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New Jersey
Vegetative Plantings Technical Reference

Establishment and Maintenance Guide

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Introduction

The information contained in the New Jersey Conservation Planting Guide is an official part of the Field Office Technical Guide (FOTG), and is incorporated by reference into many conservation practice standards contained in Section IV of the FOTG. This Planting Guide provides additional information, recommendations, and specifications for most planting, seeding, or revegetation operations performed as stand-alone cover practices, or as components of other conservation practices.

This Planting Guide is organized as follows:

Section 1 - General Requirements and Reference Tables Applicable to All Plantings - contains **guidelines for planting seeds of different sizes and types in a grass/forb mixture**. This section also contains a table that cross-references New Jersey conservation practices with recommended planting types, the USDA Plant Hardiness Zone Map for New Jersey, and a table of recommended planting dates for permanent cover.

Section 2 - Upland Herbaceous Conservation Plantings: Conservation Cover Plantings - contains recommended seed mixes for permanent herbaceous cover with low to medium plant density. Depending on the species, these conservation cover mixes may need a year or more to become fully established, and may eventually become dense with maturity, especially without periodic disturbance. These mixes are generally used for wildlife habitat and water quality purposes, and can provide protection from erosion when site conditions are not severe. Some mixes are also suitable for areas that receive light to moderate human use, such as for paths, walkways, and travel lanes. Plantings are generally not harvested, hayed, or grazed for agricultural production.

Section 3 - Upland Herbaceous Conservation Plantings: Critical Area Plantings - contains recommended seed mixes for temporary and permanent herbaceous cover with high plant density. These critical area planting mixes are designed to provide cover that establishes relatively quickly and is very durable. These mixes are typically used on sites that have, or are expected to have, high erosion rates, as well as on sites with limiting factors that make plants especially difficult to establish (e.g., on construction sites) and/or maintain (e.g., on heavily used areas). Plantings are generally not harvested, hayed, or grazed for agricultural production.

Section 4 - Tree and Shrub Plantings - contains recommended trees and shrubs (and several woody vines) that can be planted for native cover, hedgerows, windbreaks/shelterbelts, forest production, wetland restoration, and other purposes.

Section 5 - Streambank and Shoreline Plantings - contains recommended woody and herbaceous plantings for streambank and shoreline stabilization and protection.

Section 6 - Wetland Plantings - contains recommended plantings for wetlands and shallow water areas.

Section 7 - Forage and Biomass Plantings - contains recommendations for establishing adapted and/or native species, varieties, or cultivars of herbaceous plants suitable for pasture, hay, or biomass production.

Section 8 - Cover Crop Plantings - contains recommendations for establishing grasses, legumes, and forbs for seasonal vegetative cover.

Section 9 – Vegetative Barriers – contains recommendations for establishing vegetative barriers for soil erosion purposes.

Section 10 – References – contains a master reference list used in this document. Each section also includes a reference list specific to the information in each section.

Using this Planting Guide

1. Start with Section 1. The general information at the beginning of this section is applicable to all plantings in the Guide.

2. Using Table 1.1, select the appropriate conservation practice and type of planting. Most practices have an option for more than one planting type, depending on site conditions and/or how the planting will be used.

3. Use Figure 1.1 to identify the Plant Hardiness Zone where the planting will be established.

4. Go to the Planting Guide section (as directed in Table 1.1) for additional information and tables of recommended species/mixes for planting. Select vegetative cover to accomplish the intended purpose of the practice and the objectives of the client. Select plant types and species based on their compatibility in growth rates, moisture requirements, and other characteristics.

5. Return to Section 1 and use Table 1.2 to determine the appropriate planting dates for the type of plant materials (e.g., warm-season grasses, cool-season grasses, trees, etc.) selected for permanent cover. Planting dates for temporary cover, when applicable, are included in separate tables elsewhere in this Guide.

Section 1 - General Requirements and Reference Tables Applicable to all Plantings

Use Table 1.1 to find the location in this Planting Guide of recommended plantings for each listed conservation practice and type of planting.

Use Figure 1.1 and Table 1.2 to determine the appropriate planting dates for the different types of plant materials for permanent cover. Planting dates for temporary cover, when applicable, are included in separate tables elsewhere in this Guide.

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GENERAL REQUIREMENTS AND REFERENCE TABLES APPLICABLE TO ALL PLANTINGS

Use Table 1.1 to find the location in this Planting Guide of recommended plantings for each listed conservation practice and type of planting.

Use Figure 1.1 and Table 1.2 to determine the appropriate planting dates for the different types of plant materials for permanent cover. Planting dates for temporary cover, when applicable, are included in separate tables elsewhere in this Guide.

***When using this planting guide, you may notice some information within the tables is not populated. Most often this is due to the high variance in characteristics of each variety within a species. Consult with the proper specialist for species and variety specific information.*

Guidelines for Planting Seeds

Use Certified Seed When Available

Using certified seed for plantings is the right course of action because this seed has known identity and meets certified seed quality standards (for purity and germination). It gives the user the best chance of success and the least chance of introducing unwanted weed problems to a given field. Certified seed also provides the varietal link from the breeder/developer like the NRCS Plant Materials Centers to the landowner. Planners should specify varieties that have

been developed and proven for specific geographic regions of the country. The varieties listed in the seed mix tables to follow are the most up to date recommendations.

Buy and Plant Seed on a Pure Live Seed (PLS) basis

Native grass seed, and often wildflower seed, is sold on a pure live seed (PLS) basis. Some enlightened seed dealers are now also selling cool season grass seed on a PLS basis. It is in the best interest of the customer to purchase seed this way because it ensures that the desired product is what is being paid for (living seed vs. leaf pieces, stems, unwanted seed, and dead seed). A pound of pure live seed contains 16 ounces of living seed of the desired species plus additional weight of the other material that has not been removed by the cleaning processes. Using the seed analysis tag which shows percent germination and percent purity, one can calculate the PLS percentage and compare the quality of different batches or "lots" of seed. For instance, a seed lot which has a tested germination of 80 percent and a purity of 90 percent has a PLS percentage of 72 (.80 x .90 = .72). If one wishes to plant 1.0 PLS pound of this seed lot the gross amount of weight to buy and plant would be 1.39 pounds (1.00 divided by .72).

Buy Individual Species and Mix Before Planting

Some grass seed mixes are sold as pre-mixed "canned" mixes. This is not a good way to buy seed because the mix may contain unwanted varieties, unwanted species, or poor quality seed. It also means that the seed cannot be unmixed if the planting is not made. **Seed should be received in individual species lots and then mixed just prior to planting.** Seeds of grasses, legumes, and wildflowers have a wide variety of seed sizes. Some of the native grasses and wildflowers are also "chaffy" -- that is, they have awns (stiff or fluffy bristles) attached to the seeds that prevent them from flowing smoothly through a traditional drill or broadcast seeder. Grasses with chaffy seeds include big bluestem, little bluestem, broomsedge, Indiangrass, Canada wild rye, and Virginia wild rye. Smooth-seeded native grass species include deertongue, beaked panicgrass, coastal panicgrass, redtop panicgrass, purpletop, and switchgrass. Although the seeds of native legume and wildflower species are often smooth, some such as goldenrods and asters are chaffy. Native wildflower and legume seeds also vary greatly in size. The planting method and/or the type of machine to be used can affect the way the seed is mixed. For instance, it is often easier to plant smooth seeds together as a mix separate from fluffy seed (which comprises a second mix). Some drills can handle these in separate seed boxes. When hand broadcasting is the method of choice or when only a fluffy seed box is available on the drill, then mix all the seed together. Frequent agitation of the seed will help to keep the smooth seed from settling out of the fluffy seed.

Native Grass Seed Drills

Mixes with seeds of different types and sizes require special equipment and/or methods for planting. Native seed drills (i.e., drills with a chaffy seed box) can be used to plant mixes with chaffy seed. For mixes with different size seeds, a drill with a small seed box is required to provide proper seed distribution. Native grass drills are designed to handle the fluffy seeds of the bluestems and indiangrass, as well as the smaller, smooth seed such as switchgrass. The most prevalent system utilizes a picker wheel (looks like a coarse-toothed radial saw blade) which pulls the seed down into the drop tubes. Native grass drills also have large diameter drop tubes, so the seed does not hang up in the tube, and double disk openers with depth bands. The depth bands help to limit seed depth to 1/2 inch maximum. Conventional drills do not have feed mechanisms which can handle the fluffy seeds, and do not have depth bands because they need to plant grain seed deeper than 1/2 inch. Cultipacker type seeders will not meter the fluffy seeds and are not as effective in proper seed placement as are the native grass drills.

The following list of suitable drill manufacturers is not complete, but it does contain the most common drills that are available. Some Soil and Water Conservation Districts have a drill that is on this list. These makers may also produce models that are not meant for native grass use, so the name alone is not enough information, the specific machine needs to be equipped as described above. Truax, Great Plains, Buffalo, Kincaid, Brillion and Tye are manufacturers that supply native grass drills.

Use of Carriers

Traditional drills, drop seeders, and broadcast seeders require the use of a carrier when planting variable seed mixes. A drop seeder is usually a better choice than a broadcast seeder because seed variability can affect the distribution of the seed and result in a non-uniform stand. Broadcast and drop seeders also require additional seedbed cultivation to promote good seed-to-soil contact, which can be accomplished using a cultipacker (preferred), rake, harrow, or drag. When using a broadcast seeder, use a high ratio of carrier to seed and calibrate the seeder to put down only half the amount in one pass. Then apply the seed in two passes -- one horizontal and one vertical -- to enhance seed distribution. If the seed is mixed with a carrier, select the type of the carrier with the type of seeding equipment in mind, and calibrate the equipment to deliver a specific amount of carrier and seed per acre. Many seeders and spreaders will not deliver less than a certain amount of material, so the type of equipment may dictate the carrier weight to seed weight ratio. For example, a fertilizer spreader may be designed to deliver no less than 100 pounds per acre, which is significantly higher than most seeding rates. A minimum ratio of 1:1 carrier weight to seed weight should be used, but the ratio should be high enough to make the seed flow through the seeder/spreader and mix the different kinds of seed.

For seed mixes with smooth seeds of different sizes, a minimum 5:1 ratio (carrier weight to seed weight) is recommended to bulk up the mix, especially for small seeds that tend to separate in the hopper of the seeder. For chaffy seeds, use a 15:1 to 20:1 ratio. A 40:1 ratio is recommended for seeds with very stiff awns, such as the wild ryes.

Some common carriers include pelletized lime is readily available and is seldom applied in high enough amounts to alter the pH. For example, a 20:1 ratio with a 5-pound per acre seed mix only adds 100 pounds of lime per acre. Rice hulls, non-clumping cat litter or even sand has been used as a carrier. Oats will also serve as a carrier and may be especially useful on sites with steeper slopes, where the oats will also serve as a nurse crop.

TABLE 1.1: Location of Recommended Plantings for Vegetative Practices

Conservation Practice	Planting Guide Section for Recommended Plantings							
	2	3	4	5	6	7	8	9
Conservation Cover (327)	■							
Cover Crop (340)							■	
Critical Area Planting (342)								
Herbaceous cover		■						
Trees/shrubs			■					
Fence (382)								
Herbaceous cover - conservation cover	■							
Herbaceous cover - critical areas		■						
Forage/biomass						■		
Field Border (386)								
Herbaceous cover - conservation cover	■							
Herbaceous cover - critical areas		■						
Shrubs			■					
Filter Strip (393)		■						
Forage and Biomass Planting (512)						■		
Hedgerow Planting (422)								
Stiff-stemmed grasses	■							
Trees/shrubs			■					
High Tunnel System (325)		■						
Riparian Forest Buffer (391)			■					
Riparian Herbaceous Cover (390)								
Herbaceous cover - conservation cover	■							
Forage/biomass						■		
Shallow Water Development and Management (646)								
Herbaceous cover in the buffer - conservation cover	■							
Herbaceous cover in the buffer - critical areas		■						
Trees/shrubs in the buffer			■					
Herbaceous vegetation in the pool area					■			
Silvopasture (381)			■			■		
Streambank and Shoreline Protection (580)								
Bioengineering, tidal marsh, and dune plantings				■				
Herbaceous cover for outside the floodplain		■						
Tree/Shrub Establishment (612)			■					
Vegetative Barrier (601)								■
Wetland Restoration (657)								
Herbaceous cover in the buffer - conservation cover	■							
Herbaceous cover in the buffer - critical areas		■						
Trees/shrubs in the buffer and pool area			■		■			
Herbaceous vegetation in the pool area					■			
Wildlife Habitat Planting (420)	■		■		■			
Windbreak/Shelterbelt Establishment (380)			■					
Other - Vegetative Stabilization for Engineering Practices		■	Or as specified in the engineering practice.					

FIGURE 1.1: USDA Plant Hardiness Zones for New Jersey

https://planthardiness.ars.usda.gov/

FIGURE 1.1 NOTE: This map is intended for general guidance. For more specific county-level Plant Hardiness Zone information, refer to local GIS data.

TABLE 1.2 Recommended Planting Dates for Permanent Cover in New Jersey [1]

Type of Plant Material		Plant Hardiness Zones		
		6a	6b	7a and 7b
Grasses and Legumes	Cool-Season Seed Mixes	Mar 15 to May 31 Aug 1 to Sep 30	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 1 to Apr 30 Aug 15 to Oct 31 Nov 1 to Nov 30**
	Warm-Season/ Cool-Season Seed Mixes	Mar 15 to May 31 Jun 1 to Jun 15*	Mar 1 to Apr 30 May 1 to Jun 15*	Feb 1 to Apr 30 May 1 to May 31*
	Cool-Season Sod	Mar 15 to May 31 Jun 1 to Aug 31* Sep 1 to Oct 15	Mar 1 to Apr 30 May 1 to Sep 14* Sep 15 to Oct 31	Feb 1 to Apr 30 May 1 to Sep 30* Oct 1 to Dec 15
Forbs	Seeds	Mar 15 to May 31	Mar 1 to Apr 30	Feb 1 to Apr 30
	Bare-Root Seedlings	Apr 1 to May 31 Jun 1 to Jun 30*	Mar 15 to May 15 May 16 to Jun 30*	Feb 15 to Apr 30 May 1 to Jun 30*
	Containerized Stock	Apr 1 to May 31 Jun 1 to Jun 30* Sep 1 to Oct 1*	Mar 15 to May 15 May 16 to Jun 30* Sep 15 to Oct 15*	Mar 1 to Apr 30 May 1 to Jun 30* Oct 1 to Nov 15*
Woody Plants	Dormant Cuttings	Mar 1 to Mar 31 Nov 1 to Nov 15	Feb 15 to Mar 15 Nov 15 to Nov 30	Feb 1 to Feb 28 Nov 15 to Nov 30
	Bare-Root Seedlings	Apr 1 to May 31 Jun 1 to Jun 30*	Mar 15 to May 15 May 16 to Jun 30*	Feb 15 to Apr 30 May 1 to Jun 30*
	Containerized Stock	Apr 1 to May 31Jun 1 to Jun 30* Sep 1 to Oct 1*	Mar 15 to May 15May 16 to Jun 30* Sep 15 to Oct 15*	Mar 1 to Apr 30 May 1 to Jun 30* Oct 1 to Nov 15*

[1] The planting dates listed are averages for each zone. These dates may require adjustment to reflect local conditions, especially near the boundaries of the zones. When seeding toward the end of the listed planting dates, or when conditions are expected to be less than optimal, select an appropriate nurse crop from Table 1 and plant with the permanent seeding mix. (See Table 1, Note 1 for more information.)

** Additional planting dates for the lower Coastal Plain, dependent on annual rainfall and temperature trends. Recommend adding a nurse crop, as noted above, if planting during this period.

* Additional planting dates during which supplemental watering may be needed to ensure plant establishment.

Section 2 - Upland Herbaceous Plantings: Conservation Cover Plantings

This section contains recommended seed mixes for permanent herbaceous cover with low to medium plant density. Depending on the species, these conservation cover mixes may need a year or more to become fully established, and may eventually become dense with maturity, especially without periodic disturbance. These mixes are generally used for wildlife habitat and water quality purposes and can provide protection from erosion when site conditions are not severe. Some mixes are also suitable for areas that receive light to moderate human use, such as for paths, walkways, and travel lanes. Plantings in this section are generally not harvested, hayed, or grazed for agricultural production.

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Selecting Mixes and Establishing Plantings

Tables in this section supplement the applicable conservation practice standards (see Section 1, Table 1.1), and contain additional requirements for species selection, planting rates, and methods of establishment.

Plantings shall consist of two or more species to provide vegetative diversity.

Refer to Table 2.1 to select appropriate mixes for specific purposes.

Refer to Table 2.2 for recommended herbaceous cover mixes and seeding rates. Other herbaceous species that are native to New Jersey, or are introduced and are non-invasive, may also be suitable.

For optimum wildlife and pollinator habitat, Mixes 15 and 16 are designed to establish highly diverse herbaceous stands containing native grasses and wildflowers. New Jersey native grasses are matched with native wildflowers for dry-mesic and mesic-wet soil moisture conditions.

The grasses are generally 3 feet in height or shorter, and tend to be less competitive than non-native grasses and tall-statured native grasses. This makes them more compatible with native wildflowers. All of the grasses tend to have a bunch-type growth form and are suitable for sites with low fertility.

Table 2.3 provides a list of native grasses, grass-like plants, and their characteristics.

Table 2.4 provides a list of native wildflowers and legumes, and their characteristics. Information in these tables may be used to select alternative species to substitute for species that are not currently available, or when desired by the client or planner. They may also be used to develop custom mixes.

TABLE 2.1: Recommended Upland Herbaceous Seeding Mixes for Conservation Cover by Purpose or Primary Use of the Planting

TABLE 2.1: Recommended Upland Herbaceous Seeding Mixes for Conservation Cover by Purpose or Primary Use of the Planting																	
Purpose or Primary Use of the Planting	**Recommended Mix (see Table 2.2)**																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Reduce sheet, rill, and wind erosion (provide perennial cover)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			◆	◆	◆	
Improve surface water quality (by nutrient uptake and reduced sedimentation)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			◆	◆	◆	
Improve groundwater quality (by nutrient uptake)	✓	✓															
Reduce dust (provide vegetated travel lanes for light to moderate use in perennial crop systems, such as orchards and vineyards)						◆	◆		◆								
Enhance wildlife, pollinator, and beneficial organism habitat (provide diverse mixes of grasses and forbs)			◆	◆	◆	◆	◆	◆	◆		◆			✓	✓	✓	
Improve soil health (provide high volumes of organic matter)	✓	✓	◆	◆	✓	◆	◆	◆	◆		◆			◆	◆	◆	
Firebreak (cool-season grass strips adjacent to flammable vegetation, such as warm-season grasses, woodland, etc.)						✓	✓	✓	✓	✓							
Paths/Walkways (low-growing, low-maintenance grasses for light to moderate use)									✓			◆	◆				
Companion planting (low-growing, non-competitive grasses to control erosion in conjunction with tree/shrub plantings)									✓								
Inter-row cover requiring low maintenance for tree nut, fruit, and other perennials in low fertility and low pH soils												✓	✓				
Near coastal areas/salt affected soils													✓				✓

✓ Recommended mix for this purpose.

◆ Alternative mix, depending on site conditions and preferences of the client.

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes for Conservation Cover

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover									
	Mix	**Recommended Cultivar**	**Seeding Rate (lbs/ac)[1]**	**Plant Hardiness Zones**	**Soil Drainage Class[2]**	**Max. Height (feet)**	**All Native Species[3]**	**Type of Grass in Mix**	**Remarks**
1	**SELECT THREE OF THE FOLLOWING:**								**This mix is suitable for dry to mesic sites.**
	Big Bluestem *Andropogon gerardii*	**Niagara, Suther Germplasm**	**2 - 4**						**Grasses in bold are typically used.**
	Little Bluestem *Schizachyrium scoparium*	**Aldous, Blaze**	**3 - 5**						All of these grasses, except Little Bluestem, are tall-statured, and can be aggressive, especially on W - MW drained sites.
	Switchgrass *Panicum virgatum*	**Shelter, Carthage**	**2 - 4**						Coastal Panicgrass is primarily a coastal species but can also be used inland.
	Coastal Panicgrass *Panicum amarum*	Atlantic	2 - 4	All (See Remarks)	E - MW	6 - 8	Y	Warm season grasses	Big Bluestem, Indiangrass, and Little Bluestem have fluffy seeds, which require a native seed drill.
	Indiangrass *Sorghastrum nutans*	Rumsey	2 - 4						Because the grasses tend to dominate a stand, wildflowers may not persist. Wildflowers may be more persistent on very dry sites.
	OPTIONAL – SELECT ONE OF THE FOLLOWING:								
	Partridge Pea *Chamaecrista fasciculata*		1						
	Round-head Bush-Clover *Lespedeza capitata*		0.4						
	Mix 14		Varies						
2	**SELECT THREE OF THE FOLLOWING:**								**This mix is suitable for mesic sites.**
	Coastal Panicgrass *Panicum amarum*	**Atlantic**	**1 - 2**						**Grasses in bold are typically used.**
	Florida Paspalum *Paspalum floridanum*	**Common**	**1 ½ - 3**						All of these grasses, except Little Bluestem and Red Fescue, are tall-statured grasses, and can be aggressive on sites with good moisture.
	Switchgrass *Panicum virgatum*	**Shelter, Carthage**	**1 ½ - 3**						Little Bluestem prefers drier sites. Red Fescue is a cool-season grass, and can be used on wetter sites.
	Indiangrass *Sorghastrum nutans*	Rumsey, Suther	2 - 4	All (See Remarks)	W - SP	6 - 8	Y	Warm and cool season grasses	Coastal Panicgrass and Florida Paspalum are primarily coastal species.
	Little Bluestem *Schizachyrium scoparium*	Aldous, Blaze	3 - 5						Can add Eastern Gamagrass 'Meadowcrest' as a 4th species at 5 - 10 lb/ac. Eastern Gamagrass has large seed that must be planted separately from the other species.
	Red Fescue *Festuca rubra*	Common	1 - 2						Indiangrass and Little Bluestem have a fluffy seed that requires a native seed drill.
	OPTIONAL – SELECT ONE OF THE FOLLOWING:								
	Partridge Pea *Chamaecrista fasciculate*		1						
	Round-head Bush-Clover *Lespedeza capitata*		0.4						
	Mix 14		Varies						

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover									
	Mix	**Recommended Cultivar**	**Seeding Rate (lbs/ac)[1]**	**Plant Hardiness Zones**	**Soil Drainage Class[2]**	**Max. Height (feet)**	**All Native Species[3]**	**Type of Grass in Mix**	**Remarks**
3	**SELECT TWO WARM SEASON GRASSES:**			All (See Remarks)	E - MW	3 - 4	Y	Warm and cool season grasses	**This mix is suitable for dry to mesic sites.**
	Little Bluestem *Schizachyrium scoparium*	**Aldous, Blaze**	**4 - 6**						**Grasses in bold are typically used.**
	Purpletop *Tridens flavus*	**Common**	**1 ½ - 3**						All of these species are short-statured, native grasses.
	Broomsedge *Andropogon virginicus*	Common	1 - 2						Canada Wildrye and Virginia Wildrye are CSGs.
	Splitbeard Bluestem *Andropogon ternarius*	Common	3 - 4						Canada Wildrye prefers dry sites; Virginia Wildrye prefers mesic sites. Canada Wildrye is not currently listed as native in DE, but occurs naturally in adjacent states.
	Purple Lovegrass *Eragrostis spectabilis*	Common	½ - 1						Splitbeard Bluestem is a Coastal Plain species.
	AND ONE COOL SEASON GRASS:								
	Canada Wildrye *Elymus canadensis*	Common	4 - 6						
	Virginia Wildrye *Elymus virginicus*	**Common**	**5 - 8**						
	AND ONE OF THE FOLLOWING:								
	Partridge Pea *Chamaecrista fasciculata*		1						
	Mix 14		Varies						
4	**SELECT TWO WARM SEASON GRASSES:**			All (See Remarks)	W - SP	3 - 4	Y	Warm and cool season grasses	**This mix is suitable for mesic sites.**
	Broomsedge *Andropogon virginicus*	**Common**	**½ - 1**						**Grasses in bold are typically used.**
	Little Bluestem *Schizachyrium scoparium*	**Aldous, Blaze**	**3 - 5**						All of these species are short-statured, native grasses, except Florida Paspalum, the seedheads of which can reach 5 feet.
	Splitbeard Bluestem *Andropogon ternarius*	Common	2 - 3						Little Bluestem prefers drier sites.
	Purple Lovegrass *Eragrostis spectabilis*	Common	½ - 1						Splitbeard Bluestem is a Coastal Plain species.
	Purpletop *Tridens flavus*	Common	1 - 2						Use River Oats in the Piedmont, and Slender Woodoats on the Coastal Plain.
	Florida Paspalum *Paspalum floridanum*	Common	1 ½ - 3						
	AND ONE COOL SEASON GRASS:								
	Virginia Wildrye *Elymus virginicus*	**Common**	**4 - 8**						
	River Oats *Chasmanthium latifolium*	Common	4 - 8						
	Riverbank Wildrye *Elymus riparius*	Common	4 - 8						
	Slender Woodoats *Chasmanthium laxum*	Common	4 - 8						
	AND ONE OF THE FOLLOWING:								
	Partridge Pea *Chamaecrista fasciculata*		1						
	Mix 14		Varies						

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover									
	Mix	**Recommended Cultivar**	**Seeding Rate (lbs/ac)[1]**	**Plant Hardiness Zones**	**Soil Drainage Class[2]**	**Max. Height (feet)**	**All Native Species[3]**	**Type of Grass in Mix**	**Remarks**
5	**SELECT ONE WARM SEASON GRASSES:**								**This mix is suitable for wet sites.**
	Redtop Panicgrass *Panicum rigidulum*	**Common**	**0.5 - 1**						**Grasses/sedges in bold are typically used.**
	Bushy Broomsedge *Andropogon glomeratus*	Common	0.5 - 1						All but Florida Paspalum and Riverbank Wildrye are short-statured grasses.
	Beaked Panicgrass *Panicum anceps*	Common	1 - 2						Florida Paspalum is a Coastal Plain species.
	Florida Paspalum *Paspalum floridanum*	Mid-Atlantic Germplasm	2 - 4						Use River Oats in the Piedmont, and Slender Woodoats on the Coastal Plain.
	AND SELECT ONE COOL SEASON GRASS:								Rattlesnake Grass occurs in the Piedmont region.
	Virginia Wildrye *Elymus virginicus*	**Common**	**4 - 8**						
	River Oats *Chasmanthium latifolium*	Common	5 - 7						
	Riverbank Wildrye *Elymus riparius*	Common	5 - 7	All				Warm and	
	Slender Woodoats *Chasmanthium laxum*	Common	5 - 7	(See Remarks)	P - VP	3 - 5	Y	cool season grasses, and sedges	
	AND SELECT ONE OF THE FOLLOWING:								
	Fox Sedge *Carex vulpinoidea*	**Common**	**0.25 - 0.5**						
	Hop Sedge *Carex lupulina*	Common	4 - 6						
	Lurid Sedge *Carex lurida*	Common	1 ½ - 3						
	Fowl Mannagrass *Glyceria striata*	Common	0.25 - 0.5						
	Rattlesnake Grass *Glyceria canadensis*	Common	0.25 - 0.5						
	AND ADD:								
	Mix 14		Varies						

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover									
	Mix	**Recommended Cultivar**	**Seeding Rate (lbs/ac)[1]**	**Plant Hardiness Zones**	**Soil Drainage Class[2]**	**Max. Height (feet)**	**All Native Species[3]**	**Type of Grass in Mix**	**Remarks**
6	**ADD ALL OF THE FOLLOWING:**								Once well-established, orchardgrass may tend to dominate the stand. Alsike clover can be toxic to horses.
	Orchardgrass *Dactylis glomerata*	Any	3 - 4						
	Red Fescue *Festuca rubra*	Common	3 - 4	All	W - MW	2 - 3	N	Cool season grasses	
	Alsike Clover *Trifolium hybridum*	Common	1 - 2						
	White Clover *Trifolium repens*	Common	1 - 2						
7	**ADD:**								Timothy generally does not perform well in PHZs 7a and 7b, but may be suitable where local conditions are cool and soil moisture is adequate. Once well-established, orchardgrass may tend to dominate the stand.
	Orchardgrass *Dactylis glomerata*	Any	2 - 4						
	AND ONE OR BOTH OF THE FOLLOWING:	Not a turf type	1 - 2						
	Bluegrass *Poa pratensis*	Climax	2 - 4	All					
	Timothy *Phleum pratense*				W - MW	2 - 3	N	Cool season grasses	
	AND ADD ONE OF THE FOLLOWING:			(See remarks)					
	White Clover *Trifolium repens*	Common	1 - 2						
	Red Clover *Trifolium pratense*	Any	1 - 2						
8	**ADD BOTH OF THE FOLLOWING**								All native, shade-tolerant CSG grass mix for mesic to wet sites. Use River Oats in the Piedmont and Slender Woodoats on the Coastal Plain. Add Mix 8c to provide a grass-forb mix for wildlife habitat.
	Riverbank Wildrye *Elymus riparius*	Common	4 - 6						
	Virginia Wildrye *Elymus virginicus*	Common	4 - 6						
	AND ADD ONE OF THE FOLLOWING:	Common	5 - 10	All	MW - P	3 - 4	Y	Cool season grasses	
	River Oats Chasmanthium latifolium								
	Slender Woodoats Chasmanthium laxum	Common	5 - 10						
	OPTIONAL – ADD THE FOLLOWING:								
	Mix 14		Varies						

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover									
	Mix	**Recommended Cultivar**	**Seeding Rate (lbs/ac)[1]**	**Plant Hardiness Zones**	**Soil Drainage Class[2]**	**Max. Height (feet)**	**All Native Species[3]**	**Type of Grass in Mix**	**Remarks**
9	**ADD ALL OF THE FOLLOWING:** Chewings Fescue *Festuca rubra ssp. fallax* Hard Fescue *Festuca brevipila* Sheep fescue *Festuca ovina* **AND ADD EITHER THE WILDFLOWER MIX:** Mix 14 **OR ADD THE FOLLOWING CLOVER MIX:** White Clover *Trifolium repens* Red Clover *Trifolium pratense*	 Common Beacon, Gotham, Spartan II, Sword Bighorn, Covar Common Any	 1 - 2 1 - 2 1 - 2 Varies 1 - 2 1 - 2	All	W - MW	2 - 3	N	Cool season grasses	Attractive, low-growing grass and wildflower (or clover) mix. Select the clover option when using this mix for travel lanes and companion plantings. Clover may be omitted when using this mix for paths/walkways.
10	**ADD:** Rough Bluegrass *Poa trivialis* **AND ADD ONE OF THE FOLLOWING:** Virginia Wildrye *Elymus virginicus* Riverbank Wildrye *Elymus riparius* **AND ADD ONE OF THE FOLLOWING:** Fowl Meadowgrass *Poa palustris* Red Fescue *Festuca rubra*	 Common Common Common Common Common	 1 - 2 5 - 8 4 - 6 1 - 2 1 - 2	All	SP - P	4 - 5	N	Cool season grasses	Use Red Fescue on drier soils and Fowl Meadowgrass on wetter soils.
11	**ADD ALL OF THE FOLLOWING:** Fowl Meadowgrass *Poa palustris* Virginia Wildrye *Elymus virginicus* Red Fescue *Festuca rubra* **AND ADD EITHER:** Partridge Pea *Chamaecrista fasciculata* **OR ADD THE FOLLOWING CLOVER MIX:** Alsike Clover *Trifolium hybridum* White Clover *Trifolium repens*	 Common Common Common Common Common Common	 1 - 2 4 - 6 1 - 2 1 - 2 1 - 2 1 – 2	All	SP - P	2 - 3	Y (See Remarks)	Cool season grasses	Low-growing mix of native grasses for wet sites. Use Partridge Pea if an all-native mix is desired. (Alsike and White Clover are not native to New Jersey.) Alsike Clover can be toxic to horses.

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover									
	Mix	**Recommended Cultivar**	**Seeding Rate (lbs/ac)[1]**	**Plant Hardiness Zones**	**Soil Drainage Class[2]**	**Max. Height (feet)**	**All Native Species[3]**	**Type of Grass in Mix**	**Remarks**
12	**ADD ALL OF THE FOLLOWING:** Red Fescue *Festuca rubra* Hard Fescue *Festuca brevipila* Sheep fescue *Festuca ovina* Perennial ryegrass *Lolium perenne L.* **OPTIONAL – ADD THE FOLLOWING:** White Clover *Trifolium repens*	 Pennlawn, Flyer Fortress, Durar, Minimus Bighorn, Covar, Quatro Pennfine, Blazer common	 15 30 15 5	All	W-MW	1-1.5	N	Cool season grass and legume	Low maintenance, cool season grass mix for alleyways in orchards, vineyard, etc.
13	**ADD ALL OF THE FOLLOWING:** Red Fescue *Festuca rubra* Tall Fescue *Festuca arundinacea* (turf-type) Perennial ryegrass *Lolium perenne L.* **OPTIONAL – ADD THE FOLLOWING:** Alkali saltgrass *Puccinellia distans*	 Dawson, Shoreline Turf-type Pennfine, Blazer Fults, Salty	 45 40 15	All	W-MW	1-1.5	N	Cool season grass	Use cultivars specified under saline conditions. tall fescue should be turf-type varieties. Traditional tall fescue (forage varieties) will require more maintenance and better site conditions.
14. 15. 16.	**See separate pollinator species Tables that follow this one.**								
17.	**ADD ALL OF THE FOLLOWING:** Rose mallow *Hibiscus moscheutos* Plains coreopsis *Coreopsis tinctoria* Arrowleaf tearthumb *Polygonum sagittatum* Bearded beggartick *Bidens aristosa* **OPTIONAL-ADD THE FOLLOWING IF AVAILABLE** Seaside goldenrod *Solidago sempervirens* Seashore mallow *Koseletzkya virginica*	 Common Common Common Common Monarch Germ., common common	 1 0.1 1.5 1.5 0.25 0.25	All	MW-PD	3-4	N	None	Cost effective pollinator mix for saline areas that occasionally flood. Seaside goldenrod and seashore mallow-limited commercial availability as seed. Plugs are available from selected native plant nurseries.

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover

14. New Jersey Native Wildflowers and Legumes

Select **at least 4 wildflowers** and **one legume**. It is preferable to include species that will bloom at different times during the growing season. Add this mix to all-grass Mixes 1 - 5, 11, and 12 for added wildlife and aesthetic value. For the highest diversity grass/wildflower mixes that have a predominant wildflower component (i.e., "pollinator mixes"), use Mix 15 or 16, as appropriate for site conditions.

Common Name	Scientific Name	Moisture [4]			Seeding Rate (lbs/ac) [5]	Life Cycle [6]	Legume	Flowering Period and Flower Color								
		D	M	W				M	A	M	J	J	A	S	O	N
Tall White Beardtongue	*Penstemon digitalis*	■	■		0.2	P										
Butterfly Milkweed	*Asclepias tuberosa*	■	■		0.4	P										
Common Milkweed	*Asclepias syriaca*	■	■		0.4	P										
Swamp Milkweed	*Asclepias incarnata*			■	0.4	P										
Wild Bergamot	*Monarda fistulosa*		■		0.05	P										
Virginia Mountain Mint	*Pycnanthemum virginianum*	■	■		0.02	P										
Dense Blazing Star	*Liatris spicata*	■	■		0.25	P										
Common Boneset	*Eupatorium perfoliatum*			■	0.02	P										
Orange Coneflower	*Rudbeckia fulgida*	■	■		0.1	P										
Joe-Pye Weed	*Eutrochium fistulosum*		■	■	0.03	P										
New York Aster	*Symphyotrichum novi-belgii*			■	0.07	P										
Rough-leaf Goldenrod	*Solidago patula*			■	0.15	P										
Wrinkle-leaf Goldenrod	*Solidago rugosa*	■	■		0.1	P										
Narrowleaf Sunflower	*Helianthus angustifolius*		■	■	0.15	P										
New York Ironweed	*Vernonia noveboracensis*		■	■	0.15	P										
Showy Tickseed	*Bidens aristosa*			■	0.5	A										
Yellow False Indigo	*Baptisia tinctoria*	■	■		0.15	P	■									
Partridge Pea	*Chamaecrista fasciculata*	■	■		0.5	A	■									
American Senna	*Senna hebecarpa*		■	■	0.5	P	■									
Round Head Bush-Clover	*Lespedeza capitata*	■	■		0.2	P	■									
Hairy Bush-Clover	*Lespedeza hirta*	■	■		0.2	P	■									

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover

15. New Jersey Native Grass-Forb Mix for Pollinators: Dry - Mesic Sites[7]

The species composition of this mix is appropriate for a range of soil moisture conditions from **excessively drained to well-drained**.

Alternative native species may be substituted for a listed species due to desirability or lack of availability. When possible, select an alternative that has flowering period that is similar to the species for which it is being substituted. Omit the grasses when using this mix to interseed existing native grass stands.

Common Name	Scientific Name	% by Seed[8]	Seeding Rate (lbs/ac)[9]	Life Cycle[6]	Legume	Flowering Period and Flower Color								
						M	A	M	J	J	A	S	O	N
Tall White Beardtongue	*Penstemon digitalis*	10.0%	0.65	P										
Virginia Spiderwort	*Tradescantia virginiana*	1.0%	0.15	P										
Butterfly Milkweed	*Asclepias tuberosa*	1.0%	0.37	P										
Common Milkweed	*Asclepias syriaca*	1.0%	0.37	P										
Dotted Mint	*Monarda punctata*	10.0%	0.18	P										
Lanceleaf Coreopsis	*Coreopsis lanceolata*	8.0%	0.95	P										
Perennial Blanketflower	*Gaillardia aristata*	5.0%	0.59	P										
Blackeyed Susan	*Rudbeckia hirta*	7.0%	0.12	B										
Purple Coneflower	*Echinacea purpurea*	5.0%	1.13	P										
Partridge Pea	*Chamaecrista fasciculata*	1.0%	0.40	A	■									
Wild Bergamot	*Monarda fistulosa*	10.0%	0.21	P										
Virginia Mountain Mint	*Pycnanthemum virginianum*	8.0%	0.05	P										
New England Aster	*Symphyotrichum novae-angliae*	8.0%	0.19	P										
Wrinkleleaf Goldenrod	*Solidago rugosa*	4.0%	0.10	P										
Purpletop	*Tridens flavus*	5.0%	0.28	P										
Broomsedge	*Andropogon virginicus*	2.0%	0.07	P										
Little Bluestem	*Schizachyrium scoparium*	14.0%	2.54	P										
Totals		**100%**	**8.34**	Total seeding rate is approximately **60 seeds/SF**.										

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover

16. New Jersey Native Grass-Forb Mix for Pollinators: Mesic - Wet Sites

The species composition of this mix is appropriate for a range of soil moisture conditions from **well-drained to somewhat poorly drained**.

Alternative native species may be substituted for a listed species due to desirability or lack of availability. When possible, select an alternative that has flowering period that is similar to the species for which it is being substituted. Omit the grasses/sedge when using this mix to interseed existing native grass stands.

Common Name	Scientific Name	% by Seed [8]	Seeding Rate (lbs/ac) [9]	Life Cycle [6]	Legume	Flowering Period and Flower Color								
						M	A	M	J	J	A	S	O	N
Golden Alexanders	*Zizia aurea*	1.0%	0.15	P										
Tall White Beardtongue	*Penstemon digitalis*	7.0%	0.46	P										
Virginia Spiderwort	*Tradescantia virginiana*	1.0%	0.15	P										
Bigleaf Mountain Mint	*Pycnanthemum muticum*	8.0%	0.04	P										
Common Boneset	*Eupatorium perfoliatum*	7.0%	0.06	P										
Common Milkweed	*Asclepias syriaca*	1.0%	0.37	P										
Culver's Root	*Veronicastrum virginicum*	5.0%	0.02	P										
Dense Blazing Star	*Liatris spicata*	1.0%	0.26	P										
Great Blue Lobelia	*Lobelia siphilitica*	9.0%	0.03	P										
Partridge Pea	*Chamaecrista fasciculata*	1.0%	0.40	A	■									
Swamp Milkweed	*Asclepias incarnata*	2.0%	0.75	P										
Wild Bergamot	*Monarda fistulosa*	7.0%	0.14	P										
Narrowleaf Sunflower	*Helianthus angustifolius*	3.0%	0.16	P										
New England Aster	*Symphyotrichum novae-angliae*	4.0%	0.10	P										
New York Ironweed	*Vernonia noveboracensis*	2.0%	0.17	P										
Showy Tickseed	*Bidens aristosa*	5.0%	1.01	A										
Sneezeweed	*Helenium autumnale*	5.0%	0.09	P										
Wrinkleleaf Goldenrod	*Solidago rugosa*	3.0%	0.08	P										
Blue Vervain	*Verbena hastata*	10.0%	0.18	P										
Broomsedge	*Andropogon virginicus*	3.0%	0.10	P										
Deertongue	*Panicum clandestinum*	5.0%	0.47	P										
Fox Sedge	*Carex vulpinoidea*	5.0%	0.10	P										
Purpletop	*Tridens flavus*	5.0%	0.28	P										
Totals		**100%**	**5.56**	Total seeding rate is approximately **60 seeds/SF**.										

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Cover

1. **Seeding Rate:** Seeding rates listed are for planting methods that incorporate seed into the soil. These methods include drilling (conventional or no-till), and broadcast seeding on a prepared seedbed, followed by light soil incorporation with a cultipacker.
   Seeding rates for the native grasses, sedges, legumes, and other wildflowers are in pounds of Pure Live Seed (PLS). Order seed from the supplier based on the PLS rate; the seed supplier will adjust the bulk amount to be planted based on percent seed germination and purity, as tested.
   Adjustments are not usually needed for the introduced grasses and legumes. However, be aware that some seed may be polymer-coated. This coating can double the weight of the seed, so that a bag of seed may contain only 50% seed by weight (e.g., a 10-pound bag of grass seed may contain only 5 pounds of seed, with the other 5 pounds consisting of the polymer coating). Be sure to read the seed analysis label when purchasing seed, and adjust the per acre weight to be planted accordingly.
   Legume seeds shall be inoculated before planting with the appropriate Rhizobium bacteria. When feasible, hard-seeded legumes should be scarified to improve germination.
   When a seeding rate is expressed as a range (i.e., 4 - 6), the lower rate should be used if erosion is not a concern. Where erosion is a concern, use the higher seeding rate and add one of the following nurse crops with the selected mix: 20 - 40 lbs/ac of oats or barley. This can be planted with the selected mix at the time of seeding. If using a conservation tillage method, plant the small grain as a cover crop in the fall, mow in early spring, and drill the permanent planting into the remaining stubble. Do not use cereal rye as a nurse crop. It has allelopathic properties that inhibit the germination and growth of other plants.
   Oats are the recommended nurse crop for warm-season grasses.
2. **Soil Drainage Class** (refer to the county soil survey for further information):
   E - Excessively Drained; W - Well Drained; MW - Moderately Well Drained; SP - Somewhat Poorly Drained; P - Poorly Drained; VP - Very Poorly Drained.
3. **Native Species:** The term "native" refers to species that occur naturally in one or more geographic regions of New Jersey. Native mixes may include non-native nurse crops (which are short-lived) for site stabilization during establishment of the permanent planting.
4. **Moisture:** The amount of moisture the species needs or tolerates, as part of a mix. D - Dry (excessively drained to well-drained soil); M - Mesic (moderately well to somewhat poorly drained soil); W – Wet (poorly to very poorly drained soil).
5. **Seeding Rate:** The value listed is the seeding rate in pure live seed (PLS). It is calculated based on the number of seeds per pound, at a seeding rate ranging from 0.5 to 2 seeds/SF for each species.
6. **Life Cycle:** P – Perennial; A – Annual.
7. To create a custom mix, use the Xerces Society Seed Mix Calculator, available at http://www.xerces.org/wp-content/uploads/2009/11/XERCES-SEED-MIX-CALCULATOR.xls
8. Composition of this seed mix is calculated based on seeds per square foot, not percent by weight.
9. Seeding rate per acre for each species varies significantly because of the desired composition of the mix (seeds per square foot) and variation in seed size.

TABLE 2.3: Characteristics of Native Grasses and Grass-like Plants

TABLE 2.3: Selected Characteristics of Native Grasses and Grass-like Plants													
Scientific Name	Region [1]		Soil Drainage Class [2]	Moisture [3]			Wetland AGCP EMP [4]	Est. Seeds/lb	PLS Lbs/Ac [5]		Height	Drought Tolerant	Shade Tolerant	Remarks
	NNJ	CP		D	M	W			Grass Mix	Forb Mix				
WARM-SEASON GRASSES														
Andropogon gerardii Big Bluestem	■	■	E - SP	■	■		FAC FAC	144,000	2.5	0.3	5 - 8	■		One of the taller species. Can be aggressive.
Andropogon glomeratus Bushy Broomsedge	■	■	SP - P			■	FACW FACW	800,000	0.4	0.05	1½ - 3			Often volunteers in wet, idle crop fields in association with *Andropogon virginicus*.
Andropogon ternarius Splitbeard Bluestem		■	E - SP	■	■		FACU FACU	216,000	1.5	0.2	1½ - 3	■		Blooms earlier than other bluestem species. Highly drought tolerant.
Andropogon virginicus Broomsedge	■	■	E - SP	■	■		FAC FACU	800,000	0.4	0.05	1½ - 3	■		Often volunteers in idle crop fields with low fertility and low pH.
Dichanthelium clandestinum Deertongue	■	■	E - SP	■	■		FACW FAC	350,000	1	0.1	1½ - 3	■		Tolerates a wide range of site conditions. Tendency to fall over.
Eragrostis spectabilis Purple Lovegrass	■	■	MW - SP	■	■		FACU UPL	1,059,100	0.3	0.04	1 - 3	■		Prefers sandy sites. Seed is extremely small.
Panicum amarum Coastal Panicgrass		■	E - SP	■	■		FAC FACU	325,000	1	0.15	3 - 6	■		Similar to *Panicum virgatum*, but with a closed panicle. Found naturally on dunes and sandy, droughty sites. Can be aggressive.
Panicum anceps Beaked Panicgrass	■	■	SP - P			■	FAC FAC	570,000	0.6	0.08	2 - 4			Spreads from short rhizomes to form dense clumps. Prefers some shade.
Panicum rigidulum Redtop Panicgrass	■	■	SP - VP			■	FACW FACW	800,000	0.4	0.05	2 - 3			Prefers wet sites. Seed is extremely small, so seeding rate should be proportionally smaller in a mix.
Panicum virgatum Switchgrass	■	■	E - VP	■	■	■	FAC FAC	259,000	1.5	0.15	4 - 6	■		Common native species that has been cultivated for wildlife, biomass, and erosion control. Can be aggressive. Site adaptability varies with cultivar.
Panicum virgatum Switchgrass 'Cave-in-Rock'	■	■	W - P		■	■		259,000	1.5	0.15		■		Midwestern variety with high biomass production.
Panicum virgatum Switchgrass 'Kanlow'	■	■	SP - VP			■		259,000	1.5	0.15				Midwestern plains variety. Adapted to wet soils.

TABLE 2.3: Selected Characteristics of Native Grasses and Grass-like Plants													
Scientific Name	Region [1]		Soil Drainage Class [2]	Moisture [3]			Wetland AGCP EMP [4]	Est. Seeds/lb	PLS Lbs/Ac [5]		Height	Drought Tolerant	Shade Tolerant	Remarks
	NNJ	CP		D	M	W			Grass Mix	Forb Mix				
Panicum virgatum Switchgrass 'Shelter'	■	■	E - SP	■	■			259,000	1.5	0.15		■		Northeast variety selected for its stiff stems, which allow it to remain standing under snow loads and provide winter cover.
Paspalum floridanum Florida paspalum		■	W - P	■	■	■	FACW FACW	259,000	1.5	0.15	3 - 5			Tolerates a wide range of soils. Relatively large seeds are used by wildlife. Deteriorates rapidly after maturity
WARM-SEASON GRASSES (cont'd)														
Schizachyrium scoparium Little Bluestem	■	■	E - W	■			FACU FACU	144,000	2.5	0.3	2 - 3	■		Prefers dry sites. Similar in appearance to *Andropogon virginicus*.
Sorghastrum nutans Indiangrass	■	■	E - SP	■	■		FACU FACU	175,000	2	0.25	4 - 6	■		May be somewhat aggressive on sites with normal moisture or fertility. Golden flower panicle is very attractive.
Tridens flavus Purpletop	■	■	E - SP	■	■		FACU FACU	465,000	0.7	0.09	3 - 4	■		Best suited for dry, sandy areas or sites with shallow soils.
Tripsacum dactyloides Eastern Gamagrass	■	■	W - P		■	■	FAC FACW	7,000	10	1	3 - 5			Can be found on roadsides in both dry and wet locations. A distant relative to corn, it has large seeds that can be planted with a conventional drill. Unless seed is bought cold stratified the seed will need to be stratified.
COOL-SEASON GRASSES														
Agrostis scabra Rough Bentgrass	■	■	W - P		■	■	FAC FAC	5,000,000	0.07	0.009	2 - 3			Short-lived, perennial bunchgrass. Can be used for quick cover on disturbed areas.
Chasmanthium latifolium River Oats	■		W - SP		■	■	FAC FACU	85,000	4	0.5	2 - 4		■	Can be used for soil erosion control in shaded areas and along streams. Flood tolerant. Attractive seed heads.
Chasmanthium laxum Slender Woodoats		■	MW - SP		■	■	FACW FAC	85,000	4	0.5	2 - 3	■	■	Shade tolerant. Can be used in riparian areas and floodplains.
Cinna arundinacea Wood Reedgrass	■	■	MW - P		■	■	FACW FACW	1,300,000	0.25	0.03	3 - 5		■	Found in shaded riparian areas and forested wetlands.
Elymus canadensis Canada Wildrye	■	■	E - MW	■			FAC FACU	114,000	3	0.4	3 - 4	■	■	Prefers partial shade. Seedlings establish quickly, but are not highly competitive with other grasses. Not compatible with prescribed burning.
Elymus histrix Bottlebrush Grass	■	■	W - SP		■		UPL UPL	75,000	4.5	0.6	2 - 4		■	A woodland grass with a conspicuous panicle.

TABLE 2.3: Selected Characteristics of Native Grasses and Grass-like Plants													
Scientific Name	Region [1]		Soil Drainage Class [2]	Moisture [3]			Wetland AGCP EMP [4]	Est. Seeds/lb	PLS Lbs/Ac [5]		Height	Drought Tolerant	Shade Tolerant	Remarks
	NNJ	CP		D	M	W			Grass Mix	Forb Mix				
Elymus riparius Riverbank Wildrye	■	■	MW - P		■	■	FACW FACW	125,000	2.5	0.35	3 - 5		■	Shade tolerant. Occurs on stream banks and in forested wetlands. Used for soil stabilization.
Elymus virginicus Virginia Wildrye	■	■	MW - P		■	■	FAC FACW	100,000	3.5	0.45	3 - 4		■	See remarks for *Elymus canadensis*. Prefers moist sites.
Poa palustris Fowl Meadowgrass	■	■	SP - P			■	FAC FACW	1,900,000	0.15	0.02	2 - 4			A native bluegrass of wet meadows.
GRASS-LIKE WETLAND OBLIGATE PLANTS														
Carex lupulina Hop Sedge	■	■	P - VP			■	OBL OBL	94,700	3.5	0.45	1½ - 3		■	Obligate wetland sedge. Provides food and cover for wildlife. MD ecotype available.
Carex lurida Lurid Sedge	■	■	P - VP			■	OBL OBL	250,000	1.5	0.15	1 - 3			Obligate wetland sedge. Provides food and cover for wildlife.
Carex vulpinoidea Fox Sedge	■	■	P - VP			■	FACW OBL	1,300,000	0.25	0.03	1½ - 3			Provides food and cover for wildlife. Can be aggressive. Seed is extremely small.
Glyceria canadensis *Rattlesnake Grass*	■		SP - VP			■	OBL OBL	1,184,000	0.3	0.04	2 - 3			Obligate wetland bunchgrass found in marshes and swamps.
Glyceria striata *Fowl Mannagrass*	■	■	SP - VP			■	OBL OBL	1,540,000	0.2	0.03	3 - 5		■	Obligate wetland bunchgrass found in forests and marshes.
Schoenoplectus tabernaemontani Softstem Bulrush	■	■	P - VP			■	OBL OBL	496,000	0.65	0.09	5 - 10			Provides food and cover for wildlife. Found in and around the edges of waterbodies, including flooded wetlands.
Scirpus cyperinus Woolgrass	■	■	P - VP			■	OBL OBL	36,000,000	0.009	0.001	4 - 5			A tall, bunch type sedge of wet meadows and marshes.
Sparganium americanum Eastern Bur Reed	■	■	P - VP			■	OBL OBL	50,000	6.5	0.85	2½ - 3			An herbaceous emergent aquatic plant with distinct ball-like seed heads.

TABLE 2.3: Selected Characteristics of Native Grasses and Grass-like Plants

Scientific Name	Region [1]		Soil Drainage Class [2]	Moisture [3]			Wetland AGCP EMP [4]	Est. Seeds/lb	PLS Lbs/Ac [5]		Height	Drought Tolerant	Shade Tolerant	Remarks
	NNJ	CP		D	M	W			Grass Mix	Forb Mix				

1. **Region:** The physiographic region where the species usually occurs in New Jersey, under natural conditions. NNJ – North New Jersey and includes the Valley and Ridge, Highlands, and Piedmont regions ; CP - Coastal Plain. Visit the New Jersey DEP website to determine which region includes your project site or view the "Physiographic Provinces" layer in Conservation Desktop.
2. **Soil Drainage Class** (refer to the county soil survey for further information):
   E - Excessively Drained; W - Well Drained; MW - Moderately Well Drained; SP - Somewhat Poorly Drained; P - Poorly Drained; VP - Very Poorly Drained.
3. **Moisture:** The amount of moisture the species needs or tolerates, as part of a mix. D - Dry (excessively drained to well-drained soil); M - Mesic (moderately well to somewhat poorly drained soil); W – Wet (poorly to very poorly drained soil).
4. **Wetland:** Wetland indicator status for the Atlantic and Gulf Coastal Plain (AGCP) and Eastern Mountains and Piedmont (EMP).
5. **PLS Lbs/Ac:** The value listed is the seeding rate in pure live seed (PLS) for the individual species within a Grasses with Wildflowers mix (a predominantly grass planting; column header "Grass Mix") and a Wildflower Meadow mix (a predominantly wildflower planting; column header "Forb Mix"). Rates are based 30 PLS/SF with 3 spp grass and 5 spp forbs at a 75:25 ratio in the Grass Mix, and 30 PLS/SF with 3 spp grass and 10 spp forbs at 10:90 in the Forb Mix.

TABLE 2.4: Characteristics of Native Wildflowers and Legumes

TABLE 2.4: Selected Characteristics of Native Wildflowers and Legumes																						
Scientific Name	Common Name	Region [1]		Duration [2]	Moisture [3]			Wetland [4]		Est. Seeds/Lb	PLS Lbs/Ac [5]		Traits [6]	Flowering Period and Flower Color								
		NNJ	CP		D	M	W	AGCP	EMP		Grass Mix	Forb Mix		M	A	M	J	J	A	S	O	N
Asclepias incarnata	Swamp Milkweed	■	■	P			■	OBL	OBL	70,000	0.45	1.5	T									
Asclepias syriaca	Common Milkweed	■	■	P	■	■		UPL	FACU	70,000	0.45	1.5	T									
Asclepias tuberosa	Butterfly Milkweed	■	■	P	■	■		NI	NI	70,000	0.45	1.5	D,T									
Baptisia tinctoria	Yellow False Indigo	■	■	P	■	■		NI	NI	300,000	0.1	0.4	D,T									
Bidens aristosa	Bur Marigold		■	A			■	FACW	FACW	130,000	0.25	0.9										
Bidens cernua	Nodding Bur Marigold	■	■	A			■	OBL	OBL	130,000	0.25	0.9										
Bidens frondosa	Beggar Ticks	■	■	A			■	FACW	FACW	80,000	0.4	1.5										
Caltha palustris	Marsh Marigold	■	■	P			■	OBL	OBL	554,000	0.06	0.2										
Chamaecrista fasciculata	Partridge Pea	■	■	A	■	■		FACU	FACU	65,000	0.25	1	T									
Chelone glabra	White Turtlehead	■	■	P			■	OBL	OBL	1,472,000	0.02	0.08	S									
Conoclinium coelestinum	Mistflower	■	■	P		■	■	FAC	FAC	1,500,000	0.02	0.08	A									
Coreopsis lanceolata	Lanceleaf Tickseed			P		■		UPL	FACU	221,000	0.15	0.55										
Coreopsis tinctoria	Golden Tickseed	■	■	A		■		FAC	FAC	3,222,222	0.01	0.04										
Coreopsis verticillata	Whorled Tickseed	■	■	P	■	■		NI	NI	200,000	0.15	0.6	D									
Desmodium canadense	Showy Tick-Trefoil	■		P		■		FAC	FAC	72,500	0.45	1.5	T									
Desmodium paniculatum	Panicled Tick-Trefoil	■	■	P	■	■		FACU	FACU	200,000	0.15	0.6	D,T									
Doellingeria umbellata var. *umbellata*	Flat-topped White Aster	■	■	P		■	■	FACW	FACW	800,000	0.04	0.15										
Echinacea purpurea	Purple Coneflower			P		■		NI	NI	116,000	0.3	1										
Eupatorium perfoliatum	Boneset	■	■	P			■	FACW	FACW	2,800,000	0.01	0.04	S									
Euthamia graminifolia	Grass-leaved Goldenrod	■	■	P	■	■	■	FAC	FAC	5,600,000	0.006	0.02	A,D									
Eutrochium dubium	Coastal Plain Joe-Pye Weed	■	■	P		■	■	FACW	FACW	2,000,000	0.02	0.06										
Eutrochium fistulosum	Joe-Pye Weed	■	■	P		■	■	FACW	FACW	2,000,000	0.02	0.06	S									
Eutrochium purpureum	Sweet-scented Joe-Pye Weed	■	■	P		■	■	FAC	FAC	672,000	0.05	0.2										
Helenium autumnale	Yellow Sneezeweed	■	■	P		■	■	FACW	FACW	1,464,000	0.02	0.08	T									
Helenium flexuosum	Purple Sneezeweed	■	■	P		■		FACW	FAC	2,000,000	0.02	0.06	T									

TABLE 2.4: Selected Characteristics of Native Wildflowers and Legumes

Scientific Name	Common Name	Region [1]		Duration [2]	Moisture [3]			Wetland [4]		Est. Seeds/Lb	PLS Lbs/Ac [5]		Traits [6]	Flowering Period and Flower Color								
		NNJ	CP		D	M	W	AGCP	EMP		Grass Mix	Forb Mix		M	A	M	J	J	A	S	O	N
Helianthus angustifolius	Swamp Sunflower		■	P		■	■	FACW	FACW	500,000	0.07	0.25										
Heliopsis helianthoides	Smooth Oxeye	■	■	P	■	■		UPL	FACU	116,410	0.3	1										
Lespedeza capitata	Round-head Bush-Clover	■	■	P	■	■		FACU	FACU	174,000	0.2	0.7	D,T									
Lespedeza hirta	Hairy Bush-Clover	■	■	P	■	■		NI	NI	175,000	0.2	0.65	D,T									
Liatris pilosa	Grass-leaf Blazing Star	■	■	P	■	■		NI	NI	290,000	0.1	0.4	D									
Liatris scariosa	Large Blazing Star	■	■	P		■		UPL	FACU	100,000	0.35	1										
Lobelia cardinalis	Cardinal Flower	■	■	P			■	FACW	FACW	11,292,758	0.003	0.01	S									
Lobelia siphilitica	Blue Lobelia	■		P			■	OBL	FACW	8,000,000	0.004	0.01	S									
Mimulus ringens	Square-stemmed Monkeyflower	■	■	P			■	OBL	OBL	22,900,000	0.001	0.005										
Monarda didyma	Scarlet Bee-balm			P		■	■	FAC	FAC	1,272,500	0.03	0.09	S									
Monarda fistulosa	Wild Bergamot	■	■	P		■		FACU	UPL	1,272,500	0.03	0.09	S									
Monarda punctata	Spotted Bee-balm	■	■	P	■	■		FACU	UPL	1,440,000	0.02	0.08										
Penstemon canescens	Gray Beard-tongue	■		P	■			NI	NI	400,000	0.08	0.3										
Penstemon digitalis	Tall White Beard-tongue	■	■	P	■	■		FAC	FAC	400,000	0.08	0.3	D,S									
Pycnanthemum incanum	Hoary Mountain Mint	■	■	P	■	■		NI	NI	4,500,000	0.007	0.03	S									
Pycnanthemum muticum	Big-leaf Mountain Mint		■	P	■	■	■	FAC	FAC	4,500,000	0.007	0.03	S									
Pycnanthemum tenuifolium	Narrow-leaf Mountain Mint	■	■	P	■	■	■	FACW	FACW	4,500,000	0.007	0.03	A,S									
Rudbeckia fulgida var. *fulgida*	Orange Coneflower	■	■	P		■		FAC	FAC	500,000	0.07	0.25										
Rudbeckia hirta	Black-eyed Susan	■	■	B	■	■		FACU	FACU	1,575,760	0.02	0.07	D									
Rudbeckia triloba	Brown-eyed Susan	■	■	P		■		FACU	FACU	536,000	0.06	0.2										
Senna hebecarpa	American Senna	■	■	P		■	■	FAC	FAC	20,500	0.25	1	T									
Senna marilandica	Maryland Senna	■	■	P	■	■		FAC	FAC	20,500	0.25	1	D,T									
Silphium perfoliatum	Cup Plant	■		P		■		FAC	FAC	100,000	0.35	1	A									
Solidago juncea	Early Goldenrod	■	■	P	■	■		NI	NI	2,500,000	0.01	0.05	D									
Solidago nemoralis	Gray Goldenrod	■	■	P	■	■		NI	NI	1,008,000	0.03	0.1	D									
Solidago patula	Rough-leaved Goldenrod	■		P			■	OBL	OBL	700,000	0.05	0.15										
Solidago rugosa	Wrinkle-leaf Goldenrod	■	■	P	■	■		FAC	FAC	1,000,000	0.03	0.1	A,D									
Symphyotrichum ericoides	White Heath Aster	■		P	■	■		UPL	FACU	700,000	0.05	0.15										

TABLE 2.4: Selected Characteristics of Native Wildflowers and Legumes

Scientific Name	Common Name	Region [1]		Duration [2]	Moisture [3]			Wetland [4]		Est. Seeds/Lb	PLS Lbs/Ac [5]		Traits [6]	Flowering Period and Flower Color								
		NNJ	CP		D	M	W	AGCP	EMP		Grass Mix	Forb Mix		M	A	M	J	J	A	S	O	N
Symphyotrichum laeve var. *laeve*	Smooth Blue Aster	■	■	P	■	■		UPL	FACU	1,014,000	0.03	0.1	D									
Symphyotrichum lateriflorum var. *lateriflorum*	Calico Aster	■	■	P		■	■	FAC	FACW	750,000	0.04	0.15	D									
Symphyotrichum novae-angliae	New England Aster	■	■	P		■	■	FACW	FACW	1,100,000	0.03	0.1										
Symphyotrichum novi-belgii	New York Aster	■	■	P			■	OBL	FACW	700,000	0.05	0.15										
Symphyotrichum oblongifolium	Aromatic Aster	■		P	■	■		NI	NI	700,000	0.05	0.15										
Symphyotrichum pilosum	White Oldfield Aster	■	■	P	■	■		FAC	FAC	700,000	0.05	0.15	D									
Symphyotrichum prenanthoides	Zigzag Aster	■		P		■		FAC	FAC	700,000	0.05	0.15	D									
Symphyotrichum puniceum	Purple-stemmed Aster	■	■	P			■	OBL	OBL	700,000	0.05	0.15										
Symphyotrichum urophyllum	White Arrowleaf Aster	■	■	P	■	■		NI	NI	700,000	0.05	0.15										
Thalictrum pubescens	Tall Meadow Rue	■	■	P		■	■	FACW	FACW	192,000	0.15	0.6	S									
Tradescantia ohiensis	Ohio Spiderwort	■	■	P		■		FAC	FAC	1,750,000	0.02	0.07	S									
Tradescantia virginiana	Virginia Spiderwort	■	■	P	■	■	■	FAC	FACU	1,750,000	0.02	0.07	D,S									
Verbena hastata	Blue (Swamp) Vervain	■	■	P			■	FAC	FACW	1,500,000	0.02	0.08										
Vernonia noveboracensis	New York Ironweed	■	■	P		■	■	FACW	FACW	300,000	0.1	0.4	S									
Veronicastrum virginicum	Culver's Root	■		P		■	■	FACW	FACU	7,800,000	0.004	0.02										
Zizia aurea	Golden Alexanders	■	■	P		■		FAC	FAC	168,400	0.2	0.7	S									

1. **Region:** The physiographic region where the species usually occurs in New Jersey, under natural conditions. NNJ – North New Jersey and includes the Valley and Ridge, Highlands, and Piedmont regions ; CP - Coastal Plain. Visit the New Jersey DEP website to determine which region includes your project site or view the "Physiographic Provinces" layer in Conservation Desktop.
2. **Dur (Duration):** A – Annual; B – Biennial; P – Perennial.
3. **Moisture:** The amount of moisture the species needs or tolerates, as part of a mix. D - Dry (excessively drained to well-drained soil); M - Mesic (moderately well to somewhat poorly drained soil); W – Wet (poorly to very poorly drained soil).
4. **Wetland:** Wetland indicator status for the Atlantic and Gulf Coastal Plain (AGCP) and Eastern Mountains and Piedmont (EMP).
5. **PLS Lbs/Ac:** The value listed is the seeding rate in pure live seed (PLS) for the individual species within a Grasses with Wildflowers mix (a predominantly grass planting; column header "Grass Mix") and a Wildflower Meadow mix (a predominantly wildflower planting; column header "Forb Mix"). Rates are based 30 PLS/SF with 3 spp grass and 5 spp forbs at a 75:25 ratio in the Grass Mix, and 30 PLS/SF with 3 spp grass and 10 spp forbs at 10:90 in the Forb Mix.
6. **Traits:** A - Can be aggressive; D - Drought tolerant; S - Shade tolerant; T - Potential toxicity to livestock.

Section 3 - Upland Herbaceous Plantings: Critical Area Plantings

This section contains recommended seed mixes for temporary and permanent herbaceous cover with high plant density. These critical area planting mixes are designed to provide cover that establishes relatively quickly and is very durable. These mixes are typically used on sites that have, or are expected to have, high erosion rates, and on sites with limiting factors that make plants especially difficult to establish (e.g. coastal dunes, storm damaged areas, construction sites) and/or maintain (e.g., on heavily used areas). Plantings are generally not harvested, hayed, or grazed for agricultural production.

The following tables supplement the applicable conservation practice standards (see Section 1, Table 1.1), and contain additional requirements for species selection, planting rates, and establishment methods, and care in handling and planting of the seed or planting stock.

SECTION 3 TABLE OF CONTENTS

Selecting Mixes and Establishing Plantings

Refer to Table 3.1 for recommended annual species, seeding rates, and planting dates for temporary cover.

Refer to Table 3.2 to select appropriate permanent herbaceous cover mixes for specific purposes.

Refer to Table 3.3 for recommended permanent herbaceous cover mixes and seeding rates. Other herbaceous species that are native to New Jersey, or are introduced and are non-invasive, may also be suitable.

Refer to the NJ Sea Grant Dune Manual for specific recommendations for coastal dune plantings.

TABLE 3.1: Temporary Seeding for Site Stabilization

TABLE 3.1: Temporary Seeding for Site Stabilization						
Plant Species	**Seeding Rate[1]**		**Seeding Depth (inches)[2]**	**Recommended Seeding Dates by Plant Hardiness Zone[3]**		
	lbs./ac.	**lbs./ 1,000sq.ft.**		**6a**	**6b**	**7a and 7b**
COOL-SEASON GRASSES						
Annual Ryegrass *Lolium perenne* ssp. *multiflorum*	40	1.0	0.5	Mar 15 to May 31 Aug 1 to Sep 30	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 1 to Apr 30 Aug 15 to Nov 30
Barley *Hordeum vulgare*	96	2.2	1.0	Mar 15 to May 31 Aug 1 to Sep 30	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 1 to Apr 30 Aug 15 to Nov 30
Oats *Avena sativa*	86	2.0	1.0	Mar 15 to May 31 Aug 1 to Sep 30	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 1 to Apr 30 Aug 15 to Nov 30
Wheat *Triticum aestivum*	120	2.8	1.0	Mar 15 to May 31 Aug 1 to Sep 30	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 1 to Apr 30 Aug 15 to Nov 30
Cereal Rye *Secale cereale*	112	2.8	1.0	Mar 15 to May 31 Aug 1 to Oct 15	Mar 1 to Apr 30 Aug 1 to Nov 1	Feb 1 to Apr 30 Aug 15 to Nov 1
WARM-SEASON GRASSES						
Foxtail Millet *Setaria italica*	30	0.7	0.5	Jun 1 to Jul 31	May 1 to Jul 31	May 1 to Aug 14
Pearl Millet *Pennisetum glaucum*	20	0.5	0.5	Jun 1 to Jul 31	May 1 to Jul 31	May 1 to Aug 14
Japanese Millet *Echinochloa crus-galli var frumentacea*	10	0.23	0.25	Jun 1 to Jul 31	May 1 to Jul 31	May 1 to Aug 14

[1] Seeding rates for the warm-season grasses are in pounds of Pure Live Seed (PLS). Actual planting rates shall be adjusted to reflect percent seed germination and purity, as tested. No adjustments are necessary for the cool-season grasses.
Seeding rates listed above are for temporary seedings, when planted alone. When planted as a nurse crop with permanent seed mixes, use 1/3 the seeding rate listedabove for barley, oats, wheat, and cereal rye. For smaller-seeded grasses (annual ryegrass, pearl millet, foxtail millet), do not exceed more than 5% (by weight) of the overall permanent seeding mix.
Oats are the recommended nurse crop for warm-season grasses. Do not use cereal rye with warm-season grasses; it has been shown to have allelopathic properties that inhibit the germination and growth of warm-season grasses.
[2] For sandy soils, plant seeds at twice the depth listed above.
[3] The planting dates listed are averages for each Zone, and may require adjustment to reflect local conditions, especially near the boundaries of the zone.

TABLE 3.2: Recommended Permanent Seeding Mixtures by Purpose

TABLE 3.2: Recommended Permanent Seeding Mixtures by Purpose													
Purpose of the Planting	**Recommended Mix (see Table 3.3)**												
	1	**2**	**3**	**4**	**5**	**6**	**8**	**7**	**9**	**10**	**11**	**12**	**13**
Steep Slopes, Roadsides	✓	◆	✓	✓	✓	◆	◆			◆	◆		✓
Sand and Gravel Pits, Sanitary Landfills	✓	◆	✓	✓	✓	◆				◆	◆		◆
Mine Spoil, Dredged Material, and Spoil Banks	◆	◆	✓		◆				◆				
Utility Rights-of-Way	✓	✓	✓	✓		✓	◆		◆	✓	✓		◆
Dikes and Dams	◆	◆	✓	◆		✓	◆		✓	✓	✓	◆	◆
Berms, Low Embankments (not on Ponds)	✓	✓	✓	✓	✓	✓	◆		✓	✓	✓	✓	◆
Pond and Channel Banks, Streambanks	✓	✓	✓	✓	◆	◆	◆			◆	◆	✓	
Grassed Waterways, Diversions, Terraces, Spillways	◆	◆			◆	✓	✓		✓	✓		◆	◆
Bottom of Drainage Ditches, Swales, Detention Basins		◆			◆	✓	◆			◆		✓	✓
Field Borders, Filter Strips, Contour Buffer Strips	✓	◆	✓	✓	✓	✓	◆		✓	◆	✓	✓	◆
Wastewater Treatment Strips and Areas									◆	◆			✓
Athletic Fields, Residential and Commercial Lawns							◆	✓	✓	✓			
Recreation Areas						◆	✓	✓	✓	◆	◆		
Salt affected coastal areas					✓							✓	

✓ Recommended mix for this purpose.

◆ Alternative mix, depending on site conditions and preferences of the client.

TABLE 3.3: Permanent Herbaceous Seeding Mixtures

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
	Mix	Recommended Cultivars (Endophyte free)	Seeding Rate[1] lbs./ac.	Seeding Rate[1] lbs./ 1000 sq. ft.	Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
1	**SELECT ONE WARM-SEASON GRASS:**							
	Switchgrass *Panicum virgatum*	Carthage	5	0.11				*** NJPMC Coastal Plain waterway mix**
	Coastal Panicgrass *Panicum amarum*	Atlantic	10	0.23				
	AND ADD THE FOLLOWING COOL SEASON GRASSES:							Performs well on excessively droughty/ sandy soils. All species are native to New Jersey
	Creeping Red Fescue Festuca rubra var rubra	Pennlawn, Flyer, Fortess, Salem,	30	0.70				
	Canada or Southeastern wildrye		10	0.23				Plant this mix with a regular grass drill.
	Perennial ryegrass		10	0.23	E – P	4 - 7	C - D	Creeping Red Fescue, Canada wildrye and perennial ryegrass provide quick cover, erosion protection while the warm-season grasses are becoming established.
	PLUS ONE OF THE FOLLOWING LEGUMES:							
	Partridge Pea *Chamaecrista fasciculata*		2	0.04				
	Round Bush Clover *Lespedeza capitata?*	Common	0.5	0.01				
	Tick trefoil *Desmodium canadense/paniculatum*	Common	0.5	0.01				Switchgrass, Coastal Panicgrass, the 'Dawson' variety of Creeping Red Fescue and Partridge Pea are moderately salt-tolerant.
		Common						Bush Clover does not tolerate wet sites.
2	**ALL OF THE FOLLOWING:**							
	Deertongue *Dicanthelium clandestinum*	Tioga	15	0.34				Use Virginia wild rye on moist, shady sites.
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Pennlawn, Flyer, Fortess, Salem	20	0.46	W - P	2 - 3	C - D	Use Canada wild rye on droughty sites.
	AND ADD ONE OF THE FOLLOWING:	Common	5	0.11				
	Virginia Wild Rye *Elymus virginicus*							
	Canada Wild Rye *Elymus canadensis*	Common	5	0.11				

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
	Mix	Recommended Cultivars (Endophyte free)	Seeding Rate[1] lbs./ac.	Seeding Rate[1] lbs./ 1000 sq. ft.	Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
3	**SELECT ONE OF THE FOLLOWING:**							
	Sheep Fescue *Festuca ovina*	Covar, Quatro, Bighorn	20	0.46				
	Canada Wild Rye *Elymus canadensis*	Common	3	0.07				
	AND ADD BOTH:		20	0.46				
	Deertongue *Dicantheliumclandestinum*	Tioga			E - MW	2 – 4	C – D	Excellent for excessively droughty, low pH (acidic) soils. Sheep fescue, Canada wild rye, and Redtop are cool-season grasses that will provide erosionprotection while the deertongueis becoming established.
	Redtop *Agrostis gigantea*	Streaker	1	0.02				
	AND ADD THE FOLLOWING LEGUME:		2	0.05				
	Round bushclover *Lespedezacapitata*		2	0.05				
4	**ALL OF THE FOLLOWING:**							
	Big Bluestem *Andropogon gerardii*	Niagara	6	0.14				
	Indiangrass *Sorghastrum nutans*	Rumsey, Americus, Suther	6	0.14				
	Little Bluestem *Schizachyrium scoparium*	Aldous, Suther	4	0.09				All species are native to the Northeast.
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Pennlawn, Flyer, Fortess, Salem	15	0.34	E - MW	6 - 8	C - D	The indiangrass and bluestems have fluffy seeds. Plant with a specialized native seed drill. Creeping red fescue is a cool-season grass that will provide erosion protection while the warm-season grasses are becoming established.
	AND ADD ONE OF THE FOLLOWING LEGUMES:							
	Partridge Pea *Chamaecrista fasciculata*	Common	4	0.09				
	Bush Clover *Lespedeza capitata*	Common	2	0.05				

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
	Mix	Recommended Cultivars (Endophyte free)	Seeding Rate[1] lbs./ac.	Seeding Rate[1] lbs./ 1000 sq. ft.	Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
5	**ALL OF THE FOLLOWING:**							
	Coastal panicgrass *Panicum amarum var amarulum*	Atlantic	15	0.35				Native warm/cool season grass buffer planting for coastal areas that occasionally get inundated.
	Switchgrass *Panicum virgatum*	High Tide Germ.	10	0.23				Cultivars specified have shown some salt tolerant
	Eastern gamagrass Tripsacum dactyloides	Meadowcrest	10	0.23				
	AND ADD ONE OF THE FOLLOWING: (if available)				E-P	3-4	D	
	Florida paspalum *Paspalum floridanum*	Mid-Atlantic	5	0.11				
	Smooth panicgrass Panicum dichotomiflorum	Common	5	0.11				
	Canada wildrye *Elymus canadensis*	Mandan, Shire, common	10	0.23				Canada wildrye is a native cool season. Used as a nurse crop for warm season grass plantings.
6	**CHOOSE ONE OF THE FOLLOWING:**							
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Dawson, Pennlawn,Flyer, Fortess, Salem	20	0.46				
	Hard Fescue *Festuca trachyphylla*	Durar, Minimus	20	0.46				Use either creeping red fescue orhard fescue in heavy shade, but only hard fescue in sunny conditions and/or droughty soils.
	AND ADD ONE OF THE FOLLOWING:				E – P	2 – 3	B – D	
	Perennial Ryegrass *Lolium perenne*	Blazer II, Pennfine	5	0.11				Perennial ryegrass and redtop willestablish more rapidly than eitherfescue. Use redtop on low pH soils. Flatpea will suppress woody vegetation. It should be planted in the spring, or as a dormant seeding (overseeding) in late fall or winter. It may not be winter- hardy if planted late summer - fall.
	Redtop *Agrostis gigantea*	Streaker	1	0.02				
	AND ADD THE FOLLOWING (OPTIONAL):							
	Flatpea Lathyrus sylvestrus	Lathco	15	0.34				
7	Tall Fescue *Lolium arundinaceum* *Use only for high impact turfgrassseedings in sunny to partially shaded, well-drained sites	Endophyte-enhanced recommended NJ turf-types[4]	100	2.3	E - P	2 - 3	A - D	Tall fescue produces a dense turf if frequently mowed but tends tobe bunchy if mowed only occasionally. For best results, use a blend of 3cultivars.

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
	Mix	Recommended Cultivars (Endophyte free)	Seeding Rate[1] lbs./ac.	Seeding Rate[1] lbs./ 1000 sq. ft.	Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
8	**SELECT ONE OF THE FOLLOWING:**							
	Tall Fescue *Lolium arundinaceum*	Fawn, Johnstone, Barcel, Festorina	40	0.93				These recommended foragecultivars of tall fescue are endophyte free.
	Smooth bromegrass *Bromus inermis*	Saratoga, Baylor	22	0.50				
	AND ADD:				E – P	2 – 3	C – D	Smooth bromegrass best adaptedto Piedmont & Mountian region Birdsfoot trefoil is suitable for useonly in Zones 5b and 6a.
	Kentucky Bluegrass *Poa pratensis*	Turf-types[4]	15	0.34				
	AND ADD ONE OF THE FOLLOWING LEGUMES:							White clover is adaptedstatewide.
	Birdsfoot trefoil *Lotus corniculatus*	Viking, Norcen	5	0.15				
	White clover *Trifolium repens*	Common	2	0.05				
9	**SELECT ONE OF THE FOLLOWING:**							
	Tall Fescue *Lolium arundinaceum*	Endophyte-enhanced turf-types[4]	60	1.38				Mix is good for high impact turfareas such as athletic fields andrecreation areas.
	Hard Fescue *Festuca trachyphylla*	Durar, Minimus	40	0.92				Tall fescue is more suitable for compacted, high use areas. Hard fescue produces finer- textured turf with more shade tolerance. For best results, recommend using a blend of 3 cultivars each of tall fescue andKentucky bluegrass
	AND ADD BOTH:	Recommended NJ turf-types[4]						
	Kentucky Bluegrass4 *Poa pratensis*		40	0.92	E - P	2 - 3	A - D	
	Perennial Ryegrass *Lolium perenne*	Blazer II, Pennfine	20	0.46				

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
	Mix	Recommended Cultivars (Endophyte free)	Seeding Rate[1] lbs./ac.	Seeding Rate[1] lbs./ 1000 sq. ft.	Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
10	**ALL OF THE FOLLOWING:**							
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Dawson, Pennlawn,Flyer, Fortess, Ruby, or Salem	43	1.0	E - MW	2 - 3	B - D	Suitable mix for shady turf areas. Add rough bluegrass under moist,shady conditions only.
	Kentucky Bluegrass *Poa pratensis*	Recommended NJ turf-types[4]	22	0.50				
	OPTIONAL - ADD THE FOLLOWING							
	Rough Bluegrass *Poa trivialis*	Sabre, Laser	15	0.34				
11	**ADD THE FOLLOWING:**							
	Chewings Fescue *Festuca rubra* ssp. *commutata*		25	0.57				
	Hard Fescue *Festuca trachyphylla*	Durar, Minimus	25	0.57				Attractive mix of fine fescues and wildflowers for low maintenance conditions. Once well-established,the grasses may tend to outcompete the wildflowers Hydroseeding is not recommended for this mix ifwildflowers are used. (They have very small seeds.)
	Sheep Fescue *Festuca ovina*	Bighorn, Covar, Quatro	25	0.57				
	AND ADD THE WILDFLOWER MIX							
	Black-eyed Susan *Rudbeckia hirta*	Common	2	0.05	E - MW	2 - 3	C - D	
	Lance-leaved Coreopsis *Coreopsis lanceolata*	Common	2	0.05				
	Purple Coneflower *Echinacea purpurea*	Common	2	0.05				
	Partridge Pea *Chamaecrista fasciculata*	Common	5	.11				
	OR ADD THE CLOVER MIX							
	White Clover *Trifolium repens*	Common	3	0.07				
	Red Clover *Trifolium pratense*	Any	3	0.07				

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
Mix		Recommended Cultivars (Endophyte free)	Seeding Rate[1] lbs./ac.	Seeding Rate[1] lbs./ 1000 sq. ft.	Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
12	**ADD THE FOLLOWING:**							Saltgrass will persist only under saline conditions.
	Alkali Saltgrass *Puccinellia distans*	Fults or Salty	20	0.46				Use the 'Dawson' variety of creeping red fescue in saline conditions.
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Dawson, Pennlawn, Flyer, Fortess, Salem	15	0.34				
	Fowl Meadowgrass *Poa palustris* ***OR***	Common	2	0.05				Fowl meadowgrass is a native wetsite bluegrass. Add bentgrass for wet, saline conditions.
	Creeping Bentgrass Agrostis palustris	Seaside, Southshore	2	0.05	W - P	2 - 3	B - D	
	AND ADD THE FOLLOWING (OPTIONAL Nurse Crop):							
	Japanese millet		10	0.23				Use Japanese millet where quick cover is needed.
13	**ADD ALL OF THE FOLLOWING:**							Low maintenance mix that is easyto establish.
	Orchardgrass *Dactylis glomerata*	Any	25	0.57				Omit the clovers if using this mixfor wastewater treatment strips and areas.
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	10	0.23				
	Redtop *Agrostis gigantea*	Streaker	1	0.02	W - SP	2 - 3	C - D	
	Alsike Clover *Trifolium hybridum*	Common	3	0.07				
	White Clover *Trifolium repens*	Common	3	0.07				

[1] Seeding rates for the warm-season grasses are in pounds of Pure Live Seed (PLS). Actual planting rates shall be adjusted to reflect percent seed germination and purity, as tested. No adjustments are necessary for the cool-season grasses, legumes, or wildflowers. All legume seeds shall be inoculated before planting with the appropriate Rhizobium bacteria.

[2] Soil Drainage Class (refer to the county soil survey for further information): E - Excessively Drained; W - Well Drained; MW - Moderately Well DrainedSP - Somewhat Poorly Drained P - Poorly Drained

[3] Maintenance Level: A - Intensive mowing (every 2 - 4 days), fertilization, lime, insect and weed control, and watering (examples: high maintenance lawns and athletic fields);B - Frequent mowing (every 4 - 7 days), occasional fertilization, lime, pest control, and watering (examples: residential, school, and commercial lawns); C - Periodic mowing (every 7 - 14 days), occasional fertilization and lime (examples: residential lawns, parks); D - Infrequent or no mowing, fertilization, or lime after the first year of establishment (examples: wildlife areas, roadsides, steep banks)

[4] Recommended cultivars for New Jersey. Refer to Rutgers Cooperative Extension Service Turfgrass Fact Sheets

TABLE 3.4 Quality of Seed

TABLE 3.4: Quality of Seed[1]					
Species	**Minimum Seed Purity (%)**	**Minimum Seed Germination (%)**	**Species**	**Minimum Seed Purity (%)**	**Minimum Seed Germination (%)**
Cool-Season Grasses			***Warm-Season Grasses***		
Barley	98	85	Bluestem, Big	60	60
Bentgrass, Creeping	95	85	Bluestem, Little	55	60
Bluegrass, Canada	90	80	Deertongue	95	75
Bluegrass, Kentucky	90	80	Indiangrass	60	60
Bluegrass, Rough	90	80	Millet, Foxtail or Pearl	98	80
Fescue, Chewings	95	85	Panicgrass, Coastal	95	70
Fescue, Creeping Red	95	85	Switchgrass	95	75
Fescue, Hard	95	85	Other native WSGs	--	--
Fescue, Sheep	95	85	***Legumes/Forbs***		
Fescue, Tall	95	85	Clover, Alsike	99	85
Oats	98	85	Clover, Red	99	85
Orchardgrass	90	80	Clover, White	98	90
Redtop	92	80	Flatpea	98	75
Rye, Cereal	98	85	Pea, Partridge	98	70
Ryegrass, Annual or Perennial	95	85	Other native legumes	--	--
Saltgrass, Alkali	85	80	Trefoil, Birdsfoot	98	85
Wheat	98	85	Wildflowers	--	--
Wild Rye, Canada	85	70			
Other native CSGs	--	--			

[1] All seed shall comply with the New Jersey State Seed Law. Seed shall be free of prohibited or restricted noxious weeds.

References (Section 3)

[All online citations accessed October 8 2021]

Salon, P.R., C.F. Miller. 2012. A Guide to Conservation Plantings on Critical Areas for the Northeast. USDA – NRCS Big Flats Plant Materials Center, Corning NY. https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/nypmspu11417.pdf

Wootton, L., J. Miller, C.F. Miller, M. Peek, A. Williams, P. Rowe. 2016. New Jersey Sea Grant Consortium Dune Manual. Njseagrant.org/dunemanual

NRCS Plant Materials Program. 2021. Plant Materials Technical Note 5: Using the Appropriate Legume Innoculant for Conservation Plantings. USDA Natural Resources Conservation Service. Washington, D.C. https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/natpmtn13723.pdf

Section 4 - Tree and Shrub Plantings

This section contains recommended trees and shrubs (and several woody vines) that can be planted for native cover, hedgerows, windbreaks/shelterbelts, forest production, wetland restoration, and other purposes.

SECTION 4 TABLE OF CONTENTS

Selecting Species and Establishing Plantings

Plant materials shall comply with minimum standards, such as those as established by the American Nursery and Landscape Association or U.S. Forest Service.

The following tables provide recommended planting rates and/or spacing for specific uses:

Refer to Table4.1: Recommended Site Preparation Based on Soil Type and Previous Land Management to determine the type of site preparation required based on current site conditions.

Refer to Table 4.2: Planting Dates to recommend the appropriate timing of the planting based on the type of materials that will be planted.

Refer to Tables 4.3 – Table 4.8 for the planting densities depending on the purpose and the type of stock being planted. For wildlife plantings, refer to the "Spacing for Wildlife and Forestry Health" section directly following Table 4.8

If pressure from wildlife is expected to impact the success of the planting, review the information and tables from the "Seedling Protection from Wildlife" section.

Refer to Tables 4.10 – Table 4.11 for species specific information such as suitability to the planned site and additional characteristics that can be used to determine if the species will meet the planned objectives.

PREPARATION OF PLANTING SITES, PLANTING METHOD, AND PLANTING DATES

Planting sites must be properly prepared based on the soil type and vegetative conditions listed in Table 5. Utilize New Jersey Conservation Practice Standard Tree/Shrub Site Preparation (490) when needed.
Site conditions and possible erosion and sedimentation must be considered and mitigated when preparing sites adjacent to streambanks or shorelines.

Competitive weeds, particularly Canada thistle, multiflora rose, or undesirable grasses need to be controlled prior to planting. Avoid sites that have had recent application of pesticides harmful to the woody species to be planted. If pesticides are used for site preparation, apply only when needed and handle and dispose of properly and within federal, state and local regulations. Follow label directions and heed all precautions listed on the container.

Fabric mulch may be used for weed control and moisture conservation for new plantings on all sites, particularly those with pronounced growing season moisture deficits, or invasive weeds. Refer to New Jersey Conservation Practice Standard Mulching (484) for further guidance.

TABLE 4.1: Recommended Site Preparation Based on Soil Type and Previous Land Management

TABLE 4.1: Recommended Site Preparation Based on Soil Type and Previous Land Management		
Soil Type(s)	**Previous Land Management**	**Recommended Site Preparation**
Loamy or clayey	Sod or hay	Sod may be killed by non-selective herbicides the year before planting. Plant stock in the residue. On heavy soils, tillage is usually necessary to achieve a satisfactory planting, especially when a tree planting machine is used.
Sandy	Sod or hay	When hand planting without site preparation, scalp or strip the existing vegetation from an area at least 3 feet in diameter and two to four inches deep. Plant plants in the center of the scalped area. Alternatively, rototill a 3-foot-wide strip and place plants in the center of the tilled area. Where a drip watering system will not be used, rototill the strip the year prior to planting.
Loamy, clayey, or sandy	Small grain or row crop	If the site is in small grain, corn, or similar clean tilled crops, and it is reasonably free of weeds, plant stock in the stubble without prior preparation. It may be necessary to till a narrow strip with a disk, or other implement to kill weeds or volunteer grain, or to prevent stalks and other residue from clogging the tree planter. If fabric mulch is used, disking may be needed. A cover crop or stubble may be needed between the rows to protect the planting from erosion.
All soils	Previously forested areas	Consult with a professional forester for proper site preparation prior to planting. Methods may include the following mechanical treatments: drum chopping, root-raking, and/or woodland disking. Herbicide treatments may also be used.
Non-tillable sites or erosive sites: On sites where it is not practical or possible to operate equipment (steepness, rockiness, etc.) or tillage of the site will cause excessive erosion, the methods listed below may be used. Sites with undesirable brush will need initial treatments that physically remove or kill the brush. Suitable methods include hand-cutting and removal, brush hogging, or herbicides applications. Machine or hand scalp an area at least 6 inches in diameter with subsequent plant placement in the center of the scalped area. Rototill a strip at least 36 inches wide the year prior to tree planting with subsequent plant placement in the center of the tilled strip. Kill the vegetation in a 36-inch diameter or larger area or in a 36-inch or wider strip with a non-selective herbicide the year prior to planting and plant in the center or along the center-line of the treated area.		

CARE, HANDLING, SIZE AND PLANTING REQUIREMENTS FOR WOODY PLANTING STOCK

Planting stock needs be stored in a cool, moist environment (34-38 degrees F) or heeled in, which refers to the practice of digging a trench six inches deep by several feet long and placing seedlings in the trench for temporary storage. When seedlings are heeled in, they are placed side by side and soil is placed over the roots to planting depth.

During all stages of handling and storage, keep stock tops dry and free of mold and roots moist and cool. Destroy stock that has been allowed to dry, to heat up in storage (e.g. within a bale, delivery carton or container) or that has developed mold or other pests. Live cuttings that will not be immediately planted should be promptly placed in controlled storage conditions (34-38 degrees F) and protected until planting time.

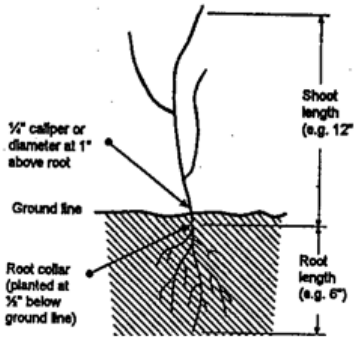

Figure 2: Shoot-to-root ratio is 2:1

Seedlings shall not be less than 1/4" in caliper at 1" above the root collar. For cuttings, avoid using material less than 1/4" in diameter. Rooted planting stock must not exceed a 2:1 shoot-to-root ratio. Container stock should not exceed a 1-gallon can size. Refer to Figure 1.

Roots of bare-root stock must be kept moist during planting operations by placing in a water-soil (mud) slurry, peat moss, super-absorbent (e.g. polyacrylamide) slurry or other equivalent material. Rooting medium of container or potted stock should be kept moist at all times by periodic watering.

Pre-treat stored cuttings with several days of soaking just before planting. Stock shall not be planted when the soil is frozen or dry. Rooted stock will be planted in a vertical position with the root collars approximately 1/2-inch below the soil surface.

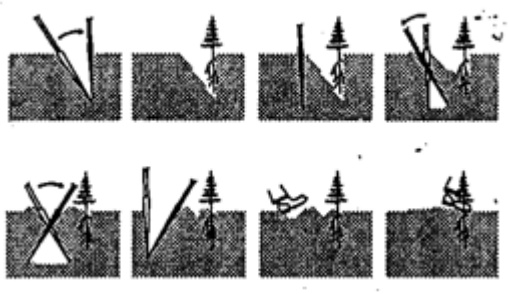

Figure 3: Proper Plant and Root Placement of Rooted Stock Using a Planting Bar

Insert cuttings to the depth required to reach adequate soil moisture with at least 2-3 buds above ground. The planting trench or hole must be deep and wide enough to permit roots to spread out and down without J-rooting or L-rooting. After planting of rooted stock or cuttings, pack soil around each plant firmly to eliminate air pockets. If using a planting bar, refer to figure 2 for

TABLE 4.2: Planting Dates

TABLE 4.2: Planting Dates[1]			
Type of Plant Material	**Plant Hardiness Zone**		
	6a	**6b**	**7a and 7b**
Bare-Root Plants[2]	Mar 15 to May 15* Nov. 1 to Dec. 15 ☼	Mar 1 to May 1* Nov. 1 to Dec. 15 ☼	Feb 15 to April 30* Nov. 1 to Dec. 15 ☼
Containerized Stock; Ball-and-Burlap Stock	Mar 15 to May 31* Oct 15 to Dec 1☼	Mar 1 to May 15* Oct 15 to Dec 15 ☼	Feb 15 to May 5* Nov 1 to Dec 15 ☼

1. The planting dates listed are averages for each zone. These dates may require adjustment to reflect local conditions, especially near the boundaries of the zones.
2. When planted during the growing season, most of these materials must be purchased and kept in a dormant condition until planting.

* These periods may be extended if irrigation is available.

☼ Frequent freezing and thawing of wet soils may result in frost-heaving of materials planted in late fall, if plants have not sufficiently rooted in place. Large containerized and ball-and-burlap stock may be planted into the winter months as long as the ground is not frozen and soil moisture is adequate.

PLANTING DENSITY SPECIFICATIONS BY PURPOSE

TABLE 4.3: Spacing and Densities for Traditional Forestry Products and Carbon Sequestration

TABLE 4.3: Spacing and Densities Traditional Forestry Products and Carbon Sequestration			
Site Condition	**Tree Type and Required Spacing**		
	PINES AND OTHER CONIFERS	HARDWOODS	ATLANTIC WHITE CEDAR
Agricultural field or cleared woodlots with few if any trees.	600 minimum per acre. 8' X 9' approximate spacing	400 minimum per acre. 10' X 10' approximate spacing	1000 minimum per acre. 6' X 7' approximate spacing
Understocked woodlands (A professional forester should prepare the plan)	300 minimum per acre. Total number of planted and existing desirable seedlings should equal 600 minimum per acre	200 minimum per acre Total number of planted and existing desirable seedlings should equal 400 minimum per acre	500 minimum per acre. Total number of planted and existing desirable seedlings should equal 1000 minimum per acre

TABLE 4.4: Spacing and Densities for Riparian Forest Buffers

TABLE 4.4: Spacing and Densities for Riparian Forest Buffers	
Plant Types with Typical Heights at 20 Years of Age	**Plant –To –Plant Spacing (Ft)***
Shrubs, less than 10 feet	3 – 6
Shrubs and trees, 10 to 25 feet (includes columnar trees)	5 – 8
Trees, greater than 25 feet	8 – 12
* Greater spacing between trees and shrubs is permissible in Zone 2 if early successional habitat is desired. A minimum planting density is 200 trees and shrubs per acre.	

TABLE 4.5: Spacing and Densities for Reducing Erosion and/or Improving Water Quality

TABLE 4.5: Spacing and Densities for Reducing Erosion and/or Improving Water Quality				
Establishment Goal (number of trees and/or shrubs per acre after two years)	**Type of Planting Stock**	**Planting Rate [1] (per acre)**	**Number of Plants Needed (per acre) for Standard Spacing (in feet)**	**Remarks**
300 - 400	Bare-root seedlings	462 - 615	544 plants at 8 x 10	Use the appropriate mix from Section 2 to provide ground cover on highly erodible land and on other land where erosion is a concern.
	Containerized (1 gallon or larger)	316 - 421	363 plants at 10 x 12	
1. The planting rate is determined by dividing the establishment goal by the expected survival rate. For example, if the establishment goal is 300 - 400, and the expected survival rate is 65% (0.65), then the planting rate is 462 - 615. The planting rates in this table are based on estimated survival rates of 65% for bare-root seedlings and 95% for containerized stock. It may be necessary to adjust planting rates if survival is expected to be significantly different than the 65% or 95% rates.				

TABLE 4.6: Spacing for Windbreaks and Shelterbelts

TABLE 4.6: Spacing Within and Between Rows for Windbreaks and Shelterbelts					
Plant Type	**Spacing Within Rows (Ft)**				**Spacing Between Rows (Ft)**
	PROTECTION FROM WIND AND WIND- BORNE ODORS, PARTICULATES, CHEMICALS, SNOW		NOISE AND VISUAL SCREENS		ALL PURPOSES
	Single Row	Multiple Rows	Single Row	Multiple Rows	
Shrubs	3 - 5	3 - 6	2 - 4	2 - 5	10 - 20
Deciduous Trees	8 - 12	10 - 18	5 - 8	8 - 10	10 - 20
Evergreen Trees (columnar form)	5 - 8	6 - 10	3 - 5	4 - 8	10 - 20
Evergreen Trees (conical & broad forms)	8 - 12	8 - 16	4 - 6	6 - 10	10 - 20

TABLE 4.7: Densities for Windbreaks and Shelterbelts

TABLE 4.7: Densities for Windbreaks and Shelterbelts		
Purpose	**Required Density and Location of Planting [1]**	**Minimum Number of Rows and Type of Plants [2]**
Provide shelter for structures, animals, and people	At least 65%; upwind and within 10H of area to be protected	Plant two rows of medium and/or high density species. If year-round protection is needed, use at least one row of evergreens.
Improve air quality (reduce airborne particulates, chemicals, odors)	At least 50%; upwind and within 10H of the source area	Plant one row of medium and/or high density species, or two rows of low density species. If year-round protection is needed, use at least one row of evergreens.
	At least 65%; downwind and within 10H of the source area	Plant two rows of medium and/or high density species. If year-round protection is needed, use at least one row of evergreens.
Noise screens	At least 65%; downwind as close to the noise source as feasible	Plant two rows of medium and/or high density species. Select species with a mature height that is as tall as the noise source as feasible. If year-round protection is needed, use at least one row of evergreens. Plant as close together as practical to form a tight barrier.
Visual screens	Dense enough to block the view; located as close to the observer as possible	For year-round screening, plant one row of evergreens. Alternatively, one row of densely branched deciduous species may be sufficient to provide the desired amount of screening.
Reduce energy use; reduce wind erosion; improve irrigation efficiency; increase carbon storage	Density and location as appropriate for the purpose	Minimum one row. Select plants with a mature height that will be taller than the structures or crops to be protected. For carbon sequestration, design the windbreak to maximize above and below ground biomass production. Refer to Additional Criteria in the Windbreak Shelterbelt Establishment (380) standard for specific requirements.
Manage snow	25 to 50%; within 20H upwind of an area for snow distribution	Plant one row of low, medium, or high density species to distribute snow across a field or other area. To achieve the overall specified density, use a closer spacing for low density species, and wider spacing for high density species.
	At least 50%; within 20H upwind of an area for snow accumulation	Plant one row of medium and/or high density species, or two rows of low density species to reduce wind velocities sufficiently for snow to accumulate within 100-200 feet on the downwind side of the windbreak.
Enhance wildlife and/or pollinator habitat	Density and location as appropriate for the primary purpose	Minimum two rows for wildlife; one row can be used for pollinators. Select trees and/or shrubs that will provide food, nesting cover, and/or protective cover for the desired wildlife species or pollinators. Refer to Additional Criteria in the Windbreak Shelterbelt Establishment (380) standard for specific requirements.

1. The maximum design height (H) for the windbreak is the expected height of the tallest row of trees or shrubs in 20 years. Select species with an appropriate mature height to provide protection.

2. For higher levels of protection (at a density $\geq$50%), use at least three rows of trees and shrubs, with at least one row being evergreen trees. Refer to Table 4.6 for the summer and winter densities of each species.

TABLE 4.8: Hedgerows Spacing

TABLE 4.8: Spacing for Hedgerows [1]		
Plant Type	**Spacing (in feet) Within and Between Rows for:**	
	Visual Screens and Physical Barriers	**Wildlife Habitat, Landscaping, and Other Uses**
Perennial Bunch Grasses	1 - 2	2 - 4
Perennial Forbs (as plugs - optional companion plantings with bunch grasses, trees, and/or shrubs)	N/A	2
Shrubs [2]	2 - 4	4 - 8
Deciduous Trees	6 - 12	8 - 14
Evergreen Trees	6 - 10	8 - 14

1. Within a row, use only one species, or select a mix of species that have similar growth forms and growth rates. Use staggered spacing in multiple row plantings. Plant taller-growing trees or shrubs in center rows, and medium or lower growing species in outer rows. Or, for a more "natural appearing" effect, intersperse trees, shrubs, grasses, and forbs in the hedgerow.

2. Use a spacing of 2 feet between rows if drilling seeds of leguminous shrubs

Spacing for Wildlife and Forest Health

Greater spacing between trees and shrubs is permissible if the stated purpose is for wildlife or forest health. Planting density should be considered on a case-by-case basis factoring in wildlife species specific habitat needs, existing desirable vegetation and expected regeneration. Consider planting trees/shrubs in clumps of 3-7 of the same species to simulate natural regeneration.

NATURAL REGENERATION

Natural regeneration is a good management tool where invasive plant species competition is not a concern and rapid establishment is not a priority. Adequate seed trees or advanced reproduction needs to be present or provided when using natural regeneration. The acceptability and timing of coppice (sprouting from stumps or roots) regeneration shall be based on species, age, and diameter. If heavy deer browse is anticipated or observed a different management technique needs to be considered or protection measures need to be used. See Table 6 for information on protection measures. The presence of plants that have a tendency to become competitive (ferns, Mountain laurel, etc.) on site also needs to be considered in the planning and monitoring during establishment of the regeneration.

Prescribed Burning (338) is a vital to for some evergreen trees such as pitch pine to release seed. Fire management should also be considered for controlling undesirable non-native invasive species. Fire management is effective in managing oak regeneration by controlling thin barked species such as beech and birch. This kind of management is also desirable for weeding regenerating forest stands.

A naturally regenerated forest is considered established when plant densities reach forest management plan objectives. Three growing seasons is a reasonable amount of time in which to determine if natural regeneration is successful. Trees and shrubs are considered established when they have grown above deer browse (generally above six feet).

Direct seeding is the act of seeding tree seeds by either drilling or broadcasting the seeds onto the forest floor. Once the seeds have been planted management is similar to natural regeneration.

SEEDLING PROTECTION FROM WILDLIFE

Newly planted seedlings can be damaged by wildlife. Deer browsing is by far the greatest wildlife hazard, though, beavers will eat new seedlings in certain locales. In addition, mice and voles can chew on the bark and cambium of new seedlings. Since deer-browsing is the biggest wildlife threat to seedling survival, protection strategies from deer are discussed below. Additional information is available from the NJ State Forest Service, Rutgers Cooperative Extension, and commercial vendors of products that protect tree seedlings. These products are advertised in garden or forestry supply catalogues.

In areas of heavy deer populations, use one or more of the three methods in Table 7: Options to Protect Seedlings from Deer Pressure to protect seedlings.

TABLE 4.9: Options to Protect Seedlings from Deer Pressure

TABLE 4.9: Options to Protect Seedlings from Deer Pressure
OPTION 1: FENCING
Livestock-type fencing can be installed around the perimeter of the planting site. Non-electric fence should be 8 feet tall to prevent deer from jumping over the fence. Electric fence can be lower in height, since deer first try to go through or under a fence, before they leap. In this case, they get a shock and remember to avoid the area. See Rutgers Cooperative Extension Fact Sheet Number FS888 "Portable Electric Fencing for Preventing Wildlife Damage".
OPTION 2: TREE SHELTERS
Several types of individual seedling protectors are commercially available. These protectors are small diameter cylindrical covers made out of mesh or opaque materials that are placed over each seedling like a chimney. The solid cylinders not only protect the seedling from predation, but also, create a greenhouse effect that increases seedling growth. To create this greenhouse effect, the base of the shelters must be covered by soil.
OPTION 3: TREE STAKES
Use 1" square rot resistant, heartwood stakes of sufficient height to support the tree or tree shelter. It is acceptable to use PVC pipe in flood prone areas.
OPTION 3: CHEMICAL REPELLANTS
There are several chemical repellants available commercially that discourage deer from browsing on seedlings. These products contain substances that are noxious to deer, such as rotten eggs or hot peppers. These products usually last for 1 to 2 months depending on the weather, after which another application is needed. In areas with extremely high deer population, this method is not very effective without continuous reapplications.

TABLE 4.10: Recommended Trees, Shrubs, and Woody Vines for Selected Uses

TABLE 4.10: Recommended Trees, Shrubs, and Woody Vines for Selected Uses (see Table 4.8 for detailed species information)

Plant Names	Region [1]		Moisture [2]			Native to New Jersey	Habitat Use Characteristics [3]								Hedgerows and Windbreaks [4]			Wetlands (surface saturation/ infrequent inundation)	Wetlands (surface saturation/ frequent or prolonged inundation)
							Cover		Fruit/Seed Consumption			Pollinator Food							
	Northern Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage	Toxic to Livestock	Wildlife Habitat	Screens/ Barriers	Poultry		
DECIDUOUS TREES																			
ASPEN, LARGE-TOOTHED *Populus grandidentata*	■	■	■	■		■	■						■						
ASPEN, QUAKING *Populus tremuloides*	■		■	■		■	■	■	■	■					■				
BASSWOOD, AMERICAN *Tilia americana*	■	■	■	■		■	■					■				■			
BEECH *Fagus grandifolia*	■	■	■	■		■	■		■		■		■			■			
BRICH, BLACK *Betula lenta*	■		■	■		■	■			■					■				
BRICH, GREY *Betula populifolia*	■		■	■		■	■			■					■				
BIRCH, RIVER *Betula nigra*	■	■	■	■	■	■	■			■			■					■	
BRICH, YELLOW *Betula allegheniensis*	■		■	■		■			■				■						
BLACKGUM *Nyssa sylvatica*	■	■	■	■	■	■	■			■		■				■		■	
BOX-ELDER *Acer negundo*	■	■		■	■	■	■			■						■		■	
BUTTERNUT *Juglans cinerea*	■			■		■	■			■	■		■	■		■			
CHERRY, BLACK *Prunus serotina*	■	■	■	■		■	■		■		■	■	■	■		■			

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							Cover		Fruit/Seed Consumption			Pollinator Food		Toxic to Livestock					
	Northern Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage		Wildlife Habitat	Screens/ Barriers	Poultry		
CHESTNUT, AMERICAN *Castanea dentata*	■	■	■	■		■	■		■		■		■						
CHINQUAPIN *Castanea pumila*		■	■	■		■	■			■	■		■		■	■			
CHOKECHERRY *Prunus virginiana*	■		■	■		■	■		■		■	■	■	■	■	■			
COTTONWOOD, EASTERN *Populus deltoides*	■	■	■	■	■	■	■									■		■	
CRABAPPLE, SOUTHERN *Malus angustifolia*		■	■	■		■	■		■		■	■	■		■	■			
CRABAPPLE, SWEET *Malus coronaria*	■	■	■	■		■	■		■		■	■	■		■	■			
CYPRESS, BALD *Taxodium distichum*		■		■	■	■	■									■	■		■
DOGWOOD, FLOWERING *Cornus florida*	■	■	■	■		■	■		■			■			■				
DOGWOOD, PAGODA *Cornus alternifolia*	■	■	■	■		■	■		■			■			■				
ELM, AMERICAN *Ulmus americana*	■	■	■	■	■	■	■						■			■	■	■	
ELM, SLIPPERY *Ulmus rubra*	■	■	■	■	■	■	■						■			■		■	
HACKBERRY *Celtis occidentalis*	■	■	■	■		■	■		■		■	■	■		■	■	■		
HAWTHORN, COCKSPUR *Crataegus crus-galli*	■	■	■	■		■	■			■	■	■			■	■			
HICKORY, BITTERNUT *Carya cordiformis*	■	■		■	■	■	■						■			■		■	
HICKORY, MOCKERNUT *Carya tomentosa*	■	■	■	■		■	■		■		■		■			■			

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	Northern Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage	Toxic to Livestock	Wildlife Habitat	Screens/ Barriers	Poultry		
HICKORY, PIGNUT *Carya glabra*	■	■	■	■		■	■			■			■			■			
HICKORY, SHAGBARK *Carya ovata*	■	■	■	■		■	■		■		■		■			■			
HONEYLOCUST *Gleditsia triacanthos*	■	■	■	■			■					■	■			■	■		
HOP-HORNBEAM *Ostrya virginiana*	■		■	■		■	■			■						■			
HORNBEAM, AMERICAN *Carpinus caroliniana*	■	■		■	■	■	■			■						■		■	
LARCH (ALL TAMARACKS) *Larix laricina*	■			■	■	■												■	■
LOCUST, BLACK *Robinia pseudoacacia*	■	■	■				■					■		■		■	■		
MAGNOLIA, SWEETBAY *Magnolia virginiana*		■		■	■	■	■			■		■			■	■		■	
MAPLE, RED *Acer rubrum*	■	■	■	■	■	■	■			■		■	■	■		■	■		■
MAPLE, SILVER *Acer saccharinum*	■			■	■	■	■			■		■	■			■			■
MAPLE, SUGAR *Acer saccharum*	■		■	■			■		■			■	■		■				
MULBERRY, RED *Morus rubra*	■	■	■	■		■	■		■		■					■			
OAK, BLACK *Quercus velutina*	■	■	■	■		■	■		■				■	■		■			
OAK, BLACKJACK *Quercus marilandica*	■	■	■			■	■		■				■	■		■			
OAK, CHERRYBARK *Quercus pagoda*		■			■	■	■		■				■	■		■		■	

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	Northern Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage		Wildlife Habitat	Screens/ Barriers	Poultry		
OAK, CHESTNUT *Quercus montana* (*Q. prinus)*	■	■	■			■	■		■		■		■	■		■			
OAK, CHINQUAPIN *Quercus muehlenbergii*	■		■			■	■		■		■		■	■		■			
OAK, NORTHERN RED *Quercus rubra*	■	■	■	■		■	■		■				■	■		■			
OAK, OVERCUP *Quercus lyrata*		■		■	■	■	■		■		■		■	■		■			■
OAK, PIN *Quercus palustris*	■	■		■	■	■	■		■				■	■		■		■	
OAK, POST *Quercus stellata*	■	■	■	■		■	■		■		■		■	■		■			
OAK, SOUTHERN RED *Quercus falcata*	■	■	■	■		■	■		■				■	■		■			
OAK, SWAMP CHESTNUT *Quercus michauxii*		■		■	■	■	■		■		■		■	■		■		■	
OAK, SWAMP WHITE *Quercus bicolor*		■		■	■	■	■		■		■		■	■		■		■	
OAK, WATER *Quercus nigra*		■		■	■	■	■		■				■	■		■		■	
OAK, WHITE *Quercus alba*	■	■	■	■		■	■		■		■		■	■		■			
OAK, WILLOW *Quercus phellos*		■		■	■	■	■		■				■	■		■		■	
OSAGE-ORANGE *Maclura pomifera*	■	■	■	■			■									■	■		
PAWPAW *Asimina triloba*	■	■		■	■	■	■		■		■		■		■			■	
PERSIMMON, COMMON *Diospyros virginiana*	■	■	■	■	■	■	■		■		■	■			■			■	

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PLUM, AMERICAN *Prunus americana*	■	■	■	■		■	■		■		■	■		■	■	■			
POPLAR, HYBRID *Populus deltoides x nigra* 'Spike'	■	■		■			■								■	■			
POPLAR, TULIP *Liriodendron tulipifera*	■	■	■	■		■	■					■	■		■	■			
REDBUD *Cercis canadensis*	■			■		■	■					■			■				
REDWOOD, DAWN *Metasequoia glyptostroboides*	■	■		■	■		■									■	■		
SASSAFRAS *Sassafras albidum*	■	■	■			■	■			■	■	■	■		■	■			
SWEETGUM *Liquidambar styraciflua*	■	■		■	■	■	■									■		■	
SYCAMORE *Platanus occidentalis*	■	■		■	■	■	■									■		■	
TUPELO, SWAMP (SWAMP BLACK GUM) *Nyssa biflora*		■		■	■	■	■			■		■				■			■
WALNUT, BLACK *Juglans nigra*	■	■		■		■	■			■	■		■	■					
WILLOW, BLACK *Salix nigra*	■	■		■	■	■	■					■	■			■			■
EVERGREEN TREES																			
ARBORVITAE *Thuja occidentalis*	■		■	■	■		■	■								■	■		
ARBORVITAE *Thuja plicata x standishii* 'Green Giant'	■	■	■	■			■	■								■	■		

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CEDAR, ATLANTIC WHITE *Chamaecyparis thyoides*		■		■	■	■	■	■		■						■	■		■
CEDAR, EASTERN RED *Juniperus virginiana*	■	■	■	■		■	■	■							■	■	■		
CYPRESS, LEYLAND *x Cupressocyparis leylandii*	■	■	■	■			■	■								■			
FIR, DOUGLAS *Pseudotsuga menziesii*	■		■				■	■											
HEMLOCK, EASTERN *Tsuga canadensis*	■	■	■	■		■	■	■		■						■		■	
HOLLY, AMERICAN *Ilex opaca*	■	■	■	■	■	■	■	■		■					■	■	■	■	
PINE, AUSTRIAN *Pinus nigra*	■	■	■	■	■		■	■								■			
JAPANESE PINE *Pinus thumbergii*		■	■				■	■											
PINE, LOBLOLLY *Pinus taeda*		■		■	■	■	■	■		■			■			■		■	
PINE, PITCH *Pinus rigida*	■	■	■	■		■	■	■		■			■			■			
PINE, SHORTLEAF *Pinus echinata*		■	■			■	■	■											
PINE, VIRGINIA *Pinus virginiana*	■	■	■	■		■	■	■		■			■			■			
PINE, WHITE *Pinus strobus*	■	■	■	■			■	■		■			■			■			
SPRUCE, BLACK *Picea mariana*	■			■	■	■	■	■											
SPRUCE, NORWAY *Picea abies*	■	■	■	■			■	■								■	■		

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	Northern Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage	Toxic to Livestock	Wildlife Habitat	Screens/ Barriers	Poultry		
SHRUBS AND WOODY VINES																			
ALDER, SMOOTH *Alnus serrulata*	■	■		■	■	■	■	■	■						■	■			■
ALDER, SPECKLED (GRAY) *Alnus incana*	■	■	■	■		■	■	■	■						■	■		■	
ARROWWOOD *Viburnum dentatum*	■	■	■	■	■	■	■	■	■						■	■		■	
AZALEA, PINXTER *Rhododendron periclymenoides*	■	■	■	■	■	■	■					■		■	■			■	
AZALEA, SWAMP *Rhododendron viscosum*		■		■	■	■	■					■		■	■			■	
BAYBERRY, NORTHERN *Morella pensylvanica* *(Myrica pensylvanica)*	■	■	■	■	■	■	■	■	■						■	■	■	■	
BEACHPLUM *PRUNUS MARITIMA*		■	■	■		■	■	■	■						■				
BLADDERNUT, AMERICAN *Staphylea trifolia*	■	■	■	■	■					■					■				
BLACKBERRY, ALLEGHENY *Rubus allegheniensis*	■		■	■		■	■	■	■		■	■			■	■			
BLACKBERRY, SAND *Rubus cuneifolius*		■	■	■		■	■	■	■		■	■			■				
BLACK-HAW *Viburnum prunifolium*	■	■	■	■		■	■	■	■		■				■	■			
BLUEBERRY, HIGHBUSH *Vaccinium corymbosum*	■	■		■	■	■	■	■	■		■	■	■		■	■		■	
BLUEBERRY, LOWBUSH *Vaccinium angustifolium*	■		■	■		■	■	■	■		■	■	■		■				

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	Northern Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage	Toxic to Livestock	Wildlife Habitat	Screens/ Barriers	Poultry		
BUSH, HIGH TIDE (GROUNDSEL) *Baccharis halimifolia*		■		■	■	■	■	■								■		■	
BUSH, HIGH TIDE (MARSH-ELDER) *Iva frutescens*		■		■	■	■	■	■								■		■	
BUTTONBUSH *Cephalanthus occidentalis*	■	■		■	■	■	■	■				■			■	■			■
CHOKEBERRY, BLACK *Aronia melanocarpa*	■		■	■	■	■	■	■		■	■	■			■	■		■	
CHOKEBERRY, RED *Aronia arbutifolia*	■	■	■	■	■	■	■	■		■	■	■			■	■		■	
CHOKECHERRY *Prunus virginiana*	■	■	■	■		■	■	■		■					■				
CRANBERRY BUSH, AMERICAN *Viburnum trilobum*	■	■		■		■			■			■			■				
CURRANT, AMERICAN (WILD) BLACK *Ribes americanum*	■			■	■	■			■						■			■	
DEWBERRY, BRISTLY *Rubus hispidus*		■			■	■	■			■	■		■		■			■	
DEWBERRY, COMMON *Rubus flagellaris*	■	■	■	■		■	■			■	■	■							
DOGWOOD, GRAY *Cornus racemosa*	■		■	■		■	■	■	■			■			■	■			
DOGWOOD, REDOSIER *Cornus sericea*	■			■	■	■	■	■	■			■			■	■			■
DOGWOOD, SILKY *Cornus amomum*	■	■		■	■	■	■	■	■			■			■	■		■	
ELDERBERRY *Sambucus nigra* ssp. *canadensis* (*Sambucus canadensis)*	■	■		■	■	■	■	■	■		■	■		■	■	■		■	

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FETTERBUSH *Eubotrys racemosa* *(Leucothoe racemosa)*		■		■	■	■	■	■						■		■		■	
GRAPE, FOX *Vitis labrusca*	■	■	■	■		■	■	■	■		■				■				
GRAPE, RIVERBANK *Vitis riparia (commercially available)*	■	■			■		■	■	■		■				■			■	
HACKBERRY, DWARF *Celtis pumila*	■	■	■	■			■		■		■	■	■		■	■	■		
HAZELNUT (AMERICAN FILBERT) *Corylus americana*	■	■	■	■		■	■	■	■		■				■	■			
HAZELNUT, BEAKED *Corylus cornuta*	■		■	■		■	■	■	■		■				■	■			
HUCKLEBERRY, BLACK *Gaylussacia baccata*	■	■	■	■	■	■	■	■	■		■	■	■		■			■	
HUCKLEBERRY, BLUE *Gaylussacia frondosa*	■	■	■	■	■	■	■	■	■		■	■	■		■			■	
INDIGO, FALSE (INDIGO BUSH) *Amorpha fruticosa*	■	■	■	■	■	■	■	■		■		■			■	■		■	
INKBERRY *Ilex glabra*		■		■	■	■	■	■	■						■	■			■
MAPLE-LEAF VIBURNUM *Viburnum acerifolium*	■	■	■			■	■			■									
MEADOWSWEET, WHITE *Spiraea alba*	■			■	■	■	■	■		■		■	■		■	■		■	
NANNYBERRY *Viburnum lentago*	■		■	■		■			■						■				
NINEBARK, COMMON *Physocarpus opulifolius*	■		■	■	■	■	■	■		■		■			■	■		■	

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PEPPERBUSH, SWEET *Clethra alnifolia*	■	■		■	■	■	■	■				■			■	■		■	
POSSUM-HAW *Viburnum nudum*	■	■		■	■	■	■	■		■	■				■	■		■	
RAISIN, WILD *Viburnum nudum* var. *cassinoides*				■	■	■	■	■		■	■				■	■		■	
RASPBERRY, BLACK *Rubus occidentalis*	■		■	■		■	■	■	■		■	■			■	■			
RHODODENDRON *Rhododendron maximum*	■	■	■	■	■	■	■				■	■						■	
ROSE, CAROLINA *Rosa carolina*	■	■	■	■		■	■	■	■		■	■			■	■			
ROSE, SWAMP *Rosa palustris*	■	■		■	■	■	■	■	■		■	■			■	■			■
ROSE, VIRGINIA *Rosa virginiana*	■	■	■	■		■	■	■	■		■	■			■	■			
SERVICEBERRY, CANADIAN *Amelanchier canadensis*	■	■		■	■	■	■		■		■	■	■		■	■		■	
SERVICEBERRY, COMMON *Amelanchier arborea*	■	■	■	■	■	■	■		■		■	■	■		■	■		■	
SPICEBUSH *Lindera benzoin*	■	■		■	■	■	■	■	■		■		■		■	■		■	
STEEPLEBUSH *Spiraea tomentosa*	■	■		■	■	■	■	■				■	■		■	■		■	
SUMAC, SMOOTH *Rhus glabra*	■	■	■			■	■			■						■			
SUMAC, STAGHORN *Rhus typhina*	■	■	■			■	■	■			■					■			
SUMAC, WINGED *Rhus copallinum*	■	■		■	■	■			■						■			■	

TABLE 4.10: Recommended Trees, Shrubs, and Woody Vines for Selected Uses (see Table 4.8 for detailed species information)																				
Plant Names	Region [1]		Moisture [2]			Native to New Jersey	Habitat Use Characteristics [3]								Hedgerows and Windbreaks [4]			Wetlands (surface saturation/ infrequent inundation)	Wetlands (surface saturation/ frequent or prolonged inundation)
							Cover		Fruit/Seed Consumption			Pollinator Food		Toxic to Livestock					
	Northern Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage		Wildlife Habitat	Screens/ Barriers	Poultry		
SWEETSPIRE, VIRGINIA *Itea virginica*		■	■	■	■	■	■				■			■	■			■	
WAXMYRTLE, SOUTHERN *Morella cerifera (Myrica cerifera)*		■	■	■	■	■	■	■						■	■			■	
WILLOWS *Salix spp.*	■	■		■	■	■	■	■	■			■			■	■		■	
WILLOW, HYBRID *Salix matsudana x alba* 'Austree'	■	■	■	■	■		■	■								■	■		
WILLOW, PURPLEOSIER *Salix purpurea* 'Streamco'	■	■		■	■		■	■								■	■		
WILLOW, PUSSY *Salix discolor*	■	■		■	■	■	■	■	■			■			■	■		■	
WINTERBERRY HOLLY *Ilex verticillata*	■	■		■	■	■	■	■	■						■	■		■	
WITCH-HAZEL *Hamamelis virginiana*	■	■	■	■		■	■	■				■			■	■			

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Plant Names	Region [1]		Moisture [2]			Native to New Jersey	Habitat Use Characteristics [3]								Hedgerows and Windbreaks [4]			Wetlands (surface saturation/ infrequent inundation)	Wetlands (surface saturation/ frequent or prolonged inundation)
							Cover		Fruit/Seed Consumption			Pollinator Food							
	Northern Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage	Toxic to Livestock	Wildlife Habitat	Screens/ Barriers	Poultry		

[1] Region: The physiographic region where the species usually occurs in New Jersey, under natural conditions. NNJ – North New Jersey and includes the Valley and Ridge, Highlands, and Piedmont regions ; CP - Coastal Plain. Visit the New Jersey DEP website to determine which region includes your project site or view the "Physiographic Provinces" layer in Conservation Desktop.

[2] Moisture: The amount of moisture the species needs or tolerates. Dry - excessively drained to well-drained soil; Mesic - moderately well to somewhat poorly drained soil; Wet - poorly to very poorly drained soil.

[3] Habitat Use Characteristics: Cover - All plants provide some type of cover for wildlife, depending on the time of year and the wildlife species of interest. These columns describe the cover use primarily for birds and small mammals, as follows:

- Nesting/Resting - Provides nesting and/or resting cover.
- Protection - Provides protective habitat, typically characterized by high stem density near ground level and/or dense, persistent foliage (usually evergreens, but also some deciduous species that retain leaves well into the winter).
- Fruit/Seed Consumption - These columns note whether a fruit or seed is a good food source for wildlife, or may be eaten by humans:
- Wildlife - (H) Highly preferred food for many birds and mammals, or (M) Medium value, and is utilized by fewer species or is produced in smaller quantities than similar foods. Plant species not noted as having High or Medium value have Low or unknown value. Refer to Table 4.6 for detailed wildlife food value information.
- Humans - May be consumed by people. Caution: This list should not solely be relied upon for knowledge of human edibility. Many plants with palatable parts also contain parts that are to a certain degree toxic to humans. Toxicity effects can vary with people and environment, and not all human toxicity effects are known for wild plants. People who intend to consume parts of wild plants should ensure their own safety and health by consulting experts and/or trusted plant references.
- Pollinator Food - These columns note whether a species provides a food source for adult and larval-stage pollinators:
- Nectar/Pollen - Species produces nectar and/or pollen that are consumed by adults or larvae of various pollinator species.
- Foliage - Species has vegetative plant parts (foliage, stems, etc.) that are consumed by various insect pollinators, especially while in the larval stage.
- Toxic to Livestock - Reported to be slightly to highly toxic if consumed by livestock. Toxicity may include flowers, fruits/nuts, foliage, and other plant parts, and can vary with species of livestock, age of the animal, and growth stage of the plant.

[4] Hedgerows and Windbreaks:

- Wildlife Habitat - Species is a recommended planting for wildlife habitat. Recommended species are native to New Jersey, and are shrubs and small trees that have moderate to high value as food for birds, mammals, and/or pollinators.
- Screens/Barriers - Species is a recommended planting for visual screens and/or barriers to noise, dust, and odors. Recommended species are expected to grow to at least 6 feet in height at 20 years, and have a medium or high foliar density for at least part of the year. For year-round protection, most screens/barriers will need one or more rows of evergreens. Shorter or less dense species may be selected for planting in additional rows, provided there are sufficient rows of recommended species to meet the objectives of the planting.
- Poultry - For hedgerows around poultry houses, especially in fan impact areas, refer to the Delaware NRCS 422 Hedgerow Planting Fact Sheet *Trees and Shrubs for Poultry Houses* for additional information concerning recommended woody species that are tolerant of harsh conditions.

TABLE 4.11: Characteristics of Trees, Shrubs, and Woody Vines

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Plant Names	**Plant Hardiness Zones**	**Natural Distribution in New Jersey [1]**	**Soil Drainage Class [2]**	**Height at 20 Years**	**Growth Rate [3]**	**Density [4] - Summer**	**Density - Winter**	**Wildlife Food Value for Birds and Mammals and Pollinators**	**Remarks**
DECIDUOUS TREES									
ASPEN, LARGE-TOOTHED *Populus grandidentata*	All	Statewide	W - SP	40 ft.	Fast	Low	Very Low	Medium: browsed by deer and rabbits; bark and buds eaten by beaver.	Beneficial to cavity-nesting species when trees get older. Very fast-growing; relatively short-lived tree. In hedgrerows and windbreaks, can be planted in one row, and add one or more other rows of species with higher density foliage. Has aggressive roots—keep away from structures, sewers, and tile lines.
ASPEN, QUAKING *Populus tremuliodes*	All	Northern NJ	W-SP	40 ft.	Fast	Low	Very Low	Medium: deer and porcupine will browse, favorite food of beaver, important grouse food source	can be brittle and also drop branches; fluttering gray-green leaves, short lives early successional species that grows fast.
BASSWOOD, AMERICAN *Tilia americana*	All	Mostly Northern New Jersey	W - SP	40 ft.	Fast	Medium to High	Low	Low: seeds eaten by quail and squirrels; browsed by deer and rabbits.	Prefers rich, moist, well-drained soils; tolerates some drought. Good den tree when mature. Fragrant white flowers attract bees and other pollinators.
BEECH, AMERICAN *Betula lenta*	All	Statewide	W - SP	20 ft.	Slow	Medium	Low	High: fruits eaten by squirrels, quail, turkey, songbirds, deer.	Prefers rich, moist, well-drained soils; can tolerate drier or wetter conditions. Suckers and forms colonies. Shade tolerant.
BIRCH, BLACK *Betula lenta*	All	Mostly Northern New Jersey	W-SP	40 ft	Mediu m	Medium	Low	moderate - catkins, seeds	reddish brown bark, “birch beer”taste to twigs
BIRCH, GREY *Betula populifolia*	All	Mostly Northern New Jersey	MW-SP	20 ft	Fast	Medium	Low	moderate - seeds, buds favored by birds, small mammals	white/grey bark, tends to grow in clumps on moist to wet sites, small tree

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BIRCH, RIVER *Betula nigra*	All	Statewide	W - P	30 ft.	Fast	Low	Very Low	Medium: seeds eaten by ducks and songbirds.	Naturally occurring on streambanks and floodplains. Unique peeling reddish bark. Attractive for landscaping.
BIRCH, YELLOW *Betula allegheniensis*	All	North Jersey	W-P	20 ft	Slow	Medium	Low	high - seeds favorite winter food of pine siskins and redpolls; used by hawks for nesting	Shining golden bark, has commercial timber value, twigs have "birch beer" taste
BLACKGUM *Nyssa sylvatica*	All	Statewide	W - P	30 ft.	Mod.	Medium	Low	Medium: fruits eaten by squirrels, quail, turkey, and songbirds; browsed by deer.	Foliage turns bright red in early fall.
BOX-ELDER *Acer negundo*	All	Statewide	MW - P	40 ft.	Fast	Medium to High	Low	Medium: seeds eaten by gamebirds, songbirds, squirrels; browsed by deer.	Naturally occurring on streambanks and floodplains. Soft wood may split in ice storms. Abundant seed produced in late summer. Attracts box-elder bugs.
BUTTERNUT *Juglans cinerea*	All	Northern New Jersey	MW - SP	40 ft.	Fast	Medium	Low	Medium: nuts eaten by squirrels.	Fast-growing but relatively short-lived tree. Nuts are similar to black walnut, with thick, hard shells that are not easily accessible as food for most wildlife (except squirrels). Butternut can be allelopathic to other plants. Susceptible to butternut canker, an introduced fungal disease.
CHERRY, BLACK *Prunus serotina*	All	Statewide	W - SP	40 ft.	Fast	Medium	Low	High: fruits eaten by songbirds, turkey, quail; browsed by rabbits and deer.	Clusters of white flowers attract bees and other pollinators. Leaves and branches are poisonous if eaten by livestock.

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CHESTNUT, AMERICAN *Castanea dentata*	All	Statewide	W - MW	20 ft.	Slow	Medium	Low	High: nuts eaten by turkey, squirrels, and deer; browsed by deer.	Native trees are susceptible to the Asian chestnut blight fungus. Stump sprouts occur, but rarely grow mature enough to produce seeds. Blight-resistant strains are being tested but are not readily available. Host plant for butterfly larvae.
CHINQUAPIN *Castanea pumila*	All	Coastal Plain; uncommon	W - MW	15 ft.	Slow	Medium	Low	Medium: nuts eaten by turkey, squirrels, and deer; browsed by deer.	Small tree or shrub. Moderately resistant to the Asian chestnut blight fungus that kills the related American chestnut (*C. dentata*). Nuts preferred by wildlife, but amount produced is low. Host plant for butterfly larvae.
CHOKECHERRY *Prunus virginiana*	All	Northern New Jersey	W - SP	15 ft.	Fast	High	Low	High: fruits eaten by songbirds, turkey, quail; browsed by rabbits and deer.	Small tree or shrub; tends to spread by root suckering. Clusters of white flowers attract bees and other pollinators. Leaves and branches are poisonous if eaten by livestock.
COTTONWOOD, EASTERN *Populus deltoides*	All	Statewide	W - P	80 ft.	Fast	Medium to High	Low	Medium: browsed by deer and rabbits; buds and catkins eaten by squirrels and quail.	Naturally occurring on streambanks and floodplains. Tolerates dry soils. Grows rapidly, can be used to quickly establish cover for wildlife. Is weak-wooded, tends to be messy. Has aggressive roots; keep away from structures, sewers, and tile lines.
CRABAPPLE, SOUTHERN *Malus angustifolia*	All	Coastal Plain	W - SP	20 ft.	Slow	Medium to High	Medium	High: fruits eaten by songbirds, turkey, quail, and various mammals; browsed by rabbits and deer.	Small tree or shrub; can spread by root suckering. Pink-white flowers attract bees and other pollinators. Plant at least 500 ft. away from red cedar *(Juniperus virginiana)* to avoid spread of cedar-apple rust.
CRABAPPLE, SWEET *Malus coronaria*	All	Statewide; common	W - SP	20 ft.	Slow	Medium to High	Medium	High: same as above.	Same as above.
CYPRESS, BALD *Taxodium distichum*	All	Statewide	MW - P	45 ft.	Fast	High	Medium	Low: seeds eaten by ducks and marsh birds.	Naturally occurring on streambanks and in swamps.

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DOGWOOD, FLOWERING *Cornus florida*	All	Statewide	W - SP	20 ft.	Slow	Low	Low	High: berries eaten by songbirds, turkey, quail, squirrels; browsed by deer, rabbits.	White flowers and red fruit. Widely planted as an ornamental. Susceptible to dogwood anthracnose disease.
DOGWOOD, PAGODA *Cornus alternifolia*	All	Mostly Northern New Jersey	W - SP	25 ft.	Slow	Low	Low	High: berries eaten by songbirds, turkey, quail, squirrels; browsed by deer, rabbits.	Small tree or shrub; may be multi-stemmed. Usually found on dry, rocky sites, but will tolerate some moisture. White flowers and bluish-black fruit. Attracts pollinators.
ELM, AMERICAN *Ulmus americana* 'New Harmony' and 'Valley Forge'	All	Statewide	W - P	35 ft.	Mod.	Medium	Low	Low: seeds eaten by songbirds, turkey, quail; browsed by rabbits and deer.	Prefers moist soil but will tolerate drier sites. Species is susceptible to Dutch elm disease. The New Harmony and Valley Forge cultivars are disease resistant.
ELM, SLIPPERY *Ulmus rubra*	All	Statewide	W - P	45 ft.	Fast	Medium	Low	Low: seeds eaten by songbirds, turkey, quail; browsed by rabbits and deer.	Naturally occurring on streambanks, floodplains, and uplands. Shade tolerant.
HACKBERRY *Celtis occidentalis*	All	Statewide	W - SP	25 ft.	Mod.	Medium to High	Low	High: fruits eaten by quail, turkey, and songbirds.	Small tree. Adaptable to a wide range of conditions. Flowers attractive to butterflies and other pollinators. Host plant for several species of butterfly larvae.
HAWTHORN, COCKSPUR *Crataegus crus-galli*	All	Statewide	W - SP	25 ft.	Slow	High	Medium	Medium: fruits eaten by songbirds, gamebirds, squirrels; browsed by deer.	Small tree or shrub. Attractive white flowers produce bright orange-red fruits that may persist into winter. Thorny stems. Flowers attract bees and other pollinators.
HICKORY, BITTERNUT *Carya cordiformis*	All	Statewide	MW - P	25 ft.	Slow	Medium	Low	Low: nuts are very bitter and are not a preferred food; may be eaten by squirrels.	Naturally occurring on floodplains and in wetlands; occasionally on dry sites. Wood used for furniture, tool handles, charcoal, firewood.
HICKORY, MOCKERNUT *Carya tomentosa*	All	Statewide	W - SP	20 ft.	Slow	Medium	Low	High: nuts eaten by squirrels, turkey, quail, deer.	Usually found on well-drained sites; tolerates some moisture. Wood used for furniture, tool handles, charcoal, firewood.

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HICKORY, PIGNUT *Carya glabra*	All	Statewide	W - SP	20 ft.	Slow	Medium	Low	Medium: nuts are usually bitter and are not a preferred food; may be eaten by squirrels and other mammals.	Same as above.
HICKORY, SHAGBARK *Carya ovata*	All	Mostly Northern New Jersey	W - SP	20 ft.	Slow	Medium	Low	High: nuts eaten by squirrels, turkey, quail, deer.	Same as above.
HONEYLOCUST *Gleditsia triacanthos*	All	Introduced to New Jersey; native to Central U.S.	W - SP	40 ft.	Fast	Low to Medium	Very Low	Low: seeds eaten by songbirds and squirrels.	Prefers well-drained sites, but will tolerate brief inundation. Drought-resistant and somewhat tolerant of salinity. Fragrant white flowers attract bees and other pollinators.
HOP-HORNBEAM *Ostrya virginiana*	All	Northern New Jersey; uncommon	W - SP	20 ft.	Slow	Medium	Low	Medium: seeds eaten by songbirds, turkey, squirrels; browsed by deer, rabbits.	Occurs as an understory tree in moist woods and on rocky slopes. Produces hop-like, papery seed clusters.
HORNBEAM, AMERICAN *Carpinus caroliniana*	All	Statewide	MW - P	20 ft.	Slow	Medium	Low	Medium: seeds eaten by songbirds, turkey, squirrels; browsed by deer, rabbits, beaver.	Understory tree in woodlands; may be multi-stemmed. Prefers moist soil and partial shade.
LARCH (ALL TAMARACKS) *Larix larcina*	All	North Jersey	VP-SP	40 ft.	fast	Medium	Low	Low: cover in summer	Once established, can withstand high soil moisture, high soil acidity, and low soil temperatures
LOCUST, BLACK *Robinia pseudoacacia*	All	Introduced to New Jersey; native to Central U.S.	W - MW	40 ft.	Fast	Low to Medium	Very Low	Low: seeds eaten by songbirds and squirrels.	Spreads readily; seeds freely and suckers. Nitrogen fixing. Fragrant white flowers attract bees and other pollinators. Flowers are poisonous if eaten by livestock.
MAGNOLIA, SWEETBAY *Magnolia virginiana*	All	Coastal Plain	SP - P	30 ft.	Mod.	Medium	Low to Medium	Medium: seeds eaten by songbirds and squirrels; browsed by deer.	Considered a small tree or shrub. May be evergreen in mild winters. Creamy white flowers up to 3" diameter. Host plant for three species of swallowtail butterfly larvae.

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MAPLE, RED *Acer rubrum*	All	Statewide	W - P	40 ft.	Fast	Medium to High	Low	Medium: seeds eaten by ducks, gamebirds, songbirds, squirrels; browsed by deer.	Abundant seed produced in the spring. Red fall color and blooms. May provide an early source of pollen for bees.
MAPLE, SILVER *Acer saccharinum*	All	Mostly Northern New Jersey	SP - P	45 ft.	Fast	Medium to High	Low	Medium: seeds eaten by ducks, gamebirds, songbirds, squirrels; browsed by deer.	Naturally occurring on streambanks and floodplains. Good source of woody debris for riparian systems. Roots can be aggressive. Abundant seed produced in the spring. May provide an early source of pollen for bees.
MAPLE, SUGAR *Acer saccharum*	ALL	Northern New Jersey	W-P	40 ft	Mod	Medium to High	Low	High – the seeds, leaves, and bark of the tree are used by wildlife for food and habitat	Brilliant yellow-orange and red fall colors. Preferred landscape specimen. High value lumber. Used for commercial syrup production
MULBERRY, RED *Morus rubra*	All	Statewide	W - SP	35 ft.	Mod.	Medium	Low	High: fruits eaten by songbirds, squirrels, and other mammals.	Occurs in rich, moist woods and along field edges. Produces numerous, large, reddish-purple fruits that can be messy when fallen.
OAK, BLACK *Quercus velutina*	All	Statewide; more common in Northern New Jersey	W - MW	35 ft.	Mod.	Medium to High	Low	High: acorns eaten by quail, turkey, squirrels, and deer.	Prefers moist, well-drained sites, but tolerates drier conditions.
OAK, BLACKJACK *Quercus marilandica*	All	Coastal Plain; uncommon	W - MW	30 ft.	Mod.	Medium to High	Low	High: same as above.	Occurs on dry, sandy or shaly soils, including serpentine barrens and back dunes.
OAK, CHERRYBARK *Quercus pagoda*	All	Coastal Plain	SP - P	35 ft.	Mod.	Medium to High	Low	High: same as above.	Occurs in moist, wooded floodplains and wetlands.
OAK, CHESTNUT *Quercus montana (Quercus prinus)*	All	Statewide	W - MW	35 ft.	Mod.	Medium to High	Low	High: same as above.	Grows well on dry, rocky, or gravelly soils.

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OAK, CHINQUAPIN *Quercus muehlenbergii*	All	Northern New Jersey; uncommon	W - MW	35 ft.	Mod.	Medium to High	Low	High: same as above.	Under-used, native tree. Usually found on dry, limestone outcrops.
OAK, NORTHERN RED *Quercus rubra*	All	Statewide	W - SP	35 ft.	Mod.	Medium to High	Low	High: same as above.	Excellent red fall color. Tolerates urban conditions.
OAK, OVERCUP *Quercus lyrata*	All	Coastal Plain; uncommon	SP - P	30 ft.	Mod.	Medium to High	Low	High: same as above.	Important lumber tree. Withstands flooding and prolonged inundation.
OAK, PIN *Quercus palustris*	All	Statewide	MW - P	40 ft.	Fast	High	Medium	High: same as above.	Bronze or red fall foliage. Widely planted as an ornamental. Produces small acorns.
OAK, POST *Quercus stellata*	All	Statewide	W - SP	30 ft.	Mod.	Medium to High	Low	High: same as above.	Often occurs in thin-canopy woods and on field edges, usually on dry sites.
OAK, SOUTHERN RED *Quercus falcata*	All	Statewide	W - SP	35 ft.	Mod.	Medium to High	Low	High: same as above.	Excellent red fall color. Tolerates poor, dry soil.
OAK, SWAMP CHESTNUT (BASKET OAK) *Quercus michauxii*	All	Mostly Coastal Plain	SP - P	35 ft.	Mod.	Medium to High	Low	High: acorns eaten by quail, turkey, squirrels, and deer.	Naturally occurring on floodplains and other wet areas. Important lumber tree.
OAK, SWAMP WHITE *Quercus bicolor*	All	Mostly Coastal Plain	SP - P	30 ft.	Mod.	Medium to High	Low	High: same as above.	Good choice for wet sites. Important lumber tree. Requires acid soils.
OAK, WATER *Quercus nigra*	All	Mostly South Jersey	SP - P	30 ft.	Mod.	Medium to High	Low	High: same as above.	Naturally occurring on floodplains and other wet areas, but can tolerate a wide range of conditions, including well-drained uplands. Produces small acorns.
OAK, WHITE *Quercus alba*	All	Statewide	W - SP	25 ft.	Slow	Medium to High	Low	High: same as above.	Variable fall color, stately tree. Important lumber tree.
OAK, WILLOW *Quercus phellos*	All	Mostly Coastal Plain	MW - P	60 ft.	Fast	Medium to High	Low	High: same as above.	Frequently used as an ornamental planting. Produces small acorns. Red fall color.

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OSAGE-ORANGE *Maclura pomifera*	All	Introduced: native to Midwestern U.S.	W - SP	20 ft.	Slow	High	Low	Low: seeds eaten quail and squirrels.	Adapted to a wide range of soil and site conditions. Trunk is usually short and divides into several prominent limbs. Fruits are messy, so select male plants. 'White Shield' may be the most thorn-free cultivar.
PAWPAW *Asimina triloba*	All	Statewide; infrequent	MW - P	25 ft.	Slow	Medium	Low	High: important food for fox, raccoon, opossum; also turkey, songbirds, deer, and other mammals.	Suckers and forms colonies. Purple flowers; large yellow fruits. Host plant for zebra swallowtail larvae.
PERSIMMON, COMMON *Diospyros virginiana*	All	Statewide	E - P	25 ft.	Slow	Medium	Low	High: important food for fox, raccoon, opossum; also turkey, songbirds, deer, and other mammals.	Slow growing tree. Adaptable to a wide range of conditions. Attracts pollinators. Produces edible fruit.
PLUM, AMERICAN *Prunus americana*	All	Statewide	W - SP	20 ft.	Slow	High	Medium	High: fruits eaten by songbirds, turkey, quail; browsed by rabbits and deer.	Small tree or shrub, with thorny stems. Prefers full sun and mesic moisture conditions. Can sucker and form thickets. Provides cover for wildlife and attracts pollinators.
POPLAR, HYBRID *Populus deltoides x nigra* 'Spike'	All	Introduced; hybrid of U.S. and European species	MW -SP	40 ft.	Fast	Medium	Low	Unknown. Presumably similar to other species of *Populus*.	Sterile hybrid.
POPLAR, TULIP *Liriodendron tulipifera*	All	Statewide	W - SP	40 ft.	Fast	Medium	Low	Low: seeds eaten by squirrels and songbirds; seedlings browsed by deer.	Flowers produce abundant nectar, much used by bees. Dropped flowers and fruits can be messy. Tends to be weak-wooded; not recommended near buildings. Important lumber tree.
REDBUD *Cercis canadensis*	All	Mostly Northern New Jersey	MW -SP	20 ft.	Slow	Medium	Low	Low: seeds eaten by quail, pheasants, and deer.	Nitrogen-fixing. Bright pink flowers, appearing in early spring before the leaves, provide an early source of nectar/pollen for bees and other insects. Useful as an ornamental.
REDWOOD, DAWN *Metasequoia glyptostroboides*	All	Introduced; native to China	MW - P	35 ft.	Mod.	High	Medium	Low. Presumably similar to bald cypress.	Prefers moist soil but will tolerate drier sites. Needle-leaved deciduous tree; similar in appearance to bald cypress. Sometimes planted as an ornamental.

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SASSAFRAS *Sassafras albidum*	All	Statewide	W - MW	20 ft.	Slow	Medium	Low	Medium: fruits eaten by songbirds, quail, turkey, and squirrels. Browsed by deer and rabbits.	Small tree; forms dense thickets by suckering. Greenish-yellow flowers are pollinated by small bees and other insects. Host plant for spicebush and tiger swallowtail larvae, as well as several species of moths.
SWEETGUM *Liquidambar styraciflua*	All	Statewide	MW - P	40 ft.	Fast	Medium	Low	Low: seeds eaten by songbirds, squirrels, and chipmunks.	Excellent yellow-red fall color. Widely planted as an ornamental. Fallen seed heads are a nuisance on lawns. Fruitless types are available.
SYCAMORE *Platanus occidentalis*	All	Statewide	MW - P	65 ft.	Fast	Medium to High	Low	Low: seeds eaten by songbirds and squirrels.	Naturally occurring on streambanks and floodplains. Unique peeling bark, fast growth rate. Susceptible to anthracnose; mix with other species for disease control. Constantly drops leaves, twigs, and fruits. Good den tree.
TUPELO, SWAMP (SWAMP BLACK GUM) *Nyssa biflora*	All	Southern New Jersey	SP - P	35 ft.	Mod.	Medium to High	Low	Medium: fruits eaten by squirrels, quail, turkey, and songbirds. Browsed by deer.	Naturally occurring on streambanks, floodplains, and bottomland swamps. Foliage turns bright red in early fall.
WALNUT, BLACK *Juglans nigra*	All	Statewide	MW -SP	40 ft.	Fast	Low	Low	Medium: nuts eaten by squirrels.	Very important lumber tree. Valuable for furniture and nut production. Nuts are large and sweet, with thick, hard shells; nuts are not easily accessible as food for most wildlife (except squirrels). Black walnut can be allelopathic to other plants.
WILLOW, BLACK *Salix nigra*	All	Statewide	SP -P	50 ft.	Fast	Medium	Low	Medium: browsed by beaver, and deer.	Naturally occurring on streambanks and floodplains. Can be aggressive and weedy. Flowers provide an early source of nectar/pollen in the spring for bees.

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EVERGREEN TREES									
ARBORVITAE *Thuja occidentalis*	All	Introduced; native to Appalachian Mountains and north	W - P	25 ft.	Slow	Very High	Very High	Low: browsed by deer.	Frequently planted statewide as an ornamental. Prefers moist, well-drained soil, but tolerates a wide range of conditions. Prone to bagworms.
ARBORVITAE *Thuja plicata x standishii* 'Green Giant'	All	Introduced; hybrid of Western U.S. and Japanese species	W - MW	40 ft.	Fast	Very High	Very High	Low: browsed by deer.	Prefers well-drained soil, but tolerates a wide range of conditions. Bagworms are potential pests.
CEDAR, ATLANTIC WHITE *Chamaecyparis thyoides*	All	Coastal Plain; uncommon	SP - P	20 ft.	Slow	Very High	Very High	Low: seeds eaten by songbirds; browsed by deer.	Cannot compete with hardwoods; best planted in solid stands.
CEDAR, EASTERN RED *Juniperus virginiana*	All	Statewide	W - SP	20 ft.	Slow	Very High	Very High	Medium: seeds eaten by songbirds, quail, turkey; browsed by deer and rabbits.	Should not be planted near apple orchards; alternate host of cedar-apple rust.
CYPRESS, LEYLAND *x Cupressocyparis leylandii*	All	Introduced; not native to U.S.	W - SP	40 ft.	Very Fast	Very High	Very High	Low: browsed by deer.	This is a hybrid of Cupressus macrocarpa and Chamaecyparis nootkatensis. Adaptable to adverse sites; growth is best on good sites. Prone to bagworms, canker, and windthrow. Use in multiple-row plantings to minimize windthrow. Green Giant arborvitae is a preferred alternative to Leyland cypress.

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FIR, DOUGLAS *Pseudotsuga menziesii*	ALL	Introduced, found in Northern NJ, native to western US	W-MW	30 ft	Medium	Very High	Very High	High: provides nesting and cover, food for chickadees, red crossbill, finches, chipmunks, deer, shrews, grouse and other mammals	Suffers from several diseases such as needle decline, should be sprayed regularly in NJ. Often planted as a variety of Christmas tree; excellent lumber for construction uses Prefers deep, moist, well drained soils
HEMLOCK, EASTERN *Tsuga canadensis*	All	Mostly Northern New Jersey	W - SP	20 ft.	Slow	Very High	Very High	Medium: seeds eaten by songbirds and squirrels; browsed by deer.	Often planted as an ornamental. Can become infested with hemlock woolly adelgid, a serious insect pest.
HOLLY, AMERICAN *Ilex opaca*	All	Statewide	W - P	20 ft.	Slow	High	High	Medium: fruits eaten by songbirds, quail, and squirrels.	Need male and female plants for fruit production. Shade tolerant. In hedgerows and windbreaks, can be planted in one row, and add one or more other rows of faster-growing species.
PINE, AUSTRIAN *Pinus nigra*	All	Introduced; not native to U.S.	E - P	35 ft.	Mod.	Low to Medium	Low to Medium	Unknown. Presumably similar to other pines.	Frequently planted statewide as an ornamental. Prefers moist, well-drained soil, but tolerates a wide range of conditions. Withstands dryness better than other pines. Fairly salt tolerant.
PINE, JAPANESE *Pinus thumbergii*	All	Introduced; not native to U.S.	EW-MW	20 ft.	Fast	Medium	Medium	Unknown. Presumably similar to other pines	Potted plants are recommended for the use on dunes. Plant is salt tolerant and is often planted in seashore communities. Protection from strong winds in the first and second years may improve survival.
PINE, LOBLOLLY *Pinus taeda*	All	Mostly Coastal Plain	MW - P	45 ft.	Fast	Low to Medium	Low to Medium	Medium: seeds eaten by songbirds, quail, turkey; browsed by deer and rabbits.	Self-prunes lower limbs, so best suited in a multiple-row planting.
PINE, PITCH *Pinus rigida*	All	Mostly Coastal Plain; uncommon	W - SP	30 ft.	Mod.	Low to Medium	Low to Medium	Medium: seeds eaten by songbirds, quail, turkey; browsed by deer and rabbits.	Tolerant of dry, sandy soils. Mature trees are resistant to fire. Will reproduce from stump sprouts.

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PINE, SHORTLEAF *Pinus echinata*	All	Southern New Jersey	W-MW	30 ft	Mod	Medium	Medium	Moderate – when young acts as a protective cover	Plant in Pine Barrens, high timber value
PINE, VIRGINIA *Pinus virginiana*	All	Statewide	W - MW	30 ft.	Mod.	Low to Medium	Low to Medium	Medium: same as above.	Can be used for pulpwood. Tolerant of adverse site conditions.
PINE, WHITE *Pinus strobus*	All	Introduced; native to Appalachian Mountains and north	W - MW	40 ft.	Fast	Low to Medium	Low to Medium	Medium: same as above.	Frequently planted statewide as an ornamental.
SPRUCE, BLACK *Picea mariana*	All	Northern NJ	SP-VP	20 ft.	Slow	High	High	Low: Cover, nesting	Primarily used for pulp wood, larger trees may have value as lumber
SPRUCE, NORWAY *Picea abies*	All	Introduced; not native to U.S.	W - MW	35 ft.	Mod.	High	High	Unknown. Presumably similar to white spruce.	Fast growth rate when young, slows down with age. Prefers moderately moist, well-drained soil. Often planted as an ornamental.
SHRUBS AND WOODY VINES									
ALDER, SMOOTH *Alnus serrulata*	All	Statewide; less common on Coastal Plain	SP - P	10 ft.	Fast	Medium	Low	High: seeds eaten by ducks, quail, doves; browsed by deer, beaver.	Nitrogen-fixing. Attractive catkins. Provides good cover for woodcock.
ALDER, SPECKLED (GRAY) *Alnus incana*	All	Statewide	W-VP	20 ft	Fast	low	Very low	moderate - buds & twigs browsed by musk- rat, rabbits, moose, deer, beaver, grouse	tiny cones make Xmas decorations, good ban stabilizing plant
ARROWWOOD *Viburnum dentatum*	All	Statewide	W - P	10 ft.	Fast	Medium	Low	High: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	Suckers freely; wood used to make arrows. White flowers, bluish-black berries. Attracts pollinators.

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AZALEA, PINXTER *Rhododendron periclymenoides*	All	Statewide	MW-P	8 ft	moderate	medium	medium	moderate - spring flower attracts insects	Attractive spring flowers
AZALEA, SWAMP *Rhododendron viscosum*	All	Coastal Plain	SP - P	8 ft.	Slow	Low	Low	Low: nectar attractive to hummingbirds; plants browsed by deer.	Naturally occurring in shrub swamps, forested wetlands, and on streambanks. Showy pink-white tubular flowers attract pollinators.
BAYBERRY, NORTHERN *Morella pensylvanica (Myrica pensylvanica)*	All	Statewide	W - P	10 ft.	Mod.	Medium	Low	High: fruits eaten by quail, songbirds. Browsed by deer.	Need male and female plants for fruit production. Waxy berries may persist through winter. Salt tolerant (0-20 ppt.) Suckers to form colonies.
BEACHPLUM *PRUNUS MARITIMA*	All	Statewide	EX-SP	Inland 16-18' Coastal 4-7'	Mod	Medium	Low	Moderate – utilized by coastal wildlife	Does well along the coast. Most useful for the stabilization and restoration of coastal sand dunes.
BLADDERNUT, AMERICAN *Staphylea trifolia*	All	Statewide	MW-SP	10 ft	Mod.	Medium	Low	moderate - fruit	unique fall fruits in “bladder’
BLACKBERRY, ALLEGHENY *Rubus allegheniensis*	All	Northern New Jersey	W - SP	6 ft.	Fast	High	Medium	High: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	Arching stems (canes) can develop into dense, thorny thickets. White flowers attract pollinators, and produce purplish black berries.
BLACKBERRY, SAND *Rubus cuneifolius*	All	Mostly Coastal Plain	W - SP	3 ft.	Fast	High	Medium	High: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	Same as above.
BLACK-HAW *Viburnum prunifolium*	All	Statewide	W - SP	12 ft.	Fast	Medium	Low	High: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	White flower clusters, blue berries, red fall color. Fruits may remain on shrubs for much of the winter.

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BLUEBERRY, HIGHBUSH *Vaccinium corymbosum*	All	Statewide	MW - P	12 ft.	Mod.	Medium to High	Low to Medium	High: fruits eaten by songbirds, turkey, squirrel; browsed by deer, rabbits.	Prefers acid soils. Small white flowers attract bees.
BLUEBERRY, LOWBUSH *Vaccinium angustifolium*	All	Northern New Jersey	W - SP	2 ft.	Mod.	Medium to High	Low to Medium	High: fruits eaten by songbirds, turkey, squirrel; browsed by deer, rabbits.	Same as above.
BUSH, HIGH TIDE (GROUNDSEL) *Baccharis halimifolia*	All	Coastal Plain	MW - P	10 ft.	Mod.	Medium	Low	Low: minimal value for food; occasionally browsed by deer.	Usually in brackish and coastal marshes, above MHW. Salinity 0-15 ppt. Has fluffy white seeds. Male flowers & female flowers on separate plants. Prefers full sun.
BUSH, HIGH TIDE (MARSH-ELDER) *Iva frutescens*	All	Coastal Plain	MW - P	10 ft.	Mod.	Medium	Low	Low: minimal value for food; occasionally browsed by deer.	Usually in brackish and coastal marshes, above MHW. Salinity 0-15 ppt. Prefers full sun.
BUTTONBUSH *Cephalanthus occidentalis*	All	Statewide	SP - P	10 ft.	Mod.	Medium	Low	Low: seeds eaten by ducks and rails; browsed by deer.	Unusual, round white flowers. Tolerates extended periods of flooding and ponding. Prefers permanent saturation. Attracts butterflies and other insects.
CHOKEBERRY, BLACK *Aronia melanocarpa*	All	Northern New Jersey	W – P	6 ft.	Mod.	Medium	Low	Medium: fruits eaten by songbirds, squirrel; browsed by deer, rabbits.	White flowers in spring. Lush summer foliage. Black berries in late summer persist into winter. Colorful red foliage in fall. Suckers and forms thickets. Tolerant of a wide range of soil and moisture conditions. Attracts small bees.
CHOKEBERRY, RED *Aronia arbutifolia*	All	Statewide	W – P	10 ft.	Mod.	Medium	Low	Medium: fruits eaten by songbirds, squirrel; browsed by deer, rabbits.	Similar to black chokeberry, but with red berries, and slightly taller and more upright growth habit. Attracts small bees.
CHOKECHERRY *Prunus virginiana*	All	Statewide	W-P	20 ft	Mod.	Medium	Low	moderate - fruits, cover	flowers, fruits, good fall color

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CRANBERRY BUSH, AMERICAN *Viburnum trilobum*	All	Statewide	W-VP	10 ft.	Mod-slow	Medium	Low	high - fruits persist into winter	white flower clusters, scarlet fruits, good fall color
CURRANT, AMERICAN (WILD) BLACK *Ribes americanum*	All	Northern New Jersey	W-VP	6 ft	Mod.	Medium	Low	high - abundant summer fruit	attractive spring flowers; fall foliage
DEWBERRY, BRISTLY *Rubus hispidus*	All	Coastal Plain	SP – P	1 ft.	Fast	Medium	Low	High: berries eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	More like a vine than a shrub. Very low-growing, with long, trailing stems; in moist woods and wetlands. White flowers attract pollinators, and produce small, reddish-purple berries.
DEWBERRY, COMMON *Rubus flagellaris*	All	Statewide	W – MW	2 ft.	Fast	Medium	Low	High: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	More like a vine than a shrub. Mostly low, trailing stems (less than 1 foot tall), but flowering stems can be taller. White flowers attract pollinators, and produce small, reddish-purple berries.
DOGWOOD, GRAY *Cornus racemosa*	All	Northern New Jersey	W – SP	6 ft.	Mod.	High	Medium	High: fruits eaten by songbirds, turkey, quail, squirrels; browsed by deer, rabbits.	Low growing, thickly branched shrub. Suckers and forms thickets. Not well adapted to the Coastal Plain. Beneficial for wildlife and pollinators.
DOGWOOD, REDOSIER *Cornus sericea*	All	Northern New Jersey	MW - P	12 ft.	Mod.	Medium	Low	High: fruits eaten by songbirds, turkey, quail, squirrels; browsed by deer, rabbits.	Attractive red stem color. White flowers and fruit. Attracts pollinators.
DOGWOOD, SILKY *Cornus amomum*	All	Statewide	MW - P	10 ft.	Mod.	Medium to High	Low to Medium	High: fruits eaten by songbirds, turkey, quail, squirrels; browsed by deer, rabbits.	Produces fruit at 3-5 years of age. White flowers with blue berries. Prefers some shade. Attracts pollinators.
ELDERBERRY *Sambucus nigra* ssp. *canadensis* (*Sambucus canadensis)*	All	Statewide	MW - P	8 ft.	Fast	Medium	Low	High: fruits eaten by songbirds, turkey, squirrels; browsed by deer, rabbits.	Large clusters of white flowers followed by purple berries; fast growth rate. Suckers freely. Attracts bees.

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FETTERBUSH *Eubotrys racemosa* *(Leucothoe racemosa)*	All	Mostly Coastal Plain; common	SP - P	12 ft.	Mod.	Medium to High	Low to Medium	Low: seeds eaten by songbirds; browsed by deer.	Small white flowers in drooping racemes. Tends to sucker and form thickets. Prefers permanent saturation.
GRAPE, FOX *Vitis labrusca*	All	Statewide	W – SP	20 ft. (in trees)	Fast	Medium	Low	High: fruits eaten by songbirds, turkey, squirrels; browsed by deer, rabbits.	Vine that climbs up tree trunks and sprawls over shrubs. Commonly found in thickets and fence rows, and along woodland edges.
GRAPE, RIVERBANK *Vitis riparia*	All	Introduced; native to Northern U.S.	SP – P	20 ft. (in trees)	Fast	Medium	Low	High: fruits eaten by songbirds, turkey, squirrels; browsed by deer, rabbits.	Vine that climbs up tree trunks and sprawls over shrubs. Commonly found in thickets and fence rows, and along woodland edges.
HACKBERRY, DWARF *Celtis pumila*	All	Introduced; native to SoutheasternU.S.	W - SP	15 ft.	Mod.	High	Low	High: fruits eaten by quail, turkey, and songbirds.	Adapted to a wide range of soil and site conditions. Flowers attractive to butterflies and other pollinators. Host plant for several species of butterfly larvae.
HAZELNUT (AMERICAN FILBERT) *Corylus americana*	All	Statewide	W - SP	10 ft.	Mod.	Medium	Low	Medium: seeds eaten by turkey, squirrels; browsed by deer, rabbits.	Thicket-forming. Good ornamental; not many diseases/pests. Monecious flowers (needs both male and female plants to produce nuts).
HAZELNUT, BEAKED *Corylus cornuta*	All	Northern New Jersey; uncommon	W - SP	15 ft.	Mod.	High	Medium	Medium: seeds eaten by turkey, squirrels; browsed by deer, rabbits.	Same as above.
HUCKLEBERRY, BLACK *Gaylussacia baccata*	All	Statewide	W - P	3 ft.	Mod.	High	Medium	High: fruits eaten by songbirds, quail, turkey, squirrels; browsed by deer.	Overall appearance is very similar to highbush blueberry. Forms thickets. Berries are edible but seedier than blueberries. Small flowers attract bees and other pollinators.
HUCKLEBERRY, BLUE (DANGLEBERRY) *Gaylussacia frondosa*	All	Mostly Coastal Plain	W - P	4 ft.	Mod.	High	Medium	High: fruits eaten by songbirds, quail, turkey, squirrels; browsed by deer.	Same as above.

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INDIGO, FALSE (INDIGO BUSH) *Amorpha fruticosa*	All	Statewide; uncommon	W - P	6 ft.	Slow	Medium to High	Low	Medium: seeds eaten by quail, turkey, and doves; browsed by deer.	Nitrogen-fixing multi-stemmed shrub. Flowers in purple spikes during late spring; attracts pollinators. Tolerates a wide range of moisture conditions, from seasonal saturation to drought. Individual plants may have a limited life span (5-10 years), but naturally regenerate from seed.
INKBERRY *Ilex glabra*	All	Coastal Plain	SP - P	6 ft.	Slow	Medium	Low	High: fruits eaten by songbirds, quail, and squirrels.	Black fruits persist during the winter. Extensive rhizomes, often forms colonies. Prefers permanent saturation.
MAPLE-LEAF VIBURNUM *Viburnum acerifolium*	All	Statewide	W-SP	6 ft.	Mod.	Medium	Low	moderate - fruits eaten by birds	fruits, attractive foliage, good fall color
MEADOWSWEET, WHITE *Spiraea alba*	All	Northern New Jersey; uncommon	SP - P	6 ft.	Mod.	High	Medium	Low: seeds eaten by songbirds; browsed by deer and rabbits.	Deciduous upright shrub. Prefers moist to wet sites. Clusters of white flowers in summer attract pollinators. Host plant for butterfly and moth larvae.
NANNYBERRY *Viburnum lentago*	All	Northern NJ	W-SP	10 ft	Mod.	Medium	Low	high - fruits remain into winter	fruits, good fall color
NINEBARK, COMMON *Physocarpus opulifolius*	All	Northern New Jersey; uncommon	W - P	10 ft.	Slow	High	Medium	Medium: fruits eaten by songbirds.	Deciduous upright, spreading shrub. Adaptable to a wide range of soil and moisture conditions. Cultivars commonly used in landscape plantings. White flowers in spring attract pollinators.
PEPPERBUSH, SWEET *Clethra alnifolia*	All	Statewide	MW - P	10 ft.	Mod.	Medium	Low	Low: seeds eaten by songbirds; browsed by deer.	Showy, fragrant white flower spikes in mid-summer, often when other flowers and nectar are less abundant. Many cultivars available. Attracts pollinators.

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POSSUM-HAW *Viburnum nudum*	All	Statewide	SP - P	12 ft.	Mod.	Medium	Low	Medium: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	White flower clusters, red berries, red fall color. Fruits may remain on shrubs for much of the winter.
RAISIN, WILD *Viburnum nudum* var. *cassinoides*	All	Northern New Jersey	SP - P	8 ft.	Mod.	Medium	Low	Medium: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	White flower clusters, black berries. Fruits may remain on shrubs for much of the winter. Reddish-purple foliage in fall.
RASPBERRY, BLACK *Rubus occidentalis*	All	Mostly Northern New Jersey	W - SP	6 ft.	Fast	High	Medium	High: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	Arching stems (canes) can develop into dense, thorny thickets. White flowers attract pollinators, and produce black berries.
RHODODENDRON *Rhododendron maximum*	All	Statewide	W-SP	12ft	Mod	High	High	moderate - spring flower attracts insects	evergreen foliage; large spring flowers
ROSE, CAROLINA *Rosa carolina*	All	Statewide	W - MW	3 ft.	Mod.	High	Medium	High: fruits eaten by songbirds; browsed by deer.	Occurs on field edges and in pastures; forms thorny thickets. Pink flowers attract bees and other pollinators. Red fruits may remain for much of the winter.
ROSE, SWAMP *Rosa palustris*	All	Statewide	SP - P	6 ft.	Mod.	Medium	Low	High: fruits eaten by songbirds; browsed by deer.	Prefers wetlands with permanent saturation and full sun; forms thorny thickets. Pink flowers attract bees and other pollinators. Red fruits may remain for much of the winter.
ROSE, VIRGINIA *Rosa virginiana*	All	Statewide	W - SP	6 ft.	Mod.	High	Medium	High: fruits eaten by songbirds; browsed by deer.	Occurs on field edges and in pastures; forms thorny thickets. Pink flowers attract bees and other pollinators. Red fruits may remain for much of the winter.

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SERVICEBERRY, CANADIAN *Amelanchier canadensis*	All	Statewide	MW - P	20 ft.	Slow	High	Low	High: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	Small tree or shrub; usually multi-stemmed. Showy white flowers provide an early spring food source for bees, butterflies, and other pollinators. Also a food source for several species of butterfly and moth larvae. Produces purple-black fruits.
SERVICEBERRY, COMMON *Amelanchier arborea*	All	Statewide	W - P	20 ft.	Slow	High	Low	High: fruits eaten by turkey, songbirds, squirrels; browsed by rabbits, deer.	Small tree or shrub; single or multi-stemmed. Tolerates a wide range of moisture conditions. Other characteristics similar to Canadian serviceberry.
SPICEBUSH *Lindera benzoin*	All	Statewide	MW - P	12 ft.	Slow	Medium	Low	High: fruits eaten by songbirds (especially thrushes) and small mammals; browsed by rabbits, deer.	Fragrant leaves and twigs; yellow fall color. Bright red berries. Leaves are a main food source for larvae of spicebush and eastern tiger swallowtail butterflies, and prometheus moths.
STEEPLEBUSH *Spiraea tomentosa*	All	Mostly Coastal Plain	SP -P	6 ft.	Mod.	High	Medium	Low: seeds eaten by songbirds; browsed by deer and rabbits.	Deciduous upright shrub. Spreads by root suckering. Prefers moist to wet sites; acidic soils. Terminal clusters of pink flowers in summer attract pollinators. Host plant for butterfly and moth larvae.
SUMAC, SMOOTH *Rhus glabra*	All	Statewide	EX-MW	15 ft	Fast	Low	Very Low	high - fruits	red fruit clusters, orange-red fall colors
SUMAC, STAGHORN *Rhus typhina*	All	Statewide	EX-MW	20 ft	Fast	Low	Very Low	very high - fruits late winter survival food for mammals and migrating songbirds; twigs eaten by moose, deer, N E cottontail rabbit	colorful fruit clusters, brilliant fall color; velvet covered branches
SUMAC, WINGED *Rhus copallinum*	All	Statewide	P-VP	5 ft	Fast	Low	Very Low	high - abundant winter fruit	vibrant fall foliage; bright red winter fruits

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SWEETSPIRE, VIRGINIA *Itea virginica*	All	Coastal Plain	SP - P	8 ft.	Mod.	Medium	Low	Low: seeds eaten by songbirds; foliage and twigs not generally browsed by wildlife.	Small white flowers in elongated clusters up to 6 inches long. Prefers permanent saturation. Attracts pollinators.
WAXMYRTLE, SOUTHERN *Morella cerifera* *(Myrica cerifera)*	All	Coastal Plain	W - P	10 ft.	Mod.	Medium	Medium	Medium: fruits eaten by quail, songbirds; browsed by deer.	Evergreen. Need male and female plants for fruit production. Salt tolerant (0-10 ppt).
WILLOWS *Salix spp.*	All	Includes both native and introduced	W-VP	4-20 ft	Fast	High	Medium	high - provides good cover	Variety of shrub type willows both native and introduced. Good bank stabilizer and clump forming. Spread rapidly
WILLOW, HYBRID *Salix matsudana x alba* 'Austree'	All	Introduced; hybrid of Chinese and European species	W - P	60 ft.	Very Fast	Medium to High	Medium	Unknown. Presumably similar to other willows.	Sterile hybrid. Due to its extremely fast growth (>3 ft/yr), can provide visual screen in 1 – 2 years. Dense branch structure.
WILLOW, PURPLEOSIER *Salix purpurea* 'Streamco'	All	Introduced from Europe	MW - P	20 ft.	Fast	Medium to High	Medium	Low: browsed by deer, beaver, and rabbits.	Non-invasive small tree or shrub; usually multi-stemmed. Streamco is a male clone, does not root sucker, and does not spread readily beyond the planting site.
WILLOW, PUSSY *Salix discolor*	All	Statewide	P-VP	20 ft	Fast	High	Medium	moderate - nesting; buds eaten; male flowers attract butterflies	early buds are used in horticultural arrangements Good bank stabilizer
WINTERBERRY *Ilex verticillata*	All	Statewide	SP - P	10 ft.	Mod.	Medium to High	Low to Medium	Medium: fruits eaten by songbirds, quail, and squirrels.	Need male and female plants for fruit production. Bright red berries persist after leaves drop.
WITCH-HAZEL *Hamamelis virginiana*	All	Statewide	W - SP	15 ft.	Slow	Medium	Low	Low: seeds eaten by squirrels; browsed by deer.	Bark is used for making witch-hazel lotion. Blooms in the fall; fragrant yellow flowers attract bees and other pollinators.

TABLE 4.11: Characteristics of Trees, Shrubs, and Woody Vines									
Plant Names	**Plant Hardiness Zones**	**Natural Distribution in New Jersey [1]**	**Soil Drainage Class [2]**	**Height at 20 Years**	**Growth Rate [3]**	**Density [4] - Summer**	**Density - Winter**	**Wildlife Food Value for Birds and Mammals and Pollinators**	**Remarks**

[1] Region: The physiographic region where the species usually occurs in New Jersey, under natural conditions. NNJ – North New Jersey and includes the Valley and Ridge, Highlands, and Piedmont regions ; CP - Coastal Plain. Visit the New Jersey DEP website to determine which region includes your project site or view the "Physiographic Provinces" layer in Conservation Desktop.

[2] Soil Drainage Class (refer to the county soil survey for further information): E - Excessively Drained; W - Well Drained; MW - Moderately Well Drained; SP - Somewhat Poorly Drained; P - Poorly Drained.

[3] Growth Rate: Slow = usually 1 ft/year or less; Moderate = 1–2 ft/year; Fast = 2-3 ft/year; Very Fast = more than 3 ft/year.

[4] Density: For an individual plant species, defined as the amount of space that is occupied by foliage, twigs, and branches, and can be estimated by the amount of light that can be seen through the plant. Low density – 25-35% of space occupied by plant material (with 65-75% open space through which air can travel); Medium density – 40-60% of space occupied by plant material; High density - 60-80% of space occupied by plant material; Very High – more than 80% of space occupied by plant material. The overall density of a windbreak is affected by the species selected, number of rows, and spacing between plants.

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Section 5 - Streambank and Shoreline Plantings

This section contains recommended woody and herbaceous plantings for streambank and shoreline stabilization and protection.

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Selecting Species and Establishing Plantings

Select bioengineering plant materials and tidal marsh plantings from Tables 5.1 to 5.3. For additional lists of suitable bioengineering plants, and details concerning site preparation and use of these plants, refer to the NRCS Engineering Field Handbook, Chapter 16, *Streambank and Shoreline Protection* and East Region Supplement No. 1.

When using unrooted woody plant materials (e.g., whips, fascines, and live stakes), select species that have a rooting ability of "Good" or better. (See Table 5.1) Species rated as "Fair" can be mixed with better rooting species. For species rated "Poor," use only bare-root or containerized materials.

Select and establish dune plantings based on recommendations in the New Jersey Sea Grant Consortium Dune Manual as found in the “Refences” section.

TABLE 5.1: Characteristics of Woody Plants for Streambank and Shoreline Stabilization

TABLE 5.1: Characteristics of Woody Plants for Streambank and Shoreline Stabilization										
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ**	**Planting Zone [2]**	**Sun/ Shade [3]**	**Growth Rate**	**Height at 20 Years**	**Rooting Ability from Cuttings [4]**	**Type of Plant Material Available**	**Natural Habitat and Other Characteristics**
ARROWWOOD *Viburnum dentatum*	All	Statewide	■	Mid to Upper Bank	□ - »	Fast	10 ft.	Fair	Bare-root, Containerized	Shrub swamps and forested wetlands. Suckers freely. White flowers, bluish-black berries.
BLACK-HAW *Viburnum prunifolium*	All	Statewide	■	Upper Bank	□ - »	Slow	12 ft.	Poor	Bare-root, Containerized	Upland forests and hedgerows. White flower clusters, blue berries, red fall color. Fruits may remain on shrubs for much of the winter.
BUSH, HIGH-TIDE (GROUNDSEL) *Baccharis halimifolia*	All	Coastal Plain	■	Mid to Upper Bank	□	Moderate	10 ft.	Fair	Whips, Fascines, Bare-root, Containerized	Brackish and coastal marshes, usually above MHW. Salinity 0-15 ppt. Has fluffy white seeds. Male flowers & female flowers on separate plants.
BUSH, HIGH-TIDE (MARSH-ELDER) *Iva frutescens*	All	Coastal Plain	■	Lower to Mid Bank	□	Moderate	10 ft.	Fair	Whips, Fascines, Bare-root, Containerized	Brackish and coastal marshes, usually above MHW. Salinity 0-15 ppt.
BUTTONBUSH *Cephalanthus occidentalis*	All	Statewide	■	Toe	□ - »	Slow	8 ft.	Fair - Good	Bare-root, Containerized	Shrub swamps and streambanks. Unusual, round white flowers. Tolerates long periods of inundation.
DOGWOOD, GRAY *Cornus racemosa*	All	Mostly Northern New Jersey	■	Mid to Upper Bank	□ - »	Fast	10 ft.	Poor	Bare-root, Containerized	Forested wetlands and streambanks. Produces fruit at 3-5 years of age. White flowers with white berries on reddish stalks. Prefers some shade.
DOGWOOD, REDOSIER *Cornus sericea* 'Ruby'	All	Northern New Jersey; uncommon	■	Toe to Mid Bank	□ - »	Fast	8 ft.	Good	Whips, Fascines, Live Stakes, Bare-root, Containerized	Forested wetlands and streambanks. Attractive red stem color. White flowers and fruit.

TABLE 5.1: Characteristics of Woody Plants for Streambank and Shoreline Stabilization										
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ**	**Planting Zone [2]**	**Sun/ Shade [3]**	**Growth Rate**	**Height at 20 Years**	**Rooting Ability from Cuttings [4]**	**Type of Plant Material Available**	**Natural Habitat and Other Characteristics**
DOGWOOD, SILKY *Cornus amomum*	All	Statewide	■	Lower to Mid Bank	□ - »	Fast	10 ft.	Fair	Whips, Fascines, Live Stakes, Bare-root, Containerized	Forested wetlands and streambanks. Produces fruit at 3-5 years of age. White flowers with blue berries. Prefers some shade.
ELDERBERRY *Sambucus nigra ssp. canadensis*	All	Statewide	■	Toe to Upper Bank	□ - »	Fast	12 ft.	Fair	Whips, Fascines, Live Stakes, Bare-root, Containerized	Open, forested wetlands and streambanks. Suitable for use as a secondary component of plantings with willows and dogwoods. Suckers freely.
VIBURNUM, MAPLE-LEAF *Viburnum acerifolium*	All	Statewide	■	Lower to Mid Bank	□ - »	Moderate	12 ft.	Poor	Bare-root, Containerized	Moist or dry forests; streambanks. Yellow to red fall color; white flower clusters. Bright red berries.
WILLOW, DWARF *Salix X cottetii* 'Bankers'	All	Introduced; not native to U.S.		Toe to Mid Bank	□ - »	Fast	5 ft.	Good	Whips, Fascines, Live Stakes, Bare-root, Containerized	Male hybrid (sterile), non-invasive. Semi-prostrate shrub, sends up many branches from the roots to form dense surface cover in 2-3 years.
WILLOW, PURPLEOSIER *Salix purpurea* 'Streamco'	All	Introduced; not native to U.S.		Toe to Upper Bank	□ - »	Fast	20 ft.	Excellent	Whips, Fascines, Live Stakes, Poles, Bare-root, Containerized	Non-invasive shrub. 'Streamco' is a male clone, does not root sucker, and does not spread readily beyond the planting site.
WILLOW, PUSSY *Salix discolor*	All	Northern New Jersey	■	Toe to Mid Bank	□ - »	Fast	20 ft.	Very Good	Whips, Fascines, Live Stakes, Poles, Bare-root, Containerized	Forested wetlands and streambanks. Fuzzy flower catkins appear in early spring. Grows rapidly, but does not spread readily beyond the planting site.
WILLOW, SANDBAR *Salix exigua (S. interior)* 'Greenbank'	All	Coastal Plain (historical)	■	Toe	□	Fast	15 ft.	Good	Whips, Fascines, Live Stakes, Poles, Bare-root, Containerized	Streambanks and sandbars. **Caution:** This is a native species that may aggressively spread by root suckering into adjacent areas.

TABLE 5.1: Characteristics of Woody Plants for Streambank and Shoreline Stabilization										
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ**	**Planting Zone [2]**	**Sun/ Shade [3]**	**Growth Rate**	**Height at 20 Years**	**Rooting Ability from Cuttings [4]**	**Type of Plant Material Available**	**Natural Habitat and Other Characteristics**
WILLOW, SILKY *Salix sericea*	All	Statewide; uncommon	■	Toe to Mid Bank	□ - »	Fast	20 ft.	Good	Whips, Fascines, Live Stakes, Poles, Bare-root, Containerized	Forested wetlands and streambanks. Fuzzy flower catkins appear in early spring. Grows rapidly, but does not spread readily beyond the planting site.

[1] Region: The physiographic region where the species usually occurs in New Jersey, under natural conditions. NNJ – North New Jersey and includes the Valley and Ridge, Highlands, and Piedmont regions ; CP - Coastal Plain. Visit the New Jersey DEP website to determine which region includes your project site or view the "Physiographic Provinces" layer in Conservation Desktop.

[2] Planting Zone: Recommended area for planting each species, based on tolerance of flooding, long periods of saturation, and drought.

- Toe - at base flow elevation;
- Lower to Mid Bank - just above the baseflow elevation to the two-year flood elevation;
- Upper Bank - above the two-year flood elevation and onto the floodplain.

[3]Sun - Shade: Sunlight and shade tolerance for each species.

□ Full Sun - 6 or more hours of light per day or 4 hours of midday sun;
» Part Shade - 3 to 6 hours of light per day;
□ Shade - less than 3 hours of light per day.

[4] Rooting Ability from Cuttings: Subjective rating of the ability of cut stems of woody plants to root in soil without any special measures (e.g., without the use of a rooting hormone or greenhouse conditions). When using unrooted woody plant materials such as whips, fascines, live stakes, or poles, select species that have a rooting ability of "Good" or better. Species rated as "Fair" can be mixed with better rooting species. For species rated "Poor," use only bare-root or containerized materials.

Generally, no special site preparation or soil amendments are required at the time of planting. Sites with low fertility, based on results from a soil test, may benefit from top-dressing with fertilizer after leaf-out.

TABLE 5.2: Characteristics of Companion Grasses for Woody Bioengineering Plantings

TABLE 5.2: Characteristics of Companion Grasses [1] for Woody Bioengineering Plantings									
Plant Names	**Recommended Cultivar**	**Plant Hardiness Zones [2]**	**Native to NJ**	**Planting Zone [3]**	**Sun/ Shade [4]**	**Growth Rate**	**Max. Height**	**Planting Rate [5]**	**Natural Habitat and Other Characteristics**
BLUEGRASS, ROUGH *Poa trivialis*	Colt, Cypress, Sabre	All		Lower to Mid Bank	□ - □	Moderate	2 ft.	Plant seed at the rate of 10 lbs./acre (0.23 lbs./1,000 SF).	Cool-season, sod-forming grass. Medium textured, non-competitive. Prefers moist, shady sites; moderately well drained to somewhat poorly drained soils. More shade tolerant than *Poa palustris*. May be short-lived on the Coastal Plain, especially on drier sites in full sun.
FESCUE, CREEPING RED *Festuca rubra*	Dawson, Jasper, Navigator II	All	■	Mid to Upper Bank	□ - □	Moderate	2 ft.	Plant seed at the rate of 20 lbs./acre (0.45 lbs./1,000 SF).	Found in shady, upland areas. Cool-season, sod-forming grass. Fine textured, non-competitive. Use on upland sites, especially in shady conditions. Prefers well drained to somewhat poorly drained soils. The 'Dawson' variety is salt-tolerant.
MEADOWGRASS, FOWL *Poa palustris*	Common	All		Lower to Mid Bank	□ - »	Moderate	3 ft.	Plant seed at the rate of 10 lbs./acre (0.23 lbs./1,000 SF).	Native to N. US; introduced in DE. Found in moist, shady sites. Cool-season, sod-forming grass. Fine textured, non-competitive. Prefers moderately well drained to somewhat poorly drained soils. May be short-lived on the Coastal Plain, especially on drier sites in full sun.
RYEGRASS, PERENNIAL *Lolium perenne*	Recommended DE turf-types	All		Mid to Upper Bank	□ - »	Fast	2 ft.	Plant seed at the rate of 10 lbs./acre (0.23 lbs./1,000 SF).	Cool-season, bunch grass with medium longevity. Seedlings establish quickly. Prefers moist sites; moderately well drained to somewhat poorly drained soils.
WILDRYE, RIVERBANK *Elymus riparius*	Common	All	■	Lower to Mid Bank	□ - □	Moderate	5 ft.	Plant seed at the rate of 10 lbs/ac (0.23 lbs/1,000 SF) This seeding rate is for Pure Live Seed. (Seed is usually sold with awns still attached.)	Found along rivers and streams on moist, shady sites. Cool-season, coarse-textured bunch grass. Short-lived perennial. Seedlings establish quickly, but are not highly competitive with other plantings.

TABLE 5.2: Characteristics of Companion Grasses [1] for Woody Bioengineering Plantings									
Plant Names	**Recommended Cultivar**	**Plant Hardiness Zones [2]**	**Native to NJ**	**Planting Zone [3]**	**Sun/ Shade [4]**	**Growth Rate**	**Max. Height**	**Planting Rate [5]**	**Natural Habitat and Other Characteristics**
WILDRYE, VIRGINIA *Elymus virginicus*	Common	All	■	Lower to Mid Bank	□ - □	Moderate	3 ft.	Plant seed at the rate of 10 lbs./acre (0.23 lbs./1,000 SF). This seeding rate is for Pure Live Seed. (Seed is usually sold with awns still attached.)	Found along rivers and streams on moist, shady sites. Cool-season, coarse-textured bunch grass. Short-lived perennial. Seedlings establish quickly, but are not highly competitive with other plantings. Prefers moderately well drained to poorly drained soils. *Elymus virginicus* var. *halophilus* is a naturally occurring salt-tolerant variety, but is not readily available from commercial sources.

1 Companion Grasses can be used in combination with woody species to provide ground cover and reduce erosion, especially while woody plantings are becoming established.

2 The **Plant Hardiness Zones** designate where a species can be successfully planted in New Jersey.

3 Planting Zone: Recommended area for planting each species, based on tolerance of flooding, long periods of saturation, and drought.

- Toe - at base flow elevation;
- Lower to Mid Bank - just above the baseflow elevation to the two-year flood elevation;
- Upper Bank - above the two-year flood elevation and onto the floodplain.

4 Sun - Shade: Sunlight and shade tolerance for each species.

□ Full Sun - 6 or more hours of light per day or 4 hours of midday sun;
» Part Shade - 3 to 6 hours of light per day;
□ Shade - less than 3 hours of light per day.

5 Planting Rate: Generally, no special site preparation or soil amendments are required at the time of planting. Sites with very low fertility, based on results of a soil test, may benefit from top-dressing when plants are actively growing.

TABLE 5.3: Characteristics of Grasses and Grass-like Plants for Tidal Shoreline Stabilization

TABLE 5.3: Characteristics of Grasses and Grass-like Plants for Tidal Shoreline Stabilization									
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ [2]**	**Planting Zone [3]**	**Sun/ Shade [4]**	**Growth Rate**	**Max. Height**	**Planting Rate [5]**	**Natural Habitat and Other Characteristics**
BEACHGRASS, AMERICAN *Ammophila breviligulata* 'Cape'	All	Coastal Plain	■	Above MHT	□	Fast	3 ft.	Plant containerized plants and bare-root plants 18 to 24 inches apart, in staggered rows. If the site is exposed to severe wind erosion, spacing needs to be reduced to 12 inches.	Upland sites with sandy or other coarse textured soils. Cool-season grass. Strongly rhizomatous. Highly salt tolerant and drought tolerant. Does not tolerate much soil moisture. Use on coastlines for initial stabilization of frontal sand dunes.
BULRUSH, THREE-SQUARE *Schoenoplectus pungens*	All	Coastal Plain	■	Mid-tide to MHT	□	Fast	3 ft.	Plant containerized plants and bare-root plants 12 to 24 inches apart, in staggered rows.	Shallow fresh to brackish marshes and open water fringes. Salinity 0–15 ppt.
CORDGRASS, GIANT *Spartina cynosuroides*	All	Coastal Plain	■	Near MHT to above MHT	□	Moderate	10 ft.	Plant containerized plants and bare-root plants 18 to 36 inches apart, in staggered rows.	Upper intertidal zone of tidal marshes, and saturated soils above MHT. Warm-season grass. Up to 0.5 feet of lateral spread can be expected annually. Salinity 0 – 10 ppt.
CORDGRASS, PRAIRIE *Spartina pectinata*	All	Statewide; infrequent	■	Mid-tide to above MHT	□	Fast	6 ft.	Plant containerized plants and bare-root plants in staggered rows 24 to 36 inches apart, with plants 24 inches apart in each row.	Occurs in wet ditches and on upper margins of tidal fresh areas, and in saturated nontidal wetlands. Warm-season grass. Strongly rhizomatous; 5 – 10 feet of lateral spread can be expected annually. Tolerates seasonal dryness once established. Low tolerance to prolonged flooding or ponding. Salinity 0-3 ppt.

TABLE 5.3: Characteristics of Grasses and Grass-like Plants for Tidal Shoreline Stabilization									
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ [2]**	**Planting Zone [3]**	**Sun/ Shade [4]**	**Growth Rate**	**Max. Height**	**Planting Rate [5]**	**Natural Habitat and Other Characteristics**
CORDGRASS, SALTMEADOW *Spartina patens* 'Avalon', 'Flageo', 'Sharp'	All	Coastal Plain	■	Above MHT	□	Fast	3 ft.	Plant containerized plants and bare-root plants 18 to 36 inches apart, in staggered rows.	Tidal marshes between MHT and the 15-foot elevation above MHT. Warm-season grass. Strongly rhizomatous; up to 2 feet of lateral spread can be expected annually. Salinity 0 – 35 ppt.
CORDGRASS, SMOOTH *Spartina alterniflora*	All	Coastal Plain	■	Mid-tide to MHT	□	Fast	6 ft.	Plant containerized plants and bare-root plants 18 to 36 inches apart, in staggered rows.	Intertidal zone of tidal marshes. Warm-season grass. Up to 2 feet of lateral spread can be expected annually. Salinity 0 – 35 ppt.
PANICGRASS, COASTAL *Panicum amarum* var. *amarulum* 'Atlantic'	All	Coastal Plain	■	Above MHT	□	Moderate	6 ft.	Plant containerized plants and bare-root plants in staggered rows 2 to 3 feet apart, with plants 2 feet apart in each row. Plant seed at the rate of 20 lbs./acre (0.45 lbs./1,000 SF).	Naturally found on dry upland sites. Warm-season grass. Drought tolerant. Moderately salt tolerant. Used extensively for secondary dune stabilization. May be interseeded between rows of American Beachgrass.
RUSH, SOFT *Juncus effusus*	All	Statewide	■	Near MHT to above MHT	□	Moderate	3 ft.	Plant containerized plants and bare-root plants 6 to 12 inches apart, in staggered rows.	Upper intertidal zone of tidal fresh marshes, saturated soils above MHT, and in saturated nontidal wetlands. Moderately drought tolerant once established. Salinity to 0.5 ppt (fresh water).

TABLE 5.3: Characteristics of Grasses and Grass-like Plants for Tidal Shoreline Stabilization									
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ [2]**	**Planting Zone [3]**	**Sun/ Shade [4]**	**Growth Rate**	**Max. Height**	**Planting Rate [5]**	**Natural Habitat and Other Characteristics**
SWITCHGRASS *Panicum virgatum* 'Carthage' 'Kanlow' 'High Tide' 'Shelter'	All	Coastal Plain	■	Above MHT	□	Moderate	6 ft.	Plant containerized plants and bare-root plants in staggered rows 2 to 3 feet apart, with plants 2 feet apart in each row. Plant seed at the rate of 20 lbs./acre (0.45 lbs./1,000 SF).	Occurs on upper margins of fresh and brackish tidal marshes. Native, warm-season bunchgrass. Wide range of adaptation from dry uplands to poorly drained sites. Moderately salt tolerant. Salinity 0 – 10 ppt. 'Carthage,' and 'Shelter' varieties are better suited for well-drained to somewhat poorly drained sites. 'Kanlow' is a lowland type that tolerates droughty soils, but is better suited to wet sites and frequent flooding. 'High Tide' is a Mid-Atlantic ecotype specifically selected for tidal shorelines and streambank stabilization.

[1] **Region:** The physiographic region where the species usually occurs in New Jersey, under natural conditions. NNJ – North New Jersey and includes the Valley and Ridge, Highlands, and Piedmont regions; CP - Coastal Plain. Visit the New Jersey DEP website to determine which region includes your project site or view the "Physiographic Provinces" layer in Conservation Desktop.

[2] **Native to New Jersey:** The term "native" refers to species that occur naturally in one or more geographic regions of New Jersey Due to page limitations, this list is not all-inclusive. There are many other species that may be suitable, depending on site conditions.

[3] **Planting Zone:** Recommended area for planting each species, based on tolerance of flooding, long periods of saturation, and drought.
Mid-tide – elevation midway between mean low tide (MLT) and mean high tide (MHT); MHT – elevation at mean high tide; Above MHT - above the mean high tide elevation.

[4] **.Sun - Shade:** Sunlight and shade tolerance for each species.
□ Full Sun - 6 or more hours of light per day or 4 hours of midday sun; » Part Shade - 3 to 6 hours of light per day; □ Shade - less than 3 hours of light per day.

[5] **Planting Rate:** Generally, no special site preparation or soil amendments are required at the time of planting. Sites with low fertility, based on results of a soil test, may benefit from top-dressing with fertilizer when plants are actively growing.

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Section 6 - Wetland Plantings

This section contains recommended plantings for wetlands and shallow water areas. Other wetland plantings that are native to New Jersey may also be suitable.

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Selecting Species and Establishing Plantings

Planting can be used as appropriate to hasten establishment of desired species or to supplement the natural regeneration process. The use of species native to New Jersey is required for all permanent plantings (not including temporary seedings or nurse crops) in a wetland or shallow water area.

Where needed, use an appropriate seed mix for wetlands to provide short-term herbaceous cover to control erosion and to help build the organic components of the soil. Temporary or non-competitive permanent mixes may be needed in areas where natural regeneration is planned, woody species will be planted, or other permanent plantings will be delayed. Plantings for short-term cover shall be non-competitive to the introduction and establishment of the desired species.

Table 6.1: Recommended Trees, Shrubs and Woody Vines for Wetlands contains a quick reference to recommended trees, shrubs, and woody vines for wetlands. (Refer to Section 4 for more detailed information concerning each species.)

Refer to Table 6.2: Recommended Herbaceous Mixes for Wetlands for mixes that can be used for temporary site stabilization, companion plantings with trees and shrubs, and early successional plantings.

Table 6.3: Characteristics of Herbaceous Wetland Plants provides additional information for herbaceous wetland species.

TABLE 6.1: Recommended Trees, Shrubs and Woody Vines for Wetlands (see Section 4 for detailed species information)

TABLE 6.1: Recommended Trees, Shrubs, and Woody Vines for Wetlands (see Section 4 for detailed species information)																
Plant Names	Region [1]		Moisture [2]			Native to New Jersey	Habitat Use Characteristics [3]								Water Regime (surface saturation/ infrequent inundation)	Water Regime (surface saturation/ frequent or prolonged inundation)
							Cover		Fruit/Seed Consumption			Pollinator Food				
	Northern New Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage	Toxic to Livestock		
DECIDUOUS TREES																
BIRCH, RIVER *Betula nigra*	■	■	■	■	■	■	■			■			■		■	
BLACKGUM *Nyssa sylvatica*	■	■	■	■	■	■	■			■		■			■	
BOX-ELDER *Acer negundo*	■	■		■	■	■	■			■					■	
COTTONWOOD, EASTERN *Populus deltoides*	■	■	■	■	■	■	■								■	
CYPRESS, BALD *Taxodium distichum*		■		■	■	■	■									■
ELM, AMERICAN *Ulmus americana*	■	■	■	■	■	■	■						■		■	
ELM, SLIPPERY *Ulmus rubra*	■	■	■	■	■	■	■						■		■	
HICKORY, BITTERNUT *Carya cordiformis*	■	■		■	■	■	■						■		■	
HORNBEAM, AMERICAN *Carpinus caroliniana*	■	■		■	■	■	■			■					■	
LARCH (ALL TAMARACKS) *Larix laricina*	■			■	■	■	■								■	■
MAGNOLIA, SWEETBAY *Magnolia virginiana*		■		■	■	■	■			■		■			■	
MAPLE, RED *Acer rubrum*	■	■	■	■	■	■	■			■		■	■	■		■

TABLE 6.1: Recommended Trees, Shrubs, and Woody Vines for Wetlands (see Section 4 for detailed species information)

Plant Names	Region [1]		Moisture [2]			Native to New Jersey	Habitat Use Characteristics [3]								Water Regime (surface saturation/ infrequent inundation)	Water Regime (surface saturation/ frequent or prolonged inundation)
							Cover		Fruit/Seed Consumption			Pollinator Food				
	Northern New Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage	Toxic to Livestock		
MAPLE, SILVER *Acer saccharinum*	■			■	■	■	■			■		■	■			■
OAK, CHERRYBARK *Quercus pagoda*		■			■	■	■		■				■	■	■	
OAK, OVERCUP *Quercus lyrata*		■		■	■	■	■		■		■		■	■		■
OAK, PIN *Quercus palustris*	■	■		■	■	■	■		■				■	■	■	
OAK, SWAMP CHESTNUT *Quercus michauxii*		■		■	■	■	■		■		■		■	■	■	
OAK, SWAMP WHITE *Quercus bicolor*		■		■	■	■	■		■		■		■	■	■	
OAK, WATER *Quercus nigra*		■		■	■	■	■		■				■	■	■	
OAK, WILLOW *Quercus phellos*		■		■	■	■	■		■				■	■	■	
PAWPAW *Asimina triloba*	■	■		■	■	■	■		■		■		■		■	
PERSIMMON, COMMON *Diospyros virginiana*	■	■	■	■	■	■	■		■		■	■			■	
SERVICEBERRY, CANADIAN *Amelanchier canadensis*	■	■		■	■	■	■		■		■	■	■		■	
SERVICEBERRY, COMMON *Amelanchier arborea*	■	■	■	■	■	■	■		■		■	■	■		■	
SWEETGUM *Liquidambar styraciflua*	■	■		■	■	■	■								■	
SYCAMORE *Platanus occidentalis*	■	■		■	■	■	■								■	
TUPELO, SWAMP (SWAMP BLACK GUM) *Nyssa biflora*		■		■	■	■	■			■		■				■

TABLE 6.1: Recommended Trees, Shrubs, and Woody Vines for Wetlands (see Section 4 for detailed species information)																	
Plant Names	Region [1]		Moisture [2]			Native to New Jersey	Habitat Use Characteristics [3]									Water Regime (surface saturation/ infrequent inundation)	Water Regime (surface saturation/ frequent or prolonged inundation)
							Cover		Fruit/Seed Consumption			Pollinator Food					
	Northern New Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage	Toxic to Livestock			
WILLOW, BLACK *Salix nigra*	■	■		■	■	■	■					■	■				■
EVERGREEN TREES																	
CEDAR, ATLANTIC WHITE *Chamaecyparis thyoides*		■		■	■	■	■	■		■							■
HEMLOCK, EASTERN *Tsuga canadensis*	■	■	■	■		■	■	■		■						■	
HOLLY, AMERICAN *Ilex opaca*	■	■	■	■	■	■	■	■		■						■	
PINE, LOBLOLLY *Pinus taeda*		■		■	■	■	■	■		■			■			■	
SPRUCE, BLACK *Picea mariana*	■			■	■	■	■	■								■	
SHRUBS AND WOODY VINES																	
ALDER, SMOOTH *Alnus serrulata*	■	■		■	■	■	■	■	■								■
ALDER, SPECKLED (GRAY) *Alnus incana*	■	■	■	■		■	■	■	■							■	■
ARROWWOOD *Viburnum dentatum*	■	■	■	■	■	■	■	■	■							■	
AZALEA, PINXTER *Rhododendron periclymenoides*	■	■	■	■	■	■	■	■	■			■		■		■	
AZALEA, SWAMP *Rhododendron viscosum*		■		■	■	■	■					■		■		■	
BAYBERRY, NORTHERN *Morella pensylvanica* *(Myrica pensylvanica)*	■	■	■	■	■	■	■	■	■							■	
BLUEBERRY, HIGHBUSH *Vaccinium corymbosum*	■	■		■	■	■	■	■	■		■	■	■			■	

TABLE 6.1: Recommended Trees, Shrubs, and Woody Vines for Wetlands (see Section 4 for detailed species information)																	
Plant Names	Region [1]		Moisture [2]			Native to New Jersey	Habitat Use Characteristics [3]								Water Regime (surface saturation/ infrequent inundation)	Water Regime (surface saturation/ frequent or prolonged inundation)
							Cover		Fruit/Seed Consumption			Pollinator Food		Toxic to Livestock		
	Northern New Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage			
BUSH, HIGH TIDE (GROUNDSEL) *Baccharis halimifolia (coastal counties)*		■		■	■	■	■	■							■	
BUSH, HIGH TIDE (MARSH-ELDER) *Iva frutescens (coastal counties)*		■		■	■	■	■	■							■	
BUTTONBUSH *Cephalanthus occidentalis*	■	■		■	■	■	■	■				■				■
CHOKEBERRY, BLACK *Aronia melanocarpa*	■		■	■	■	■	■	■		■	■	■			■	
CHOKEBERRY, RED *Aronia arbutifolia*	■	■	■	■	■	■	■	■		■	■	■			■	
CURRANT, AMERICAN (WILD) BLACK *Ribes americanum*	■			■	■	■			■						■	
DEWBERRY, BRISTLY *Rubus hispidus*		■			■	■	■			■	■		■		■	
DOGWOOD, REDOSIER *Cornus sericea*	■			■	■	■	■	■	■			■				■
DOGWOOD, SILKY *Cornus amomum*	■	■		■	■	■	■	■	■			■			■	
DOGWOOD, STIFF *Cornus foemina*		■		■	■	■	■	■	■			■			■	
ELDERBERRY *Sambucus nigra* ssp. *canadensis*	■	■		■	■	■	■	■	■		■	■		■	■	
FETTERBUSH *Eubotrys racemosa* *(Leucothoe racemosa)*		■		■	■	■	■	■						■	■	
GRAPE, RIVERBANK *Vitis riparia*	■	■			■		■	■	■		■				■	
HUCKLEBERRY, BLACK *Gaylussacia baccata*	■	■	■	■	■	■	■	■	■		■	■	■		■	
HUCKLEBERRY, BLUE *Gaylussacia frondosa*	■	■	■	■	■	■	■	■	■		■	■	■		■	

TABLE 6.1: Recommended Trees, Shrubs, and Woody Vines for Wetlands (see Section 4 for detailed species information)

Plant Names	Region [1]		Moisture [2]			Native to New Jersey	Habitat Use Characteristics [3]								Water Regime (surface saturation/ infrequent inundation)	Water Regime (surface saturation/ frequent or prolonged inundation)
							Cover		Fruit/Seed Consumption			Pollinator Food		Toxic to Livestock		
	Northern New Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage			
INDIGO, FALSE (INDIGO BUSH) *Amorpha fruticosa*	■	■	■	■	■	■	■	■		■		■			■	
INKBERRY *Ilex glabra*		■		■	■	■	■	■	■							■
MEADOWSWEET, WHITE *Spiraea alba*	■			■	■	■	■	■		■		■	■		■	
NINEBARK, COMMON *Physocarpus opulifolius*	■		■	■	■	■	■	■		■		■			■	
PEPPERBUSH, SWEET *Clethra alnifolia*	■	■		■	■	■	■	■				■			■	
POSSUM-HAW *Viburnum nudum*	■	■		■	■	■	■	■		■	■				■	
RAISIN, WILD *Viburnum nudum* var. *cassinoides*				■	■	■	■	■		■	■				■	
RHODODENDRON *Rhododendron maximum*	■	■	■	■	■	■	■				■	■			■	
ROSE, SWAMP *Rosa palustris*	■	■		■	■	■	■	■	■		■	■				■
SPICEBUSH *Lindera benzoin*	■	■		■	■	■	■	■	■		■		■		■	
STEEPLEBUSH *Spiraea tomentosa*	■	■		■	■	■	■	■				■	■		■	
SUMAC, WINGED *Rhus copallinum*	■	■		■	■	■	■			■					■	
SWEETSPIRE, VIRGINIA[4] *Itea virginica*		■		■	■	■	■	■				■			■	
WAXMYRTLE, SOUTHERN *Morella cerifera (Myrica cerifera)*		■	■	■	■	■	■	■	■						■	
WILLOW, PUSSY *Salix discolor*	■	■		■	■	■	■	■	■			■			■	

TABLE 6.1: Recommended Trees, Shrubs, and Woody Vines for Wetlands (see Section 4 for detailed species information)

Plant Names	Region [1]		Moisture [2]			Native to New Jersey	Habitat Use Characteristics [3]								Water Regime (surface saturation/ infrequent inundation)	Water Regime (surface saturation/ frequent or prolonged inundation)
							Cover		Fruit/Seed Consumption			Pollinator Food				
	Northern New Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage	Toxic to Livestock		
WINTERBERRY *Ilex verticillata*	■	■		■	■	■	■	■	■						■	

[1] Region: The physiographic region where the species usually occurs in New Jersey, under natural conditions. NNJ – North New Jersey and includes the Valley and Ridge, Highlands, and Piedmont regions ; CP - Coastal Plain. Visit the New Jersey DEP website to determine which region includes your project site or view the "Physiographic Provinces" layer in Conservation Desktop.

[2] Moisture: The amount of moisture the species needs or tolerates. Dry - excessively drained to well-drained soil; Mesic - moderately well to somewhat poorly drained soil; Wet - poorly to very poorly drained soil.

[3] Habitat Use Characteristics:

Cover - All plants provide some type of cover for wildlife, depending on the time of year and the wildlife species of interest. These columns describe the cover use primarily for birds and small mammals, as follows: Nesting/Resting - Provides nesting and/or resting cover. Protection - Provides protective habitat, typically characterized by high stem density near ground level and/or dense, persistent foliage (usually evergreens, but also some deciduous species that retain leaves well into the winter).

Fruit/Seed Consumption - These columns note whether a fruit or seed is a good food source for wildlife, or may be eaten by humans:

- Wildlife - (H) Highly preferred food for many birds and mammals, or (M) Medium value, and is utilized by fewer species or is produced in smaller quantities than similar foods. Plant species not noted as having High or Medium value have Low or unknown value. Refer to Section 4, Table 4.6, for detailed wildlife food value information.
- Humans - May be consumed by people. Caution: This list should not solely be relied upon for knowledge of human edibility. Many plants with palatable parts also contain parts that are to a certain degree toxic to humans. Toxicity effects can vary with people and environment, and not all human toxicity effects are known for wild plants. People who intend to consume parts of wild plants should ensure their own safety and health by consulting experts and/or trusted plant references.

Pollinator Food - These columns note whether a species provides a food source for adult and larval-stage pollinators:

- Nectar/Pollen - Species produces nectar and/or pollen that are consumed by adults or larvae of various pollinator species.
- Foliage - Species has vegetative plant parts (foliage, stems, etc.) that are consumed by various insect pollinators, especially while in the larval stage.

Toxic to Livestock - Reported to be slightly to highly toxic if consumed by livestock. Toxicity may include flowers, fruits/nuts, foliage, and other plant parts, and can vary with species of livestock, age of the animal, and growth stage of the plant.

[4] This species is found in South Jersey and Somerset and Middlesex

TABLE 6.2: Recommended Herbaceous Mixes for Wetlands

TABLE 6.2: Recommended Herbaceous Mixes for Wetlands [1]							
	Mix	**Recommended Cultivar**	**Seeding Rate (lbs/ac) [2]**	**Plant Hardiness Zones [3]**	**Max. Height (feet)**	**Type of Grass in Mix**	**Remarks**
1	**ADD ALL OF THE FOLLOWING:**						
	Rough Barnyard Grass *Echinochloa muricata*	Common	5 - 10				
	Riverbank Wildrye *Elymus riparius*	Common	4 - 6	All	3 - 4	Warm & cool season grasses	Mix for temporary site stabilization. Native, short-lived grasses. Can be used when permanent plantings will be delayed. (For example, use this mix to stabilize the site in late fall, then plant permanent vegetation the following spring.)
	Virginia Wildrye *Elymus virginicus*	Common	4 - 6				Suitable for seasonally saturated wetlands and adjacent somewhat poorly drained areas. Tolerates dry conditions and brief periods of inundation after establishment.
2	**ADD ALL OF THE FOLLOWING:**						
	Virginia Wildrye *Elymus virginicus*	Common	2 - 3				Early successional mix. Low-growing all-native species. Use this as a basic "starter mix" to provide cover in areas where natural regeneration is planned. Suitable for seasonally saturated wetlands and adjacent somewhat poorly drained areas. Tolerates dry conditions and brief periods of inundation after establishment.
	Red Fescue *Festuca rubra*	Common	3 - 4				
	AND ONE OF THE FOLLOWING:						
	Fowl Meadowgrass *Poa palustris*	Common	2 - 4	All	2 - 3	Warm & cool season grasses	
	Deertongue *Dichanthelium clandestinum*	Tioga	2 - 4				Fowl Meadowgrass may be short-lived on the Coastal Plain, especially on drier sites in full sun.
	AND ADD:						
	Partridge Pea *Chamaecrista fasciculata*	Common	1				
3	**ADD ALL OF THE FOLLOWING:**						
	Rough Barnyard Grass *Echinochloa muricata*	Common	2 - 4				Early successional mix. All native species. The Barnyard Grass is an annual warm-season grass that provides temporary cover and wildlife food. Use this mix as a basic "starter mix" to provide cover in areas where natural regeneration is planned.
	Fowl Meadowgrass *Poa palustris*	Common	2 - 4				
	Virginia Wildrye *Elymus virginicus*	Common	2 - 4				Diverse mix that is suitable for seasonally saturated wetlands and adjacent somewhat poorly drained areas. Tolerates dry conditions and brief periods of inundation after establishment.
	AND ADD THE FOLLOWING WILDFLOWER MIX:			All	3 - 4	Warm & cool season grasses	
	Partridge Pea *Chamaecrista fasciculata*	Common	1				Fowl Meadowgrass may be short-lived on the Coastal Plain, especially on drier sites in full sun.
	Beggar Ticks *Bidens frondosa*	Common	1				
	Smartweed *Polygonum pensylvanicum*	Common	0.5 - 1				
	Swamp Milkweed *Asclepias incarnata*	Common	2				

TABLE 6.2: Recommended Herbaceous Mixes for Wetlands [1]							
	Mix	Recommended Cultivar	Seeding Rate (lbs/ac) [2]	Plant Hardiness Zones [3]	Max. Height (feet)	Type of Grass in Mix	Remarks
4	**ADD ALL OF THE FOLLOWING:**						This is a diverse, all-native species for emergent wetlands and shallow water areas that will provide food and cover for waterfowl and other wetland wildlife. Substitutions: Can substitute Hop Sedge (*Carex lupulina*) for Fox Sedge or Lurid Sedge at a rate of 1.5 lb/ac. Can substitute Fowl Mannagrass (*Glyceria striata*) for Redtop Panicgrass at a rate of 0.1 lb/ac, or can substitute Woolgrass (*Scirpus cyperinus*) for Redtop Panicgrass at a rate of 0.01 lb/ac. If a wildflower in the mix is not available, double the rate of one of the other wildflower species. For example, if Swamp Milkweed is not available, Joe-Pye Weed can be increased to 0.2 lb/ac.
	Eastern Bur Reed *Sparganium americanum*	Common	0.5	All	5 - 8	Warm & cool season grasses	
	Fox Sedge *Carex vulpinoidea*	Common	0.2				
	Lurid Sedge *Carex lurida*	Common	0.5				
	Redtop Panicgrass *Panicum rigidulum*	Common	0.3				
	Riverbank Wildrye *Elymus riparius*	Common	2				
	Rough Barnyard Grass *Echinochloa muricata*	Common	1				
	Softstem Bulrush *Schoenoplectus tabernaemontani*	Common	0.1				
	AND ADD THE FOLLOWING WILDFLOWERS:						
	Beggar Ticks *Bidens frondosa*	Common	1				
	Blue (Swamp) Vervain *Verbena hastata*	Common	0.1				
	Joe-Pye Weed *Eutrochium fistulosum*	Common	0.1				
	Nodding Bur Marigold *Bidens cernua*	Common	0.5				
	Pennsylvania Smartweed *Polygonum pensylvanicum*	Common	1				
	Swamp Milkweed *Asclepias incarnata*	Common	1				
	Yellow Sneezeweed *Helenium autumnale*	Common	0.1				
5	**ADD ALL OF THE FOLLOWING:**						Companion planting for trees and shrubs. Low-growing, native perennial grasses. Mix provides semi-permanent grass cover that helps to suppress weeds and control erosion. May be planted at the same time as woody plantings. Suitable for seasonally saturated wetlands and adjacent somewhat poorly drained areas. Tolerates dry conditions and brief periods of inundation after establishment.
	Rough Bentgrass *Agrostis scabra*	Common	4 - 6	All	1 - 2	Cool season grasses	
	Fowl Meadowgrass *Poa palustris*	Common	4 - 8				

1. **Herbaceous Mixes for Wetlands:** This is a list of mixes that can be used for temporary site stabilization, companion plantings for trees and shrubs, and as basic "starter mixes" to provide initial cover and food for wildlife. See the "Remarks" column of this table for recommended uses. Due to page limitations, this list is not all-inclusive. There are many other mixes that may be suitable, depending on site conditions and the purpose of the planting.

2. **Seeding Rate:** Seeding rates for native grasses, sedges, legumes, and other wildflowers are in pounds of Pure Live Seed (PLS). Order seed from the supplier based on the PLS rate; the seed supplier will adjust the bulk amount to be planted based on percent seed germination and purity, as tested. Legume seeds shall be inoculated before planting with the appropriate *Rhizobium* bacteria. When feasible, hard-seeded legumes should be scarified to improve germination.

   When a seeding rate is expressed as a range (i.e., 4 - 6), the lower rate should be used if site conditions are generally good and erosion is not a concern.

3. The **Plant Hardiness Zones** designate where a species can be successfully planted in New Jersey.

TABLE 6.3: Characteristics of Herbaceous Wetland Plants

TABLE 6.3: Characteristics of Herbaceous Wetland Plants								
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ [2]**	**Sun/ Shade [3]**	**Height at Maturity**	**Rate of Spread [4]**	**Wildlife Value for Food**	**Natural Habitat and Other Characteristics**
Water Regime: Surface Saturation to Infrequent Inundation								
ASTER, NEW ENGLAND *Symphyotrichum novae-angliae*	All	Statewide; common	■	m - »	3-6 ft.	Slow	Flowers attractive to butterflies. Seeds eaten by songbirds.	Wet meadows. Prefers full sun. Attractive clusters of purple flowers.
ASTER, NEW YORK *Symphyotrichum novi-belgii*	All	Mostly Coastal Plain; common	■	m - »	3-6 ft.	Slow	Flowers attractive to butterflies. Seeds eaten by songbirds.	Wet meadows. Prefers full sun. Attractive clusters of violet flowers.
ASTER, PURPLE-STEMMED *Symphyotrichum puniceum*	All	Statewide; common	■	m - »	3-6 ft.	Slow	Flowers attractive to butterflies. Seeds eaten by songbirds.	Wet meadows. Prefers full sun. Attractive clusters of violet flowers.
BENTGRASS, CREEPING *Agrostis stolonifera*	All	Statewide; common		m	<3 ft.	Slow	Seeds eaten by songbirds.	Wet meadows. Cool-season grass with creeping habit. Widely naturalized, but not native to US.
BLUESTEM, BUSHY *Andropogon glomeratus*	All	Coastal Plain	■	m	<3 ft.	Fast	Seeds eaten by songbirds.	Wet meadows. Warm-season grass with stiff stems.
BONESET *Eupatorium perfoliatum*	All	Statewide; common	■	m - »	3-6 ft.	Slow	Flowers attractive to butterflies.	Wet meadows. Small white flower clusters.
CARDINAL FLOWER *Lobelia cardinalis*	All	Statewide; common	■	»	<3 ft.	Slow	Flowers attractive to hummingbirds & butterflies.	Wet meadows and open forested wetlands. Spike of attractive bright red flowers.
CORDGRASS, SALTMEADOW *Spartina patens*	All	Coastal Plain; common	■	m	<3 ft.	Fast	Seeds eaten by waterfowl & songbirds. Roots eaten by waterfowl and muskrats.	Tidal marshes above MHT. Warm-season grass. Salinity 0 – 35 ppt.
DEERTONGUE *Dichanthelium clandestinum*	All	Statewide; common	■	m - »	<3 ft.	Slow	Seeds eaten by songbirds.	Wet meadows. Warm-season grass. Tolerates seasonal wetness and drought.
FESCUE, RED *Festuca rubra*	All	Statewide; common	■	m - □	<3 ft.	Slow	Seeds eaten by songbirds.	Shady uplands and moist sites. Cool-season, sod-forming grass. Very fine leaves. Tolerates drought once established.
FERN, MARSH *Thelypteris palustris*	All	Statewide; common	■	m - »	<3 ft.	Fast	Minimal value for food. Occasionally browsed by deer.	Open forested wetlands and wet meadows.

TABLE 6.3: Characteristics of Herbaceous Wetland Plants								
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ [2]**	**Sun/ Shade [3]**	**Height at Maturity**	**Rate of Spread [4]**	**Wildlife Value for Food**	**Natural Habitat and Other Characteristics**
IRONWEED *Vernonia noveboracensis*	All	Statewide; common	■	m	3-6 ft.	Slow	Flowers attractive to butterflies.	Wet meadows. Deep purple flower clusters.
JOE-PYE WEED *Eutrochium fistulosum*	All	Statewide	■	m - »	3-6 ft.	Slow	Flowers attractive to butterflies.	Wet meadows. Pink-purple flower clusters.
LOBELIA, BLUE *Lobelia siphilitica*	All	Northern New Jersey; common	■	»	<3 ft.	Slow	Flowers attractive to butterflies. Leaves and stems eaten by deer.	Wet meadows (often in shade) and saturated forested wetlands. Attractive blue flower spike.
MEADOWGRASS, FOWL *Poa palustris*	All	Statewide		m - »	<3 ft.	Slow	Seeds eaten by songbirds.	Wet meadows. Cool-season grass. May be short-lived, especially on drier sites in full sun. Native to northern US.
MILKWEED, SWAMP *Asclepias incarnata*	All	Statewide; common	■	m	3-6 ft.	Slow	Flowers attractive to butterflies. Important plant for Monarchs.	Wet meadows. Small pink flowers in clusters.
MONKEY FLOWER, WINGED *Mimulus alatus*	All	Statewide; common	■	m	<3 ft.	Slow	Flowers attractive to butterflies.	Wet meadows. Pink-purple flowers similar to snapdragons.
MONKEY FLOWER, ALLEGHANY *Mimulus ringens*	All	Statewide; common	■	m - »	<3 ft.	Slow	Flowers attractive to butterflies.	Openings in saturated forested wetlands. Pink-purple flowers similar to snapdragons.
PASPALUM, FLORIDA *Paspalum floridanum (southern NJ counties only)*	All	Coastal Plain; common	■	m	3-5 ft.	Moderate	Large seeds eaten by quail, dove, turkeys, and other birds. Wildlife browse the foliage.	Native warm-season bunch grass. Readily grows on moist, disturbed areas and roadside ditches. Foliage deteriorates rapidly after maturity. Commercial Availability limited
PEA, PARTRIDGE *Chamaecrista fasciculata*	All	Statewide; common	■	m - »	<3 ft.	Fast	Seeds eaten by quail, turkeys, songbirds.	Mostly in upland fields. Tolerates moist sites. Reseeding annual legume. Feathery foliage; yellow flowers.
REEDGRASS, WOOD *Cinna arundinacea*	All	Statewide; common	■	m - »	3-6 ft.	Slow	Seeds eaten by songbirds. Foliage eaten by deer.	Saturated forested wetlands. Cool-season grass.
TICKSEED *Coreopsis tinctoria*	All	Statewide		m - »	<3 ft.	Fast	Seeds eaten by songbirds.	River banks and floodplains. Prefers moist soils; tolerates dry sites. Re-seeding annual with yellow flowers. Native to central and western US.

TABLE 6.3: Characteristics of Herbaceous Wetland Plants								
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ [2]**	**Sun/ Shade [3]**	**Height at Maturity**	**Rate of Spread [4]**	**Wildlife Value for Food**	**Natural Habitat and Other Characteristics**
VERVAIN, BLUE *Verbena hastata*	All	Statewide; common	■	m	3-6 ft.	Slow	Seeds eaten by songbirds.	Wet meadows. Small blue flowers in spikes.
WILD RYE, RIVERBANK *Elymus riparius*	All	Statewide; common	■	m - »	3-5 ft.	Fast	Foliage eaten by wildlife in early spring.	Wet meadows and river banks. Cool-season grass.
WILDRYE, VIRGINIA *Elymus virginicus*	All	Statewide; common	■	m - »	<3 ft.	Fast	Foliage eaten by wildlife in early spring.	Wet meadows and river banks. Cool-season grass.
WOODOATS, SLENDER *Chasmanthium laxum*	All	Coastal Plain; common	■	m - »	2-3 ft.	Moderate	Occasionally browsed by wildlife. Seeds eaten by birds.	Stream banks, floodplains, moist meadows.
Water Regime: Surface Saturation to +3 inches of Surface Water								
CUTGRASS, RICE *Leersia oryzoides*	All	Statewide; common	■	m	<3 ft.	Fast	Seeds eaten by waterfowl, songbirds. Roots eaten by waterfowl.	Shallow fresh marshes & wet meadows. Cool-season grass. Leaves have sawtoothed edges.
FERN, SENSITIVE *Onoclea sensibilis*	All	Statewide; common	■	m - □	<3 ft.	Fast	Minimal value for food. Occasionally browsed by deer.	Wet meadows and saturated forested wetlands.
FERN, CINNAMON *Osmunda cinnamomea*	All	Statewide; common	■	□	3-6 ft.	Slow	Minimal value for food. Occasionally browsed by deer.	Saturated forested wetlands.
FERN, ROYAL *Osmunda regalis*	All	Statewide; common	■	» - □	3-6 ft.	Slow	Minimal value for food. Occasionally browsed by deer.	Wooded swamps and saturated forested wetlands.
IRIS, BLUE *Iris versicolor*	All	Statewide; common	■	m	<3 ft.	Slow	Plants eaten by muskrats.	Shallow fresh marshes. Attractive blue flower.
MALLOW, MARSH *Kosteletzkya virginica*	All	Coastal Plain; common	■	m	3-6 ft.	Slow	Flowers attractive to hummingbirds.	Brackish & fresh tidal marshes; saturated soils above MHT. Salinity 0 - 10 ppt. Large, showy pink flowers.
MALLOW, ROSE *Hibiscus moscheutos*	All	Coastal Plain; common	■	m	3-6 ft.	Slow	Flowers attractive to hummingbirds.	Brackish & fresh tidal marshes; saturated soils above MHT. Salinity 0 - 15 ppt. Large, showy white flowers.
MANNA GRASS *Glyceria canadensis*	All	Statewide; uncommon	■	m - »	3-6 ft.	Fast	Seeds eaten by songbirds, waterfowl. Plants eaten by deer, muskrats.	Shallow fresh marshes, wet meadows, open forested wetlands. Cool-season grass.

TABLE 6.3: Characteristics of Herbaceous Wetland Plants								
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to NJ [2]**	**Sun/ Shade [3]**	**Height at Maturity**	**Rate of Spread [4]**	**Wildlife Value for Food**	**Natural Habitat and Other Characteristics**
MANNA GRASS, EASTERN *Glyceria septentrionalis*	All	Statewide; common	■	m	3-6 ft.	Fast	Seeds eaten by songbirds, waterfowl. Plants eaten by deer, muskrats.	Shallow fresh marshes and wet meadows. Cool-season grass.
MANNA GRASS, FOWL *Glyceria striata*	All	Statewide; common	■	m - »	<3 ft.	Slow	Seeds eaten by songbirds, waterfowl. Plants eaten by deer, muskrats.	Wet meadows. Cool-season grass. Contains prussic acid; can be poisonous to livestock.
MILLET, WALTER'S *Echinochloa walteri*	All	Coastal Plain; common	■	m	<3 ft.	Slow	Seeds eaten by songbirds, waterfowl.	Shallow fresh marshes and wet meadows. Annual, warm-season grass.
REEDGRASS, BLUE-JOINT *Calamagrostis canadensis*	All	Coastal Plain; uncommon	■	m - »	3-6 ft.	Slow	Stems, leaves, & rootstocks eaten by muskrats, deer.	Shallow fresh marshes, wet meadows, open forested wetlands. Cool-season grass.
RUSH, SOFT *Juncus effusus*	All	Statewide; common	■	m	<3 ft.	Slow	Seeds eaten by songbirds, waterfowl.	Shallow fresh marshes and wet meadows.
SMARTWEED, PENNSYLVANIA *Polygonum pensylvanicum*	All	Statewide; common	■	m	3-6 ft.	Fast	Seeds eaten by waterfowl, songbirds.	Shallow marshes and wet meadows. Small pink flowers.
SMARTWEED, SWAMP *Polygonum hydropiperoides*	All	Coastal Plain; uncommon	■	m	<3 ft.	Fast	Seeds eaten by waterfowl, songbirds.	Shallow fresh marshes and wet meadows. Small white flowers.
SWITCHGRASS *Panicum virgatum*	All	Coastal Plain; common	■	m	3-6 ft.	Slow	Seeds eaten by songbirds. Foliage eaten by rabbits, deer.	Wet meadows; shallow edges of fresh & brackish marshes. Warm-season grass. Salinity 0 - 10 ppt.
TEARTHUMB *Polygonum arifolium* *Polygonum sagittatum*	All	Statewide; common	■	m	Vine	Fast	Seeds eaten by waterfowl, songbirds.	Shallow fresh marshes and wet meadows. Small white-pink flowers. Many small prickles on stems.
WOOL-GRASS *Scirpus cyperinus*	All	Statewide; common	■	m	3-6 ft.	Fast	Seeds eaten by songbirds, waterfowl. Rootstocks & foliage eaten by muskrats.	Shallow fresh marshes and wet meadows. A bulrush, not a grass.
WILD RICE *Zizania aquatica*	All	Mostly Coastal Plain	■	m	6-9 ft.	Slow	Seeds eaten by songbirds, waterfowl.	Mostly in tidal fresh marshes. Annual, cool-season grass.

TABLE 6.3: Selected Characteristics of Herbaceous Wetland Plants								
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to DE [2]**	**Sun/ Shade [3]**	**Height at Maturity**	**Rate of Spread [4/]**	**Wildlife Value for Food**	**Natural Habitat and Other Characteristics**
Water Regime: Surface Saturation to +6 inches of Surface Water								
ARROW-ARUM *Peltandra virginica*	All	Coastal Plain; common	■	m - »	<3 ft.	Slow	Seeds eaten by waterfowl, rails, muskrats.	Shallow marshes and stream edges. Salinity 0 - 2 ppt. Plant also known as "Duck Corn." Inconspicuous green flowers.
BURREED, AMERICAN *Sparganium americanum*	All	Statewide; common	■	m - »	<3 ft.	Fast	Seeds eaten by waterfowl and rails. Stems and leaves eaten by muskrats.	Shallow fresh marshes, especially along rivers & streams. White flowers.
BURREED, GIANT *Sparganium eurycarpum*	All	Statewide; common	■	m	3-6 ft.	Fast	Seeds eaten by waterfowl and rails. Stems and leaves eaten by muskrats.	Shallow fresh marshes. White flowers.
BULRUSH, GREEN *Scirpus atrovirens*	All	Northern New Jersey; uncommon	■	m	3-6 ft.	Fast	Seeds eaten by waterfowl, songbirds. Rootstocks & stems eaten by muskrats.	Shallow fresh marshes and wet meadows.
BULRUSH, RIVER *Schoenoplectus fluviatilis*	All	Coastal Plain; common	■	m - »	3-6 ft.	Fast	Seeds eaten by waterfowl, songbirds. Rootstocks & stems eaten by muskrats.	Shallow fresh marshes.
BULRUSH, SOFT-STEM *Schoenoplectus tabernaemontani*	All	Statewide; common	■	m	6-9 ft.	Fast	Seeds eaten by waterfowl, songbirds. Rootstocks & stems eaten by muskrats.	Shallow fresh to slightly brackish marshes. Salinity 0 - 5 ppt.
BULRUSH, THREE-SQUARE *Schoenoplectus pungens*	All	Coastal Plain; common	■	m	<3 ft.	Fast	Seeds eaten by waterfowl, songbirds. Rootstocks & stems eaten by muskrats.	Shallow fresh to brackish marshes and open water fringes. Salinity 0 - 15 ppt.
CORDGRASS, SALTMARSH *Spartina alterniflora*	All	Coastal Plain; common	■	m	3-6 ft.	Fast	Seeds eaten by waterfowl & songbirds. Roots eaten by waterfowl and muskrats.	Tidal marshes between mid tide and MHT. Warm-season grass. Salinity 0 - 35 ppt.
SEDGE, FOX *Carex vulpinoidea*	All	Statewide; common	■	m	<3 ft.	Slow	Seeds eaten by waterfowl, songbirds, rails. Foliage eaten by deer.	Shallow fresh marshes.
SEDGE, FRINGED *Carex crinita*	All	Statewide; common	■	m - »	<3 ft.	Slow	Seeds eaten by waterfowl, songbirds, rails. Foliage eaten by deer.	Forested wetlands and thickets.

TABLE 6.3: Selected Characteristics of Herbaceous Wetland Plants								
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to DE [2]**	**Sun/ Shade [3]**	**Height at Maturity**	**Rate of Spread [4/]**	**Wildlife Value for Food**	**Natural Habitat and Other Characteristics**
SEDGE, SHALLOW *Carex lurida*	All	Statewide; common	■	m - »	<3 ft.	Slow	Seeds eaten by waterfowl, songbirds, rails. Foliage eaten by deer.	Forested wetlands with shallow water and/or saturated soil.
SEDGE, THREE-WAY *Dulichium arundinaceum*	All	Statewide; common	■	m	<3 ft.	Slow	Foliage eaten by deer.	Shallow fresh marshes and openings in forested wetlands.
SEDGE, TUSSOCK *Carex stricta*	All	Statewide; common	■	m	<3 ft.	Slow	Seeds eaten by waterfowl, songbirds, rails. Foliage eaten by deer.	Shallow fresh marshes and wet meadows.
SPIKERUSH, BLUNT *Eleocharis obtusa*	All	Statewide; common	■	m - »	<3 ft.	Slow	Seeds and plants eaten by waterfowl, muskrats.	Shallow fresh marshes and open water fringes.
SWEETFLAG *Acorus calamus*	All	Statewide; more common on Coastal Plain		m - »	<3 ft.	Fast	Roots eaten by waterfowl, muskrats.	Shallow fresh to brackish marshes, stream edges, wet meadows. Widely naturalized, but not native to US. Salinity 0 - 10 ppt.
Water Regime: Surface Saturation to +12 inches of Surface Water								
ARROWHEAD, BROADLEAF *Sagittaria latifolia*	All	Statewide; common	■	m - »	<3 ft.	Fast	Seeds and tubers eaten by waterfowl, wading birds, muskrats.	Shallow fresh marshes. White flowers.
ARROWHEAD, RIGID *Sagittaria rigida*	All	Formerly Coastal Plain; extirpated	■	m - »	<3 ft.	Fast	Seeds and tubers eaten by waterfowl, wading birds, muskrats.	Shallow fresh marshes. White flowers.
CATTAIL, NARROW-LEAF *Typha angustifolia*	All	Statewide		m	3-6 ft.	Fast	Rootstocks eaten by geese and muskrats. Stems also eaten by muskrats.	Shallow fresh and brackish marshes. Salinity 0 - 15 ppt. **Aggressive species.** Tends to dominate wetlands, to the exclusion of other plants. Should not be planted if a mix of plant species is desired.
CATTAIL, BROAD-LEAF *Typha latifolia*	All	Statewide; common	■	m	3-6 ft.	Fast	Rootstocks eaten by geese and muskrats. Stems also eaten by muskrats.	Shallow fresh marshes. **Aggressive species.** Tends to dominate wetlands, to the exclusion of other plants. Should not be planted if a mix of plant species is desired.
CLUB, GOLDEN *Orontium aquaticum*	All	Coastal Plain; common		m	<3 ft.	Fast	Seeds eaten by waterfowl, muskrats.	Tidal fresh marshes, shallow ponds, slow streams. Small yellow flowers on a spathe.

TABLE 6.3: Selected Characteristics of Herbaceous Wetland Plants								
Plant Names	**Plant Hardiness Zones**	**Geographic Distribution in New Jersey [1]**	**Native to DE [2]**	**Sun/ Shade [3]**	**Height at Maturity**	**Rate of Spread [4/]**	**Wildlife Value for Food**	**Natural Habitat and Other Characteristics**
LIZARD'S-TAIL *Saururus cernuus*	All	Statewide; common		m - »	<3 ft.	Fast	Occasionally eaten by wood ducks.	Shallow fresh marshes and openings in forested wetlands. Nodding spike of small white flowers.
PICKEREL-WEED *Pontederia cordata*	All	Coastal Plain; common		m - »	<3 ft.	Fast	Seeds and roots eaten by waterfowl. Flowers attractive to butterflies.	Shallow fresh to slightly brackish marshes and slow streams. Salinity 0-3 ppt. Showy, small blue flowers on spikes up to 6" long.
POND-LILY, YELLOW (SPATTERDOCK) *Nuphar lutea*	All	Statewide; common		m - »	<3 ft.	Fast	Seeds eaten by waterfowl, muskrats. Stems also eaten by muskrats.	Tidal fresh marshes, shallow ponds, slow streams. Tolerates tidal inundation up to 3 feet. Large, heart-shaped leaves. Bright yellow flowers.
Water Regime: +12 inches to +36 inches of Surface Water, and Deeper								
LOTUS, AMERICAN *Nelumbo lutea*	All	Coastal Plain; uncommon		m	3-6 ft.	Fast	Seeds eaten by waterfowl, muskrats. Stems also eaten by muskrats.	Shallow ponds, slow streams. Large, round leaves, floating or raised above the water. Can grow in water up to 6 feet deep. Pale yellow flowers on stalks extending up to 3 feet above the water.
WATER-LILY, WHITE *Nymphaea odorata*	All	Statewide; common		m - »	3-6 ft.	Fast	Seeds eaten by waterfowl, muskrats. Stems also eaten by muskrats.	Tidal fresh marshes, shallow ponds and bogs. Can grow in water up to 4 feet deep. Leaves and flowers float on the water surface. Attractive white flowers.

[1] Region: The physiographic region where the species usually occurs in New Jersey, under natural conditions. NNJ – North New Jersey and includes the Valley and Ridge, Highlands, and Piedmont regions; CP - Coastal Plain. Visit the New Jersey DEP website to determine which region includes your project site or view the "Physiographic Provinces" layer in Conservation Desktop.

[2] Native to New Jersey: The term "native" refers to species that occur naturally in one or more geographic regions of New Jersey. Due to page limitations, this listing of native species is not all-inclusive. There are many more native plants that occur in New Jersey and may be suitable for planting in and around wetlands.

[3] Sun - Shade: Sunlight and shade tolerance for each species.
- m Full Sun - 6 or more hours of light per day or 4 hours of midday sun;
- » Part Shade - 3 to 6 hours of light per day;
- □ Shade - less than 3 hours of light per day.

[4] Rate of Spread: Relative rate of spreading under ideal conditions.
Slow: spreading at a rate of < 0.5 ft. per year.
Fast: spreading at a rate of ≥0.5 ft. per year.

Section 7 - Forage and Biomass Plantings

This section contains recommendations for establishing adapted and/or native species, varieties, or cultivars of herbaceous plants suitable for pasture, hay, or biomass production.

SECTION 7 TABLE OF CONTENTS

Selecting Species and Establishing Plantings

Refer to the following tables to select the appropriate plant species and seeding rates to meet the client's needs:

- Table 7.1: Common Forage Characteristics and Tolerances - Use this table to choose species that are compatible with the site characteristics.
- Table 7.2: Grass and Legume Grazing and Harvest Characteristics – Use this table to determine if the chosen species will perform well under the planned or expected management conditions.
- Table 7.3: Forage and Hay Seeding Rates and Notes – Use this table if a custom mix will be prescribed. If using a standard mix from a reputable seed dealer, follow the seeding recommendations on the mix tech sheet. This table also provides additional notes such as potential advantages and challenges for the listed species.

Other species that are native to New Jersey, or are introduced and are non-invasive, may also be suitable.

All information in this section is based on general trends of a particular species. Hay and forage varieties of the same species have been bred to meet a diverse range of objectives. It is always best to consult with the seed tech sheet or seed manufacturer to ensure the correct variety is being chosen for the planned objectives.

Always choose forage species that are suitable and desirable for the site and the grazing species. A list of desirable and undesirable species can be found in the New Jersey Desirable Species Guide.

TABLE 7.1: Common Forage Characteristics and Tolerances

TABLE 7.1: Common Forage Characteristics and Tolerances									
Species	**Seedling Vigor**	**Plant Growth Habit**	**Tolerances**			**Lifespan**	**Nitrogen Fixation (Legumes)**	**Fertility Requirement**	**pH Range**
			Shade	**Drought**	**Salinity**				
WARM SEASON GRASSES									
Bermudagrass[7/] *Cynodon dactylon*	moderate	Sod	intolerant	high	moderate	long	NA	Moderate-high	5.0-7.5
Bluestem, big *Andropogon gerardii*	low	bunch	intolerant	high	medium	long	NA	low	6.0-7.5
Bluestem, little *Schizachyrium scoparium*	low	bunch	intermediate	medium	high	long	NA	low	5.0-8.4
Eastern gamagrass *Tripsacum dactyloides*	low	bunch	intolerant	low	Low-medium	long	NA	high	5.1-7.5
Indiangrass *Sorghastrum nutans*	medium	bunch	intolerant	medium	medium	long	NA	low	4.0-7.5
Purpletop *Tridens flavus*	medium	bunch	intolerant	high	none	short	NA	low	4.5-6.5
Switchgrass *Panicum virgatum*	medium	bunch	intolerant	medium	Medium-high	long	NA	high	4.5-8.0
COOL SEASON GRASSES									
Festulolium	Festolium is a cross between fescue and perennial ryegrass. The fescue in the cross is normally a tall or meadow fescue, resulting in big differences between varieties. Specific varieties should be recommended based on the purpose of the planting.								
Kentucky bluegrass *Poa pratensis*	low	sod	intolerant	low	low	long	NA	high	5.0-8.4
Meadow brome *Bromus biebersteinii*	low	sod	intermediate		low	moderate	NA	medium	
Orchardgrass *Dactylis glomerata*	high	bunch	tolerant	medium	medium	moderate	NA	medium	5.2-7.8
Perennial ryegrass *Lolium perenne*	high	bunch	intolerant	low	high	short	NA	high	5.0-8.0
Red fescue *Festuca rubra*	medium	sod	tolerant	medium	low	long	NA	high	5.0-7.5
Smooth brome *Bromus inermis*	high	bunch	intolerant	medium	medium	long	NA	high	5.5-8.1
tall fescue *Festuca arundinacea*	high	bunch	intermediate	medium	Medium-high	moderate	NA	high	5.0-9.0
Timothy *Phleum pratense*	medium	bunch	intermediate	low	low	short	NA	medium	5.0-7.8

TABLE 7.1: Common Forage Characteristics and Tolerances									
Species	**Seedling Vigor**	**Plant Growth Habit**	**Tolerances**			**Lifespan**	**Nitrogen Fixation (Legumes)**	**Fertility Requirement**	**pH Range**
			Shade	**Drought**	**Salinity**				
LEGUMES									
Alfalfa *Medicago sativa*	high	Bunch	low	high	medium	long	high	high	6.0-8.5
Alsike Clover *Trifolium hybridum*	medium	Bunch	medium	low	low	short	high	medium	5.6-7.5
Birdsfoot Trefoil *Lotus corniculatus*	low	Bunch	medium	medium	high	moderate	medium	medium	5.0-8.0
Crown Vetch *Securigera varia*	high	Spreading	low	medium	low	long	medium	medium	5.0-8.0
Red Clover *Trifolium pratense*	high	Bunch	low	low	low	short	medium	medium	5.5-7.6
White Clover *Trifolium repens*	low	Spreading	medium	low	low	moderate	high	high	5.2-8.0

TABLE 7.2 Grass and Legume Grazing and Harvesting Characteristics

TABLE 7.2 Grass and Legume Grazing and Harvesting Characteristics								
Species	**Stand Persistence [1]**	**Bloat Potential (Legumes)**	**Forage Quality [2]**		**Suitability for Grazing [3]**		**Suitability for Mechanical Harvest [4]**	
			Palatability	**Digestibility**	**Rotational**	**Continuous**	**Hay**	**Silage/Haylage**
WARM SEASON GRASSES								
Bermudagrass *Cynodon dactylon*	moderate - long	NA	high	moderate	good	good	good	good
Bluestem, big *Andropogon gerardii*	long	NA	high	high	excellent	poor	excellent	poor
Bluestem, little *Schizachyrium scoparium*	long	NA	moderate	moderate	excellent	poor	excellent	poor
Eastern gamagrass *Tripsacum dactyloides*	long	NA	very high	high	excellent	poor	good	good
Indiangrass *Sorghastrum nutans*	long	NA	high	moderate	excellent	poor	excellent	poor
Purpletop *Tridens flavus*	Moderate-long	NA	Moderate (after frost)	moderate	Fair	Poor	Fair	poor
Switchgrass *Panicum virgatum*	long	NA	moderate	high	good	poor	good	poor
COOL SEASON GRASSES								
Festulolium	Festolium is a cross between fescue and perennial ryegrass. The fescue in the cross is normally a tall or meadow fescue, resulting in big differences between varieties. Specific varieties should be recommended based on the purpose of the planting.							
Kentucky bluegrass *Poa pratensis*	Long	NA	High	Moderate	Excellent	Excellent	Poor	Poor
Meadow brome *Bromus biebersteinii*	Short*	NA	High	Moderate	Excellent	Good	Excellent	Good
Orchardgrass *Dactylis glomerata*	Moderate	NA	Moderate	Moderate	Excellent	Good	Excellent	Excellent
Perennial ryegrass *Lolium perenne*	Short	NA	High	High	Excellent	Poor	Good	Excellent
Red fescue *Festuca rubra*	short	NA	moderate	moderate	Good	Poor	Poor	Poor
Smooth brome *Bromus inermis*	Short	NA	High	Moderate	Late	Good	Poor	Excellent
Tall fescue *Festuca arundinacea*	High	NA	Moderate	Moderate	Excellent	Poor	Good	Excellent
Timothy *Phleum pratense*	Short	NA	Moderate	Moderate	Good	Poor	Excellent	Excellent

TABLE 7.2 Grass and Legume Grazing and Harvesting Characteristics								
Species	**Stand Persistence [1]**	**Bloat Potential (Legumes)**	**Forage Quality [2]**		**Suitability for Grazing [3]**		**Suitability for Mechanical Harvest [4]**	
			Palatability	**Digestibility**	**Rotational**	**Continuous**	**Hay**	**Silage/Haylage**
LEGUMES								
Alfalfa [10/] *Medicago sativa*	high	high	High	high	excellent	poor	excellent	Excellent
Alsike Clover *Trifolium hybridum*	low	high	high	high	good	poor	low	low
Birdsfoot Trefoil *Lotus corniculatus*	medium	none	high	High	Good	Good	Good	Good
Crown Vetch *Securigera varia*	high	low	high	high	good	low	Low	low
Red Clover *Trifolium pratense*	low	high	moderate	high	good	poor	good	good
White Clover *Trifolium repens*	high	low	high	high	excellent	good	good	good

[1] Stand Persistence (Short, Moderate, Long): Persistence of the species (without replanting) as compared to other grasses or legumes. This is an indication of how soon the planting will need to be renovated or overseeded. Long - Generally 5 years or more; Moderate - 3 to 5 years; Short - 1 or 2 years.

[2] Forage Quality (Low, Moderate, High): Values of each species for palatability and digestibility, as compared to other forages. When developing pasture mixes, select species that have similar palatability to minimize selective grazing.

[3] Suitability for Grazing Management (Poor, Fair, Good, Excellent): Describes the suitability of each species for grazing, depending on the type of grazing system used. Rotational Grazing – A system that provides a rest and regrowth period for pastures. Continuous Grazing – A system that allows livestock to have continuous access to pastures.

[4] Suitability for Mechanical Harvest (Poor, Fair, Good, Excellent): Describes the suitability of each species as a mechanically harvested forage crop, depending on whether the forage will be harvested and stored as hay or as silage.

TABLE 7.3: Forage and Hay Seeding Rates and Notes

TABLE 7.3: Forage and Hay Seeding Rates and Notes[1]			
Species	**Standalone Seeding Rate (lbs./ac PLS)[2]**	**Seeding Rate in a Mix (lbs./ac PLS)[3]**	**Notes**
WARM SEASON GRASSES			
Bermudagrass *Cynodon dactylon*			Bermuda grass is an excellent choice for areas that will experience heavy traffic or grazing. Varieties bred for northern climates must be chosen of the grass will winter kill.
Bluestem, big *Andropogon gerardii*	12	3-9	
Bluestem, little *Schizachyrium scoparium*	10	3-8	
Eastern gamagrass *Tripsacum dactyloides*	8-10	4-8	
Indiangrass *Sorghastrum nutans*	12-15	6-8	TOXICITY: Indiangrass will produce prussic acid early in the season and should not be grazed until there is at least 6" of growth.
Purpletop *Tridens flavus*	20	5-15	
Switchgrass *Panicum virgatum*	8	3-6	TOXICITY: Switchgrass contains diosgenin and should only be in pastures and hay stands as a mix. This compound, if consumed in enough concentrations causes photosensitivity in livestock.
COOL SEASON GRASSES			
Festulolium	25	6-19	Festolium is a cross between fescue and perennial ryegrass. The fescue in the cross is normally a tall or meadow fescue, resulting in big differences between varieties. Specific varieties should be recommended based on the purpose of the planting.
Kentucky bluegrass *Poa pratensis*	10-14	3-7	Kentucky blue grass does not produce as much biomass as other cool season grasses but it is well suited for equine pastures and sacrifice areas because it can tolerate close grazing and "self-heals" due to it's sod forming properties.
Meadow brome *Bromus biebersteinii*	20	5-15	Meadow brome will have short stand persistence if not allowed to re-seed itself.
Orchardgrass *Dactylis glomerata*	12	4-8	
Perennial ryegrass *Lolium perenne*	24	6-18	Perennial ryegrass does very well being seeded through frost seeding. Perennial ryegrass varieties with high sugar content is an excellent choice for grazing dairy animals.
Red fescue *Festuca rubra*	4-8	2-4	TOXICITY Red fescue can accumulate copper, lead, manganese, and zinc from contaminated soils. Caution should be used if grazing or harvesting red fescue from contaminated sites.
Smooth brome *Bromus inermis*	12-16	6-8	Smooth brome can be hard to establish at times, but due to its sod forming growth habit it makes an excellent forage and once established is long lived.
Tall fescue *Festuca arundinacea*	15	8-10	TOXICITY: Endophyte infected tall fescue varieties produce ergot alkaloids and can cause fescue toxicosis. Endophyte-free or novel fescues should be chosen to avoid detrimental effects.

TABLE 7.3: Forage and Hay Seeding Rates and Notes[1]			
Species	**Standalone Seeding Rate (lbs./ac PLS)[2]**	**Seeding Rate in a Mix (lbs./ac PLS)[3]**	**Notes**
Timothy *Phleum pratense*	8	4-6	Timothy is more suitable for hay fields than pastures due to its short stand persistence under grazing conditions.
LEGUMES			
Alfalfa *Medicago sativa*	15	8-10	Alfalfa requires areas with good drainage and/or landscape position as it does not do well in wetter areas.
Alsike Clover *Trifolium hybridum*	9	2-7	TOXICITY: Equine grazing of alsike clover can cause photosensitivity, liver disease, and neurologic disorders.
Birdsfoot Trefoil *Lotus corniculatus*	8-10	6-8	Birdsfoot trefoil does very well being seeded through frost seeding. This species is particularly suited for small ruminants because of it's low bloat potential and anti-parasitic properties in goats and sheep.
Crown Vetch *Coronilla varia*	10-15	5-10	TOXICITY: Crown vetch produces nitroglycosides in non-ruminants such as horses and can cause weight loss, ataxia, paralysis, and death.
Red Clover *Trifolium pratense*	10-12	6-8	TOXICITY: Red clover may cause reproductive issues when grazed by sheep. Red clover is an excellent candidate for frost seeding if older pastures or hay fields are low in legumes.
White Clover *Trifolium repens*	5	2-4	If choosing white clover for species with higher grazing tendencies or for browsers, choose an upright variety such as Alice White Clover

[1] If using a standard hay or pasture mix from a reputable seed company, refer to the mix tech sheet for seeding recommendations. Standard mixes should be evaluated to ensure the species and varieties will meet the planting objectives.

[2]Some seeding rates are variety dependent; refer to seeding recommendations based on variety specific tech sheets, if available. If the site has the potential to erode higher seeding rates might be needed.

[3] Mix rates will be dependent on the number of species in each mix. If there will be four species in the mix, use ¼ of the standalone rate for each species; if there will be three species in the mix use 1/3 the standalone rate, and so on for each mix. If more than four species will be in the mix use at least the minimum shown on the chart.

Section 7 References

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Section 8 – Cover Crop Plantings

This section contains recommendations for cover crops based on the site location and objectives.

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Selecting and Establishing Plantings

Refer to Tables 8.1 and 8.2 for a listing of cover crops, seeding rates, seeding depths, planting dates, and suitable uses. Select species based upon time of year, availability, and cost of seed, and geographic location. Adjust the seeding rate as appropriate based on the method of planting.

Always choose cover crops with a strong ability to address the site-specific soil concern. If the cover crop is not being used to treat a soil concern (such as pest management), choose a mix that best treats the resource concern.

Plant cover crops as early as possible and terminate as late as feasible to maximize plant biomass and nutrient uptake, considering crop insurance criteria, the time needed to prepare the field for the following crop, and soil moisture depletion.

See Appendix A: Cover Crop Termination Guidelines to ensure the cover crop termination method is planned within the approved timeline and for more information on how termination dates may affect a producer's crop insurance claims.

Table 8.1: Cover Crop Selection Based on Ability to Treat Soil Concern

Table 8.1: Cover Crop Selection Based on Ability to Treat Soil Concern[1]									
		Species	**Nutrient Losses**	**Nitrogen Fixation**	**Organic Matter & Overall Structure**	**Erosion**	**Weeds**	**Subsoil Compaction & Infiltration**	**Topsoil Compaction & Infiltration**
Warm Season	Grasses	Sorghum Sudan Grass	S	W	S	S	S	S	M
		Pearl/Proso Millet	M	W	S	S	S	W	S
		Teff	S	W	S	S	S	W	M
	Brassicas and Non-Leguminous Broadleaves	Buckwheat	W	W	M	W	S	W	S
		Safflower	S	W	M	M	M	S	M
		Sunflower	S	W	M	M	M	S	M
	Legumes	Cowpea	W	S	M	S	S	S	S
		Sunn Hemp	M	S	S	M	S	S	M
		Berseem Clover	S	S	S	S	S	W	S
		Soybean	W	S	W	W	M	W	M
Cool Season	Grasses	Annual Ryegrass	S	W	S	S	S	M	S
		Rye	S	W	S	S	S	W	S
		Barley	S	W	S	S	S	M	S
		Wheat	S	W	S	S	S	M	S
		Triticale	S	W	S	S	S	M	S
		Oats	S	W	M	S	S	W	S
	Brassicas and Non-Leguminous Broadleaves	Radish	S	W	S	S	S	S	M
		Rapeseed and Canola	S	W	M	S	S	M	M

Table 8.1: Cover Crop Selection Based on Ability to Treat Soil Concern[1]									
		Species	**Nutrient Losses**	**Nitrogen Fixation**	**Organic Matter & Overall Structure**	**Erosion**	**Weeds**	**Subsoil Compaction & Infiltration**	**Topsoil Compaction & Infiltration**
Cool Season	Brassicas and Non-Leguminous Broadleaves	Mustards	M	W	S	S	S	W	S
		Phacelia	S	W	M	M	M	W	S
		Turnip	S	W	W	W	S	S	S
	Legumes	Red Clover	M	S	S	M	S	S	M
		Sweetclover	W	S	S	S	S	S	S
		White Clover	W	S	M	S	S	W	S
		Subterranean Clover	W	S	S	S	S	W	M
		Crimson Clover	M	S	S	S	S	W	M
		Field Peas	W	S	S	S	S	W	M
		Hairy Vetch	W	S	S	M	M	M	S

[1] S = Strong ability to treat concern; M = Moderate ability to treat concern; W = Weak ability to treat concern

TABLE 8.2: Cover Crop Seeding Rates, Dates and Additional Information

Table 8.2: Additional Cover Crop Planting Information and Recommendations[1]						
Species	**Seeding Rate (lbs. /ac.) (in PLS)**		**Seeding Depth (inches)**	**Planting Dates by Hardiness Zone**		**Comments**
	Drilled	Broadcast		6a and 6b	7a and 7b	
Warm Season Grasses						
Sorghum – Sudan (*Sorghum bicolor x S. bicolor* var. *Sudanese*) Also called Sudex or Sudax	35	52.5	½ - 1½	5/1 – 5/31	4/15 – 4/30	▪ Best to mix with buckwheat, sunn hemp, soybeans, or cowpeas. ▪ Sorghum – Sudan grass can yield very high amounts of biomass, growing 5-12 feet tall. ▪ Mowing when plants reach 3 to 4 feet deep will increase root mass five to eight times compared to non-mowed stands. ▪ This species is high in prussic acid and can contribute to livestock health issues if grazed. Once the plants reach maturity, the stems can become woody.
Pearl/Proso Millet (*Pennisetum glaucum*)/ (*Panicum miliaceum*)	14	21	½ - ¾	5/1 – 6/15	5/15 – 7/1	▪ Millet is drought tolerant and adapted to areas that have poor soil quality. ▪ Millet can grow to be 12 feet tall; residue management may be a problem.
Teff (*Eragrostis tef*)	5	7.5	¼	5/15 – 7/1	5/15 – 7/1	▪ Planting teff grass deeper than ¼ " can lead to a stand failure. This grass must be planted shallow for good establishment. ▪ Soil temperature should be at least 65° before planting.
Warm Season Brassicas/Non-Legume Broadleaf						
Buckwheat (*Fagopyrum esculentum*)	50	75	½ - 1 ½	7/1 – 8/1	6/15 – 7/30	▪ Best to mix with sorghum-sudangrass hybrids and sunn hemp. ▪ Buckwheat will grow on a wide variety of soils and soils of poor quality. It will grow rapidly once planted. Buckwheat is very frost sensitive and does not grow well on heavy limestone soils. ▪ Buckwheat is quick to germinate and grow a dense ground cover. It will decompose quickly at the end of the season, releasing nutrients for the following crop. ▪ Buckwheat may become a weed if not terminated 7 to 10 days after flowering begins.
Safflower (*Carthamus tinctoris)*	15	22.5	1 – 1½	4/1 – 5/1	4/1 – 5/1	▪ Safflower taproots can reach 8 to 10 feet deep, depending on subsoil moisture and temperature. ▪ Safflower is sensitive to residual herbicides that are usually used on small grains. ▪ Due to the initial slow growth of safflower, weed control can be a problem and can hurt stands. Once safflower begins to grow, the canopy will close in allowing the plant to out compete late emerging weeds. ▪ A heavy stand of safflower is difficult to walk through due to the "spikes" on the leaves and stems.
Sunflower	5	7.5	½ - 1	5/15 – 8/15	5/15 – 8/15	▪ Sunflower tap roots can grow as deep as 6.5 feet.

Table 8.2: Additional Cover Crop Planting Information and Recommendations[1]						
Species	**Seeding Rate (lbs. /ac.) (in PLS)**		**Seeding Depth (inches)**	**Planting Dates by Hardiness Zone**		**Comments**
	Drilled	Broadcast		6a and 6b	7a and 7b	
(***Helianthus annuus***)						
Warm Season Legumes						
Cowpea (***Vigna unguiculata***)	50	Not rec.	1 - 1½	7/1 – 8/15	7/15 – 9/1	▪ Best to mix with sorghum-sudangrass and millets. ▪ In New Jersey, cowpea should be mixed with another cover crop if weed suppression is desired. ▪ Due to the nectaries on cowpea, it serves as an excellent crop for beneficial insects. ▪ If cowpeas are going to be used as a green manure, the entire plant should be green at the time of kill down for a quick release of nutrients back into the system. ▪ Mowing or rolling has not been found to be effective as stand-alone practices to terminate the crop.
Sunn Hemp (***Crotalaria juncea***)	10	15	½ - 1	Up to 8/15	Up to 9/1	▪ Sunn Hemp has the ability to fix high amounts of N (up to 140 lbs. /ac.) and a large amount of biomass in as little as 60 days from the time of planting. ▪ Sunn Hemp is adapted to many poor soil conditions and will grow on poor sandy soils better than other warm season cover crops. ▪ Sunn Hemp can grow as tall as 4 feet in 60 days and can reach heights of 6 feet after 90 days.
Berseem Clover (***Trifolium alexandrinum***)	7	10.5	¼ - ¾	8/1 – 8/31	8/15 – 9/15	▪ Best to mix with oats, ryegrass, and small grains. ▪ Berseem Clover can fix 100 to 200 lbs. of N or more, making it an ideal cover following small grains before a heavy N user such as corn is planted. It will winterkill, so a cover good at scavenging N should be planted if N management is the goal. ▪ If soil tests show P levels at below 20 ppm, phosphorus amendments must be applied for Berseem Clover to grow.
Cool Season Grasses						
Annual Ryegrass (***Lolium multiflorum***)	20	30	¼ - ½	8/1 – 9/15	9/1 – 10/31	▪ Best to mix with other grasses and legumes. ▪ Ryegrass prefers well drained loam or sandy loam soils, but will establish well on poor soils. ▪ Annual ryegrass has the capability to scavenge high amounts of nitrate in the topsoil over winter and into spring.
Rye (***Secale cereale***)	90	135	¾ - 2	8/1 – 10/31	9/1 – 10/31	▪ Best to mix with legumes, grasses, and other small grains. ▪ Rye's residue will take a relatively long time to break down in the spring. N could be immobilized, requiring a higher than normal N application at planting time. ▪ The allelopathic effects of rye usually begin to taper off after 30 days. When planting small seeded crops such as carrots or onions, leave at least 3 to 4 weeks between the time the rye was killed and the time the crop is planted. Rye seedlings have more allelopathic compounds than mature rye.

Table 8.2: Additional Cover Crop Planting Information and Recommendations[1]						
Species	**Seeding Rate (lbs. /ac.) (in PLS)**		**Seeding Depth (inches)**	**Planting Dates by Hardiness Zone**		**Comments**
	Drilled	Broadcast		6a and 6b	7a and 7b	
Barley (*Hordeum vulgare*)	95	142.5	¾ - 2	8/1 – 9/31	8/15 – 10/15	▪ Best to mix with annual legumes, ryegrass, and other small grains. ▪ Has the capability of producing more biomass in a shorter time than other cereal crops. ▪ Can develop deep fibrous roots up to 6.5 feet deep. ▪ Will release allelopathic chemicals to help weed suppression. ▪ Barley is less winter hardy than wheat, triticale, or rye. ▪ Best small grain to use in salt affected soils.
Wheat (*Triticum aestivum*)	110	165	¾ - 2	8/1 – 10/31	9/1 – 10/31	▪ Best to mix with legumes, ryegrass, or other small grains. ▪ Wheat is excellent at recycling nitrogen, potassium, and phosphorus if the stems and leaves aren't removed during harvest or kill down.
Triticale (*Triticale hexaploide*)	90	135	½ - 1 ½	8/15 – 10/15	9/1 – 10/31	▪ Triticale is a cross between Durham wheat and rye. It has the disease resistance of wheat and the hardiness of rye. ▪ Triticale generally does not grow as tall as rye, and therefore is easier to manage for residue in the spring.
Oats (*Avena sativa*)	90	135	½ - 1½	8/1 – 10/15	9/1 – 10/31	▪ Best to mix with clovers, peas, vetches, and other small grains. ▪ Allelopathic compounds can suppress weeds, but may also hinder the growth of subsequent crops such as lettuce, cress, timothy, rice, wheat, and peas. Oats should be killed down at least three weeks prior to planting these crops.
Cool Season Brassicas/Non-Legume Broadleaf						
Radish (*Raphanus sativus*)	6	9	¼ - ½	8/1 – 9/15	9/1 – 10/1	▪ If odor is a concern, radish should be planted in a mix with other cover crops and the seeding rate reduced to no more than 2-3 lbs./ac. ▪ Produces large amounts of above and below ground biomass. ▪ The varieties 'niger' and 'longipinnatus' have very long, thick tap roots. These varieties are sometimes referred to as "tillage" radishes because they can be used to break up hard pans. The variety 'oleiferus' (usually grown for oilseed) has shorter roots but is somewhat more winter hardy. ▪ Will die-off once temperatures reach about 25° F
Rapeseed/Canola (*Brassica rapa) / (Brassica napus)*	5	7.5	¼ - ¾	8/1 – 9/15	9/1 – 10/1	▪ Best to mix with other brassicas, small grains, and crimson clover ▪ All brassicas (rape, mustards, and turnips) will release bio-toxic compounds or metabolic by-products that exhibit broad activity against bacteria, fungi, insects, nematodes, and weeds. ▪ If grown on sandy soils, extra sulfate sulfur may be needed for improved growth. ▪ Some winter-type cultivars can withstand temperatures of 10° F. ▪ Will grow to be 3 – 5 feet tall.
Mustards (*Brassica hirta/ Brassica juncea)*	12	18	¼ - ¾	7/15 – 9/1	7/15 – 9/1	▪ Best to mix with other brassicas, small grains, and crimson clover ▪ Mustards have the highest concentration (of the brassica family) of bio-toxic compounds or metabolic by-products. ▪ Will die-off once temperatures reach about 25° F.

Table 8.2: Additional Cover Crop Planting Information and Recommendations[1]						
Species	**Seeding Rate (lbs. /ac.) (in PLS)**		**Seeding Depth (inches)**	**Planting Dates by Hardiness Zone**		**Comments**
	Drilled	Broadcast		6a and 6b	7a and 7b	
Phacelia (*Phacelia tanacetifolia*)	7	Not Rec.	¼ - ½	3/15 – 5/15 or 8/1 – 9/1	3/15 – 5/15 or 8/1 – 9/1	▪ Phacelia has shallow root systems, but can greatly improve soil structure and aggregation within the top two inches of the profile. ▪ This is a fast growing crop that can reach grow up to 4 feet tall. ▪ Excellent cover crop to be used by pollinators. ▪ Will winter kill once temperatures reach the mid-teens.
Turnip *(Brassica rapa)*	3	4.5	¼ - ½	8/1 – 9/15	9/1 – 10/1	▪ Best to mix with other brassicas, small grains, and crimson clover ▪ Will die-off once temperatures reach about 25° F.
Cool Season Legumes						
Red Clover (*Trifolium pratense*)	10	15	¼ - ¾	8/15 – 9/15	9/1 – 10/1	▪ Best to mix with small grains, sweetclover, corn, soybeans, vegetables, and grass forages. ▪ Red clover is shade tolerant and can germinate at temperatures as low as 41° F. ▪ Do not plant red clover within six weeks of when a pre-emergent herbicide was applied.
Sweetclovers (*Melilotus sp.*) Yellow Sweetclover and White Sweetclover	10	15	¼ - 1	8/1 – 9/15	8/15 – 10/1	▪ Best to mix with small grains and red clover. ▪ Sweetclovers are very drought tolerant and winter hardy. ▪ Sweetclovers are able to mine phosphorus, potassium, and micronutrients from the soil and release them to be available to other soil biota. ▪ For maximum effect of subsoiling, use the lowest recommended seeding rate. ▪ Sweetclover residue is allelopathic towards Russian thistle, dandelion, perennial sowthistle, jimson weed, green foxtail, and Canada thistle. ▪ Sweetclover is a poor competitor with weeds within the establishment year.
White Clover (*Trifolium repens*)	3 – 9	5 – 14	¼ - ½	8/15 – 9/15	9/1 – 10/1	▪ Best mixed with annual ryegrass and red clover. ▪ White clover is one of the best cover crops to plant (frost seed or broadcast) into a growing cash crop. ▪ White clover is less tolerant of soils with pH's above 7 than the other clovers. ▪ White clover holds up to 45% of the plant's N in the roots. Light tillage will increase the release of N into the soil system.
Subterranean Clover (*Trifolium subterraneum*)	24	36	¼ - ½	10/1 – 10/15	10/1 – 10/15	▪ Best to mix with other clovers. ▪ Subclovers provide good weed suppression without needing to grow height-wise. ▪ Subclover can be relatively hard to kill in the spring using only light tillage before the plant blooms. ▪ Subclovers will release allelopathic compounds that can hinder the growth of crops if the clover isn't killed early enough. ▪ Subclovers will generally need the average low temperature to be 63-67°F for successful germination of the stand to occur.

Table 8.2: Additional Cover Crop Planting Information and Recommendations[1]						
Species	**Seeding Rate (lbs. /ac.) (in PLS)**		**Seeding Depth (inches)**	**Planting Dates by Hardiness Zone**		**Comments**
	Drilled	Broadcast		6a and 6b	7a and 7b	
Crimson Clover (*Trifolium incarnatum*)	15	22.5	¼ - ¾	8/15 – 9/15	9/1 – 10/1	▪ Best to mix with rye and other cereal crops, vetches, annual ryegrass, subterranean clover, and red clover. ▪ Crimson clover can often overwinter in New Jersey. ▪ Does best in well drained soils; it may not grow well on heavy clay, waterlogged, extremely acidic or alkaline soils. ▪ Do not plant too early in the summer/fall.
Field Peas (*Pisum sativum subsp. Arvense*)	50	75	1½ - 3	8/1 – 9/15	8/15 – 10/1	▪ Best to mix with wheat, rye, triticale, or barley. ▪ Do not plant winter hardy peas (Austrian winter pea) too early in the summer as this will cause minimized growth of the plants. ▪ Austrian winter pea is an exceptional choice for a green manure due to quick and sustained N mineralization. ▪ Can withstand temperatures as low as 10° F.
Hairy Vetch (*Vicia villosa*)	20	30	½ - 1½	8/1 – 9/15	9/1 – 10/1	▪ Best to mix with small grains, field peas, crimson clover, and buckwheat. ▪ Hairy Vetch can produce its maximum nitrogen inputs in the spring before corn is planted. ▪ Mixes of hairy vetch and oats have been proven to reduce the amount of surface ponding and soil crusting in loam and sandy loam soils.

1 All of the information in this table is for planning purposes. Seed suppliers may have varieties specifically adapted for alternative uses or climates not represented in this table. Additionally, the information in this table is for the traditional use of each cover crop; sometimes a cover crop is planted outside of the traditional planting window for a variety of reasons and purposes. Consult with the NJ Conservation Agronomist or with the seed dealer if the cover crop will be used outside of the normal planting season.

Section 9 – Vegetative Barrier Plantings

NRCS Conservation Practice Standard (CPS) Vegetative Barrier (VB) (Code 601) is a conservation buffer practice consisting of permanent strips of stiff, narrow (3- to 5-ft wide), dense vegetation planted along the general contour of slopes or across concentrated flow areas at angles convenient for farming (Kemper et al., 1992; fig. 1). They reduce sheet and rill erosion, decrease ephemeral gully erosion, manage water flow, stabilize steep slopes, and trap sediment (Dabney et al., 1993; Meyer et al., 1994, fig. 2). Vegetative barriers may be used in conjunction with other conservation practices or conservation tillage system (McGregor and Dabney, (1993) to reduce soil erosion and improve water quality

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Selecting and Establishing Plantings

Refer to Appendix B: Plant Materials Technical Note No 6: Vegetative Barriers to determine the species, planting dates, and spacing of vegetative barrier plantings.

Section 10: References

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Appendix A: NRCS Cover Crop Termination Guidelines –Updated June 2019

USDA United States Department of Agriculture

NRCS Cover Crop Termination Guidelines Version 4: June 2019

Cover Crops and Crop Insurance Overview – What you need to know as a producer:

Prior to the passage of the 2018 Farm Bill, the NRCS Cover Crop Termination Guidelines (Guidelines) had to be followed, or a deviation had to be approved in advance, for insurance to attach to a crop planted in a management system that included cover crops. However, cover crop adoption and regional availability of data on successful cover crop management have expanded significantly since the last Guidelines revision in 2014. For crops planted in the 2020 crop year and later, insurance will now attach at time of planting the insured crop and cover crop management practices will be reviewed under Risk Management Agency (RMA) rules for Good Farming Practice (GFP) determinations similar to other management decisions (e.g. fertilizer application, seeding rates, etc.)

Insurance attaches at planting as per the changes in the 2018 Farm Bill. In the event of a claim that is questioned by an Approved Insurance Provider (AIP) on the grounds of cover crop management, the AIP will complete research to adhere to procedure in order to make an initial GFP decision. For additional details regarding good farming practice determinations please see the RMA Good Farming Practice Handbook.

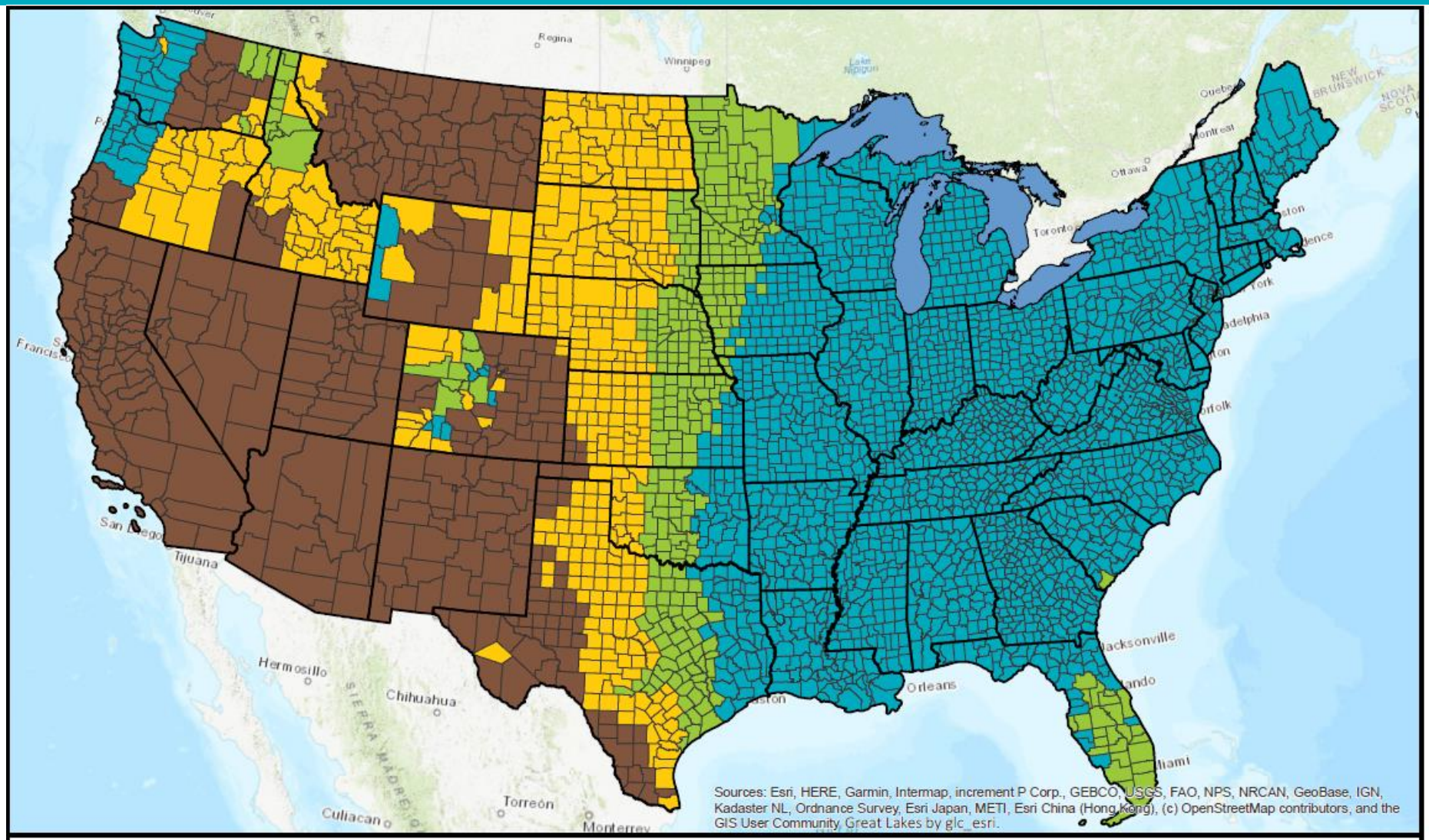
These Guidelines[1] are not intended as a substitute for best locally adaptive management for cover crop termination timing that optimizes water use efficiency, erosion control, soil health improvement, weed and pest control, allelopathy, habitat for beneficial organisms, nutrient cycling, and water quality improvement. The Guidelines provide a pre-approved latest end date for termination from a water availability standpoint for USDA programs. The Guidelines only apply to non-irrigated cropland, including systems that contain a fallow period. Cover crops in an irrigated cropping system should be terminated based on the crop system, water availability, and the conservation purpose, but before the planted crop emerges.

BACKGROUND

To ensure that USDA policies are coordinated and up to date with evolving cover crop practices, the Chief of the Natural Resources Conservation Service (NRCS), and the administrators of RMA and Farm Service Agency (FSA) organized an interagency workgroup to develop consistent, simple and flexible policy across the three agencies. National and local experts, along with multiple stakeholders, were involved in the process. Research literature, plant growth, soil hydrology models, and input from national/local experts in cover crop management provided the basis for the Guidelines to achieve their conservation benefits while minimizing risk of reducing yield to the following crop due to soil water use. These Guidelines are applicable to all USDA programs. The agencies welcome stakeholders to provide literature and data for use in improving these Guidelines over time. To share literature and data, stakeholders may contact their local NRCS office.

1 The purpose of these Guidelines is to provide an additional level of comfort for producers that may be unfamiliar with cover crops and want up front assurance that their crop is insured and their cover cropping management decisions will be considered a GFP. These Guidelines serve as a recognized nationally applicable agricultural expert resource for cover crop termination in cover cropping management systems. However, producers may also be implementing innovative cover cropping systems that fall outside these Guidelines. To help maximize additional flexibility and up - front assurance, producers can choose to pursue any one of the following options to assure that their cover cropping management system is a GFP.

1. A producer can follow the generalized zonal guidance provided in these Guidelines,
2. A producer can utilize already available published materials from agricultural experts (e.g., from a university) that are applicable for the crop and the area that support the cover crop management practice as a GFP determination (per the GFP Handbook
3. In rare instance where 1 and 2 do not cover a specific cover cropping management system, request an exception to these Guidelines by receiving agricultural expert support in writing in accordance with the GFP Handbook.



Zone 1 - Terminated Cover Crop 35 Days or Earlier Before Planting, except for RMA Summerfallow Practice.

Zone 2 - Terminated Cover Crop 15 Days or Earlier Before Planting, except for RMA Summerfallow Practice.

Zone 3 - Terminated Cover Crop at or Before Planting, except for RMA Summerfallow Practice.

Zone 4 - Terminated Cover Crop Before Crop Emergence.

Map Legend

Zone 1 – See Map	Zone 2 – See Map	Zone 3 – See Map	Zone 4 – See Map
For Late Spring to Fall Seeded Crops – Terminate cover crops 35 days or earlier prior to planting the crop. Early Spring Seeded Crops – Terminate cover crops as soon as practical prior to planting the crop. (Additional Zone Guidance #2 and Definition #12.)	For Late Spring to Fall Seeded Crops – Terminate cover crops 15 days or earlier prior to planting the crop. Early Spring Seeded Crops – Terminate cover crops as soon as practical prior to planting the crop. (Additional Zone Guidance #2 and Definition #12.)	Terminate cover crop at or before planting the crop	Terminate cover crop before crop emergence.
RMA Designated Summerfallow Practice (See Definition #13 for additional guidance)	RMA Designated Summerfallow Practice See Definition #13 for additional guidance)	RMA Designated Summerfallow Practice See Definition #13 for additional guidance)	

Additional Zone Guidance

1. If the cover crop is part of a no-till system, termination may be delayed up to 7 days from the zone-based termination deadline.
2. Fall seeded cover crops will have limited growth in the spring prior to "early" spring seeded crops, seeded prior to March 20, (e.g., spring wheat, sugar beets, corn), and therefore the cover crop may be terminated as late as at crop planting.
3. When earlier than normal planting occurs due to favorable weather or soil conditions, cover crop termination will naturally occur closer to planting. For example, if planting occurs 15 days earlier than normal, the cover crop termination period may be 15 days closer to planting (or at planting in zone 2).
4. If the season is drier than normal nearing cover crop termination time, consider an earlier termination to conserve soil moisture.
5. If the spring season is wetter than normal at cover crop termination time, consider a later termination to use excess soil moisture, increase infiltration of additional rain, and improve soil health and seedbed condition. For example, in zone 2, if the field is too wet to terminate a cover crop 15 days before planting, the cover crop may be terminated closer to planting.
6. Seasonal cover species used as herbaceous wind barriers or nurse crops (short season cover crops) that protect the insured crop as it establishes (see definitions) are not considered cover crops and do not impede insurability. The seasonal covers used for the purpose of early crop establishment must be appropriate species for the area and the planned purpose.

Definitions

1. **Cover Crop** – Crops including grasses, legumes and forbs for seasonal cover and other conservation purposes. Cover crops are primarily used for erosion control, soil health improvement, weed and other pest control, habitat for beneficial organisms, improved water efficiency, nutrient cycling, and water quality improvement. A cover crop managed and terminated according to these Guidelines is not considered a "crop" for crop insurance purposes. The cover crop may be terminated by natural causes such as frost, or intentionally terminated through management such as chemical application, crimping, rolling, tillage, grazing, or cutting.
2. **Cover Crop Termination** – Means a practice that historically and under reasonable circumstances results in the termination of the growth of a cover crop.
3. **Good Farming Practice** – RMAterm - The production methods utilized to produce the insured crop and allow it to make normal progress toward maturity and produce at least the yield used to determine the production guarantee or amount of insurance, including any adjustments for late planted acreage, which are those generally recognized by agricultural experts or organic agricultural experts, depending on the practice, for the area.
4. **Continuous Cropping** – RMA Term – Any non-irrigated production practice that does not qualify as a summerfallow practice.
5. **Over-Seeding/Interseeding** – Both terms can be defined as planting one or more cover crop species into an existing or established crop. Common uses that involve over-seeding or interseeding include: (1) over-seeding a grass and/or legume cover crop into an existing stand of small grain at an appropriate time for the cover and germination, or (2) seeding a cover crop into an existing crop (e.g., corn or soybeans) and in a way where cover crop and main crop planting permits separate agronomic maintenance or management at a time that will not impact the yield or harvest of the insured crop. This seeding method does not affect the insurability of the main crop. Insurance attaches at the time of planting the insured crop and overseeding/interseeding occurs after the insured crop is planted, so the crop is insurable. Overseeding/interseeding is a separate planting method from interplanting.
6. **Interplanting** – This involves multiple crop species grown together, with no distinct row pattern and does not permit separate agronomic maintenance or management. For RMA purposes, this means if a cover crop and insured crop are planted in a way that does not permit separate agronomic maintenance or management, then that crop is not insurable. This would also apply to cover crops if interplanted into the insured crop and the cover crop interfered with the agronomic management and harvest of the main crop.
7. **Relay Cropping** – The practice of interseeding a second crop into the first crop well before the first crop is harvested. The relay cropping strategy is used to enable production of a second crop in areas where time for seeding the second crop following harvest of the first is considered inadequate for double cropping. This is not considered a cover cropping practice, but a method of double cropping and may fall under the RMA 1st / 2nd crop rules.
8. **Double-Cropping** – RMA and NRCS term - Producing at least 2 crops for harvest from the same acreage in the same crop year. This does not include cover crops that have been managed and terminated according to these Guidelines.
9. **Early Spring-Seeded Crops** – Crops planted as early as possible after the spring thaw are considered early spring crops (e.g., spring wheat, spring barley, sugar beets, corn).
10. **Herbaceous Wind Barriers** – There are specific cropping situations when seasonal cover is needed to protect young seedlings from wind erosion abrasion. The typical seasonal covers may include such crops as wheat, rye, or oats that are planted in rows (e.g., 20 feet apart, single or double row of small grain). These seasonal covers fall under the NRCS CPS Herbaceous Wind Barriers (Code 603). These barriers are not considered cover crops.

Definitions

11. **Nurse crop (companion crop)** – A crop planted into the same acreage as another crop, that is intended to be harvested or terminated separately, and which is planted to improve growing conditions for the crop with which it is grown. Short season cover crops are nurse crops in specific cropping situations, where the producer will plant the intended crop, plus a short-term seasonal cover crop (NRCS CPS Cover Crop, (Code 340)) prior to or at the same time as planting the main or insured crop. In this case the seasonal cover emerges first and provides short term wind erosion protection until the main crop becomes established and provides its own protection from wind erosion. These seasonal cover crops are terminated by cultivation, frost /winterkill, or herbicides once the main crop is established. The seasonal covers used for the purpose of early crop establishment must be appropriate species for the area and the planned purpose and permit separate agronomic maintenance or management that will not impact the yield or harvest of the insured crop and in accordance with applicable crop provisions.

12. **Cover Crop Haying, Grazing, or Forage Harvest** – Cover crops may be hayed, grazed, or harvested as silage, unless prohibited by RMA crop insurance policy provisions. Cover crops cannot be harvested for grain or seed.

13. **RMA Summerfallow Practice** – If a cover crop is planted during the fallow year, the acreage may be insured under the summerfallow practice for the current crop year provided the cover crop was not hayed, grazed, or otherwise harvested, and terminated in accordance with the Guidelines but no later than June 1 preceding the insured crop. RMA summerfallow practice is an insurability requirement and cover crops planted on summerfallow acreage must be terminated in accordance with this definition. Producers should contact their local NRCS office for appropriate cover crops that can be grown in summerfallow regions. Examples of high water use cover crops are alfalfa, sugar beets, cereal rye, corn, mustard, radishes, and turnips.

    For the 2020 and succeeding crop years, if a cover crop was planted during the fallow year was hayed, grazed, or otherwise harvested, or not terminated by June 1, the acreage may be insured under the "continuous cropping practice" (if available in your county), or by written agreement (if continuous cropping is not available in your county).

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https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1263176.pdf
RMA Good Farming Practice Handbook -
https://www.rma.usda.gov/en/Policy-and-Procedure/Program-Administration---14000
NRCS State FOTG for list of approved cover crop species -
https://efotg.sc.egov.usda.gov/#/details

Appendix B: Plant Materials Technical Note No. 6: Vegetative Barriers

https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/natpmtn13722.pdf

United States Department of Agriculture

Natural Resources Conservation Service

Plant Materials Program
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Plant Materials Technical Note No. 6

Selecting, Planting, and Managing Grasses for Vegetative Barriers




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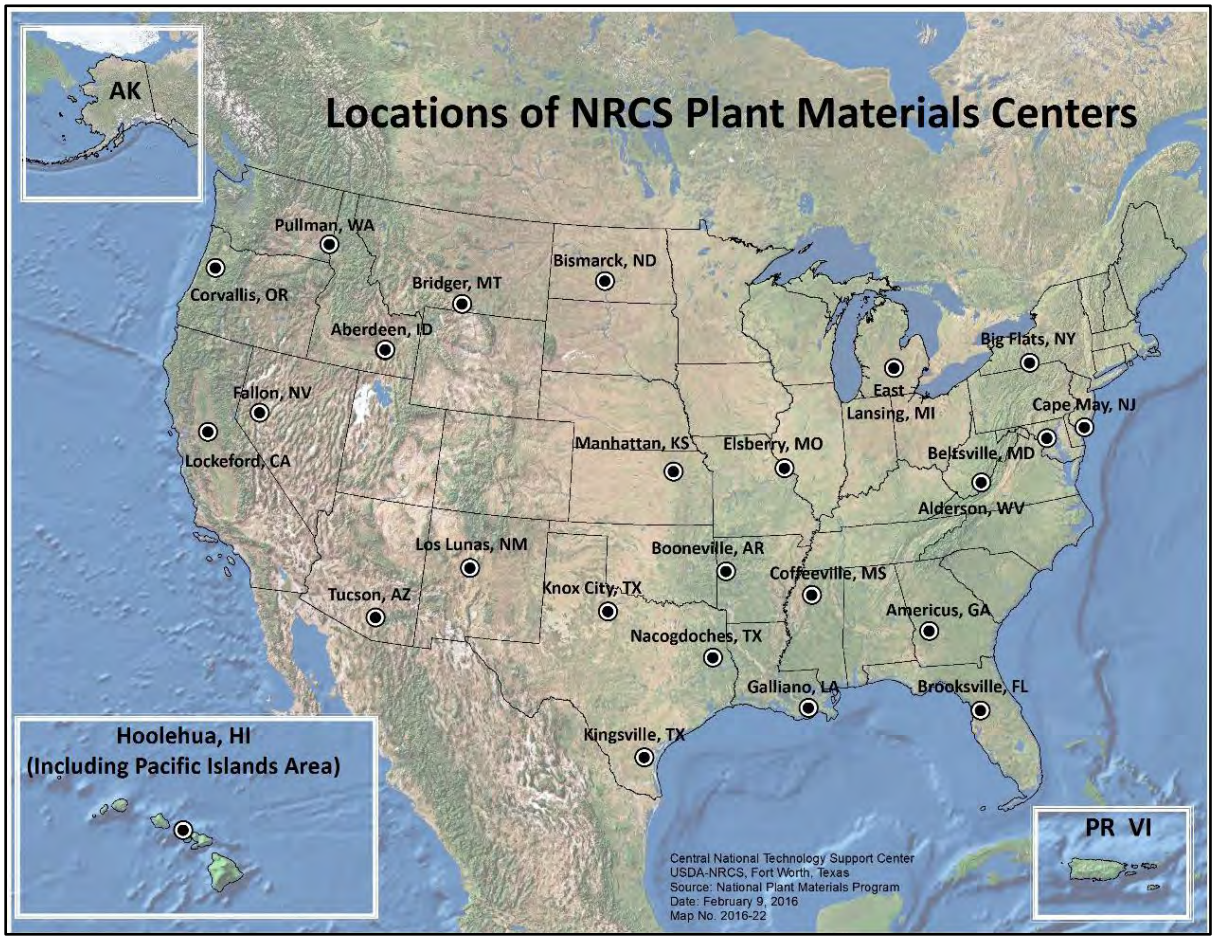
Preface

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Plant Materials Program has been involved in the evaluation of conservation plants and planting technology for more than 80 years. The Plant Materials Program releases plant material for use in conservation applications. This technical note provides information on perennial warm and cool season grasses that meet requirements for the installation of NRCS Conservation Practice Standard Vegetative Barrier (VB) (Code 601) or those suitable for improving the efficiency of other conservation buffers such as filter strips, field borders, riparian forest buffers, and contour buffer strips. Species not meeting the VB standard are listed in Appendix A of this technical note for reference.

For additional information on specific species of plants mentioned in this publication, please see the USDA PLANTS database at: (http://plants.usda.gov/java/) or contact the nearest Plant Materials Center or plant materials specialist (https://www.nrcs.usda.gov/wps/portal/nrcs/main/plantmaterials/contact/directory/) that serves the State. Additional technical resources on the National Plant Materials Program web site at: (https://www.plant-materials.nrcs.usda.gov/).



Introduction

NRCS Conservation Practice Standard (CPS) Vegetative Barrier (VB) (Code 601) is a conservation buffer practice consisting of permanent strips of stiff, narrow (3- to 5-ft wide), dense vegetation planted along the general contour of slopes or across concentrated flow areas at angles convenient for farming (Kemper et al., 1992; fig. 1). They reduce sheet and rill erosion, decrease ephemeral gully erosion, manage water flow, stabilize steep slopes, and trap sediment (Dabney et al., 1993; Meyer et al., 1994, fig. 2). Vegetative barriers may be used in conjunction with other conservation practices or conservation tillage system (McGregor and Dabney, 1993) to reduce soil erosion and improve water quality.

Figure 1: Vegetative barrier planted to 'Alamo' switchgrass in a cotton field in Quitman county, MS.

Figure 2: Vegetative barrier trap sediment on the upslope side of the barrier.

Vegetative Barrier Vegetation Requirements

Research at the USDA-Agricultural Research Service, National Sedimentation Laboratory, Oxford, MS, established minimum stem diameter and stem density values for vegetation stiffness index (VSI) for concentrated flow areas (VSI = 0.10) and other purposes (VSI = 0.05) to improve the efficiency of conservation buffer practices such as NRCS CPSs Filter Strip (Code 393), Field Border (Code 386), Riparian Forest Buffer (Code 391), and Contour Buffer Strips (Code 332) (table 1).

Selecting Grasses for Vegetative Barriers

Research has shown that perennial grasses that have coarse stems will work as VB if they can be established as a uniform and dense strip and are tolerant of sediment deposition (Dabney et al., 1999). Vegetative barriers consist of stiff, erect, perennial grasses adapted to local soil and climatic conditions with enough stem strength to remain erect against expected water flows.

Suitable VB plants must satisfy several criteria. They must be tolerant to the following: (a) herbicides used on adjacent cultivated crops; (b) partial shading from cultivated crops; (c) inundation by sediment; (d) local climatic extremes (wetness, drought, freezing temperatures, etc.); and, (e) easily established (Dewald et al., 1996). They must also be long-lived and manageable as a narrow strip, non-weedy and not too competitive with adjacent cultivated crops.

Table 1. Stem diameter and minimum stem density values for vegetation stiffness index (VSI) of 0.10 and 0.05[1/].

Stem Diameter (Inches)	Concentrated Flow Areas Stem Density Per Square Foot @ VSI=0.10	Other Purposes Stem Density Per Square Foot @ VSI=0.05
0.10	1,000	500
0.15	200	100
0.20	60	30
0.25	30	15
0.30	15	7
0.35	7	4
0.50	3	2
=/>1.00	1	1

1/ Table adopted from the 2020 revised Vegetative Barrier Practice Standard.

Stem Properties of Warm and Cool Season Grasses

Plant Materials Centers collected stem diameter and stem density values of commercially available cultivars and pre-varietal germplasms of native and introduced, cool and warm season perennial grasses to determine their usefulness as a vegetative barrier based on the calculation of VSI of the grass (Dunn and Dabney, 1996).

$$\text{Vegetation Stiffness Index} = \text{Stems/ft}^2 \times \text{Stem diameter to the } 4^{\text{th}} \text{ power}$$

For example: Grass has 70 stem/ft^2 with an average stem diameter of 0.20. To calculate the VSI multiply 70 by 0.20 to the 4th power. The VSI calculation is 0.112.

The product from the VSI calculation must be $\geq$ 0.10 for concentrated flow areas and $\geq$ 0.05 for other conservation buffer practices such as CPSs Filter Strip (Code 393), Field Border (Code 386), Riparian Forest Buffer (Code 391), and Contour Buffer Strips (Code 332).

Plant grasses at the recommended critical area (CPS Critical Area Planting (Code 342)) seeding rate for quick, dense stands to meet the minimum requirements for VSI. Grasses listed in tables 2 and 3 met the VSI of 0.10 and/or 0.05. It is important to note that grass cultivars or pre-varietal germplasm selections that meet VSI requirements in the region tested may not necessarily meet the VSI requirements when grown in a different region of the United States, where adapted. For example, 'Alamo' switchgrass met the VSI requirements for concentrated flow areas in Kingsville, TX, and Coffeeville, MS, but did not meet the VSI requirement in Beltsville, MD. However, Alamo met the VSI of 0.05 for other purposes of the practice in MD. To determine the area of adaptation of a cultivar or pre-varietal germplasm, see the release brochure hyperlinked in tables 2 and 3 or visit the Plant Materials Program Releases webpage.

It is critical that conservation planners plan the VB practice based on cultivars or pre-varietal releases from table 2 and 3 and not based on the species alone, unless the VSI of the grass is known. Furthermore, do not recommend unnamed species (VNS or variety not stated). If a perennial grass has the desirable characteristics of a VB species, and is not on the list, a VSI must be determined before recommending it for the practice. Failure to consider this step in the planning process may jeopardize the planting and effectiveness of the conservation practice. Named selections of grasses which do not meet a VSI of at least 0.05 at the time of this publication are included in Appendix A, tables 4 and 5. As additional measurements are made some of these grasses may be found to meet VSI or 0.10 or 0.05 and these tables will be updated.

Table 2. Warm and cool season perennial grasses meeting the vegetation stiffness index of 0.10 and 0.05.

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Alamo	*Panicum virgatum*	switchgrass	Kingsville, TX; Coffeeville, MS
Falfurrias Germplasm	*Sporobolus wrightii*	big sacaton	Kingsville, TX
Magnar	*Leymus cinereus*	basin wildrye	Aberdeen, ID
Sunshine	*Chrysopogon zizanioides*	vetivergrass	Kingsville, TX; Hoolehua, HI
Timber Germplasm	*Panicum virgatum*	switchgrass	Cape May, NJ

Table 3. Warm and cool season perennial grasses meeting the vegetation stiffness index of 0.05.

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Alamo	*Panicum virgatum*	switchgrass	Beltsville, MD
Atlantic	*Panicum amarum*	coastal panicgrass	Cape May, NJ; Beltsville, MD
Blackwell	*Panicum virgatum*	switchgrass	Beltsville, MD
Bromar	*Bromus marginatus*	mountain brome	Pullman, WA
Coastal Germplasm	*Sorghastrum nutans*	Indiangrass	Cape May, NJ
High Tide Germplasm	*Panicum virgatum*	switchgrass	Cape May, NJ
Kanlow	*Panicum virgatum*	switchgrass	Manhattan, KS
Niagara	*Andropogon gerardii*	big bluestem	Beltsville, MD
Rumsey	*Sorghastrum nutans*	Indiangrass	Beltsville, MD
Southlow Germplasm	*Andropogon gerardii*	big bluestem	Beltsville, MD
Suther Germplasm	*Sorghastrum nutans*	Indiangrass	Cape May, NJ

Planting Vegetative Barriers

General Planning

Plan the VB practice several months in advance of the planting. Row spacing and width of the farming equipment are critical factors in the planning process. Planners may need to adjust the location of the VB in the field based on the producer's row crop equipment. For example, a producer with 8 row, 40-in. equipment (26.7 ft wide), may prefer to make two passes between each VB so the distance between each barrier would be about 54 ft.

Cropping history is also important in the planning process because residual herbicide from a previous season may damage or affect germination of the VB grass. The use of precision agriculture technology such as GPS guidance systems and/or field mapping, allow a producer to plan where future VBs will be installed prior to their establishment. Detailed planning can prevent loss to a producer because the strip(s) can be unplanted to the cash crop and excluded from herbicide use.

Timing

It is beneficial for the producer to get as many of the normal cropping system applications (tillage, spraying, etc.) completed before seeding the VB. This may cause the planting date to be later than the normal planting window of the VB grass species, but with less risk of mechanical or herbicide injury to young seedlings. Soil moisture should be the limiting factor on the latest possible planting date of a VB.

Planting

After laying out the VB strip(s) according to the design plan and specifications in the VB practice standard, determine the total number of linear feet of VB to plant (fig. 3). The total number of linear feet is important for calculating the amount of seed needed for the VB.

For example*: 5,000 linear feet of planned VB multiplied by 5 ft (width of the VB) equals 25,000 ft^2 divided by 43,560 equals 0.6 acres.*

$$\frac{5000\ ft * 5ft}{43{,}560\ ft^2\ in\ an\ acre} = 0.6\ acres$$

The critical area (conservation practice standard 342) seeding rate for the VB species is 10 PLS/acre. The amount of seed needed to purchase is 6 PLS lbs. It's always a good idea to purchase a few extra pounds of seed in case there are issues during the planting operation.

*10 PLS lbs * 0.6 acres = 6 PLS lbs*

Figure 3: Determine the number of linear feet of VB to plant.

Seedbed Preparation

A 5-ft-wide rototiller is ideal for preparing a seedbed for VB planting (fig. 4). Firm the soil using a cultipacker or similar implement prior to planting (fig. 5). Broadcast seed with hand-operated spreader and cultipack afterwards to ensure a seed-to-soil contact (fig. 6) or use a cultipacker seeder to plant the seed and firm the soil in one operation (fig. 7). For vegetative plant materials, establish a double row of transplants, 6 inches apart in the concentrated flow areas (fig. 8). Additional measures to secure new transplants in the concentrated flow areas may include staking haybales end to end on the upslope side of the VB or attaching burlap or silt fencing to stakes across concentrated flow area to protect the transplants until they are established (fig. 9).

Figure 4: Preparing a seedbed with a 5-ft wide rototiller.

Figure 5: Firm the soil prior to planting.

Figure 6: Planting VB on a well-prepared seedbed.

Figure 7: Cultipacker seeder.

Figure 8: Repairing washout in concentrated flow areas using 'Alamo' switchgrass transplants.

Figure 9: Haybales positioned across the concentrated flow area to protect new 'Alamo' switchgrass transplants.

Maintenance

To repair washouts in the concentrated flow areas or fill in gaps in the VB, follow the general guidance provided above for establishing plants in concentrated flow areas.

Control weeds in the VB before they become aggressive or spread into the adjacent crop. Apply labeled herbicides that will not harm the VB species or the cash crop. Spot spraying weeds with a broad-spectrum herbicide is also an option for controlling weeds in the VB. Contact your local extension weed specialist for assistance with herbicide recommendations, rates and dates of application in your state.

Generally, enough fertilizer is applied during the fertilization of the cash crop to maintain healthy VB plants. However, if this is not the case, fertilize the VB plants with a maintenance fertilizer rate to keep plants growing vigorously.

Mowing VB may be used as a management practice to encourage the development of a dense stand and prevent shading of crops in adjacent rows. Mow no closer than 15 inches. Mowing in concentrated flow areas is discouraged because it will reduce stem diameter and lower the VSI. If residue control is needed in concentrated flow areas, mow in the dormant season.

For more information on design specifications, operation, and maintenance refer to the CPS Vegetative Barrier (Code 601) (National Conservation Practice Standards).

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Appendix A

Grasses listed in tables 4 and 5 **do not meet the VSI of 0.10 and/or 0.05** at the time of publication and are included for reference.

Table 4. Warm and cool season perennial grasses that may have potential to meet the vegetation stiffness index of 0.05 with additional stem counts but are not currently recommended for use in the VB practice.

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Bison	*Andropogon gerardii*	big bluestem	Bismarck, ND
Bonilla	*Andropogon gerardii*	big bluestem	Bismarck, ND
Kaw	*Andropogon gerardii*	big bluestem	Bismarck, ND
Rountree	*Andropogon gerardii*	big bluestem	Bismarck, ND
Whitepass Germplasm	*Elymus glaucus*	blue wildrye	Pullman, WA
Red River Germplasm	*Spartina pectinata*	prairie cordgrass	Bismarck, ND
Americus	*Sorghastrum nutans*	Indiangrass	Americus, GA
Carthage	*Panicum virgatum*	switchgrass	Cape May, NJ
Cave-in-Rock	*Panicum virgatum*	switchgrass	Beltsville, MD; Elsberry, MO
Shawnee	*Panicum virgatum*	switchgrass	Elsberry, MO
Shelter	*Panicum virgatum*	switchgrass	Beltsville, MD
Alamo	*Panicum virgatum*	switchgrass	Americus, GA
Alkar	*Thinopyrum ponticum*	tall wheatgrass	Pullman, WA

Table 5. Warm and cool season perennial grasses that have been evaluated and **do not meet** the vegetation stiffness index for concentrated flow areas or other purposes of the practice.

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Rio	*Leymus triticoides*	beardless wildrye	Lockeford, CA
Berber	*Dactylis glomerata*	orchardgrass	Lockeford, CA
Windbreaker	*Sporobolus wrightii*	big sacaton	Lockeford, CA
Bell	*Chloris gayana*	rhodesgrass	Hoolehua, HI
Blackwell	*Panicum virgatum*	switchgrass	Manhattan, KS
Prairie View Germplasm	*Sorghastrum nutans*	Indiangrass	Beltsville, MD
Forestburg	*Panicum virgatum*	switchgrass	Bismarck, ND
Dacotah	*Panicum virgatum*	switchgrass	Bismarck, ND
Sunburst	*Panicum virgatum*	switchgrass	Bismarck, ND
NE 28	*Panicum virgatum*	switchgrass	Bismarck, ND
Trailblazer	*Panicum virgatum*	switchgrass	Bismarck, ND
NE 2643	*Panicum virgatum*	switchgrass	Bismarck, ND
Shawnee	*Panicum virgatum*	switchgrass	Bismarck, ND
Pathfinder	*Panicum virgatum*	switchgrass	Bismarck, ND
Shelter	*Panicum virgatum*	switchgrass	Bismarck, ND

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
Manska	*Thinopyrum intermedium*	pubescent wheatgrass	Bismarck, ND
Manifest	*Thinopyrum intermedium*	Intermediate wheatgrass	Bismarck, ND
Bounty	*Andropogon gerardii*	big bluestem	Bismarck, ND
Latar	*Dactylis glomerata*	orchardgrass	Pullman, WA
Union Flat Germplasm	*Elymus glaucus*	blue wildrye	Pullman, WA
Whitmar	*Pseudoroegneria spicata ssp. inermis*	bluebunch wheatgrass	Pullman, WA
Secar	*Elymus wawawaiensis*	Snake River wheatgrass	Pullman, WA
Durar	*Festuca brevipila*	hard fescue	Pullman, WA
Canbar	*Poa secunda*	Canby bluegrass	Pullman, WA