *Festuca glauca* shares a pot with *Lonicera nitida* 'Baggesen's Gold' at the Royal Horticultural Society's garden, Wisley, in Surrey, England, in mid July. BOTTOM *Festuca glauca* 'Blaufink' blooms in early June at

Longwood Gardens in Pennsylvania.

TOP LEFT *Festuca glauca* 'Elijah Blue' in mid June at Longwood Gardens in Pennsylvania. BOTTOM *Festuca glauca* 'Golden

Toupee' in early May in Portland, Oregon.

TOP RIGHT *Festuca glauca* 'Blaufuchs' in light rain at the Friendship Island garden in Pots-

dam, Germany, in late August. BOTTOM *Festuca glauca* 'Siskiyou Blue' with *Aloe plicatilis* in early April at Leaning Pine Arboretum in San Luis Obispo, California.



Festuca idahoensis Elmer

Idaho fescue

Despite the common name, this clump-forming species is native to open woods and rocky slopes from British Columbia to Alberta south to central California and Colorado. A cool-season grower with gray-green or blue-gray foliage, occurring from sea level up to alpine meadows. The best-known selection associated with this species, 'Siskiyou Blue' in fact represents *Festuca glauca* Villars; however, other correctly identified selections are available. Zone 4.

'Snow Mountain'. A slightly larger blue-gray selection by Nevin Smith from Snow Mountain in California.

'Stony Creek'. A blue-gray selection introduced by California's East Bay Regional Parks Botanic Garden from a population in Del Norte County.

Festuca longifolia Thuiller

[*Festuca caesia* J. E. Smith]

This species name is often used incorrectly to refer to hard fescue, *Festuca trachyphylla*, but correctly refers to this European species which has foliage often strongly glaucous blue-green and is very similar to the commonly cultivated blue fescue, *F. glauca* Villars. It often has pronounced pink coloration in the flowering stems similar to *F. amethystina*. Clump-forming, typically 1 foot (30 cm) tall in flower. Propagate by seed, or by division in spring. Zone 6.

Festuca mairei St. Yves

Atlas fescue

Native to the Atlas Mountains of Morocco, at elevations to 7500 feet (2300 m). Well-known to German grass pioneer Karl Foerster, this unique and useful mid-sized grass is handsome and still generally underappreciated. It forms a neat mound of flat, gray-green foliage 2 to 2½ feet (60–75 cm) tall, topped by very slender flower panicles in June. A cool-season grower, but much more tolerant of hot summers than many fescues. Slow-growing but durable and long-lived. Fully evergreen in milder climates, where a hand-combing to remove spent foliage in spring is the only recommended maintenance. Prefers full sun. Propagate by seed, or by division in spring. Zone 5.



TOP *Festuca longifolia* in mid July at the Royal Botanic Gardens, Kew, in Surrey, England.
BOTTOM *Festuca mairei* in light late-August rain in Berlin, Germany.

OPPOSITE LEFT A drift of *Festuca mairei* at Leaning Pine Arboretum in San Luis Obispo, California, in early April. RIGHT *Festuca rubra* 'Patrick's Point' at the University of California Botanical Garden, Berkeley, in late October.



Festuca novae-zelandiae (Hackel) Cockayne

Fescue tussock, hard tussock

Endemic to New Zealand, occurring on both North and South Islands, typically in tussock grasslands and also in river bottoms. Upright and clump-forming, to 16 inches (40 cm) in height. Leaves are green when young, turning tawny with age. This and accumulated dead foliage result in an overall tawny color, attractive and characteristic of tussock grasslands. Propagate by seed or division. Zone 6, possibly colder.

Festuca ovina Linnaeus

Sheep's fescue

Typically green-leaved, this widespread European species is weedy and naturalized in other parts of the world, including disturbed ground in North America, but is not often deliberately cultivated, especially in gardens and other designed landscapes. The common blue fescues, often offered commercially as "*Festuca ovina glauca*" correctly belong in *F. glauca* Villars. Zone 5.



Festuca rubra Linnaeus

Creeping red fescue

This widespread species is native throughout Europe and North America. Spreads by short rhizomes and is best known for the many selections that have been developed for use as mown turfgrasses. These green-leaved varieties generally require generous moisture for good growth, and many are escaped and naturalized. This species is also often included in "hard fescue" mixes with *Festuca trachyphylla* for use in soil stabilization and conservation, and for no-mow or periodically mown water-conserving alternative lawns. Because of the variability of the species, it is best to choose selections that are adapted to your regional conditions. For example, selections from California populations have proved especially drought-tolerant and are well suited to drier climates. Prefers sun but will tolerate light shade. Propagate by seed or division. Zone 4.

'Jughandle'. Compact, with dense blue-gray foliage. A David Amme selection from California's Mendocino County coast. Needs protection from excessive heat and drought.

'Molate Blue'. Foliage gray-green. An especially drought tolerant selection by David Amme from a population in Contra Costa County, California.

'Patrick's Point'. Compact, with blue-gray foliage. A selection by Roger Raiche from California's Humboldt County coast.

Festuca trachyphylla (Hackel) Krajina

[*Festuca longifolia* auctor, non Thuiller, *F. duriuscula* auctor, non Linnaeus]

Hard fescue

This European species has been widely introduced in North America for forage and low maintenance turf or ground-cover use. Hard fescue is often sold as *Festuca longifolia* or *F. duriuscula*; however, these names correctly refer to different grasses. It is often sold in mixes including other species, especially *F. rubra*. Tufted and clump-forming, typically with blue-green foliage 6 to 12 inches (15–30 cm) tall. Grows best on fertile clay soil, weakly acidic or alkaline, but will grow on lighter soils and is somewhat salt-tolerant. Best on drier sites. Will not endure inundation. A cool-season grower, it may become semidormant in summer heat but will resume growth in autumn when temperatures drop and moisture increases. Will tolerate periodic mowing or can be left unmowed to create a durable, water-conserving alternative to traditional turf. Propagate by seed sown in early spring, or in fall when moisture is available. Zone 4.

Festuca valesiaca Schleicher ex Gaudin

Wallis fescue

This widespread Eurasian species is a cool-season clump-forming fescue, similar in most practical respects to the common blue fescues but typically more compact. Zone 5.

‘*Glaucantha*’. Compact, under 6 inches (15 cm) tall with blue-green foliage.

‘*Silbersee*’ (silverlake). To 9 inches (23 cm) tall with silver-blue foliage.

Festuca vivipara (Linnaeus) Smith

This grass is unusual for its means of vegetative reproduction in which new plantlets are formed within the inflorescences. It is recognized by many taxonomists as a circumpolar species, occurring in northern and eastern Europe, cold-temperate Asia including Siberia, and subarctic North America. Others consider this a catchall name for viviparous fescue grasses. Prefers sun and well-drained soil. Propagate by plantlets or by division. Zone 3.

Gahnia J. R. Forster & G. Forster

Sedge family, *Cyperaceae*

Cutty-grass, saw sedge

The genus is named for eighteenth-century Swedish botanist Henricus Gahn, a student of Linnaeus. Comprises approximately 40 perennial species centered in New Zealand and Australia and extending through to Pacific Islands including Hawaii to eastern Asia. The common name refers to the often

finely toothed leaves, which are familiar to bush walkers for the cuts they can make to exposed arms and legs. Though uncommon in cultivation, these plants are distinctive in their native habitats and anyone who encounters them there will be impressed by their grace and architectural qualities. Progressive regional nurseries such as Taupo Native Plant Nursery in New Zealand are working to improve propagation techniques, and *Gahnia* species are likely to become more available commercially. They are of relatively easy culture and can be divided, though established plants resent root disturbance and transplanting can be difficult. Plants can be propagated by seed, though germination often takes months. Most species are clump-forming, although a few including *G. lacera* are rhizomatous spreaders. All have conspicuous inflorescences, often arching above and out from the foliage and becoming quite conspicuous as the nutlike seeds mature to various shades of brown and near black. *Gahnia* species often provide important habitat for local fauna, and in some cases are the main food supply for specialist species.

Gahnia lacera (A. Richard) Steudel

Saw-sedge, tarangarara

Native to New Zealand’s North Island, typically occurring in open forests or coastal scrub. Leaves soft and bright yellow-green. Grows 3 to 5 feet (90–150 cm) tall, spreading slowly by rhizomes. Of relatively easy cultivation in light shade. Prefers average to moist soil but is drought-tolerant once established. Zone 8, possibly colder.

Gahnia procera J. R. Forster & G. Forster

Cutty-grass

Native to high mountain forest and scrub on New Zealand’s North Island and also on the South Island in subalpine scrub and descending to sea level at the island’s southernmost (coldest) tip. Among the smaller species, producing a neat tussock of fountainlike foliage 2 to 3 feet (60–90 cm) tall. Leaves are deep green in shade and tend to be lighter yellow-green or olive-green in full sun at high altitudes. The inflorescences are held within the foliage and are not as conspicuous as those of many other species, though the dark-brown color of the maturing seedheads is noticeably attractive. Prefers shade in warmer regions but will grow in full sun in cool climates or upper elevations. Best in average to moist soil but is drought-tolerant once established. Zone 8, possibly colder.

Gahnia setifolia (A. Richard) Hooker f.

Saw-sedge, cutty-grass, mapere

Native primarily to New Zealand’s North Island and the northern part of South Island, this large species reaches up



TOP LEFT *Festuca vivipara* in late July at the Royal Botanic Gardens, Kew, in England. BOTTOM *Gahnia lacera* grows in light shade in late August (winter) in the Waitakere Ranges west of Auckland, New Zealand.

TOP RIGHT *Gahnia procera* in early September (spring) in high mountain scrub forest in Tongariro National Park on New Zealand's North Island. BOTTOM Foliage of *Gahnia procera* growing partly shaded by southern beech, *Nothofagus solandri*, is deeper green than that of plants in full sun.



to 8 feet (2.4 m) tall in light forests and open scrub. It grows most luxuriant with plentiful moisture, but is widely adaptable and drought-tolerant, often occurring on relatively dry cuts and roadbanks. A sculptural plant with gracefully arching inflorescences, it deserves more attention in gardens and other designed landscapes. Zone 8, possibly colder.

Gahnia sieberiana J. R. Forster & G. Forster

Red-fruited saw-sedge, sword-grass

This is the most commonly cultivated of the Australian native species. It typically grows in damp habitats including swamp margins and coastal wet heaths, there often in association with swamp banksia, *Banksia robur*. It is the main food plant for larvae of Australia's sword-grass brown butterfly, *Tisiphone abeona albifascia*, and is being planted to enhance and conserve this butterfly population in parts of Australia. More upright than many of the New Zealand species, with upright-arching inflorescences and seeds that are red-colored for a period as they mature. Prefers sun or light shade and average to moist soil. Propagate by seed or division. Zone 8, possibly colder.



TOP LEFT Boldly architectural and nearly 5 feet (1.5 m) tall, *Gahnia setifolia* grows naturally on a steep, sunny embankment near Otaki on New Zealand's South Island in late August (winter). TOP RIGHT Detail of

arching-pendulous seedheads of *Gahnia setifolia*.

RIGHT *Gahnia sieberiana* at the Royal Botanic Gardens Cranbourne in Victoria, Australia, in early September (spring).



Gahnia xanthocarpa (Hooker f.) Hooker f.

This large species can grow more than 10 feet (3 m) tall in flower. The foliage is relatively broad and usually glossy dark green. It occurs on both the North and South Islands of New Zealand, typically in forest habitats. Prefers shade but will grow in sun with adequate moisture and is fairly drought tolerant once established. Propagate by seed or division. Zone 8, possibly colder.

Glyceria R. Brown

Grass family, *Poaceae*

Manna grass, sweet grass, sweet hay, reed sweet grass

The genus name is derived from the Greek *glykeros*, sweet, referring to the sweetness of the grain, which is attractive to waterfowl, and the foliage, which is favored by grazing livestock. Comprises approximately 40 perennial species native to wet places in temperate zones throughout the world. Most are strongly rhizomatous.

Glyceria grandis S. Watson

American manna grass, reed manna grass, tall manna grass
Native in swamps, marshes, streambanks, and other habitats with shallow water from Quebec and Nova Scotia south to Virginia and west to the Pacific Coast. Blooms in mid to late summer, to 5 feet (1.5 m) tall. Leaves medium green. Spreads by rhizomes, sometimes forming extensive masses. Prefers full sun and constant moisture. Propagate by seed or division. Zone 3.



Glyceria maxima (Hartman) Holmboe

[*Glyceria aquatica* Linnaeus]

Manna grass, great water grass, reed sweet grass, sweet hay
Native to Europe and temperate Asia, occurring primarily on wet soils and shallow water in marshes and at the edges of rivers, ponds, and lakes. Green-leaved, with erect, airy flower panicles 6 to 8 feet (1.8–2.4 m) tall, appearing in mid to late summer. Spreads aggressively by stout rhizomes, covering large areas if unchecked. It has been introduced widely beyond its native range as livestock forage in seasonally inundated meadows and has naturalized in some areas. Attractive to waterfowl for food and cover. Requires full sun or very light shade and constant moisture. Grows on a wide range of soil types. Propagate by seed, or by division in spring. Zone 6.

‘*Variiegata*’. Variegated manna grass. Differs from the species in having leaves with bright cream-yellow stripes, often



TOP *Gahnia xanthocarpa* in kauri (*Agathis australis*) forest in the Waitakere Ranges of New Zealand's North Island in late August (winter). CENTER Pendant

seedhead of *Gahnia xanthocarpa* in late August (winter). BOTTOM *Glyceria maxima* at the Munich Botanic Garden in late August.



tinted pink during cool periods in spring and autumn. The overall effect is a pleasing light yellow. Much lower growing than the species, usually less 20 inches (50 cm) in height, and rarely flowering. A strong runner that can overpower less hardy companion plants, it can be a low-maintenance cover in pond gardens and other low wet places when sited properly with defined limits. Foliage is deciduous in winter and somewhat unkempt in appearance. Of easy culture in full sun or light shade in moist soil or shallow water. Makes a fine container subject. Propagate by division in spring. Zone 5.

Glyceria obtusa (Muhlenberg) Trinius

Atlantic manna grass, blunt manna grass
Native to bogs and marshy places from Nova Scotia south along the coast through the New Jersey Pine Barrens to North Carolina, and inland to eastern Pennsylvania. Rela-

ABOVE Stepping stones pass through *Glyceria maxima* 'Variegata' in a wet section of Linda Cochran's garden, Froggy Bottom, near Seattle, Washington, in mid May.

ABOVE RIGHT *Glyceria obtusa* reads as a bright green line across the naturally dark waters of the New Jersey Pine Barrens in mid August.





Three images show the seasonal progression of Atlantic manna grass, *Glyceria obtusa*, growing in the New Jersey Pine Barrens.

OPPOSITE BOTTOM *Glyceria obtusa* is light green in mid July.

LEFT Seedheads of *Glyceria obtusa* are chocolate brown in mid September.

BOTTOM LEFT *Glyceria obtusa* has been bleached by winter sun but is still standing in early March.

tively low-growing, less than 2 feet (60 cm) tall when blooming in early summer. Runs by rhizomes, often creating sweeping lines of bright green foliage at water's edge. Inflorescences open green, turning chocolate brown by autumn as seeds mature, and eventually bleaching to light straw and standing above the surface through winter. An important food source for native waterfowl. Prefers full sun. Requires constant moisture. Tolerates acidic conditions. Propagate by seed, or by division in spring. Zone 4.

Hakonechloa Makino ex Honda

Grass family, *Poaceae*

Hakone grass, urahagusa

A monotypic genus comprising only one species native to moist mountain habitats in Japan.

Hakonechloa macra (Munro) Makino

Hakone grass, urahagusa

Native to wet, rocky cliffs in the mountains of Japan's main island, Honshu, including the region near Mount Hakone, from which the genus name is derived. The graceful, arching stems of this slow spreader form loose, cascading mounds 1 to 3 feet (30–90 cm) high. The soft foliage is rich green and quite reminiscent of bamboo. Plants form clumps that increase slowly by rhizomes. Subtle inflorescences appear in mid summer between the leaves toward the ends of the stems.

Though a warm-season species, Hakone grass requires a cool, moist environment similar to its native habitat for best growth. In cooler, moist climates such as England or the U.S. Pacific Northwest, it will grow luxuriant even in full sun, but in warm, dry climates it requires substantial shade and supplemental moisture.

The boldly variegated cultivar 'Aureola' was the first Hakone grass introduced to Western horticulture, and though a superb garden plant, its popularity has overshadowed the merits of the typical green-leaved form, which is more sun-tolerant, drought-tolerant, and cold hardy, faster growing, and easier to propagate.

Suitable for use as a groundcover if planted closely, since the rate of spread is relatively slow. Hakone grass has historically been a favorite pot-plant in Japan, often displayed as a



companion to bonsai. A number of Japanese cultivated varieties are now readily available to Western gardeners.

Requires moist, organic, well-drained soils. Best propagated by division in spring. Spring is also the best time for transplanting. The roots are shallow, and fall transplants are prone to cold damage and frost heaving. Zone 4.

'Albovariegata' ('Albostriata'). White-variegated Hakone grass, white-striped Hakone grass. Leaves are green with many fine longitudinal white stripes of varying widths. Larger and much more vigorous than 'Aureola', growing 3 feet (90 cm) tall. Also more tolerant of warm, sunny sites and easier to propagate by division. Most material in the United States can be traced to the introduction of plants from the private garden of Masato Yokoi, a Japanese specialist in variegated plants. A number of other white-striped selections are in collectors' gardens in Japan and some of these have been exported to other countries. Though they are usually lumped under the cultivar names 'Albovariegata' or 'Albostriata', not all are equally striped or equally vigorous. Zone 4.

'All Gold'. Leaves solid, bright yellow, especially when

grown in sun. Named by Masato Yokoi of Japan. Growth rate and size are slightly greater than 'Aureola'. Requires partial shade in warm climates. Zone 6.

'Aureola' ('Albo-aurea'). Golden-variegated Hakone grass. Leaves almost entirely yellow-variegated with only a few slender stripes of green remaining, especially at the margins. The variegation is affected by siting and climatic conditions. When the plant is grown in deep shade, the leaf variegation is yellow-green. When grown in partial sun in warm regions, the variegation is a strong golden yellow. When grown in sun in cool climates, the variegation is more cream-white than yellow. Suffusions of pink and red are common during cool periods in spring, and especially in autumn and early winter. Grows shorter than typical, usually under 18 inches (45 cm) in height. Zone 6.

'Beni Fuchi'. Foliage is bronze in summer and red in autumn, especially toward the tips. There is more than one clone in Japan having these characteristics. Uncommon in cultivation outside Japan. Zone 5.





OPPOSITE *Hakonechloa macrochaeta* used as a groundcover in partial shade at the Chicago Botanic Garden in early October.

TOP LEFT *Hakonechloa macrochaeta* 'Albovariegata' in mid September in the author's Pennsylvania garden. CENTER *Hakonechloa macrochaeta* 'Albovariegata' in late October in the author's Pennsylvania garden. BOTTOM *Hakonechloa macrochaeta* 'All

Gold' growing in full sun in a well-watered pot in early April in Jamie Collins's New Jersey garden.

ABOVE *Hakonechloa macrochaeta* 'Aureola' brightens the ground in a woodland section of Chanticleer garden in Wayne, Pennsylvania, growing with *Ligularia dentata* 'Othello' and *L. przewalskii*.



Helictotrichon Besser ex Roemer & SchultesGrass family, *Poaceae*

Oat-grass

The genus name is from the Greek *heliktos*, twisted, and *trichon*, hair or bristle, referring to the shape of the awns. Comprises nearly 100 perennial species, mostly native to dry hillsides, meadows, and margins of woods in temperate Eurasia, but extending to other temperate and subtropical regions throughout the world, including Africa and North America.

Helictotrichon sempervirens (Villars) Pilger[*Avena sempervirens* Pilger]

Blue oat-grass

Native to open, often rocky habitats, primarily in Europe's southern Alps. Strictly clump-forming, producing a dense tuft of erect, silver-blue foliage to 30 inches (75 cm) high. Fo-



OPPOSITE TOP LEFT Detail of *Hakonechloa macra* 'Aureola' in late June at Chanticleer. RIGHT The red-bronze color of *Hakonechloa macra* 'Beni Fuchi' is accentuated by cool late autumn temperatures in Takayama, Japan. BOTTOM A small clump of *Hakonechloa macra* 'Aureola' provides a bright color accent in Karl Wienke's garden in Suhl, Germany, in late August.

ABOVE The bright silver-blue of *Helictotrichon sempervirens* is complemented by red roses and chartreuse *Alchemilla mollis*

in this combination by Lynden Miller in Battery Park City, New York.

TOP RIGHT *Helictotrichon sempervirens* blooms profusely in mid June at Chanticleer in Wayne, Pennsylvania. CENTER *Helictotrichon sempervirens* is a vibrant color note in this sophisticated suite at the Scott Arboretum of Swarthmore College in Pennsylvania, in early November. BOTTOM *Helictotrichon sempervirens* drifts through Dave Fross's California garden in early April.



liage of this cool-season grower is evergreen in mild climates and semievergreen in colder climates. Blooms in late spring, with flowers held more than 2 feet (60 cm) above the foliage on slender, arching stems. Flowering is best on plants in climates where springtime conditions are cool and steadily moist; however, this grass is worth growing just for the foliage. Susceptible to foliar rusts during periods of heat and high humidity. Prefers full sun and requires well-drained soil for long life and healthy growth. Among the very best of the mid-sized blue-leaved grasses for gardens. Superb singly, in sweeps, or displayed in a pot. Propagate by seed, or by division in spring. Zone 4.

'Pendula'. Blooms more heavily, with strongly nodding inflorescences.

'Robust'. A rust-resistant selection by Eckhard Schimana.

'Saphirsprudel' (sapphire fountain). Has bright silver-blue foliage and improved rust resistance. Selected and introduced by Heinz Klose Nursery of Germany.

Hesperostipa (Elias) Barkworth

Grass family, *Poaceae*

Needle grass, western stipa

The genus name is derived from the Greek *esperis*, western, and *Stipa*, the grass genus from which *Hesperostipa* was segregated. Comprises four or perhaps five perennial species, all endemic to drier habitats, often at higher elevations, in western and southwestern North America. Most have conspicuously long, needlelike awns. All are pronounced cool-season growers. Closely related to *Nassella* and *Piptochaetium*.

Hesperostipa comata (Trinius & Ruprecht) Barkworth

[*Stipa comata* Trinius & Ruprecht]

Needle and thread, needle grass

Native mostly to higher-mountain habitats including deserts, sagebrush, pinyon-juniper forests, and open grasslands in western North America. This delicate, luminous species can be difficult to grow at lower elevations. Reaches 2 to 2½ feet (60–75 cm) tall with gray-green foliage, blooming in spring and early summer with long, slender, luminous awns that are subtly spectacular when sunlit. Requires full sun. Grows best in well-drained soil. Very drought tolerant. Best propagated by seed. Zone 4.

Needlelike awns of *Hesperostipa spartea* catch the late afternoon light in mid June in a Minnesota prairie.

Hesperostipa spartea (Trinius) Barkworth

[*Stipa spartea* Trinius]

Porcupine grass

Native to plains and prairies at middle to upper elevations in central North America. Clump-forming and upright, to 12 to 18 inches (30–45 cm) tall in flower. Nodding at the tops of the flowering culms, the inflorescences are remarkable for their flowing awns. Nearly 8 inches (20 cm) long, threadlike, and translucent, they shimmer and sparkle in strong sun as breezes blow across the surface of the prairies. Plants of this species are much easier to grow at lower elevations than *Hesperostipa comata*. Prefers full sun on most soils of average moisture. Self-sows manageably. Propagate by seed. Zone 3.

Hierochloa R. Brown

Grass family, *Poaceae*

Holy grass, sweetgrass, vanilla grass

The genus name is derived from the Greek *hieros*, sacred or holy, and *chloe*, grass. The fragrant leaves of some species, particularly *Hierochloa odorata*, have traditionally been used to scent churches on holy days. Plants have also traditionally been braided and used as incense. Comprises 30 perennial species of woods, marshes, grasslands, and tundra in temperate and subarctic regions.



Hierochloa occidentalis Buckley

California sweetgrass

Native to coniferous forests in California and Washington, mostly in moist habitats. Crushed leaves and stems are sweetly fragrant. Upright and mostly clump-forming with short rhizomes, to 2 to 3 feet (60–90 cm) tall in flower. Prefers light or dense shade and regular moisture. Propagate by seed or division. Zone 7.

Hierochloa odorata (Linnaeus) P. Beauvois

Vanilla grass, sweetgrass, holy grass, Seneca grass

A circumboreal species occurring in moist meadows, bog margins, and other damp places in North America and Eurasia. Upright, to 2 feet (60 cm) tall in flower, running by rhizomes. Called Seneca grass by American tribal people and used to make fragrant baskets. Of easy culture in sun or partial shade on average to moist soils. Propagate by seed or division. Zone 4.

Holcus Linnaeus

Grass family, *Poaceae*

Velvet grass

Comprises nine mostly perennial species native to grasslands and open woods in Europe, temperate Asia, Africa, and the Canary Islands.

Holcus lanatus Linnaeus

Velvet grass, Yorkshire fog

Native to moist or dry meadows and open woodlands throughout the British Isles, continental Europe, temperate Asia, and northern Africa, and introduced and widely naturalized in North and South America. The leaves and stems of this grass are densely covered with fine hairs and feel like the softest velvet when touched. Clump-forming and upright to 12 to 30 inches (30–75 cm) tall when blooming in spring or early summer. Inflorescence opens white to pale green, often with pink or purple tints, and dries narrower but fluffy and cream-white. A cool-season grower, often semidormant in the heat of mid summer. Easy to grow in full sun on any soil. Self-sows readily. Best propagated by seed, or by division in spring or fall. Zone 5.

Holcus mollis Linnaeus

Creeping softgrass

Native to woods and poor grasslands in Europe, especially on acidic soils. Similar to velvet grass but not as softly hairy, and creeping by rhizomes to form extensive mats. Because of its vigorous spread and tendency to self-sow, the green-leaved typical form is rarely cultivated. Zone 5.



TOP *Holcus lanatus* blooms in late June on Martha's Vineyard off the Massachusetts coast.

BOTTOM *Holcus mollis* 'Var-

iegatus' in early October (mid spring) at the Christchurch Botanic Garden on New Zealand's South Island.

'*Variegatus*' ('*Albovariegatus*'). Leaves heavily striped white. Much less vigorous than the typical form and easily managed in the garden. Creeps by rhizomes and can serve as a durable groundcover in cooler, milder climates. Foliage is usually only 4 to 8 inches (10–20 cm) high and looks best in cooler seasons. Summer heat and drought can induce dormancy. Not a strong bloomer. Best in full sun in cooler climates or slightly shaded sites in warmer regions. Propagate by division in spring or fall. Zone 6.

'*White Fog*'. Compact, with especially pronounced variegation. Less heat-tolerant.

Hordeum LinnaeusGrass family, *Poaceae*

Barley

Name from the old Latin word for barley, *hordeum*. Comprises approximately 40 annual and perennial species widely distributed in the world's temperate regions. Includes cultivated barley, *Hordeum vulgare*, an important cereal crop valued for its short growing season and salt tolerance.

Hordeum jubatum Linnaeus

Foxtail barley

Native to meadows and open ground from Newfoundland to Alaska south to Maryland, Texas, California, and Mexico, and widely introduced and naturalized elsewhere. Though perennial, this species is often short-lived. The most ornamental of the wild barleys, with long-awned, translucent pink-suffused inflorescences. A cool-season grower to 30 inches (75 cm) tall, flowering in June and July. Makes superb cut material. Self-sows prolifically and should be introduced with caution near sensitive areas. It is considered a noxious weed in irrigated pastures in the western United States. Easily grown from seed in full sun on any soil, even on salt-laden coastal sands. Zone 4.

TOP *Hordeum jubatum* blooms in early August along the coast of Maine.

BOTTOM *Hordeum jubatum* in a sunny border at the Sichtungsgarten in Weihenstephan, Germany, in late August.



Imperata CirilloGrass family, *Poaceae*

Comprises nine species widely distributed from warm-temperate to tropical regions of both hemispheres. All are strongly rhizomatous perennials and some are notoriously weedy.

Imperata brevifolia Vasey

Satintail

This innocuous grass is native to moist meadows within otherwise arid desert regions from western Texas through Utah, Nevada, and California. It has been eliminated from most of its original habitat by development, and is now rare and possibly threatened. Curiously, California for a while included it on the state's noxious weed list in a fine example of well-intentioned bureaucratic ignorance in dealing with the issue of invasive plants. It has since been removed from the list, but the only explanation for its inclusion in the first place is confusion with introduced *Imperata* species. Grows 2 to 4 feet (60–120 cm) tall when flowering in summer, with satiny inflorescences held upright above bright green foliage. A subtly attractive addition to wet or moist meadows, in sun or light shade. Propagate by seed or division. Zone 7.

Imperata cylindrica (Linnaeus) P. Beauvois

Modern classification takes a broad approach to this exceptionally variable species, which exhibits different behavioral patterns related to provenance. At one time the temperate

BELOW California native *Imperata brevifolia* in the Theodore Payne native plant garden at Descanso in Southern California in mid October.

TOP RIGHT *Imperata cylindrica* 'Red Baron' blooms in late May in Pennsylvania. CENTER *Imperata cylindrica* 'Red Baron'

with *Sedum* 'Frosty Morn' (foreground) in late June at Seaside Gardens in Carpinteria, California. BOTTOM *Imperata cylindrica* 'Red Baron' erupts like flames from a groundcover of black *Ophiopogon planiscapus* in early August at the Scott Arboretum of Swarthmore College in Pennsylvania.



phase, which is common to lowlands in Japan, China, Korea, and Manchuria, was segregated as *Imperata koenigii* (Retzius) Beauvois or as a botanical variety, *I. cylindrica* var. *koenigii* (Retzius) Perkins. This phase is low-growing and common in open, moist and dry, often disturbed habitats within its native range.

A tropical phase, once segregated as *Imperata cylindrica* var. *major* (Nees) C. E. Hubb, is large and very aggressive, and is a notorious and widespread ecological invasive in tropical and warm-temperate environments. This phase was introduced to the southeastern United States and has since naturalized, and the United States Department of Agriculture lists the species, *I. cylindrica*, as a noxious weed. The cultivar 'Red Baron' is of Japanese origin and clearly represents the less aggressive temperate phase; however, it is included in the listing. There is reasonable concern that tissue culture propaga-

tion of 'Red Baron' results in a percentage of plants having the aggressive traits of the tropical phase. Zone 7.

'Red Baron' ('Rubra'). Japanese blood grass. Leaves suffused red, especially at the tips, with red color increasing over the course of the growing season. The form most common in cultivation has been known for more than a century in Japan, where it is most often grown in shallow containers as a companion plant to bonsai. The name 'Red Baron' was coined by nurseryman Kurt Bluemel. This grass never blooms when grown in shallow containers. When plants are grown in the ground, the foliage is typically less than 1 foot (30 cm) tall, and flowering is occasional. Occasionally reverts to solid green. Deciduous in winter in colder climates. Prefers full sun and moist, fertile soil. Drought-tolerant once established. Propagate by division in spring. Fall transplants are vulnerable to frost-heaving in cool climates. Zone 6.



Isolepis R. BrownSedge family, *Cyperaceae*

As currently defined, this genus includes more than 60 annual and perennial species of worldwide distribution in temperate and cooler tropical regions, centered in Africa and Australia. Very closely related to and often included in *Scirpus*. All lack typical, well-developed leaves. Photosynthesis takes place in the green, cylindrical, often threadlike stems.

Isolepis cernua (Vahl) Roemer & Schultes[*Scirpus cernuus* Vahl]

Mop-sedge, fiber-optics plant

This variable species is native to freshwater or slightly brackish moist to wet open habitats typically near the coasts in western North America, Eurasia, Africa, Australia, and New Zealand. Forms a dense, moplike tuft of fine bright green or yellow-green stems. Similar in appearance to the spike-rushes, *Eleocharis* species, in having tiny terminal flower spikes. Of easy culture in moist soil in full sun or light shade. Amenable to pot culture or greenhouse display. Propagate by seed or division. Zone 7 with some protection.

**Jarava** Ruíz & PavónGrass family, *Poaceae*

Feather grass, needle grass, ichu

Comprises 50 or more species native to Central and South America. This genus was originally described in 1894, but until recently most species have been included in *Stipa*. Closely related to *Achnatherum* and also related to *Nassella*. Many feathergrasses have extremely feathery or plumose inflorescences and can be highly ornamental, though their potential for naturalizing beyond their native range and becoming ecologically disruptive warrants close observation of any introductions to vulnerable regions such as the arid southwestern United States. All are clump-forming, cool-season growers. In South America the name “ichu” is sometimes used generically to refer to all the feather bunchgrasses, including the namesake *Jarava ichu*.

Jarava ambigua (Spegazzini) Penailillo[*Stipa ambigua* Spegazzini]

Feather grass, needle grass

Native to South America. Narrowly upright, to 3 feet (90 cm) tall when blooming. Leaves fine, dark green. Prefers full sun. Very drought tolerant. Propagate by seed or division. Zone 8, possibly colder.

OPPOSITE Locally native, *Imperata cylindrica* grows on disturbed slopes and between rice fields on Awaji Island in Japan. The red color in this mid-December photo is typical for this time of year.

LEFT *Isolepis cernua* in early June at Ashland Hollow in northern Delaware.

BELOW *Jarava ambigua* in late August at the Royal Botanical Gardens, Kew, in England.



Jarava caudata (Trinius) Penailillo[*Stipa caudata* Trinius]

Feather grass, needle grass

Native to South America. Fine-textured deep green foliage forms a rounded mound, to 18 inches (45 cm) tall, scarcely overtopped by the flowering stalks. Prefers full sun. Very drought tolerant. Propagate by seed or division. Zone 8, possibly colder.

Jarava ichu Ruíz & Pavón[*Stipa ichu* (Ruíz & Pavón) Kunth]

Peruvian feather grass, ichu

The type species for the genus *Jarava* and perhaps the most spectacular in bloom. Native to Mexico, Argentina, Bolivia, Ecuador, and Peru. Upright, to 3 feet (90 cm) tall when blooming. The inflorescences are full and feathery, especially as they dry and seeds mature. Prefers full sun. Very drought tolerant. Sometimes used in soil stabilization and revegetation projects in its native Andean region. Propagate by seed or division. Zone 8, possibly colder.

Jarava plumosa (Trinius) S. W. L. Jacobs & J. Everett[*Stipa plumosa* Trinius, *S. papposa* Nees]

Feather grass

Native to Argentina, Bolivia, Chile, and Peru, and introduced and naturalized in Africa and Australia. Similar in appearance to *Jarava ichu*. Prefers full sun. Very drought tolerant. Propagate by seed or division. Zone 8, possibly colder.

***Juncus*** LinnaeusRush family, *Juncaceae*

Rush

A cosmopolitan genus comprising more than 200 mostly perennial, rhizomatous species native primarily to moist or wet habitats throughout the world's temperate zones, though some are adapted to dry conditions and many can withstand seasonally dry periods. The majority lack normally developed leaves with flat blades and instead rely upon the green cylindrical stems to carry on photosynthesis. Where they occur, rushes are often locally abundant. The rhizomatous nature of many species often results in large, dense sweeps or masses. The plants' strictly vertical lines are unique and characteristic elements in many regional landscapes, and many species play important roles in nutrient cycles and filtration of wetland habitats. Rushes are evergreen in milder climates and semievergreen even in cool climates. As a group, rushes are long-lived, durable plants. Old stems tend to accumulate and gradually bleach to light tan. Most rushes are easily grown on a variety of soils and can be propagated by seed or division.

Juncus acutus* subsp. *leopoldii (Parlatore) Snogerup[*Juncus acutus* var. *sphaerocarpus* Engelm.]

Spiny rush

Native to moist, often saline places including alkaline seeps and salt marshes from southwestern North America to South America and also in southern Africa. The stiff, green stems radiate neatly from the core to form a neat, spiny green sphere. Grows 2 to 4 feet (60–120 cm) tall, with flowers clustered near the tips of the stems. Prefers full sun and average to moist soils but is very drought tolerant once established. A durable, uniquely sculptural plant. Propagate by seed, or by division during moist times of the year. Zone 8.

OPPOSITE LEFT *Jarava caudata* in a private garden designed by Ximena Nazal and Pablo Cornejo near Santiago, Chile, in January (mid summer). Photo by Jaime Peñaloza. BOTTOM RIGHT This planting in Peñalolén, Chile, by Ximena Nazal and Teodoro Fernández places *Jarava caudata* (in the foreground) against a backdrop of Cerro San Ramón, part of the Andean foothills, in late August (late winter). Photo by Ximena Nazal. TOP A young plant of Peruvian feather grass,

Jarava ichu, blooms in early December in Jason Kubrock's garden in Encinitas, California.

LEFT TOP *Jarava ichu* with *Agave obscura* (in the foreground) in early July at Quail Botanical Gardens in Encinitas, California. CENTER *Jarava plumosa* is sidelit by the late-July sun at the Royal Botanical Gardens, Kew, in England. BOTTOM *Juncus acutus* subsp. *leopoldii* in late June at the Santa Barbara Botanic Garden in California.



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***Juncus*** LinnaeusRush family, *Juncaceae*

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LEFT TOP *Jarava ichu* with *Agave obscura* (in the foreground) in early July at Quail Botanical Gardens in Encinitas, California. CENTER *Jarava plumosa* is sidelit by the late-July sun at the Royal Botanical Gardens, Kew, in England. BOTTOM *Juncus acutus* subsp. *leopoldii* in late June at the Santa Barbara Botanic Garden in California.



Juncus biflorus Elliott

Native to sunny moist or seasonal wet habitats from Massachusetts to Michigan south to Florida and Texas, and also in Alaska. This unusual rush actually has a few flat-bladed long, narrow leaves accompanying the green stems and so looks quite different from many species including common rush, *Juncus effusus*. The inflorescences are terminal. The dark brown flowers mature to red-brown seed capsules. Slender and upright, the plant reaches 2 to 3 feet (30–90 cm) tall. Requires moist soil. Propagate by seed or division. Zone 3.

Juncus conglomeratus Linnaeus

Native to wet, often acidic pastures, meadows, and bogs in Europe. Stiffly upright, to 3 feet (90 cm) tall. Blooms in early to mid summer, with flowers in tight clusters about one-fifth of the way down from the tops of the stems. Stems are gray-green. Of easy culture on a wide variety of soil types. Prefers moist to wet siting in full sun. Propagate by seed or division. Zone 7.

Juncus effusus Linnaeus

Common rush, soft rush

One of the most widely distributed rush species, occurring in moist to wet, sunny or lightly shaded habitats in the world's temperate regions. It is the most commonly encountered species in North America, found in most regions except arid deserts. It is also Japan's most common rush and has been used for centuries in the making of tatami mats. An architecturally interesting plant with dark forest-green stems, upright



and arching in a broad fan, up to 4 feet (1.2 m) in height. The cold hardiness varies between plants of different provenance, but the hardiest are reliable into Zone 3.

'Frenzy'. Variegated corkscrew rush. Stems twisted and spiraling, with vivid light yellow striping.

'Gold Strike'. Stems straight and vertical, with yellow striping.

'Spiralis'. Corkscrew rush. Stems spiraling, solid medium green.

'Unicorn'. Corkscrew rush. Stems spiraling, solid dark green.

OPPOSITE LEFT *Juncus biflorus* in early August in low, wet ground in southern Delaware.

OPPOSITE TOP *Juncus conglomeratus* in early August at the Berggarten in Hanover, Germany. BOTTOM *Juncus effusus*

in early June at the sunny edge of wet deciduous woodlands in northern Delaware.

BELOW *Juncus effusus* in late June at Chanticleer in Wayne, Pennsylvania.



RIGHT A sweeping mass of *Juncus effusus* adds its autumn color and texture to this New Jersey Pine Barrens wetland habitat, as highbush blueberries, *Vaccinium corymbosum* (in the background), turn crimson and *Itea virginica* (in the foreground) is scarlet at the water's edge. BOTTOM The striking architecture of *Juncus effusus* is silhouetted near dusk at Whitesbog in the New Jersey Pine Barrens in early June.

OPPOSITE TOP LEFT *Juncus effusus* 'Spiralis' in early June at Longwood Gardens in Pennsylvania. BOTTOM *Juncus effusus* 'Frenzy' in late June in Southern California.

OPPOSITE TOP RIGHT *Juncus inflexus* in mid August at Barry Yinger's garden in Pennsylvania. BOTTOM *Juncus inflexus* 'Love-sick Blues' in mid July at Tony Avent's Juniper Level Botanic Garden in North Carolina.





Juncus inflexus Linnaeus

Hard rush

Widely distributed in the world's temperate regions including Europe and North America, typically growing in moist or wet sunny habitats. The typical form has cylindrical stems similar to those of the common rush, *Juncus effusus*, but are glaucous gray-green or blue-green and much stiffer. Grows 2 to 4 feet (60–120 cm) tall. Much more drought-tolerant than common rush and will grow well in average or even slightly dry soils. Propagate by seed or division. Zone 4.

'Afro'. Stems gray-green, twisted, and spiraled. Overall height is under 1 foot (30 cm). Prefers sun and average to moist soil but is very drought tolerant once established. Most seedlings retain the twisted character. Named by Tony Avent of Plant Delights Nursery in North Carolina.

'Lovesick Blues'. Weeping blue hard rush. Stems lax, strongly glaucous gray-blue. Produces a graceful fountain of foliage up to 14 inches (35 cm) tall. Introduced by Plant Delights Nursery.

Juncus kraussii Hochstetter

Native to coastal, often saline or brackish wetland habitats in Australia and Africa. Strongly rhizomatous, growing 3 to 4 feet (90–120 cm) tall, with relatively large, heavily branched inflorescences at the tips of the stems. Prefers full sun and shallow water. Salt-tolerant. Propagate by seed or division. Zone 8.

Juncus militaris Bigelow

Bayonet rush, jointed bog rush

This distinctive aquatic species occurs in freshwater habitats including bogs and other shallow waters along the North American coast from Nova Scotia to Delaware and inland to New York, southern Ontario, and Michigan. Stout, glossy green jointed stems grow vertically from a submersed, horizontal rhizome. A stiff stemlike leaf grows upright from the middle of each stem, overtopping the branched, vase-shaped inflorescence. Grows 40 inches (1 m) in overall height, ris-

ing above the water's surface as much as 2 feet (60 cm). The lower portion of the stems is often attractively red-tinted. Blooms in mid to late summer, the inflorescences ripening to a rich red-brown color. In addition to the upright stems and leaves, the rhizomes often produce volumes of submersed threadlike leaves that are arranged in flowing patterns by stream currents. Propagate by seed or division. Small plants or plugs may be planted at almost any time of year as long as they are able to make at least six weeks of root growth before the arrival of freezing winter temperatures. Zone 3.

BELOW *Juncus kraussii* in late August (winter) at the Auckland Botanic Gardens in New Zealand.

OPPOSITE TOP LEFT Spreading by submersed, horizontal rhizomes, *Juncus militaris* grows in dense sweeps in the shallow waters of the Oswego River in the New Jersey Pine Barrens in mid-July. RIGHT Bayonet-like stems and leaves of *Juncus mili-*

taris partly obscure the brown, branched inflorescences in mid-July. BOTTOM In mid-July the organically tea-colored waters of southern New Jersey's Oswego River provide a stunning background for the textural interplay of *Juncus militaris* and local waterlilies, *Nymphaea odorata*. In foreground, submersed threadlike leaves of the rush reveal the currents of this gently moving stream.





Juncus patens E. Meyer

California gray rush, wire grass

Although this species is native to moist habitats in California and Oregon, it is capable of growing in average to dry soils and can withstand periods of seasonal drought. It is similar to the common rush, *Juncus effusus*, but with more stiffly erect, glaucous blue-green or gray-green stems, and is also

more tolerant of summer heat and drought. Mostly ever-green, especially in mild climates. Grows to 2 feet (60 cm) tall. Prefers full sun, in moist soil or shallow water. Zone 7.

'Carman's Gray'. A gray-green selection by Ed Carman of California.

'Elk Blue'. Stems glaucous blue-green.

'Occidental Blue'. Stems glaucous gray-green.



ABOVE *Juncus patens* 'Elk Blue' at Leaning Pine Arboretum in San Luis Obispo, California, in early April. ABOVE RIGHT Detail of *Juncus patens* 'Elk Blue'. RIGHT *Juncus patens* at Descanso Gardens in Southern California in early May.



Juncus polyanthemus Buchenau

Australian gray rush

Native to swampy habitats, mostly near the coast, in Australia. Much larger than the common rushes, typically 5 feet (1.5 m) tall, with gray-green to gray-blue stems up to 3/8 inch (9 mm) in diameter. Evergreen in milder climates. Forms large clumps and increases slowly by rhizomes. Prefers full sun and constantly moist soil or shallow water. Propagate by seed or division. Zone 8, possibly colder.

Koeleria Linnaeus

Grass family, *Poaceae*

Hair grass

The genus commemorates botanist G. L. Koeler (1765–1806), who specialized in grasses. A cosmopolitan genus of approximately 35 annual and perennial species native to open habitats throughout the world's north- and south-temperate regions. They are cool-season growers, usually flowering in late spring or early summer and then going partly or fully dormant in areas where summers are hot and humid. In cooler climates they remain presentable through autumn. Individual plants tend to be short-lived, but populations often persist indefinitely by self-sowing. Upright in growth, with fine-textured tufts of leaves topped by narrow erect flower panicles. Inflorescences open light green and translucent, drying to a pleasing buff color. Hair grasses bloom earlier than many grasses and are worth including to extend flowering interest over the season. They are ideal for naturalizing in meadow gardens. Easily grown in full sun on moist or moderately dry soils. Best propagated by seed, or by division in spring. Zone 5.

Koeleria glauca (Schrader) De Candolle

[*Koeleria macrantha* subsp. *glauca* (Schrader) P. D. Sell]

Blue hair grass

This distinctly glaucous species is native to Europe and north-temperate Asia, particularly on sandy soils. Grows 1 to

2 feet (30–60 cm) tall when blooming in late spring or early summer. Foliage is bright gray-blue. Of easy culture in sun on a wide variety of soils. Drought-tolerant. Zone 6.

'Coolio'. Leaves gray-blue, typical of the species.

Koeleria macrantha (Ledebour) Schultes

[*Koeleria cristata* auctor pro parte, non Persoon, *K. pyramidata* auctor pro parte, non (Lamarck) Beauvois]

Hair grass, June grass (United States), prairie June grass, crested hair grass

A frequent and attractive presence in prairies and open woods over much of the western, central, and northeastern

BELOW LEFT *Koeleria glauca* begins blooming in early June at Longwood Gardens in Pennsylvania. RIGHT Seedheads of *Koeleria glauca* have turned tawny by mid July at the Center for Urban Horticulture in Seattle, Washington.

BELOW *Koeleria macrantha* blooms in early June at the Shaw Nature Reserve in Gray Summit, Missouri, with purple coneflower (in the background).



United States, where it is called June grass or prairie June grass, this species is also native to temperate Eurasia. Grows 1 to 2 feet (30–60 cm) tall when blooming in late spring or early summer. Foliage is bright green. Of easy culture in full sun. Prefers sandy, well-drained soils. Best propagated by seed. Cold hardiness varies with provenance. Plants of northern prairie provenance are cold hardy to Zone 4.

Leptocarpus R. Brown

Restio family, *Restionaceae*

Comprises approximately 15 dioecious species mostly native to Australia, with one species endemic to New Zealand and another native to Chile. All are rushlike perennials lacking normally developed leaves and frequently found in moist habitats.

Leptocarpus similis Edgar

Jointed wire rush, oioi

Endemic to New Zealand's North, South, Stewart, and Chatham Islands, in coastal habitats among salt marshes and dunes, and inland in damp marshes. Often forms large colonies. Stems are narrow, blue-green, 2 to 4 feet (60–120 cm) tall depending upon available moisture. When grown in full sun and dry conditions the stems will turn orange. Although naturally occurring mostly in moist habitats, this adaptable, durable plant can tolerate considerable drought. It is frequently used in traffic islands and other similarly challenging urban and suburban sites in New Zealand. Of easy culture on a wide range of soil types. Can be propagated by seed; however, division is easiest. Zone 8.





OPPOSITE *Leptocarpus similis* at sunset in late August (winter) in natural habitat north of Wellington, New Zealand.

TOP *Leptocarpus similis* planted in drifts along the public beach in Pauahatanui near Wellington, New Zealand, in late August (winter). ABOVE Trish Bartleet's

poolside design for this private garden in Auckland, New Zealand, incorporates a waveform sweep of *Leptocarpus similis*. Photographed in early September (spring).

RIGHT Foliage of *Leymus arenarius* is typically glaucous gray-blue.

Leymus Hochstetter

Grass family, *Poaceae*

Wild rye, blue wild rye, lyme grass, blue lyme grass

Comprises nearly 40 perennial, rhizomatous species native to coastal sands and other saline or alkaline habitats and to stony slopes and steppes, mostly in north-temperate regions. Formerly included in *Elymus*. Many species are very important stabilizers of coastal habitats, and a few have long been popular as garden plants, despite their sometimes aggressively rhizomatous habit of growth. The foliage is often glaucous and silver-blue to blue-gray. All the species are drought-tolerant and salt-tolerant.

Leymus arenarius (Linnaeus) Hochstetter

[*Elymus arenarius* Linnaeus, *E. glaucus* hort., non Buckley]

European dune grass, lyme grass, sea lyme grass, blue wild rye

Native to dunes and other shifting coastal sands of northern and western Europe including the British Isles. An important dune stabilizer that spreads rapidly by rhizomes, especially in loose, fertile soil, this species has long been popular with British gardeners, including Gertrude Jekyll, for its glaucous silver-blue foliage. The growth habit is somewhat sprawling, with lax stems growing upright and arching to a height of 1 to 2 feet (30–60 cm) topped by slender flower spikes to a total height of 3 to 4 feet (90–120 cm) in summer. Though a cool-season grower, it is quite tolerant of summer heat and humidity. The low, running habit makes it especially suitable for groundcover use. Can be difficult to contain in a traditional flower border. The foliage is evergreen in mild climates and semievergreen in cold climates. This species is adapted to use in traffic islands and other challenging sites with poor, compacted soil and exposure to salt. Propagate by seed, or by division in spring.





TOP LEFT *Leymus arenarius* in mid July in Beth Chatto's unirrigated gravel garden in Colchester, England. RIGHT In early July, *Leymus arenarius* plays on the color of a weathered copper urn

at The Coach House, Penelope Hobhouse's garden, in England. BOTTOM LEFT A young plant of *Leymus arenarius* 'Blue Dune' in late October in southern New Jersey.

'Blue Dune'. Leaves strongly silver-blue.

'Findhorn'. Slightly compact and shorter growing, less rapidly spreading.

'Glaucus'. This is a catchall name for glaucous forms. It does not reliably refer to any clonal variety. Since the species is glaucous, this name is truly unnecessary; however, it is still widely used in commerce.

Leymus cinereus (Scribner & Merrill) Á. Löve
[*Elymus cinereus* Scribner & Merrill]

Great Basin wild rye, ashy wild rye, gray wild rye
Native to meadows, canyons, streamsides, sagebrush scrub, and open woodland from Minnesota to British Columbia



south to Colorado, Nevada, and California, typically at higher elevations than *Leymus condensatus*. Characteristically erect, with stems and foliage distinctly gray-green. Grows 6 to 8 feet (1.8–2.4 m) tall in bloom. Differs from most other cultivated *Leymus* species in being a modest spreader, increasing slowly by rhizomes, and is easily managed in clumps or small patches. Mostly evergreen except in the coldest climates. A statuesque species that is highly effective in drifts or sweeps in broad meadows or clearings. Prefers full sun, cool summer night temperatures, and low humidity. Grows well in cool northern Europe. Very drought tolerant and much more cold hardy than *L. condensatus*. Propagate by seed, or by division in spring. Zone 5.

Leymus condensatus (Presl) Á. Löve
[*Elymus condensatus* J. Presl]

Giant wild rye

This species resembles *Leymus cinereus* in its upright stance, growing even taller, to 9 feet (2.7 m) in height. The foliage and stems are typically green and only slightly glaucous. The species has a more southern distribution than *L.*



TOP LEFT *Leymus cinereus* blooming in mid June at the Santa Barbara Botanic Garden. RIGHT *Leymus cinereus* in mid June in the meadow at the Santa Barbara Botanic Garden in California.

BOTTOM LEFT *Leymus condensatus* blooms in late June near Morro Bay, California. RIGHT *Leymus condensatus*, flowering detail, in late June.



cinereus, growing on dry sunny slopes and open woodlands from Southern California into Mexico, and is much less cold hardy. It spreads slowly by rhizomes, but is a prolific self-seeder and is easiest to manage in large-scale landscapes. Very drought tolerant and fairly salt tolerant. Prefers full sun or light shade. Zone 7.

‘**Canyon Prince**’. Canyon Prince wild rye. Named and introduced by the Santa Barbara Botanic Garden from an original collection on Prince Island, an islet in the Channel Island group off the Southern California coast. The entire plant is highly glaucous, with a blue-silver appearance, and is relatively short, growing 4 to 5 feet (1.2–1.5 m) to the tops of the flowering stems. It also spreads more rapidly than typical for the species. *Leymus* species are known to hybridize readily, and there is a possibility that the more glaucous foliage, short stature, and more running habit of this cultivar is due to hybridization, perhaps with *L. mollis*. In any case, it is a distinct and superb grass, of easy cultivation in a wide range of conditions from sun to light shade, in dry or slightly moist soil. Propagate by division. Zone 7, possibly colder.

Leymus mollis (Trinius) Hara

[*Elymus mollis* Trinius, *E. arenarius* var. *villosus* E. May]

American dune grass, sea lyme grass

Native to coastal sands on both coasts of North America south to Massachusetts and California, inland along the shores of Lake Superior, and also along the coast of north-eastern Asia. More upright than *Leymus arenarius* with foliage more green, less glaucous. An important stabilizer of coastal habitats. Propagate by seed or division. Zone 3.

Leymus racemosus (Lamarck) Tzvelev

[*Elymus racemosus* Lamarck, *E. giganteus* Vahl, *E. glaucus* hort., non Buckley]

Volga wild rye, giant blue wild rye, mammoth wild rye

This Eurasian species is slightly larger than *Leymus arenarius*; however, it is otherwise so similar that the two are often confused in commerce. Since the foliage is typically glaucous, with a silver-blue overall appearance, the frequently encountered cultivar name ‘Glaucus’ is superfluous.

Leymus triticoides (Buckley) Pilger

Creeping wild rye

Native to moist, sunny, sometimes saline meadows at low to mid elevations in California, Washington, Montana, and south in mountains to Texas. Unlike the dune species, it is not strongly glaucous and has green or bluish gray-green

TOP *Leymus condensatus* ‘Canyon Prince’ in late June at the Santa Barbara Botanic Garden.

BOTTOM *Leymus mollis*, foliage detail, in late July at the Royal Botanic Gardens, Kew.

foliage to 3 feet (90 cm) high. Very strongly rhizomatous, typically forming extensive sods. Because of this, it is often planted for stabilization and revegetation purposes, or simply to create a soft, low-maintenance grassy meadow. It usually remains green through summer even in hot, dry regions. Of easy culture in sun on moist to average soils. Very tolerant of saline and alkaline conditions. Best propagated by division. Zone 4.

'Gray Dawn'. Foliage glossy bluish gray-green, to 2 feet (60 cm). A California selection by Nevin Smith.

'Shell Creek'. Compact, to 18 inches (45 cm) tall, with bluish gray-green foliage. Selected by Dave Fross from a population near Shell Creek east of San Luis Obispo, California.

Luzula De Candolle

Rush family, *Juncaceae*

Wood rush

A cosmopolitan genus of approximately 80 mostly perennial species most frequent in temperate and cold regions of the Northern Hemisphere. Though *Luzula* species are true rushes closely related to *Juncus*, most have normally developed leaves with flat blades and look superficially like sedges. The foliage is typically basal, and the plants clump-forming or spreading by rhizomes. Flowers are produced in spring on upright stalks and are relatively small and brown or tan in color with conspicuous light yellow anthers. As the common name implies, *Luzula* species are primarily plants of woodland, shaded habitats, some drier but most moist. A few European woodrushes have long been cultivated in shade gardens; however, many more species, including North American natives, deserve more attention for use in woodland landscapes. The leaves are often somewhat thick and slightly leathery, remaining green through winter and being replaced by new growth in spring along with the flowers. Some woodrushes have distinct hairs along their leaf margins. They can be grown from seed, or by division in spring or early autumn.

Luzula acuminata Rafinesque

Hairy wood rush

This North American native occurs in woods and clearings and on bluffs from Canada south to upland Georgia and west to Illinois and South Dakota. The basal leaves are deep green, lustrous, and relatively broad, to ½ inch (12 mm) wide. The

TOP *Leymus triticoides* in early April in the Morgridge garden in San Luis Obispo, California. CENTER *Luzula acuminata* grows at the base of a large tulip poplar, *Liriodendron tulipifera*,

in early December at the Mount Cuba Center in northern Delaware. BOTTOM *Luzula acuminata* foliage is glossy green with blades approximately ½ inch (12 mm) wide in late October.





LEFT New leaves and flowers of *Luzula acuminata* grow out of old basal foliage in late April. ABOVE *Luzula echinata* blooms

in late March at Tony Avent's Juniper Level Botanic Garden in Raleigh, North Carolina.

margins are finely hairy. Blooms in April and May, with flowering stalks to 14 inches (35 cm) tall and flowers tan and red-brown. Spreads slowly by rhizomes and can be employed as a woodland groundcover if planted fairly closely. Its rate of increase is much slower than the larger European wood rush, *Luzula sylvatica*. Tolerates dense deciduous shade and moist or moderately dry conditions. Prefers organic soil and most often occurs in neutral to acidic soils, though plants of more southern distribution common to calcareous wooded slopes are sometimes distinguished as *L. acuminata* var. *carolinae* (S. Watson) Fernald, and these are best for alkaline garden soils. Zone 4.

Luzula echinata (Small) F. J. Hermann

Wood rush

The specific epithet means like a hedgehog, and indeed this delicate North American species does look like a spiny sphere when flowering, though it is actually quite soft to the touch. Native to woods, thickets, and clearings from Georgia and

Alabama north to New York and west to Illinois. Similar to *Luzula multiflora*, with basal leaves only ¼ inch (6 mm) wide, but more rounded in form, growing 8 inches (20 cm) tall. Of easy culture in shade on moist to moderately dry soil. Propagate by seed or division. Zone 6.

Luzula luzuloides (Lamarck) Dandy & Willmott

European wood rush

Native to central and southern Europe. Loosely tufted and rhizomatous. Basal leaves narrow, to ¼ inch (6 mm) wide, gray-green with hairy margins. Inflorescences to 24 inches (60 cm) tall, with dense, off-white to light tan flowers in clusters that become increasingly pendulous as seeds mature. A useful, easily grown groundcover for sun or partial shade on moist or moderately dry soil. Zone 6.

Luzula multiflora (Retzius) Lejuene

Common wood rush (North America)

Widely distributed over eastern North America, growing in open woods, fields, and meadows, and the most commonly encountered in much of its range. Similar in appearance to *Luzula echinata*, but more upright in form. Leaves green, narrow, to ¼ inch (6 mm) wide. Blooms in spring, to 10 inches (25 cm) tall. Of easy culture in shade or in sun with moisture. Not as durable or persistent as *L. acuminata*. Zone 3.



Luzula nivea (Linnaeus) De Candolle

Snowy wood rush, snow rush

Native to central and southern Europe, commonly in alpine regions. Similar to *Luzula luzuloides*, but the flowers are typically lighter, whiter. Loosely tufted and slowly rhizomatous. Narrow green basal leaves less than ¼ inch (6 mm) wide with conspicuously hairy margins. Flowering stalks to 24 inches (60 cm) tall in early summer, with dense clusters of off-white to near-white flowers that become increasingly pendulous as seeds mature. Durable and useful as a groundcover in sun or partial shade. Of easy culture in moist or moderately dry soil. Zone 6.

‘Schneehäschen’ (little snow hare). Flower clusters near-white.

‘Snowbird’. Flower clusters near-white.

Luzula pilosa (Linnaeus) Willdenow

Hairy wood rush

This Eurasian native is nearly identical to the North American species *Luzula acuminata* and considered synonymous with it by many authorities. Plants of European provenance may not be as winter hardy as plants from colder parts of North America. Zone 5.



Luzula sylvatica (Hudson) Gaudin

[*Luzula maxima* (Reichard) De Candolle]

Greater wood rush

Native to woodlands, moorlands, streamsides, and other typically acidic habitats in the British Isles, and also in western, central, and southern Europe, the Caucasus, and Turkey. The largest of the wood rushes. Glossy green basal leaves up to 1 inch (2.5 cm) wide with hairy margins. Forms large clumps that increase fairly rapidly by rhizomes and is capable of creating a continuous mat. The most durable and long-lived wood rush for groundcover use. Blooms in spring. Upright inflorescences to 20 inches (50 cm) tall with loose, open flower clusters. Adaptable to a wide range of soil and moisture conditions in shade or partial sun. Propagate by seed, or by division in spring or early autumn. Zone 4.

‘Aurea’. Golden wood rush. Leaves yellow-green. Zone 6.

‘Hohe Tatra’ (high Tatra). Leaves to 1 inch (2.5 cm) wide, the widest available. A selection by Herman Müssel from the Tatra Mountains.



TOP *Luzula multiflora* grows in moss in light shade on a rock outcrop near Pawling, New York, blooming in late May.

Luzula nivea ‘Schneehäschen’ in mid July in New York. BOTTOM *Luzula nivea* leaf margins are finely hairy.



TOP LEFT The wide leaves of *Luzula sylvatica* 'Hohe Tatra' with a one-Euro coin ($\frac{7}{8}$ inch or 23 mm in diameter) for scale. RIGHT *Luzula sylvatica* 'Marginata' blooms in early May

below a venerable redbud tree at Springwood, the Lightys' garden in Pennsylvania. ABOVE *Luzula sylvatica* 'Hohe Tatra' in late August in dense shade in the Sichtungsgarten in Weihenstephan, Germany.

'Marginata'. Leaf margins neatly cream-white variegated. 'Schattenlicht' (shadow light). Leaves dark green with fine white longitudinal stripes.

'Taggart's Cream'. New growth is nearly white, gradually darkening to green. Zone 5.

'Tauernpass'. A wide-leaved green selection by Heinz Klose.

Melica Linnaeus

Grass family, *Poaceae*

Melic

Includes nearly 80 perennial, clump-forming species native to sunny, dry, stony slopes and shaded woodlands in temperate regions around the world with the exception of Australia. Melic grasses are pronounced cool-season growers, beginning growth with the onset of winter rains. Many contribute showy cream-white flowers to the spring landscape, then go dormant or semidormant when summer heat sets in. The foliage is light or dark green and often unremarkable, and summer-dormant plants that become unkempt may be cut back to the ground. Though the European, African, and South American species are most established in cultivation, the California species are highly attractive grasses that deserve wider attention, especially in dry regions. Propagation is best by seed. Some species self-sow, but manageably.

Melica altissima Linnaeus

Siberian melic

Native to shrubby thickets and forest borders from central and eastern Europe to Siberia. Mostly upright with leafy



stems, to 4 feet (1.2 m) tall when flowering in late spring or early summer. Grows most upright in full sun but will tolerate light shade. Of easy culture in moist or moderately dry soil. Summer dormant in hot climates. Self-sows manageably. Zone 5.

'Alba'. Spikelets opening white, fading to tan.

'Atropurpurea'. Spikelets mauve-colored, fading to tan.

Melica californica Scribner

California melic

The most dramatic of the California species, occurring naturally in a wide range of habitats including sunny meadows, dry rocky slopes, and open, dry or slightly moist woodlands. Upright and 2 to 4 feet (60 to 120 cm) tall when flowering in spring. The narrow inflorescences are shimmering white when opening, eventually drying to tan, and often remaining upright and attractive even as plants enter partial or full summer dormancy in hot, dry regions. Of easy culture on a wide range of soils. Best in full sun or very light shade. Drought-tolerant. Propagate by seed. Zone 8.

Melica ciliata Linnaeus

Hairy melic grass, silky-spike melic

Native to Europe, northern Africa, and southwestern Asia. Leaves narrow, medium green, mostly basal. Appearing in late spring or early summer, the flowering stems are upright and arching, forming graceful fans of light cream-white flower spikes to 2 feet (60 cm) in height that fade to tan and remain attractive for a month or more. Compact and rela-



TOP *Melica altissima* in late July at Merriments Gardens in East Sussex, England. ABOVE *Melica californica* begins flowering in early April at Leaning Pine Arboretum in San Luis Obispo,

California. RIGHT The rounded form of *Melica ciliata* fits perfectly into the curve of a stone path at Wave Hill in New York in late June.





ABOVE *Melica ciliata* is extraordinarily luminous when sidelit in late June at Longwood Gardens in Pennsylvania.

RIGHT *Melica macra* in late July at the Royal Botanic Gardens, Kew, in England.



tively low growing. A delightful addition to the early season landscape. Prefers sun or light shade, moist or moderately dry soil. Partly or fully summer dormant in warmer climates. Individual plants are often relatively short-lived. Self-sows manageably. Zone 6.

Melica imperfecta Trinius

Coast range melic, foothill melic, little California melic. Primarily coastal in its distribution, this upright species is native on dunes and dry rocky hillsides and in open woods in Southern California and Mexico. Grows to 2 feet (60 cm) tall when flowering in early spring. The inflorescences are branched and somewhat open and not as narrowly spike-like or dramatically white as some others. Still, this grass is a graceful addition to meadow gardens and other informal designs. Easy to grow from seed in sun or very light shade. Zone 8.

Melica macra Nees

This clump-forming perennial is native to sunny habitats in South America. Grows 2 to 3 feet (60–90 cm) tall when flowering in late spring or summer. The narrow spike-like inflorescences open bright white and fade to tan. Foliage is dark

green, narrow, and finely tapered. Stems typically become lax after flowering, often attractive in their recline. Of easy culture in full sun. Propagate by seed. Zone 8.

Melinis P. Beauvois

Grass family, *Poaceae*

The commonly cultivated *Melinis* species were formerly included in the genus *Rhynchelytrum*; however, recent taxonomic studies have shown that the distinction between the two is artificial and that the oldest name, *Melinis*, is now used for all. Includes 20 or more annual and perennial species native to open grasslands, savannahs, and other dry habitats, primarily in Africa but also in western Asia. A few species are widely naturalized in disturbed habitats far beyond their original range, most notably *M. repens*, which is considered a pernicious weed in many warm regions. This and the other commonly cultivated species, *M. nerviglumis*, are primarily warm-season growers with limited cold hardiness. Though both are perennial, they are most often grown as annuals in cool-temperate and cold-temperate climates. Flowering varies with culture. Plants grown in the ground in warm regions will typically bloom in summer. Plants set out as annuals in cooler climates require a couple of months of vegetative

growth before blooming in late summer or autumn. Plants grown under glass can be timed to bloom in winter.

Melinis nerviglumis (Franchet) Zizka

[*Rhynchelytrum nerviglume* (Franchet) Chiovenda]

Ruby grass, pink crystals ruby grass

This perennial species is of southern African origin. Its more intense flower color and clump-forming habit make it a better garden subject than *Melinis repens*; however, it is not as cold hardy. Much of the material in cultivation was originally introduced as seed obtained in the 1980s by Gayle Weinstein, then on the Denver Botanic Gardens staff, from the Drakensberg Botanic Garden in Harrismith, South Africa. The foliage of this material is blue-green and the flowers deep ruby-red to pink-purple at first, opening to iridescent pink. Grows 18 to 24 inches (45–60 cm) high in flower. Plants are often marketed with the name “Pink Crystals”; however, this is a common name, not a clonal cultivar name. In cold regions

it is best to start plants indoors and set them out early in the season, for flowering in mid summer to autumn. Best in full sun. Very drought tolerant. Best propagated by seed. Zone 9.

Melinis repens (Willdenow) Zizka

[*Rhynchelytrum repens* (Willdenow) C. Hubbard, *R. roseum* (Nees) Stapf & C. Hubbard, *Tricholaena repens* (Willdenow) A. S. Hitchcock, *T. rosea* Nees]

Ruby grass, Natal ruby grass

Though more cold hardy than *Melinis nerviglumis*, this species, which is probably of African origin, is not as intensely color-

BELOW LEFT Flowers of *Melinis nerviglumis* open deep pink to pink-purple. BOTTOM *Melinis nerviglumis* in late June at Leaning Pine Arboretum in San Luis Obispo, California.

BELOW *Melinis nerviglumis* flower detail explains why this grass is often sold as “pink crystals.” BOTTOM *Melinis repens* flowers in a sweep at the Huntington Botanical Gardens in San Marino, California, in late June.



ful in flower and has definite weedy tendencies, spreading both by seed and by vegetative means. It can be quite stunning when planted in large sweeps or masses; however, its potential for naturalizing warrants caution in warm climates where it is perennial. Grows to 3 feet (90 cm) tall in full sun. Very drought tolerant. Best propagated by seed. Zone 8.

Merxmuellera Conert

Grass family, *Poaceae*

Named for German botanist Hermann Merxmüller. Comprises 16 perennial clump-forming species native to very dry, open habitats in southern Africa, often in mountains.

Merxmuellera macowanii (Stapf) Conert

[*Danthonia macowanii* Stapf]

This large, distinctly attractive species is native to mountain regions in southern Africa, often occurring in large masses, and often near waterways in moist habitats. Clump-forming and evergreen, it forms a neat rounded mound of narrow blue-green foliage to 3 feet (90 cm) high, topped by narrow flower panicles in spring or summer and reaching a total height of 5 feet (1.5 m). Though still rare in cultivation in

Western gardens, it has been a persistent and dramatic presence in the grass collection at the Royal Botanic Gardens, Kew, in England for many years, and deserves more attention in gardens. Propagate by seed, or by division during cooler, moist times of the year. Zone 8, possibly colder.

Milium Linnaeus

Grass family, *Poaceae*

Wood millet, millet

Includes four annual and perennial species widely distributed in the world's temperate regions, typically growing in mixed woods but also in open, often dry habitats. This genus does not include the millet grasses that are important cereal grains, which primarily represent *Sorghum* species but also belong in other genera including *Panicum* and *Setaria*.

Milium effusum Linnaeus

Wood millet

This species is native to temperate and subarctic regions in the Northern Hemisphere. Two very similar-looking botanical varieties are often recognized, the typical one being a Eurasian native and the other, *Milium effusum* var. *cisatlanti-*



LEFT *Merxmuellera macowanii* in late July at the Royal Botanic Gardens, Kew, in England.

BELOW *Milium effusum* 'Aureum' blooms in early May at Heronswood Nursery in Kingston, Washington.

BELOW LEFT Detail of *Milium effusum* 'Aureum' foliage.



cum Fernald, a native of eastern North American woodlands. Forms with bright yellow spring foliage have long been cultivated and the origin of this material is uncertain, but most of it is probably European. A cool-season grower, wood millet blooms in early spring and sometimes goes dormant or partly dormant in mid-summer heat, especially if conditions are dry. With shade and moist soil, plants will remain green through the growing season. Typically 2 to 3 feet (60 to 90 cm) tall in flower. Mostly clump-forming but capable of spreading by rhizomes. Propagated most easily by seed. Zone 5.

‘**Aureum**’. Golden wood millet, Bowles’ golden grass. New spring foliage is among the clearest, brightest yellow of all the grasses. The color darkens to yellow-green or green as the season progresses, especially in warmer climates. Prefers light shade and constant moisture, though it can be sited in full sun in cool climates. Seedlings often retain the yellow foliage trait. Zone 5.

Miscanthus Andersson

Grass family, *Poaceae*

Miscanthus, eulalia, Japanese silver grass, susuki zoku The genus name is derived from the Greek *mischos*, stalk, and *anthos*, flower, referring to the stalked spikelets. Comprises approximately 20 perennial, warm-season species native to eastern and southeastern Asia in a wide variety of open habitats including coastal lowlands, marshes, mountain sides, and forest edges. African species formerly included in *Miscanthus* are now generally placed in *Miscanthidium* Stapf.

Miscanthus is known as *susuki* in Japan, which is the center of origin of most cultivated *Miscanthus* species. It is much celebrated there in traditional art and, along with Japanese maples, as a symbol of autumn. It has also been traditionally used in the roof thatching of residences and temples.

Miscanthus has been popular in Western gardens for more than a century, and there is good reason for this. As a group among ornamental grasses, *miscanthus* is unsurpassed in the beauty and diversity of its flowers, foliage, autumn color, and winter presence, and in its extraordinary adaptability to myriad garden purposes. It is also capable of thriving in some of the most challenging cultural conditions imaginable and can play a genuine role in reducing maintenance and water use in many designed landscapes.

The prolonged enthusiasm for *miscanthus* has led to the selection of more than a hundred cultivated varieties, many of which are still available commercially. Its winning attributes have been enhanced by selection and breeding in recent years, and this has contributed to a still-increasing popularity. While most of the acclaim is well deserved, there is one major caveat, and that is that *miscanthus* is increasingly

demonstrating a potential for naturalizing and playing a role in ecological disturbance far beyond its native range.

Miscanthus is highly competitive in moist, sunny temperate and subtropical regions. Near monocultures of *Miscanthus* species in parts of Japan and Southeast Asia demonstrate the vigor of this grass and hint at its potential under similar conditions elsewhere in the world. As always, the risk of ecological invasiveness is a regional matter, and strategies for responsible management of this risk must be regionally constructed. For example, *Miscanthus* species pose little or no threat in England, where the growing season lacks the warmth and duration of sunlight required for significant production of fertile seed. Cooler parts of North America such as the Northeast north of upper New York State, the Upper Midwest, and the Pacific Northwest are also low-risk to no-risk regions. Arid parts of the United States including New Mexico, Arizona, and Southern California offer plenty of heat but not enough water, and except in riparian areas there is little or no potential for *Miscanthus* to naturalize.

The situation in the mid Atlantic and southeastern United States is entirely different. These areas most closely approximate the native habitat of *miscanthus*, offering fertile soils, long growing seasons, and plenty of moisture, and there are already numerous instances where *Miscanthus sinensis* has naturalized and begun to dominate regional ecosystems. Ironically, the invasive potential of *miscanthus* has been enhanced by horticultural development. Antique cultivars of *miscanthus* including ‘*Gracillimus*’, ‘*Variegatus*’, and ‘*Zeb-rinus*’ require relatively long growing seasons if they are to flower at all, and their seeds rarely mature in regions where they flower very late in autumn.

Many recent introductions were developed for their ability to flower in short seasons, and this group includes many of the striking selections from Pagels Nursery in northern Germany. These are superb new choices for northern Europe, England, and colder zones in the United States, finally allowing gardeners in these places to enjoy the plummy magnificence of *miscanthus*. Unfortunately, these same selections have proved to be prolific self-sowers in warmer regions. They readily naturalize in and out of the garden, posing a threat to regional ecosystems and often becoming genuine nuisances in meadow gardens and other manicured landscapes. The most responsible approach in these areas is to choose later blooming, less fertile cultivars, to select seed-sterile cultivars, or to substitute other less problematic grasses that will serve similar purposes. For example, North American native warm-season grasses such as *Panicum* and *Muhlenbergia* species are beautiful and versatile, and new selections of these are greatly enriching the choices available to contemporary gardeners.

Miscanthus species are often capable of hybridizing, and there is real potential for the deliberate hybridization and development of sterile polyploids. Such work could enrich the garden palette of miscanthus while reducing the risk of undesirable ecological ramifications.

True warm-season growers, miscanthus grasses are late-starting in spring but grow with increasing vigor as summer warmth arrives. They grow most luxuriant in warm, moist situations and are undeterred by high humidity. They are of easy culture on a wide variety of soils from loose sands to heavy clays, and can withstand periods of inundation or considerable droughts. Excess fertility or irrigation will cause overly lush, lax, and floppy growth, as will siting in too much shade. Most species and cultivars prefer full sun but will tolerate light shade.

The genus includes clump-formers such as *Miscanthus sinensis* and strongly rhizomatous types such as *M. sacchariflorus*. Individual plants live for many years, but older clumps will eventually die out in their centers and should be renewed by taking divisions from the perimeter of the clump. Divide or transplant in spring or early summer, or in autumn in milder climates. Mature specimens of the larger miscanthus cultivars are often too large for smaller residential gar-

dens, and periodic division is a frequently employed method of reducing the plant size while retaining the desirable attributes of form and flowering. A sharp spade is an indispensable tool for such tasks. Be cautious of the often sharp-edged leaves, especially common to *M. sinensis*, which can cause minor but irritating cuts to hands and face.

Seed propagation is easy but is not appropriate for the clonal cultivars. Miscanthus blooms from mid summer into autumn, the timing varying with species and cultivars. The flowers typically open with red tints, becoming silvery and fluffy on drying, and usually remaining attractive through winter. Cold hardiness varies with species and cultivated varieties.

Miscanthus floridulus (Labillardière) Warburg

Giant miscanthus, Tokiwa susuki

This is the largest species, capable of growing more than 8 feet (2.4 m) tall, with broad, coarse leaves to 1¼ inches (32 mm) wide. It is native to lowlands in warmer parts of southern Japan, and also to Taiwan and the Pacific islands. The inflorescences have a dominant central rachis, a character which distinguishes this from other Asian *Miscanthus* species. Although common and often occurring in extensive popula-





tions in its native range, this species is uncommon in cultivation in Western gardens. Plants offered commercially as *M. floridulus* in fact represent a plant of obscure origin that is now confirmed to be a hybrid which has been described and published as *M. ×giganteus*. True *M. floridulus* is less cold hardy than *M. sinensis* but is a statuesque plant that deserves further attention in appropriate regions. Zone 7, possibly colder with the introduction of plants from colder provenance.

‘Karl Foerster’. A selection by German naturalist Karl Patsch from a population growing around a bog in Japan’s Alps, on Honshu, a location outside the normal range of this species. It promises increased cold hardiness but is yet untested for areas colder than Zone 7.

Miscanthus ×giganteus Greif & Deuter

Giant miscanthus

This magnificent and long-popular garden plant has had a tortuous nomenclatural history which has finally arrived at

OPPOSITE *Miscanthus floridulus* (right) dwarfs *M. sinensis* (left) in mid December at the Awaji Landscape Planning and Horticulture Academy in Hyogo, Japan.

TOP LEFT The strong central rachis present in inflorescences of *Miscanthus floridulus* is evident in this mid-December photo

in Japan. BOTTOM Though it rarely blooms in England, *Miscanthus ×giganteus* ‘Aksel Olsen’ has remarkable stature, form, and texture, seen here in late July at Great Dixter in Northiam, England. BELOW *Miscanthus ×giganteus* ‘Aksel Olsen’ in flower in early October at Kurt Bluemel Nurseries in Maryland.





a firm conclusion and a durable name. It has been traced to plants received from Yokohama, Japan, in the 1930s by Danish botanist Aksel Olsen. German nurseryman Karl Foerster obtained divisions in time to list it in his 1935 catalog as *Miscanthus sinensis* 'Giganteus'. Foerster later began using the name *M. floridulus* to describe the plant. Recent studies have proved it to be a hybrid (a triploid with 57 chromosomes) between *M. sacchariflorus* and *M. sinensis*. This accounts for the grass having intermediate characters between the two. The flowers resemble those of *M. sacchariflorus*, but this grass lacks the rhizomatous spread of that species. *Miscanthus x giganteus* is an upright clump-former growing nearly 10 feet (3 m) when blooming. The leaves are deep green, 1 inch (25 mm) wide, and typically pendant, giving the overall effect of a large fountain. Trials have confirmed that it does not produce sterile seeds, and therefore it must be propagated by division. It blooms in late summer, the flowers opening light pink and quickly drying to silver. The lowest foliage frequently turns brown or dies in late summer, so it is often best to place companion plantings in front to mask this. Prefers full sun and average to moist soil, though is quite drought-tolerant. Zone 4.



LEFT *Miscanthus x giganteus* 'Jubilar' at the Royal Horticultural Society garden, Wisley, in Surrey, England, in late August. CENTER Detail of *Miscanthus x giganteus*



'Jubilar' foliage. RIGHT *Miscanthus nepalensis* opens metallic gold in late August at Beth Chatto's garden in Colchester, England

'Aksel Olsen'. This name is now generally used to refer to the material long-established in cultivation that can be traced back to Danish botanist Aksel Olsen in the 1930s. Other plants resulting from similar hybridization of *Miscanthus sacchariflorus* and *M. sinensis* would merit distinct cultivar names or any of these plants can be simply called *M. x giganteus*.

'Jubilar'. Leaves longitudinally striped yellow-green. Originated as a sport of *Miscanthus x giganteus* 'Aksel Olsen'. Identical in all other characters.

Miscanthus nepalensis (Trinius) Hackel

Himalaya fairy grass

Native to the Himalayas and Burma. Green-leaved, to 6 feet (1.8 m) tall in flower, with distinctively drooping gold-tinted inflorescences. Recent introductions from higher elevations have produced plants that are more robust and cold hardy than earlier collections. These appear to be reliable in southern England and may prove hardy in colder regions.

Miscanthus oligostachyus Stapf

Kari yasu modoki

Much smaller than *Miscanthus sinensis*, usually less than 4 feet (1.2 m) tall in bloom, with a more open habit. Leaves are shorter, approximately ½ inch (12 mm) wide, and are relatively soft and thin in substance. They are also very flat,



TOP LEFT *Miscanthus nepalensis* in mid August in the Temperate House at the Royal Botanic Gardens, Kew, in England.

TOP RIGHT *Miscanthus oligostachyus* in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England.

BOTTOM LEFT Photographed in Japan in early November, this is one of a few variegated selections of *Miscanthus oligostachyus* that do not have Western cultivar

names and are rare outside of Japan. BOTTOM RIGHT *Miscanthus oligostachyus* in late August at the Westpark in Munich, Germany.

with a less pronounced white midrib than *M. sinensis*. Blooms relatively early in summer, usually in July or August. The inflorescences are sparsely branched and not nearly as full and fluffy as the larger species. Fall color often includes bronzed-red tones. Useful for its compact size, tolerance of light shade, and exceptional cold hardiness. Variegated forms have been selected in Japan and are grown in specialty gardens; however, few if any of these have Western cultivar names and they are still rare outside Japan. Propagate by seed or division. Generally does not self-sow. Zone 4.

***Miscanthus* 'Purpurascens'**

Autumn flame miscanthus

Though it is still uncertain what species this plant represents, it remains one of the most beautiful and useful of all miscanthus. It offers small size, upright stature, early flowering, exceptional cold hardiness, and in many parts of the world, the most reliable red-orange autumn color. In addition to this, it rarely if ever produces fertile seed, making it a safe choice for those who want to grow miscanthus but are concerned about seeding beyond the garden.

Propagated by division, this clonal cultivar began with seed obtained from Japan in the 1960s as *Miscanthus purpurascens* Andersson by Hans Simon of Germany. Modern classification includes this species within *M. sinensis*; however, *M. 'Purpurascens'* does not represent that species. This plant is known as *M. 'Herkules'* in Germany; however, it is of minor importance there since it rarely attains fall color in Germany's climatic conditions. It is possibly a hybrid involving *M. oligostachyus*, but further research, including chromosome studies, is necessary to confirm this.

In climates such as the eastern United States it blooms by August, growing to 5 feet (1.5 m) tall in flower. The narrowly vertical inflorescences open with the slightest pink tint but quickly turn silvery. Leaves are ½ inch (12 mm) wide and slightly gray-green. One of the most reliably upright miscanthus, rarely lodging or flopping even when growing in light shade. Prefers full sun and average to moist soil. Not as drought-tolerant as *Miscanthus sinensis*. A similar, but smaller plant was once available as 'Herbstfeuer' (autumn fire); however, it proved lacking in vigor and is now generally unavailable. Zone 4.





OPPOSITE A vast sweep of *Miscanthus* 'Purpurascens' catches the morning light in early October at the Chicago Botanic Garden. TOP Inflorescences of *Miscanthus* 'Purpurascens' are characteristically narrow and upright. ABOVE *Miscanthus* 'Purpurascens' lives up to its common name, autumn flame

Miscanthus, in late September at Lauritzen Gardens in Omaha, Nebraska.

RIGHT TOP *Miscanthus sacchariflorus* in late August at Longwood Gardens in Pennsylvania. BOTTOM *Miscanthus sacchariflorus* 'Gotemba' in mid September in Pennsylvania.

Miscanthus sacchariflorus (Maximowicz) Bentham

Silver banner grass, Amur silver grass, ogi
Common to wet places in lowlands of Japan, also Manchuria, Korea, and northern China. Distinguished primarily by its stout rhizomes and strongly running habit. Blooms relatively early in summer, typically by August, growing to 8 feet (2.4 m) tall in flower. Narrower and more upright than those of *Miscanthus sinensis*, the inflorescences are held well above the foliage, opening silver and becoming fluffy white upon drying, and remaining attractive through most of winter. Leaves up to 1¼ inches (32 mm) wide, with pronounced white midrib. The lower foliage often turns brown during summer dry periods. The running habit can be useful for colonizing large sites such as parking lot berms or banks of ponds but can be extremely difficult to control in smaller gardens. Self-sows. Zone 4.

'Gotemba'. Leaves mostly variegated yellow and yellow-



green, with darker green longitudinal stripes. Introduced in Japan by Kenji Watanabe's Gotemba nursery. Barry Yinger established the name in Western horticulture to recognize its origin. Though it spreads vigorously by rhizomes, it has never flowered in more than a decade of cultivation in Pennsylvania.

'**Robustus**'. An early, superfluous cultivar name for an already robust species.

Miscanthus sinensis Andersson

[*Eulalia japonica* Trinius]

Miscanthus, eulalia, Japanese silver grass, susuki

The classic garden miscanthus, native to slopes in the lowlands and mountains of Japan, from Hokkaido south through Yaku Island and the Ryukyus to Taiwan, also the southern Kuriles, Korea, and China. Clump-forming. Leaves typically deep green with white midribs. The typical form of the species is actually uncommon in cultivation, usually supplanted by cultivated varieties. Generally blooms late in the season, from August into October, or not at all in cooler climates. Inflorescences are heavily branched, full, and dense, with numerous racemes usually opening red or pink-suffused and drying to silver-white. In temperate climates the foliage turns pleasing shades of yellow and amber in autumn. Stoutier plants, more common near seashores, have been distinguished botanically as *Miscanthus sinensis* var. *condensatus* and are treated under a separate entry following this species.

In gardens, *Miscanthus sinensis* is represented by a myriad of cultivated varieties differing significantly in size, height, texture, summer and autumn foliage color, flowering times and colors, and cold hardiness. The following are among the best or most widely available. All prefer full sun unless otherwise noted. Heights given are flowering heights for mature specimens under best conditions; many grow much smaller in colder or drier conditions. Fall color is golden yellow unless noted. All are hardy to Zone 6 unless otherwise noted.

'**Adagio**'. A compact selection by Kurt Bluemel, similar to 'Yaku Jima', but superior for its consistent production of inflorescences that extend beyond the tops of the foliage. Leaves green, very narrow, turning yellow in autumn. Grows to 5 feet (1.5 m) tall when blooming in August. Inflorescences open with red tints. A fine-textured choice for smaller landscapes.

'**Aethiopian**'. A small, slow-growing selection with strong burgundy-red foliage tints in autumn. An Ernst Pagels selection.

'**Altweibersommer**' (Indian summer). Blooms in late summer or early autumn, with inflorescences to 7 feet (2.1 m) tall. An Ernst Pagels selection.

'**Andante**'. Blooms from mid to late summer with especially large inflorescences held well above the foliage, reaching to 7 feet (2.1 m) high, and opening pink-suffused but quickly turning translucent silver. Leaves narrow, green. A distinctly attractive Kurt Bluemel selection.

'**Arabesque**'. Compact, to 5 feet (1.5 m) tall when flowering in mid summer. A Kurt Bluemel selection.

'**Autumn Light**'. Tall growing, to 8 feet (2.4 m) when flowering in late summer. More cold hardy than typical. Zone 4.

'**Blondo**'. Medium-coarse textured, to 6 feet (1.8 m) tall. More cold hardy than typical. Zone 4.

'**Blütenwunder**' (blooming wonder). An early bloomer, reliably flowering in northern regions. To 7 feet (2.1 m).

'**Bronceturm**' (bronze tower). Leaves broad, overall texture very coarse. Tall growing, to 9 feet (2.7 m). Flowers open copper-bronze in mid summer, not elevated much above the foliage. An Ernst Pagels selection. Propagate by division.

'**Dixieland**'. Leaves with white longitudinal stripes. Much more compact than 'Variegatus', growing 4 to 5 feet (1.2–1.5 m) tall.

'**Ernst Pagels**'. Very upright and lower growing than typical. Named by Karl Partsch in honor of Ernst Pagels.

'**Ferne Osten**' (far east). One of the most distinct Ernst Pagels selections, with flowers opening deep red in mid to late summer. Slightly wider leaves than 'Gracillimus'.

'**Flamingo**'. Narrowly upright with loosely open inflorescences opening pink-tinted in late summer, to 6 feet (1.8 m) tall. An Ernst Pagels selection.

'**Gold Bar**'. This distinctive, patented selection by Joy Creek Nursery of Scappoose, Oregon, is compact, growing only 4 to 5 feet (1.2–1.5 m) tall, and has the most conspicuous zebra-striped foliage of any cultivar introduced to date. Originated in the mid-1990s as a seedling in the nursery.

'**Goldfeder**' (gold feather). Still one of the most beautiful of the longitudinally variegated miscanthus, with leaves striped golden yellow. Hans Simon of Germany named this cultivar in the late 1950s from a sport on his well-known selection 'Silberfeder'. It is similar to 'Silberfeder' in being somewhat open growing, with mid-summer inflorescences held well above the foliage, to 7 feet (2.1 m) tall. In warm climates the variegation darkens to light yellow-green by late summer.

'**Gracillimus**'. Maiden grass. One of the oldest and perhaps the best known of all the miscanthus cultivars, valued for its fine-textured foliage and gracefully rounded overall form. It is among the last to bloom, with copper-red inflorescences opening in late September or October, or not at all in



TOP LEFT *Miscanthus sinensis* 'Adagio' in early October at Kurt Bluemel Nurseries in Maryland. CENTER *Miscanthus sinensis* 'Bronceturm' flowers open red-

tinted in late August at Ernst Pagels's nursery in northern Germany. RIGHT A young plant of *Miscanthus sinensis* 'Flamingo' blooms in mid August in Germany.

BOTTOM LEFT *Miscanthus sinensis* 'Ferne Osten' opens deep red in mid August at Knoll Gardens near Wimborne, England. RIGHT *Miscanthus si-*

ensis 'Ferne Osten' begins turning silver in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England.



regions with a short growing season. To 7 feet (2.1 m) tall. Garden reference books from a century ago often refer to 'Gracillimus' as *Eulalia japonica* var. *gracillima* or *E. gracillima* var. *univittata*, which are horticultural names that predate the modern system of cultivar names. Seedlings of 'Gracillimus' are often indistinguishable from the parent, and this cultivar has been propagated both by seed and division over the decades. It is not a clonal cultivar. Plants purchased as 'Gracillimus' should have narrow leaves, rounded form, and late-season reddish flowers, but they may not all be identical. Young plants stand up well, but old specimens tend to become floppy, especially when grown in shade or in soil that is too moist or high in fertility. Though many earlier-blooming, green narrow-leaved alternatives to 'Gracillimus' are available, not all possess the graceful rounded form. Zone 5.

'Graziella'. Blooms in August or early September, the inflorescences held high above the foliage, and quickly turning silvery and very fluffy when dry. To 7 feet (2.1 m) tall. Slightly more upright in form than 'Gracillimus'. The narrow foliage often turns rich copper-red and orange in autumn. An especially refined selection by Ernst Pagels. Propagate by division. Zone 5.

'Grosse Fontäne' (large fountain). Blooms mid summer, with large plumose inflorescences to 8 feet (2.4 m) tall. An Ernst Pagels selection. Zone 5.

'Helga Reich'. Similar in texture to 'Gracillimus' but slightly narrower in form, blooming earlier with flowers quickly becoming silvery translucent.

'Hinjo'. Similar to 'Zebrinus', with zebra-striped variegation, but smaller in all respects, to 6 feet (1.8 m) tall. Sturdy and upright, not prone to lodging as is 'Zebrinus'. Often sold with the name Little Nicky™.

'Huron Sunrise'. A very cold hardy selection by Canadian Martin Quinn. Red-tinted inflorescences in late summer. Plant patent applied for (PPAF). Zone 4.

OPPOSITE TOP LEFT *Miscanthus sinensis* 'Gold Bar'. Photo courtesy Joy Creek Nursery.

RIGHT *Miscanthus sinensis* 'Goldfeder' in late August at the Westpark in Munich, Germany.

OPPOSITE BOTTOM LEFT Detail of *Miscanthus sinensis* 'Goldfeder' foliage in late August.

RIGHT The rounded form and fine texture of *Miscanthus sinensis* 'Gracillimus' make an elegant

backdrop for a flower border at Wave Hill in New York in mid July.

TOP RIGHT *Miscanthus sinensis* 'Graziella' turns deep copper-red in early November at Kurt Bluemel Nurseries in Maryland.

BOTTOM *Miscanthus sinensis* 'Helga Reich' at Olbrich Botanical Gardens in Madison, Wisconsin, in late October.



'Juli' (July). Upright and coarse-textured, with broad leaves spaced far apart on the stems. An Ernst Pagels selection.

'Kaskade' (cascade). The flowering best of Ernst Pagels's selections have exceptionally plumose inflorescences, and this is one of those. Blooms relatively early, typically by August.

'Kleine Fontäne' (little fountain). A fine-textured compact selection by Ernst Pagels that still manages to put on a good flowering display. To 5 feet (1.5 m) tall.

'Kleine Silberspinne' (little silver spider). A fine-textured upright-growing compact selection by Ernst Pagels.

'Little Kitten'. Dwarf maiden grass. This really does look like 'Gracillimus' in miniature. Even mature plants barely reach 4 feet (1.2 m) height in flower. Much smaller than 'Adagio' or 'Yaku Jima' and ideal for small spaces. A selection of Japanese origin. Zone 5.

'Little Zebra'. Dwarf zebra grass. This is currently the most compact of the zebra-striped cultivars, growing barely 4 feet (1.2 m) tall in bloom. A patented selection by Thomas Walsh of Michigan.

'Malepartus'. Another of Ernst Pagels's distinctive selections, resembling 'Gracillimus' but blooming a month earlier with plumose inflorescences that quickly turn from red to silver. Often has red or orange autumn color. Zone 5.

'Morning Light'. Among the most refined, elegant of all miscanthus. Very much like 'Gracillimus', with neatly rounded form, but with leaf margins cleanly and uniformly white-variegated. Known to cultivation in Japan for a century or more and introduced to Western gardens in 1976 by the U.S. National Arboretum from plants obtained from Japanese variegated plant specialist Masato Yokoi. The name 'Morning Light' was applied by Kurt Bluemel. Not inclined to be floppy like 'Gracillimus' and stands up even in light shade. Zone 5.

'Nippon'. Compact and narrowly upright to 5 feet (1.5 m) tall, blooming in mid summer. Sometimes with orange-red autumn color. An Ernst Pagels selection. Zone 5.

'November Sunset'. Narrow-leaved and late blooming, to 8 feet (2.4 m) tall with flowers opening red-tinted. A Kurt Bluemel selection. Zone 5.

'Positano'. Fine-textured and narrowly graceful, often with pronounced orange-red autumn color. Blooms in late summer, to 6 feet (1.8 m) tall. An Ernst Pagels selection. Zone 5.

'Pünktchen' (little dot). Upright, with distinctly spiky foliage texture. The leaves are zebra-striped but not as conspicuously as 'Gold Bar' or others. An Ernst Pagels selection.



TOP *Miscanthus sinensis* 'Kaskade' in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England.

BOTTOM *Miscanthus sinensis* 'Kleine Fontäne' in late August in a public park planting by Hans Simon in Marktheidenfeld, Germany.

OPPOSITE TOP LEFT *Miscanthus sinensis* 'Little Kitten' with red-leaved *Itea virginica* 'Henry's Garnet' in northern Delaware in mid October. RIGHT *Miscanthus sinensis* 'Little Zebra' in late October at Hoffman Nursery in Rougemont, North Carolina.



BOTTOM LEFT *Miscanthus sinensis* 'Malepartus' opens red in mid August at Knoll Gardens near Wimborne, England.

CENTER *Miscanthus sinensis* 'Malepartus' in a groundcover of

goldenrod *Solidago rugosa* 'Fireworks' at the Chicago Botanic Garden in Illinois in early October. RIGHT *Miscanthus sinensis* 'Morning Light' has narrow leaves with white margins.



TOP LEFT *Miscanthus sinensis* 'Morning Light' is appreciably brighter than other greens in Beth Chatto's garden in Colchester, England, in late July and

provides a contrasting backdrop for *Penstemon* 'Dazzler'. RIGHT The characteristic form and graceful line of *Miscanthus*

sinensis 'Morning Light' are set off in this elegant composition at Wave Hill in New York in mid September.

BOTTOM LEFT Gently luminous, *Miscanthus sinensis* 'Morning Light' frames a walkway at the Bellevue Botanic Garden in Washington State in mid August.

'Rigoletto'. Similar to 'Variegatus', with leaves longitudinally white-striped, but much more compact, typically less than 5 feet (1.5 m) tall. A Kurt Bluemel selection. Zone 5.

'Roland'. Coarse-textured, with relatively broad leaves. Blooms in mid summer, to 8 feet (2.4 m) tall. An Ernst Pagels selection.

'Roterpfel' (red arrow). Inflorescences open with red tints. Often has good red color in autumn. An Ernst Pagels selection.

'Sarabande'. Similar to 'Gracillimus'. Inflorescences open with gold tints in late summer. Very cold hardy. Zone 4.

'Seahorses'. An unusual selection from Mesker Nursery in the Netherlands with deep red-pink inflorescences that are coiled in the upper portion, very much resembling the form of a seahorse. Zone 5.

'Silberfeder' (silver feather). Inflorescences held unusually high above the foliage, opening with very little red color and quickly becoming silvery and featherlike. Grows to 7 feet (2.1 m) tall and is somewhat lax-stemmed. Selected in the early 1950s in Germany by Hans Simon. Free-flowering and very cold hardy. Zone 4.



OPPOSITE BOTTOM RIGHT *Miscanthus sinensis* 'Pünktchen' and *Verbena bonariensis* in enclosed garden space mulched with gravel and blue glass at Merriments Gardens in East Sussex, England, in late July.

ABOVE *Miscanthus sinensis* 'Rigoletto' in late August in England.



TOP RIGHT *Miscanthus sinensis* 'Roland' (background) and *M. oligostachyus* (foreground) are dramatically different in texture and scale in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England. RIGHT *Miscanthus sinensis* 'Silberfeder' is sidelit by the late-September sun at Wave Hill in New York.



'**Silberpfeil**' (silver arrow). Almost impossible to distinguish from 'Variegatus' and often confused with it in commerce.

'**Silberspinne**' (silver spider). Fine-textured and upright. Flowers opening silver with red-pink tints in mid summer, on inflorescences to 6 feet (1.8 m) tall. A graceful Ernst Pagels introduction.

'**Silberturm**' (silver tower). Tall-growing, to 9 feet (2.7 m), with inflorescences towering above the foliage. An Ernst Pagels selection.

'**Strictus**' ('*Zebrinus Strictus*'). Porcupine grass. Similar to 'Zebrinus' but reliably more upright. The foliage is also more erect, resulting in a spiky effect and increasing the visibility of the variegation. Zone 5.

'**Undine**'. Similar to 'Graziella' but slightly taller. An Ernst Pagels selection. Zone 5.

'**Variegatus**'. Leaves longitudinally white-striped. An antique cultivar which is still one of the whitest in overall appearance. Blooms in late summer, to 7 feet (2.1 m) tall, with inflorescences strongly red-tinted. Zone 5.

'**Wetterfahne**' (weathervane). The relatively short, broad leaves are held almost horizontally, looking something like a weathervane. Blooms in mid summer, to 8 feet (2.4 m) tall, with inflorescences tinted red-pink at first. An Ernst Pagels selection.



LEFT *Miscanthus sinensis* 'Silberspinne' begins to bloom in late August at the Royal Botanic Gardens, Kew, in England.

TOP *Miscanthus sinensis* 'Silberturm' flowers are 9 feet (2.7 m)

tall in mid October at Kurt Bluemel Nurseries in Maryland. ABOVE *Miscanthus sinensis* 'Undine' inflorescences are drying and luminous in mid October at Kurt Bluemel Nurseries in Maryland.



TOP LEFT A mature specimen of *Miscanthus sinensis* 'Variegatus' in Beth Chatto's garden in Colchester, England, in late July. BOTTOM *Miscanthus sinensis* 'Strictus' is naturally sidelit by late-August sun in southern Germany.

TOP RIGHT A young plant of *Miscanthus sinensis* 'Variegatus' at Great Dixter in Northiam, England, in mid July. BOTTOM *Miscanthus sinensis* 'Wetterfahne' in late August at Ernst Pagels's nursery in northern Germany.



LEFT Magnificently mature specimens of *Miscanthus sinensis* 'Yaku Jima' in mid October at Kurt Bluemel Nurseries in Maryland.

ABOVE *Miscanthus sinensis* 'Zebrinus' foliage is more relaxed than that of 'Strictus'.

'Yaku Jima'. Not really a clonal cultivar, but something of a catchall name for compact, narrow-leaved plants that look like 'Gracillimus' except for their smaller size. Such forms are common on the Japanese island of Yaku (also known as Yaku Jima). Seeds from this island were originally introduced to the United States by the U.S. National Arboretum.

'Zebrinus'. Zebra grass. Leaves with irregularly spaced horizontal bands of yellow variegation commonly referred to as zebra-striped. This antique cultivar is inclined to lax growth and flopping, and the variegation is not as closely spaced or conspicuous as some of the more recent selections such as 'Gold Bar'. Grows to 8 feet (2.4 m) tall, with copper-red-tinted flowers in late summer. Zone 5.

'Zwergelefant' (dwarf elephant). Compact, with leaves relatively broad and overall texture somewhat coarse. Grows to 6 feet (1.8 m) when flowering in mid to late summer. An Ernst Pagels selection.

Miscanthus sinensis* var. *condensatus (Hackel) Makino
[*Miscanthus condensatus* Hackel]

Hachijo susuki

Taller, more robust, and with wider leaves than typical *Miscanthus sinensis*, this botanical variety most frequently occurs in coastal areas in Japan, including Hachijo island off Honshu, but is also found at higher elevations in Japan as

well as in Korea, China, Indochina, and the Pacific islands. It has been recognized as a separate species by some taxonomists. Plants representing this botanical variety are sometimes labeled 'Condensatus', implying cultivar status, but this is incorrect. Blooms in late summer, opening red-copper tinted. Foliage often produces an extra flush of growth late in autumn, and remains green longer in winter than the typical variety. Zone 5.

'Cabaret'. Arguably the boldest of all the variegated miscanthus, with leaves 1¼ inches (32 mm) wide, cream white in the center with uniformly dark green margins. Requires a long hot season to flower, but is worth growing for foliage alone. Blooms in very late summer or early autumn, with flowers opening copper-pink to 9 feet (2.7 m) tall. The flowering stems are typically suffused deep pink during cool days of late summer and fall. Discovered by Kokin Watanabe of Japan and introduced to the United States in 1976 by the U.S. National Arboretum from plants obtained from Masato Yokoi. The name 'Cabaret' was applied by Kurt Bluemel. Rarely if ever produces viable seed. Tolerant of light shade.

'Cosmo Revert'. This name is often used to refer to solid green reversions of 'Cosmopolitan', which occur with some frequency.

'Cosmopolitan'. Very much like 'Cabaret' except the pattern of variegation is reversed: the leaf centers are mostly



TOP LEFT *Miscanthus sinensis* var. *condensatus* in late August in native habitat in coastal Honshu, Japan. BOTTOM A young plant of *Miscanthus sinensis* var. *condensatus* 'Cabaret' at the Delaware Center for Horticulture in Wilmington in early September, next to a recycled baluster from an historic Wilmington bridge.



TOP RIGHT *Miscanthus sinensis* var. *condensatus* 'Cabaret' in late June at Seaside Gardens in Carpinteria, California. CENTER *Miscanthus sinensis* var. *condensatus* 'Cabaret' leaves are white in the center with green margins. BOTTOM *Miscanthus sinensis* var. *condensatus* 'Cosmopolitan' leaves are mostly green in the center with white margins.



TOP LEFT *Miscanthus sinensis* var. *condensatus* 'Cosmopolitan' is more than 8 feet (2.4 m) tall in mid September in Maryland. RIGHT A young plant of *Miscanthus sinensis* var. *condensatus* 'Cosmopolitan' is set against dark beech foliage in late August in Germany.

BOTTOM LEFT These stalks of *Miscanthus tinctorius* have been harvested to make dye. They are from plants grown from seed collected in the mountains in Miyama-cho, Japan. RIGHT *Miscanthus transmorrissonensis* in mid October at Kurt Bluemel Nurseries in Maryland.

green and the margins are variegated creamy white. Often has secondary stripes. Blooms more freely and slightly earlier than 'Cabaret', with flowers opening copper-red in late summer, reaching a height of up to 10 feet (3 m). Originally found in Japan in the 1940s by Toyochi Aoki of Tokyo. The U.S. National Arboretum obtained plants from Masato Yokoi and introduced material to the United States in 1976. The name 'Cosmopolitan' was applied by Kurt Bluemel.

Miscanthus tinctorius (Steudel) Hackel

Kari yasu

Uncommon in cultivation outside Japan, this species is native to mountains on Japan's central island, Honshu, where it was traditionally highly valued as a thatching reed. The specific epithet *tinctorius* means of dyes, and this plant can be used in the making of chrome-yellow dye. The species closely resembles *Miscanthus oligostachyus* but is narrower and more upright in form, growing to 4 feet (1.2 m) in height. Inflorescences are narrow, less branched, and much less plumose than *M. sinensis*. Leaves are typically sold green and up to ½ inch (13 mm) wide. The name 'Nanus Variegatus' has been used to refer to more than one compact Japanese selection with longitudinally variegated leaves. Some plants offered under this name may actually be *M. oligostachyus*. Zone 6.

Miscanthus transmorrisonensis Hayata

Evergreen miscanthus, Taiwanese miscanthus

Introduced to Western horticulture in 1979 from Taiwan by Paul Meyer of the Morris Arboretum and C. Ferris Miller of Chollipo Arboretum, who collected seed of plants growing at 9500 feet (2900 m) elevation on Mount Daxue. This species is frequent on exposed mountain slopes at medium to high altitudes throughout the island of Taiwan. It is closely related to *Miscanthus sinensis* but horticulturally quite distinct, with narrow green foliage rarely topping 3 feet (90 cm) and late July or early August flowers held high above the foliage on long graceful stems. The foliage often stays green into late December as far north as Zone 6, and is fully evergreen in England, northern Europe, and Southern California if provided sufficient moisture. Propagate by seed or division. Zone 6.

Molinia Shrank

Grass family, *Poaceae*

Purple moor grass, moor grass

The genus name commemorates Juan Ignacio Molina (1740–1829), who studied the natural history of Chile. Comprises two to five species native to wet, open habitats, typically heaths and moorlands, in temperate Eurasia. All are perennial, cool-season growers and are strictly clump-forming.

The only commonly cultivated species, *Molinia caerulea*, is usually separated into two subspecies, which differ most obviously in their size. The typical subspecies, *M. caerulea* subsp. *caerulea*, is referred to simply as moor grass or purple moor grass and is represented by plants that grow 2 to 4 feet (60–120 cm) tall when flowering. Tall purple moor grass, *M. caerulea* subsp. *arundinacea*, is represented by plants that grow up to 8 feet (2.4 m) tall. In the past, various taxonomic botanists classified the taller plants as a separate species rather than a subspecies, using the names *M. arundinacea*, *M. litoralis*, and *M. altissima*. These names are now all considered synonyms of *M. caerulea* subsp. *arundinacea* but are still sometimes encountered in older books and in commerce.

One variegated purple moor grass is prized for its foliage. The others are essentially green plants valued for their strong architectural forms and airy inflorescences. The purple moor grasses have long been prized by European gardeners for their line, form, and luminous qualities, but they are still underappreciated in North America, with the exception of the variegated form. As gardeners and landscape designers continue to develop an eye for the sculptural beauty of green grasses, the *Molinia* species and cultivars are certain to become more widely used.

Very cold hardy, they grow best in cool-temperate climates with regularly available moisture and cool summer nights; however, they are a broadly adaptable group and offer satisfying performance and long life in a wide range of conditions. Cultivated varieties of both subspecies have been selected primarily for variations in flowering form. Some are nearly vertical in stance, and others have inflorescences bending so strongly that some stems are nearly horizontal. Though green during the growing season, all acquire vivid autumn tones of amber and gold before going fully dormant in winter.

Molinia caerulea (Linnaeus) Moench

Purple moor grass

Native to moist, sunny, open habitats including moors, bogs, fens, mountain grasslands, and lakeshores in temperate Eurasia. Clump-forming, producing a low mound of basal foliage with leaves to ⅜ inch (9 mm) wide. The foliage and flowering stems are green during the growing season but turn bright golden yellow in autumn. Flowering is relatively late among cool-season grasses, typically occurring in mid summer, with narrow panicles held well above the foliage on slender stalks which may be upright or arching. Overall height varies with seedlings and cultivars from 2 to 4 feet (60–120 cm). Plants bloom most fully in climates with cooler summer night temperatures. The flower spikelets are typically green-purple, due mostly to the color of the exposed anthers; however, the flowers of some plants are amber-gold. Best in full sun with

regular moisture but will grow well in light shade, especially in sunnier regions. Tolerant of a range of acidic or alkaline conditions. Propagate by seed, or by division in spring. Zone 4.

'Dauerstrahl' (enduring ray). Green-leaved and upright-divergent, 2½ to 4 feet (75–120 cm) tall in flower.

'Edith Dudszus'. Green-leaved and upright-divergent, 2½ to 4 feet (75–120 cm) tall in flower.

'Heidebraut' (heather bride). Green-leaved and narrowly upright-divergent, 2½ to 4 feet (75–120 cm) tall in flower.

'Moorflamme' (moor flame). Green-leaved and upright-divergent, 2½ to 3½ feet (75–105 cm).

'Moorhexe' (moor witch). Green-leaved and narrowly upright, 2½ to 4 feet (75–120 cm) tall in flower.

'Rotschopf' (red tuft). Upright-divergent, 2½ to 4 feet (75–120 cm) tall in flower, with green foliage increasingly suffused dark red later in the growing season.

'Strahlenquelle' (source of rays). Green-leaved and widely arching, 2 to 3 feet (60–90 cm) tall in flower.

'Variegata'. Arching and rounded in form, with leaves vividly yellow and cream-white striped, 2 to 2½ feet (60–75 cm) tall in flower. Zone 5.





OPPOSITE TOP *Molinia caerulea* 'Dauerstrahl' in late August at the Berggarten in Hanover, Germany. BOTTOM LEFT *Molinia caerulea* 'Edith Dudszus' in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England. CENTER *Molinia caerulea* 'Heidebraut' in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England. BOTTOM RIGHT *Molinia caerulea* 'Moorhexe' in northern Germany in late August.

ABOVE LEFT *Molinia caerulea* 'Strahlenquelle' in late August at the Sichtungsgarten in Weihenstephan, Germany. RIGHT *Molinia caerulea* 'Variegata' in mid July at the Royal Horticultural Society's garden, Wisley, in Surrey, England.

LEFT *Molinia caerulea* 'Variegata' in northern Germany in late August.

Molinia caerulea* subsp. *arundinacea (Schrank) H. Paul
[*Molinia arundinacea* Schrank, *M. litoralis* Host, *M. altissima*
Link]

Tall purple moor grass

Native to moist, sunny, open habitats in temperate Eurasia including moors, bogs, fens, mountain grasslands, and river margins. Differs from the typical subspecies primarily in size, usually producing mounded basal foliage 2 to 3 feet (60–90 cm) high topped by inflorescences held high above the foliage, to 8 feet (2.4 m) tall. Leaves are up to ½ inch (12 mm) wide and green or slightly gray-green during the growing season. The entire plant turns rich golden yellow in autumn.

Few grasses rival the stately drama of tall purple moor grass, which combines strong sculptural form with graceful response to summer breezes. Many of the named cultivars are similar to one another; however, the extremes are quite distinct. They vary in the relative stance of the flowering stems, which may be nearly vertical or strongly arching. Some bloom very heavily, producing dense masses of flowering stalks, and others have fewer stalks that result in a “see-through” quality. All are most effective when sidelit or backlit by the sun, especially when positioned against a contrasting background. Though ultimately large, this grass requires two or three seasons to reach mature size. It is worth the wait, since all purple moor grasses are long-lived and highly durable.

Prefers sun and regular moisture but is adapted to a wide range of soil types. Grows best in climates with cooler night

temperatures. Excessive summer heat and humidity encourage disfiguring foliar rust diseases. The flowering stems usually remain upright and attractive through autumn, then begin to disintegrate, at which time plants may be cut back. All cultivars are green-leaved. Zone 4.

‘**Bergfreund**’ (mountain friend). Upright-arching and somewhat open, to 5 feet (1.5 m) tall in flower. A Karl Partsch selection.

‘**Karl Foerster**’. Perhaps the oldest cultivar still available and still among the best, honoring German nurseryman and grass pioneer Karl Foerster. Mostly upright and slightly arching, to 7 feet (2.1 m) tall in flower.

‘**Skyracer**’. A distinct Kurt Bluemel selection, narrowly upright and up to 7 feet (2.1 m) tall.

‘**Stäfa**’. Mostly upright, fine-textured, to 5 feet (1.5 m) tall in flower. Named for the Swiss city.

‘**Transparent**’. Arching and fine-textured, with a transparent quality resulting from slender inflorescences and their positioning high above the foliage on unbranched stems. To 6 feet (1.8 m) tall in flower. A Karl Partsch selection.

‘**Windspiel**’ (wind’s game). Mostly upright, to 7 feet (2.1 m) tall in flower, with supple flowering stalks that are especially responsive to the wind.

‘**Zuneigung**’ (affection, inclination). Broadly arching, to 6 feet (1.8 m) tall in flower, with equal spread. A distinct selection by Karl Partsch. The flowering stems become heavily laden with seeds, and the tips become quite pendulous.



LEFT *Molinia caerulea* subsp. *arundinacea* ‘Bergfreund’ in late August in a community park planting by Hans Simon in Marktheidenfeld, Germany.

OPPOSITE TOP LEFT *Molinia caerulea* subsp. *arundinacea* ‘Karl Foerster’ is exquisitely sidelit by early September sun at the U.S. National Arboretum in Washington, D.C. BOTTOM *Molinia caerulea* subsp. *arundinacea* ‘Transparent’ in mid August in a planting by Hans Simon in Germany.

OPPOSITE TOP RIGHT *Molinia caerulea* subsp. *arundinacea* ‘Skyracer’ turns gold in early November in southeastern Pennsylvania. BOTTOM *Molinia caerulea* subsp. *arundinacea* ‘Skyracer’ fades from gold to amber but is still colorfully sculptural in mid November at Chanticleer in Wayne, Pennsylvania.





TOP *Molinia caerulea* subsp. *arundinacea* 'Windspiel' in late August at the Sichtungsgarten in Weihenstephan, Germany.



BOTTOM *Molinia caerulea* subsp. *arundinacea* 'Zuneigung' in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England.

Muhlenbergia Schreber

Grass family, *Poaceae*

Muhly

Named for botanist G. H. E. Muhlenberg (1753–1815), a specialist in grasses, this genus includes approximately 155 mostly perennial species native to open, frequently arid or semiarid habitats in the Western Hemisphere. The majority occur in the southern United States and Mexico, where they are often important range grasses.

Muhly grasses were uncommon in gardens until recently, but are quickly gaining in popularity for their beauty and utility. Many of them have attractive, fine-textured basal foliage in shades of green to glaucous blue, topped by airy inflorescences, some of which are strongly colored pink, purple-red, or purple-gray. Most are extremely drought tolerant and are ideal choices for water-conserving designs in hot, dry regions. Although the selection and commercial availability are much greater than they were a decade ago, the diversity of *Muhlenbergia* species holds even greater promise for the future. A few of the species are wide-ranging, and provenance will likely prove an important factor in selecting plants with greater cold hardiness for garden use.

All are warm-season growers and most are effectively clump-forming. They are of easy culture in full sun on a range of soils. In cooler regions, well-drained soil is essential to good health and winter hardiness.

Muhlenbergia capillaris (Lamarck) Trinius

[*Muhlenbergia capillaris* var. *filipes* (M. A. Curtis) Chapman ex Beal, *M. filipes* M. A. Curtis]

Pink muhly, pink hair grass, Gulf muhly, purple muhly
This spectacularly pink-flowered species is native in the West Indies, eastern Mexico, and much of the southeastern United States from Texas to Florida and north to Kansas, Indiana, and Massachusetts, though it is increasingly uncommon in the northern parts of its range. It grows in a variety of habitats and soil types, from rocky or clay soils to sandy soils and from open woodlands and savannahs to wet, sandy pine woods and bogs in coastal areas. Plants of southeastern coastal habitats have in the past been segregated as a botanical variety, *Muhlenbergia capillaris* var. *filipes*, or even as a species, *M. filipes*; however, there is no clear delineation and the modern consensus is that all belong to one wide-ranging, somewhat variable species: *M. capillaris*.

This is the most ornamental of the muhly grasses, producing a neat mound of rich green glossy basal foliage overtopped by masses of delicately branched flower panicles in late summer or early autumn that look like pink clouds. Clump-forming, to 3 feet (90 cm) tall when blooming. Best



in full sun but tolerant of very light shade in hotter regions. Extremely drought tolerant. Propagate by seed, or by division in spring. Winter hardiness varies with plants of different provenance. The hardiest are reliable in Zone 6.

'Lenca'. Deep pink flowers. Selected by Mountain States Nursery of Arizona and marketed with the name Regal Mist™.

'White Cloud'. A remarkably attractive white form of a grass known for its pink color. From Superior Trees in Florida.

Muhlenbergia dubia Fournier ex Hemsley

Pine muhly

Native to steep slopes, canyons, and rocky hills at elevations up to 7000 feet (2100 m) in western Texas, New Mexico, and northern Mexico. A densely tufted clump-former. Leaves



TOP An especially fine form of *Muhlenbergia capillaris* in mid October at Hoffman Nursery in Rougemont, North Carolina. ABOVE *Muhlenbergia capillaris* 'White Cloud' in mid October at Hoffman Nursery in North Carolina.

TOP RIGHT Pink-flowered *Muhlenbergia capillaris* and white-flowered *M. capillaris* 'White Cloud' in mid October at Hoffman Nursery in North Carolina. BOTTOM *Muhlenbergia dubia* in mid November at the Ladybird Johnson Wildflower Center in Austin, Texas.



light green, fine-textured. Blooms August to November, the inflorescences relatively narrow, 2 to 3 feet (60–90 cm) in height, opening purplish gray and fading quickly to light cream color. Drought-tolerant. Prefers full sun. Propagate by seed, or by division in spring. Zone 7.

Muhlenbergia dubioides C. O. Goodding

Southwestern muhly, weeping muhly
Native to canyons and rocky slopes in southern Arizona. Clump-forming, with basal foliage in a draping mound. Inflorescences narrow, purplish-gray, erect, to 3 feet (90 cm) tall. Drought-tolerant. Prefers full sun. Zone 7.

Muhlenbergia dumosa Scribner ex Vasey

Bamboo muhly
Native to rocky canyon slopes and valleys at low and middle elevations from Arizona into southern Mexico. Unlike most muhly grasses, this billowy species has erect or arching stems to 4 feet (1.2 m) that are finely branched and have narrow leaves that lack broad blades. The overall texture is exceptionally fine and quite bamboolike, with a strong resemblance to some *Chusquea* species. The stems are supple and move gracefully with the slightest breeze. Increases slowly by creeping rhizomes. The flower panicles are numerous but are very short and visually insignificant.

Drought-tolerant, but not as much as the true desert species. Looks best with occasional moisture. An ideal textural complement to cacti and other bold-textured succulents. In regions where it is not cold hardy, it can be grown in a pot outdoors in summer and overwintered in a cold frame or greenhouse. Prefers full sun but tolerates partial shade. Propagate by seed or division. Zone 8.



LEFT Set out for seasonal display, large potted specimens of *Muhlenbergia dumosa* enliven a courtyard in mid September at Chanticleer in Wayne, Pennsylvania.

TOP *Muhlenbergia dumosa* in mid December at the University of California Botanical Garden, Berkeley. ABOVE *Muhlenbergia dumosa* is the perfect textural foil for a pot-grown *Agave* at Peckerwood Gardens in Texas in mid November.

Muhlenbergia emersleyi Vasey

Bullgrass

Native to rocky slopes, woods, canyons, and ravines in Arizona, New Mexico, and Texas. Clumping, with medium-textured gray-green foliage in a dense basal mound. Blooms in late summer or early autumn with mostly upright flowering stalks to 3 feet (90 cm) tall. The inflorescences are red-purple or gray-purple and dense, not airy like pink muhly, *Muhlenbergia capillaris*. Very drought tolerant. Best in full sun or very light shade. Propagate by seed or division. Zone 7.

'Lenem'. Red-purple flowers. Selected by Mountain States Nursery of Arizona and marketed with the name El Toro™.

Muhlenbergia involuta Swallen

Edwards Plateau muhly

Native to rocky prairies and uplands, usually near small streams, only on the Edwards Plateau of Texas. Clump-forming, with green basal foliage. Blooms in late summer or early autumn. Inflorescences are loose and airy, much like *Muhlenbergia capillaris*, to 4 feet (1.2 m) tall. Propagate by seed or division. Zone 7.

Muhlenbergia lindheimeri Hitchcock

Lindheimer's muhly

The common and botanical names commemorate Jacob Ferdinand Lindheimer (1801–1879), who devoted many years to

the study of the Texas flora. Native on sandy and rocky, often calcareous soils in open habitats in Mexico and Texas. A uniquely handsome clump-former with fine-textured, semi-evergreen blue-gray basal foliage and upright inflorescences to 5 feet (1.5 m) tall. The form, both in foliage and when blooming, is reminiscent of *Calamagrostis × acutiflora*. Tolerant of drought and summer heat. Blooms in late summer or early autumn, the light purplish-gray inflorescences fading to tan and lasting mostly through winter. Prefers full sun but tolerates very light shade in warmer climates. Propagate by seed or division. If provided with well-drained soil and protected from waterlogged winter conditions, it is hardy to Zone 6.

'Lenli'. A selection by Mountain States Nursery of Arizona marketed with the name Autumn Glow™.



ABOVE *Muhlenbergia involuta* in mid November at the Ladybird Johnson Wildflower Center in Austin, Texas.



TOP RIGHT *Muhlenbergia lindheimeri* basal foliage in mid July in the author's Pennsylvania garden. BOTTOM *Muhlenbergia lindheimeri* blooming in mid October in the author's Pennsylvania garden.



Muhlenbergia pubescens (Humboldt, Bonpland & Kunth) Hitchcock

Soft muhly, blue muhly, Mexican muhly

Native to open, arid habitats in Mexico's Sonoran Desert region, this distinct species forms a mound of soft blue-gray to gray-green foliage 12 to 18 inches (30–45 cm) high, which is overtopped in late summer by pale purple inflorescences to 4 feet (1.2 m) in height. The foliage is mostly evergreen and the clumps maintain an attractive appearance without being cut back annually. Prefers full sun and well-drained soil. Very drought tolerant. Not tolerant of excessive moisture. An uncommonly grown species that truly deserves more attention in water-conserving designs for warm climates. Zone 8.

Muhlenbergia racemosa (Michaux) Britton, Sterns & Poggenberg

Marsh muhly

Native to moist prairies, seasonally wet meadows, stream-banks, and other generally moist, sunny, open habitats from Manitoba to Alberta, and from Michigan and Indiana to Washington and south to Oklahoma and Arizona. Unlike so many muhly grasses from arid regions, this species likes moisture. It is a good choice for naturalizing in moist meadows. Leaves green. Blooms at the beginning of summer, 3 to

4 feet (90–120 cm) tall in flower. Propagate by seed, or by division in spring. Zone 4.

Muhlenbergia reverchonii Vasey & Scribner

Seep muhly

Native to limestone soils and seep areas in Texas and Oklahoma. Clump-forming, with green, densely tufted basal foliage. Inflorescences in late summer or early autumn to 30 inches (75 cm) tall, open and airy, resembling *Muhlenbergia capillaris* in form and texture. Propagate by seed or division. Zone 6.

Muhlenbergia rigens (Bentham) Hitchcock

Deergrass

Native to a wide variety of habitats including gravelly or sandy washes, moist sandy slopes, and open forests at low to middle elevations in Arizona, New Mexico, Nevada, Texas, California and south into Mexico. Clump-forming, with semievergreen gray-green leaves forming a large basal mound. Narrow whiplike inflorescences to 5 feet (1.5 m) are produced in late summer, soon drying to light straw color and remaining upright and attractive long through winter. This durable, long-lived, easy-to-grow grass is a real work-horse for arid gardens and other managed landscapes. Large



enough to use in defining spaces, it is also a dramatic vertical presence, singly or in small groups, especially when illuminated by the sun. Very drought tolerant. Prefers full sun. Propagate by seed. Division of established plants is difficult. Zone 7.

Muhlenbergia rigida (Kunth) Trinius

Purple muhly, upland bunchgrass

Native to sunny, rocky slopes in Texas, Arizona, and northern Mexico, and also in South America. Clump-forming, with green basal foliage topped by upright-arching feathery inflorescences to 3 feet (90 cm) tall in late summer or early autumn, opening brownish purple to dark purple and fading to tan. Adaptable and easy to grow on a wide range of soil types. Drought-tolerant. Dormant in winter. A lower-growing alternative to deergrass, *Muhlenbergia rigens*. Zone 7.



OPPOSITE TOP LEFT *Muhlenbergia pubescens* in early December at Quail Botanical Gardens in Encinitas, California. BOTTOM *Muhlenbergia racemosa* begins blooming in mid June in a Minnesota prairie.

OPPOSITE RIGHT *Muhlenbergia rigens* in early April in the Valentine garden, designed by Isabelle Greene, in Santa Barbara, California.

BELOW *Muhlenbergia rigens* grows in a sandy wash in native habitat outside Ojai, California, in early July.

ABOVE *Muhlenbergia rigida* is dormant but still attractive in mid February at High Country Gardens in Santa Fe, New Mexico.



'Lenri'. A strongly purple-flowered selection made by Mountain States Nursery of Arizona, marketed with the name Nashville™.

Nassella E. Desvaux

Grass family, *Poaceae*

Needle grass

Comprises approximately 80 species native to open, sunny habitats in North and primarily South America, with the greatest number in Argentina, Bolivia, and Chile. Many of the species were formerly included in the genus *Stipa*. All are fine-textured, graceful plants often with long, showy awns. Many are prolific seeders with the capacity to naturalize beyond their range, and the introduction of South American species into other warm, arid regions including the southwestern United States and Australia should be undertaken with proper caution. All are cool-season growers, typically blooming in spring following winter rains and going partly or fully dormant in summer. The three California native species, *Nassella cernua*, *N. lepida*, and *N. pulchra*, are among the most beautiful and are superb choices for water-conserving gardens there.

Nassella cernua (Stebbins & Á. Löve) Barkworth

[*Stipa cernua* Stebbins & Á. Löve]

Nodding needle grass

Native to sandy, dry slopes in open grasslands, coastal scrub, chaparral, and juniper woodlands in California. Clump-forming and tufted. A true cool-season grower, dormant in

summer. Inflorescences in late winter to early spring, delicate and open, to 3 feet (90 cm), with awns to 4½ inches (11 cm) long, purplish at first, drying silvery, usually nodding. Prefers full sun, best on well-drained soil but is broadly tolerant. Ideal for naturalizing in meadows and meadow gardens, but needs open ground for seeds to establish. Self-sows. Propagate by seed or division. Zone 8.

Nassella lepida (Hitchcock) Barkworth

[*Stipa lepida* Hitchcock]

Foothill needle grass

Native to dry slopes in oak grasslands, chaparral, and coastal scrub in California. Clump-forming and tufted. Similar in appearance to *Nassella cernua*, but with overall finer texture, and the flowers are less characteristically nodding. A true cool-season grower. Dormant in summer. Blooms in late winter or early spring. Inflorescences delicate and open, with awns to 2 inches (5 cm) long. Prefers full sun. Best on well-drained soil but broadly tolerant. Ideal for naturalizing in meadows and meadow gardens, but needs open ground for seeds to establish. Self-sows but not invasive. Propagate by seed. Zone 8.

Nassella neesiana (Trinius & Ruprecht) Barkworth

[*Stipa neesiana* Trinius & Ruprecht]

Chilean needle grass

Native to dry, sunny habitats in Argentina, Bolivia, Brazil, Chile, Ecuador, and Uruguay. Upright and clump-forming, 2 to 3 feet (60–90 cm) tall in flower. Supple stems move readily





OPPOSITE *Nassella cernua* in mid June at the Santa Barbara Botanic Garden in California.

ABOVE *Nassella neesiana* moves to breezes in Ximena Nazal's garden in Panquehue, Chile, in

December (early summer), with *Crocsmia*, *Kniphofia*, *Tulbaghia*, and *Achillea*. Photo by Jaime Peñaloza. LEFT *Nassella neesiana* in mid July at the Royal Botanic Gardens, Kew, in England.

with the wind. A graceful presence in South American landscapes and gardens, but a significant weed species in southern Australia. A prolific self-seeder. Propagate by seed or division. Zone 8.

Nassella pulchra (Hitchcock) Barkworth

[*Stipa pulchra* Hitchcock]

Purple needle grass

Designated in 2004 as the official state grass of California, this delicately beautiful species was once widespread and emblematic of California's grasslands before the wholesale introduction of exotic grass species and the destruction of much of its original habitat. It is native to dry grasslands, chaparral, and coastal scrub only in California. Blooms in late winter or early spring, with inflorescences to 3 feet (90 cm) tall on erect stalks. The spikelets have graceful awns to 4 inches (10



TOP LEFT *Nassella pulchra* begins blooming in late February along with California poppies at the Santa Barbara Botanic Garden in California. BOTTOM In full bloom in early April, *Nassella pulchra* responds to spring

breezes at the Santa Barbara Botanic Garden.

ABOVE *Nassella pulchra* detail explains the name "purple needle grass."

cm) long, purplish at first but quickly becoming translucent and silvery. Truly eye-catching when sidelit or backlit by the sun. A pronounced cool-season grower, dormant in summer, resuming growth in fall and continuing through winter. Of easy culture in full sun. Prefers well-drained soil but is adaptable. Ideal for naturalizing in meadows and meadow gardens, but requires open ground for seeds to establish. Propagate by seed or division. Self-sows. Zone 8.

Nassella tenuissima (Trinius) Barkworth

[*Stipa tenuissima* Trinius]

Mexican feather-grass

Native to dry, open ground, open woods, and rocky slopes in Texas, New Mexico, Mexico, and Argentina. Among the finest textured of all grasses, producing a dense green fountain of hairlike leaves and threadlike stems ending in silvery inflorescences with slender awns to 3 inches (80 cm) long. Blooms in spring in warm climates and in early summer in cool-temperate climates. To 2 feet (60 cm) tall, the inflores-



cences becoming light straw-colored and remaining attractive into winter. A cool-season grower that is green over winter in mild climates but goes dormant during summer's heat. Delicate and extraordinarily responsive to breezes. Prefers full sun but will grow in very light shade. Very drought tolerant. Not tolerant of waterlogged soils. When this grass is grown in cool-temperate regions, well-drained soil is essential to winter cold hardiness. Makes a fine container specimen, set out for the growing season in regions where it is not winter hardy. Self-sows readily but usually is easily managed. Zone 7.

Nassella trichotoma (Nees) Hackel ex Arechavaleta

[*Stipa trichotoma* Nees]

Serrated tussock grass

This South American species is similar to *Nassella tenuissima* in form, producing a low mound of basal foliage. It is becoming popular in British gardens, where it is well behaved, but is listed as a noxious weed in parts of the United States and

TOP LEFT Overwintering foliage of *Nassella tenuissima* offers fine-textured contrast with *Narcissus* 'Hawera' blooming in mid April in the author's Pennsylvania garden. RIGHT *Nassella tenuissima* blooms in late June in the author's Pennsylvania garden

with *Achillea* 'Anthea' and the spearlake leaves of *Gladiolus*.

ABOVE *Nassella tenuissima* with *Eryngium* 'Silver Ghost' in late July in Beth Chatto's unirrigated gravel garden in Colchester, England.



Nassella trichotoma grows in a gravel-mulched bed at the Royal Horticultural Society's garden, Wisley, in Surrey, England, in mid July.

in Australia. Self-sows readily. Propagate by seed or division. Zone 8.

Nassella viridula (Trinius) Barkworth

[*Stipa viridula* Trinius]

Green needle grass

Native to plains and dry slopes in North America, from Alberta and Saskatchewan to Wisconsin and Illinois west to Montana and Arizona. It is sometimes found near railways and other disturbed ground beyond its native range. An upright, clump-forming, cool-season grower, to 3½ feet (105 cm) tall when blooming in early summer. Inflorescences are terminal, somewhat feathery, opening green and quickly drying to silver and tan. The awns are relatively short, but numerous and luminous. This Great Plains grass deserves more attention in gardens and conserved landscapes. Of easy culture in full sun on average to dry soil. Propagate by seed, or by division in spring or fall. Zone 3.

Panicum Linnaeus

Grass family, *Poaceae*

Panic grass

Comprises approximately 400 annual and perennial species native primarily to the tropics but extending into temperate regions including North America, occurring in a wide range of habitats from deserts and savannahs to swamps, bogs, and open woodlands. The inflorescences are panicles, typically terminal, and often finely branched. Long popular in continental Europe, particularly Germany, the North American species *Panicum virgatum* has become increasingly popular in recent years as a design alternative to miscanthus and because of a new wealth of distinct cultivated varieties. Other perennial North American species deserve further attention. All are warm-season growers, slow to begin growth in spring but very heat tolerant, blooming late in the year and generally remaining attractive through winter.

Panicum amarum Elliott

Coastal switchgrass, bitter switchgrass, bitter panic grass Unlike common switchgrass, *Panicum virgatum*, which is found in a multitude of habitats, this species naturally occurs only on sandy soils along the North American coast from Connecticut south to Florida and Texas and west to north-eastern Mexico. The inflorescences are much narrower and more dense than those of *P. virgatum* and typically arch outward above the foliage, creating a fountainlike effect. This species also increases more rapidly by rhizomes, although it is easily maintained as a clump in the garden. Leaves typically ½ inch (12 mm) wide, often glaucous and gray-green or gray-blue. Mature plants grow 3 to 5 feet (90–150 cm) tall in flower, depending upon available moisture. Blooms mid to late summer. Long valued for its stabilizing role in coastal dune ecosystems, this heat-tolerant and drought-tolerant species has great potential for gardens in semiarid regions. It will grow in a wide range of soils from pure sand to clay and is fairly salt tolerant. Excessive fertility and moisture will cause lax growth. Prefers full sun. Readily propagated by seed, or by division in spring or fall. Zone 5.

'Dewey Blue'. Leaves exceptionally glaucous and gray-blue, to 5 feet (1.5 m) in flower. Selected and named by the author in cooperation with Dale Hendricks of North Creek Nurseries, from plants grown from seed of a naturally occurring population along the southern Delaware coast near the town of Dewey. Zone 5.



TOP LEFT The typical green-leaved form of *Panicum amarum* grows with seaside goldenrod, *Solidago sempervirens*, in sand along the central New Jersey coast in early October.

TOP RIGHT *Panicum amarum* 'Dewey Blue' grows full and lush in rich loamy soil in the author's Pennsylvania garden and begins to bloom in mid July.

LEFT *Panicum amarum* 'Dewey Blue' (center) grows strictly upright on this unirrigated sandy site in southern Delaware, flanked by *Panicum virgatum* 'Northwind' with *Aster oblongifolius* (in the foreground). The planting is part of the Enhancing Delaware Highways program.



Panicum rigidulum Bosc ex Nees

Redtop panic grass

Native to a wide variety of wet or moist habitats including river, pond, and lake edges, marshes, swamps, and wet open woodlands, from Maine to Michigan and south to Florida and Texas. Grows 2½ to 4 feet (75–120 cm) tall when blooming in mid summer. Inflorescence a terminal panicle, opening with a strong red color and gradually fading to tan. The foliage is deep green and relatively coarse in texture and overall appearance. A natural companion to other moisture-loving species such as *Asclepias incarnata*, *Cephalanthus occidentalis*, *Hibiscus moscheutos*, *Ilex verticillata*, *Lobelia cardinalis*, and *Verbena hastata*, and often encountered growing with these in native habitats. Will grow in a wide range of soils, in average to moist conditions. Tolerates dry periods but will not thrive on normally dry sites. Readily propagated by seed, or by division in spring or fall. Zone 4.

ABOVE *Panicum rigidulum* blooms with marsh mallow, *Hibiscus moscheutos*, in moist, sunny habitat in Queen Anne's County, Maryland, in late July.

ABOVE RIGHT *Panicum rigidulum* growing on unirrigated loam in the author's Pennsylvania garden in late July.



Panicum virgatum Linnaeus

Grass family, *Poaceae*

Switchgrass, panic grass

Native to prairies and open ground, open woods, and brackish marshes from Nova Scotia and Quebec to Manitoba and Montana south to Arizona, Mexico, and into the West Indies. A major component of the once-vast American tallgrass prairie, this large, handsome species was for decades appreciated in European gardens and ignored at home. It is increasingly recognized for its beauty, durability, and easy culture, for designed gardens and managed regional landscapes. An increasing array of distinct and useful cultivated varieties is available, and more are certain to be introduced as this variable species is more closely observed.

Grows from 4 to 8 feet (1.2–2.4 m) tall in flower. Although always forming recognizable clumps, it may also run by rhizomes, sometimes slowly, sometimes with moderate speed. It may be erect-stemmed and narrow, or lax and billowing in form. Summer foliage color ranges from typical deep green to bright powder-blue, and autumn tones vary from typical golden yellow to deep burgundy. Like many North American prairie grasses, switchgrass is a long-lived, warm-season grower. It begins growth late in spring, grows strongly in the

heat of summer, and flowers in July or August. The profuse, airy panicles are often pink or red-tinted when first opening. All parts of the plant are quite sturdy even when dry and dormant, standing through winter unless snows are exceptionally heavy, and providing important cover for spring-nesting birds.

Switchgrass remains upright much longer than the other tallgrass species *Andropogon virginicus* and *Sorghastrum nutans*. Versatile in the garden, effective as a specimen, in sweeps or masses, for screening, at the edges of pools or ponds, or in a large decorative container. Of easy culture in full sun on almost any soil from quartz sands to fertile heavy clays. Requires little maintenance except cutting back annually in late winter or spring. Drought-tolerant once established and yet withstands soggy soils or periodic inundation. Also somewhat salt-tolerant. Self-sowing is usually minimal but can be prolific on open, moist soil; this can be valuable for naturalizing, but can be a problem when attempting to maintain uniform sweeps of clonal cultivars, since seedlings often differ noticeably from parents. Some varieties, such as 'Heavy

BELOW *Panicum virgatum* growth from the previous season continues to stand erect in mid May, providing cover for birds and still-attractive color and textural contrast with blooming golden club, *Orontium aquati-*

cum, in the New Jersey Pine Barrens. RIGHT *Panicum virgatum* 'Cloud Nine' in mid September in the trial gardens at North Creek Nurseries in Landenberg, Pennsylvania.

Metal', are prone to foliar rust diseases in hot, moist summers. Drought tolerance varies and is usually better among glaucous-leaved forms with thicker leaves. Propagate the species by seed, or by division in spring, the cultivars by division only. Zone 4.

'Amber Wave'. This is one of a few unusual introductions by Gary and Sandy Trucks of Amber Waves Gardens in Michigan. It has glaucous-blue foliage that turns increasingly red-purple toward the growing season. Slow-growing but long-lived, typically less than 4 feet (1.2 m) tall in flower.

'Blue Tower'. Leaves glaucous blue, to 8 feet (2.4 m) tall in flower. Selected by Greg Speichert of Crystal Palace Perennials from a population growing naturally in Princeton, Illinois.

'Cheyenne Sky'. Blue-green foliage turns deep red-purple from late summer through autumn. Inflorescences with strong purple tint. A distinct selection by Gary and Sandy Trucks of Amber Waves Gardens in Michigan.

'Cloud Nine'. Produces a literal cloud of fine-textured inflorescences, opening green and appearing gold when sunlit. Grows to 7 feet (2.1 m) tall in flower. Leaves are just slightly glaucous and blue-green. The entire plant turns dark golden yellow in autumn and stands up well through winter. Moderately drought tolerant. A selection by Bluemount Nursery of Maryland.

'Dallas Blues'. One of the best and most distinct varieties, with broad, steel-blue to gray-green foliage and huge





TOP LEFT A fine-textured wall of *Panicum virgatum* 'Cloud Nine' creates a graceful separation between the garden and a parking area in the Barton garden in Landenberg, Pennsylvania. BOTTOM *Panicum virgatum* 'Dallas Blues' is a commanding presence long before it flowers, as evident in this June view in the author's Pennsylvania garden.

TOP RIGHT Inflorescences of *Panicum virgatum* 'Dallas Blues' are lavender-purple and the flowering stems typically lax in late August in the author's Pennsylvania garden. CENTER AND BOTTOM *Panicum virgatum* 'Dallas Blues' flower color gradually shifts from lavender to purple-red at the end of summer. CENTER *Panicum virgatum* 'Dallas Blues' in mid September. BOTTOM *Panicum virgatum* 'Dallas Blues' in mid October.





purplish flower panicles. Selected and patented by Ken and Linda Smith of Change of Scenery nursery in Ohio, from a seedling discovered in a Dallas, Texas, garden. Big and bold-textured, reaching 6 feet (1.8 m) height with equal or greater spread, and glaucous leaves $\frac{3}{4}$ to $1\frac{1}{2}$ inches (2–4 cm) wide. Blooms in mid summer, the flowers opening with mauve tones that change to deep red-purple before eventually drying to light amber. The sturdy stems and inflorescences stand up well into winter. Prefers full sun. Very drought tolerant. Zone 4.

'Hänse Herms'. Foliage is green in summer, becoming increasingly red-suffused in late summer and autumn. Relatively short-growing, typically 4 feet (1.2 m) tall in flower. Upright in form, with slender stems that bend gracefully during rains and usually pick themselves up when dry. Easily knocked down by heavy snows. Average drought tolerance. Very similar to 'Rehbraun' and 'Rotstrahlbusch' and the three are sometimes confused in commerce. None are as strongly red-colored as the more recent introduction, 'Shenandoah'.

'Heavy Metal'. Still one of the most upright-growing of the blue-leaved varieties, this selection by Kurt Bluemel never leans or lodges. Foliage is strongly glaucous and gray-blue, topped by inflorescences opening with a noticeable pink tint in August, typically less than 5 feet (1.5 m) tall. Susceptible to foliar rust diseases in hot, humid climates. Better than average drought tolerance.

'Heiliger Hain' (sacred grove). Leaves glaucous blue, with deep wine-colored suffusion especially toward the end of the growing season. Upright, to 4 feet (1.2 m) tall in flower, with inflorescences opening pink-beige.



TOP LEFT Still standing in late January, *Panicum virgatum* 'Dallas Blues' holds cups of snow in the author's Pennsylvania garden. It does this every year when snows are wet and heavy. RIGHT *Panicum virgatum* 'Hänse Herms' in late Novem-

ber with *Itea virginica* 'Henry's Garnet' in Wilmington, Delaware. ABOVE *Panicum virgatum* 'Hänse Herms' displayed in a large container at Longwood Gardens in mid October, with threadleaf bluestar, *Amsonia hubrichtii* (at right).

'Northwind'. An absolute workhorse of a grass, standing upright like few others through all weather and seasons. Relatively broad, blue-green leaves have an especially waxy cuticle, contributing to this cultivar's superior drought tolerance. Narrowly upright, to 6 feet tall when blooming in August. The inflorescences are much narrower and less diffuse than 'Cloud Nine'. Selected by Roy Diblik of Northwind Perennial Farm in Wisconsin, from a seedling that appeared in the nursery in the early 1980s. Virtually immune to foliar rusts. Takes on rich gold tones in autumn.

'Prairie Fire'. Foliage begins green, turns deep red-purple from late summer through autumn. An unusual selection by Gary and Sandy Trucks of Amber Waves Gardens in Michigan.

'Prairie Sky'. Roger Gettig of Wisconsin found this exceptionally glaucous-blue plant growing along a railroad right-of-way. It is much lighter and bluer than 'Heavy Metal', but

not quite so strictly upright. It stands up well in drier colder regions, but can be lax and floppy when grown on rich soils in warm climates. Relatively rust-resistant. Grows no more than 5 feet (1.5 m) tall when flowering in August.

'Prairie Wind'. A truly distinct new selection with huge, finely branched, cascading inflorescences that are spectacular when sunlit. Leaves are green and glossy, not at all glaucous. Grows 6 to 8 feet (1.8–2.4 m) tall. Selected by Bluebird Nursery of Clarkson, Nebraska.

'Red Cloud'. Green foliage is topped by strongly red tinted inflorescences to 5 feet (1.5 m) tall.

'Rehbraun' (russet). Leaves green in summer, increasingly suffused dark red as autumn approaches. Upright, to 4 feet (1.2 m) tall.

'Rotstrahlbusch' (red ray bush). This antique cultivar was in Karl Foerster's catalog a half century ago. It is upright with green leaves that are increasingly red-tinted toward the end



of the growing season and into autumn. The color is never as intense as the more recent introduction, 'Shenandoah'.

'Shenandoah'. The red autumn foliage is currently the most intense and reliable of all readily available switchgrasses. Selected by Hans Simon of Germany from his evaluations of more than 500 seedlings of 'Hänse Herms'. Leaves green in early summer, taking on dark red tones by July, and turning wholly wine-colored by September. Slower-growing than average, to 4 feet (1.2 m) tall in flower. Upright in stance and usually remaining so through winter.

'Squaw'. A green-leaved selection by Kurt Bluemel with inflorescences strongly pink-suffused. Shorter than 'Warrior', to 5 feet (1.5 m) tall in flower.

'Strictum'. This older, somewhat glaucous selection has mostly been superseded by newer, bluer cultivars, but is still a viable choice if there's a need for a mostly upright, gray-green switchgrass 5 to 6 feet (1.5–1.8 m) tall.



OPPOSITE TOP LEFT *Panicum virgatum* 'Heavy Metal' in mid July in Newark, Delaware. CENTER AND RIGHT *Panicum virgatum* 'Northwind' in the author's Pennsylvania garden. CENTER *Panicum virgatum* 'Northwind' at the beginning of August. RIGHT *Panicum virgatum* 'Northwind' at the beginning of November.

OPPOSITE BOTTOM LEFT *Panicum virgatum* 'Northwind' blooms in mass in early October

near water's edge at the Chicago Botanic Garden in Illinois. RIGHT Cascading, fountain-like inflorescences of *Panicum virgatum* 'Prairie Wind' are lit by the mid-September sun in the author's Pennsylvania garden.

ABOVE *Panicum virgatum* 'Shenandoah' is backlit by the late afternoon sun in mid October in the author's Pennsylvania garden.

'Warrior'. A green-leaved selection by Kurt Bluemel with inflorescences strongly pink-red in late summer and early autumn. Taller than 'Squaw', to 6 feet (1.8 m) in flower.

Pennisetum Richard ex Persoon

Grass family, *Poaceae*

Fountain grass

The genus name is derived from the Latin *penna*, feather, and *seta*, bristle, referring to the bristlelike inflorescences. Includes more than 80 mostly perennial species native to open and woodland habitats in the world's tropical and warm-temperate regions. The fountain grasses are aptly named. Most produce fountains of flowers flowing from neatly mounded basal foliage. All are warm-season growers, well adapted to hot summers and humid conditions. They typically flower from the beginning of summer into early autumn, and often remain intact and attractive long into winter in cool-temperate regions. Most are clump-formers, though a few spread rapidly by rhizomes. They range in size from less than 1 foot (30 cm) to more than 5 feet (1.5 m) in height. The majority prefer full sun but will often perform reasonably well in partial shade. Some, especially the hardy *Pennisetum alopecuroides*, are durable enough to be used as long-term groundcovers.

In addition to the hardy perennials, the genus includes species from tropical and subtropical regions that are often cultivated as annuals in cool-temperate gardens. These also make superb choices for container display.

Many species self-sow readily, and a few are considered noxious weeds in parts of the world. Recent research has determined that some of the purple fountain grasses previously known as *Pennisetum setaceum* are in fact hybrids between this species and *P. macrostachyum*, and are now correctly referred to by the newly published name *P. ×advena*.

Pennisetum ×advena Wipff & Veldkamp

[*Pennisetum setaceum* var. *rubrum* hort., *P. cupreum* Hitchcock ex L. H. Bailey]

Purple fountain grass

This newly published species includes the red-purple fountain grasses that have long been listed as *Pennisetum setaceum*. Grass taxonomist and plant breeder J. K. Wipff determined that these popular garden plants are actually hybrids between *P. macrostachyum* and *P. setaceum*, and was able to confirm this by controlled crosses of the two species. The origin of most material in cultivation is obscure. The hybrids are typically more like *P. setaceum* in general appearance, with relatively narrow leaves usually less than ¾ inch (2 cm) wide, but with the purplish stem, leaf, and flower color of *P. macrostachyum*. Upright and clump-forming, typically bloom-

ing from mid summer into autumn when grown in temperate regions. Plants are tender, requiring temperatures of 40°F (4°C) or above for survival. Fertile seed production is uncommon, and propagation is by division or by rooted stem cuttings. Best in full sun with adequate moisture, but fairly drought tolerant once established. Most often grown as a summer annual from plants held over in greenhouses or purchased annually. Zone 9.

'Eaton Canyon' ('Cupreum Compactum', 'Rubrum Dwarf'). A truly compact variety, rarely exceeding 30 inches (75 cm) in height when blooming. Similar to forms offered as 'Rubrum' but smaller in all parts. Originated as a seedling at Magic Growers nursery on Eaton Canyon Drive in Pasadena, California.

'Rubrum' ('Cupreum', 'Atropurpureum', 'Purpureum'). All parts of the plant are a rich red-burgundy color. Grows

upright to 5 feet (1.5 m) tall, with inflorescences sometimes more than 1 foot (30 cm) long. The name 'Rubrum' is best used to refer to the material long in cultivation that is typically propagated vegetatively. If additional hybrids occur or are deliberately made, resulting clonal varieties should be assigned new cultivar names.

Pennisetum alopecuroides (Linnaeus) Sprengel

[*Pennisetum japonicum* Trinius]

Fountain grass, chikara shiba

Native to sunny, open lowlands and grassy places in Japan and over much of southeastern Asia, this extremely variable species is the most commonly grown of the truly cold-hardy fountain grasses. Typically grows 2 to 3 feet (60–90 cm) tall in flower, but cultivated varieties range from under 1 foot (30 cm) to over 5 feet (1.5 m) in height. The foliage is



TOP LEFT *Pennisetum xadvena* 'Eaton Canyon' in mid August at Longwood Gardens in Pennsylvania. BOTTOM *Pennisetum xadvena* 'Rubrum' in late June, growing in the ground at Seaside Gardens in Carpinteria, California.

ABOVE *Pennisetum xadvena* 'Rubrum' displayed in a container in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England.

usually green in summer turning golden yellow in autumn. The leaves are narrow, up to ½ inch (12 mm) wide. Inflorescences are spikelike racemes, usually dense and cylindrical, resembling large foxtails; they are superb as cut material for fresh bouquets. Flower color varies from dark purple to cream-white, with flowering beginning as early as June or as late as September. Depending upon the cultivar, inflorescences remain attractive into late fall or early winter, then begin to shatter. The foliage often is presentable through winter. Easily grown in full sun or light shade on most soils. Best with regular moisture, but drought-tolerant once established. The species is propagated by seed, or by division in spring, the cultivars by division only. Self-sows, usually at a manageable level; however, some of the fall-blooming varieties such as ‘Moudry’ and ‘National Arboretum’ are particularly fertile and can be very weedy if conditions are suitably

moist. They often become established in irrigated cool-season turf. Zone 6, sometimes colder.

‘Cassian’. Flowers light cream-colored beginning in August, to 3 feet (90 cm) high in an arching mound, with foliage that reliably turns gold with rich red tints in autumn. A Kurt Bluemel selection named for German horticulturist Cassian Schmidt.

‘Caudatum’ (*Pennisetum caudatum* hort.). Flowers are nearly white beginning in August, 3 to 4 feet (90–120 cm) tall when blooming.

‘Hameln’. Compact, only 2 to 3 feet (60–90 cm) tall in flower, and deservedly popular for groundcover use. Flowers are light green to white. Fall foliage reliably turns deep golden amber.

‘Little Bunny’. A true miniature, less than 18 inches (45 cm) tall when blooming. Originated as a seedling of ‘Hameln’



TOP LEFT Photographed in late September, this planting of *Pennisetum alopecuroides* has been in place at Longwood Gardens for two decades, demonstrating the durable beauty of this common form of hardy fountain grass. BOTTOM Though the flowers have faded, the same planting of *Pennisetum alopecuroides* at Longwood Gardens is neat and attractive even on a dark, foggy day in February.

ABOVE *Pennisetum alopecuroides* (center) in a classic combination with *Sedum* ‘Autumn Joy’ (foreground) and *Rudbeckia* ‘Goldsturm’ (background) on a frosty late-October morning in southeastern Pennsylvania.



TOP LEFT Though plants are dormant and the flowers dry in mid November, *Pennisetum alopecuroides* is still a glowing presence in late afternoon at the Bard College campus in Annandale-on-Hudson in New York. BOTTOM *Pennisetum alopecuroides* 'Cassian' softens the edges of the pool in the Bluemel garden in Fallston, Maryland, in late September.

TOP RIGHT *Pennisetum alopecuroides* 'Hameln' in early August at Longwood Gardens in Pennsylvania. CENTER *Pennisetum alopecuroides* 'Little Bunny' in late August at Longwood Gardens in Pennsylvania. BOTTOM *Pennisetum alopecuroides* 'Moudry' in early October in the author's former Delaware garden.



found by Jack Weiskott of Ornamental Plantings Nursery on Long Island, New York.

'Little Honey'. Nearly identical to 'Little Bunny', of which it is a sport, but with leaves longitudinally white-striped. Typically 12 to 18 inches (30–45 cm) tall in flower. Found and named by Cliff Russell of Russell Nurseries in Pennsylvania.

'Moudry'. Distinctly different, with dark green, glossy, relatively wide leaves to $\frac{7}{16}$ inch (11 mm) across forming a neat mound of basal foliage to 2 feet (60 cm) high. The flowers are dark purple, extending above the foliage and arching only slightly on relatively stiff stalks. Blooms much later than typical for the species, generally at flowering peak in late September. Originated from seed introduced by the U.S. National Arboretum from Japan, where populations of wide-leaved, late-blooming, dark-purple-flowered plants are common. The cultivar name recognizes G. Moudry, who pioneered the use of grasses in urban Baltimore. This cultivar and other similar forms self-sow prolifically, especially in moist conditions, and can be weedy in gardens and adjacent cool-season turfgrass lawns.

'National Arboretum'. Essentially the same as 'Moudry', though the flowers more reliably extend outward from the basal foliage.

'Paul's Giant'. Unusually large but strictly clump-forming, growing to 5 feet (1.5 m) in height when blooming in August. Flowers cream-white to tan. The foliage routinely turns yellow-orange in autumn. Discovered as a seedling by Paul Skibinski of Delaware.

'Weserbergland' (Weser mountain country). Similar to 'Hameln' but slightly larger, typically 3 feet (90 cm) tall in flower.

'Woodside'. Mervyn Feeseey of Barnstaple, England, selected this seedling from his garden, Woodside, for its habit of blooming early and reliably. Relatively compact, 2 to 3 feet (60–90 cm) tall with cream-white flowers.

TOP The same plant of *Pennisetum alopecuroides* 'Moudry' laden with frosty dew two weeks later in late October. CENTER *Pennisetum alopecuroides* 'Paul's

Giant' at Longwood Gardens in early October. BOTTOM The same plant of *Pennisetum alopecuroides* 'Paul's Giant' in late October.

***Pennisetum* 'Fairy Tails'**

Originated as a seedling in Greenlee Nursery in Pomona, California, and is possibly a hybrid involving *Pennisetum incomptum*. Appears to be seed-sterile but warrants continued observation. Foliage is semievergreen, especially in mild climates, and blue-green to gray-green in color. Mostly clump-forming, 4 to 5 feet (1.2–1.5 m) tall when blooming. Flowering stems erect, flowers emerge light pink and fade to tan at maturity. Cold hardiness unknown, but likely at least to Zone 7.

Pennisetum glaucum (Linnaeus) R. Brown

Pearl millet

This Asian species is an annual, typically grown for grain, birdseed, and forage, but is included because the following hybrid is widely grown in otherwise perennial gardens.

'Purple Majesty'. A strikingly purple plant developed as an offshoot of agricultural breeding trials at the University of Nebraska in Lincoln by David Andrews and John Rajewski. Plants set out in spring will grow 4 to 5 feet (1.2–1.5 m) tall, flowering in summer. Prefers full sun and well-drained soil.

Pennisetum incomptum Nees ex Steudel

[*Pennisetum flaccidum* Grisebach]

Spreading fountain grass

This native of northern China and the Himalayas spreads vigorously by rhizomes to form large masses to 4 feet (1.2 m) tall in flower. Leaves are narrow, green to gray-green. Blooms in early summer often continuing through the growing season. Flowers greenish white, drying light tan, on nearly upright stems. The racemes are longer and much more slender than *Pennisetum alopecuroides*. Grows best in full sun but adapted to a wide range of soil and moisture conditions. Spreads too aggressively to be manageable in a mixed flower border, but is relatively early flowering, has good fall and winter presence, and can be an appropriate choice for difficult, contained sites such as traffic islands. The rhizomes are extremely persistent and can be difficult to eradicate once established. Zone 4.

Pennisetum macrourum Trinius

Fountain grass

Native to moist, sunny habitats in Africa, this species resembles *Pennisetum incomptum* in having long, narrowly cylindrical racemes and a spreading growth habit, but is much less cold hardy and is not as aggressively rhizomatous. Zone 7.

TOP *Pennisetum glaucum* 'Purple Majesty' at Rutgers Gardens in New Brunswick, New Jersey, in late July.

BOTTOM A concrete planter at Denver Botanic Gardens in Colorado is an ideal site for the running species *Pennisetum incomptum*. Photographed in late August.





Pennisetum macrostachyum (Brongniart) Trinius

Large purple fountain grass, kikuyu grass
Native to the South Pacific, specifically New Guinea, Borneo, and adjacent islands, this is the boldest textured of the fountain grasses, with burgundy stems and broad leaves to 1½ inches (4 cm) wide. Upright, clump-forming, to 6 feet (1.8 m). Inflorescences colored like the foliage, produced in summer. Perennial, but very tender, requiring temperatures above 40°F (4°C). Makes a superb summer annual in cooler regions when planted in the ground for the season or grown in a pot. Prefers full sun and regular moisture. Does not set seed when grown in temperate regions, but can easily be propagated by stem cuttings rooted in sand under mist. Zone 10.

‘Burgundy Giant’. A very burgundy-colored clonal cultivar named by the author, representing Longwood Gardens, in cooperation with Marie Selby Botanical Gardens in Florida, from material at Selby of unknown garden origin.



Pennisetum massaicum Stapf

This perennial species is native to open savannahs in Africa. Clump-forming, 2 to 3 feet (60–90 cm) tall in flower. The inflorescences are relatively short compared to most other *Pennisetum* species, and open with a strong red tint. Zone 8, possibly colder.

‘Red Buttons’. This cultivar is fairly typical of the species and is often marketed with the common name “red bunny tails.”

TOP *Pennisetum macrourum* in late August at the Royal Botanic Gardens, Kew. CENTER *Pennisetum macrostachyum* ‘Burgundy Giant’ in late August with *Verbena bonariensis* at the Denver Botanic Gardens in Colorado. BOTTOM *Pennisetum massaicum* ‘Red Buttons’ in early July at

Quail Botanical Gardens in Encinitas, California.

BELOW *Pennisetum massaicum* ‘Red Buttons’ in late August at the Royal Horticultural Society’s garden, Wisley, in Surrey, England.



***Pennisetum* 'Oceanside'**

Of unknown species, this giant grows more than 9 feet (2.7 m) tall in a single season. Originally discovered growing near Oceanside, California, by Richard Neufeld, it was named by John Greenlee. Foliage is green and coarse. Large terminal inflorescences are produced in late summer or early autumn. Zone 8. Ultimate hardiness is yet unproven.

Pennisetum orientale Richard

Oriental fountain grass

Native from central and southwestern Asia to northwestern India. Typically lower-growing, more compact, and less cold hardy than *Pennisetum alopecuroides*, with fluffy, nearly white inflorescences with strong pearlescent-pink tints. Blooms over an exceptionally long period, from early summer into autumn frost. Strictly clump-forming, with gray to gray-green fine-textured foliage. Requires well-drained soil and a warm, sunny site for optimum growth and flowering, but will perform well in light shade. This species has become much more popular in recent years with the introduction of distinct cultivars of greater size and varied flower color. The species is most easily propagated by seed, the cultivars by division only. Zone 6.

'**Karley Rose**'. This patented introduction by Sunny Border Nurseries was discovered by David Skwiot and named for his daughter, Karley. Truly distinct, it is taller than typical, growing 4 feet (1.2 m) high in flower, and has large, strongly pink colored flower racemes.

'**Tall Tails**'. The name is a pun, referring to the tall, tail-like inflorescences, and is unfortunately often listed incorrectly as 'Tall Tales'. Selected from seed brought to the United States from Pakistan by the U.S. Department of Agriculture for forage crop research, this distinct cultivar is significantly taller than typical, often reaching 6 feet (1.8 m) height in flower. Inflorescences are long and ivory-white, and often pendant. Vigorous and heat-tolerant. Self-sows somewhat. Zone 6.

TOP *Pennisetum orientale* in late June at Seaside Gardens in Carpinteria, California. CENTER *Pennisetum orientale* 'Karley Rose' in late August at the Royal

Horticultural Society's garden, Wisley, in Surrey, England. BOTTOM *Pennisetum orientale* 'Tall Tails' in late August at Wisley.





Pennisetum setaceum (Forskål) Chiovenda

[*Pennisetum ruppelii* Steudel, *P. ruppelianum* Hochstetter, *P. macrostachyum* Fresenius, non (Brongniart) Trinius]

Tender fountain grass

Native to tropical Africa, southwestern Asia, and Arabia, this old-fashioned garden favorite is actually perennial but is most often grown from seed as an annual due to its limited cold hardiness. Green-leaved and clump-forming. Grows erect to arching, to 5 feet (1.5 m) tall with purplish-pink racemes nearly 15 inches (38 cm) long produced from mid summer into early autumn. A superb cut flower. Taller and narrower than *Pennisetum alopecuroides*, this species sometimes requires staking in late summer, especially on moist, rich soils. Requires full sun. Self-sows in warm climates, and has escaped and naturalized in various parts of the world. In cold zones, propagate by seed sown indoors in late winter. New plants should not be set out until danger of frost is past. The tender red-purple fountain grasses formerly ascribed to this species are now understood to be hybrids representing *P. ×advena*. Zone 9.

Pennisetum villosum R. Brown ex Fresenius

Feathertop

Native to mountains in northeastern tropical Africa. Inflorescences are soft, feathery, and ivory to nearly pure white. The racemes are shorter, fuller, and more rounded than most fountain grasses. Prized by florists as a cut flower, this tender perennial species is often grown in cool-temperate gardens as an annual. It is more cold hardy than tender fountain grass,



TOP LEFT *Pennisetum orientale* cultivars 'Karley Rose' (foreground) and 'Tall Tails' (background) at Wisley in late August. RIGHT *Pennisetum setaceum* at Longwood Gardens in late August.

ABOVE *Pennisetum setaceum* at the Rudolph Schindler house in Los Angeles, California.



TOP *Pennisetum villosum* in late June at Seaside Gardens in Carpinteria, California.

BOTTOM *Pennisetum villosum* spills over a stone walkway at Sissinghurst in England in mid August.

Pennisetum setaceum, occasionally surviving winters in Zone 7. The fine stems usually bend under the weight of the flowers, and the entire plant sprawls attractively. Grows 2 to 2½ feet (60–75 cm) tall. Best in full sun with regular moisture. A superb container subject. Propagate by seed. Zone 8.

Phalaris Linnaeus

Grass family, *Poaceae*

Canary grass

Comprises approximately 20 annual and perennial species native to cool-temperate zones including North America and Eurasia, and also in Mediterranean regions and South America. Canary grass, *Phalaris canariensis* Linnaeus, an annual species native to the Canary Islands and southern Europe, is widely cultivated for birdseed and has naturalized in many parts of the world. It has short, wide flower panicles which are readily distinguished from the long, narrow panicles of reed canary grass, *P. arundinacea*, which is perennial. The species are known to hybridize, and some of the hybrids are aggressively weedy. Only the variegated forms of *P. arundinacea* are common in cultivation.

Phalaris arundinacea Linnaeus

Reed Canary grass

Native to moist, sunny habitats in North America and Eurasia, this cool-season perennial species is a good example of how behavior differs among plants of different provenance, even though they may belong to the same species. Plants of European origin (which may be referred to as European genotypes) were widely planted for forage and erosion control in North America, where they were found to be much more vigorous than the American genotype. The European material has since naturalized in marshes and other wetland ecosystems in northern North America, where it has proved capable of completely displacing native wetland and wet prairie species. It forms huge monocultures which spread by seed and by strong rhizomes. There is no easy method of distinguishing European types from North American types in the field, since they are nearly identical in appearance.

Frequent burning is one method of controlling *Phalaris arundinacea*. The draining and artificial lowering of water levels in wetlands has resulted in conditions favorable to *P. arundinacea*. Since reed canary grass is favored by moist but not constantly wet conditions, restoring water to higher levels is another possible means of control.

Typically green-leaved, reed canary grass grows upright to 5 feet (1.5 m) tall, flowering in early summer. The variegated cultivars, which are all derived from European genotypes, are less floriferous and less vigorous than the typical form, but are easily managed, distinctive grasses for gardens. True cool-season growers, they go partly or fully dormant in



mid summer in hot climates. If cut back in mid season, they will produce a strong new flush of leaves which will remain crisply attractive into early winter. Of easy culture on a wide range of soils. Best in sun or partial shade with regular moisture. Self-sowing is minor in the garden; however, all spread aggressively by rhizomes and require regular maintenance to keep contained. Tawny blotch disease, caused by *Stagonospora foliicola* fungi, sometimes causes the leaves to turn brown but can be treated with fungicides. All cultivars must be propagated by division in spring or fall. Zone 4.

'Feeseey' ('Strawberries and Cream'). This variety is the nearest to white, with leaves often mostly white with green stripes. The white is cooler than the warm white of the old standard 'Picta' and frequently is pink-suffused during cold periods in early spring and early autumn. Named for British horticulturist and grass specialist Mervyn Feeseey.

'Luteopicta' ('Aureovariegata'). Leaves striped cream-yellow, especially in spring. The variegation dims to dull green in the heat of summer, especially in full sun.

'Picta' ('Elegantissima', var. *picta*, f. *picta*, var. *variegata*). Ribbon grass, gardener's-garters. Leaves strongly striped



TOP LEFT *Phalaris arundinacea* in mid July, naturalized along a floodplain in southeastern Pennsylvania.

suffused pink in cool early May weather in Pennsylvania.

CENTER *Phalaris arundinacea* 'Feeseey' brightens a dark, rainy day at Holger Winenga's Garden Treasures Nursery on Long Island, New York. FAR LEFT *Phalaris arundinacea* 'Feeseey' is

BOTTOM CENTER *Phalaris arundinacea* 'Luteopicta' variegation is pronounced in mid April in Pennsylvania. BELOW *Phalaris arundinacea* 'Picta' with bright red-flowered nasturtiums at Merriments Gardens in East Sussex, England, in late July.



cream-white. This old favorite has been popular since the nineteenth century, often persisting in gardens through successions of owners.

‘Tricolor’. An old name for white-variegated forms that are sometimes pink-suffused during cool periods. Some are similar to or indistinguishable from ‘Feesey’.

‘Woods Dwarf’. Similar to ‘Picta’ but more compact.

Phragmites Adanson

Grass family, *Poaceae*

Reed, common reed

Prevailing taxonomic opinion now views *Phragmites* as monotypic, comprising a single species, *P. australis*, of cosmopolitan distribution. This highly variable perennial, warm-season grower occurs in wet or moist habitats on all continents except Antarctica. The genus name is derived from the Greek *phragma*, fence or screen, referring to the fencelike screening effect of dense stands of this large grass. At one time plants in the Northern Hemisphere were called *P. communis* and southern plants were called *P. australis*, but now all are included in the latter, earliest published name. The specific epithet *communis* referred to the extensive communities often formed by this vigorously rhizomatous species. The broad classification of the genus no longer recognizes *P. karka* as a separate species, but includes it in *P. australis*.

Phragmites australis (Cavanilles) Trinius ex Steudel

[*Phragmites communis* Trinius, *P. karka* (Retzius) Trinius ex Steudel]

Common reed, carrizo

Native to freshwater and brackish wetlands throughout the world, and especially common in temperate zones. Sturdy and upright, typically 10 to 13 feet (3–4 m) tall, with gray-green leaves to 2 inches (5 cm) wide. The large, terminal inflorescences are produced in late summer, opening gold to bronze in color, quickly drying to translucent silver. The canes (stems) have been historically used for thatching.

As discussed in chapter one of this book, this highly variable species is quite controversial, particularly in North America, due to the disruptive effects of exotic genotypes in wetland ecosystems. Early twentieth century herbarium specimens document the existence of North American genotypes in many areas such as the Hackensack Meadowlands of northern New Jersey, yet today these areas are largely or entirely occupied by European genotypes which are so well adapted to North American conditions that they create extensive monocultures.

Methods aimed at eradication are problematic. Cutting and disking usually result in encouraging the reed, since it can establish from rhizome sections. Repeated burning or

mowing can significantly reduce populations but is often impractical. Chemical herbicides are the most effective and can result in complete elimination of *Phragmites* in small sites. In large, dynamic systems, chemical control is limited in effectiveness and must be done regularly every two to five years, but the long-term effects of such deliberate application of toxins are unknown.

Phragmites is much less salt-tolerant than the North American cordgrasses, *Spartina* species (excluding *S. pectinata*), and restoring saline conditions to many coastal wetlands previously modified by human activity is a promising method of long-term, large-scale management of the reed. To its credit, in eastern North America *Phragmites* is breeding habitat for more than 70 species of birds, many of which also use the reed for shelter. *Phragmites* often serves as an important soil stabilizer, helping to control erosion, and it plays a role in enhancing water quality through nutrient cycling. In highly polluted areas, which make up a considerable portion of the habitats the grass now dominates, it is one of the few species that can truly thrive in such conditions. The typical form of common reed is rarely cultivated; however, two variegated selections are popular in gardens.

‘Candy Stripe’. Leaves variegated, white-striped. The entire plant is smaller than typical. Formerly included in *Phragmites karka*.

‘Variegatus’. Leaves variegated, bright yellow-striped. Less vigorous than typical plants with solid green leaves but still a vigorous spreader. It is popular in water gardens, and its size can be effectively controlled by limiting available root space through planting in a sturdy submerged container.

Phragmites australis subsp. altissimus (Bentham) W. D. Clayton

Differs from the typical subspecies primarily in height, which can reach 18 feet (5.5 m). Such tall-growing forms are often listed commercially and incorrectly as ‘Pseudodonax’.

OPPOSITE TOP LEFT The late-October sun sets over nearly monocultural stands of *Phragmites australis* in coastal Maryland, made up of European genotypes inadvertently introduced. BOTTOM The Empire State Building (at left) is visible in this February view of New Jersey’s Hackensack Meadowlands. *Phragmites australis* has been called the glue that holds

North Jersey together, and indeed anyone who has viewed the Hackensack Meadowlands from the New Jersey Turnpike or from a train window on the way to New York City can attest to the omnipresence of this grass. Cornell University research has confirmed that virtually 100 percent of *Phragmites* in the Meadowlands is comprised of the European genotype



ABOVE TOP *Phragmites australis* 'Variegatus' in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England.

ABOVE Detail of *Phragmites australis* 'Variegatus' in late August.



ABOVE Set against dark rocks at the Santa Barbara Botanic Garden in California, a spreading patch of *Pleuraphis jamesii* is illuminated by the June sun.

Pleuraphis Torrey

Grass family, *Poaceae*
Galleta

Comprises three perennial, warm-season species native to dry habitats in the western United States and northern Mexico. All are sometimes included in the genus *Hilaria*. Though none are common in cultivation, they are attractive, drought-tolerant grasses that deserve more attention in water-conserving landscapes and gardens.

Pleuraphis jamesii Torrey

[*Hilaria jamesii* (Torrey) Bentham]

Native in deserts, canyons, and dry plains from California to Texas and Wyoming. This fine-textured grass spreads by rhizomes to create a dense mass of upright stems 1 to 2 feet (30–60 cm) tall, with gray-green leaves topped by narrow, ivory-white inflorescences in early summer. It is long-lived and extremely drought tolerant, and is of easy culture in sun or light shade on a range of soil types. A warm-season grower

RIGHT *Pleuraphis jamesii* blooms at the end of June in the Santa Barbara Botanic Garden.



that goes fully dormant in winter. Propagate by seed or division. Zone 8.

Pleuraphis rigida Thurber

[*Hilaria rigida* (Thurber) Scribner]
Big galleta

Very similar to *Pleuraphis jamesii*, but larger, to 3 feet (90 cm) tall, more coarsely textured, and less upright in stance. Though much less rhizomatous, it is less neat in overall appearance and is better suited to larger, naturalistic designs or conserved landscapes. Prefers full sun. Very drought tolerant. Propagate by seed or division. Zone 8.

Poa Linnaeus

Grass family, *Poaceae*
Bluegrass, meadow grass

Includes approximately 500 annual and perennial grasses native mostly to cool-temperate regions throughout the world. Kentucky bluegrass (*Poa pratensis*) is perhaps the best-known species due to its widespread use in lawns. Ironically, it is not native to Kentucky or even to North America, but is of Eurasian and African origin. In addition to the turf types, the genus *Poa* includes a number of attractive, fine-textured tussock-forming species similar in appearance to their close relatives in the genus *Festuca*, often with attractive flowers or conspicuously glaucous-blue foliage. Most species are pro-

nounced cool-season growers, but many are more drought-tolerant than Kentucky bluegrass.

Poa arachnifera Torrey

Texas bluegrass

Native to Texas, Kansas, and Oklahoma. A rhizomatous spreader that can be used as a more water-conserving alternative to Kentucky bluegrass or grown as a tufted clump for its attractive blue-green foliage and feathery inflorescences. Typically 12 to 18 inches (30–45 cm) tall when blooming in early spring. Propagate by seed or division. Zone 6.



Poa chaixii Villars

Broad-leaved meadow grass, forest bluegrass
Native primarily to mountain habitats in central and southern Europe, but also naturalized in woodlands in the northern British Isles. Leaves bright green, up to 3/8 inch (9 mm) wide. Blooms spring or early summer, to 3 feet (90 cm) tall. Zone 5.

Poa cita Edgar

[*Poa caespitosa* Sprengel]

Silver tussock

Poa is the largest and most widespread grass genus in New Zealand, and silver tussock is perhaps the most graceful of the tussock-forming species. It is common and widespread on the North, South, and Stewart Islands, occurring in open habitats from coastal lowlands to subalpine grasslands. Forms a densely fine-textured mound of shining light brown to light green foliage, 2 to 3 feet (60–90 cm) in height. Slender inflorescences rise above the foliage in upright-arching stalks. The foliage color is distinct from the superficially similar red tussock, *Chionochloa rubra*, and this and the smaller

LEFT *Poa arachnifera* blooms in early April at the Ladybird Johnson Wildflower Center in Austin, Texas.

BELOW LEFT *Poa cita* grows on limestone and shale at the

Manaaki Whenua Landcare Research campus in Lincoln, near Christchurch on New Zealand's South Island, in late August (winter). BELOW *Poa cita* in late August (winter) at the Auckland Botanic Garden in New Zealand.



size make it an attractive addition or alternative to red tussock in gardens and other designed landscapes. Of easy culture in full sun on a wide range of soils. Very drought tolerant. Grows well on shale or limestone. Propagate by seed or division. Zone 8, possibly colder.

Poa colensoi Hooker f.

New Zealand bluegrass, blue tussock

This New Zealand endemic occurs in lowland and alpine habitats on the North and South Islands, and is widespread in tussock grasslands. The foliage is often quite glaucous and gray-blue to blue-green, and such forms are most often cultivated in gardens. Clump-forming, with fine-textured foliage forming a neat mound to 10 inches (25 cm) in height, overtopped by upright inflorescences in early spring. Propagate by seed or division. Zone 7.

Poa labillardieri Steudel

Australian bluegrass

Native to moist river flats and open areas in forests in Australia and naturalized in parts of New Zealand. Densely tufted and clump-forming, with fine-textured, glaucous-blue foliage. Begins blooming in late spring and continues into summer with available moisture. Grows 3 to 4 feet (90 to 120 cm) tall in flower. Zone 8, possibly colder.

RIGHT *Poa colensoi* at the Royal Botanic Garden, Edinburgh, in Scotland in late July.

BELOW *Poa labillardieri* in mid July at Beth Chatto's garden in

Colchester, England. BELOW RIGHT *Poa labillardieri* in mid September (early spring) at the Royal Botanic Gardens, Melbourne, in Australia.



Restio LinnaeusRestio family, *Restionaceae*

Restio

Comprises 90 or more mostly dioecious, rushlike species native to southern Africa, Australia, and Madagascar. Cool-season growers, most active in spring and autumn, but all are evergreen or semievergreen. In native habitat, new growth appears after winter rains. *Restio* species are related to *Elegia* and *Rhodocoma*, and are sometimes similar in appearance, with green stems finely branched at the nodes, especially on new growth. Mature growth is often unbranched. Restios are of relatively easy culture in sun on well-drained soils if provided plenty of air circulation. Some have proved hardy in southern England.

Restio festucaeformis Masters

Restio

Native to hills and lower mountains between Bredasdorp and Somerset West in the South African Cape, sometimes growing along streambanks or forming vast sweeps in marshy areas. Most *Restio* species are South African, primarily native to the southwestern Cape Region. They are part of the fynbos plant community, which is characterized by natural burning, and are generally found on well-drained soils of low fertility. Tufted and clump-forming, to 18 inches (45 cm) tall. The evergreen stems are sparsely branched and attractively arching. Germinates readily from smoke-treated seed, growing quickly and flowering within two years. Golden-brown bracts on inflorescences are quite showy and long-lasting. Plants are difficult to divide as the roots do not like to be disturbed. Best planted in spring or autumn in Mediterranean type climates. A fine container subject in areas beyond its winter cold hardiness. Zone 8.

Restio tetraphyllus Labillardière

Tassel cord-rush, plume-rush

This Australian native has proved to be one of the easier species to grow and propagate, and is one of the more commercially available species. Upright, with green stems 3 to 4 feet (90–120 cm) tall. Spreads by rhizomes and can form extensive masses, but is easily contained as a clump if desired. New growth is heavily branched, but mature stems are typically unbranched in their upper portions. Of easy culture in full sun or light shade. Prefers average to moist soil and does well at the margins of pools or ponds. Requires good air circulation. Propagate by seed or division. A fine container subject in areas beyond its winter cold hardiness. Zone 8.



TOP *Restio tetraphyllus* at Berkeley Horticultural Nursery in Berkeley, California, in early April.

BOTTOM *Restio tetraphyllus* at Cranbourne Botanic Garden in Victoria, Australia, in early September (spring).

Rhodocoma Nees

Restio family, *Restionaceae*

Comprises up to six clump-forming species native to the eastern Cape Region of South Africa. All were at one time included in *Restio* and are superficially similar to many *Restio* species, often with stems finely branched in whorls at the nodes. This type of growth is termed *verticillated*. The species are best propagated by seed that has been smoke treated. Division is possible but like most members of the restio family, *Rhodocoma* species do not like to have their roots disturbed once in place. All make interesting container subjects in cold regions. Some species have proved hardy in the warmer parts of England including Cornwall and in California as far north as the San Francisco Bay area.

Rhodocoma arida H. P. Linder & Vlok

Native to dry, open habitats in South Africa's Cape Region. Gray-green stems are unbranched below, terminating in conspicuous inflorescences, to 4 feet (1.2 m) tall in flower. Very drought tolerant. Zone 8.

Rhodocoma capensis Steudel

Often occurs in large populations along river bottoms in the eastern Cape Region of South Africa. Grows to 5 feet (1.5 m) tall with upright stems finely verticillated at the nodes. Zone 8.

Rhodocoma foliosa (N. E. Brown) Linder

[*Restio foliosus* N. E. Brown]

Often confused with *Rhodocoma gigantea*, this species is similar but not as tall, growing 5 to 7 feet (1.5–2.1 m) in height, and the stems are finely branched their entire length. A uniquely sculptural species with stems often arching and fountainlike. Blooms in spring or early summer.

Rhodocoma gigantea (Kunth) H. P. Linder

A distinct and magnificent species, growing 7 to 8 feet (2.1 to 2.4 m) tall. The stems are finely verticillated below and are topped by huge red-brown inflorescences. Prefers full sun and relatively dry soil. Zone 8.



ABOVE *Rhodocoma arida* in early April at the University of California Botanical Garden, Berkeley.



RIGHT *Rhodocoma arida* in early April at Leaning Pine Arboretum in San Luis Obispo, California.



Rhynchospora Vahl

Sedge family, *Cyperaceae*.

White-top sedge, beak-rush

The genus name is from the Greek *rhynchos*, beak, and *sporos*, seed, referring to the elongated, beaklike seeds. This large genus includes more than 200 mostly perennial species native to wet or moist habitats in warm regions of both hemispheres. In recent years the genus has been broadened to include species formerly in *Dichromena*. Commonly known as white-top or star sedges, these are distinct in having conspicuously long, leafy bracts radiating from the terminal inflorescences in a starlike pattern. The bracts are nearly white except at the extended tips, which are green. The genus name *Dichromena* was derived from the Greek *dis*, double, and *chroma*, color, referring to the green-and-white bracts. Spreading manageably by rhizomes, these distinct sedges are eye-catching when grown in mass in natural habitats and make attractive additions to aquatic gardens. They are also easily grown in tubs or pots. Best in full sun with constant moisture. If plants dry out the bracts will scorch and turn brown. All the species may be propagated by seed or division.

Rhynchospora colorata (Linnaeus) H. Pfeiffer

[*Dichromena colorata* (Linnaeus) Hitchcock]

White-top sedge, white-bracted sedge, star sedge, umbrella-grass, star-rush

Native to moist sand, swamps, and pond edges, mainly in coastal habitats from Virginia to Florida, Texas, and into Mexico. Grows 20 inches (50 cm) tall, blooming in summer and continuing into winter in the warmer regions. Inflorescences with three to seven bracts of unequal length, white at the base. Easily grown in full sun or light shade on moist soils or in shallow water up to 2 inches (5 cm) deep. Tolerant of brackish conditions. Runs by rhizomes to produce dense clusters but easily contained. Zone 8.

Rhynchospora latifolia (Baldwin ex Elliott) W. W. Thomas

[*Dichromena latifolia* Baldwin ex Elliott]

White-top sedge, white-bracted sedge, star sedge, star-rush

Native to moist sand, savannahs, pine woods, swamps, and pond edges in the southeastern United States from South Carolina to Florida and Texas. Slightly taller and showier than *Rhynchospora colorata*, to 32 inches (80 cm) tall. Blooms in summer, sometimes into winter in the warmer regions, with 6 to 10 bracts of unequal lengths, white at the base. Eas-



TOP *Rhodocoma foliosa* blooming in late June at Seaside Gardens in Carpinteria, California.

BOTTOM *Rhodocoma gigantea* is 8 feet (2.4 m) tall in early April at the University of California Botanical Garden, Berkeley.



TOP *Rhynchospora latifolia* begins blooming in early May in Alabama.

BOTTOM *Rhynchospora latifolia* in a pot with red-leaved *Plantago major* at Seaside Gardens in Carpinteria, California.

ily grown in full sun or light shade on moist soils or in shallow water to 2 inches (5 cm) deep. Runs by rhizomes to produce dense clusters but easily contained. Zone 8.

Rhynchospora nervosa (Vahl) Böckeler

[*Dichromena nervosa* Vahl]

White-top sedge, star sedge

This native of Central and South America and the Caribbean is similar to *Rhynchospora colorata* and *R. latifolia*, but larger and taller, to 5 feet (1.5 m), and more tender. Zone 10.

Saccharum Linnaeus

Grass family, *Poaceae*

Plumegrass, sugarcane

The genus name is derived from the Greek *sakchar*, sugar. *Saccharum* includes approximately 40 perennial species native throughout the tropics and subtropics and extending into temperate regions. The best-known species is sugarcane, *S. officinarum*, which is widely cultivated in warm regions for sugar production and sometimes for ornamental purposes. Most species occur in moist habitats including riverbanks and floodplains, though some are found on drier open hillsides.

The broad, modern interpretation of *Saccharum* now includes all species formerly in the genus *Erianthus*, which was originally split from *Saccharum* based on the presence of awns on the lemmas. Among these awned species are ravenna grass, now *S. ravennae*, which is widely grown in temperate gardens, and several North American species that are common in regional habitats and are becoming more popular in gardens and other designed landscapes. The North American species are similar in their narrow, upright form and have strong vertical impact even in relatively small spaces.

All *Saccharum* species are warm-season growers, producing large terminal feathery inflorescences that remain translucent and attractive throughout winter. Many also have rich autumn foliage color. Most are clump-forming but a few spread by rhizomes. They generally prefer full sun but some are adapted to light shade. All are easily propagated by seed, or by division in spring.

Saccharum alopecuroides (Linnaeus) Nuttall

[*Erianthus alopecuroides* (Linnaeus) Elliott]

Silver plumegrass

Native to moist, open woodlands and woodland edges, from New Jersey to southern Indiana and south to Florida and Texas. Distinct from many other North American species in its preference for somewhat shaded conditions, its habit of spreading by rhizomes, and the unusually silvery hairs in the



ABOVE The plume of *Saccharum alopecuroides* (right) is noticeably lighter and more silvery than that of *S. contortum* (left) in October in the author's Pennsylvania garden. RIGHT *Saccharum arundinaceum* blooms nearly 14 feet (4.2 m) tall at Hoffman Nursery in Rougemont, North Carolina, in early October.



inflorescences. Awns are among the most important distinguishing features of the North American species, and the awns of silver plumegrass are flattened and spirally twisted at the base. Variable in height, growing vertically, to 4 to 8 feet (1.4–2.4 m) tall when blooming in late summer. Leaves green, turning golden yellow in autumn. Prefers light shade but will grow in full sun with regular moisture. Tolerant of soggy or waterlogged soils and suited to pond margins. Remains upright though winter. Self-sows. Propagate by seed, or by division in spring. Zone 6.

Saccharum arundinaceum Retzius

Giant plumegrass, hardy sugarcane
This eastern Asian is relatively new to cultivation in Western gardens. Similar in appearance to *Saccharum ravennae*, but more leafy and fuller in form. It is extremely vigorous, growing 12 to 15 feet (3.7–4.6 m) tall. Blooms in late summer or

early autumn. The huge terminal inflorescences open with a strong pink cast, then fade to translucent silver. Leaves are gray-green. Prefers full sun and is adapted to a wide range of soil and moisture conditions. Very drought tolerant. Propagate by seed or division. Has proved hardy to Zone 7 but needs further testing in colder regions. Probably hardy to Zone 6.

Saccharum baldwinii Sprengel

[*Erianthus strictus* Elliott]

Narrow plumegrass

One of the smaller, less common North American species, native to moist, often sandy and sometimes shaded habitats on the coastal plain from Virginia south to Florida and Texas west to Tennessee and Missouri. Clump-forming and strictly upright. Blooms late summer, to 7 feet (2.1 m) tall, the inflorescence narrow with straight awns. Prefers sun or light

shade and average to moist soil. Foliage is green in summer, often richly colored dark orange or purple-red in autumn. Propagate by seed, or by division in spring. Self-sows. Zone 7.

Saccharum brevibarbe (Michaux) Persoon

[*Erianthus brevibarbis* Michaux]

Shortbeard plume grass, short-awn plume grass, brown plume grass

Native to damp, often sandy, open habitats on the coastal plain from Delaware and Maryland to Louisiana and north to Arkansas and southern Illinois. Grows 6 to 8 feet (1.8–2.4 m) tall when flowering in late summer or early autumn. The inflorescences open bronze-amber to copper-gold, eventually drying to cinnamon-silver and remaining translucent and attractive through winter. The awns are straight or slightly sinuous. Leaves are green in summer, turning various shades of

purple, bronze, and orange-red in autumn, and often retaining noticeable red pigment through winter, which is especially evident when plants are wet. Of easy culture on a wide variety of soils, in full sun or very light shade. Drought-tolerant. Self-sows. Propagate by seed, or by division in spring. Zone 6.

Saccharum contortum (Elliott) Nuttall

[*Erianthus contortus* Elliott, *Saccharum brevibarbe* var.

contortum (Elliott) R. Webster]

Bent-awn plume grass

Nearly identical in size and appearance to *Saccharum brevibarbe* but with characteristically twisted awns. Occurs on moist sandy and clay soils from Delaware and Maryland to Louisiana north to southern Arkansas and Illinois. Self-sows. Propagate by seed, or by division in spring. Zone 6.

Saccharum giganteum (Walter) Persoon

[*Erianthus giganteus* (Walter) Hubbard, non Muhlenberg]

Sugarcane plume grass, giant plume grass

Native to wet or constantly moist habitats both sunny and lightly shaded, from New Jersey to Kentucky and Arkansas south to Florida and Texas, and continuing into Central America. Although this is the largest and most fully plumed of the North American species, growing upright to 10 feet (3 m) tall, it is much slimmer and smaller in overall size and



LEFT *Saccharum brevibarbe* grows 7 feet (2.1 m) tall at a moist woodland edge in North Carolina in early October.

BELOW LEFT *Saccharum contortum* blooms 7 feet (2.1 m) tall in late August in the author's Pennsylvania garden, growing in a mass of threadleaf bluestar, *Amsonia hubrichtii*, with golden

Rudbeckia laciniata. CENTER The translucent, twisted awns of *Saccharum contortum* are visible with the aid of late-October sunlight in the author's Pennsylvania garden. RIGHT *Saccharum contortum* is still sturdy and upright in mid February in the author's Pennsylvania garden, undeterred by multiple snows.



flowers than the Asian *Saccharum arundinaceum* or the Mediterranean *S. ravennae*. Blooms late summer or early autumn, the inflorescences strongly pink-suffused at first, drying to light beige and remaining translucent and attractive through most of winter. The awns are straight. Green summer foliage turns yellow, red, or bronze-purple in autumn. Grows best in sun or light shade, on average to moist soil. Self-sows. Propagate by seed, or by division in spring. Zone 6.

Saccharum officinarum Linnaeus

Sugarcane

This large grass has been grown for centuries for sugar and widely distributed in warm regions by human activity. Its ultimate origin is uncertain, though it is probably from tropical Asia and the South Pacific islands. Selections with colored leaves and stems are increasingly popular in gardens as tender perennials. Capable of reaching nearly 20 feet (6 m) in height in tropical regions, it typically grows 6 to 8 feet (1.8–2.4 m) tall when planted for seasonal display in cooler climates. Of easy culture in sun or light shade on a variety of soils. Prefers moist soil but is fairly drought tolerant once established. Propagate by division, or by rooting stem sections. Zone 10.

‘Pele’s Smoke’. Purple-stemmed sugarcane. Foliage is smoky-purple, and stems are shiny mahogany-purple with conspicuous cream-colored bands marking the nodes. The stems remain attractive into winter in cold climates, long after the foliage has withered from frosts. Plants sold by this

BELOW *Saccharum giganteum* in mid September at the Norfolk Botanical Garden in Virginia. CENTER *Saccharum officinarum* ‘Pele’s Smoke’ stems are still burgundy in early February in Southern California. RIGHT Backlit by the late-October sun at Longwood Gardens, *Saccha-*

rum ravennae epitomizes the drama of line, form, and translucency that is unique to the grasses.

RIGHT *Saccharum officinarum* ‘Pele’s Smoke’ in late October at Hoffman Nursery in Rougemont, North Carolina.

more recent name are often indistinguishable from the following variety.

‘Violaceum’. Purple-stemmed sugarcane. Forms with purple leaves and stems have historically been offered with this variety name.

Saccharum ravennae (Linnaeus) Linnaeus

[*Erianthus ravennae* (Linnaeus) P. Beauvois]

Ravenna grass, hardy pampas grass

Native to southern Europe and the Mediterranean, and also to northern Africa and western Asia. The first common name refers to the Italian city of Ravenna, which long ago served as the seat of the Roman Empire. This large, full-flowered species has also been called hardy pampas grass because it has traditionally been grown in place of the more tender, true pampas grass, *Cortaderia selloana*, in cold climates.



It is among the largest and most dramatic of all cold-hardy grasses, growing upright to 14 feet (4.2 m) tall when flowering. Strictly clump-forming, it produces a huge basal mound of gray-green foliage nearly 4 feet (1.2 m) high. Large plumes are produced in late summer or early autumn, held aloft on stout, upright-divergent stalks. The flowers are pink-tinted at first, quickly turning lustrous silver, and retaining their translucent appeal well into winter. Makes a superb cut flower, especially if inflorescences are gathered just before



opening. The flowering stalks are often conspicuously red-suffused in late summer, and the foliage takes on pleasing orange tones in autumn.

Requires full sun and a relatively long season to bloom. Not particular about soil type and will grow on wet or dry sites. Excessive moisture and fertility result in lax, floppy growth. Self-sows and has naturalized on disturbed ground in a number of warm-temperate regions. Propagate by seed or division. Zone 6.

Schizachyrium Nees

Grass family, *Poaceae*

Includes approximately 60 annual and warm-season perennial species native to tropical, subtropical, and temperate regions around the world. The only commonly cultivated species, *Schizachyrium scoparium*, is one of nine native to North America, and it was formerly included in the closely related genus *Andropogon*. In *Schizachyrium* each peduncle ends in a single raceme (technically called a rame and comprised of a single axis with repeating pairs of sessile and pedicellate spikelets). The peduncles of *Andropogon* end in multiple racemes. This difference can be observed with the naked eye. In *Schizachyrium* each individual raceme is located at the end of a slender peduncle that extends visibly from a node of the stem (see chapter two, figure 10). The racemes of *Andropogon* are clustered, two to four on each peduncle, and the peduncles are short and mostly enclosed by the leaf sheaths.

Schizachyrium littorale (Nash) E. P. Bicknell

Shore bluestem, dune bluestem

Similar in general appearance to *Schizachyrium scoparium*, this North American species is native only to shifting sands along the Atlantic coast from Massachusetts south, along the Gulf coast, and around the Great Lakes. The leaves are usually



TOP LEFT Mature plants of *Saccharum ravennae* grow more than 12 feet (3.7 m) tall at Longwood Gardens in late October. BOTTOM LEFT *Saccharum ravennae* is still a radiantly powerful presence in the late-October landscape of Longwood Gardens, with an allée of baldcypress trees, *Taxodium distichum*, as a backdrop. BOTTOM RIGHT *Saccharum ravennae* flowering stems are richly suffused red in late October.

strongly glaucous and gray-blue in appearance. Although not actually rhizomatous, this grass is capable of rooting from nodes covered by sand, and because of this it plays a role in dune stabilization. It is not commonly cultivated but deserves consideration for coastal gardens and landscapes. Propagate by seed or division. Zone 5.

Schizachyrium scoparium (Michaux) Nash

[*Andropogon scoparius* Michaux]

Little bluestem, prairie beardgrass

Native to prairies and open woods, and often occurring on old fields from New Brunswick and Quebec to Alberta south to Florida and Mexico, little bluestem was originally one of the characteristic grasses of the North American tallgrass prairie. A highly variable species, it is tolerant of a range of

moisture conditions from average to nearly arid, and is able to grow on both acidic and alkaline soils. Unlike its close relative *Andropogon virginicus*, little bluestem is a valuable forage grass and has been widely planted for this purpose since the demise of the great prairies.

Mostly upright and clump-forming, it is fine-textured but not always little, growing from 2 to 4 feet (60–120 cm) in height. The foliage is variable in color, ranging from bright green to glaucous gray-blue. Glaucous forms often have secondary red-purple tints, especially on the stems. Fall color ranges from copper-orange to deep purple-red, and winter color can be light straw or strongly orange-red. The deeper red and purple hues are most common among plants with glaucous summer foliage. A true warm-season grower, blooming in late summer. The inflorescences are delicate and relatively inconspicuous until they dry and become translucent and silvery. Though the stems are slender, little bluestem usually remains standing through winter, even after repeated snows. It requires nearly full sun for upright growth. Shade, excess fertility, and too much moisture will all contribute to lax, floppy growth.



LEFT *Schizachyrium littorale* grows in full sun on shifting sand along the Massachusetts coast in late August.

BOTTOM LEFT Slender peduncles extend from the stem of *Schizachyrium scoparium* (right), each ending in a single raceme. *Andropogon virginicus* (left) has

multiple racemes tightly clustered and mostly enclosed by leaf sheaths. BELOW *Schizachyrium scoparium* grows on dry sand with the evergreen common bearberry, *Arctostaphylos uva-ursi*, helping to define a path through the Wellfleet Bay Wildlife Sanctuary in Massachusetts in late December.





ABOVE *Schizachyrium scoparium* 'The Blues' at Adkins Arboretum in Ridgely, Maryland, in late July with *Rudbeckia laciniata* 'Herbstsonne' (in the background).

Many standard garden soils are too rich for this grass, but it does extremely well in low-nutrient soils and dry conditions. Can be propagated by seed sown in spring, or by division in late winter or spring. Clonal cultivars, propagated by division, are increasingly popular and available, though there is plenty of opportunity for further selection. Zone 3.

'Aldous'. A seed cultivar originally developed for forage, producing a high percentage of tall, blue-leaved plants.

'Blaze'. A seed cultivar originally developed for forage, producing plants that generally have strong reddish autumn and winter hues.

'Cimarron'. A seed cultivar originally developed for forage, producing a high percentage of blue-leaved plants.

'Stars & Stripes'. A clonal cultivar with cream-yellow striped green leaves.

'The Blues'. A clonal cultivar with strongly glaucous, light blue stems, named by Kurt Bluemel Nurseries and North Creek Nurseries, selected from seedlings of 'Aldous' provided by Richard Lighty. Propagated only by division.

RIGHT *Schizachyrium scoparium* 'The Blues' is orange-red in late October at Adkins Arboretum in Ridgely, Maryland.



Schoenoplectus (Reichenbach) Palla

Sedge family, *Cyperaceae*

Bulrush, clubrush

Includes approximately 80 annual and perennial species of cosmopolitan distribution in aquatic and semiaquatic habitats. Many species were formerly included in the closely related genus *Scirpus*, such as the great bulrush, *Schoenoplectus tabernaemontani*, which has traditionally been used for thatching material and has long been cultivated in water gardens. *Schoenoplectus* species are important to the health of many wetland ecologies, contributing to nutrient cycling as well as food and shelter for wetland fauna. Though botanically they are sedges, they look much like rushes, typically lacking normal leaves and instead having green, often cylindrical stems with flowers clustered at or just below the stem tips. Many species are strongly rhizomatous, forming large populations in aquatic environs.

Schoenoplectus californicus (C. A. Meyer) Soják

[*Scirpus californicus* (C. A. Meyer) Steudel]

Southern bulrush, giant bulrush, California bulrush, tule Native to freshwater marshes across the southern United States and south to Chile and Argentina. Strongly rhizoma-



tous, with cylindrical green or gray-green stems to 9 feet (2.7) in height. Inflorescences are open-branched panicles, located at the stem tips. Known as tule in California, where it occurred in vast populations in inland lakes, it has been traditionally used by tribal people as thatching for houses and for the making of mats, baskets, and clothing. Though too large for most residential gardens, it is something to be appreciated and conserved in regional aquatic habitats, where it provides food and shelter for waterfowl and other wetland fauna. Zone 7.

Schoenoplectus subterminalis (Torrey) Soják

[*Scirpus subterminalis* Torrey]

Swaying-rush

Native to ponds, peaty shores, bogs, and other slow-moving, often acidic waters across northern North America. A subtly beautiful plant, growing mostly submerged in up to 5 feet (1.5 m) of water. The long, threadlike, lime-green stems float just beneath the water's surface, gently revealing undulations in the current. The specific epithet *subterminalis* refers to the tiny inflorescences, which are just below the tips of stems that extend a few inches out of water at flowering time in mid summer. Runs by rhizomes, often creating exten-



TOP LEFT *Schoenoplectus californicus* in late June at the San Luis Obispo Botanical Garden in California. RIGHT Patterns of *Schoenoplectus subterminalis* reflect the gently flowing waters of the Wading River in the New

Jersey Pine Barrens in mid September.

ABOVE Flowering stems of *Schoenoplectus subterminalis* rise above the water's surface.

sive masses. Not suited to smaller aquatic gardens, but truly worth establishing, enhancing, or conserving in larger landscapes. Propagate by seed or division. Zone 4.

Schoenoplectus tabernaemontani (C. C. Gmelin) Palla
[*Scirpus tabernaemontani* C. C. Gmelin, *S. validus* Vahl, *S. lacustris* Linnaeus, *Schoenoplectus lacustris* subsp. *tabernaemontani* (C. C. Gmelin) Á. & D. Löve]

Great bulrush, clubrush

Of cosmopolitan distribution in freshwater and brackish wetland habitats including marshes, lakes, ponds, and river margins. Spreads by rhizomes, often creating significant sweeps and masses. Stems deep green and rushlike, carrying on the usual photosynthetic functions of leaves and bearing open panicles of reddish-brown flowers near the stem tips. This highly variable species is the center of a large complex of similar plants that readily hybridize, which has caused consider-

able taxonomic confusion and resulted in often conflicting approaches to classification and naming. These sturdy plants have proved eminently adapted to modern conditions, frequently growing beyond their original range and establishing themselves in highly disturbed or modified environments, where they contribute measurably to ecological health and diversity. Though spreading sometimes extensively by rhizomes, great bulrush is easily contained as a clump or modest-sized mass in aquatic gardens, where its deep green line and form are visually powerful, providing a perfect textural foil to waterlilies and other broad-leaved species. Grows 3 to 7 feet (90 to 210 cm) tall, blooming in summer. The variegated forms are readily available and of equally easy culture. Prefers full sun and wet or constantly moist soil. Best in neutral to acidic conditions. Propagate by division in spring. Zone 4.

'Albescens' ('Variegatus'). White bulrush, variegated bul-



rush. Stems strongly variegated cream-white to very light green, the entire plant appearing nearly white. Zone 5.

'Golden Spears'. Stems yellow in spring, darkening to green as the season progresses. Zone 5.

'Zebrinus'. Zebra bulrush. Stems dark green with vivid light yellow horizontal bands. Less vigorous than typical, usually less than 4 feet (1.2 m) in height.

Scirpus Linnaeus

Sedge family, *Cyperaceae*

Bulrush

Includes approximately 35 species of cosmopolitan distribution in moist freshwater and sometimes brackish habitats. All are perennial, warm-season growers, blooming in mid to late summer. Many species formerly placed in *Scirpus* are now classified in *Schoenoplectus*. Though generally called bulrushes, *Scirpus* species are usually less rushlike than *Schoeno-*

plectus species, having normally developed leaves with flat blades. Located at or very near the top of the stems, the inflorescences are heavily branched, with clusters of red-brown flowers. Most are clump-forming but some are sufficiently rhizomatous to form extensive masses over time.

Scirpus atrovirens Willdenow

Black bulrush

The specific epithet means dark green, but in fact the flowering clusters of this distinctive species quickly turn very dark brown and appear almost black from a short distance. Native to moist meadows, bogs, and low thickets in eastern North America from Newfoundland and Quebec to Washington and south to Georgia, Texas, and Arizona. Relatively slight, with few stems rising to 4 feet (1.2 m) in height from dark blue-green basal foliage. Blooms in early summer. Prefers full sun and moist soil. Propagate by seed or division. Zone 3.



OPPOSITE TOP LEFT *Schoenoplectus tabernaemontani* (foreground) in a formal fountain pool in Battery Park City, New York, in mid June. RIGHT *Schoenoplectus tabernaemontani* ventures from the richly vegetated margin of a pond at the Berggarten in Hanover, Germany, in late August. Common cattail, *Typha latifolia*, is visible at rear right.

OPPOSITE BOTTOM LEFT *Schoenoplectus tabernaemontani* panicle in late June in northern Delaware. CENTER *Schoenoplectus tabernaemontani* 'Albescens' in late August at the Denver Botanic Gardens in Colorado. RIGHT *Schoenoplectus tabernaemontani* 'Zebrinus' in early June at Longwood Gardens in Pennsylvania.



ABOVE LEFT *Schoenoplectus tabernaemontani* 'Albescens' in late August in Herman Müssel's garden in Heigenhausen, Germany. The wood structure beyond the pond is a garden house.

ABOVE RIGHT *Scirpus atrovirens* seed clusters are dark brown in late July at the edge of a moist meadow in eastern Pennsylvania.

Scirpus cyperinus (Linnaeus) Kunth[*Scirpus rubricosus* (Linnaeus) Kunth]

Woolgrass

Native to wet meadows, marshes, and bogs from Newfoundland to British Columbia south to Florida and Texas, and often naturalized in drainage ditches, roadside swales, and other moist habitat created inadvertently by human activity. Truly distinct for the intensely woolly seedheads. Blooms in mid summer, the inflorescences elevated above the bright green basal foliage on upright stalks 4 to 6 feet (1.2–1.8 m) in height. Flowers open light green and mature to fluffy seed clusters that are rich salmon-red in color. These typically remain standing and attractive entirely through winter, even in cold regions. Prefers full sun and moist to wet soil but is very adaptable and will grow in soils of average moisture and will tolerate periodic dryness. Well adapted to pond margins and other often-waterlogged soils. Self-sows manageably and is easily naturalized in moist meadow gardens. Somewhat

salt-tolerant. Propagate by seed, or by division in spring or autumn. Zone 3.

Scirpus robustus Pursh[*Schoenoplectus robustus* (Pursh) M. T. Strong, *Bolboschoenus robustus* (Pursh) Soják]

Saltmarsh bulrush

Native to brackish or saline coastal marshes from Nova Scotia to Texas, in California, and also in Mexico and South America. Somewhat rushlike in appearance, but with normal leaves with flat blades. Consensus is growing to reclassify this species in the segregate genus *Bolboschoenus*. Stems and leaves are mostly upright, 2 to 5 feet (60–150 cm) tall. Blooms in mid summer, the inflorescences at the tops of the stems but greatly exceeded by leafy bracts. A common yet distinct textural presence in coastal marshes. The seeds provide food for ducks, geese, and other waterfowl. Propagate by seed, or by division in spring or fall. Zone 3.





Sesleria Scopoli

Grass family, *Poaceae*

Moor grass

The genus commemorates Leonardo Sesler, physician and botanist of eighteenth-century Venice who studied the European flora. Includes approximately 25 species native to Europe, western Asia, and northern Africa, most often in rocky, mountain habitats. The European species are centered in the Balkan and Carpathian Mountains, often occurring on limestone substrate. All are densely tufted clump-forming perennials with evergreen or semievergreen foliage. Though they are cool-season growers, their adaptation to the often rocky, droughty, alkaline conditions of their natural habitats makes them unusually tolerant of warm, dry conditions. As a group the moor grasses are often overlooked because their flowers are relatively insignificant; however, they are durable, long-lived grasses of easy culture that are superbly suited for groundcover use in small or large landscapes, in full sun or partial shade. The species vary in size and in foliage color, which ranges from nearly chartreuse to light gray-blue. Most are quite cold hardy and tolerant of alkaline conditions, which makes them good candidates for roof gardens and other urban spaces where the soil pH has been elevated by mortar and other building materials. All moor grasses can be propagated by seed, or by division in spring or fall.

Sesleria argentea (Savi) Savi

Native to sunny grasslands and open woodlands in southwestern Europe and northern Africa. Very similar to the

OPPOSITE TOP LEFT *Scirpus cyperinus* begins blooming in early August at the sunny edge of a moist Delaware woodland, with white-flowered sweet pepperbush, *Clethra alnifolia*; sour gum, *Nyssa sylvatica* (right background); and red maple, *Acer rubrum* (left background). RIGHT Colorful *Scirpus cyperinus* looks like a broad brushstroke across a sunny moist Delaware meadow in early September, along with goldenrod *Solidago canadensis*; groundsel-bush, *Baccharis halimifolia*; and sweetgum, *Liquidambar styraciflua*.

OPPOSITE BOTTOM LEFT Upright-flowering stalks rise from the bright green basal foliage of *Scirpus cyperinus*, set against

the autumn color of sweetgum, *Liquidambar styraciflua*, in a managed drainage swale along a Delaware highway in mid October. CENTER AND RIGHT In a little more than two months, the light green inflorescences of *Scirpus cyperinus* transform themselves into woolly salmon-colored seedheads. CENTER *Scirpus cyperinus* in early August. RIGHT *Scirpus cyperinus* in mid October.

TOP LEFT *Scirpus robustus* at the edge of a coastal Massachusetts salt marsh in late August, with *Spartina alterniflora* visible across the water. BOTTOM *Sesleria argentea* blooms in full sun at the Berggarten in Hanover, Germany, in late August.

more commonly cultivated *Sesleria autumnalis*, with foliage that is medium green in light shade or moist conditions and nearly chartreuse in sun or drier soil. Forms a low tuft of foliage to 12 inches (30 cm) high, topped by narrow cream-white inflorescences on slender flowering stalks in mid summer, to 18 inches (45 cm) total height. Of easy culture in full sun or partial shade. Drought-tolerant. Zone 4.

Sesleria autumnalis (Scopoli) F. W. Schultz

Autumn moor grass

Native to southern Europe and the Caucasus in grasslands and open woodlands, often in calcareous mountain habitats. Tufted, with green to yellow-green leaves to 12 inches (30 cm) long. Blooms in mid summer, with narrow cream-white inflorescences to 18 inches (45 cm) in overall height. Of easy culture in full sun or partial shade. Drought-tolerant. Zone 4.



Sesleria caerulea (Linnaeus) Arduino[*Sesleria albicans* Kitaibel ex Schultes]

Blue moor grass

Native to Europe including the British Isles, in calcareous grassland habitats, limestone rock crevices, and screes. One of the lowest and most compact of the moor grasses, forming basal mounds of strongly blue-green foliage up to 8 inches (20 cm) high. To $\frac{3}{16}$ inch (4 mm) wide, the leaves are strongly glaucous blue on their upper surfaces with dark green undersides. The leaves are often upright, so both colors are always visible. Blooms in April and May, the small spike-like panicles held above the foliage on slender stalks. Flowers are blackish at first, with light yellow pollen sacs, turning mostly green and quickly becoming inconspicuous. Of easy culture in full sun or light shade. Drought-tolerant. Zone 4.

***Sesleria heufleriana*** Schur

Blue-green moor grass

Also native to Europe, this species is very similar to *Sesleria caerulea* but is broader and taller in both foliage and flower. Forms neat tufted mounds to 15 inches (37 cm) high. The early spring flowers are black with cream-yellow pollen sacs, held above the foliage on slender stalks that continue to grow taller as the seed matures and then fall to the sides, becoming inconspicuous. Of easy culture in full sun or light shade. Drought-tolerant. Zone 4.



OPPOSITE LEFT *Sesleria autumnalis* provides a subtle color accent, contributing to a lime-green subtheme at Ashland Hollow in Delaware in mid August.

OPPOSITE RIGHT TOP *Sesleria autumnalis* in full sun in late June at Seaside Gardens in Carpinteria, California. CENTER The two-toned color of *Sesleria caerulea* is from leaves that are typically light gray-blue on top and dark blue-green below. BOTTOM *Sesleria caerulea* blooms in early May in Pennsylvania. The flowers quickly fade from view and never require shearing for the sake of neatness.

LEFT TOP AND BOTTOM Views of the same planting at Longwood Gardens demonstrate the multiseason appeal of *Sesleria caerulea* as a groundcover. Behind the paperbark maple, *Acer griseum*, is a sweep of tufted hair grass, *Deschampsia cespitosa*, interplanted with daffodils. The *Deschampsia* changes form dramatically from spring to winter as the *Sesleria* remains a steady blue-green presence. TOP *Sesleria caerulea* in early May. BOTTOM *Sesleria caerulea* in mid December.

ABOVE *Sesleria heufleriana* with pink-flowered soapwort, *Saponaria x lempergii*, in southern Germany in late August.

Sesleria nitida Tenore

Gray moor grass

Native to central and southern Italy. Taller-growing, with glaucous gray-green to gray-blue foliage to 20 inches (50 cm) tall. Blooms in spring, the relatively inconspicuous inflorescences nearly black with bright yellow anthers. Grows best in full sun. Very drought tolerant. Zone 4.

***Sesleria rigida*** Heuffel ex Reichenbach

Carpathian moor grass, blue moor grass

This Eurasian native occurs in open, calcareous habitats in the Carpathian and Balkan Mountains. It is similar to *Sesleria nitida*, with glaucous gray-green to gray-blue foliage to 12 inches (30 cm) high and relatively stiff. The flowering stalks are much sturdier, too, standing upright to 2 feet (60 cm), the terminal flower clusters remaining dark-colored and attractive long past the spring blooming period. Grows best in full sun. Very tolerant of drought and alkaline conditions. Zone 5, possibly colder.



TOP LEFT *Sesleria nitida* in full sun in late July in England. BOTTOM *Sesleria nitida* in full sun at Seaside Gardens in Carpinteria, California, in late June.

ABOVE *Sesleria rigida* in late August on the rooftop of Herrenhausen's Rain Forest House in Hanover, Germany.

Setaria PalibinGrass family, *Poaceae*

Foxtail

From the Latin *seta*, bristle, referring to the bristlelike inflorescence. Includes more than 100 annual and perennial species of open grasslands and woodlands, widely distributed in tropical, subtropical, and temperate zones. The annual foxtails are best known as cosmopolitan weeds, sometimes attractive but rarely cultivated deliberately. The following perennial species is a tender tropical, grown in gardens mostly for its bold, palmlike foliage.

Setaria palmifolia (Köenig) Stapf

Palm grass

Native to tropical Asia, this coarse-textured perennial can reach 10 feet (3 m) in height when flowering in tropical climates. Typically green, the leaves are 3 to 5 inches (8–13 cm) wide and conspicuously ribbed. Requires a long warm sea-

son to produce its large foxtail-like inflorescences held above the foliage on relatively slender stems. In colder climates palm grass is often grown in greenhouses, but it also makes an interesting tropical accent displayed in a pot set out during warm periods and protected over winters. It may also be planted in the ground for summer and removed to protection in winter. It is not tolerant of prolonged temperatures below 40°F (4°C). Grows well in full sun with moisture, or in considerable shade. Fairly drought tolerant. Propagate by division. This grass poses no risk to local ecologies in cooler regions where it fails to flower, but it is notoriously weedy and ecologically disruptive in tropical regions and should be cultivated with caution in hot climates. Zone 9.

'**Rubra**' ('*Rubra Aurea*'). Stems deep purple, leaves lime-green.

'**Rubra Variegata**'. Stems deep purple, leaves lime-green with cream-variegated blade and sheath margins.



FAR LEFT *Setaria palmifolia* in mid June in Sydney Baumgartner's garden in Santa Barbara, California. ABOVE *Setaria palmifolia* 'Rubra' in a tropical display set out for the summer at the Scott Arboretum of Swarthmore College in Pennsylvania. LEFT *Setaria palmifolia* foliage is distinctly ribbed.

Sorghastrum NashGrass family, *Poaceae*

Indian grass, woodgrass

From the genus *Sorghum* plus the Latin suffix *-astrum*, imitation, referring to the resemblance to sorghum. Includes approximately 18 annual and perennial species native primarily to tropical, subtropical, and temperate America, with two species in Africa. Best known for Indian grass, *Sorghastrum nutans*, an essential and characteristic element of the original North American tallgrass prairies. The North American *Sorghastrum* species are perennial, warm-season growers, flowering in late summer or early autumn with conspicuous copper-colored inflorescences. Though Indian grass is most common in cultivation, the other two species below deserve further attention.

Sorghastrum elliotii (C. Mohr) Nash

Slender Indian grass, Elliott's woodgrass

Native to dry, often sandy open woodlands, mostly on the coastal plain, from Maryland to Florida and Texas, and also inland to Arkansas and Tennessee. Similar to *Sorghastrum nutans* but a strict clump-former, without any tendency to spread by rhizomes. The mostly green leaves are also narrower and the inflorescences are more open and not as richly copper-gold in color. Blooms in mid summer, 3 to 5 feet (90–150 cm) tall in flower. Of easy culture on a variety of soils in sun or partial shade. Drought-tolerant. Propagate by seed, or by division in spring. Zone 6.

Sorghastrum nutans (Linnaeus) Nash[*Sorghastrum avenaceum* Michaux) Nash, *Chrysopogon nutans* Bentham]

Indian grass

One of the most beautiful and characteristic grasses of the once-vast North American tallgrass prairie, Indian grass was second most prevalent to big bluestem, *Andropogon gerardii*, in the principal group of tall-growing warm-season grasses that also included switchgrass, *Panicum virgatum*, and little bluestem, *Schizachyrium scoparium*. It is native to a variety of habitats including prairies, savannahs, dry slopes, and open woodlands from Quebec and Maine to Manitoba and North Dakota south to Florida, Arizona, and Mexico.

Mostly clump-forming but capable of spreading modestly by rhizomes, it grows upright to 5 to 8 feet (1.5–2.4 m) in height when blooming in mid to late summer. Inflorescences open strongly copper-colored with conspicuous bright yellow anthers. Loose and open at first, the panicles narrow upon drying, becoming light chestnut-colored and translucent and remaining attractive through winter. Plants of central prairie provenance tend to be taller, growing with broad leaves, up to ½ inch (12 mm) wide, that are often glaucous. Plants at the eastern extent of the range are shorter, more sturdily upright, and generally have green foliage that often turns rich orange-red in autumn.

Indian grass is very adaptable and of easy culture in a wide range of soil and moisture conditions. It grows most upright in full sun. It self-sows and is one of the easiest of the tall-





OPPOSITE *Sorghastrum nutans* blooms in early September, creating golden-copper bands of color in this seeded meadow on peripheral grounds of Longwood Gardens in Pennsylvania.

ABOVE AND LEFT Inflorescences of *Sorghastrum nutans* undergo considerable change in color and form from the time they open until maturation of seeds. TOP When they first appear in late August, inflorescences of *Sorghastrum nutans* are open and copper-colored with bright yellow anthers. CENTER By early September,

Sorghastrum nutans inflorescences have narrowed and turned dark pink-purple. The flowering stems are often somewhat lax and arching at this stage, as they are in this image of a dewy morning. BOTTOM By early November, *Sorghastrum nutans* seeds are ripe and beginning to disperse. The now-dry flowering stalks have stiffened and straightened to the nearly vertical position they will retain through winter. Though the seedheads are not colorful at

this stage, the awns and tiny hairs attached to the spikelets are translucent and easily illuminated by winter sunlight.

ABOVE TOP *Sorghastrum nutans* is incandescent in early September sunlight in the author's Pennsylvania garden. BOTTOM Glowing seedheads of *Sorghastrum nutans* in a small meadow area are alluringly visible from an outdoor dining table in the author's Pennsylvania garden in late October.

grass species to naturalize in prairie or meadow gardens. Frequently used for soil stabilization and forage, and a number of seed cultivars have been developed for these purposes. Propagate by seed sown in late winter or early spring, or by division in spring or fall. Zone 3.

'Bluebird'. Leaves glaucous, grows 3 to 5 feet (90–150 cm) tall in flower. A selection from Bluebird Nursery of Clarkson, Nebraska.

'Cheyenne'. A seed cultivar of Oklahoma provenance developed primarily for forage and pasture use.

'Holt'. A seed cultivar of Nebraska provenance developed primarily for forage and pasture use.

'Müllerslust' (Müller's joy). A clonal cultivar selected in Germany, with glaucous foliage and upright stature.

'Osage'. A seed cultivar developed from plants of Kansas and Oklahoma provenance primarily for forage and pasture use. Produces a high percentage of seedlings with glaucous foliage.

TOP LEFT Allowed to stand into mid April, *Sorghastrum nutans* provides cover for spring nesting birds in the author's Pennsylvania garden, while its still-upright stems provide line and color contrast for a blooming redbud tree, *Cercis canadensis*. **RIGHT** The glaucous foliage of *Sorghastrum nutans* 'Müllerslust' (in the foreground) is dramatically bluer than that of *Panicum virgatum* 'Cloud Nine' (rear left and right) in Hans Simon's planting at the Berggarten in Hanover, Germany, in late August.

BOTTOM LEFT *Sorghastrum nutans* 'Sioux Blue' stands upright, blooming on the last day of August at Longwood Gardens in Pennsylvania. **CENTER** Still under evaluation at the time of this writing, a spectacularly glaucous blue form of *Sorghastrum nutans* blooms in trial beds at Bluebird Nursery in Clarkson, Nebraska. Plants like this are proof of the mostly untapped beauty and diversity of North American grasses. Photo courtesy Bluebird Nursery. **RIGHT** *Sorghastrum secundum* blooms in open woods. Photo by Ted Bodner, © Southern Weed Science Society.



‘**Sioux Blue**’. Leaves glaucous gray-blue. More upright than most prairie types. A clonal cultivar selected and named by the author from a seedling of ‘Osage’ after evaluation at Longwood Gardens.

Sorghastrum secundum (Elliott) Nash

Lopsided Indiangrass, drooping woodgrass
Native to sandy, open woodlands and woods edges from South Carolina to Florida and Texas. Strictly clump-forming. Green-leaved, growing 3 to 5 feet (90 to 150 cm) tall when blooming in mid summer. The relatively narrow inflorescences are distinct in having flowers mostly to one side of the central stalk. Will grow in shade or sun. Drought-tolerant. Propagate by seed, or by division in spring. Zone 7, possibly colder.

Spartina Schreber

Grass family, *Poaceae*

Cordgrass

Comprises 15 to 17 perennial, warm-season species primarily native to wet or moist habitats on both coasts of the Americas and to the Atlantic coasts of Africa and Europe, especially in temperate and subtropical zones. Most cordgrasses spread by rhizomes to form extensive colonies and are important soil builders and stabilizers in coastal and interior marshes, where they often provide shelter and food for local fauna. Natural hybrids occur, and some of these have become problematic in coastal habitats, where their superior vigor sometimes overwhelms local native species. The majority of cordgrasses occur in brackish or saltwater environments and are essential to the beauty and diversity of these landscapes. Prairie cordgrass, *Spartina pectinata*, and sand cordgrass, *S. bakeri*, are freshwater species adaptable to cultivation on dry ground.

Spartina alterniflora Loiseleur-Deslongchamps

Smooth cordgrass

This strongly rhizomatous species is native to coastal salt marshes in North America from Quebec and Newfoundland to Florida and Texas and also on the Atlantic coasts of South America and northern Europe. It occurs primarily in the intertidal zone, where it grows tallest near the water and much shorter at upper tidal margins. The foliage ranges in height from 3 to 5 feet (90–150 cm). Blooms in mid to late summer, the narrow one-sided inflorescences held high above the leaves on slender upright stalks.

This species plays an important role in the stabilization of coastal soils and for its ability to extend marsh habitat further seaward by its spread. It has historically been planted in some coastal areas to create additional land area suitable for farming and grazing. Deliberate introduction of this species



TOP Beyond a drift of a sea lavender, *Limonium nashii*, a band of *Spartina alterniflora* meets the water's edge at Robert's Cove on Cape Cod, Massachusetts, blooming on upright stalks in

late August. BOTTOM The same band of *Spartina alterniflora* is visible at water's edge in late December. The foreground, closer to the high tide level, is matted with salt-hay,



TOP LEFT *Spartina alterniflora* is an integral part of saltmarsh habitat along the Massachusetts coast in late July. BOTTOM *Spartina alterniflora* blooms along the Massachusetts coast in early September.

RIGHT *Spartina bakeri* defines the entrance walk at Historic Bok Sanctuary in Lake Wales, Florida, in early February.

beyond its original range has resulted in hybrids, and some of these, including crosses with the European *Spartina maritima*, have proved ecologically disruptive. Smooth cordgrass is increasingly being planted within its native range to restore the health and stability of coastal marshes. Propagate by seed or division. Zone 3.

Spartina bakeri Merrill

Sand cordgrass

Unlike many cordgrasses, this species is not a marsh dweller, but is native to sandy ocean beaches and the edges of freshwater inland lakes and other waterways in South Carolina, Georgia, and Florida. Clump-forming and fine-textured, with medium-green leaves only ¼ inch (6 mm) wide, sand cordgrass forms a dense mound 3 to 6 feet (90–180 cm) tall. The inflorescences are narrow panicles with appressed branches, elevated on stalks above the foliage. Drought-tolerant and of easy culture in sun or partial shade. Sturdy and long-lived, it is suitable for massed plantings and for defining garden spaces. Best propagated by seed. Can be divided but larger established clumps are difficult to handle. Zone 8.

Spartina cynosuroides (Linnaeus) Roth

Big cordgrass

Native to brackish and saltwater marshes along the North American Atlantic and Gulf coasts from Massachusetts to Florida and Texas. The tallest of the North American cordgrasses, capable of reaching 13 feet (4 m) in height when blooming in mid summer. Strongly rhizomatous, sometimes

creating extensive colonies. The rhizomes are eaten by geese and muskrats, and the seeds provide food for many birds. Propagate by seed or division. Zone 5.

Spartina patens (Aiton) Muhlenberg

Salt hay, marsh hay, saltmeadow cordgrass

Native to salt meadows, marshes, brackish flats, and on low dunes only periodically flooded along the North American Atlantic and Gulf coasts from Quebec to Florida and Texas, extending to the north coast of South America. In eastern North America, huge quantities were once cut for hay, pack-

BELOW TOP *Spartina cynosuroides* grows 10 feet (3 m) tall along the Massachusetts coast in mid August. BOTTOM *Spartina cynosuroides* blooms in early August along the Massachusetts coast, towering over common cattail, *Typha latifolia*.

RIGHT Three views follow seasonal progression of salt-hay, *Spartina patens*, in the salt marsh at Robert's Cove on Cape Cod, Massachusetts. TOP *Spartina patens* blooms in August. CENTER Cinnamon-brown in December, *Spartina patens* forms characteristic cowlicks. BOTTOM *Spartina patens* is visible through December snow.



ing, and bedding, and plants are still cut to a lesser extent for use as mulch. Narrow-leaved, fine-textured, and relatively low growing, rarely more than 3 feet (90 cm) in height when blooming, this species is easily distinguished from other cordgrasses in its range. The leaves are typically blue-green in early season, turning yellow-green toward the end of summer and then cinnamon-brown over winter. Strongly rhizomatous, growing in extensive masses. Blooms from early summer into early autumn, with narrow, one-sided inflorescences held above the foliage on slender stalks. The fine foliage and flowering stems are typically flattened by winds and tides, and by mid summer have become a continuous low mat with characteristic curls resembling cowlicks. Propagate by seed or division. Zone 3.

Spartina pectinata Link

Prairie cordgrass

This North American species is native to freshwater marshes and wet prairies from Newfoundland and Quebec to Alberta and Washington, and south to North Carolina and Texas. The common name points to its prevalence in the prairie states.

Spreads strongly by rhizomes, sometimes creating extensive masses. Leaves are typically deep green and glossy, to $\frac{5}{8}$ inch (15 mm) wide. The stems are mostly upright, to 7 feet (2.1 m) tall when blooming in mid summer, often becoming lax with the weight of developing seedheads. Grows best in full sun. Tolerant of waterlogged soils and suitable for edges of aquatic gardens, but also grows well on soils of average moisture. Drought-tolerant once established. Propagate by seed or division. Zone 3.

'*Aureomarginata*' ('*Variegata*'). Differs from the species in having bright yellow variegated leaf margins. Propagate by division.

TOP LEFT Running by rhizomes, *Spartina pectinata* 'Aureomarginata' forms a dense patch at Merriments Gardens in East Sussex, England, in late July.

BOTTOM *Spartina pectinata* 'Aureomarginata' leaf margins are neatly gold-variegated.

BELOW *Spartina pectinata* 'Aureomarginata' inflorescences tower above an assemblage of marginal plants in an aquatic display at Longwood Gardens in late September.



Spodiopogon R. BrownGrass family, *Poaceae*

Graybeard grass

From the Greek *spodios*, ashen or gray, and *pogon*, beard, referring to the gray hairs associated with the spikelets that impart a grayish color to the inflorescences. Includes 10 mostly perennial species native to open grassland habitats primarily in temperate and subtropical Asia. Only the following species is common in cultivation.

Spodiopogon sibiricus Trinius

Spodiopogon, Siberian graybeard, o-abura-suzuki

Native to open, grassy mountain habitats in Japan, Korea, Manchuria, China, and also Siberia, where it frequently occurs in forest glades and among shrubs. Clump-forming and



TOP LEFT *Spodiopogon sibiricus* growing in full sun turns rich burgundy-red in early October in Pennsylvania. BOTTOM *Spodiopogon sibiricus* 'West Lake' flower color is accentuated by nearby plantings of Joe-pye-weed, *Eupatorium fistulosum* (center right), and the shorter-flowered purple coneflower, *Echinacea purpurea*, in late August at the Sichtungs-

garten (study garden) in Weihe-
stephan, Germany.

TOP RIGHT Typically rounded in form, *Spodiopogon sibiricus* blooms in the Friendship Island garden in Potsdam, Germany, in late August. ABOVE *Spodiopogon sibiricus* 'West Lake' at the Ega Exhibition Park in Erfurt, Germany, in late August.

upright, with a neatly rounded form. Grows 4 to 5 feet (1.2–1.5 m) tall when blooming in early to mid summer. The erect terminal panicles are typically buff colored, but are covered with innumerable fine hairs that readily catch sunlight. Recent introduction of material of Chinese origin has produced plants with pronounced red pigment in the inflorescences. The bright green leaves are relatively broad, to $\frac{5}{8}$ inch (15 mm) in width, and are held nearly horizontally, reminiscent of bamboo. Fall color is often unremarkable, but plants grown in sun will in some years turn rich red and burgundy. Grows well in full sun in cooler climates such as northern Europe. In warmer climates it is better placed in light shade or provided regular moisture. Tolerant of fairly dense deciduous shade but the form will be looser. Of easy culture on a wide range of soil types. Durable and long-lived. Can be effective singly or in sweeps. Propagate by seed or division. Zone 4.

'West Lake'. Inflorescences strongly colored red-pink. From material collected in China by Roy Lancaster, introduced in cooperation with Hans Simon.

Sporobolus R. Brown

Grass family, *Poaceae*

Dropseed

Includes more than 160 annual and perennial species of cosmopolitan distribution in tropical, subtropical, and temperate regions, occurring in a diversity of habitats but most frequently in open savannahs. The perennial species are mostly clump-forming and are warm-season growers.

Sporobolus airoides (Torrey) Torrey

Alkali sacaton, alkali dropseed

Native to open, grassy habitats, especially on alkaline soils, from South Dakota and Missouri west to eastern Washington south to California, Texas, and Mexico. Clump-forming, with gray-green leaves to $\frac{1}{4}$ inch (6 mm) wide, forming a loose flowing mound to 1 foot (30 cm) high. Usually blooms early to mid summer, with open-branched panicles held well above the foliage on nearly upright stalks, to 4 feet (1.2 m) in height. The inflorescences open with a strong pink-red cast, drying to light beige. Deep-rooted, durable, and drought-tolerant. Easy to grow on a wide range of soils from sand to clay. Does well in alkaline conditions. Best propagated by seed. Zone 4.

TOP *Sporobolus airoides* in late June at the Santa Barbara Botanic Garden in California. BOTTOM *Sporobolus heterolepis* at the sunny edge in front of cutleaf

sumac, *Rhus typhina* 'Laciniata', in late May at the Delaware Center for Horticulture in Wilmington.



Sporobolus heterolepis (A. Gray) A. Gray

Prairie dropseed

Native to North American prairies, from Quebec to Saskatchewan south to Connecticut, eastern Texas, and Colorado. The most elegant and refined of the prairie grasses, with thread-like leaves just over $\frac{1}{16}$ inch (less than 2 mm) wide, producing a dense, flowing fine-textured mound to 15 inches (37 cm) high. The foliage is glossy, medium green in summer, reliably turning deep orange in autumn before fading to its light copper winter color. In August or September, fragile open panicles are held high above the foliage on very slender stalks, to 30 inches (75 cm) high, and are conspicuously attractive when illuminated by the sun. Most unusually, they are strongly fragrant. The fragrance has been called delicate, sweet or pungent, and has been described as evoking crushed cilantro (coriander leaves) or slightly burnt buttered popcorn. The scent of a large group of flowering plants can be detected from a distance of many yards.

Prairie dropseed is relatively slow-growing, requiring a few years to attain mature size, but it is worth the wait. This trouble-free grass can live for decades without any center die-back or need for renewal.

Of easy culture on a wide range of soil types in full sun or light shade. Grows fullest on moist fertile soil but is deep-rooted and extremely drought tolerant once established. Durable enough to be used for large-scale groundcover purposes. Refined enough to fit into a formal garden, but also a natural choice for prairie and meadow gardens. Best propagated by seed since mature clumps are very dense and difficult to divide. Zone 3.

'Tara'. Compact, less than 2 feet (60 cm) tall when blooming in mid August. Foliage is stiffer than typical, more vertical, as are the flowering stems. Good orange-red fall color. A selection from Roy Diblik and Northwind Perennial Farm of Wisconsin.

'Wisconsin'. Selected for reliable bloom in Europe, by Germany nurseryman Hans Simon, from material of Wisconsin provenance supplied by Prairie Nursery.

Sporobolus wrightii Munro ex Scribner

Sacaton, giant sacaton

Native from southeastern Arizona east to western Texas and Oklahoma, and south to northern Mexico, occurring most often in semidesert habitats but also in moister situations on floodplains and around desert lakes and marshes. Dramatically larger and more sculptural in quality than prairie dropseed, growing 5 to 8 feet (1.5–2.4 m) tall when blooming in early to mid summer. Foliage is light gray-green, the leaves up to $\frac{3}{8}$ inch (9 mm) wide. The inflorescences are not colorful, but are architecturally interesting, and typically remain



TOP *Sporobolus heterolepis* blooms in early September in the author's Pennsylvania garden.
BOTTOM *Sporobolus heterol-*

epis turns deep orange in early October at the Chicago Botanic Garden in Illinois. Photo © C. Colston Burrell.



intact well into winter. Prefers full sun and well-drained soil. Very drought tolerant and fairly salt tolerant. Propagate by seed or division. Zone 5.

Stenotaphrum Trinius

Grass family, *Poaceae*

Includes seven annual and perennial, mostly stoloniferous species native to open, sunny, primarily coastal habitats in New and Old World tropics. Only the following species is commonly cultivated.

Stenotaphrum secundatum (Walter) Kuntze

Saint Augustine grass

Widely planted for turf in warm regions, this stoloniferous grass is of tropical origin and is widely naturalized in many parts of the world. It is documented as occurring in the southeastern United States prior to 1800, but these plants may have been introduced through human activity. The species is easily rooted from stem cuttings. The following variegated variety is often grown in hanging baskets or other containers, treated as a summer annual in cold climates. Brazilian landscape architect Roberto Burle Marx used it for landscape effect, created huge undulating sweeps of the variegated form alternating with the green form. Zone 9.

‘*Variegatum*’. Leaves longitudinally striped cream-white.

Stipa Linnaeus

Grass family, *Poaceae*

Needle grass, spear grass, feather grass

This genus was once very broadly defined and included many dissimilar grasses. Modern taxonomic research supports a narrower definition of *Stipa*, and many species have been reclassified in other genera including *Achnatherum*, *Anemathetele*, *Austrostipa*, *Hesperostipa*, *Jarava*, and *Nassella*. Up to 50 species remain in *Stipa*. All are clump-forming, cool-season perennials native to open, sunny, typically dry habitats in temperate and subtropical parts of Eurasia and Africa. They typically form a low mound of basal foliage from which upright flowering stalks arise in early to mid summer. Needle grasses are distinct for their characteristically long awns, which may be 12 inches (30 cm) or more in length. The awns may be straight or twisted, and are sometimes fringed with minute hairs. They play marvelously in the wind and sun, imparting a unique beauty that often lasts through summer and autumn. As a group *Stipa* species prefer full sun, well-drained soils, and low humidity. Best propagated by seed.



TOP *Sporobolus wrightii* blooms in mid July at Plant Delights Nursery in Raleigh, North Carolina.

BOTTOM LEFT *Sporobolus wrightii*, flowering detail.
RIGHT *Sporobolus wrightii* is still mostly intact in late February in Abiquiu, New Mexico

Stipa barbata Desfontaines

Feather grass

Native to southern Europe and northern Africa. Basal foliage less than 10 inches (25 cm) high, topped by slender, upright-arching flowering stems to 30 inches (75 cm) tall in mid summer. The awns, to 8 inches (20 cm) long, are fringed most of their length with fine hairs and are extraordinarily luminous when sunlit. The awns are supple, undulating with summer breezes in a way that evokes underwater movement. Requires full sun, dry conditions, and well-drained soil. Zone 7.

Stipa capillata Linnaeus

Needle grass

Native to central and southern Europe, India, and eastern Asia. Basal foliage less than 14 inches (35 cm) high, topped by slender, upright-divergent flowering stems to 35 inches (88 cm) tall in early to mid summer. The awns are relatively firm and needlelike, 4 to 6 inches (10–15 cm) long and without hairs. They are spirally twisted near the base and sometimes curl toward the tips in the latter part of the growing season. Zone 7.

Stipa gigantea Link[*Macrochloa arenaria* (Brotero) Kunth]

Giant feather grass, giant-oat

Native to southwestern Europe and northern Africa, this is the largest and most spectacular of the *Stipa* species and is among the most elegant and stately of all grasses. Forms a relatively dense mound of fine-textured basal foliage to 2 feet (60 cm) high, with gray-green leaves $\frac{1}{8}$ inch (3 mm) wide. The foliage is evergreen in mild climates. Blooms from early to mid summer, the loose, open panicles held high above the foliage on sturdy stems to 8 feet (2.4 m) tall. The spikelets are golden, with straight awns to 5 inches (13 cm) long. The inflorescences are especially radiant when lit by the summer sun even after the long-awned seeds have been shed. Superb for cut or dried arrangements. Like many of the Old World feather grasses and needle grasses, this species is at its best in England, northern Europe, and the U.S. Pacific Northwest, but can be grown satisfactorily in areas with hot, humid summers if provided a sunny site and very well-drained soil. It cannot withstand waterlogged conditions, especially during winter. Zone 5.

TOP Long, plumose awns of *Stipa barbata* respond to late July breezes, fronted by purple-flowered *Allium sphaerocephalum* in Beth Chatto's unirrigated gravel garden in Colchester, England.

BOTTOM *Stipa capillata* is resplendent in afternoon sunlight at the Westpark in Munich, Germany, in late August.







'Gold Fontäne' (gold fountain). A clonal selection by German nurseryman Ernst Pagels, with reliably large, golden inflorescences. Propagate by division.

Stipa grandis P. Smirnov

Needle grass

Native to Siberia, China, and Mongolia. Narrowly upright, 2 to 3½ feet (60 to 105 cm) tall when blooming in early to mid summer. The awns are 5 to 10 inches (13–25 cm) long, spirally twisted at the base, and typically curling toward the tips. Zone 5.

Stipa lessingiana Trinius & Ruprecht

Needle grass

This Eurasian native grows upright, 2 to 4 feet (60–120 cm) tall when blooming in mid summer. The green foliage is nearly as long as the flowering stems. The awns are relatively short, less than 1 inch (2.5 cm) in length, and are often twisted at the base so that they extend nearly at right angles from the narrowly constricted inflorescences. Zone 6.



OPPOSITE TOP LEFT Upright-flowering stalks of *Stipa gigantea* tower above the basal foliage in late August at the Royal Horticultural Society's garden, Wisley, in Surrey, England. RIGHT *Stipa gigantea* inflorescence detail in late August after the seeds have been shed.

OPPOSITE BOTTOM LEFT The stately, arching form of *Stipa gigantea* is revealed in this composition in Beth Chatto's gravel garden in Colchester, England, in late July. RIGHT *Stipa gigantea* inflorescences are lit by the sun against background shadow at the Royal Botanic Gardens, Kew, in England in late July.

TOP LEFT Glowing gold in the late afternoon sunlight, *Stipa gigantea* is an enticement to continue down this path at Gravetye Manor in West Sussex, England, in late July. BOTTOM LEFT The forms and textures of *Stipa gigantea* and yellow-flowered *Verbascum* hybrids play against the

manor house at Great Dixter in Northiam, England, in late July. CENTER *Stipa grandis* in late July at Beth Chatto's garden in Colchester, England. RIGHT *Stipa lessingiana* in mid July at the Royal Horticultural Society's garden, Wisley, in Surrey, England.

Stipa pennata Linnaeus

European feather grass

Native to Europe, temperate Asia, and northern Africa.

Forms a basal mound of narrow, green or gray-green foliage to 12 inches (30 cm) high. Blooms in mid summer, the inflorescences to 2 feet (60 cm) high on upright stalks. Awns up to 10 inches (25 cm) long, fringed with fine hairs. Zone 6.

Stipa pulcherrima K. Koch

European feather grass

Native to Europe, temperate Asia, and northern Africa. Similar to *Stipa barbata* and sometimes confused with it in commerce, especially *S. pulcherrima* f. *nudicostata* Martinovský, which has extraordinary awns 12 inches (30 cm) or more in length and fringed with fine hairs. Zone 7.***Stipa tenacissima*** Linnaeus

Esparto grass

This coarse western Mediterranean native has historically been grown for fiber and papermaking, and is occasionally cultivated as an ornamental. It grows 4 to 6 feet (1.2–1.8 m) tall when flowering in summer. The narrow inflorescences are held high above the green basal foliage on slender, mostly leafless stalks. The awns are approximately 3 inches (8 cm) long and without any hairs. The name is sometimes confused

LEFT *Stipa pulcherrima* in late August, after the long-awned seeds have been shed, at the Hof Botanical Garden in Germany.

the Hof Botanical Garden in late August, seeds of *Stipa pulcherrima* have plumose awns fringed with fine hairs.

RIGHT Gathered from plants at

with *Stipa tenuissima*, the old name for the widely cultivated, fine-textured species now known as *Nassella tenuissima*.

Thamnochortus P. J. BergiusRestio family, *Restionaceae*

Thatching reed

Comprises approximately 31 dioecious evergreen species native to the southwestern and eastern Cape and Namaqualand in South Africa. They are part of the fynbos plant community, which is characterized by natural burning, and occur on well-drained soils relatively low in fertility. All are cool-season growers, most active in spring and autumn. New growth is produced after winter rains. Some species have simple, unbranched stems, and others have sterile branches clustered at the nodes. Many species are quite beautiful and are increasingly available commercially due to improved methods of seed germination using smoke treatment. Plants are difficult to divide, since the roots do not like to be disturbed. They resent high fertility. Best planted when moisture is available in late winter or early spring, or in autumn in Mediterranean climates. When grown in the ground, they do best sited where there is good air movement. They also make fine container subjects in areas beyond their winter cold hardiness.

Thamnochortus cinereus H. P. Linder[*Thamnochortus argenteus* Pillans]

Silver thatching reed

Native to the southern Cape of South Africa, from Malmesbury to Willowmore and Humansdorp. Upright and clump-forming, more than 5 feet (1.5 m) tall, with threadlike sterile branches clustered at nodes, and large velvety-pubescent



inflorescences arching at the tops of stems. An exceptionally beautiful species deserving more attention. Zone 8.

Thamnochortus insignis Masters

Thatching reed, dekriet

Native along the South African coast between Cape Agulhas and Albertinia, mostly on sandy, limestone-derived soils. Clump-forming, to 6 feet (1.8 m) tall, stems unbranched,

with relatively inconspicuous inflorescences clustered at the tops of stems. Upright and stately, this species was most commonly used in thatching of traditional Cape Dutch houses in South Africa. With a renewed interest in traditional architecture, the thatching industry is again thriving, and dekriet-harvesting areas are being developed and managed. This is one of the more readily available restios and is of relatively easy culture in full sun on well-drained soil. Zone 8.



TOP LEFT *Thamnochortus cinereus* grows 5 feet (1.5 m) tall in mid September (early spring) in the Cape region of South Africa. BOTTOM *Thamnochortus insignis* in early April at Leaning Pine Arboretum in San Luis Obispo, California.

ABOVE *Thamnochortus insignis* in mid August (late winter) at the Kirstenbosch National Botanical Garden in Cape Town, South Africa.



TOP *Thamnochortus lucens* in early April at the University of California Botanical Garden, Berkeley.

BOTTOM An early September (late winter) view of *Themeda australis* planted in large block patterns at the Royal Botanic Gardens, Melbourne, in Australia.

Thamnochortus lucens Poiret

[*Thamnochortus dichotomus* Pillans]

Native to the South African Cape region, from Malmesbury and Ceres to Riversdale. One of the smaller species, generally less than 3 feet (90 cm) tall, with unbranched stems that are erect or arching. Zone 8.

Themeda Forsskål

Grass family, *Poaceae*

Includes annual and perennial species native to open savannas in Africa, eastern Asia, and Australia. The classification of the most commonly cultivated species is in flux, with increasing consensus for treating *Themeda triandra* broadly to include *T. australis* and *T. japonica*. Whether one species or three, these clump-forming warm-season perennial grasses are quite variable in size, foliage color, and cold hardiness. Though the flowers are relatively subtle, the drought tolerance, durability, and architectural form of these grasses makes them worthy of attention in gardens and other regional landscapes.

Themeda australis (R. Brown) Stapf

Kangaroo grass

Native over most of Australia and also New Guinea. It was once the dominant grass on the western basalt plains of Victoria and has become popular in Australian gardens, particularly for the blue forms that are somewhat prevalent in Australian populations. Forms a dense tussock 3 to 5 feet (90–150 cm) tall with upright-arching stems. The foliage typically turns golden bronze in autumn. Produces little viable seed, but can be easily propagated by division. Zone 6, probably colder.

'Mingo'. Foliage strongly glaucous gray-blue.

Themeda japonica (Willdenow) C. Tanaka

[*Themeda triandra* var. *japonica* (Willdenow) Makino]

Themeda, Japanese themeda, megarukaya

Native to lowlands and low mountains in Japan from Honshu south to Kyushu, also Korea, Manchuria, China, and India. Often overlooked because it lacks obvious flowers, Japanese themeda possesses a unique sculptural form and is an intriguing addition to gardens and other managed landscapes. Strictly clumping, with leafy stems radiating from the base to create a broad fountain of foliage to 5 feet (1.5 m) tall. The leaves are ¼ inch (6 mm) wide and bright green in summer, turning rich golden orange by early November. Over winter the leaves are light copper-brown and the stems golden yellow. Blooms in late summer, the flowers clustered along the upper portions of the stems and relatively insignificant. This warm-season grass begins growing late in spring, continu-

ing strongly during summer heat and humidity. Easy to grow on a broad range of soils and extremely drought tolerant once established. Effective singly or in massed plantings, this reliably long-lived, uniquely attractive grass deserves to be better known. Propagate by seed, or by division in spring. Zone 4.

Themeda triandra Forsskål

Red grass

Native to savannahs and other open, sunny grasslands in southern Africa where it is an important grazing species and is becoming more popular as a garden plant. Foliage is typically green to glaucous blue-green, turning orange-red in autumn. Plants from higher-altitude populations sometimes have foliage strongly suffused with purple, which becomes more pronounced in autumn. Zone 7, probably colder.



Thysanolaena Nees

Grass family, *Poaceae*

Tiger grass, Asian broom grass

This genus includes only one species, the name of which has been changed from *Thysanolaena maxima* to *T. latifolia*.

Thysanolaena latifolia (Roxburgh ex Hornemann) Honda

[*Thysanolaena maxima* (Roxburgh) Kuntze]

Tiger grass, Asian broom grass

Native to China, Japan, Taiwan, India, Nepal, Sri Lanka, Thailand, and Malaysia, typically in open habitats, often in mountains. This huge clump-forming grass grows 10 to 12 feet (3–3.7 m) tall, with stout upright-arching stems topped by large terminal panicles. The evergreen leaves are deep, glossy green and nearly 3 inches (8 cm) wide and tapering to narrow points. Though not native to Brazil, this distinctive



LEFT *Themeda japonica* foliage changes color from bright green to golden orange in autumn in the Bluemel garden in Fallston, Maryland. TOP *Themeda japonica* in mid August.

BOTTOM *Themeda japonica* in early November.

ABOVE *Thysanolaena latifolia* in late February (late summer) in Brazil.



tropical grass was a favorite of Brazilian landscape architect Roberto Burle Marx, who valued it for its bold texture and graceful plumes. A true tropical, it is winter hardy only in warm climates, but makes a fine greenhouse or conservatory plant, or can be grown in a large container for seasonal display outdoors in colder regions. Prefers light shade or sun with regular moisture. Propagate by seed or division. Zone 9.

Tridens Roemer & Schultes

Grass family, *Poaceae*

Comprises 14 warm-season perennial species native to meadows, plains, and open woodlands and woodland edges from the eastern United States south to Mexico.

Tridens flavus (Linnaeus) Hitchcock

[*Triodia flava* (Linnaeus) Smyth]

Purpletop, tall redtop

Best known for the purple top it puts on eastern meadows and old fields in late summer, this common species is native to meadows, fields, and woodland borders and openings from New Hampshire to Minnesota and Nebraska south to Florida and Texas. Upright and clump-forming to 4 feet (1.2 m) tall when blooming from August to September. The foliage is relatively coarse-textured, with medium-green leaves to 5/8 inch (15 mm) wide, but the open-branched flower panicles are

LEFT The flowing form of *Thysanolaena latifolia* accompanies cascading water in a fountain designed by Roberto Burle Marx for the Clemente Gomes garden in Fazenda Vargem Grande near Areias, Brazil. Miniature papyrus, *Cyperus prolifer* (at lower left), grows in the pool.

is metallic red-purple in late August in Pennsylvania. CENTER After standing through the entire Pennsylvania winter, a delicate panicle of *Tridens flavus* is festooned with morning frost in late March. RIGHT Feathery pink stigmas of female spikelets in the lower portion of this *Tripisacum dactyloides* inflorescence are readily visible in early July in Delaware.

BELOW LEFT The graceful inflorescence of *Tridens flavus*





delicate and graceful. They open metallic red-purple, drying to silvery buff color, and standing tall above the foliage and through winter snows, usually lasting into the following spring. They make attractive cut flowers. The foliage is tinted bronze-purple in autumn before going fully deciduous. Self-sows readily and is often one of the first grasses noticed when a field or turf is left unmown for a few years. Ideal for naturalizing in full sun or light shade. Prefers average to moist soil. Propagate by seed or division. Zone 4.

Tripsacum Linnaeus

Grass family, *Poaceae*

Includes 12 perennial species native to open woodlands and sunny, moist edges from North America into South America. All are clump-forming, warm-season growers. The inflorescences are terminal or sometimes axillary, all with the male flower spikelets located at the upper end and female spikelets nearest the base.

Tripsacum dactyloides (Linnaeus) Linnaeus

Eastern gama grass

Native to wet swales, streambanks, and other moist places from Massachusetts west to Michigan, Iowa, and Nebraska, and south to Florida and Texas. A large, coarse-textured mostly clump-forming grass that can reach 8 feet (2.4 m) in height when blooming in mid to late summer. The basal foliage grows 3 to 4 feet (90–120 cm) high. The leaves are gray-green, to 1½ inches (3 cm) wide with a prominent midrib. The terminal inflorescences are narrowly cylindrical. The female spikelets in the lower portion produce conspicuous, feathery pink-red stigmas. The anthers of the male flowers are also sometimes deep red in color. Easily grown in full sun or light shade and most soils. Tolerant of waterlogged soil but also fairly drought tolerant. Propagate by seed or division. Use caution when handling the plant as the leaf margins are quite sharp and can cause razorlike cuts. Zone 5.

Tripsacum floridanum Porter ex Vasey

Florida gama grass, mock gama grass, dwarf fakahatchee grass

Native to rocky pinelands in southern Florida, this species is similar to eastern gama grass, *Tripsacum dactyloides*, but smaller in all respects. It is much finer textured with gray-green leaves approximately ⅛ inch (3 mm) wide. It forms a clump of mounded foliage 12 to 18 inches (30–45 cm) high,



TOP *Tripsacum dactyloides* blooms in late August at the Berggarten in Hanover, Germany.

BOTTOM *Tripsacum floridanum* grows in nearly pure sand at McKee Botanical Garden in Vero Beach, Florida, in mid February.



overtopped by narrow inflorescences on slender, upright stalks. Prefers full sun. Very drought tolerant. Zone 8, possibly colder.

Typha Linnaeus

Cattail family, *Typhaceae*

Cattail, reedmace, bulrush

Typha is the only genus in the cattail family and comprises up to 15 warm-season species native to marshes and other wetland habitats throughout the world's temperate and tropical regions. Cattails have proved well adapted to the modern environment, capable of growing almost anywhere there is moist soil and sun, including drainage ditches and other low places in urban and suburban environments. Tolerant of saline conditions and of relatively polluted waters, cattails spread by rhizomes and are capable of forming extensive colonies that are important to the cleansing and nutrient cycles of wetland habitats. They also provide important cover for wildlife. Green or gray-green in summer, the thick, flat leaves arise vertically from the rhizomes and often turn gold in fall. The familiar flower spikes have tiny female flowers in the lower section and males at the top, sometimes separated by a sterile section. The female section begins green-colored, maturing to various shades of brown depending upon the species. Cattails vary considerably in size, and the larger ones are too vigorous in their spread for small landscapes. They are capable of quickly dominating a small pond if uncon-

LEFT Male and female segments of the inflorescences of narrow-leaved cattail, *Typha angustifolia*, are separated by a sterile, naked section, as evident in this mid-June image of plants in local habitat in Delaware.

RIGHT *Typha angustifolia* is still standing after a late-March snowstorm in Bloomfield Hills, Michigan.

trolled. The smaller species are easily managed, and all are adaptable to cultivation in tubs or other containers, which is the simplest way to contain their spread. Cattails are best propagated by division, but they may also be grown from seed.

Typha angustifolia Linnaeus

Narrow-leaved cattail, narrow-leaved reedmace, lesser bulrush

A nearly cosmopolitan species, occurring over much of North and South America and Eurasia. Flowering stems to 6 feet (1.8 m) tall. Male and female segments of the inflorescence are separated by a sterile, naked section. Mature female spikes are red-brown to dark brown and up to 5/8 inch (15 mm) in diameter. Generally more slender and graceful than common cattail, *Typha latifolia*, though intermediate hybrids known as *T. xglauca* Godron occur with some frequency. These hybrids are mostly seed-sterile, but can form large colonies by vegetative spread. Zone 3.

Typha domingensis (Persoon) Steudel

Southern cattail

A pantropical species with a more southern distribution than *Typha angustifolia* or *T. latifolia*, extending north in North America to Delaware on the Atlantic coast and Nebraska inland. Similar to *T. angustifolia* but taller, capable of reaching 12 feet (3.7 m) in height, with leaves thicker and more numerous. Male and female segments of the inflorescence are separated by a sterile, naked section. Zone 5.

Typha latifolia Linnaeus

Common cattail, broad-leaved cattail, great reedmace, bulrush

A truly cosmopolitan species, most prevalent in the Northern Hemisphere but occurring in Africa and South America, it is the most commonly encountered species in North America. Flowering stems to 10 feet (3 m) tall. Male and female segments of the inflorescence are continuous, without a sterile section. Mature female spikes are brown to blackish brown and up to 1 3/8 inches (35 mm) in diameter. Zone 3.



ABOVE *Typha latifolia* leaves are glaucous blue-green and maturing seedheads are dark brown in late August at the Berggarten in Hanover, Germany.

TOP RIGHT Graceful lines of *Typha latifolia* are reflected in a pond at the Berggarten in late August. BOTTOM *Typha latifolia* glows golden in late-October sunlight in eastern Pennsylvania.





'*Variegata*'. Leaves longitudinally striped cream-white. Much less vigorous and less cold hardy than the species. Foliage is best in light shade. A superb container specimen. Zone 5.

Typha laxmannii Lepechin

Narrow-leaved European cattail

Native to Europe and eastern Asia, this species is narrow-leaved like *Typha angustifolia*, but much smaller in all its parts and less vigorous. It typically grows 4 to 5 feet (1.2–1.5 m) tall. Male and female segments of the inflorescence are separated by a sterile, naked section. Much more easily contained than the larger species, and popular in small pools, ponds, and other water garden spaces for this reason. Zone 4.

Typha minima Funck ex Hoppe

Miniature cat-tail, miniature reedmace

This Eurasian species truly is miniature, generally only 2 to 2½ feet (60–75 cm) tall in flower. The mature female spikes are brown or red-brown and very shortly cylindrical to nearly round, to 2 inches (5 cm) long and approximately 1¼ inches (32 mm) in diameter. The male and female segments of the inflorescence are separated by a sterile, naked section. Ideal for small ponds, pools, and containers. Zone 5.

LEFT *Typha latifolia* 'Variegata' in mid August at Barry Yinger's garden in Pennsylvania.

a small pond garden in Suhl, Germany, in late August. RIGHT *Typha laxmannii*, inflorescence detail, in late August in Germany.

BELOW LEFT *Typha laxmannii* provides a vertical accent in





Uncinia Persoon

Sedge family, *Cyperaceae*

Hook sedge

The genus name is derived from the Latin *uncinatus*, hooked, referring to a tiny hooklike structure attached to each seed which aids in dispersal. Includes between 40 and 50 tufted or rhizomatous perennial species mostly occurring in the Southern Hemisphere. They are concentrated in Australasia but extend to New Guinea and South and Central America. They are absent in Africa. Nearly all the hook sedges in cultivation are endemic to New Zealand. Closely related to and often superficially similar to *Carex*, they are low-growing plants prized for their fine-textured, colorful, evergreen foliage, which ranges from medium green to bronze, orange, or dark red. Leaf color can be extremely variable between seedlings of the same species, and for this reason it is difficult to identify plants based upon foliage color alone. The color is also typically most pronounced during the winter months. A plant that is orange-red in summer may turn deep burgundy as cool weather arrives. *Uncinia* inflorescences are narrow, held out from the foliage on slender stalks, and visually insignificant. Evolved in New Zealand's cool climate and in generally moist habitats, hook sedges thrive when grown in places such as England or the U.S. Pacific Northwest. They can be grown in places with warm, humid summers and icy winters, but require well-drained soils and some protection from heat and humidity. They make superb container subjects. Easily propagated by seed or division.



TOP LEFT *Typha minima* in mid May in Dale Hendricks's garden in Pennsylvania. RIGHT Detail of *Typha minima* in mid May.

ABOVE *Uncinia egmontiana* in full sun in early April at Berkeley Horticultural Nursery in Berkeley, California.

Uncinia egmontiana Hamlin

Hook sedge

Native to tussock grasslands, scrub, or bogs on New Zealand's North and South Islands at elevations to 4000 feet (1200 m). The species was described from plants growing near the vol-



TOP A young potted plant of *Uncinia uncinata* in Cole Burrell's Virginia garden in mid October.



BOTTOM *Uncinia rubra* growing in a pot in a greenhouse at Longwood Gardens in mid March.

cano Taranaki, which is also known as Mount Egmont, on the North Island. Grows 10 to 16 inches (25–40 cm) high, with narrow foliage that is most often orange or dull red but may be bronze-green. The winter color is often deep orange-red and for this reason plants in commerce are often mislabeled as *Uncinia rubra*. Zone 8.

Uncinia rubra Boott

Red hook sedge

Native to grasslands, open scrub, and bogs from near sea level to 4600 feet (1400 m) elevation on New Zealand's North and South Islands. Typically smaller than *Uncinia egmontiana*, growing 6 to 12 inches (15–30 cm) high, and almost always with very narrow, red or bronze-red foliage. The red coloration is most pronounced in sun and during winter. Plants grown in shade may be greenish. Zone 8.

Uncinia uncinata (Linnaeus f.) Kükenthal

Hook sedge

Native to New Zealand's North, South, Stewart, Chatham, and Auckland Islands, typically in forest and scrub habitats but occasionally in bogs, from sea level to 3000 feet (900 m) elevation. Larger and more robust than *Uncinia rubra*, capable of growing more than 2 feet (60 cm) tall. Foliage color varies from rich green when grown in shade to deep red in sun. Young, red-leaved plants are sometimes mistaken for *U. rubra*; however, the leaves of *U. uncinata* are typically much wider. Zone 8.

Uniola Linnaeus

Grass family, *Poaceae*

Sea-oats

Includes two perennial species native to sand dunes and flats along the North American Atlantic and Gulf coasts, to the Bahamas and Cuba, and south from Mexico to Ecuador along the Pacific Coast. The common name is appropriate, recognizing the oatlike appearance of the flower spikelets and the intimate association these grasses have with the sea. At one time this genus was more broadly interpreted to include grasses now classified in *Chasmanthium*. The common name sea-oats persists in commerce for *C. latifolium* (formerly *Uniola latifolia*), but is misleading since this is an inland species having nothing to do with the sea. *Uniola* species are warm-season growers that play important roles in dune stabilization.

Uniola paniculata Linnaeus

Sea-oats

This rhizomatous grass is native primarily to sand dunes and flats along the North American Atlantic and Gulf coasts and barrier islands, but also occurs in Cuba and the Bahamas, and extends south to Mexico. It is important to dune habi-

tats for stabilization and for its seeds, which are consumed by many bird species. Produces a loose mound of gray-green basal foliage from which upright flowering stems arise in summer, to 5 feet (1.5 m) tall. The oatlike spikelets often persist through much of winter. Once common, sea-oats is now threatened or endangered along much of the Atlantic coast due to habitat destruction and disturbance by human activity including the use of off-road vehicles. It is often deliberately planted for stabilization and is pretty enough to be included in coastal gardens, where it may be viewed silhouetted against the sea, moving to ocean breezes. It is typically propagated by seed, though germination rates are low. Seed can be difficult to obtain due to endangered status. Very salt tolerant. Zone 7.

Vetiveria Bory

Grass family, *Poaceae*

Vetiver

Includes 10 perennial, warm-season species native to floodplains and streambanks in Old World tropics. The following species has been used in medicines and perfumes since prehistoric times and is occasionally grown for ornament.

Vetiveria zizanioides (Linnaeus) Nash

Vetiver, khus khus

This East Indian native has been cultivated for centuries for the aromatic oils concentrated in its stout rhizomes, and is now widely naturalized in tropical America. Upright, to 8 feet (2.4 m) tall in bloom, with narrow panicles produced in late summer only in warm climates. The leaves are bright green and nearly vertical but are characteristically bent backwards near their tips. This grass is architecturally interesting for its foliage alone. In addition to the production of medicines and perfumes, vetiver has traditionally been used to make baskets and screens that are fragrant when wetted. It has also been planted for erosion control and for landscape screening in tropical climates. It is not cold hardy in temperate zones, but makes a striking container specimen that can be set outdoors during the growing season and held over winter in a greenhouse. Plants grown this way never bloom, but the foliage often takes on attractive bronze-purple tones in autumn. Propagate by division. Zone 9.

TOP LEFT *Uniola paniculata* moves to late-February ocean breezes along the Florida coast. RIGHT Dry and light buff-colored in mid February, the oatlike spikelets of *Uniola paniculata* are set against the gray-

green and olive hues of coastal scrub along the Florida coast.

BOTTOM *Vetiveria zizanioides* in mid August at Longwood Gardens in Pennsylvania.





TOP Visible from the southern section of the New Jersey turnpike, *Zizania aquatica* blooms in huge sweeps in late July.

BOTTOM *Zizania aquatica* blooms 9 feet (2.7 m) tall along a Delaware waterway in early August.

Zizania Linnaeus

Grass family, *Poaceae*

Wild rice, water rice

Comprises four annual and perennial species native to marshes and shallow water in North America and eastern Asia. All bloom in summer with open-branched, terminal panicles having male flowers in the lower portion and females above. Though only distantly related to common cultivated rice, *Oryza sativa*, the *Zizania* species do produce edible grains.

Zizania aquatica Linnaeus

Annual wild rice, wild rice, Canada wild rice, water rice
Native to freshwater and brackish marshes and the borders of streams and ponds from southern Quebec and Maine west to Illinois and south mostly in the coastal states to Florida and Louisiana. This annual species is the primary source of edible wild rice. It costs more than common rice due to the labor involved in harvesting. Wild rice was traditionally harvested by early North American peoples who bent and shook the tall stems so that the rice dropped into their canoes. Modern commercial production still often employs similar methods though plants are also cultivated in paddies. The grains are eaten by a variety of waterfowl, and this grass is sometimes planted for this reason in refuges and game preserves. Wild rice flowers from mid summer into fall, producing graceful airy panicles to 9 feet (2.7 m) tall. The lower male spikelets have conspicuous yellow pollen sacs. The grains are produced by the upper female spikelets. Suited to naturalizing in wet areas, annual wild rice is also a stately addition to water gardens. Plants may be set out in spring from seedlings started indoors. Zone 3.



RIGHT Bright yellow pollen sacs of male spikelets in the lower portion of this *Zizania aquatica* are visible in late July. A few long-awned female spikelets are visible above, and these will produce the wild rice grains.

Zizania latifolia (Grisebach) Turczaninow ex Stapf

Asian wild rice, Manchurian wild rice, water rice
This Asian counterpart to the North American *Zizania aquatica* is fully perennial but not as tall. Native to ponds and riverbanks in Japan and south through the Ryukyus and Taiwan, Indochina, China, Korea, and eastern Siberia, it grows upright to 8 feet (2.4 m) in height when blooming in summer. Leaves are held upright and are up to 1¼ inches (32 mm) wide, green in summer, turning yellow in fall. Propagate by seed, or by division in spring. Useful in shallow ponds, pools, or large containers. Zone 7.

Zizania palustris Linnaeus

[*Zizania aquatica* var. *angustifolia* Hitchcock]

Northern wild rice

This annual North American species is very similar to *Zizania aquatica* and has been included within that species by some taxonomists. It is more northern in distribution, growing

mostly in the Great Lakes region but ranging from Quebec and New Brunswick to Pennsylvania and west to Iowa and Minnesota. Zone 3.

Zizania texana Hitchcock

Texas wild rice

This rare and endangered perennial species is native only to Texas and occurs there only in the spring-fed headwaters of the San Marcos River. It is much lower growing than *Zizania aquatica*, with flowering stems produced in late summer typically elevated less than 2 feet (60 cm) above the water's surface. Zone 7.

BELOW *Zizania latifolia* in late September in the aquatic display at Longwood Gardens in Pennsylvania





Glossary

ANNUAL. A plant that completes its entire life cycle (from seed to seed) in one year.

ANTHER. The pollen-producing part of the stamen, located at the tip of a slender stalk (the filament). Sometimes called a pollen sac.

AWN. A slender bristlelike or needlelike appendage extending from the lemma or glume. Awns may be short and barely conspicuous or they may be many inches long, contributing significantly to the beauty and translucency of grass flowers.

BIENNIAL. A plant which completes its life cycle (from seed to seed) in two years. Biennial species usually produce only foliage during the first year. They flower and produce seed in the second year.

BIOME. The plants and animals in an ecosystem.

BLADE. The flat, expanded portion of the leaf above the sheath. The blade may be reduced or modified in various ways, or be absent altogether.

BRACT. A general term for any structure that represents a modified leaf; most commonly used to refer to reduced, leaflike structures associated with inflorescences. In grasses the glumes, lemmas, and paleas are considered bracts.

CALCAREOUS. Containing much higher than average amounts of calcium or lime. Calcareous habitats are often characterized by the presence of limestone and are typically alkaline.

CARYOPSIS. The single-seeded fruit typical of members of the grass family, Poaceae. A caryopsis, often called a grain, does not open at maturity and is typically hard and dry.

CESPITOSE, CAESPITOSE. Tufted, clump-forming. Grasses with a cespitose growth habit are often referred to as bunchgrasses.

CIRCUMBOREAL. Around the northern regions.

CLONAL CULTIVAR. A plant that requires asexual propagation to retain its unique characteristics.

CROWN. The base of the plant.

Although occasionally requiring renewal by division, this old well planting of giant reed, *Arundo donax*, has been a dramatic fixture at Christopher Lloyd's Great Dixter in Northiam, England, for decades.

- CULM.** The aboveground stem of a grass plant. Culms are usually upright but may be horizontal.
- DECIDUOUS.** Shedding or falling off. In grasses, plants that go dormant for part of the year, eventually replacing old growth with new.
- DIOECIOUS.** Of a species with male and female flowers on separate plants.
- ECOTYPE.** A population adapted to a particular set of environmental conditions.
- ENDEMIC.** Native and restricted to or occurring only in a particular place. Sometimes used in a broader sense to mean native, not introduced or naturalized.
- ENDOSPERM.** An energy reserve in the form of starch, present in the grains of grasses and in the seeds of many other types of plants.
- EVERGREEN.** Remaining green or living throughout the year.
- FILAMENT.** The threadlike stalk which bears the anther at its tip. The filament and anther comprise a stamen.
- FLORET.** In grasses, the collective term for an individual flower plus the enclosing palea and lemma.
- FORB.** A broad-leaved flowering plant, as opposed to the grasses, sedges, and rushes.
- GENOTYPE.** A group of organisms having the same genetic constitution.
- GERM.** The embryonic grass plant.
- GLAUOUS.** Covered with a thin layer of wax. Glauous plant parts often appear blue-gray, blue-green, or gray-green. The term is also used to denote such coloration.
- GLUME.** A bract located at the base of a grass spikelet. Typically there are two glumes associated with each spikelet.
- GRAIN.** The single-seeded fruit of true grasses, *Poaceae*, technically called a caryopsis.
- HERBACEOUS.** Lacking true woody (secondary) tissue.
- HONEYDEW.** A syrupy waste product produced by mealybugs and aphids
- INFLORESCENCE.** The flowering portion(s) of a plant, complete with any associated bracts.
- INTERNODE.** The section of the culm occurring between two consecutive nodes.
- LEMMA.** The lower, outer bract in the grass floret.
- LIGULE.** A thin membranous ridge or small row of hairs located at the juncture of the sheath and blade on the side facing the culm. The function of the ligule is uncertain, although it may serve to keep rain from entering the sheath. The variation in ligules is often very important in the botanical identification of grasses. It is of lesser value to gardeners in distinguishing between cultivated varieties.
- LODICULE.** One of two small scalelike structures usually present at the base of the ovary in the flowers of true grasses, *Poaceae*. The lodicules swell prior to pollination, forcing the palea and lemma apart and exposing the flower. Lodicules may represent the vestiges of sepals or petals, which are otherwise lacking in grass flowers.
- OVARY.** The enlarged lower portion of the female organ, containing the ovule or ovules.
- OVULE.** An immature, unfertilized seed, located within the ovary.
- MONOCULTURE.** A population or planting consisting of only one type of plant.
- NODE.** A point on an axis (usually a culm or stem) where a leaf or branch is attached.
- PALEA.** The upper, inner bract in the grass floret.
- PANICLE.** An inflorescence having spikelets attached at the ends of stalks that branch from the rachis (main axis).
- PERENNIAL.** A plant which lives for more than two years.
- PERIGYNIUM (plural PERIGYNIA).** A saclike, sometimes inflated structure enclosing the female flower or ovary in members of the sedge family, *Cyperaceae*, especially the genus *Carex*.
- PROVENANCE.** In an ecological context, the origin of individual plants or a group of plants. This is distinct from the native range of a plant species. Provenance may also refer to plants of garden origin.
- RACEME.** An inflorescence having individual spikelets attached to the unbranched rachis (main axis) by short stalks.
- RACHIS.** The main axis of an inflorescence.
- RAME.** In grasses, a type of raceme with repeating pairs of sessile and pedicellate spikelets, as found in *Andropogon* and *Schizachyrium*.
- RHIZOMATOUS.** Spreading by rhizomes.
- RHIZOME.** An underground horizontal stem.
- SHEATH.** The lower part of the leaf, originating at a node, which clasps or encircles the stem. In true grasses, *Poaceae*, the sheath usually has overlapping margins. In sedges, *Cyperaceae*, the sheath is usually fused around the stem.
- SHOOT.** A stem, or any portion of the plant derived from stem tissue.
- SPIKE.** An inflorescence having individual spikelets without stalks, attached directly to the unbranched rachis (main axis).
- SPIKELET.** In grasses, a small spike, consisting of one or more florets attached to a small central axis, together with the basal bracts called glumes.
- SPORT.** An individual showing marked variation from the normal type.
- STAMEN.** The male organ of a flower, consisting of a slender stalk (filament) and the pollen-producing anther.

STIGMA. The pollen-receiving structure. The stigma may be located directly at the top of the ovary, or may be separated from the ovary by a short stalk called the style.

STOLON. An aboveground horizontal stem.

STOLONIFEROUS. Spreading by stolons.

STYLE. A short stalk projecting from the top of the ovary, usually terminating in a feathery stigma which receives pollen.

TEPAL. A flower part that cannot be distinguished as either a sepal or a petal.

TERMINAL. Located at the tip or top end.

TUSSOCK. A thick tuft.

UMBEL. A type of inflorescence in which all flowering branches arise from a central point.

UTRICLE. A saclike, sometimes inflated structure enclosing the female flower or ovary in members of the sedge family, *Cyperaceae*. This term may also be used to refer to the saclike structure and the enclosed fruit.

WOODY. Having well-developed secondary tissue, as is present in trees and shrubs.

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Sources of Grass Plants & Seeds

This is a partial list, limited to nurseries that have a specialty in ornamental grasses, or that offer grasses that are generally hard to find. Catalogs or lists are available from most. No endorsement is intended, nor is criticism implied of sources not mentioned. An asterisk before a name indicates the nursery sells wholesale only.

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Pinchbeck, Spalding
Lincolnshire PE 11 3TB England
[www.alpinesandgrasses.co.uk/
index.htm](http://www.alpinesandgrasses.co.uk/index.htm)

Amber Wave
1460 Hillandale Road
Benton Harbor, Michigan 49022
www.amberwavegardens.com

Apple Court
Hordle Lane
Hordle, Lymington
Hampshire SO41 0HU England
www.applecourt.com

Australian Native Plants Nursery
9040 North Ventura Avenue
Casitas Springs, California 93001
www.australianplants.com

*Babikow Greenhouses
7838 Babikow Road
Baltimore, Maryland 21237
www.babikow.com

*Bailey Seed Company
P.O. Box 12788
Salem, Oregon 97309
www.baileyseed.com

Beeman's Nursery
3637 State Road 44
New Smyrna, Florida 32168
www.beemansnursery.com

Berkeley Horticultural Nursery
1310 McGee Avenue
Berkeley, California 94703
www.berkeleyhort.com

*Bernardo Beach Native Plant Farm
Star Route 7, Box 145
Veguita, New Mexico 87062
(505) 345-6248

Beth Chatto Gardens
Elmstead Market
Colchester CO7 7DB England
www.bethchatto.co.uk

The Big Grass Company
Hookhill Plantation
Woolfardisworthy East
Near Crediton
Devon EX17 4RX England
www.big-grass.com

*Bitterroot Restoration
P.O. Box 310
445 Quast Lane
Corvallis, Montana 59828
www.bitterrootrestoration.com

*Bluebird Nursery
P.O. Box 460
519 Bryan Street
Clarkson, Nebraska 68629
www.bluebirdnursery.com

*Bluestem Nursery
4101 Curry Road
Arlington, Texas 76001
www.bluestemnursery.com

*Carolina Nurseries
739 Gaillard Road
Moncks Corner, South Carolina 29461
www.carolinanurseries.com

Carroll Gardens
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444 E. Main Street
Westminster, Maryland 21157
www.carrollgardens.com

*Coastal Native Plants Nursery
P.O. Box 42
Mauricetown, New Jersey 08239
(856) 785-1102

Comstock Seed
917 Highway 88
Gardnerville, Nevada 89460
www.comstockseed.com

*Conard-Pyle Company
372 Rose Hill Road
West Grove, Pennsylvania 19390
www.conard-pyle.com

Corn Flower Farms
P.O. Box 896
Elk Grove, California 95759
www.cornflowerfarms.com

Curtis and Curtis
Star Route, Box 8A
4500 N. Prince
Clovis, New Mexico 88101
www.curtiseed.com

Daryll's Nursery
15770 W. Ellendale Road
Dallas, Oregon 97338
www.daryllsnursery.com

Digging Dog Nursery
P.O. Box 471
Albion, California 95410
www.diggingdog.com

*(and retail) El Nativo Growers
200 S. Peckham Road
Azusa, California 91702
www.elnativeogrowers.com

*Emerald Coast Growers
P.O. Box 10886
7400 Klondike Road
Pensacola, Florida 32526
www.ecgrowers.com

Emerisa Gardens
555 Irwin Lane
Santa Rosa, California 95401
www.emerisa.com

Ernst Conservation Seeds
9006 Mercer Pike
Meadville, Pennsylvania 16335
www.ernstseed.com

Eversley Nursery
10 Granville Avenue
Hesketh Bank, Preston
Lancashire PR4 6AH England
www.eversleynursery.co.uk

Four Seasons Seed Company
P.O. Box 6293
Albany, California 94706
(510) 526-9257

Garden Treasure Nursery
P.O. Box 1935
East Hampton, New York 11937
www.gardentreasurenursery.com/

Glasshouse Works
P.O. Box 97
Church Street
Stewart, Ohio 45778-0097
www.glasshouseworks.com

Granite Seed
1697 W. 2100 North
Lehi, Utah 84043
www.graniteseed.com

Greenlee Nursery
257 E. Franklin Avenue
Pomona, California 91766
www.greenleenursery.com

Hedgerow Farms
21740 County Road 88
Winters, California 95694
www.hedgerowfarms.com

High Country Gardens
2902 Rufina Street
Santa Fe, New Mexico 87507
www.highcountrygardens.com

*Hines Nurseries—Vacaville
8633 Winters Road
Winters, California 95694
www.hineshorticulture.com

Hoffman Nursery
5520 Bahama Road
Rougemont, North Carolina 27572
www.hoffmannnursery.com

Hortus Nursery
Shrubbery Bungalow
School Lane
Rousdon, Lyme Regis
Dorset DT7 3XW England
www.hortusnursery.com

Jelitto Perennial Seeds (NA office)
125 Chenoweth Lane, Suite 301
Louisville, Kentucky 40207
www.jelitto.com

Joy Nurseries
Jericho Road
R.D. 2
Pukekohe, New Zealand
www.joyplants.co.nz

Knoll Gardens
Hampreston, Stapehill
Near Wimborne
Dorset BH21 7ND England
www.knollgardens.co.uk

Kurt Bluemel
2740 Greene Lane
Baldwin, Maryland 21013
www.kurtbluemel.com

Larner Seeds
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Bolin, California 94924
www.larnerseeds.com

Matai Nurseries
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Waimate 8791
South Canterbury, New Zealand
www.nznatives.co.nz

Maryland Aquatic Nurseries
3427 North Furnace Road
Jarrettsville, Maryland 21084
www.marylandaquatic.com

McNeal Growers
P.O. Box 371
Manchaca, Texas 78652
www.mcnealgrowers.com

Milaeger's Gardens
4838 Douglas Avenue
Racine, Wisconsin 53402
www.milaegers.com

Monksilver
Oakington Road
Cottenham
Cambridge CB4 8TW England
www.monksilver.com

Mostly Native Nursery
P.O. Box 258
27235 Highway One
Tomales, California 94971
www.mostlynatives.com

*Mountain States Wholesale Nursery
P.O. Box 2500
Litchfield Park, Arizona 85340
www.mswm.com

Native Garden Nursery
56 Main Road
Makaraka
Gisborne, New Zealand
www.mailorderplants.co.nz

The Native Plant Nursery
P.O. Box 7841
Ann Arbor, Michigan 48107
www.nativeplant.com

Native Sons
379 W. El Campo Road
Arroyo Grande, California 93420
www.nativeson.com

The Natives
2929 JB Carter Road
Davenport, Florida 33837
www.thenatives.net

*New Moon Nursery
13 Ways Lane
Kennett Square, Pennsylvania 19348
www.newmoonnursery.com

North American Prairies Company
11754 Jarvis Avenue
Annandale, Minnesota 55302
www.northamericanprairies.com

*North Creek Nurseries
R.R. 2, Box 33
Landenberg, Pennsylvania 19350
www.northcreeknurseries.com

*Northwest Ornamental Grasses
4176 Stateline Road
Walla Walla, Washington 99362
www.northwestornamentalgrasses.com

Oratia Native Plant Nursery
625 West Coast Road
Oratia
Auckland, New Zealand
www.oratianatives.co.nz

*Pinelands Nursery
323 Island Road
Columbus, New Jersey 09022
www.pinelandsnursery.com

Plant Delights Nursery
9241 Sauls Road
Raleigh, North Carolina 27603
www.plantdelights.com

Plants of the Southwest
Agua Fria, Route 6, Box 11A
Santa Fe, New Mexico 87501
www.plantsofthesouthwest.com

The Plantsman's Preference
Hopton Road
Garboldisham, Diss
Norfolk IP22 2QN England
www.plantpref.co.uk

*Pleasant Run Nursery
P.O. Box 247
Allentown, New Jersey 08501
www.pleasantrunnursery.com

Prairie Moon Nursery
Route 3, Box 163
Winona, Minnesota 55987
www.prairiemoon.com

Prairie Nursery
P.O. Box 306
Westfield, Wisconsin 53964
www.prairienursery.com

Prairie Ridge Nursery
128 Sunset Drive
Walkerton, Indiana 46574
www.jfnew.com/nativeplant-nursery.asp

Prairie Seed Source
P.O. Box 83
North Lake, Wisconsin 53064
<http://users.ameritech.net/rasillon/Seed.html>

Prime Perennials Nursery
Llety Moel
Thos-y-garth, Llanilar
Aberystwyth SY23 4SG Wales
www.prime-perennials.co.uk

*Russell Gardens
600 New Road
Churchville, Pennsylvania 18966
(215) 322-4799

*San Marcos Growers
P.O. Box 6827
125 S. San Marcos Road
Santa Barbara, California 93160
www.smgrowers.com

Seaside Gardens
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Carpinteria, California 93013
www.seaside-gardens.com

*Shady Oaks Nursery
P.O. Box 708
1601 5th Street SE
Waseca, Minnesota 56093
www.shadyoaks.com

Southwestern Native Seeds
P.O. Box 50503
Tucson, Arizona 85703
www.thearb.org

Staudengärtner Klose
Inh. Heinz-Richard Klose
Rosenstrasse 10
34253 Lohfelden Germany
www.staudengaertner-klose.de

*Steve Schmidt Nursery
P.O. Box 53
29977 SE Weitz Lane
Eagle Creek, Oregon 97022
www.steveschmidtnursery.com

Stock Seed Farms
28008 Mill Road
Murdock, Nebraska 68407-2350
www.stockseed.com

*Suncrest Nurseries
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Watsonville, California 95076
www.suncrestnurseries.com

Taupo Native Plant Nursery
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Taupo, New Zealand
www.tauponativeplant.co.nz

Terra Nova Nurseries
10051 S. Macksburg Road
Canby, Oregon 97013
www.terranovanurseries.com

Theodore Payne Foundation
10459 Tuxford Street
Sun Valley, California 91352
www.theodorepayne.org

Triple Oaks Nursery
P.O. Box 385
2359 S. Delsea Drive
Franklinville, New Jersey 08322
www.tripleoaks.com

Western Native Seed
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Coaldale, Colorado 81222
www.westernnativeseed.com

Wild Earth Native Plant Nursery
P.O. Box 7258
Freehold, New Jersey 07728
(732) 308-9777

Wild Seed
P.O. Box 27751
Tempe, Arizona 85285
(602) 276-3536

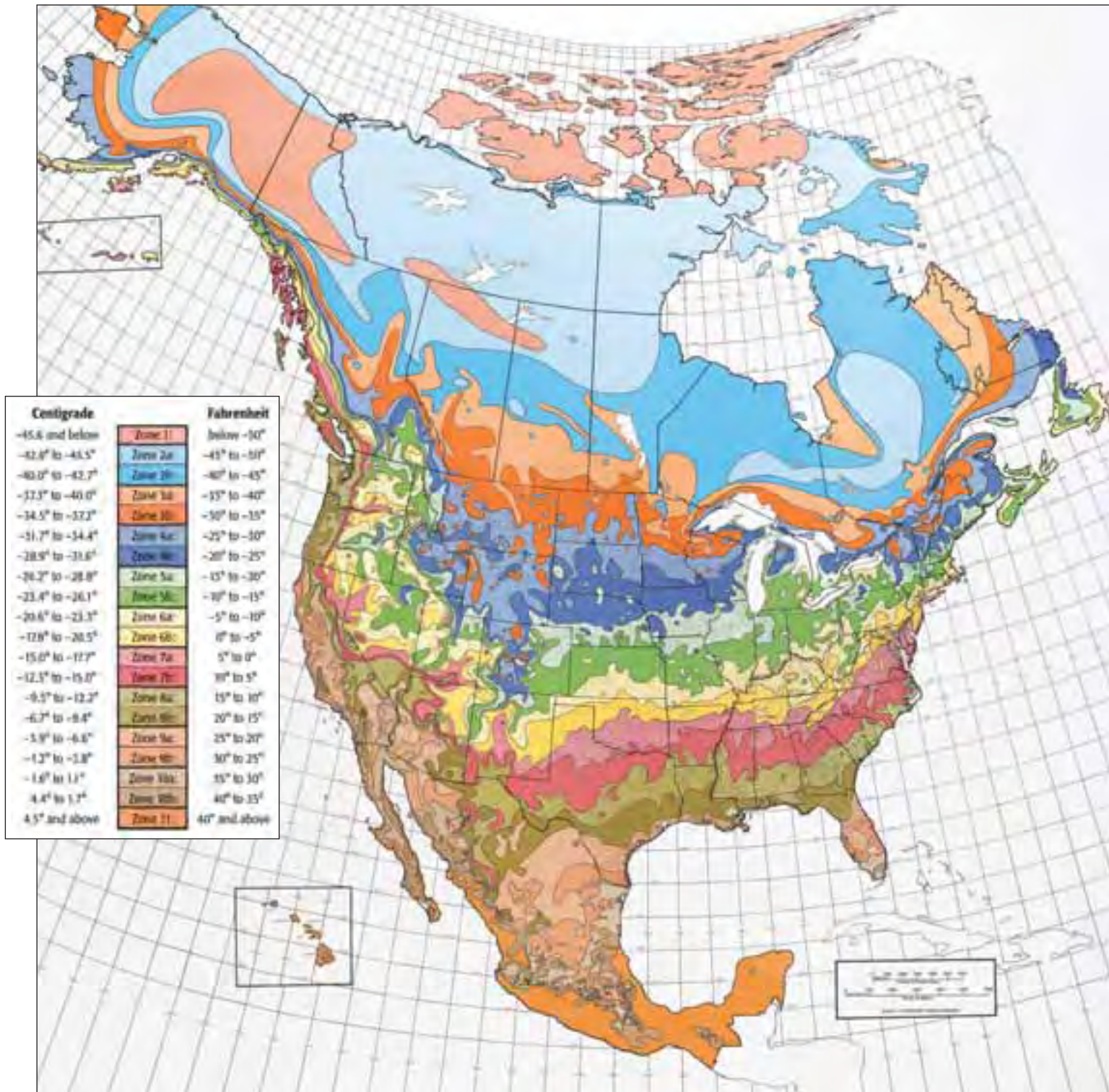
Wildtype Design, Native Plants and
Seeds
900 N. Every Road
Mason, Michigan 28854
www.wildtypeplants.com

Wind Poppy Farm and Nursery
3171 Unick Road
Ferndale, Washington 98238
www.windpoppy.com

Wind River Seed
3075 Lane 51½
Manderson, Wyoming 82432
www.windriverseed.com

Yucca Do Nursery at Peckerwood
Gardens
P.O. Box 450
Waller, Texas 77484
www.yuccado.com

USDA Hardiness Zone Map



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