Panicum amarum Ell. - Bitter Panicum; Beach Panicgrass

(Figures 27, 32; Plate X)

Note: Recent taxonomic revision has placed Panicum amarulum Hitchc. and Chase in synonymy with Panicum amarum. Differences in seed production result from differences in the number of sets of chromosomes; Panicum amarum has six sets (hexaploid) and Panicum amarulum has four sets (tetraploid). The form with six sets of chromosomes should be avoided because of low seed set; it is recognizable by being more prostrate and open-growing, and the inflorescence is narrower and sparsely flowered. Northern populations of P. amarulum are more erect and clumpy and have probably crossed with Panicum virgatum L.

PLANT CHARACTERISTICS

Ecological Function/User Applications - sand trapping and stabilization; food source and cover for birds and small mammals.

Natural Geographic Distribution/Cold Hardiness - coastal dunes; Connecticut to Florida and Gulf states; tolerates lowest temperatures throughout Florida; zones 2-7.

Optimum Soil Type - well-drained, sandy soils.

Resistance to Erosion - good, once established.

Potential Growth Rate - rapid (dense coverage in two to three growing seasons).

PLANT AVAILABILITY

Nursery Sources - liners, two- and four-inch pots; advance notice of plant quantities and/or a growing contract is necessary for the hexaploid form.

Natural Sources - cuttings, seeds (tetraploid form only).

PLANTING GUIDELINES

Elevation - above limit of wave uprush and highest spring tides.

Ground Slope - up to 30° (1 to 2).

Depth - top of root-ball four inches below sand surface.
Panicum amarum (continued)

Planting Window - March through November south of Tampa Bay/Cape Canaveral and April through October northward.

Density - small plants one and one-half feet O.C., large plants three feet O.C.

MAINTENANCE GUIDELINES

Watering - when planted, and during the first month unless heavy rainfall occurs.

Fertilization - incorporate one teaspoon per plant of a balanced, time-release fertilizer (14-14-14) when planted.

Weeding - remove and control exotics.

Pruning - lateral spread improved by clipping.

[Relevant Literature - 6, 18, 20, 22, 46, 59, 64, 81, 92]
**Paspalum vaginatum** Sw. - Salt Jointgrass; Seashore Paspalum

(Figures 23, 30, 34; Plate VIII)

Note: One recent taxonomic revision placed *Paspalum vaginatum* in synonymy with *Paspalum distichum* L. However, further study supported maintaining *P. vaginatum* as a distinct species.

**PLANT CHARACTERISTICS**

Ecological Function/User Applications - soil stabilization; food source and cover for some birds and small mammals.

Natural Geographic Distribution/Cold Hardiness - coastal plain freshwater and saltwater high marshes; North Carolina to Florida and Gulf states and south to Argentina; tolerates lowest temperatures throughout Florida; zones 2-7.

Optimum Soil Type - moist, silty sands.

Resistance to Erosion - excellent, once established.

Potential Growth Rate - rapid; dense cover possible in one to two growing seasons.

**PLANT AVAILABILITY**

Nursery Sources - liners, two-inch pots.

Natural Sources - bare-root, plugs, cuttings; vegetative state can be confused with some forms of *Sporobolus virginicus* and *Distichlis spicata*.

**PLANTING GUIDELINES**

Elevation - above MHW and in low dune areas; withstands some flooding.

Ground Slope - up to 30° (1 to 2), but plants will grow on steeper slopes.

Depth - top of root-ball slightly below soil surface.

Planting Window - March through November south of Tampa Bay/Cape Canaveral and April through October northward.

Density - two-inch plants one and one-half feet O.C., larger plants three feet O.C.
Paspalum vaginatum (continued)

MAINTENANCE GUIDELINES

Watering - not required in moist soils, but periodically during the first few weeks in drier soils if rain is lacking.

Fertilization - responds well to balanced fertilizers.

Weeding - remove and control exotics.

Pruning - mowing results in a low, dense mat.

[Relevant Literature - 11, 18, 40]
Rhizophora mangle L. - Red Mangrove

(Figures 5, 9; Plate I)

PLANT CHARACTERISTICS

Ecological Function/User Applications - shoreline protection and sediment stabilization; nursery habitat for birds and marine life; contribution to detrital-based food web; aesthetics; water-quality maintenance.

Natural Geographic Distribution/Cold Hardiness - low-energy, coastal wetlands; throughout southern Florida and tropics north on the Atlantic coast to Ponce de Leon Inlet and on the Gulf coast to Cedar Key; difficult to establish north of Melbourne on the Atlantic coast and north of Tampa Bay on the Gulf coast, due to freeze damage in colder winters; zones 4-7.

Optimum Soil Type - mixture of sand and organics inundated regularly by tides.

Resistance to Erosion - poor for propagules and small plants; large plants more resistant. Initial use of smooth cordgrass to stabilize shorelines may encourage establishment of naturally colonized and broadcast propagules.

Potential Growth Rate - shoot-length increase of six to twelve inches per year in nutrient-rich soils; moderate-nutrient substrates promote branching; low-nutrient substrates promote flower production.

PLANT AVAILABILITY

Nursery Sources - readily available in two-inch pots up to three-gallon containers; availability decreases as plant size increases.

Natural Sources - transplants rare due to government regulations regarding natural populations; propagules available in early fall (floating or removed from trees). Vegetative propagation possible, but difficult.

PLANTING GUIDELINES

Elevation - just below MHW to summer spring-tide elevations for smaller plants; check local elevation range for naturally established propagules to confirm optimum elevation range.

Ground Slope - up to 30° (1 to 2), but less than 10° (1 to 5) is preferable.
**Rhizophora mangle** (continued)

**Depth** - insert propagules two to three inches into soil surface; for rooted propagules and large plants, root-ball even with soil surface.

**Planting Window** - propagules August through November (corresponds to natural availability); nursery plants after the last frost of the winter, and no later than November; planting in the northernmost part of its range is not recommended (zone 4).

**Density** - historically, three feet O.C. or less for small plants (legal requirements will dictate maximum distance); denser plantings emulate natural recruitment and may improve overall quality of planting.

**MAINTENANCE GUIDELINES**

**Watering** - not required.

**Fertilization** - top growth increased by light application of time-release, nitrogenous fertilizer incorporated when planted.

**Weeding** - remove accumulated drift material during the first year following planting; some sea-grass wrack is desirable.

**Pruning** - does not survive severe pruning; even regular long-term clipping can cause death of plants; see state and local regulations in Guideline Category Descriptions (pp. 15-16).

[Relevant Literature - 10, 11, 13, 14, 21, 27, 32-35, 39, 41, 47-54, 57, 58, 62, 65, 66, 74, 76-78, 80, 85-91, 96]
**Spartina alterniflora** Loisel. - Smooth Cordgrass

(Figures 25, 31; Plate IX)

**PLANT CHARACTERISTICS**

Ecological Function/User Applications - shoreline protection and sediment stabilization; contribution to detrital-based food web; nursery habitat; water-quality maintenance.

Natural Geographic Distribution/Cold Hardiness - low-energy, coastal low marshes; Canada south to Florida and Gulf states, although rarer in south Florida; tolerates lowest temperatures throughout Florida; zones 2-7.

Optimum Soil Type - regularly inundated, silty sediments.

Resistance to Erosion - generally good once established.

Potential Growth Rate - rapid; dense cover possible in two growing seasons.

**PLANT AVAILABILITY**

Nursery Sources - two- and four-inch pots.

Natural Sources - bare-root, plugs; short form occurs in poorly flushed areas and tall form occurs on creek banks.

**PLANTING GUIDELINES**

Elevation - upper one-third of the tide range and slightly above MHW; can occupy a zone slightly lower than red mangrove by 0.2 - 0.3 ft.

Ground Slope - up to 15° (1 to 4).

Depth - top of root-ball two inches below soil surface.

Planting Window - March through November south of Tampa Bay/Cape Canaveral and April through October northward; no later than July for erosion-prone areas where dense growth is needed to provide shoreline protection during first winter season; planting season can be extended by using natural stock.

Density - one foot O.C. for bare-root, one and one-half feet O.C. for two-inch plugs, two feet O.C. for four-inch plugs, three feet O.C. for six-inch plugs.
Spartina alterniflora (continued)

**MAINTENANCE GUIDELINES**

**Watering** - not required.

**Fertilization** - responds well to time-release, nitrogenous fertilizer incorporated when planted.

**Weeding** - remove accumulated drift material during the first six months following planting.

**Pruning** - careful clipping can stimulate vegetative growth and spread of rhizomes; pruning while the plant is in flower can extend the period of vegetative growth into late autumn and early winter; pruning during late winter or early spring to remove frost-killed material can stimulate spring growth by reducing the shading of new tillers.

[Relevant Literature - 7, 8, 11, 13, 14, 26, 27, 28, 31, 39, 45, 47-53, 55, 56, 61, 66, 73, 75, 78, 85-91, 96]
Spartina patens (Ait.) Muhl. - Marsh-hay; Saltmeadow Cordgrass

(Figures 26, 31; Plate IX)

PLANT CHARACTERISTICS

Ecological Function/User Applications - shoreline protection and soil stabilization; forage.

Natural Geographic Distribution/Cold Hardiness - coastal high-marsh margins and dunes; Canada to Florida and Gulf states, but less common in south Florida; tolerates lowest temperatures throughout Florida; zones 2-7.

Optimum Soil Type - loose, sandy soils; tolerates a wide range of soils (except very fine-grained soils such as clay, mud and muck).

Resistance to Erosion - good, once established.

Potential Growth Rate - moderately rapid but tends to clump in wet soils; dense cover possible in two growing seasons.

PLANT AVAILABILITY

Nursery Sources - two- and four-inch pots.

Natural Sources - bare-root, plugs, larger transplants; may be mistaken vegetatively for Spartina spartinae (Grin.) Merr.

PLANTING GUIDELINES

Elevation - above MHW to highest spring-tide elevation in marsh areas; on upland side of primary dune and in swales between dunes.

Ground Slope - up to 15° (1 to 4).

Depth - top of root-ball slightly below soil surface.

Planting Window - March through November south of Tampa Bay/Cape Canaveral and April through October northward.

Density - small plants one foot O.C., increased spacing with plant size up to two and one-half feet O.C. for four-inch plugs.
Spartina patens (continued)

MAINTENANCE GUIDELINES

Watering - when planted in dune areas and until plants are established; not generally required in high-marsh areas.

Fertilization - in dunes, one teaspoon per plant of a balanced, time-release fertilizer (e.g., 14-14-14), incorporated when planted; in marsh, incorporate one teaspoon per plant of a nitrogenous, time-release fertilizer when planted.

Weeding - remove accumulated drift material during the first six months following planting in marsh areas; remove and control exotics in dune areas.

Pruning - responds well to clipping or mowing, when done properly.

[Relevant Literature - 2, 6, 11, 18, 26, 27, 30, 39, 46, 70-72, 81, 96]
Sporobolus virginicus (L.) Kunth - Seashore Dropseed

(Figures 24, 30, 35; Plate VIII)

PLANT CHARACTERISTICS

Ecological Function/User Applications - soil stabilization; food source for birds and small mammals.

Natural Geographic Distribution/Cold Hardiness - coastal dunes, high marsh, and transition areas; Virginia to Florida and Gulf states, and south to Brazil; tolerates lowest temperatures throughout Florida; zones 2-7.

Cold Hardiness - very good.

Optimum Soil Type - moderately well-drained, silty sand.

Resistance to Erosion - very good, once established.

Potential Growth Rate - rapid; dense cover possible in two growing seasons (provided initial spacing is not greater than two feet O.C.).

PLANT AVAILABILITY

Nursery Sources - limited availability in two- and four-inch pots.

Natural Sources - bare-root, plugs, seeds; vegetative state may be confused with some growth forms of Paspalum vaginatum and Distichlis spicata.

PLANTING GUIDELINES

Elevation - above MHW; tolerates occasional inundation, but may suffer with regular inundation.

Ground Slope - up to 30° (1 to 2), but plants will grow on steeper slopes.

Depth - root-ball approximately two inches below soil surface in moist soil, deeper in dry soil; larger plants slightly deeper.

Planting Window - March to November south of Tampa Bay/Cape Canaveral and April to October northward.
\textit{Sporobolus virginicus} (continued)

Density - bare-root six inches O.C., increased spacing for larger plants up to two feet O.C. for six-inch plugs.

\textbf{MAINTENANCE GUIDELINES}

Watering - when planted and periodically for the first few weeks in dry soils, unless heavy rainfall occurs; not required in moist soils.

Fertilization - incorporate one teaspoon per plant of a time-release, balanced fertilizer (e.g., 14-14-14) in dunes and nitrogenous fertilizer in wet soils.

Weeding - remove and control exotics.

Pruning - clipping or mowing stimulates vegetative growth and controls exotics.

[Relevant Literature - 2, 5, 8, 11, 18, 23, 29, 39, 81, 92]
*Uniola paniculata* L. - Sea-oats

*(Figures 28, 29, 32; Plate X)*

**PLANT CHARACTERISTICS**

Ecological Function/User Applications - sand stabilization; food source and cover for birds and small mammals; aesthetics.

Natural Geographic Distribution/Cold Hardiness - coastal dunes; Virginia to Florida and Gulf states; tolerates lowest temperatures throughout Florida; zones 2-7.

Optimum Soil Type - well-drained, sandy or calcareous soils.

Resistance to Erosion - good, once established; withstands wind erosion well, but waves wash away soil and plants.

Potential Growth Rate - highly dependent on environmental conditions and maintenance; plants can grow laterally up to four feet per year after establishment; dense cover possible in three growing seasons; flowers in second or third year.

**PLANT AVAILABILITY**

Nursery Sources - liners, two- and four-inch pots, one- and three-gallon pots.

Natural Sources - generally not available in large quantities; protected by law. Available as seeds or transplants on private property behind the CCCL.

**PLANTING GUIDELINES**

Elevation - above limits of wave uprush.

Ground Slope - up to 30° (1 to 2).

Depth - top of root-ball four inches below soil surface (many planting failures have been attributed to not planting deeply enough).

Planting Window - March through November south of Tampa Bay/Cape Canaveral and April through October northward.

Density - one- and two-inch pots one and one-half feet O.C., increased spacing to three feet O.C. for large plants (three-gallon).
*Uniola paniculata* (continued)

**MAINTENANCE GUIDELINES**

**Watering** - when planted, and weekly for first few months depending on rainfall.

**Fertilization** - one teaspoon per plant of a balanced, time-release fertilizer (e.g., 14-14-14), incorporated when planted.

**Weeding** - remove and control exotics.

**Pruning** - after establishment may respond to careful clipping by producing more tillers.

[Relevant Literature - 1-3, 15, 18-20, 22, 37, 38, 46, 64, 69, 81, 83, 92, 93, 95-97]
RELEVANT LITERATURE

The following references represent a variety of technical reports, agency publications, conference proceedings, journal articles, and other reports of relevance to salt-tolerant vegetation. This list should not be considered a complete collection of reference materials; rather, it is a representative compilation of works pertaining to various facets of plant taxonomy, functional relationships, and habitat restoration efforts that address many of the species discussed in this guide.


