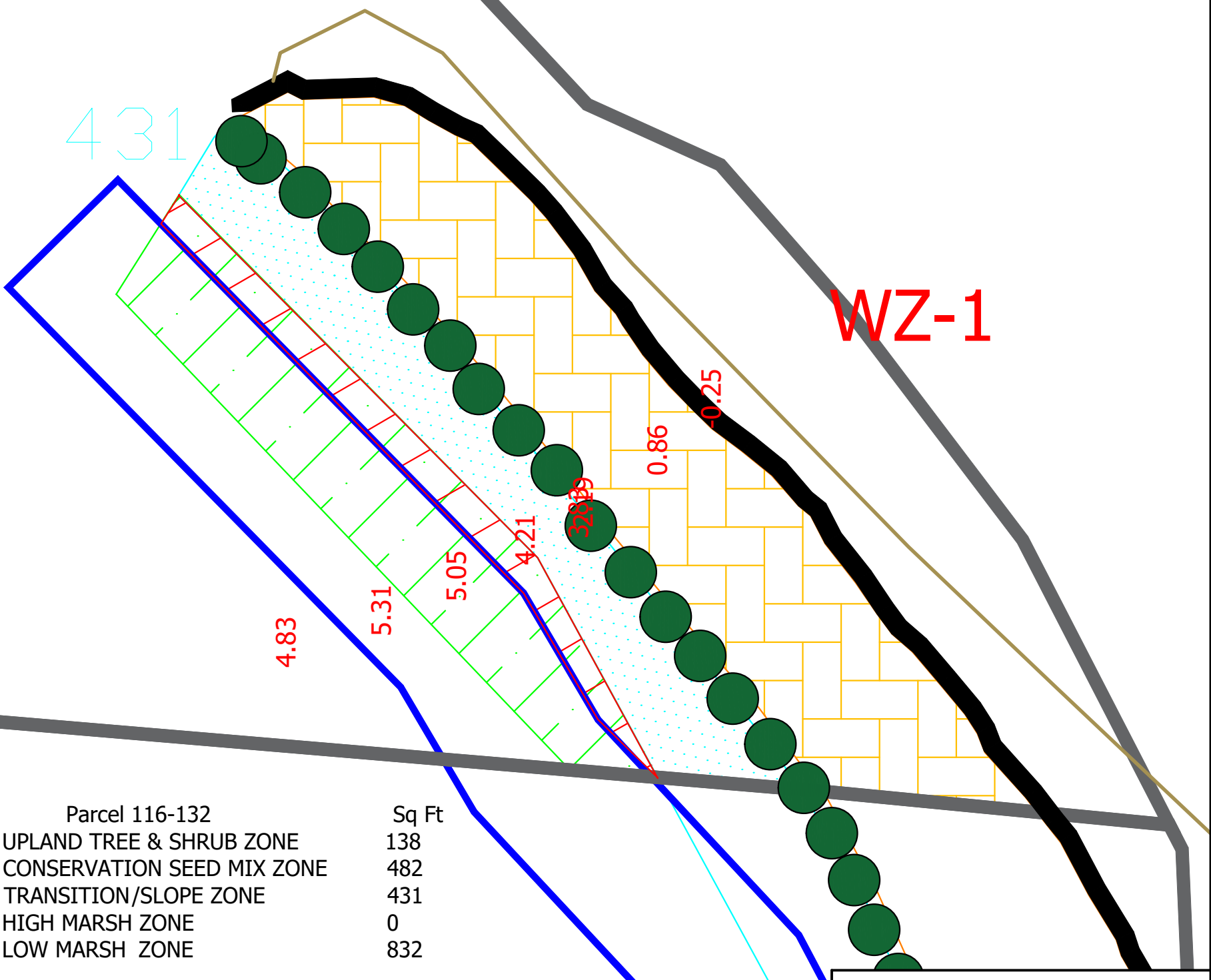


WZ-1 PLANTING PLAN
New Bedford Harbor Superfund Site
March 2021



Parcel 116-132

- UPLAND TREES & SHRUBS
- CONSERVATION SEED MIX
- TRANSITION PLANTING
- HIGH MARSH
- LOW MARSH
- MUD FLAT
- GRAVEL WEDGE
- BOULDERS
- FORMER TEMPORARY ACCESS ROAD

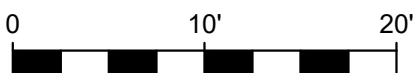


Parcel 116-132	
UPLAND TREE & SHRUB ZONE	Sq Ft 138
CONSERVATION SEED MIX ZONE	482
TRANSITION/SLOPE ZONE	431
HIGH MARSH ZONE	0
LOW MARSH ZONE	832

CRE ENVIRONMENTAL, INC. WBE
 ECOLOGICAL AND OCEANOGRAPHIC CONSULTANTS
www.crenvironmental.com

REVISIONS		
DATE	DESCRIPTION	DRAWN
2-5-21	REV1	kjt
3-10-21	Update details	kjt

Notes
 1) Scale 1"/10'
 2) Cross section points collected 1/7/2021.



Parcel 116-132

UPPER HARBOR WEST ZONE-1, **PARCEL 116-132**

PROPOSED PLANTINGS (Spring 2021) Shrubs and trees all 1 gallon containers, and number for each plant species is in parentheses. Herbaceous plugs of salt marsh grasses, seaside goldenrod, switchgrass, and coastal panic grass should be 2" diameter. Slow release fertilizer such as Osmocote for plugs and 1 gallon containers for establishment. Seed mixes are New England/ Wildlife Seed Mix and Coastal Salt Tolerant Grass Mix (Reference Figure for Parcel 116-132 for planting zones, and Table 1 for a tally of Plant Materials). Treat *Phragmites australis* just N and adjacent to the remediated area at Parcel 116-132.

- Provide temporary fencing at the upland extent to protect plantings during establishment

UPLAND Tree and Shrub Zone (5 ft o.c. triangular spacing)

(~138 sq ft)

Juniperus virginiana (3) Eastern red cedar

Clethra alnifolia (3) sweet pepperbush

Plant just landward of the transition zone alternating in a row (seaward of access road).

Overseed with **NE Conservation/Wildlife seed mix**

CONSERVATION SEED (Application rate: 25lbs/acre or 1750 sq ft/lb)

(478 sq ft)

Seed entire zone with NE Conservation/Wildlife seed mix ~0.3 lbs

TRANSITION Zone (shrubs 3 ft o.c. and herbs* 1.5 ft o.c. triangular spacing)

(431 sq ft)

Bayberry subZONE

Myrica pensylvanica (10) northern bayberry

Rosa virginiana (10) Virginia rose

Panicum virgatum (33) switchgrass*

Plant above High Tide Bush subzone. Plant in sets of 3 plants of the same species. Alternate the *M. pensylvanica* and *R. virginiana* with *P. virgatum*

High Tide Bush subZONE

Iva frutescens (10) high tide bush

Panicum amarum var *amarula* (33) coastal panic grass or substitute *P. virgatum**

Solidago sempervirens (33) seaside goldenrod*

Plant above 2-man stone where soil appears stable and seaward of the bayberry and Virginia rose

Plant in sets of 3 plants of the same species.

Overseed entire transition zone with **Coastal Salt Tolerant Grass seed mix** at rate of 1 lb/1250 sq ft or ~0.35 lbs. See attached specification sheet.

LOW MARSH (1.5 ft o.c. square spacing)

(832 sq ft)

Spartina alterniflora (370)

Plant plugs with slow release fertilizer



107

635

1128

Gravel Boat Ramp

WZ-2

WZ-3

WZ-4

WZ-5

Coir Facine

WZ-6

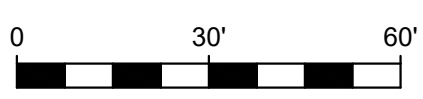
4313

WZ-7

2626

-  UPLAND TREES & SHRUBS
-  CONSERVATION SEED MIX
-  TRANSITION PLANTING
-  HIGH MARSH
-  LOW MARSH
-  MUD FLAT
-  GRAVEL WEDGE
-  BOULDERS
-  FORMER TEMPORARY ACCESS ROAD

Bayside Builders	Sq Ft
UPLAND TREE & SHRUB ZONE	1148
CONSERVATION SEED MIX ZONE	0
TRANSITION/SLOPE ZONE	3261
HIGH MARSH ZONE	0
LOW MARSH ZONE	5441



REVISIONS		
DATE	DESCRIPTION	DRAWN
2-5-21	REV1	kjt
3-10-21	Update Details	kjt

Notes
 1) Scale 1"/30'
 2) Cross section points collected 1/17/2021.



Bayside Builders
Parcel 116-86

UPPER HARBOR WEST ZONE-1, PARCEL 116-86 Bayside Builders

PROPOSED PLANTINGS (Spring 2021) Shrubs and trees all 1 gallon containers, and number for each plant species is in parentheses. Herbaceous plugs of salt marsh grasses, seaside goldenrod, switchgrass, and/or coastal panic grass should be 2" diameter. Slow release fertilizer such as Osmocote for plugs and 1 gallon containers for establishment. Seed mixes are New England/ Wildlife Seed Mix and Coastal Salt Tolerant Grass Mix (Reference Figure for Parcel 116-86 for planting zones, and Table 1 for a tally of Plant Materials).

- Provide temporary fencing at the upland extent to protect plantings during establishment

UPLAND Tree and Shrub Zone (10 ft o.c. triangular spacing)

(107 sq ft)

Clethra alnifolia (2) sweet pepperbush

(1,041 sq ft)

Juniperus virginiana (6) Eastern red cedar

Clethra alnifolia (6) sweet pepperbush

Plant landward of the transition zone in a triangular pattern. Overseed entire zone with NE Conservation/Wildlife seed mix 1 lb per 1750 sq ft or ~0.7 lbs

TRANSITION Zone (shrubs 3 ft o.c. and herbs* 1.5 ft o.c. triangular spacing)

(635 sq ft N of gravel boat ramp) (1,041 sq ft S of boat ramp)

Bayberry subZONE *Myrica pensylvanica* (60) northern bayberry

Rosa virginiana (30) Virginia rose

Panicum virgatum (136) switchgrass*

Plant above High Tide Bush subzone in sets of 3 plants of the same species. Alternate switchgrass with the bayberry and rose.

High Tide Bush subZONE

Iva frutescens (30) high tide bush

Panicum amarum var. *amarula* coastal panic grass (136) or if not available *P. virgatum* grass*

Solidago sempervirens (106) seaside goldenrod*

Plant above 2-man stone where soil appears stable and seaward of the bayberry and Virginia rose. Plant in sets of 3 plants of the same species. Alternate coastal panic grass with high tide bush and seaside goldenrod.

Overseed entire transition zone with Coastal Salt Tolerant Grass seed mix at rate of 1 lb/1250 sq ft or ~1.4 lbs.

LOW MARSH (1.5 ft o.c. square spacing)

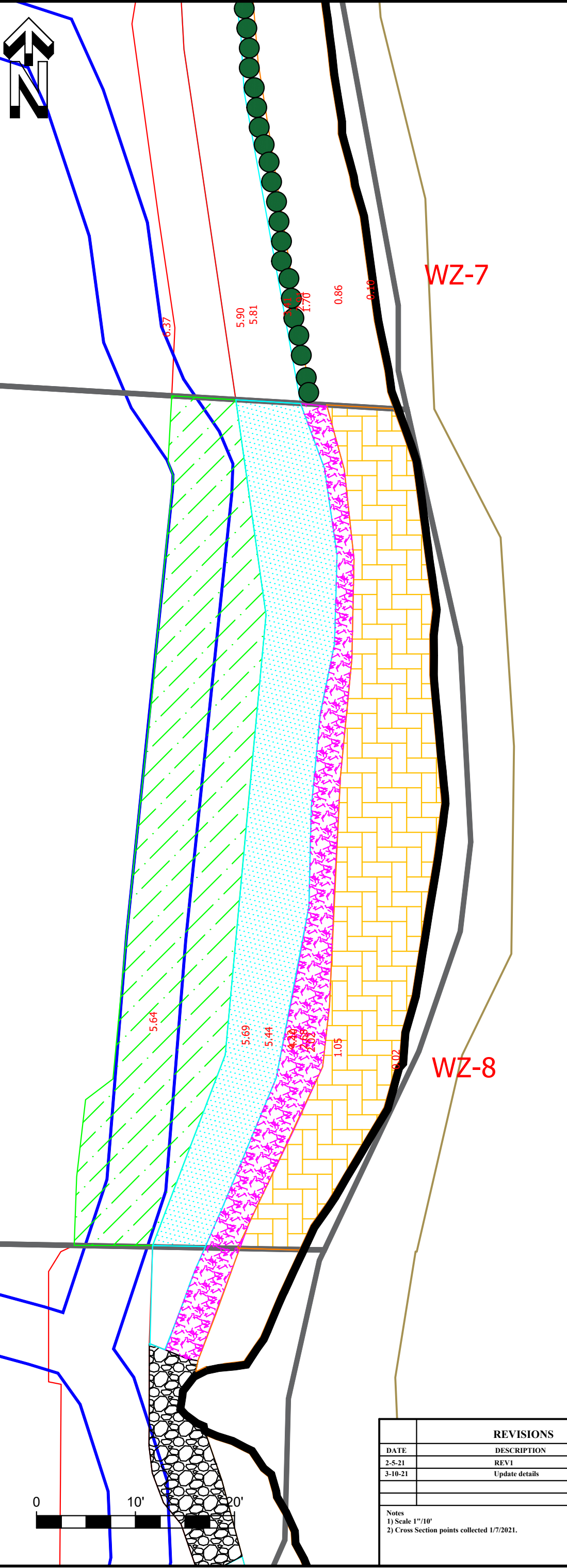
(1,128 sq ft N of boat ramp)

Spartina alterniflora (500)

(4,313 sq ft S of boat ramp)

Spartina alterniflora (1,917)

Plant 2" plugs with slow release fertilizer



- UPLAND TREES & SHRUBS
- CONSERVATION SEED MIX
- TRANSITION PLANTING
- HIGH MARSH
- LOW MARSH
- MUD FLAT
- GRAVEL WEDGE
- BOULDERS

Pico Stone	Sq Ft
UPLAND TREE & SHRUB ZONE	0
CONSERVATION SEED MIX ZONE	3421
TRANSITION/SLOPE ZONE	2260
HIGH MARSH ZONE	0
LOW MARSH ZONE	2760

ENVIRONMENTAL, INC. WBE
 ECOLOGICAL AND OCEANOGRAPHIC CONSULTANTS
www.crenvironmental.com

REVISIONS		
DATE	DESCRIPTION	DRAWN
2-5-21	REV1	kjt
3-10-21	Update details	kjt

Notes
 1) Scale 1"=10'
 2) Cross Section points collected 1/7/2021.

Pico Stone

Parcel 116-100

UPPER HARBOR WEST ZONE-1, **PARCEL 116-100 PICO Stone**

PROPOSED PLANTINGS (Spring 2021) Shrubs and trees all 1 gallon containers, and number for each plant species is in parentheses. Herbaceous plugs of salt marsh grasses, seaside goldenrod, switchgrass, and/or coastal panic grass should be 2" diameter. Slow release fertilizer for establishment. Seed mixes are New England/ Wildlife Seed Mix and Coastal Salt Tolerant Grass Mix (Reference Figure for Parcel 116-100 for planting zones, and Table 1 for a tally of Plant Materials). Provide temporary fencing at the upland extent to protect plantings during establishment

CONSERVATION SEED MIX Zone

(3,421 sq ft)

Landward of the transition zone seed entire zone with **NE Conservation/Wildlife seed mix** 1 lb per 1750 sq ft or **~2.0 lbs**

TRANSITION Zone (3 ft o.c. triangular spacing for shrubs, 1.5 ft for herbs*)

(2,260 sq ft)

Bayberry subZONE

Myrica pensylvanica (45) northern bayberry

Rosa virginiana (45) Virginia rose

Panicum virgatum (230) switchgrass*

Plant above High Tide Bush subzone in sets of 3 plants of the same species. Alternate switchgrass at 1.5 ft o.c. with bayberry and rose spaced at 3 ft o.c.

High Tide Bush subZONE

Iva frutescens (27) high tide bush

P. amarum var. *amarula* coastal panic grass (230) if not available *Panicum virgatum* switchgrass*

Solidago sempervirens (230) seaside goldenrod*

Plant above gravel wedge where soil appears stable and seaward of the bayberry and Virginia rose. Plant in sets of 3 plants of the same species.

Overseed entire transition zone with **Coastal Salt Tolerant Grass seed mix** at rate of 1 lb/1250 sq ft or **~1.8 lbs.**

LOW MARSH (1.5 ft o.c. square spacing)

(2760 sq ft)

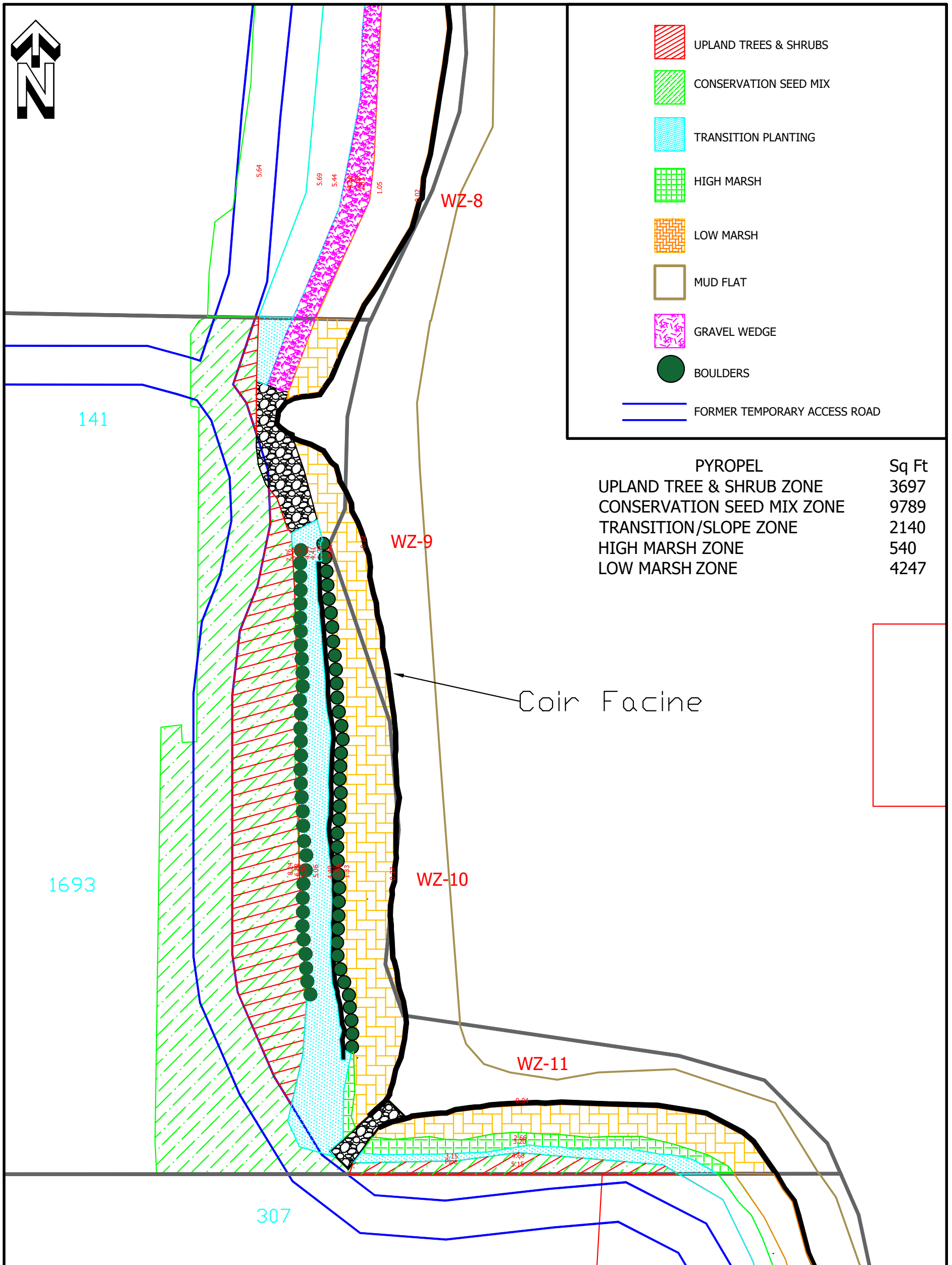
Spartina alterniflora (1227) salt marsh cordgrass

Plant 2" plugs with slow release fertilizer



- UPLAND TREES & SHRUBS
- CONSERVATION SEED MIX
- TRANSITION PLANTING
- HIGH MARSH
- LOW MARSH
- MUD FLAT
- GRAVEL WEDGE
- BOULDERS
- FORMER TEMPORARY ACCESS ROAD

	Sq Ft
UPLAND TREE & SHRUB ZONE	3697
CONSERVATION SEED MIX ZONE	9789
TRANSITION/SLOPE ZONE	2140
HIGH MARSH ZONE	540
LOW MARSH ZONE	4247

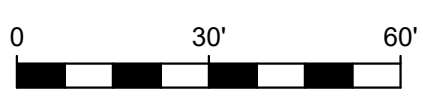


Coir Facine

1693

141

307



REVISIONS		
DATE	DESCRIPTION	DRAWN
2-5-21	REV1	kjt
3-10-21	Updated details	kjt

Notes
 1) Scale 1"/30'
 2) Cross section points collected 1/7/2021.

ENVIRONMENTAL, INC. WBE
 ECOLOGICAL AND OCEANOGRAPHIC CONSULTANTS
www.crenvironmental.com

Pyropel Parcel 116-94

UPPER HARBOR WEST ZONE-1, **PARCEL 116-94 Pyropel**

PROPOSED PLANTINGS (Spring 2021) Shrubs and trees all 1 gallon containers, and number for each plant species is in parentheses. Herbaceous plugs of salt marsh grasses, seaside goldenrod, switchgrass, and/or coastal panic grass should be 2" diameter. Slow release fertilizer such as Osmocote for plugs and 1 gallon containers for establishment. Seed mixes are New England/ Wildlife Seed Mix and Coastal Salt Tolerant Grass Mix (Reference Figure for Parcel 116-86 for planting zones, and Table 1 for a tally of Plant Materials).

- Provide temporary fencing at the upland extent to protect plantings during establishment

UPLAND Tree and Shrub Zone (~8 ft o.c. square spacing) planting a ~3,125 sq ft area up-gradient of the 2 man stones and seaward of the former access road. The remaining upland zone to be seeded with NE Conservation seed mix.

(total area is 9,788 sq ft/ planting 3,125 sq ft)

Juniperus virginiana (7) Eastern red cedar

Salix sericea (3) silky willow

Rhus aromatica (12) fragrant sumac

Rosa virginiana (21) Virginia rose

Plant landward of the transition zone. Plant rose and red cedar at the seaward edge of the upland. Then fragrant sumac and silky willow landward up to the area of the former access road. Remaining zone to receive only NE Conservation seed mix.

Overseed entire zone with **NE Conservation/Wildlife seed mix** 1 lb per 1750 sq ft or **~5.6 lbs**

TRANSITION Zone (3 ft o.c. for shrubs and 1.5 ft o.c. for herbs* square spacing)

(2,140 sq ft)

Bayberry subZONE *Myrica pensylvanica* (60) northern bayberry

Rosa virginiana (30) Virginia rose

Panicum virgatum (184) switchgrass*

Plant on shelf between the two rows of 2-man stone in sets of 3 plants of the same species; and above the high tide bush zone at southern extent of the parcel. Plant bayberry and rose at **3 ft o.c.** and switchgrass at **1.5 ft o.c.**

High Tide Bush subZONE

Iva frutescens (18) high tide bush

Panicum amarum var. *amarula* coastal panic grass (184) or if not available *P. virgatum* grass*

Solidago sempervirens (184) seaside goldenrod 2" plugs*

Plant above the high marsh zone at the southern end of the parcel. High tide bush and seaside goldenrod should be planted at the upper limit of the wrack line. High tide bush should be planted approximately **6 feet apart**. Plant seaside goldenrod between the high tide bush and the coastal panic grass landward with a spacing of **~1.5 ft o.c.**

Overseed entire transition zone with **Coastal Salt Tolerant Grass seed mix** at rate of 1 lb/1250 sq ft or **~1.7 lbs**.

UPPER HARBOR WEST ZONE-1, **PARCEL 116-94 Pyropel**

HIGH MARSH Zone (1 ft o.c. square spacing)

(540 sq ft)

Distichlis spicata (270) spike grass

Spartina patens (270) salt meadow grass

Plant 50/50 mix southern end of parcel.

LOW MARSH Zone (1.5 ft o.c. square spacing)

(4,247 sq ft)

Spartina alterniflora (1,888) salt marsh cordgrass

Plant 2" plugs with slow release fertilizer



WZ-10

WZ-11

WZ-12

-  UPLAND TREES & SHRUBS
-  CONSERVATION SEED MIX
-  TRANSITION PLANTING
-  HIGH MARSH
-  LOW MARSH
-  MUD FLAT
-  GRAVEL WEDGE
-  BOULDERS
-  FORMER TEMPORARY ACCESS ROAD

3.15
Pipe

3.26
3.58
4.68
5.15

2.44

2.92

5.96

6.09

3.27
1.57

0.99

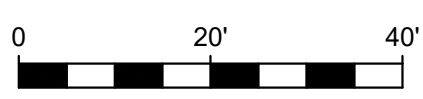
0.13

Parcel 112-65	Sq Ft
UPLAND TREE & SHRUB ZONE	7704
CONSERVATION SEED MIX ZONE	9382
TRANSITION/SLOPE ZONE	358
HIGH MARSH ZONE	324
LOW MARSH ZONE	1065

Cair

Parcel 112-65

CRE ENVIRONMENTAL, INC. WBE
 ECOLOGICAL AND OCEANOGRAPHIC CONSULTANTS
www.crenvironmental.com



REVISIONS		
DATE	DESCRIPTION	DRAWN
2-5-21	REV1	kjt
3-10-21	Update details	kjt

Notes
 1) Scale 1"=20'
 2) Cross section points collected 1/7/2021.

Precix
Parcel 112-65

UPPER HARBOR WEST ZONE-1, PARCEL 116-65 Precix

PROPOSED PLANTINGS (Spring 2021) Shrubs and trees all 1 gallon containers, and number for each plant species is in parentheses. Herbaceous plugs of salt marsh grasses, seaside goldenrod, switchgrass, and/or coastal panic grass should be 2" diameter. Slow release fertilizer such as Osmocote for plugs and 1 gallon containers for establishment. Seed mixes are New England/ Wildlife Seed Mix and Coastal Salt Tolerant Grass Mix (Reference Figure for Parcel 116-86 for planting zones, and Table 1 for a tally of Plant Materials).

*Provide temporary fencing at the upland extent to protect plantings during establishment

UPLAND Tree and Shrub Zone (~12 ft o.c. triangular spacing)

(9,382 sq ft total) about 8,812 sq ft for shrubs and trees

Quercus alba (1) white oak

Betula populifolia (3) gray birch

Juniperus virginiana (7) Eastern red cedar

Salix sericea (2) silky willow

Myrica pensylvanica (33) northern bayberry

Rhus aromatic (11) aromatic sumac

Plant landward of the transition zone. Plant bayberry, aromatic sumac and red cedar closer to the shore, and other species gray birch, sweet pepperbush, silky willow and oak landward of the access road footprint. Do not plant woody vegetation in the footprint of the access road.

Overseed entire zone with **NE Conservation/Wildlife seed mix** 1 lb per 1750 sq ft or **~5.4 lbs**

TRANSITION Zone (358 sq ft) (~1.5 ft o.c. square spacing)

Panicum amarum var. *amarula* coastal panic grass (102) or if not available *P. virgatum* switchgrass*

Iva frutescens (8) high tide bush

Solidago sempervirens (48) seaside goldenrod*

Plant above high marsh zone. Alternate sets of 3 coastal panic grass plugs with high tide bush and seaside goldenrod.

Overseed entire transition zone with **Coastal Salt Tolerant Grass seed mix** at rate of 1 lb/1250 sq ft **~ 0.3 lbs.**

HIGH MARSH Zone (1 ft o.c. square spacing)

(540 sq ft)

Distichlis spicata (162) spike grass

Spartina patens (162) salt meadow grass

Plant 50/50 mix above low marsh zone

LOW MARSH Zone (1.5 ft o.c. square spacing)

(1055 sq ft)

Spartina alterniflora (469) salt marsh cordgrass

Plant 2" plugs with slow release fertilizer

TABLE 1a

PLANTS FOR WZ-1 BY PARCEL
Original and Currently Proposed Numbers


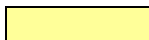
		Bayside Builders		PICO Stone		Pyropel		Precix		Original	Current	
		116-132	116-86	116-100		116-94		112-65		TOTALS	TOTALS	
<u>Shrub Species</u>	(1 gallon)	Original	Proposed	Proposed	Original	Proposed	Original	Proposed	Original	Proposed		
<i>Iva frutescens</i>	High tide bush	47	10	30		27	32	18	13	8	92	93
<i>Clethra alnifolia</i>	Sweet pepperbush	49	3	8	7		48		7		111	11
<i>Rosa virginiana</i>	Virginia rose	190	10	30		45	61	30			251	136
								21				
<i>Myrica pensylvanica</i>	Northern bayberry	21	10	60		45		60	7	33	28	208
<i>Salix sericea</i>	Silky willow							3	2	2	2	5
<i>Rhus aromatica</i>	Fragrant sumac							12		11	0	17
<u>Tree Species</u>												
<i>Acer rubrum</i>	Red Maple						2		2		4	0
<i>Juniperus virginiana</i>	Red Cedar	28	3	6				7	7	7	35	23
<i>Quercus alba</i>	White Oak									1	1	1
<i>Betula populifolia</i>	Gray Birch								1	3	1	3
	TOTAL	335	36	134	7	117	143	151	39	65	525	497

TABLE 1a

**PLANTS FOR WZ-1 BY PARCEL
Original and Currently Proposed Numbers**

	Bayside Builders		PICO Stone		Pyropel		Precix		
Herbaceous Species (Grasses and Forbs)									
<i>Panicum virgatum</i>									
<i>Panicum amarum var. amarula</i>									
<i>Solidago sempervirens</i>									
<i>Spartina alterniflora</i>									
<i>Spartina patens</i>									
<i>Distichlis spicata</i>									
New England Conservation/Wildlife seed mix (lbs) (total for Upland shrub & tree zone and Conservation seed zone) APPLICATION RATE: 25lbs/acre 1750 sq ft/lb	0.3	0.7		2		5.6		5.4	14
Coastal Salt Tolerant Grass seed mix (lbs) APPLICATION RATE: 35 lbs/acre 1250 sq ft/lb									

KEY

-  Upland Shrub & Tree Zone
-  Transition Zone
-  High Marsh Zone
-  Low Marsh Zone

Reference Jacobs Figure WZ-1 Post Excavation Limits, Parcel Figures, and Planting Directions

TABLE 1b

PLANTS FOR WZ-1 BY PARCEL





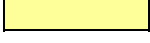
		Bayside Builders		Pico Stone	Pyropel	Precix	Current
		<u>116-132</u>	<u>116-86</u>	<u>116-100</u>	<u>116-94</u>	<u>112-65</u>	<u>TOTALS</u>
<u>Shrub Species</u>	(1 gallon)	Proposed	Proposed	Proposed	Proposed	Proposed	
<i>Iva frutescens</i>	High tide bush	10	30	27	18	8	93
<i>Clethra alnifolia</i>	Sweet pepperbush	3	8				11
<i>Rosa virginiana</i>	Virginia rose	10	30	45	30		136
					21		
<i>Myrica pensylvanica</i>	Northern bayberry	10	60	45	60	33	208
<i>Salix sericea</i>	Silky willow				3	2	5
<i>Rhus aromatica</i>	Fragrant sumac				12	11	17
<u>Tree Species</u>							
<i>Acer rubrum</i>	Red Maple						0
<i>Juniperus virginiana</i>	Red Cedar	3	6		7	7	23
<i>Quercus alba</i>	White Oak					1	1
<i>Betula populifolia</i>	Gray Birch					3	3
	TOTAL	36	134	117	151	65	497

TABLE 1b

PLANTS FOR WZ-1 BY PARCEL

	Bayside Builders		Pico Stone	Pyropel	Precix	
<u>Herbaceous Species (Grasses and Forbs)</u>						
<i>Panicum virgatum</i>	Transition Zone	Transition Zone	Transition Zone	Transition Zone		
<i>Panicum amarum var. amarula</i>	Transition Zone	Transition Zone	Transition Zone	Transition Zone	Transition Zone	
<i>Solidago sempervirens</i>	Transition Zone	Transition Zone	Transition Zone	Transition Zone	Transition Zone	
<i>Spartina alterniflora</i>	Low Marsh Zone	Low Marsh Zone	Low Marsh Zone	Low Marsh Zone	Low Marsh Zone	
<i>Spartina patens</i>				High Marsh Zone	High Marsh Zone	
<i>Distichlis spicata</i>				High Marsh Zone	High Marsh Zone	
N.E. Conservation/Wildlife seed mix (lbs) (total Conservation seed zone)	Conservation Seed Zone	Conservation Seed Zone	Conservation Seed Zone	Conservation Seed Zone	Conservation Seed Zone	
APPLICATION RATE: 25lbs/acre 1750 sq ft/lb						
Coastal Salt Tolerant Grass seed mix (lbs)	Transition Zone	Transition Zone	Transition Zone	Transition Zone	Transition Zone	
APPLICATION RATE: 35 lbs/acre 1250 sq ft/lb						

KEY

-  Upland Shrub & Tree Zone
-  Conservation Seed Zone
-  Transition Zone
-  High Marsh Zone
-  Low Marsh Zone

Reference Jacobs Figure WZ-1 Post Excavation Limits, Parcel Figures, and Planting Directions

ATTACHMENTS

SELECT PLANT IMAGES AND USDA DATA SHEETS

NEW ENGLAND SEED MIXES



SEASIDE GOLDENROD



SWITCH GRASS



COASTAL PANIC GRASS



VIRGINIA ROSE



SILKY WILLOW



NORTHERN BAYBERRY

New England Coastal Salt Tolerant Grass Mix

The New England Coastal Salt Tolerant Seed Mix contains a selection of native grasses that tolerate salty conditions. This mix is appropriate for drier coastal areas that receive salt spray or mist. Always apply on clean bare soil. The mix may be applied by hydro-seeding, by mechanical spreader, or on small sites it can be spread by hand. Lightly rake, or roll to ensure proper seed to soil contact. Best results are obtained with a Spring seeding. Late Spring and early Summer seeding will benefit with a light mulching of weed free straw to conserve moisture. If conditions are drier than usual, watering may be required. Late Fall and Winter dormant seeding require an increase in the seeding rate. Fertilization is not required unless the soils are particularly infertile. Preparation of a clean weed free soil surface is necessary for optimal results.

APPLICATION RATE: 35 lbs/acre | 1250 sq ft/lb

PRICE: \$26.00/bulk pound

Minimum order: 4 lbs

SPECIES: Canada Wild Rye (*Elymus canadensis*), Red Fescue (*Festuca rubra*), Atlantic Coastal Panic Grass (*Panicum amarum*), Big Bluestem (*Andropogon gerardii*), Indian Grass (*Sorghastrum nutans*), Switch Grass (*Panicum virgatum*), Path Rush (*Juncus tenuis*)

New England Conservation/Wildlife Mix

The New England Conservation/Wildlife Mix provides a permanent cover of grasses, wildflowers, and legumes. For both good erosion control and wildlife habitat value. The mix is designed to be a no maintenance seeding, and is appropriate for cut and fill slopes, detention basin side slopes, and disturbed areas adjacent to commercial and residential projects.

APPLICATION RATE: 25lbs/acre | 1750 sq ft/lb

PRICE: \$39.50/bulk pound

Minimum Order: 2 lbs

SPECIES: Virginia Wild Rye (*Elymus virginicus*), Little Bluestem (*Schizachyrium scoparium*), Big Bluestem (*Andropogon gerardii*), Red Fescue (*Festuca rubra*), Switch Grass (*Panicum virgatum*), Partridge Pea (*Chamaecrista fasciculata*), Panicleleaf Tick Trefoil (*Desmodium paniculatum*), Indian Grass (*Sorghastrum nutans*), Blue Vervain (*Verbena hastata*), Butterfly Milkweed (*Asclepias tuberosa*), Black Eyed Susan (*Rudbeckia hirta*), Common Sneezeweed (*Helenium autumnale*), Heath Aster (*Aster pilosus*/*Symphotrichum pilosum*), Early Goldenrod (*Solidago juncea*), Upland Bentgrass (*Agrostis perennans*).

SWITCHGRASS

Panicum virgatum L.

Plant Symbol = PAVI2



Robert H. Mohlenbrock
From the Southern Wetland Flora (1991)
@ plants.usda.gov

Uses

Livestock: Switchgrass is noted for its heavy growth during late spring and early summer. It provides good warm-season pasture and high quality hay for livestock.

Erosion Control: Switchgrass is perhaps our most valuable native grass on a wide range of sites. It is a valuable soil stabilization plant on strip-mine spoils, sand dunes, dikes, and other critical areas. It is also suitable for low windbreak plantings in truck crop fields.

Wildlife: Switchgrass provides excellent nesting and fall and winter cover for pheasants, quail, and rabbits. It holds up well in heavy snow (particularly 'Shelter' and 'Kanlow' cultivars) and is useful on shooting preserves. The seeds provide food for pheasants, quail, turkeys, doves, and songbirds.

Biofuel Source: Interest in switchgrass as a renewable biofuel resource has been increasing in recent years, primarily in the Southern United States. The Booneville, Arkansas, Plant Materials Center (PMC) and the Plant and Soil Science Department of Oklahoma State University (OSU) are cooperating to evaluate several upland types of switchgrass for use as a biomass energy resource. Selections of upland types of switchgrass have been evaluated by OSU for

several years. The development of hybrid progeny with substantial heterosis for increased biomass yield will ultimately result in improved hybrid cultivars for the Central and Southern United States. The PMC is in the process of assessing several improved lines along with commercially available cultivars for dry-matter potential and environmental adaptation. Results of this study may contribute to producers cashing in on a growing demand for renewable fuels and a decrease on our dependency on fossil fuels.

Status

Please consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status (e.g. threatened or endangered species, state noxious status, and wetland indicator values).

Weediness

This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed. Please consult with your local NRCS Field Office, Cooperative Extension Service office, or state natural resource or agriculture department regarding its status and use. Weed information is also available from the PLANTS Web site at plants.usda.gov.

Description

Panicum virgatum L., switchgrass, is native to all of the United States except California and the Pacific Northwest. It is a perennial sod-forming grass that grows 3 to 5 feet tall and can be distinguished from other warm-season grasses, even when plants are young, by the white patch of hair at the point where the leaf attaches to the stem. The stem is round and usually has a reddish tint. The seed head is an open, spreading panicle.

Adaptation and Distributions

On suitable soils, switchgrass is climatically adapted throughout the most of the United States. Moderately deep to deep, somewhat dry to poorly drained, sandy to clay loam soils are best. It does poorly on heavy soils. In the Northeast, it performs well on shallow and droughty soil.

Switchgrass is distributed throughout the majority of the United States, excluding the far west states. For a current distribution map, please consult the Plant Profile page for this species on the PLANTS Website.

Establishment

Switchgrass should be seeded in a pure stand when used for pasture or hay because it can be managed better alone than in a mixture. It may be mixed with other native grasses, forbs, or legumes for wildlife and restoration seedings. Its slick, free-flowing seed can be planted with most seed drills or with a broadcast spreader. Sow seed at a rate of approximately 4-6 pounds of pure live seed (PLS) per acre drilled in a pure stand. Broadcast seed at a rate of 8-10 pounds of pure live seed (PLS) per acre for a pure stand. Reduce the rate of switchgrass in mixes. Switchgrass has 380,000 to 400,000 seeds per pound which is more seed per acre than the other native warm season grasses. Seeding rates must be carefully designed to provide the desired balance of species.

Tilled seedbeds in areas that were formerly cropped should be firmed with a roller prior to the drilling or broadcasting of seed. If seeds are planted using the broadcast method, the area should be rolled afterward to help cover the seed. When drilled, seeds should be planted 1/4 inch deep. Seedings in areas that were formerly pastures or hay fields have been successful, where control of sod is accomplished with clipping, grazing, or herbicides.

Switchgrass and all other native warm season grasses require exposure to cold, moist conditions (stratification) before they will germinate in warm temperatures. This is easiest to accomplish by sowing seed before the last frost. The date of the last frost in most of the Appalachian Region is April 15.

Phosphorus and potassium should be applied according to soil tests before or at seeding. Nitrogen, however, should not be used at seeding time because it will stimulate weed growth. Apply nitrogen once the switchgrass is growing and is taller than the weeds in the stand at a rate of 30 to 50 pounds per acre.

Management

To control weeds during establishment, mow switchgrass to a height of 4 inches in May or 6 inches in June or July. Grazing is generally not recommended the first year, but a vigorous stand can be grazed late in the year if grazing periods are short with at least 30 days of rest provided between grazings. Switchgrass is the earliest maturing of the common native warm-season grasses and it is ready to graze in early summer.

Established stands of switchgrass may be fertilized in accordance with soil tests. Phosphorus and potassium may not be needed if the field is grazed

since these elements will be recycled back to the soil by the grazing animal.

Apply nitrogen after switchgrass has begun to produce using a single application in mid-to-late May or a split application in both May and early July. Avoid high rates of nitrogen because carry-over could spur cool-season grass growth and harm young plants the following spring. Switchgrass will utilize 80 to 100 pounds of nitrogen when it is managed well for grazing or hay. Fertilize stands managed for wildlife with 30 to 50 pounds of nitrogen per acre to produce seed.

Switchgrass will benefit from burning of plant residues just prior to initiation of spring growth. Burning fields once every 3 to 5 years decreases weed competition, eliminates excessive residue and stimulates switch grass growth. Switchgrass used for wildlife food and cover should be burned once every 3 to 4 years to reduce mulch accumulations that inhibit movement of hatchlings and attract nest predators.

Under continuous grazing management, begin grazing switchgrass after it has reached a height of 12 to 16 inches, and stop when plants are grazed to within 6 to 8 inches of the ground. A rest before frost is needed to allow plants to store carbohydrates in the stem bases and crown. Plants may be grazed to a height of 6 to 8 inches after frost. The winter stubble is needed to provide insulation. Grazed paddocks need to be rested 30-60 days before being grazed again.

Pests and Potential Problems

Grasshoppers and leafhoppers can be major pests in new seedings. Some stands are impacted by damping off and seedling blight. Leaf rust occasionally affects forage quality.

Weed Control

Establishment and maintenance of stands of switchgrass and all other native warm season grasses is highly dependent on weed control. These grasses are extremely slow to germinate and grow in their first year. Weeds can have a significant impact on stand establishment and persistence.

When establishing stands into areas that were in row crops the year before the seeding, good weed control in those cropped fields during the year prior to the seeding can minimize the impact of weeds on the seeding. Thorough tillage and cultipacking before sowing the seed is necessary to minimize the impact

of annual weeds that germinated over the winter and perennial weeds that escaped weed control measures.

When seeding into areas that were pastures or hay fields the year before the seeding, the pasture or hay crops must be killed. Cool season pasture and hay species can be grazed heavily, mowed very close, or treated with herbicide in the early spring before sowing the seed. Warm season grasses must be killed during the summer of the year prior to seeding.

The herbicide imazapic (products s Plateau and Journey) are labeled for the pre-emergent and post-emergent control of many species of weeds in native warm season grasses, but both herbicides damage switchgrass. There are no labeled pre-emergent herbicides for use on switchgrass.

Annual grass and broadleaf weeds can be controlled by mowing over the top of the switchgrass stands to cut off flowering stalks before they make mature seed. Broadleaf weeds can be controlled with broadleaf herbicides such as 2,4-D, dicamba, picloram, metsulfuron, triclopyr, and clopyralid. Broadleaf weed control can be only effective when the correct herbicide is applied to a susceptible species at the proper rate and at a susceptible stage of growth. Most herbicides must be applied when weeds are young. Cool season weeds can be controlled with a contact herbicide such as glyphosate (product Roundup) in native warm season grasses when the native warm season grasses are dormant.

Please contact your local agricultural extension specialist or county weed specialist to learn what works best in your area and how to use it safely. Always read label and safety instructions for each control method. Trade names and control measures appear in this document only to provide specific information. USDA, NRCS does not guarantee or warranty the products and control methods named, and other products may be equally effective.

Cultivars, Improved, and Selected Materials (and area of origin)

'KY-1625' was released by the Quicksand, Kentucky Plant Materials Center as a germplasm release in 1987. It was collected from Raleigh County, West Virginia and compared to 35 other switchgrass accessions before its release. It is not commercially available, but seed is available for research purposes from the Alderson, West Virginia Plant Materials Center.

There are commercially available cultivars of switchgrass that are adapted to the Appalachian Region. 'Cave-in-Rock' is originally from Illinois and was released by the Elsberry, Missouri Plant Materials Center. 'Cave-in-Rock' is a cultivar released for forage production. 'Shawnee' is a selection from 'Cave-in-Rock' from the Agricultural Research Service in Lincoln, Nebraska. 'Shawnee' was selected for its forage quality.

'Kanlow' is originally from southern Oklahoma and was released by the Manhattan, Kansas Plant Materials Center. 'Kanlow' is a stiff-stemmed, lowland type switchgrass well adapted to poorly drained areas and preferred for wildlife habitat. 'Shelter' is originally from West Virginia and was released by the Big Flats, New York Plant Materials Center. 'Shelter' is also a stiff-stemmed type and is preferred for wildlife habitat.

'Blackwell' is originally from northern Oklahoma and was released by the Manhattan, Kansas Plant Materials Center. 'Blackwell' is a low maintenance cultivar adapted to droughty, infertile sites. Seeds are available from most commercial sources and through large agricultural supply firms.

Weed Control

Please contact your local agricultural extension specialist or county weed specialist to learn what works best in your area and how to use it safely. Always read label and safety instructions for each control method. Trade names and control measures appear in this document only to provide specific information. USDA, NRCS does not guarantee or warranty the products and control methods named, and other products may be equally effective.

Prepared By:

John Vandevender, Alderson, West Virginia Plant Materials Center

For more information about this and other plants, please contact your local NRCS field office or Conservation District, and visit the PLANTS Web site <<http://plants.usda.gov>> or the Plant Materials Program Web site <<http://Plant-Materials.nrcs.usda.gov>>

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and

Independence Avenue, SW, Washington, DC 20250-9410 or call 202-720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.

Read about [Civil Rights at the Natural Resources Conservation Service](#).



COASTAL PANICGRASS

Panicum amarum Elliott var. *amarulum* (Hitc. & Chase) P.G. Palmer

Plant Symbol = PAAMA2

Common Names: coastal panicgrass; dune panic grass; dune switchgrass; seabeach grass; seaside panic grass; seaside panicum; shoredune panicum; slightly bitter panic grass; southern seabeach grass; tall sand-dune panic grass

Scientific Names: *Panicum amarulum* Hitc. & Chase; *Panicum amarum* Elliott ssp. *amarulum* (Hitc. & Chase) Freckmann & Lelong; *Panicum amarum* var. *amarulum* (Hitc. & Chase) P. Palmer

Description

General: Coastal panicgrass is a native, warm-season, clump forming, rhizomatous, perennial grass that grows 3-7 feet tall (Fernald, 1950; Surrency and Owsley, 2006). Its blueish green leaves grow from 8-20 inches long and up to 0.5 inches wide (Tiner, 2009; USDA-NRCS, 2012). Robust stems with a diameter of up to 0.5 inches form a hard, knotty base (Gleason and Conquist, 1963; USDA-NRCS, 2012). Narrow, densely flowered panicles up to 2 feet long form from July to August (Hough, 1983; Tiner, 2009). Flowers produce bright orange anthers. Elliptically shaped gray to tan seed 0.06-0.09 inches long and 0.04-0.05 inches wide (Palmer, 1975) is produced October through November (Hough, 1983; Lorenze et al., 1991; Tiner, 2009).

Coastal panicgrass is often mistaken for bitter panicgrass (*Panicum amarum* Elliott var. *amarum*), a closely related species. Coastal panicgrass tends to have a more erect, bunch forming habit while bitter panicgrass tends to be more prostrate. Panicle width and flower density have also been used to distinguish the two varieties. Bitter panicgrass has narrower and more sparsely flowered panicles compared to the wider and heavily flowered panicles of coastal panicgrass. These characteristics are at least somewhat impacted by ecological conditions with differences becoming more pronounced at the northern end of the species range and less distinct at the southern end of the range (Palmer, 1975).

Distribution: Coastal panicgrass commonly occurs on the dunes of sandy coastal beaches from the Northeast United States to Mexico. The widely accepted native range is along the east coast from New Jersey to as far south as the Yucatán Peninsula of Mexico (Lonard and Judd, 2011). Coastal panicgrass is rare in Rhode Island but it is reported to occur as far north as Barnstable County, Massachusetts (Tiner, 2009; USDA-NRCS, 2019). It can be grown in USDA hardiness zones 7a-12b but may winterkill during especially harsh winters at the northern extent of the zone and inland (USDA-NRCS, 2012). For current distribution, please consult the Plant Profile page for this species on the PLANTS Web site.

Habitat: Coastal panicgrass most frequently grows in tufts in the coastal dune environment from the leeward side of the primary dune in the pioneer zone to the scrub zone in association with American beachgrass (*Ammophila breviligulata*), saltmeadow cordgrass (*Spartina patens*), seaoats (*Uniola paniculata*), seacoast marsh elder (*Iva imbricata*), devil's-tongue (*Opuntia humifusa*), amberique-bean (*Strophostyles helvola*), southeastern wildrye (*Elymus glabriflorus*), partridge pea



(*Chamaecrista fasciculata*), Adam's needle (*Yucca filamentosa*), hairawn muhly (*Muhlenbergia capillaris*), shore little bluestem (*Schizachyrium littorale*), common evening primrose (*Oenothera biennis*), Carolina rose (*Rosa carolina*), gulf croton (*Croton punctatus*), seaside goldenrod (*Solidago sempervirens*), largeleaf pennywort (*Hydrocotyle bonariensis*), yaupon (*Illex vomitoria*), wax myrtle (*Morella cerifera*), northern bayberry (*Morella pensylvanica*), eastern baccharis (*Baccharis halimifolia*), winged sumac (*Rhus copallinum*), peppervine (*Nekemias arborea*), Virginia creeper (*Parthenocissus quinquefolia*), muscadine (*Vitis rotundifolia*), devilwood (*Osmanthus americanus*), beach plum (*Prunus maritima*), eastern red cedar (*Juniperus virginiana*), and live oak (*Quercus virginiana*) (Graetz, 1973; Slattery et al., 2003; Wootton et al., 2016). Coastal panicgrass also occurs along the borders of intertidal marshes and has been reported to colonize disturbed sandy sites (Anderson and Alexander, 1985; Hill, 1986).

Adaptation

Coastal panicgrass is extremely drought resistant and salt spray tolerant making it well adapted to its indigenous habitat on the coastal dunes (Graetz, 1973; Lorenze et al., 1991). It is a barrier plant in the dune pioneer zone, protecting more salt susceptible species beyond the primary dune. In a study examining the salinity tolerance of American beachgrass, saltmeadow cordgrass, sea oats, and coastal panicgrass seedlings, Seneca (1972) found coastal panicgrass to be the second most salt tolerant of the four species tested based on growth response. Miller (2013) also found coastal panicgrass can withstand occasional saltwater treatments. Coastal panicgrass is most adapted to the well-drained, sandy soils of the Atlantic Coastal Plains but will tolerate poorly drained soils (Lorenze et al., 1991; USDA-NRCS, 2006 a). It can withstand a soil pH range of 4.5-7.5 (Salon and Miller, 2012). It is intolerant of shade and does not do well as an understory plant (Lorenze et al., 1991).

Uses

Conservation Practices: Coastal panicgrass has an upright growth habit, is resistant to lodging, is easily established, long-lived, and manageable. These characteristics make it an ideal candidate in Hedgerow (422), Vegetative Barrier (601), and Herbaceous Wind Barrier (603) plantings (USDA-NRCS, 2012). Belt (2015) reported coastal panicgrass as a top performer in a trial evaluating the ability of 40 species to reduce or limit the spread of dust, odor, and ammonia emitted by poultry farm exhaust fans. Additionally, coastal panicgrass has proven applications for the NRCS Critical Area (342) standard for dune stabilization plantings, mined land reclamation sites, and dredged material revegetation (Knight et al., 1980; USDA-NRCS, 2012). It is one of the few dune stabilization species to be successfully established by direct seeding (Wootton et al., 2016). Coastal panicgrass may also be used to stabilize other Critical Area sites e.g. gravel pits, dikes, and road banks (USDA-NRCS, 2006 a). Coastal panicgrass could also be applied to long term management plans using the NRCS Herbaceous Weed Treatment (315) standard. Planting coastal panicgrass in coastal dune environments is recommended as a means of discouraging the recolonization of the invasive Asiatic sand sedge (*Carex kobomugi*) following successful treatment control measures (TLC, 2017).

Wildlife: Coastal panicgrass provides food and shelter for a variety of species including songbirds, waterfowl, and small mammals (Slattery et al., 2003). The calorie dense seed provides doves and quail with a concentrated energy source in the late fall/early winter when other food sources may be scarce (Surrency and Owsley, 2006). In a study of grassland bird habitat frequented for breeding purposes by the regionally rare grasshopper sparrow, Rudnicki et al. (1997) reported coastal panicgrass as a dominant species at one of the sites tested. Pernell and Soots (1975) reported a highly successful herring gull colony with nests next to bunches of coastal panicgrass. In an additional study of the nesting habits of sea birds, McNair and Gore (2000) reported coastal panicgrass as the dominant vegetation on a Florida island for two breeding seasons. Coastal panicgrass habitat is the preferred habitat of eight subspecies of beach mice: Alabama beach mouse, Perdido Key beach mouse, Santa Rosa beach mouse, Choctawatchee beach mouse, St. Andrew beach mouse, Anastasia Island beach mouse, Southeastern beach mouse, and pallid beach mouse. With the exception of the Santa Rosa beach mouse, all have been listed as threatened or endangered by either the United States Fish and Wildlife Service or the Florida Fish and Wildlife Conservation Commission (Bird et al., 2002). The beach mouse subspecies (the pallid beach mouse has been declared extinct) depend on coastal panicgrass for shelter and its seed as a constituent of their diet (Dziergowski, 2009; Lonard and Judd, 2011).

Forage: Coastal panicgrass is readily grazed by cattle and provides a sufficient level (140 g kg⁻¹) of crude protein to support beef production (Mehaffey et al., 2005). In a study examining the performance of tall fescue (*Schedonorus arundinaceus*) bermudagrass (*Cynodon dactylon*), yellow bluestem (*Bothriochloa ischemum*), and coastal panicgrass pasture systems, the coastal panicgrass pasture system produced the greatest steer gains during the warm-season grass growth period (Burns et al., 2012). However, Burns et al. (2012) reported that coastal panicgrass pastures could not support the same level of steer stocking as tall fescue/bermudagrass pasture systems without signs of severe stand weakening following a second year of grazing. The researchers concluded that coastal panicgrass pastures could be advantageous for grazing if incorporated into a rotational stocking system.

Ornamental/landscaping: The blueish green leaves and bright, vibrant orange anthers of coastal panicgrass make it a desirable plant for ornamental and landscaping purposes (Craig, 1976). This is especially true for landowners in coastal communities whose properties are adjacent to or within the vicinity of the dune environment. Many traditional ornamental plants cannot tolerate the salt spray and/or the native sandy soils of the barrier islands and littoral areas where most coastal communities occur.

Biofuel Production: In studies examining the biofuel potential of warm season grasses, coastal panicgrass has displayed greater biomass production than some big bluestem (*Andropogon gerardii*), eastern gamagrass (*Tripsacum dactyloides*), switchgrass (*Panicum virgatum*), and Indiangrass (*Sorghastrum nutans*) varieties (Viands, et al., 2010). The average annual yield of ‘Atlantic’ coastal panicgrass was slightly over 6 dry tons/acre after 4 years of data collection (USDA-NRCS, 2012). Coastal panicgrass’ tolerance for saline conditions may make it the ideal choice as a biofuel crop on marginal agricultural land that has been impacted by saltwater inundation (Miller, 2016).



Flowering spikelet of coastal panicgrass displaying orange anthers and purple stigmas. Photo by Scott Snell, USDA-NRCS, Plant Materials Program.

Ethnobotany

Various species of panicgrass were used for medicinal purposes by Native Americans. The Seminole Tribe used panicgrass medicinally as an antirheumatic (external), cough medicine, pulmonary aid, and throat aid (Hutton, 2010). The Natchez and Creek Tribes used panicgrass to treat malaria fevers (Hutton, 2010). The Miccosukee Tribe used panicgrass as a treatment for ‘gopher-tortoise sickness’ (Lamphere, 2006). The Cherokee Tribe padded their moccasins with stems from panicgrass (Lamphere, 2006).

Status

Threatened or Endangered: Coastal panicgrass is listed as endangered in Pennsylvania, threatened in Connecticut, and as a species of special concern in Rhode Island (USDA-NRCS, 2019). Coastal panicgrass is ranked as “S3” in New Jersey meaning “Not yet imperiled in state but may soon be if current trends continue” (Snyder, 2016).

Wetland Indicator: FAC for Atlantic and Gulf Coastal Plain region; FACU for all other regions in which it occurs (USACE, 2018).

Weedy or Invasive: Coastal panicgrass is listed as introduced in Massachusetts (CZM, 2019).

This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed. Please consult with your local NRCS Field Office, Cooperative Extension Service office, state natural resource, or state agriculture department regarding its status and use. Please consult the PLANTS Web site (<http://plants.usda.gov/>) and your state’s Department of Natural Resources for this plant’s current status (e.g., threatened or endangered species, state noxious status, and wetland indicator values).

Planting Guidelines

Although establishment in the coastal dune environment via vegetative plugs is the recommended method, establishment via direct seeding is possible under appropriate conditions (Lorenze et al., 1991). Soil moisture is critical with best results achieved in moist sand (Darovec et al., 1975; Slattery et al., 2003). Direct seeding into saline environments is also a feasible option. Coastal panicgrass seed will germinate at salinity levels almost equal to the levels that seedlings can tolerate (Seneca, 1972). Plant seed 1-3 inches deep; shallower for finer textured soils with higher silt content and deeper for coarse textured soils. Mulching the seeding area will improve establishment results (Craig, 1991; USDA-NRCS, 2012). In replicated seeding

depth trials on sand dunes conducted by the New Jersey Plant Materials Center, coastal panicgrass seeded 1 inch deep consistently showed greater seedling emergence than seed planted at 0.5 inch. Plant seed by broadcasting and incorporating to ensure good seed to soil contact or using a drop seeder, drill, or other seeding equipment. A single row garden push seeder is the simplest, small scale option (USDA-NRCS, 2007). Recommended seeding rates range from 6-15 lb/acre if drilled and up to 20 lb/acre if broadcast (USDA-NRCS, 2007; Wootton et al., 2016). Use containerized plugs or bare root divisions that are at least 12 inches tall for vegetative establishment. Plant spacing of 6-8 feet between rows and 18 inches within the row is recommended to obtain about 5,000 plants/acre for satisfactory coverage on dunes (Wootton et al., 2016). Recommended planting dates for seed and vegetative establishment are from November first to March first or June first to September first for the Gulf Coast region and March to May for the Mid-Atlantic region (USDA-NRCS, 2007; Wootton et al., 2016). Fertilizer application recommendations are always site dependent. While most native species do not require fertilizer amendments during the establishment year, some recommendations have been made for coastal panicgrass, see management section (Dickerson et al., 1997; USDA-NRCS, 2006 a; USDA-NRCS, 2007).

Establish seed production fields following the same guidelines and methods for coastal dune environment conservation plantings. The site should receive full sun and have soils that are well-drained and coarse to medium textured. Preferred annual precipitation is at least 30 inches. The soil pH should be amended if necessary, until slightly acidic to neutral (Dickerson et al., 1997).

Management

For wildlife habitat applications, mowing is a treatment option to control undesired vegetation. Coastal panicgrass withstands mowing well. Rudnicki et al. (1997) reported it to be a dominant species following mowing treatments of grassland bird habitat. Prescribed burning suppresses weeds, controls the spread of unwanted perennial species, and kills some weed seeds (USDA/EPA, n.d.). In addition to weed control, controlled burning assists in nutrient recycling and stimulates seed production (USDA-NRCS, 2006 a). Selective herbicide applications are a reliable means of weed control (USDA/EPA, n.d.). Please contact your local agricultural extension specialist or county weed specialist to learn what works best in your area and how to use it safely. Always read label and safety instructions for each control method. Trade names and control measures appear in this document only to provide specific information. USDA-NRCS does not guarantee or warranty the products and control methods named, and other products may be equally effective.

Fertilizer recommendations for coastal panicgrass are inconsistent. Top or side dressed single application and split applications (June and August) of 10-10-10 fertilizer applied at rates ranging from 400-600 lb/acre annually have been recommended for both seed production fields and coastal dune plantings (USDA-NRCS, 2007; USDA-NRCS, 2006 a). More recent fertilization recommendations for the coastal dune environment address water quality concerns due to excess nutrients from overfertilization. In response, lower fertilization rates (20-30 lb/acre nitrogen) and alternative nutrient sources (slow release fertilizers and organic options) are recommended for coastal dune sites (Wootton et al., 2016). In all cases, base fertilizer applications on soil test results of the planting site. Contact your local agricultural extension for soil test analysis and fertilizer application recommendations prior to implementing a fertilization plan.

Pests and Potential Problems

In the Mid-Atlantic coastal dune environment, coastal panicgrass has been reported to be negatively impacted by plant parasitic nematodes. Seliskar and Huettel (1993) reported a correlation between the presence of plant parasitic nematodes and reduction of plant health. Coastal panicgrass did not show any signs of plant stress the initial year that nematodes were found, but signs of stress were reported in following years. Coastal panicgrass is a reported host of multiple fungal rust species (Farr and Rossman, 2019).

Environmental Concerns

Coastal panicgrass is listed as introduced in Massachusetts (CZM, 2019; Lonard and Judd, 2011). Coastal panicgrass seed can remain viable for up to 5 years in its natural habitat without any specialized storage (USDA-NRCS, 2012). Although initial seed dispersal is limited to no more than 20 feet, consumption by wildlife and floatation on moving waters are two possible means by which seed could become distributed greater distances to non-native habitats (Lonard and Judd, 2011; USDA-NRCS, 2012). Coastal panicgrass rhizomes are a viable means of regeneration in favorable conditions and may spread 3 feet in a single growing season (USDA-NRCS, 2012). Coastal panicgrass has been reported to invade the frontal dune system but will not become well established due to the inevitable burial of the shifting sands (Palmer, 1975). Coastal panicgrass has not been reported to cause any allelopathic effects (USDA-NRCS, 2012).

Seeds and Plant Production

Coastal panicgrass is propagated vegetatively or by seed (USDA-NRCS, 2006 a). Seed production fields reach maturity and become productive in two growing seasons. Up to 300 lb/acre of cleaned seed is produced by properly managed seed production fields (USDA-NRCS, 2012). Seed production is stimulated by annual prescribed burns in late winter or early spring (USDA-NRCS, 2006 a). Coastal panicgrass seed ranges from 325,000-350,000 seeds/lb (Dickerson et al., 1997;

USDA-NRCS, 2012). Laboratory viability tests of seed produced at the New Jersey Plant Materials Center from 2001 to 2020 ranged from 70 to 94 percent with an average rate of 84 percent. Coastal panicgrass maintains excellent longevity under ideal storage conditions. Seed stored in a seed cooler (4°C and 40 percent relative humidity) at the New Jersey Plant Materials Center maintained 75 percent or greater viability rates after 9 years of storage with germination rates increasing after storage in some instances.

Harvest seed with hand tools (hand sickles) or on a greater scale with mechanical agricultural equipment. Seed has been successfully harvested at the New Jersey Plant Materials Center using a plot harvester with a standard grain head. Harvester settings depend on a multitude of variables (equipment, environmental conditions, management methods, etc.), but the following ranges have proven satisfactory: cylinder spacing of 0.26-0.28 inch, cylinder speed of 1000 rpm, and a low air flow setting. Seed is typically harvested in early October in the Mid-Atlantic region of the U.S.

Seed cleaning methods depend upon the harvest method. If harvested with hand tools, thresh seed before attempting to separate the chafe from the seed. Thresh seed with mechanized seed cleaning equipment or use a manual rubbing board. Small harvest amounts can be mechanically threshed using a slightly modified kitchen blender (Scianna, 2004). Air and screen seed cleaning equipment readily separates chafe from seed using 0.31-0.14 inch round holes for the top screen and 1/22 inch round holes for the bottom screen.

Cultivars, Improved, and Selected Materials (and area of origin)

These plant materials are readily available from commercial sources. ‘Atlantic’ coastal panicgrass is a cultivar developed and released in 1981 by the Cape May, NJ Plant Materials Center, USDA-NRCS. The source material for Atlantic was collected from Back Bay Wildlife Refuge, Princess Anne County, Virginia. It was selected for seedling vigor, uniform characteristics, and rust resistance (USDA-NRCS, 2006 b). It is recommended for critical area, forage, hedge row, salt affected sites, and wildlife applications (USDA-NRCS, 2012)

Literature Cited

- Anderson, L.C. and L.L. Alexander. 1985. The vegetation of Dog Island, Florida. *Florida Scientist* 48(4): 232-251.
- Belt, S.V. 2015. Plants tolerant of poultry farm emissions in the Chesapeake Bay Watershed. Maryland Plant Materials Final Report. USDA-Natural Resources Conservation Service, Norman A. Berg National Plant Materials Center, Beltsville, MD.
- Bird, B.L., L.C. Branch, and M.E. Hostetler. 2002. Beach mice, WEC 165. University of Florida / Institute of Food and Agricultural Sciences Extension, Wildlife Ecology and Conservation Department, Gainesville, FL.
- Burns, J.C., D.S. Fisher, and K.R. Pond. 2012. Steer performance and pasture productivity of a tall fescue-bermudagrass system compared with yellow bluestem and coastal panicgrass. *Prof. Anim. Sci.* 28: 272-283.
- CZM (Coastal Zone Management). 2019. Coastal Landscaping in Massachusetts – grasses and Perennials [Online]. Available at <https://www.mass.gov/info-details/coastal-landscaping-in-massachusetts-grasses-and-perennials#coastal-panic-grass-> (accessed 17 December 2019). Massachusetts Office of Coastal Zone Management (CZM), Storm Smart Coasts Program, Boston, MA.
- Craig, R.M. 1976. Grasses for coastal dune areas. *Proc. FL State Hort. Soc.* 89: 353-355.
- Craig, R.M. 1991. Plants for coastal dunes of the Gulf and South Atlantic Coasts and Puerto Rico. *Agriculture Information Bulletin* 460. USDA-Soil Conservation Service, Gainesville, FL.
- Darovec, J.E. et al. 1975. Techniques for coastal restoration and fishery enhancement in Florida. Florida Department of Natural Resources, Marine Research Laboratory, St. Petersburg, FL.
- Dickerson, J. et al. 1997. Vegetating with native grasses in Northeastern North America. USDA-Natural Resources Conservation Service, Syracuse, NY and Ducks Unlimited, Memphis, TN.
- Duncan, W.H. and M.B. Duncan. 1987. *The Smithsonian guide to seaside plants of the Gulf and Atlantic coasts*. Smithsonian Institution Press. Washington, D.C.
- Dziergowski, A. 2009. Species Account for Anastasia Island beach mouse (*Peromyscus polionotus phasma*) and Southeastern beach mouse (*Peromyscus polionotus niveiventris*). U.S. Fish and Wildlife Service, Jacksonville, FL.
- Farr, D.F. and A.Y. Rossman. 2019. Fungal Databases, U.S. National Fungus Collections [Online]. Available at <https://nt.ars-grin.gov/fungal-databases/> (accessed 18 Dec. 2019). USDA-Agricultural Research Service, Washington D.C.
- Fernald, M.L. 1950. *Gray’s manual of botany*. American Book Company, New York.
- Gleason, H.A. and A. Cronquist. 1963. *Manual of vascular plants of Northeastern United States and adjacent Canada*. Van Nostrand Reinhold Company, New York.
- Graetz, K.E. 1973. *Seacoast plants of the Carolina for conservation and beautification*. Sea Grant Publication, Chapel Hill, NC.
- Hill, S.R. 1986. An annotated checklist of the vascular flora of Assateague Island (Maryland and Virginia). *Castanea*, 51, 265–305.

- Hough, M.Y. 1983. New Jersey wild plants. Harmony Press, Harmony, NJ.
- Hutton, K. 2010. A comparative study of the plants used for medicinal purposes by the Creek and Seminoles Tribes. Graduate Theses and Dissertations, University of South Florida.
- Knight, D.B., P.L. Knutson, and E.J. Pullen. 1980. An annotated bibliography of seagrasses with emphasis on planting and propagation techniques. Miscellaneous report No. 80-7. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA.
- Lamphere, J. 2006. Plant Guide for bitter panicum (*Panicum amarum* Ell.). USDA-Natural Resources Conservation Service, Golden Meadows Plant Materials Center, Galliano, LA.
- Lonard, R.I. and F.W. Judd. 2011. The biological flora of coastal dunes and wetlands: *Panicum amarum* S. Elliott and *Panicum amarum* S. Elliott var. *amarulum* (A.S. Hitchcock and M.A. Chase) P. Palmer. *J. Coast. Res.* 27(2): 233-242.
- Lorenze, D.G., W.C. Sharp, and J.D. Ruffner. 1991. Conservation plants for the Northeast. USDA-Soil Conservation Service.
- McNair, D.B. and J.A. Gore. 2000. Recent breeding of Caspian terns in Northwest Florida. *Florida Field Naturalist* 28(1): 30-32.
- Mehaffey, M.H., D.S. Fisher, and J.C. Burns. 2005. Photosynthesis and nutritive value in leaves of three warm-season grasses before and after defoliation. *Agron. J.* 97: 755-759.
- Miller, C.M. 2013. Workshop: Living Shorelines for Coastal Erosion Protection in a Changing World, Hauppauge, NY. 15 May 2013. New York Sea Grant, NY.
- Miller, C.M. 2016. Adaptive Strategies to Alleviate the Impacts of Sea Level Rise. Mid-Atlantic Crop Management School, Ocean City, MD. 17 November 2016. [Online]. Available at <https://youtu.be/ieB0DQkwlko> (accessed 16 December 2019).
- Palmer, P.G. 1975. A biosystematic study of the *Panicum amarum*-*P. Amarulum* complex (Gramineae). *Brittonia* 27(2): 142-150.
- Pernell, J.F. and R.F. Soots. 1975. Herring and great black-backed gulls nesting in North Carolina. *The Auk* 92(1): 154-157.
- Rudnický, J.L., W.A. Patterson III, and R.P. Cook. 1997. Experimental use of prescribed fire for managing grassland bird habitat at Floyd Bennet Field, Brooklyn, New York in Grasslands of Northeastern North America: Ecology and conservation of native and agricultural landscapes. Massachusetts Audubon Society, Lincoln, MA.
- Salon, P.R. and C.F. Miller. 2012. A guide to conservation plantings on critical areas for the Northeast. USDA-Natural Resources Conservation Service, Big Flats Plant Materials Center, Corning, NY.
- Scianna, J.D. 2004. Blending dry seeds clean. *Native Plants* 5(1): 44-55.
- Seliskar, D.M. and R.N. Huettel. 1993. Nematode involvement in the dieout of *Ammophila breviligulata* (Poaceae) on the Mid-Atlantic coastal dunes of the United States. *J. Coastal Research* 9(1): 97-103.
- Seneca, E.D. 1972. Seedling response to salinity in four dune grasses from the outer banks of North Carolina. *Ecology* 53(3): 465-471.
- Slattery, B.E., K. Reshetiloff, and S.M. Zwicker. 2003. Native plants for wildlife habitat and conservation landscaping: Chesapeake Bay Watershed. U.S. Department of Interior, Fish & Wildlife Service.
- Snyder, D.B. 2016. List of Endangered Plant Species and Plant Species of Concern [Online]. Available at <https://www.nj.gov/dep/parksandforests/natural/heritage/njplantlist.pdf> (accessed 25 November 2019). New Jersey Department of Environmental Protection, Division of Parks and Forestry, Trenton, NJ.
- Surrency, D. and C.M. Owsley. 2006. Plant Materials for Wildlife. USDA-Natural Resources Conservation Service, Jimmy Carter Plant Materials Center. Americus, GA.
- Tiner, R.W. 2009. Field guide to tidal wetland plants of the Northeastern United States and neighboring Canada. University of Massachusetts Press, Amherst, MA.
- TLC (Technical Learning College). 2017. Invasive Plants Identification and Control, Professional Development Continuing Education Course [Online]. Available at <https://www.abctlc.com/downloads/courses/InvasivePlants.pdf> (accessed 19 December 2019). Chino Valley, AZ.
- US Army Corps of Engineers (USACE). 2018. National Wetland Plant List v3.3 – Species Detail Tool. [Online]. Available at https://www.branford-ct.gov/sites/default/files/field/files-docs/using_native_grasses_for_ecological_restoration.pdf (accessed 18 Dec. 2019). USDOD-Army Corps of Engineers. Washington, DC.
- USDA/EPA. n.d. Using Native Grasses for Ecological Restoration [Online]. Available at <https://www.mass.gov/info-details/coastal-landscaping-in-massachusetts-grasses-and-perennials#coastal-panic-grass-> (accessed 17 December 2019). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center. Cape May, NJ.
- USDA-NRCS. 2006. Plant fact sheet for *Panicum amarum* Ell. Var. *amarulum* (A.S. Hitchc. & Chase) P.G. Palmer, Coastal panicgrass. USDA-Natural Resources Conservation Service, Somerset, Plant Materials Program.
- USDA-NRCS. 2006. Release brochure for coastal panicgrass 'Atlantic' (*Panicum amarum* Ell. Var. *amarulum*). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center. Cape May, NJ.
- USDA-NRCS. 2007. Planting guide for establishing coastal vegetation on the Mississippi Gulf coast. USDA-Natural Resources Conservation Service, Jamie L. Whitten Plant Materials Center, Coffeeville, MS.

- USDA-NRCS. 2012. Release brochure for coastal panicgrass 'Atlantic' (*Panicum amarum* Ell. Var. *amarulum*). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center. Cape May, NJ.
- USDA-NRCS. 2019. Plants Database – *Panicum amarum* Elliott var. *amarulum* (Hitc. & Chase) P.G. Palmer, coastal panicgrass [Online]. Available at <https://plants.usda.gov/core/profile?symbol=PAAMA2> (accessed 25 November 2019). USDA-Natural Resources Conservation Service.
- Viands, D.R., H. Hansen, and H. Mayton. 2010. Production/Evaluation of Grasses for Energy Conversion in NNY in Northern New York Agricultural Development Program. Cornell University Agricultural Experiment Station, Ithaca, NY.
- Wootton, L., J. Miller, C. Miller, M. Piik, A. Williams, and P. Rowe. 2016. Dune Manual. New Jersey Sea Grant Consortium, Highlands, NJ.

Citation

Snell, S.C. 2020. Plant Guide for coastal panicgrass (*Panicum amarum* Elliott var. *amarulum*). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center, Cape May, NJ.

Published: September 2020

Edited: 20Aug2020 hld

For more information about this and other plants, please contact your local NRCS field office or Conservation District at <http://www.nrcs.usda.gov/> and visit the PLANTS Web site at <http://plants.usda.gov/> or the Plant Materials Program web site: <http://plant-materials.nrcs.usda.gov>.

PLANTS is not responsible for the content or availability of other Web sites.

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at [How to File a Program Discrimination Complaint](#) and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.

SEASIDE GOLDENROD

Solidago sempervirens L.

Plant Symbol = SOSE



Seaside goldenrod (*Solidago sempervirens* L.) Photo by, William Skaradek, USDA NRCS.

Alternate Names

Common Names:

salt-marsh goldenrod

Scientific Names:

Aster sempervirens (L) Kuntze;

A. mexicanus;

Solidago mexicana L.;

S. sempervirens subsp. *mexicana*;

S. sempervirens var. *Mexicana*

Description

General: Seaside goldenrod is a native, late-flowering perennial forb. It may grow up to 6 ft tall at maturity, blooming August through October. The terminal flowering heads are dense, clustered spikes of bright yellow flowers that are larger than those of other goldenrod species.

The leaves are fleshy, somewhat succulent, dark green, oblong, and lance-shaped. They are arranged alternately along the entire length of the stem. The leaves at the base are the largest, up to 8 in long and ½–1 ½ in wide, gradually decreasing in size towards the top of the plant.

In winter, the plant's persistent whitened leaves, coarse stalks, and dried flower parts make it easily identifiable. Red leaves sprout in late February and early March, and soon become dark green. From late August to early October, its bright yellow flowers provide an attractive contrast to its lush, thick, green vegetation.

Seaside goldenrod is a short-day perennial (flowering coincides with shortened photoperiods). So that at some point as a critical dark periods lengthens, flowering is

initiated. The flowers are an important food/energy source for fall migrating monarch butterflies traveling the Atlantic coastal flyway. This species can hybridize with rough-stemmed goldenrod (*Solidago rugosa*).

The fruit of the seaside goldenrod is a capsule with a pappus in a single circle of bristles. The seeds require no cold stratification for germination. When buried, seed viability decreases after the first year in both disturbed and undisturbed areas (Lee, 1993). Therefore, seaside goldenrod does not appear to have a persistent seed bank.

Transition areas (areas of greater sand movement and accumulation) tend to have greater amounts of seed in the seed bank (up to 58 seeds/m²) when compared to grasslands (Lee, 1993). However, studies have also found germination of the plant limited to areas of minimal sand accumulation.

Distribution: Seaside goldenrod mainly grows east of the Mississippi. It grows in the northeast from Canada and the Great Lakes region, south along the Mid-Atlantic coast to Florida, and as far west as Texas. For current distribution, please consult the Plant Profile page for this species on the PLANTS Web site.

Habitat: Stands of seaside goldenrod colonize blowouts, grasslands, and transition areas. Seaside goldenrod often occurs with other native dune plants such as coastal panicgrass (*Panicum amarum*), switchgrass (*Panicum virgatum*), salt meadow cordgrass (*Spartina patens*), and American beachgrass (*Ammophila breviligulata*).

Adaptation

Seaside goldenrod can grow in coarse to medium infertile soils with a pH range from 5.5–7.5. Seaside goldenrod is well adapted to coastal habitats including the backside of primary dunes, low secondary dunes, and edges of salt marshes. It has some tolerance for drought, allowing it to survive in the dry conditions of the dunes. Seaside goldenrod is also tolerant of high salinity, salt spray, and fire.

Uses

Wildlife Use: Like many *Solidago* spp., seaside goldenrod is an important resource for over-wintering, gall-producing insects. Some of these insects are predatory wasps that are beneficial to have near crops. In addition, gall larvae provide an excellent source of nutrition in the winter for birds such as the chickadee or woodpecker. It increases the value of wildlife habitat by providing food and shelter for butterflies, birds, and small mammals. The migrating monarch butterfly uses seaside goldenrod as one of its primary food sources in the fall.

Along with American beachgrass (*Ammophila breviligulata*), seaside goldenrod plays an important role in providing nesting habitat between primary and secondary dunes for birds such as willets (*Catoptrophorus semipalmatus*), killdeer (*Charadrius vociferous*), piping plovers (*Charadrius melodus*), and black skimmers (*Rynchops niger*) (Safina and Burger, 1983).

Erosion Control: Seaside goldenrod is a native perennial that has been successfully used in dune stabilization and erosion control projects. Stems arise from short, stocky rhizomes. The root-length is a minimum of 14 in and provides excellent erosion control. Seaside goldenrod initiates dune formation by trapping sand and debris. Sites with seaside goldenrod help the secondary establishment of annual forbs such as seaside sandmat (*Euphorbia polygonifolia*), and American searocket (*Cakile edentula*) (Ailstock, n.d.).

Ethnobotany

While the medicinal value of this particular species of goldenrod remains unknown, many species in the *Solidago* genus have been used for generations as a natural remedy for a variety of health conditions (ex. *S. Canadensis* and *S. vigaurea*). Thomas Edison explored ways of using latex from the seaside goldenrod for the production of natural rubber (caoutchouc).

Status

Threatened or Endangered: No.

Wetland Indicator: FACW (Facultative Wetland). Seaside goldenrod usually occurs in wetlands, but may occur in non-wetlands.

Please consult the PLANTS Web site (<http://plants.usda.gov/>) and your State Department of Natural Resources for this plant's current status (e.g., threatened or endangered species, state noxious status, and wetland indicator values).

Planting Guidelines

Seaside goldenrod may be propagated by seed or division. Currently the only developed method of establishing seed production plots and dune restoration plantings is with containerized stock transplanted in late winter to early spring.

The first year of establishment is the most critical for survival. Once the stand is established, it requires little maintenance and only minimal irrigation due to its ability to withstand hot and dry conditions. Producers should irrigate if an extended dry period occurs. Fertilization will increase vigor of seaside goldenrod, but is not necessary for survival.

To establish, prepare a clean, weed-free seedbed. Start seeds in 2-inch deep trays, grown into vegetative plugs, planted every 2 feet in rows with 3 feet in between centers. When planting into a dune site, it is important to

keep the substrate attached to the roots of the seedling to prevent desiccation (Shumway, 2008).

Growing plants with American beachgrass (*Ammophila breviligulata*) in both broadcast and seed-drilled experimental plots improves production. These nurse crops may lower temperature and increase moisture for seaside goldenrod populations. *S. sempervirens* has dehydromatricaria ester in the roots (Lam et al., 1992). This allelopathic compound is lethal to nematodes and inhibits the growth of rice seedlings.

Management

Producers often manage weeds with a pre-emergent herbicide and after establishment with mechanical cultivation. The decline in health of the closely associated American beachgrass could be used to signal when goldenrod should be fertilized.

Pests and Potential Problems

It has been reported that the release of root exudates by seaside goldenrod produce allelochemicals that negatively affect the growth of nearby vegetation. Studies by Cheplick and Aliotta (2009) found that seaside goldenrod has a negative effect on the growth of native grasses such as purple sandgrass (*Triplasis purpurea*) and sanddune sandbur (*Cenchrus tribuloides*). Being a perennial, seaside goldenrod should also have a distinct advantage over annuals when competing for limited resources. Nevertheless, because seaside goldenrod has a moderate growth rate, a shorter life span than other *Solidago* spp., a limited ability to spread through seed, and produces seedlings with low vigor, it is not considered an invasive plant.

Goldenrods in general are popular hosts to overwintering gall insects. Approximately half of all gall insects are lost to predation. Three common herbivores that feed on seaside goldenrod are the goldenrod leaf miner (*Microrhopala vittata*), red goldenrod aphid (*Uroleucon pieloui*) and the goldenrod leaf beetle (*Trirhabda Canadensis*). The goldenrod leaf miner feeds on the upper leaves, creating numerous small holes. Unlike aphids, population densities for the goldenrod leaf miner remain low and only occasionally create severe damage. The goldenrod leaf beetle is strongly attracted to the odor of the host plant *S. sempervirens*, and has been shown to prefer it to the odor of non-host plants (Puttick et al., 1988). There is no known research suggesting that *S. sempervirens* can negatively affect the growth of nearby food crops.

There is no significant herbivory recorded. Coastal or island herbivores such as rabbits and deer will occasionally browse plants in fall and winter.

Environmental Concerns

There are no environmental concerns with use of this plant.

Control

Please contact your local agricultural extension specialist or county weed specialist to learn what works best in your area and how to use it safely. Always read label and safety instructions for each control method. Trade names and control measures appear in this document only to provide specific information. USDA NRCS does not guarantee or warranty the products and control methods named, and other products may be equally effective.

Seeds and Plant Production

Researchers are trying to develop effective methods to grow seaside goldenrod from direct seeding in a dune setting. Seed consistently has good germination rates when grown in controlled settings such as a greenhouse or germination chamber, but stands fail to develop when directly seeded in dune trials. Currently the best way to propagate the plant is with vegetative plugs. The seed has a 3-year average of 70 % germination from 2009–2011 at the Cape May PMC, in Cape May, NJ.

Seaside goldenrod produced 75 lb/ac of seed (first year of establishment) to 220 lb/ac of seed (2 years after establishment) at the Plant Materials Center. Plants were sown 1.5 ft apart, in rows with 3.5 ft between centers. For this same population, the germination rate was 72 % after one year of storage at 40° F and 64 % after two years of storage. The plant bed was prepared with a pre-emergent herbicide and the weeds in the inter-rows were cultivated once per season.

Cold stratification and use of a light source can break dormancy and encourage germination. Seed will germinate only on the surface of sand at high temperatures. These seeds can easily dry out and die if there is no supplemental moisture or irrigation. Cross-pollination is required for viable seed. There are approximately 700,000 seeds/lb.

Cultivars, Improved, and Selected Materials (and area of origin)

Monarch Germplasm seaside goldenrod is a source-identified composite germplasm from several native populations developed by the Cape May Plant Materials Center in Cape May, NJ. Seed was collected from natural stands among the dunes of several Mid-Atlantic States: New Jersey, Delaware, and the eastern shore of Virginia. Cape May Plant Materials Center has evaluated seaside goldenrod for over ten years.

Cultivars should be selected based on the local climate, resistance to local pests, and intended use. Consult with your local land grant university, local extension or local USDA NRCS office for recommendations on adapted cultivars for use in your area.

Literature Cited

Ailstock, M.S. n.d. The in-vitro propagation of seaside goldenrod *Solidago sempervirens*. Anne Arundel

Community College, Arnold, Maryland.

<http://images.library.wisc.edu/EcoNatRes/EFacs/Wetlands/Wetlands12/reference/econatres.wetlands12.i0010.pdf> (accessed: 02 Feb. 2012)

Austin, D. F. 2004. Florida ethnobotany. CRC Press, Boca Raton, FL. p. 1075.

Cheplick, G.P., and M. Aliotta. 2009. The abundance and size of annual herbs in a coastal beach community is related to their distance from seaside goldenrod (*Solidago sempervirens*). J. Torr. Bot. Soc. 136 (1): 102-109.

Duncan, W.H., and M. B. Duncan. 1987. Seaside plants of the gulf and Atlantic coasts. Smithsonian Institution Press, Washington, D.C. p. 298.

Lam, J., L.P. Christensen, T. Farch, and T. Thomasen. 1992. Acetylenes from the roots of *Solidago* species. Phytochemistry 31(12): 4159-4161.

Lee, P.C. 1993. The effect of seed dispersal limitations on the spatial distribution of a gap species, seaside goldenrod (*Solidago sempervirens*). Can. J. Bot. 71: 978 -984.

Puttick, G.M., P.A. Morrow, and P.W. Lequesne. 1988. *Trirhabda canadensis* (Coleoptera:Chrysomelidae) responses to plant odors. J. Chem. Ecol., 14 (8): 1671-1686.

<http://www.springerlink.com/content/u6150263v5407623/fulltext.pdf> (accessed: 02 Feb. 2012)

Radford, A.E, H.E Ahles, and C. R. Bell. 1968. Manual of the vascular flora of the Carolinas. The University of North Carolina Press, Chapel Hill, NC.

Safina, C., and J. Burger. 1983. Effects of human disturbance on reproductive success in the black skimmer. Condor. March-April. 85(2): 164-171.

Shumway, S.W. 2008. Atlantic seashore: beach ecology from the Gulf of Maine to Cape Hatteras. A Falcon Guide. Morris Book Publishing, LLC, China.

The University of Texas at Austin. 2012. Native plant database. Lady Bird Johnson Wildflower Center. Austin, Texas.

http://www.wildflower.org/plants/result.php?id_plant=SOSE (accessed: 20 Jan. 2012)

USDA-ARS GRIN. Dr. Duke's phytochemical and ethnobotanical databases. <http://www.ars-grin.gov/cgi-bin/duke/ethnobot.pl> (accessed: 31 Jan. 2012)

Citation

Sheahan, C.M. 2014. Plant Guide for seaside goldenrod (*Solidago sempervirens*). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center. Cape May, 08210.

Published February, 2014

Edited:

For more information about this and other plants, please contact your local NRCS field office or Conservation District at <http://www.nrcs.usda.gov/> and visit the

PLANTS Web site at <http://plants.usda.gov/> or the
Plant Materials Program Web site:
<http://plant-materials.nrcs.usda.gov>.

PLANTS is not responsible for the content or availability
of other Web sites.

Helping People Help the Land

USDA IS AN EQUAL OPPORTUNITY PROVIDER AND EMPLOYER