USDA United States Department of Agriculture

Natural Resources Conservation Service

Published October 2021 Revised March 2026

New Jersey
Vegetative Plantings Technical Reference

Establishment and Maintenance Guide

Upper and Lower Right Photos by Chris Miller, NRCS Cape May Plant Materials Center
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VEGETATIVE PLANTING GUIDE TABLE OF CONTENTS

INTRODUCTION 3

USING THIS PLANTING GUIDE 4

SECTION 1 - GENERAL REQUIREMENTS AND REFERENCE TABLES APPLICABLE TO ALL PLANTINGS 5

SECTION 2 - UPLAND HERBACEOUS PLANTINGS: GENERAL CONSERVATION PLANTINGS 14

SECTION 3 - UPLAND HERBACEOUS PLANTINGS: CRITICAL AREA PLANTINGS 42

SECTION 4 - TREE AND SHRUB PLANTINGS 54

SECTION 5 - STREAMBANK AND SHORELINE PLANTINGS 107

SECTION 6 - WETLAND PLANTINGS 118

SECTION 7 - FORAGE AND BIOMASS PLANTINGS 134

SECTION 8 - COVER CROP PLANTINGS 153

SECTION 9 - VEGETATIVE BARRIER PLANTINGS 182

SECTION 10 - AGROFORESTRY 183

SECTION 11 - REFERENCES 205

APPENDIX A - NRCS COVER CROP TERMINATION GUIDELINES – 210

APPENDIX B - PLANT MATERIALS TECHNICAL NOTE NO. 6: VEGETATIVE BARRIERS 216

APPENDIX C - A SIMPLIFIED GUIDE TO UNDERSTANDING SEED LABELS 229

APPENDIX D - TECHNICAL TUESDAY – SEED TAGS 233

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 - Agroforestry – contains recommendations for implementing the five NRCS agroforestry practices.

Section 11 - 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.

The mention of any commercial products or services in this publication does not constitute endorsement by the United States Department of Agriculture-NRCS of the said products or services used in studies or demonstrations. Trade names appear in this document only to provide specific information. USDA NRCS does not guarantee the products named, and other products may be equally effective.

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.

SECTION 1 TABLE OF CONTENTS

GENERAL REQUIREMENTS AND REFERENCE TABLES APPLICABLE TO ALL PLANTINGS 5

GUIDELINES FOR PLANTING SEEDS 6

USE CERTIFIED SEED WHEN AVAILABLE 6

BUY AND PLANT SEED ON A PURE LIVE SEED (PLS) BASIS 6

BUYING INDIVIDUAL SPECIES AND MIX BEFORE PLANTING 6

USING PRE-SET MIXES FOR COVER CROP AND FORAGE PLANTINGS 7

NATIVE GRASS & WILDFLOWER SEED DRILLS 7

USE OF CARRIERS 8

DORMANT AND FROST SEEDINGS 9

TABLE 1.1: LOCATION OF RECOMMENDED PLANTINGS FOR VEGETATIVE PRACTICES 10

FIGURE 1.1: USDA PLANT HARDINESS ZONES FOR NEW JERSEY 11

TABLE 1.2 RECOMMENDED PLANTING DATES FOR PERMANENT COVER IN NEW JERSEY 12

SECTION 1 REFERENCES 13

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

Certified seed is recommended for plantings because it has a 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 seed companies are now 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 provides a measure of the quality of the seed. PLS is a calculated percentage based on seed lab viability tests. Percent PLS is the product of percent germination and percent purity (% PLS = % germination x % purity). PLS weight is the product of the total or bulk seed weight and the calculated percent PLS. For example, 100 pounds of seed with a known PLS of 90% would contain 90 pounds PLS (100 pounds x .90 = 90 pounds). The other 10 pounds of the bulk seed weight are made up of nonviable seed and other materials. The other materials included in the bulk seed weight most commonly include chaff (other plant parts such as leaf pieces, stems, petals, or glumes that were harvested with the seed), weed seed or other crop seed, nonviable seed, and inert matter (seed coating, sand, stones, or other foreign materials).

Hard seed or dormant seed is seed that did not readily germinate during a germination test but is determined to be viable seed. A seed may be determined viable without germinating via a tetrazolium or x-ray test (Tausch, Leipold, Reisch, and Poschlod, 2024). Because it is viable seed, it is included in the calculation of the percent PLS (USDA-NRCS, 2022). Hard seed and dormant seed percentages are not always reported separately and are sometimes grouped as a single percentage on seed labels (Englert, 2007). Oftentimes, this seed requires an additional form of stratification to germinate that was not conducted prior to the germination test. Stratification methods (exposure temperature cycles, wet/dry conditions, light/dark cycles, or abrasive measures) simulate natural conditions that help to break dormancy or penetrate a hard seed coat to initiate germination.

If seed is not sold on a PLS basis, PLS can be calculated prior to seeding based on seed viability tests or on a current seed tag. Using a seed analysis tag that 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% and a purity of 90% has a PLS of 72% (.80 x .90 = .72). The bulk weight of seed required to achieve a target PLS based seeding rate can be calculated by dividing the target PLS weight by the percent PLS (PLS weight ÷ % PLS = bulk weight). To continue the above scenario, if the target seeding rate requires 1.0-pound PLS of the seed lot with 72% PLS, the bulk weight to buy and plant would be 1.39 pounds (1.00 ÷ 0.72 = 1.39). For additional information, refer to Appendix C (A Simplified Guide to Understanding Seed Labels), Appendix D (Technical Tuesday - seed tags), or contact a Resource Staff specialist.

Under current New Jersey State Seed Law, results of a viability test conducted within a 9-month period are required for the sale of any agricultural, vegetable, flower, tree, or shrub seed. Seed packaged in a hermetically sealed container may be sold for a period of 36 months after the viability tests were conducted (NJ Rev Stat § 4:8-17.13, 2024).

Buying Individual Species and Mix Before Planting

For native covers with a wildlife objective, 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.

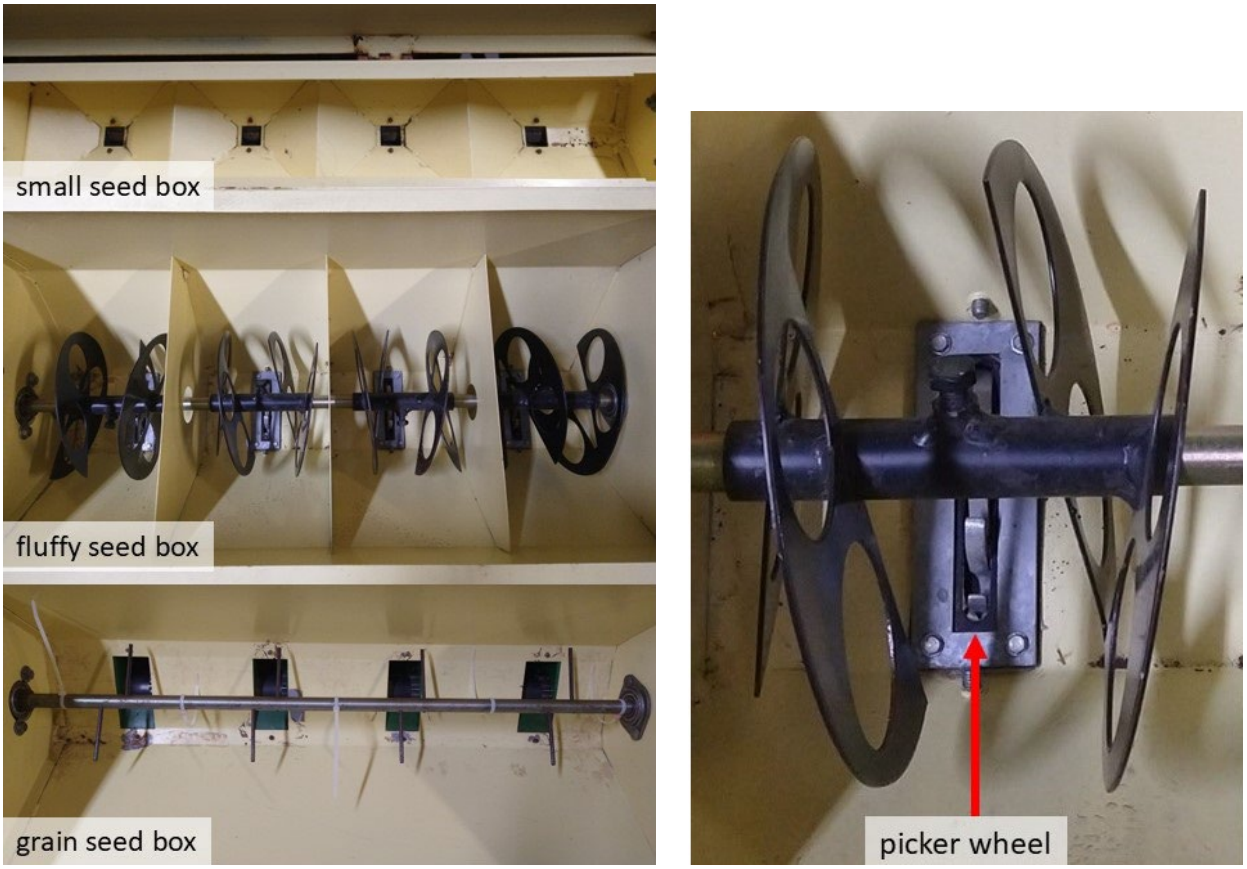
Using Pre-set Mixes for Cover Crop and Forage Plantings

Most forage and cover crop seed dealers have pre-set mixes. These mixes often have tailored the varieties to succeed certain soil types and the primary uses of the mixes. The ratios of species in the mix as well as the varieties are researched so the mix can synergize and maximize performance. These mixes are suitable to use in lieu of a custom mix if all the species and varieties in the mix are expected to meet management objectives. Often the mixes can be used as a strong base, and the objectives can be met by adding one or two additional species/varieties.

Native Grass & Wildflower 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 see photo below) 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 the 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.



The three seed boxes of a FlexII-88 Truax seed drill (left) and a close up image of a picker wheel of the fluffy seed box (right).

Use of Carriers

Traditional drills, drop seeders, and broadcast seeders may require the use of a carrier when planting 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. Select the type of carrier with the type of seeding equipment in mind and calibrate the equipment to deliver a specific amount of carrier and seed per acre. An inert carrier mixed between a range of at least a 1:2 ratio and up to 1:1 ratio (by weight) of carrier to bulk seed is recommended for general purposes (Dickerson et al., 1997; Boggess and Brooke, 2018). If the target seeding rate is lower than what the seeding equipment can apply, that ratio may be increased to as much as 4:1 to increase the bulk weight of the seed mix and accommodate the seeding equipment (Boggess and Brooke, 2018). For example, the lowest application rate of a fertilizer spreader may be 100 pounds per acre, higher than most recommended seeding rates which would require the addition of a carrier to increase the bulk weight and achieve the target seeding rate. Higher rates have been recommended for certain types of carriers. Carrier rates of up to 40 pounds wheat or 32 pounds oats per acre are recommended for warm season grass establishment via broadcast seeding (INDNR, 2006). The carrier to bulk seed ratio selected allows for some room for error, but the target goal to keep in mind is that the ratio should be high enough to allow the seed flow through the seeding equipment and mix the different kinds of seed.

Different types of carriers are recommended for varying seed types and seeding equipment: non-clumping cat litter or clay absorbent for switchgrass, clovers, or small seeded native forbs in a small seed box; vermiculite for bluestems, Indiangrass, or native grass/forb mixes in a fluffy seed box; and cracked corn for warm season grass and forb mixtures in a large seed box (Boggess and Brooke, 2018). Rice hulls, sawdust, or sand are other inert carrier options (INDNR, 2006). Oats or wheat can also serve as a carrier and may be especially useful on sites with steeper slopes where the

oats or wheat will also serve as a nurse crop. However, use of a companion crop seed as a carrier should be used with caution as it may introduce additional plant competition for resources which can be detrimental to the establishment of the intended species (Dickerson et al., 1997).

Dormant and Frost Seeding

Wildlife Purposes

For meadow plantings designed to provide nectar and pollen for native, wild bees, butterflies, and other beneficial insects, the seed mix composition is usually dominated by native perennial forbs with a warm season grass component. The majority of these species have seeds which mature in the fall and must wait until spring to break dormancy. As such, they require the cue of at least 30-60 days of cold moist stratification (below freezing outdoor weather, and/or regular freeze-thaw) before they will germinate. As a result, we strongly recommend fall dormant seeding, e.g. once the winters are reliably cold in the fall. If the fall is too wet, a wildflower drill and/or cultipacker will clump, stick, and not work well. In this case, wait until later in winter. Seeding on frozen ground in mid-winter is preferable to wet and clumpy in the fall. Ultimately, the goal is to provide ~30-60 days of freeze/thaw before the weather becomes warm.

Critical Area Planting Purposes

For critical area plantings, Salon and Miller (2012) advise that dormant seeding should be a “last resort” option and should only be implemented if proper conditions are met. This precaution is given with consideration to the additional challenges presented by dormant seeding applications such as insect predation, soil borne disease, premature germination resulting in winter mortality, and proper seedbed preparation and seeding difficulties due to soil moisture. Proper conditions for grass and legume dormant plantings primarily regard soil conditions and temperature. Warm season grasses typically display slow initial growth requiring 100-120 growing days prior to winter for successful establishment.

To minimize the risk of fall/early winter germination and winter mortality, do not dormant seed warm season grasses until after soil temperatures are consistently below 40°F, usually after December 1 in USDA Plant Hardiness Zone 7 or warmer. As general guidance for dormant grass seedings, seeding rates should be increased by 40-50% and follow up reseeding efforts should be expected (Salon and Miller, 2012). In a limited number of native warm season grass dormant seeding trials conducted and/or evaluated by the Plant Materials staff, they have concluded that dormant seedings are more likely to be successful when drill seeded on dry, coarse-textured soils with limited/minimal weed pressure. In more moist or wet, finer-textured soils with likely greater weed pressure, the risk of failure is increased.

Pasture and Hay Plantings

Frost seeding can be an effective way to overseed a pasture or hay field that is declining in production. This method allows flexibility to rejuvenate or add new species to an existing forage and/or hay stand without needing to disturb the existing vegetation. Frost seeding should not be used for new field establishment. Small seeded legumes, such as clovers and trefoil are best to use for frost seeding because they tend to better fit the cracks that are created by the freeze-thaw action.

Planning for frost seeding begins the following fall. It is best to graze or clip the vegetation down to about 3 inches. The lower forage height going into winter will open the canopy, allowing seed to reach the ground when they are broadcasted in winter. Grazing or clipping in the fall will also help the overseeding to germinate and better compete with existing forages in the spring. The seeding should be done when temperatures are below freezing at night but warm to above freezing during the day. This temperature cycle causes a freeze-thaw action in the top portion of the soil, creating macropores for seeds to drop into, improving the seed to soil contact as compared to broadcasting when temperatures are consistently above freezing. Under the right conditions and with good seed to soil contact, the seed will germinate once the days reach germination temperatures.

TABLE 1.1: Location of Recommended Plantings for Vegetative Practices

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**	**10**
Alley Cropping (311)									■
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)		■							
Forest Farming (379)									■
Forest Trails and Landings (655)			■						
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) and Wetland Enhancement (659)									
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

TABLE 1.2 Recommended Planting Dates for Permanent Cover in New Jersey[1]			
Type of Plant Material		**Planting Zone**	
		6b	**7a, 7b, and 8a**
Grasses and Legumes	Cool-Season Seed Mixes	Mar 1 to Apr 30[3] Aug 1 to Oct 15	Feb 1 to Apr 30[3] Aug 15 to Oct 31 Nov 1 to Nov 30[4]
	Warm-Season/Cool-Season Seed Mixes	Mar 1 to Apr 30 May 1 to Jun 15[2]	Feb 1 to Apr 30 May 1 to May 31[2]
Forbs	Seeds	Mar 1 to Apr 30[3]	Feb 1 to Apr 30[3]
	Bare-Root Seedlings	Mar 15 to May 15 May 16 to Jun 30[2]	Feb 15 to Apr 30 May 1 to Jun 30[2]
	Containerized Stock	Mar 15 to May 15 May 16 to Jun 30[2] Sep 15 to Oct 15[2]	Mar 1 to Apr 30 May 1 to Jun 30[2] Oct 1 to Nov 15[2]
Woody Plants	Dormant Cuttings	Feb 15 to Apr 1	Feb 1 to Mar 15
	Bare-Root Seedlings	Mar 15 to May 15 May 16 to Jun 1[2]	Mar 1 to Apr 30 May 1 to May 15[2]
	Containerized Stock	Mar 15 to May 31 Jun 1 to Jun 30[2] Oct 15 to Dec 1[2,5]	Mar 1 to May 15 May 16 to Jun 15[2] Nov 1 to Dec 15[2,5]

[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.)

[2] Additional planting dates during which supplemental watering may be needed to ensure plant establishment.

[3] Refer to the "Dormant and Frost Seeding" section for more information when seeding within these dates.

[4] 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.

[5] 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.

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Section 2 - Upland Herbaceous Plantings: General Conservation 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, including pollinators 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.

SECTION 2 TABLE OF CONTENTS

SELECTING MIXES AND ESTABLISHING PLANTINGS 14

TABLE 2.1: RECOMMENDED UPLAND HERBACEOUS SEEDING MIXES FOR CONSERVATION COVER BY PURPOSE OR PRIMARY USE OF THE PLANTING 15

TABLE 2.2: PERMANENT UPLAND HERBACEOUS COVER MIXES FOR CONSERVATION PLANTINGS 16

TABLE 2.3: SELECTED CHARACTERISTICS OF NATIVE GRASSES AND GRASS-LIKE PLANTS 30

TABLE 2.4: SELECTED CHARACTERISTICS OF NATIVE WILDFLOWERS AND LEGUMES 37

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**	**18**	**19**
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												✓	✓						
Enhance pollinator and beneficial organism habitat in the Pine Barrens and other applicable acidic sandy soil areas																	✓		
Near coastal areas/salt affected soils					✓								✓					✓	
Alkaline (high pH) soil condition/brownfields, industrial sites																			✓

✓ 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 Plantings

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: for Conservation Cover								
Mix		**Recommended Selection/Cultivar**	**Seeding Rate (lbs/ac)[2]**	**Soil Drainage Class[3]**	**Max. Height (feet)**	**All Native Species[4]**	**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*	Suther Germplasm[10], 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 *Panicum amarulum*	Atlantic	2 - 4				Warm season grasses	Coastal Panicgrass is primarily a coastal species but can also be used inland.
	Indiangrass *Sorghastrum nutans*	Coastal Germplasm[10], Suther Germplasm[10]	2 - 4	E - MW	6 - 8	Y		Big Bluestem, Indiangrass, and Little Bluestem have fluffy seeds, which require a native seed drill.
	OPTIONAL – SELECT ONE OF THE FOLLOWING:							
	Partridge Pea *Chamaecrista fasciculata*		1					Because the grasses tend to dominate a stand, wildflowers may not persist. Wildflowers may be more persistent on very dry sites.
	Roundhead lespedeza *Lespedeza capitata*		0.4					
	Mix 14		Varies					
2	**SELECT THREE OF THE FOLLOWING:**							**This mix is suitable for mesic sites.**
	Coastal Panicgrass *Panicum amarulum*	Atlantic	1 - 2					**Grasses in bold are typically used.**
	Florida Paspalum *Paspalum floridanum*	Mid-Atlantic Germplasm	1 ½ - 3				Warm and cool season grasses	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	W - SP	6 - 8	Y		
		Suther Germplasm[10]	2 - 4					Little Bluestem prefers drier sites. Red Fescue is a cool season grass and can be used on wetter sites.
	Indiangrass Sorghastrum nutans							
	Little Bluestem Schizachyrium scoparium	Suther Germplasm[10], Blaze	3 - 5					

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: for Conservation Cover								
Mix		Recommended Selection/Cultivar	Seeding Rate (lbs/ac)[2]	Soil Drainage Class[3]	Max. Height (feet)	All Native Species[4]	Type of Grass in Mix	Remarks
	Red Fescue *Festuca rubra*	common	1 - 2					Coastal Panicgrass and Florida Paspalum are primarily coastal species. 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. Indiangrass and Little Bluestem have a fluffy seed that requires a native seed drill.
	OPTIONAL – SELECT ONE OF THE FOLLOWING:							
	Partridge Pea *Chamaecrista fasciculata*		1					
	Roundhead lespedeza *Lespedeza capitata*		0.4					
	Mix 14		Varies					
3	**SELECT TWO WARM SEASON GRASSES:**							**This mix is suitable for dry to mesic sites.**
	Little Bluestem *Schizachyrium scoparium*	Suther Germplasm[10], 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					
	Splitbeard Bluestem *Andropogon ternarius*	common	3 - 4					Canada Wildrye and Virginia Wildrye are CSGs.
	Purple Lovegrass *Eragrostis spectabilis*	common	½ - 1	E - MW	3 - 4	Y	Warm and cool season grasses	Canada Wildrye prefers dry sites; Virginia Wildrye prefers mesic sites. 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:							

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: for Conservation Cover								
Mix		**Recommended Selection/Cultivar**	**Seeding Rate (lbs/ac)[2]**	**Soil Drainage Class[3]**	**Max. Height (feet)**	**All Native Species[4]**	**Type of Grass in Mix**	**Remarks**
	Partridge Pea *Chamaecrista fasciculata*		1					
	Mix 14		Varies					
4	**SELECT TWO WARM 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*	Suther Germplasm[10], 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					
	Continued next page							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					
	Florida Paspalum *Paspalum floridanum*	Mid-Atlantic Germplasm	1 ½ - 3					Use River Oats in the Piedmont, and Slender Woodoats on the Coastal Plain.
	AND ONE COOL SEASON GRASS:			W - SP	3 - 4	Y	Warm and cool season grasses	
	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					
5	**SELECT ONE WARM SEASON GRASSES:**							**This mix is suitable for wet sites.**
	Redtop Panicgrass *Panicum rigidulum*	common	0.5 - 1	P - VP	3 - 5	Y	Warm and cool season	**Grasses/sedges in bold are typically used.**

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: for Conservation Cover								
Mix		**Recommended Selection/Cultivar**	**Seeding Rate (lbs/ac)[2]**	**Soil Drainage Class[3]**	**Max. Height (feet)**	**All Native Species[4]**	**Type of Grass in Mix**	**Remarks**
	Bushy bluestem *Andropogon glomeratus**	common	0.5 - 1				grasses, and sedges	*limited commercial availability of bushy bluestem. Optional to use in mix, if available to purchase.
	Beaked Panicgrass *Panicum anceps*	common	1 - 2					All but Florida Paspalum and Riverbank Wildrye are short-statured grasses.
	Florida Paspalum *Paspalum floridanum*	Mid-Atlantic Germplasm	2 - 4					Florida Paspalum is a Coastal Plain species.
AND SELECT ONE COOL SEASON GRASS:								Use River Oats in the Piedmont, and Slender Woodoats on the Coastal Plain.
	Virginia Wildrye *Elymus virginicus*	common	4 - 8					Rattlesnake Grass occurs in the Piedmont region.
	River Oats *Chasmanthium latifolium*	common	5 - 7					
	Riverbank Wildrye *Elymus riparius*	common	5 - 7					
Slender Woodoats *Chasmanthium laxum*		common	5 - 7					
continued next page								
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: for Conservation Cover								
Mix		**Recommended Selection/Cultivar**	**Seeding Rate (lbs/ac)[2]**	**Soil Drainage Class[3]**	**Max. Height (feet)**	**All Native Species[4]**	**Type of Grass in Mix**	**Remarks**
6	**ADD ALL OF THE FOLLOWING:**							Once well-established, orchardgrass may tend to dominate the stand.
	Orchardgrass *Dactylis glomerata*	common	3 - 4					
	Red Fescue *Festuca rubra*	common	3 - 4	W - MW	2 - 3	N	Cool season grasses	Alsike clover can be toxic to horses.
	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.
	Orchardgrass *Dactylis glomerata*	common	2 - 4					
	AND ONE OR BOTH OF THE FOLLOWING:	Not a turf type	1 - 2					
	Bluegrass *Poa pratensis*	Climax	2 - 4					Once well-established, orchardgrass may tend to dominate the stand.
	Timothy *Phleum pratense*	common		W - MW	2 - 3	N	Cool season grasses	
	AND ADD ONE OF THE FOLLOWING:							
	White Clover *Trifolium repens*	common	1 - 2					
	Red Clover *Trifolium pratense*	common	1 - 2					
8	**ADD BOTH OF THE FOLLOWING**							All native, shade-tolerant CSG grass mix for mesic to wet sites.
	Riverbank Wildrye *Elymus riparius*	common	4 - 6					
	Virginia Wildrye *Elymus virginicus*	common	4 - 6	MW - P	3 - 4	Y	Cool season grasses	Use River Oats in the Piedmont and Slender Woodoats on the Coastal Plain.
	AND ADD ONE OF THE FOLLOWING:	common	5 - 10					Add Mix 8c to provide a grass-forb mix for wildlife habitat.
	River Oats Chasmanthium latifolium							

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: for Conservation Cover								
Mix		**Recommended Selection/Cultivar**	**Seeding Rate (lbs/ac)[2]**	**Soil Drainage Class[3]**	**Max. Height (feet)**	**All Native Species[4]**	**Type of Grass in Mix**	**Remarks**
	Slender Woodoats Chasmanthium laxum	common	5 - 10					
	OPTIONAL – ADD THE FOLLOWING:							
	Mix 14		Varies					
9	**ADD ALL OF THE FOLLOWING:**							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.
	Chewings Fescue *Festuca rubra ssp. commutata*	common	1 - 2					
	Hard Fescue *Festuca brevipila*	Beacon, Gotham, Spartan II, Sword	1 - 2					
	Sheep fescue *Festuca ovina*	Bighorn, Covar	1 - 2					
	AND ADD EITHER THE WILDFLOWER MIX:			W - MW	2 - 3	N	Cool season grasses	
	Mix 14		Varies					
	OR ADD THE FOLLOWING CLOVER MIX:							
	White Clover *Trifolium repens*	common	1 - 2					
	Red Clover *Trifolium pratense*	common	1 - 2					
10	**ADD:**							Use Red Fescue on drier soils and Fowl Meadowgrass on wetter soils.
	Rough Bluegrass *Poa trivialis*	common	1 - 2					
	AND ADD ONE OF THE FOLLOWING:							
	Virginia Wildrye *Elymus virginicus*	common	5 - 8	SP - P	4 - 5	N	Cool season grasses	
	Riverbank Wildrye *Elymus riparius*	common	4 - 6					
	Continued next page							
	AND ADD ONE OF THE FOLLOWING:							

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: for Conservation Cover								
Mix		**Recommended Selection/Cultivar**	**Seeding Rate (lbs/ac)[2]**	**Soil Drainage Class[3]**	**Max. Height (feet)**	**All Native Species[4]**	**Type of Grass in Mix**	**Remarks**
	Fowl Meadowgrass *Poa palustris*	common	1 - 2					
	Red Fescue *Festuca rubra*	common	1 - 2					
11	**ADD ALL OF THE FOLLOWING:**							Low-growing mix of native grasses for wet sites.
	Fowl Meadowgrass *Poa palustris*	common	1 - 2					
	Virginia Wildrye *Elymus virginicus*	common	4 - 6					
	Red Fescue *Festuca rubra*	common	1 - 2					Use Partridge Pea if an all-native mix is desired. (Alsike and White Clover are not native to New Jersey.)
	AND ADD EITHER:			SP - P	2 - 3	Y (See Remarks)	Cool season grasses	Alsike Clover can be toxic to horses.
	Partridge Pea *Chamaecrista fasciculata*	common	1 - 2					
	OR ADD THE FOLLOWING CLOVER MIX:							
	Alsike Clover *Trifolium hybridum*	common	1 - 2					
	White Clover *Trifolium repens*	common	1 – 2					
12	**ADD ALL OF THE FOLLOWING:**							Low maintenance, cool season grass mix for alleyways in orchards, vineyard, etc.
	Red Fescue *Festuca rubra*	Pennlawn, Flyer Fortress,	15					
	Hard Fescue *Festuca brevipila*	Durar, Minimus	30				Cool season grass and legume	
	Sheep fescue *Festuca ovina*	Bighorn, Covar, Quatro	15	W-MW	1-1.5	N		
	Perennial ryegrass *Lolium perenne L.*	Pennfine, Blazer	5					
	OPTIONAL – ADD THE FOLLOWING:							
	White Clover *Trifolium repens*	common	2					

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: for Conservation Cover								
Mix		Recommended Selection/Cultivar	Seeding Rate (lbs/ac)[2]	Soil Drainage Class[3]	Max. Height (feet)	All Native Species[4]	Type of Grass in Mix	Remarks
13	**ADD ALL OF THE FOLLOWING:**							Turf mixture for saline impacted areas.
	Red Fescue *Festuca rubra*	Dawson, Shoreline	45					Use cultivars specified under saline conditions.
	Tall Fescue *Festuca arundinacea* (turf-type)	Turf-type	40				Cool season grass	
	Perennial ryegrass *Lolium perenne L.*	Pennfine, Blazer	15	W-MW	1-1.5	N		tall fescue should be turf-type varieties. Traditional tall fescue (forage varieties) will require more maintenance and better site conditions.
	OPTIONAL – ADD THE FOLLOWING:							
	Alkali saltgrass *Puccinellia distans*	Fults, Salty	1					
14 15 16 17	**See separate pollinator species Tables that follow this one.**							
18	**ADD ALL OF THE FOLLOWING:**							Cost effective pollinator mix for saline areas that occasionally floods.
	Bushy bluestem *Andropogon glomeratus**	common	8					*limited commercial availability of bushy bluestem. Optional to use in mix, if available to purchase.
	Rose mallow *Hibiscus moscheutos*	common	1					
	Plains coreopsis *Coreopsis tinctoria*	common	0.1					
	Arrowleaf tearthumb *Polygonum sagittatum*	common	1.5					
	Bearded beggartick *Bidens aristosa*	common	1.5	MW-PD	3-4	N		
	Continued next page							
	OPTIONAL-ADD THE FOLLOWING IF AVAILABLE:							
	Seaside goldenrod *Solidago sempervirens*	Monarch Germplasm	0.25					Seaside goldenrod and seashore mallow-limited commercial availability as seed. Plugs are available from selected native plant nurseries.
	Virginia saltmarsh mallow *Kosteletzkya virginica*		0.25					

19	**ADD ALL OF THE FOLLOWING:**							
	Alkali saltgrass *(Puccinellia distans)*	Fults	2					
	Canada wildrye *(Elymus canadensis)*	Mandan	5					
	Tall fescue *(Festuca arundiancea)*	Fawn	5					
	AND ADD ONE OR BOTH OF:							
	Switchgrass *(Panicum virgatum)*							
	Coastal panicgrass *(Panicum amarum var amarulum)*	Forestburg	3					
	**use 3lbs./ac seeding rate if planting both and 6lbs./ac seeding rate if only planting one species*	Atlantic	3					Grass varieties specified are more Tolerant of alkaline soil conditions.
	AND ADD:							All the species above can be seeded with a drop,
	Barley as a nurse crop		40					
	OPTIONAL – ADD ONE TO THREE OF THE FOLLOWING FOR SOIL IMPROVEMENT:			W-MW		N and I	None	broadcast or hydroseeder.
	Sainfoin *(Onobrychis viciafolia)*		10					
	Yellow sweetclover *(Melilotus officinalis)*		2					If seeding either switchgrass or coastal panicgrass alone rather than both, use 6 lbs./ac.
	Alfalfa *(Medicago sativa)*		2					

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Plantings

14. Partial List of New Jersey Native Wildflowers and Legumes

Select **at least 3 early-blooming, 3-summer-blooming, and 3 fall-blooming species per mix.** Add this mix to all-grass Mixes 1 - 5, 11, and 12 for added wildlife and aesthetic value. For pollinator mixes, ensure that total seeds per square foot still adds up to 40-60seeds/sq ft. 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. For mixes designed specifically for monarch butterflies, we suggest at least 2% seeds per square foot of a native Milkweed, and at least 60% seeds per square foot of known monarch nectar plants. For additional information, please see site preparation and seed mix guidelines in Xerces Habitat Installation Guides.
Consult with NRCS Partner Pollinator Specialist for all mix adjustments and changes.

Common Name	Scientific Name	Moisture [5]			Seeding Rate (lbs/ac) [6]	Life Cycle [7]	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	■									
Roundhead lespedeza	*Lespedeza capitata*	■	■		0.2	P	■									
Hairy Bush-Clover	*Lespedeza hirta*	■	■		0.2	P	■									

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Plantings

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, and allows for diversity of plant color, shape, plant family, and host plants for butterflies, moths, or bees with specialized pollen diets. 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[7]	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 Plantings

16. New Jersey Native Grass-Forb Mix for Pollinators: Mesic - Wet Sites, NOT pine barrens

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, and allows for diversity of plant color, shape, plant family, and host plant for butterflies, moths, or bees with specialized pollen diets.

Common Name	Scientific Name	% by Seed [8]	Seeding Rate (lbs/ac) [9]	Life Cycle [7]	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 Plantings

17. New Jersey Native Grass-Forb Mix for Pollinators: Pine Barrens and Acidic, Sandy soils

The composition of this mix is appropriate for a range of acidic, sandy soils such as those in the NJ Pine Barrens. Alternative native species may be substituted for a listed species due to desirability or lack of availability. Select alternatives that are similar to the species being substituted, when considering variables including bloom time, flower color, flower shape, plant family, and role as a host plant for a butterfly, moth, or bee with a specialized pollen diet. Use locally sourced seed and straight species whenever possible, not cultivars which are often selected for visual characteristics at the expense of pollen and nectar.

Common Name	Scientific Name	% by Seed[8]	Seeding Rate (lbs/ac)[9]	Life Cycle[7]	Legume	Flowering Period and Flower Color								
						M	A	M	J	J	A	S	O	N
Lanceleaf Coreopsis	*Coreopsis lanceolata*	5.0%	0.59	P										
Virginia Tephrosia	*Tephrosia virginiana*	0.50%	0.87	P	■									
Golden Zizia	*Zizia aurea*	3.0%	0.46	P										
Common Yarrow	*Achillea millefolium*	2.0%	0.02	P										
Largeflower Tickseed	*Coreopsis grandiflora*	3.0%	0.39	P										
Smooth Beardtongue	*Penstemon digitalis*	6.0%	0.39	P										
Showy Ticktrefoil	*Desmodium canadense*	3.0%	1.08	P										
Common Milkweed	*Asclepias syriaca*	1.0%	0.37	P										
Butterfly Milkweed	*Asclepias tuberosa*	1.0%	0.37	P										
Yellow False Indigo	*Baptisa tinctoria*	1.0%	0.09	P										
Smooth Oxeye	*Heliopsis helianthoides*	3.0%	0.77	P										
Dotted Mint	*Monarda punctata*	4.0%	0.07	P										
Narrowleaf Mountain Mint	*Pycnanthemum tenuifolium*	2.0%	0.01	P										
Virginia Mountain Mint	*Pycnanthemum virginianum*	2.0%	0.01	P										
New York Aster	*Symphyotrichum novi-belgii*	3.0%	0.11	P										
Blackeyed Susan	*Rudbeckia hirta*	8.0%	0.13	B										
Early Goldenrod	*Solidago juncea*	4.0%	0.04	P										
Culver's Root	*Veronicastrum virginicum*	5.0%	0.02	P										
White Vervain	*Verbena urticifolia*	3.0%	0.08	P										
Dense Blazing Star	*Liatris spicata*	1.0%	0.26	P										
Partridge Pea	*Chamaecrista fasciculata*	5.0%	2.01	A	■									
Wrinkleleaf Goldenrod	*Solidago rugosa*	4.0%	0.10	P										
Maryland Goldenaster	*Chrysopsis mariana*	2.0%	0.05	P										
Gray Goldenrod	*Solidago nemorallis*	4.0%	0.1	P										
Purple Lovegrass	*Eragrostis spectabillis*	2.0%	0.05	P										
Nodding Wild Rye	*Elymus canadensis*	4.0%	0.92	P										
Switchgrass	*Panicum virgatum*	5.0%	0.5	P										
Little Bluestem	*Schizachyrium scoparium*	13.0%	1.26	P										
Totals		**100%**	**11.25**	Total seeding rate should be approx. 45-60 seeds/sq. ft.										

TABLE 2.2: Permanent Upland Herbaceous Cover Mixes: Conservation Plantings

Notes Applicable to All Mixes Where Indicated:

1. Refer to Section 7 for permanent pasture and hay plantings.

2. 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 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.

3. 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.

4. 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.

5. 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).

6. 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.

7. Life Cycle: P – Perennial; B—Biennial; A – Annual.

8. Composition of this seed mix is calculated based on seeds per square foot, not percentage by weight.

9. Seeding rate per acre for each species varies significantly because of the desired composition of the mix (seeds per square foot), competitive ability of the species, and variation in seed size.

10. Preferred local selection released by USDA NRCS Plant Materials Program. Plant Materials Program conservation plant releases are evaluated prior to release to help ensure that the plants will perform as needed in their recommended areas of adaptation and use.

TABLE 2.3: Selected 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 NCNE [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 FACU	144,000	2.5	0.3	5 - 8	■		One of the taller species. Can be aggressive.
Andropogon glomeratus Bushy bluestem	■	■	SP - P			■	FACW FACW NI	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 NI	216,000	1.5	0.2	1½ - 3	■		Blooms earlier than other bluestem species. Highly drought tolerant.
Andropogon virginicus Broomsedge	■	■	E - SP	■	■		FAC FACU 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 FACW	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 UPL	1,059,100	0.3	0.04	1 - 3	■		Prefers sandy sites. Seed is extremely small.

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 NCNE [4]	Est. Seeds/lb	PLS Lbs/Ac [5]		Height	Drought Tolerant	Shade Tolerant	Remarks
	NNJ	CP		D	M	W			Grass Mix	Forb Mix				
Panicum amarulum Coastal Panicgrass		■	E - SP	■	■		FAC FACU 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 FACW	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 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 FAC	259,000	1.5	0.15	4 - 6	■		Common native species that have 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.
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.

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 NCNE [4]	Est. Seeds/lb	PLS Lbs/Ac [5]		Height	Drought Tolerant	Shade Tolerant	Remarks
	NNJ	CP		D	M	W			Grass Mix	Forb Mix				
Paspalum floridanum Florida paspalum		■	W - P	■	■	■	FACW 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 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 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 UPL	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 FAC	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														

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 NCNE [4]	Est. Seeds/lb	PLS Lbs/Ac [5]		Height	Drought Tolerant	Shade Tolerant	Remarks
	NNJ	CP		D	M	W			Grass Mix	Forb Mix				
Agrostis scabra Rough Bentgrass	■	■	W - P		■	■	FAC 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 FACW	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 FACW	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 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 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 hystrix Bottlebrush Grass	■	■	W - SP		■		UPL UPL FACU	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 NCNE [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 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 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 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 OBL	94,700	3.5	0.45	1½ - 3		■	Obligate wetland sedge. Provides food and cover for wildlife.
Carex lurida Lurid Sedge	■	■	P - VP			■	OBL 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 OBL	1,300,000	0.25	0.03	1½ - 3			Provides food and cover for wildlife. Can be aggressive. Seed is extremely small.

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 NCNE [4]	Est. Seeds/lb	PLS Lbs/Ac [5]		Height	Drought Tolerant	Shade Tolerant	Remarks
	NNJ	CP		D	M	W			Grass Mix	Forb Mix				
Glyceria canadensis *Rattlesnake Grass*	■		SP - VP			■	OBL 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 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 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 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 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 NCNE [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) , Eastern Mountains and Piedmont (EMP) and Northcentral and Northeast (NCNE).

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: Selected 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	NCNE		Grass Mix	Forb Mix		M	A	M	J	J	A	S	O	N
Asclepias incarnata	Swamp Milkweed	■	■	P			■	OBL	OBL	OBL	70,000	0.45	1.5	T									
Asclepias syriaca	Common Milkweed	■	■	P	■	■		UPL	FACU	UPL	70,000	0.45	1.5	T									
Asclepias tuberosa	Butterfly Milkweed	■	■	P	■	■		NI	NI	NI	70,000	0.45	1.5	D,T									
Baptisia tinctoria	Yellow False Indigo	■	■	P	■	■		NI	NI	NI	300,000	0.1	0.4	D,T									
Bidens aristosa	Bur Marigold		■	A			■	FACW	FACW	FACW	130,000	0.25	0.9										
Bidens cernua	Nodding Bur Marigold	■	■	A			■	OBL	OBL	OBL	130,000	0.25	0.9										
Bidens frondosa	Beggar Ticks	■	■	A			■	FACW	FACW	FACW	80,000	0.4	1.5										
Caltha palustris	Marsh Marigold	■	■	P			■	OBL	OBL	OBL	554,000	0.06	0.2										
Chamaecrista fasciculata	Partridge Pea	■	■	A	■	■		FACU	FACU	FACU	65,000	0.25	1	T									
Chelone glabra	White Turtlehead	■	■	P			■	OBL	OBL	OBL	1,472,000	0.02	0.08	S									
Conoclinium coelestinum	Mistflower	■	■	P		■	■	FAC	FAC	FAC	1,500,000	0.02	0.08	A									
Coreopsis lanceolata	Lanceleaf Tickseed			P		■		UPL	FACU	FACU	221,000	0.15	0.55										
Coreopsis tinctoria	Golden Tickseed	■	■	A		■		FAC	FAC	FACU	3,222,222	0.01	0.04										
Coreopsis verticillata	Whorled Tickseed	■	■	P	■	■		NI	NI	NI	200,000	0.15	0.6	D									
Desmodium canadense	Showy Tick-Trefoil	■		P		■		FAC	FAC	FAC	72,500	0.45	1.5	T									
Desmodium paniculatum	Panicled Tick-Trefoil	■	■	P	■	■		FACU	FACU	FACU	200,000	0.15	0.6	D,T									
Doellingeria umbellata var. *umbellata*	Flat-topped White Aster	■	■	P		■	■	FACW	FACW	FACW	800,000	0.04	0.15										
Echinacea purpurea	Purple Coneflower			P		■		NI	NI	NI	116,000	0.3	1										

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	NCNE		Grass Mix	Forb Mix		M	A	M	J	J	A	S	O	N
Eupatorium perfoliatum	Boneset	■	■	P			■	FACW	FACW	FACW	2,800,000	0.01	0.04	S									
Euthamia graminifolia	Grass-leaved Goldenrod	■	■	P	■	■	■	FAC	FAC	FAC	5,600,000	0.006	0.02	A,D									
Eutrochium dubium	Coastal Plain Joe-Pye Weed	■	■	P		■	■	FACW	FACW	FACW	2,000,000	0.02	0.06										
Eutrochium fistulosum	Joe-Pye Weed	■	■	P		■	■	FACW	FACW	FACW	2,000,000	0.02	0.06	S									
Eutrochium purpureum	Sweet-scented Joe-Pye Weed	■	■	P		■	■	FAC	FAC	FAC	672,000	0.05	0.2										
Helenium autumnale	Yellow Sneezeweed	■	■	P		■	■	FACW	FACW	FACW	1,464,000	0.02	0.08	T									
Helenium flexuosum	Purple Sneezeweed	■	■	P		■		FACW	FAC	FAC	2,000,000	0.02	0.06	T									
Helianthus angustifolius	Swamp Sunflower		■	P		■	■	FACW	FACW	FACW	500,000	0.07	0.25										
Heliopsis helianthoides	Smooth Oxeye	■	■	P	■	■		UPL	FACU	FACU	116,410	0.3	1										
Lespedeza capitata	Roundhead lespedeza	■	■	P	■	■		FACU	FACU	FACU	174,000	0.2	0.7	D,T									
Lespedeza hirta	Hairy Bush-Clover	■	■	P	■	■		NI	NI	NI	175,000	0.2	0.65	D,T									
Liatris pilosa	Grass-leaf Blazing Star	■	■	P	■	■		NI	NI	NI	290,000	0.1	0.4	D									
Liatris scariosa	Large Blazing Star	■	■	P		■		UPL	FACU	UPL	100,000	0.35	1										
Lobelia cardinalis	Cardinal Flower	■	■	P			■	FACW	FACW	OBL	11,292,758	0.003	0.01	S									
Lobelia siphilitica	Blue Lobelia	■		P			■	OBL	FACW	FACW	8,000,000	0.004	0.01	S									
Mimulus ringens	Square-stemmed Monkeyflower	■	■	P			■	OBL	OBL	OBL	22,900,000	0.001	0.005										
Monarda didyma	Scarlet Bee-balm			P		■	■	FAC	FAC	FACU	1,272,500	0.03	0.09	S									
Monarda fistulosa	Wild Bergamot	■	■	P		■		FACU	UPL	FACU	1,272,500	0.03	0.09	S									
Monarda punctata	Spotted Bee-balm	■	■	P	■	■		FACU	UPL	UPL	1,440,000	0.02	0.08										

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	NCNE		Grass Mix	Forb Mix		M	A	M	J	J	A	S	O	N
Penstemon canescens	Gray Beard-tongue	■		P	■			NI	NI	NI	400,000	0.08	0.3										
Penstemon digitalis	Tall White Beard-tongue	■	■	P	■	■		FAC	FAC	FAC	400,000	0.08	0.3	D,S									
Pycnanthemum incanum	Hoary Mountain Mint	■	■	P	■	■		NI	NI	NI	4,500,000	0.007	0.03	S									
Pycnanthemum muticum	Big-leaf Mountain Mint		■	P	■	■	■	FAC	FAC	FAC	4,500,000	0.007	0.03	S									
Pycnanthemum tenuifolium	Narrow-leaf Mountain Mint	■	■	P	■	■	■	FACW	FACW	FAC	4,500,000	0.007	0.03	A,S									
Rudbeckia fulgida var. *fulgida*	Orange Coneflower	■	■	P		■		FAC	FAC	OBL	500,000	0.07	0.25										
Rudbeckia hirta	Black-eyed Susan	■	■	B	■	■		FACU	FACU	FACU	1,575,760	0.02	0.07	D									
Rudbeckia triloba	Brown-eyed Susan	■	■	P		■		FACU	FACU	FACU	536,000	0.06	0.2										
Senna hebecarpa	American Senna	■	■	P		■	■	FAC	FAC	FACW	20,500	0.25	1	T									
Senna marilandica	Maryland Senna	■	■	P	■	■		FAC	FAC	FACW	20,500	0.25	1	D,T									
Silphium perfoliatum	Cup Plant	■		P		■		FAC	FAC	FACW	100,000	0.35	1	A									
Solidago juncea	Early Goldenrod	■	■	P	■	■		NI	NI	NI	2,500,000	0.01	0.05	D									
Solidago nemoralis	Gray Goldenrod	■	■	P	■	■		NI	NI	NI	1,008,000	0.03	0.1	D									
Solidago patula	Rough-leaved Goldenrod	■		P			■	OBL	OBL	OBL	700,000	0.05	0.15										
Solidago rugosa	Wrinkle-leaf Goldenrod	■	■	P	■	■		FAC	FAC	FAC	1,000,000	0.03	0.1	A,D									
Symphyotrichum ericoides	White Heath Aster	■		P	■	■		UPL	FACU	FACU	700,000	0.05	0.15										
Symphyotrichum laeve var. *laeve*	Smooth Blue Aster	■	■	P	■	■		UPL	FACU	FACU	1,014,000	0.03	0.1	D									
Symphyotrichum lateriflorum var. *lateriflorum*	Calico Aster	■	■	P		■	■	FAC	FACW	FAC	750,000	0.04	0.15	D									
Symphyotrichum novae-angliae	New England Aster	■	■	P		■	■	FACW	FACW	FACW	1,100,000	0.03	0.1										

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	NCNE		Grass Mix	Forb Mix		M	A	M	J	J	A	S	O	N
Symphyotrichum novi-belgii	New York Aster	■	■	P			■	OBL	FACW	FACW	700,000	0.05	0.15										
Symphyotrichum oblongifolium	Aromatic Aster	■		P	■	■		NI	NI	NI	700,000	0.05	0.15										
Symphyotrichum pilosum	White Oldfield Aster	■	■	P	■	■		FAC	FAC	FACU	700,000	0.05	0.15	D									
Symphyotrichum prenanthoides	Zigzag Aster	■		P		■		FAC	FAC	FAC	700,000	0.05	0.15	D									
Symphyotrichum puniceum	Purple-stemmed Aster	■	■	P			■	OBL	OBL	OBL	700,000	0.05	0.15										
Symphyotrichum urophyllum	White Arrowleaf Aster	■	■	P	■	■		NI	NI	NI	700,000	0.05	0.15										
Thalictrum pubescens	Tall Meadow Rue	■	■	P		■	■	FACW	FACW	FACW	192,000	0.15	0.6	S									
Tradescantia ohiensis	Ohio Spiderwort	■	■	P		■		FAC	FAC	FACU	1,750,000	0.02	0.07	S									
Tradescantia virginiana	Virginia Spiderwort	■	■	P	■	■	■	FAC	FACU	UPL	1,750,000	0.02	0.07	D,S									
Verbena hastata	Blue (Swamp) Vervain	■	■	P			■	FAC	FACW	FACW	1,500,000	0.02	0.08										
Vernonia noveboracensis	New York Ironweed	■	■	P		■	■	FACW	FACW	FACW	300,000	0.1	0.4	S									
Veronicastrum virginicum	Culver's Root	■		P		■	■	FACW	FACU	FAC	7,800,000	0.004	0.02										
Zizia aurea	Golden Alexanders	■	■	P		■		FAC	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), Eastern Mountains and Piedmont (EMP) and Northcentral and Northeastern (NCNE)

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	NCNE		Grass Mix	Forb Mix		M	A	M	J	J	A	S	O	N

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 42

TABLE 3.1: TEMPORARY SEEDING FOR SITE STABILIZATION 43

TABLE 3.2: RECOMMENDED PERMANENT SEEDING MIXTURES BY PURPOSE 44

TABLE 3.3: PERMANENT HERBACEOUS SEEDING MIXTURES 45

TABLE 3.4: QUALITY OF SEED 52

SECTION 3 REFERENCES 53

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./ 1,000 sq.ft.**		**6b**	**7a, 7b, and 8a**
COOL-SEASON GRASSES					
Annual Ryegrass *Lolium perenne* ssp. *multiflorum*	40	1.0	0.5	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 15 to Apr 30 Aug 15 to Nov 30
Barley *Hordeum vulgare*	96	2.2	1.0	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 15 to Apr 30 Aug 15 to Nov 30
Oats *Avena sativa*	86	2.0	1.0	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 15 to Apr 30 Aug 15 to Nov 30
Wheat *Triticum aestivum*	120	2.8	1.0	Mar 1 to Apr 30 Aug 1 to Oct 15	Feb 15 to Apr 30 Aug 15 to Nov 30
Cereal Rye *Secale cereale*	112	2.8	1.0	Mar 1 to Apr 30 Aug 1 to Nov 1	Feb 15 to Apr 30 Aug 15 to Nov 1
WARM-SEASON GRASSES					
Foxtail Millet *Setaria italica*	30	0.7	0.5	May 1 to Jul 31	May 1 to Aug 14
Pearl Millet *Pennisetum glaucum*	20	0.5	0.5	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 listed above 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**	**7**	**8**	**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					✓							✓	
Forest Trails and Landings		◆	✓			✓		✓	✓	✓	◆		✓

✓ 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]**		**Soil Drainage Class[2]**	**Max. Height (feet)**	**Maint. Level**	**Remarks**
			lbs./ac.	**lbs./ 1000 sq. ft.**				
1	**SELECT ONE WARM-SEASON GRASS:**							
	Switchgrass *Panicum virgatum*	Carthage	5	0.11				*** NJPMC Coastal Plain waterway mix**
	Coastal Panicgrass *Panicum amarulum*	Atlantic	10	0.23				Performs well on excessively droughty/ sandy soils. All species are native to New Jersey
	AND ADD THE FOLLOWING COOL SEASON GRASSES:							
	Creeping Red Fescue Festuca rubra var rubra	Pennlawn, Flyer, Fortess, Salem,	30	0.70				Plant this mix with a regular grass drill.
	Canada or Southeastern wildrye		10	0.23				
	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*	Common	2	0.04				
	roundhead lespedeza *Lespedeza capitata*	Common	0.5	0.01				Switchgrass, Coastal Panicgrass, and the 'Dawson' variety of Creeping Red Fescue and Partridge Pea are moderately salt-tolerant.
	Tick trefoil *Desmodium canadense/paniculatum*	Common	0.5	0.01				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				Use Canada wild rye on droughty sites.
	Continued next page				W - P	2 - 3	C - D	

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
Mix		Recommended Cultivars (Endophyte free)	Seeding Rate[1]		Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
			lbs./ac.	lbs./ 1000 sq. ft.				
	AND ADD ONE OF THE FOLLOWING:	Common	5	0.11				
	Virginia Wild Rye *Elymus virginicus*							
	Canada Wild Rye *Elymus canadensis*	Common	5	0.11				
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:							
	Deertongue *Dicanthelium clandestinum*	Tioga	20	0.46	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 erosion protection while the deertongue is becoming established.
	Redtop *Agrostis gigantea*	Streaker	1	0.02				
	AND ADD THE FOLLOWING LEGUME:							
	roundhead lespedeza *Lespedeza capitata*		2	0.05				
4	**ALL OF THE FOLLOWING:**							
	Big Bluestem *Andropogon gerardii*	Niagara	6	0.14				
	Indiangrass *Sorghastrum nutans*	Americus, Suther Germplasm[5]	6	0.14				All species are native to the Northeast.
	Little Bluestem *Schizachyrium scoparium*	Suther Germplasm[5]	4	0.09	E - MW	6 - 8	C - D	The indiangrass and bluestems have fluffy seeds. Plant with a specialized native seed drill.
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Pennlawn, Flyer, Fortess, Salem						
	continued next page		15	0.34				

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
Mix		Recommended Cultivars (Endophyte free)	Seeding Rate[1]		Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
			lbs./ac.	lbs./ 1000 sq. ft.				
	AND ADD ONE OF THE FOLLOWING LEGUMES:							Creeping red fescue is a cool- season grass that will provide erosion protection while the warm-season grasses are becoming established.
	Partridge Pea *Chamaecrista fasciculata*	Common	4	0.09				
	roundhead lespedeza *Lespedeza capitata*	Common	2	0.05				
5	**ALL OF THE FOLLOWING:**							
	Coastal panicgrass *Panicum amarum var amarulum*	Atlantic	5	0.11				Native warm/cool season grass buffer planting for coastal areas that occasionally get inundated.
	Switchgrass *Panicum virgatum*	High Tide Germ	10	0.23				
	Eastern gamagrass Tripsacum dactyloides	Meadowcrest	10	0.23				
	AND ADD ONE OF THE FOLLOWING: (if available)							
	Florida paspalum *Paspalum floridanum*	Mid-Atlantic Germ	5	0.11	E-P	3-4		Cultivars specified have shown some salt tolerant
	Smooth panicgrass Panicum dichotomiflorum	Common	5	0.11				
	Canada wildrye *Elymus canadensis*	Mandan, Shire, common	10	0.23			D	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	E – P	2 – 3	B – D	Use either creeping red fescue or hard fescue in heavy shade, but only hard fescue in sunny conditions and/or droughty soils.
	Hard Fescue *Festuca trachyphylla*	Durar, Minimus	20	0.46				

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
Mix		Recommended Cultivars (Endophyte free)	Seeding Rate[1]		Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
			lbs./ac.	lbs./ 1000 sq. ft.				
	AND ADD ONE OF THE FOLLOWING: Perennial Ryegrass *Lolium perenne* Redtop *Agrostis gigantea* *continued next page*	 Blazer II, Pennfine Streaker	 5 1	 0.11 0.02				Perennial ryegrass and redtop will establish more rapidly than either fescue. 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.
	AND ADD THE FOLLOWING (OPTIONAL): Flatpea *Lathyrus sylvestrus*	 Lathco	 15	 0.34				Avoid adding Flatpea Lathyrus sylvestrus for forest trail and landing stabilization
7	Tall Fescue *Lolium arundinaceum* *Use only for high impact turfgrass seedings in sunny to partially shaded, well-drained sites	Endophyte- enhanced recommended NJ turf-types[4]	60	1.4	E - P	2 - 3	A - D	Tall fescue produces a dense turf if frequently mowed but tends to be bunchy if mowed only occasionally. For best results, use a blend of 3 cultivars.
8	**SELECT ONE OF THE FOLLOWING:** Tall Fescue *Lolium arundinaceum* Smooth bromegrass *Bromus inermis* **AND ADD:** Kentucky Bluegrass *Poa pratensis* **AND ADD ONE OF THE FOLLOWING LEGUMES:** Birdsfoot trefoil *Lotus corniculatus* White clover *Trifolium repens*	 Fawn, Johnstone, Barcel, Festorina Saratoga, Baylor Turf-types[4] Viking, Norcen Common	 40 22 15 5 2	 0.93 0.50 0.34 0.15 0.05	E – P	2 – 3	C – D	These recommended forage cultivars of tall fescue are endophyte free. Smooth bromegrass best adapted to Piedmont & Mountain region Birdsfoot trefoil is suitable for use only in Zones 5b and 6a. White clover is adapted statewide.

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
Mix		Recommended Cultivars (Endophyte free)	Seeding Rate[1]		Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
			lbs./ac.	lbs./ 1000 sq. ft.				
9	**SELECT ONE OF THE FOLLOWING:**							
	Tall Fescue *Lolium arundinaceum*	Endophyte- enhanced turf-types[4]	60	1.38				Mix is good for high impact turf areas such as athletic fields and recreation areas.
	Hard Fescue *Festuca trachyphylla* *continued next page*	Durar, Minimus	40	0.92	E - P	2 - 3	A - D	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 and Kentucky bluegrass
	AND ADD BOTH:	Recommended NJ turf-types[4]						
	Kentucky Bluegrass4 *Poa pratensis*		40	0.92				
	Perennial Ryegrass *Lolium perenne*	Blazer II, Pennfine	20	0.46				
10	**ALL OF THE FOLLOWING:**							
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	43	1.0				Suitable mix for shady turf areas.
	Kentucky Bluegrass *Poa pratensis*	Recommended NJ turf-types[4]	22	0.50	E - MW	2 - 3	B - D	
	OPTIONAL - ADD THE FOLLOWING							Add rough bluegrass under moist, shady conditions only.
	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				
	Sheep Fescue *Festuca ovina*	Bighorn, Covar, Quatro	25	0.57	E - MW	2 - 3	C - D	
	AND ADD THE WILDFLOWER MIX							
	Black-eyed Susan *Rudbeckia hirta*	Common	2	0.05				

TABLE 3.3: Permanent Herbaceous Seeding Mixtures								
Mix		Recommended Cultivars (Endophyte free)	Seeding Rate[1]		Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
			lbs./ac.	lbs./ 1000 sq. ft.				
	Lance-leaved Coreopsis *Coreopsis lanceolata* *continued next page*	Common	2	0.05				Attractive mix of fine fescues and wildflowers for low maintenance conditions. Once well-established, the grasses may tend to outcompete the wildflowers
	Purple Coneflower *Echinacea purpurea*	Common	2	0.05				
	Partridge Pea *Chamaecrista fasciculata*	Common	5	.11				Hydroseeding is not recommended for this mix if wildflowers are used.
	OR ADD THE CLOVER MIX							
	White Clover *Trifolium repens*	Common	3	0.07				(They have very small seeds.)
	Red Clover *Trifolium pratense*	Any	3	0.07				
12	**ADD THE FOLLOWING:**							Saltgrass will persist only under saline conditions.
	Alkali Saltgrass *Puccinellia distans*	Fults or Salty	20	0.46				
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Dawson, Pennlawn, Flyer, Fortess, Salem	15	0.34				Use the 'Dawson' variety of creeping red fescue in saline conditions.
	Fowl Meadowgrass *Poa palustris* ***OR***	Common	2	0.05				
	Creeping Bentgrass *Agrostis palustris*	Seaside, Southshore	2	0.05				
	AND ADD THE FOLLOWING (OPTIONAL Nurse Crop):				W - P	2 - 3	B - D	Fowl meadowgrass is a native wet site bluegrass. Add bentgrass for wet, saline conditions.
	Japanese millet		10	0.23				Use Japanese millet where quick cover is needed.

TABLE 3.3: Permanent Herbaceous Seeding Mixtures

Mix		Recommended Cultivars (Endophyte free)	Seeding Rate[1]		Soil Drainage Class[2]	Max. Height (feet)	Maint. Level	Remarks
			lbs./ac.	lbs./ 1000 sq. ft.				
13	**ADD ALL OF THE FOLLOWING:**							
	Orchardgrass *Dactylis glomerata*	Any	25	0.57				Low maintenance mix that is easy to establish.
	Creeping Red Fescue *Festuca rubra* var. *rubra*	Dawson, Pennlawn, Flyer, Fortess, Ruby, or Salem	10	0.23				Omit the clovers if using this mix for wastewater treatment strips and areas.
					W - SP	2 - 3	C - D	
	Continued next page							
	Redtop *Agrostis gigantea*	Streaker	1	0.02				
	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 Drained SP - 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

[5] Preferred local selection released by USDA NRCS Plant Materials Program. Plant Materials Program conservation plant releases are evaluated prior to release to help ensure that the plants will perform as needed in their recommended areas of adaptation and use.

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[2] *Hordeum vulgare*	96	85	Big Bluestem[2] *Andropogon gerardii*	25	--
Creeping Bentgrass[2] *Agrostis palustris*	90	80	Little Bluestem[2] *Schizachyrium scoparium*	12	--
Canada Bluegrass	90	80	Deertongue *Dicanthelium clandestinum*	95	75
Kentucky Bluegrass[2] *Poa pratensis*	85	75	Indiangrass[2] *Sorghastrum nutans*	25	--
Rough Bluegrass *Poa trivialis*	90	80	Foxtail or Pearl Millet[2] *Setaria italica or Pennisetum glaucum*	98	70
Chewings Fescue[2] *Festuca rubra ssp. commutata*	98	80	Coastal Panicgrass *Panicum amarulum*	95	70
Creeping Red Fescue[2] *Festuca rubra* var. *rubra*	98	80	Switchgrass[2] *Panicum virgatum*	90	60
Hard Fescue[2] *Festuca brevipila*	95	80	Other native WSGs	--	--
Sheep Fescue[2] *Festuca ovina*	95	80	***Legumes/Forbs***		
Tall Fescue[2] *Festuca arundiancea*	95	80	Alsike Clover[2] *Trifolium hybridum*	99	85
Oats[2] *Avena sativa*	98	85	Red Clover[2] *Trifolium pratense*	99	85
Orchardgrass[2] *Dactylis glomerata*	85	80	White Clover[2] *Trifolium repens*	99	90
Redtop *Agrostis gigantea*	92	80	Flatpea *Lathyrus sylvestrus*	98	75
Cereal Rye[2] *Secale cereale*	96	80	Partridge Pea *Chamaecrista fasciculata*	98	70
Annual or Perennial Ryegrass[2]	97	80	Other native legumes	--	--
Alkali Saltgrass *Puccinellia distans*	85	80	Birdsfoot Trefoil[2] *Lotus corniculatus*	98	80
Wheat[2] *Triticum aestivum*	96	85	Wildflowers	--	--
Canada Wild Rye[2] *Elymus canadensis*	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.
[2] Minimum purity and germination standards set by the Association of Official Seed Certifying Agencies for listed species (AOSCA, 2016).

Section 3 References

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

Section 4 - Tree and Shrub Plantings

This section contains recommended trees and shrubs (and several woody vines) that can be planted for cover, hedgerows, forest production, erosion control, water quality, wetland restoration, and other purposes. Refer to Section 10 – Agroforestry for riparian buffer spacing and windbreak/shelterbelt spacing.

SECTION 4 TABLE OF CONTENTS

SELECTING SPECIES AND ESTABLISHING PLANTINGS 54

PREPARATION OF PLANTING SITES, PLANTING METHODS, AND PLANTING DATES 56

TABLE 4.1: RECOMMENDED SITE PREPARATION BASED ON SOIL TYPE AND PREVIOUS LAND MANAGEMENT 56

CARE, HANDLING, SIZE AND PLANTING REQUIREMENTS FOR WOODY PLANTING STOCK 57

TABLE 4.2: PLANTING DATES 58

PLANTING DENSITY SPECIFICATIONS BY PURPOSE 59

TABLE 4.3: SPACING AND DENSITIES TRADITIONAL FORESTRY PRODUCTS AND CARBON SEQUESTRATION 59

TABLE 4.4: SPACING AND DENSITIES FOR REDUCING EROSION AND/OR IMPROVING WATER QUALITY 60

TABLE 4.5: SPACING FOR HEDGEROWS 61

SPACING FOR WILDLIFE, FOREST HEALTH, AND WATERSHED MANAGEMENT 62

NATURAL REGENERATION 62

SEEDLING PROTECTION FROM WILDLIFE 63

TABLE 4.6: OPTIONS TO PROTECT SEEDLINGS FROM DEER PRESSURE 63

TABLE 4.7: RECOMMENDED TREES, SHRUBS, AND WOODY VINES FOR SELECTED USES 65

TABLE 4.8: CHARACTERISTICS OF TREES, SHRUBS, AND WOODY VINES 77

TABLE 4.9: TREE AND SHRUB TOLERANCES 94

SECTION 4 REFERENCES 105

Selecting Species and Establishing Plantings

Plant materials shall comply with minimum standards, such as those as established by the U.S. Forest Service or the American Horticulture Industry Association d/b/a AmericanHort (formerly known as the American Nursery and Landscape Association).

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

Refer to Table 4.1: 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 4.5 for the planting densities depending on the purpose and the type of stock being planted. Refer to Section 10 – Agroforestry for riparian buffer spacing and windbreak/shelterbelt spacing.

For wildlife plantings, refer to the "Spacing for Wildlife and Forestry Health" section directly following Table 4.5

To facilitate natural reproduction of trees, refer to the information listed under Natural Regeneration.

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 4.7 – Table 4.9 or 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 Methods, and Planting Dates

Planting sites must be properly prepared based on the soil type and vegetative conditions listed in Table 4.1. 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 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

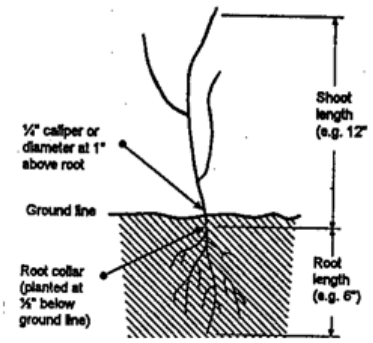
TABLE 4.1: Recommended Site Preparation Based on Soil Type and Previous Land Management		
Soil Type(s)	**Previous Land Management**	**Recommended Site Preparation**
Loamy or clayey	Sod or hay	Sod may be killed by non-selective herbicides the year before planting or in accordance with plant-back intervals listed on the herbicide label. 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.
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 24 inches in diameter with subsequent plant placement in the center of the scalped area. Rototill a strip at least 24 inches wide the year prior to tree planting with subsequent plant placement in the center of the tilled strip. Kill the vegetation in a minimum 24-inch diameter area or 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 1 : 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. Containerized plants may need root loosening or pruning to mitigate girdling roots and future problems. 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 hydrogel 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 at or slightly below the soil surface.

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.

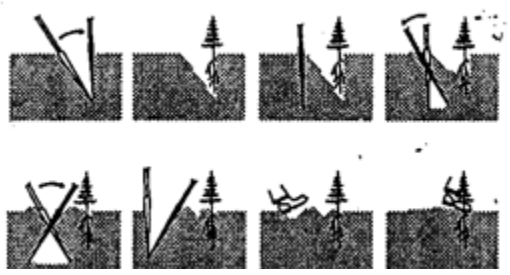


Figure 2: Proper Plant and Root Placement of Rooted Stock Using a Planting Bar

TABLE 4.2: Planting Dates

TABLE 4.2: Planting Dates[1]		
Type of Plant Material	**Plant Hardiness Zone**	
	6b	**7a, 7b and 8a**
Dormant Cuttings	Feb 15 to Apr 1	Feb 1 to Mar 15
Bare-Root Seedlings[2]	Mar 15 to May 15 May 16 to June 1*	Mar 1 to April 30 May 1 to May 15*
Containerized Stock; Ball-and-Burlap Stock	Mar 15 to May 31 Jun 1 to Jun 30* Oct 15 to Dec 1☼	Mar 1 to May 15 May 16 to Jun 15* 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.

* Extended period 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

Note: For spacing and density information for windbreaks, shelterbelts, and riparian buffers, refer to Section 10: Agroforestry.

TABLE 4.3: Spacing and Densities 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
Typical planting stock used	Bare Root	Bare Root	Plugs
Understocked woodlands (A professional forester should prepare the plan).	Use species with appropriate shade tolerance based on the existing canopy density and structure. Maintain at least 15’ spacing from existing trees.	Use species with appropriate shade tolerance based on the existing canopy density and structure. Maintain at least 15’ spacing from existing trees.	Interplant on 6’ x 7’ spacing within canopy openings that are no smaller in width than the height of existing woodland trees.
Typical planting stock used	Bare Root or Containerized	Bare Root or Containerized	Plugs or Containerized

TABLE 4.4: Spacing and Densities for Reducing Erosion and/or Improving Water Quality

TABLE 4.4: 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**
200 - 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 4.5: Spacing for Hedgerows

TABLE 4.5: 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	5 - 12	8 - 15
Evergreen Trees	5 - 8	8 - 15

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, Forest Health, and Watershed Management

Greater spacing between trees and shrubs is permissible if the stated purpose is for wildlife, forest health, or watershed management. 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 4.6 for information on protection measures. The presence of native plants that have a tendency to become overly competitive (rhizomatic fern species, spicebush, Mountain laurel, etc.) on site also needs to be considered in the establishment and monitoring of regeneration. If competing vegetation occupies more than 30% of the ground cover in a regeneration area, pre-treatment of those species is necessary as part of the site preparation.

The minimum number of seedlings or saplings required to naturally regenerate an acre so that it is fully stocked in maturity depends on the forest type, the size of the regeneration area, the size and competitive status of the regeneration, herbivory pressure, and management objectives. Natural regeneration can be divided into four broad categories to assess survivability.

1. Uncompetitive seedlings are those less than 12” tall, which are unlikely to survive when exposed to any stress. Under moderate levels of deer pressure (which at a minimum applies to most of New Jersey), uncompetitive seedling stocking should be in excess of 10,000 per acre for oaks and 6,000 per acre for most other desirable species to expect full stocking in maturity. Deer pressure should be considered moderate when some desirable regeneration is present but there is little height variability between seedlings, herbaceous plants are rare, and non-preferred browse or browse-resilient plant species are noticeably common and widespread. When deer pressure is high and browsing is evident on less palatable plants, uncompetitive seedling abundance should be more than 75,000 per acre.

2. Well-established seedlings are between 1’-3’ tall with a root collar diameter of at least ¼”. These stems will generally survive most ordinary environmental stress related to weather but remain susceptible to problems and/or mortality from repeated browsing. Under moderate herbivory pressure, the abundance of oak and other desirable species in this size class should be more than 5,000 and 3,000 per acre, respectively, for successful stand regeneration to be expected.

3. Competitive seedlings are small saplings taller than 3’ but less than 1” DBH. These stems are likely to survive some browse pressure while persisting and eventually growing beyond the reach of deer assuming adequate light is available to overcome each species light compensation point for photosynthesis. The minimum number of competitive seedlings/small saplings needed per acre is 770 regardless of species.

4. Saplings 1” DBH and larger are considered fully established and likely to become mature canopy trees assuming adequate growing space is available. A minimum of about 385 stems per acre of this size are needed depending on management objectives.

It is reasonable for natural regeneration to take up to three growing seasons to become established after a silvicultural event, and if reproduction remains inadequate after that time, adaptive strategies are needed. Even when natural regeneration is initially adequate, sites must be monitored until trees and shrubs have grown to the fully established sapling stage.

Fire ecology can be important for promoting natural regeneration in many New Jersey plant communities that are disturbance dependent, including Pitch pine and oak dominated forest types. Consider using Prescribed Burning (338) to facilitate natural regeneration in these systems. When timed correctly, prescribed burning may also be beneficial for controlling undesirable native vegetation and non-native invasive species that are inhibiting natural regeneration.

Direct seeding is the act of seeding tree seeds by either drilling or broadcasting the seeds onto the forest floor. Seed survival is predicated on several factors including adequate seed-to-soil contact, weather, and predation by insects, birds or mammals, which makes it difficult to estimate how many seeds per acre are needed with any certainty. General guidance is to establish at least 500 seedlings per acre from direct seeding. The expected 1-year survival rates are 2% for light, wind-dispersed seed types (e.g., conifers, birches, etc.) and 30% for heavy mast (e.g., oaks, walnuts, etc.). To accomplish this, the minimum per acre seeding rates are 25,000 for light seeds or 1,660 for heavy seeds. Appropriate site preparation to facilitate good seed-to-soil contact is a pre-requisite of direct seeding. Light seeds can be broadcast but hard or heavy mast should be sown or lightly disced to ensure good soil contact.

Seedling Protection from Wildlife

Newly planted seedlings can be damaged or killed by wildlife. Deer browsing is by far the greatest wildlife hazard, but beavers, rabbits, mice, voles and other rodents will chew on the bark and cambium of new seedlings and cause mortality. 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 moderate or heavy deer populations, use one or more of the three methods in Table 4.6: Options to Protect Seedlings from Deer Pressure.

TABLE 4.6: Options to Protect Seedlings from Deer Pressure

TABLE 4.6: 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 shelter 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 if the base of the shelters are covered by soil. Shelters should be at least 5’ tall. Use 1” square rot resistant, heartwood stakes of sufficient height to support the tree or tree shelter. It is acceptable to use PVC pipe or fiberglass stakes in flood prone areas. Practice good weed maintenance around shelters before the winter to minimize rodent nesting and damage at the base.
OPTION 3: WIRE CAGES
Light gauge welded wire (e.g., 14 ga.) can be used to construct cylindrical cages to protect seedlings. An advantage of using cages is that they can be made into various diameters to accommodate multi-stemmed shrubs or conifers. Cages should be

firmly secured to the ground with two stakes and installed at a minimum height of 5'. Reference the "Recommended Tree Cage Design" in FOTG under CPS 612.
OPTION 4: 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 at shorter intervals.

TABLE 4.7: Recommended Trees, Shrubs, and Woody Vines for Selected Uses **(see Table 4.8 and 4.9 for Species Characteristics and Tolerances)**																			
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		Control of Odor and PM 2.5	Screens/ Barriers		
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*	■	■	■	■		■	■		■		■	■	■	■				
chestnut, american *Castanea dentata*	■	■	■	■		■	■		■		■		■					
Chinquapin *Castanea pumila*		■	■	■		■	■			■	■		■			■		

TABLE 4.7: *Recommended Trees, Shrubs, and Woody Vines for Selected Uses* **(see Table 4.8 and 4.9 for Species Characteristics and Tolerances)**

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	Control of Odor and PM 2.5	Screens/ Barriers		
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*	■	■	■	■		■	■		■		■		■			■		
Hickory, pignut *Carya glabra*	■	■	■	■		■	■			■			■			■		
Hickory, Shagbark *Carya ovata*	■	■	■	■		■	■		■		■		■			■		
Honeylocust *Gleditsia triacanthos*	■	■	■	■			■					■	■			■		

TABLE 4.7: *Recommended Trees, Shrubs, and Woody Vines for Selected Uses* **(see Table 4.8 and 4.9 for Species Characteristics and Tolerances)**

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	Control of Odor and PM 2.5	Screens/ Barriers		
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*		■		■	■		■		■				■	■		■	■	
Oak, Chestnut *Quercus montana* (*Q. prinus)*	■	■	■			■	■		■		■		■	■		■		
Oak, Chinquapin *Quercus muehlenbergii*	■		■			■	■		■		■		■	■		■		
Oak, Northern Red *Quercus rubra*	■	■	■	■		■	■		■				■	■		■		

TABLE 4.7: *Recommended Trees, Shrubs, and Woody Vines for Selected Uses* **(see Table 4.8 and 4.9 for Species Characteristics and Tolerances)**

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	Control of Odor and PM 2.5	Screens/ Barriers		
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*	■	■	■	■		■	■		■		■	■						
Plum, American *Prunus americana*	■	■	■	■		■	■		■		■	■		■		■		
Poplar, Hybrid *Populus deltoides x nigra* 'Spike'	■	■		■			■									■		
Poplar, Tulip *Liriodendron tulipifera*	■	■		■		■	■					■	■			■		

TABLE 4.7: Recommended Trees, Shrubs, and Woody Vines for Selected Uses **(see Table 4.8 and 4.9 for Species Characteristics and Tolerances)**																		
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	Control of Odor and PM 2.5	Screens/ Barriers		
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'	■	■	■	■			■	■							■	■		
Cedar, Atlantic White *Chamaecyparis thyoides*		■		■	■	■	■	■		■					■	■		■
Cedar, Eastern Red *Juniperus virginiana*	■	■	■	■		■	■	■							■	■		
Cypress, Leyland *x Cupressocyparis leylandii*	■	■	■	■			■	■							■	■		

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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	Control of Odor and PM 2.5	Screens/ Barriers		
Hemlock, Eastern *Tsuga canadensis*	■	■	■	■		■	■	■		■					■	■		
Holly, American *Ilex opaca*	■	■	■	■		■	■	■		■					■	■		
Pine, Loblolly *Pinus taeda*		■		■	■	■	■	■		■			■		■	■	■	
Pine, Pitch *Pinus rigida*	■	■	■	■		■	■	■		■			■		■	■		
Pine, Shortleaf *Pinus echinata*		■	■			■	■	■							■	■		
Pine, Virginia *Pinus virginiana*	■	■	■	■		■	■	■		■			■		■	■		
Pine, White *Pinus strobus*	■	■	■	■			■	■		■			■		■	■		
SPRUCE, RED *Picea rubens*	■		■	■		■	■	■		■								
Spruce, Norway *Picea abies*	■	■	■	■			■	■		■					■	■		
SHRUBS AND WOODY VINES																		
Alder, Smooth *Alnus serrulata*	■	■		■	■	■	■	■	■							■		■
Alder, Speckled (Gray) *Alnus incana*	■	■	■	■	■	■	■	■	■							■	■	
Arrowwood *Viburnum dentatum*	■	■	■	■	■	■	■	■	■							■	■	
Azalea, Pinxter *Rhododendron periclymenoides*	■	■	■	■	■	■	■					■		■			■	
Azalea, Swamp *Rhododendron viscosum*		■		■	■	■	■					■		■			■	

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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		Toxic to Livestock				
	Northern Jersey	Coastal Plain	Dry Sites	Mesic Sites	Wet Sites		Nesting/ Resting	Protection	Wildlife (H)	Wildlife (M)	Humans	Nectar/ Pollen	Foliage		Control of Odor and PM 2.5	Screens/ Barriers		
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*	■		■	■		■	■	■	■		■	■	■					
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*	■	■	■	■		■	■	■		■						■		

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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		Control of Odor and PM 2.5	Screens/ Barriers		
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)*	■	■		■	■	■	■	■	■		■	■		■		■	■	
Fetterbush *Eubotrys racemosa (Leucothoe racemosa)*		■		■	■	■	■	■						■		■	■	
grape, fox *Vitis labrusca*	■	■	■	■		■	■	■	■		■						■	
grape, Riverbank *Vitis riparia (commercially available)*	■	■			■		■	■	■		■						■	
hackberry, Dwarf *Celtis pumila*	■	■	■	■			■		■		■	■	■		■	■		

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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		Control of Odor and PM 2.5	Screens/ Barriers		
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*	■		■	■	■	■	■	■		■		■				■	■	
Pepperbush, Sweet *Clethra alnifolia*	■	■		■	■	■	■	■				■				■	■	
Possum-Haw *Viburnum nudum*	■	■		■	■	■	■	■		■	■					■	■	
Raisin, Wild *Viburnum nudum* var. *cassinoides*				■	■	■	■	■		■	■					■	■	
Raspberry, Black *Rubus occidentalis*	■		■	■		■	■	■	■		■	■				■		

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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		Control of Odor and PM 2.5	Screens/ Barriers		
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*	■	■		■	■	■				■							■	
Sweetspire, virginia *Itea virginica*		■	■	■	■	■	■				■			■	■		■	
Waxmyrtle, Southern *Morella cerifera (Myrica cerifera)*		■	■	■	■	■	■	■						■	■		■	
Willows *Salix spp.*	■	■		■	■	■	■	■	■			■			■	■	■	

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							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	Control of Odor and PM 2.5	Screens/ Barriers		
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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							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		Control of Odor and PM 2.5	Screens/ Barriers		

[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.

TABLE 4.8: Characteristics of Trees, Shrubs, and Woody Vines

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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 hedgerows 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	Medium	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
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

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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.
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.

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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.
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.

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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.
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, use with caution; seeds freely and suckers. Nitrogen fixing. Fragrant white flowers attract bees and other pollinators. Flowers are poisonous if eaten by livestock.

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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.
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.
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.

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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.
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 divided 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.

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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.
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.

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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.
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.

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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.
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.

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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.
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	Statewide	W - MW	40 ft.	Fast	Low to Medium	Low to Medium	Medium: same as above.	Frequently planted statewide as an ornamental.
SPRUCE, RED *Picea rubens*	All	Northern NJ	W-SP	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.
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.

TABLE 4.8: 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**
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.
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.

TABLE 4.8: 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**
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
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.

TABLE 4.8: 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**
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.
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 are 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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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**
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.
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.

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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**
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.
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.

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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
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

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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.

[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.

TABLE 4.9: Tree and Shrub Tolerances

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Plant Names	**Flooding / Inundation Tolerance[1]**	**Shade Tolerance[2]**	**Drought Tolerance[3]**	**Salt Tolerance[4]**	**Deer Browse Preference[5]**	**pH**	**Soil Compaction Tolerance[6]**	**Rooting Type[7]**	**Remarks**
Deciduous Trees									
Ash, Green *Fraxinus pennsylvanica*	High	Med	Med	Low	Med	4.7-8.1	Med	SHL	Shade tolerance decreases with age
Ash, White *Fraxinus americana*	Med	Med	Med	Low	Med	4.7-7.5	Med	SHL	Shade tolerance decreases with age
Aspen, large-toothed *Populus grandidentata*	Low	Low	Med	Med	Med	4.8-7.2	Low	SHL	
ASPEN, QUAKING *Populus tremuliodes*	Low	Low	Med	Med	Med	4.3-9.0	Low	SHL	
basswood, american *Tilia americana*	Low	High	Med	Low	Med	4.5-7.5	Med	DPL	TAP Root in seedling stage
Beech, american *Fagus Gradifolia*	Low	High	Low	Low	Low	4.1-7.2	Low	SHL	
Birch, Black *Betula lenta*	Low	Low	Low	Med	Low	3.6-6.8	Med	DPL	Med shade tolerance as a seedling
Birch, Grey *Betula populifolia*	Low	Low	Med	Med	Low	3.5-6.5	Med	SHL	
Birch, River *Betula nigra*	High	Med	Low	Low	Low	3.0-6.5	High	SHL	
BIRCH, YELLOW *Betula allegheniensis*	Low	Med	Low	Med	Med	4.0-8.0	Low	DPL	
Blackgum *Nyssa sylvatica*	Med	Med	Med	Med	Med	6.1-6.5	Med	TAP	
Box-Elder *Acer negundo*	High	High	High	Med	Low	5.0-7.8	High	DPL	
butternut *Juglans cinerea*	Med	Low	Low	Low	Low	6.6-8.0	Low	TAP	
Cherry, Black *Prunus serotina*	Low	Low	Med	Med	Med	6.1-7.5	Med	DPL	TAP Root in seedling stage

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chestnut, american *Castanea dentata*	Low	Med	High	Low	Med	5.5-6.5	Med	TAP	Shade tolerance decreases with age
chokecherry *Prunus virginiana*	Med	Low	Med	Med	Low	5.2-8.4	Med	DPL	
Cottonwood, Eastern *Populus deltoides*	High	Low	Med	Med	Med	4.6-6.5	High	SHL	
Crabapple, *Malus SPP.*	Low	Low	Med	Low	Med	5.0-7.5	Med	DPL	
Cypress, Bald *Taxodium distichum*	High	Med	Med	High	Med	4.5-6.0	High	SHL	
Dogwood, Flowering *Cornus florida*	Low	High	Low	Low	Med	4.8-7.7	Med	SHL/DPL	
Dogwood, pagoda *Cornus alternifolia*	Low	High	Low	Low	Med	4.8-7.3	Med	SHL/DPL	
Elm, American *Ulmus americana* 'New Harmony' and 'Valley Forge'	Low	Med	Med	Low	Low	5.0-8.0	Med	DPL	
Elm, slippery *Ulmus rubra*	Low	Med	Med	Low	Low	5.0-7.0	Med	DPL	
Hackberry *Celtis occidentalis*	Med	Med	High	Low	Low	6.0-7.8	Med	DPL	
Hawthorn, cockspur *Crataegus crus-galli*	Low	Low	Med	Low	Med	6.1-8.0	Med	TAP	
Hawthorn, common *Crataegus monogyna*	Low	Low	Med	Low	Med	6.0-7.2	Med	TAP	
Hickory, BITTERNUT *Carya cordiformis*	Low	Low	High	Low	Low	5.2-7.6	Low	TAP	
Hickory, MOCKERNUT *Carya tomentosa*	Low	Low	Med	Low	Low	6.1-6.5	Low	TAP	
Hickory, pignut *Carya glabra*	Low	Med	High	Low	Low	6.1-7.5	Low	TAP	

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Hickory, Shagbark *Carya ovata*	Low	Med	High	Low	Low	5.0-6.7	Med	TAP	
Honeylocust *Gleditsia triacanthos*	Med	Low	Med	Med	Low	6.1-7.5	Med	DPL/SHL	
hop-hornbeam *Ostrya virginiana*	Low	High	Med	Low	Low	4.2-7.6	Med	DPL	
hornbeam, american *Carpinus caroliniana*	Low	High	Low	Low	Low	4.0-7.4	Med	DPL	
LARCH (ALL TAMARACKS) *Larix larcina*	High	Low	Med	Low	Low	4.8-7.5	Med	SHL	
Locust, Black *Robinia pseudoacacia*	Low	Low	High	Med	Med	5.1-7.7	Low	SHL	
Magnolia, Sweetbay *Magnolia virginiana*	Med	Med	Low	Low	Low	5.0-6.9	Med	SHL	
Maple, Red *Acer rubrum*	High	High	High	Low	High	4.5-7.0	Med	SHL	
Maple, Silver *Acer saccharinum*	High	Med	Low	Low	Low	4.0-7.3	Med	SHL	
Maple, Sugar *Acer saccharum*	Low	High	Low	Low	High	6.0-7.5	Low	SHL	
mulberry, red *Morus rubra*	Med	Med	High	Low	High	5.5-7.5	High	TAP	
Oak, black *Quercus velutina*	Low	Med	Med	Low	Med	4.5-6.5	Med	DPL/TAP	Shade tolerance decreases with age
Oak, blackjack *Quercus marilandica*	Low	Low	High	Med	Low	4.6-5.6	Med	TAP	
Oak, bUR *Quercus macrocarpa*	Med	Med	High	Low	Med	4.5-7.5	Med	TAP	
Oak, cherrybark *Quercus pagoda*	Low	Low	Low	Low	Med	4.5-6.0	Med	TAP	

TABLE 4.9: Tree and Shrub Tolerances									
Plant Names	**Flooding / Inundation Tolerance[1]**	**Shade Tolerance[2]**	**Drought Tolerance[3]**	**Salt Tolerance[4]**	**Deer Browse Preference[5]**	**pH**	**Soil Compaction Tolerance[6]**	**Rooting Type[7]**	**Remarks**
Oak, Chestnut *Quercus montana / prinus)*	Low	Med	High	Low	Med	4.5-6.5	Med	TAP	Shade tolerance decreases with age
Oak, Chinquapin *Quercus muehlenbergii*	Low	Low	High	Low	Med	5.0-8.0	Med	TAP	
Oak, Northern Red *Quercus rubra*	Low	Med	Med	Med	Med	4.3-7.3	Med	DPL/TAP	Shade tolerance decreases with age
Oak, Overcup *Quercus lyrata*	High	Med	Low	Low	Med	4.5-7.5	Med	SHL	
Oak, Pin *Quercus palustris*	High	Low	Low	Low	Med	4.5-6.5	Med	SHL	
Oak, post *Quercus stellata*	Low	Low	High	Low	Med	4.8-6.5	Med	TAP	
Oak, SCARLET *Quercus coccinea*	Low	Low	High	Low	Med	4.5-6.5	Med	TAP	
Oak, Southern Red *Quercus falcata*	Low	Low	High	Low	Med	4.8-7.0	Med	TAP	Shade tolerance decreases with age
Oak, Swamp Chestnut (Basket Oak) *Quercus michauxii*	Med	Low	Low	Low	Med	4.5-6.5	Med	TAP	
Oak, Swamp White *Quercus bicolor*	Med	Med	Low	Low	Med	4.3-6.5	Low	SHL	
Oak, Water *Quercus nigra*	High	Med	Low	Low	Med	4.8-7.3	Low	SHL	
Oak, White *Quercus alba*	Low	Med	High	Med	Med	4.5-6.8	Med	TAP	Shade tolerance decreases with age
Oak, Willow *Quercus phellos*	High	Low	Low	Med	Med	4.5-6.5	Low	SHL	
Osage-orange *Maclura pomifera*	Low	Low	High	Med	Med	5.0-8.0	High	DPL	
Pawpaw *Asimina triloba*	Low	High	Low	Low	Low	4.7-7.2	Low	TAP	

TABLE 4.9: Tree and Shrub Tolerances									
Plant Names	**Flooding / Inundation Tolerance[1]**	**Shade Tolerance[2]**	**Drought Tolerance[3]**	**Salt Tolerance[4]**	**Deer Browse Preference[5]**	**pH**	**Soil Compaction Tolerance[6]**	**Rooting Type[7]**	**Remarks**
Persimmon, Common *Diospyros virginiana*	Med	High	Med	Low	Med	6.1-6.5	Low	TAP	
Plum, American *Prunus americana*	Med	Low	Med	Low	Med	5.0-7.0	Low	SHL	
Poplar, Hybrid *Populus deltoides x nigra*	Med	Low	Med	Low	Med	6.6-7.5	Low	SHL	
Poplar, Tulip *Liriodendron tulipifera*	Low	Low	Low	Low	Med	6.1-6.5	Low	SHL/DPL	Medium shade tolerance in seedling stage
Redbud *Cercis canadensis*	Low	High	High	Low	Med	5.0-8.0	Low	TAP	
Redwood, dawn *Metasequoia glyptostroboides*	High	Low	Med	Low	Low	6.2-8.4	Low	SHL	
sassafras *Sassafras albidum*	Low	Low	High	Low	Med	6.0-6.5	High	TAP	Medium shade tolerance in seedling stage
Sweetgum *Liquidambar styraciflua*	High	Low	Low	Med	Low	4.5-7.0	Med	SHL	
Sycamore *Platanus occidentalis*	High	Low	Low	Low	Low	4.9-6.5	High	SHL	Medium shade tolerance in seedling stage
Tupelo, Swamp (Swamp Black Gum) *Nyssa biflora*	High	Low	Low	Low	Med	4.5-5.7	Med	SHL	
Walnut, Black *Juglans nigra*	Med	Low	Low	Low	Low	4.6-8.2	Med	TAP	
Willow, Black *Salix nigra*	High	Low	Low	Med	Med	4.8-8.0	High	SHL	
Evergreen Trees									
Arborvitae *Thuja occidentalis*	High	Med	Med	Med	Med	5.2-7.0	Med	SHL	
Arborvitae *Thuja plicata x standishii* 'Green Giant'	Low	Med	Med	Low	Low	6.0-8.0	Med	SHL	

TABLE 4.9: Tree and Shrub Tolerances									
Plant Names	**Flooding / Inundation Tolerance[1]**	**Shade Tolerance[2]**	**Drought Tolerance[3]**	**Salt Tolerance[4]**	**Deer Browse Preference[5]**	**pH**	**Soil Compaction Tolerance[6]**	**Rooting Type[7]**	**Remarks**
Cedar, Atlantic White *Chamaecyparis thyoides*	High	Low	Low	Low	High	3.5-5.5	Low	SHL	Medium shade tolerance and a TAP Root in seedling stage
Cedar, Eastern Red *Juniperus virginiana*	Low	Low	High	Med	Low	4.7-8.0	Med	TAP	Older foliage is more palatable than seedlings
Cypress, Leyland *Cupressocyparis x leylandii*	Low	Low	Med	Low	Med	5.5-8.0	Low	SHL	
Hemlock, Eastern *Tsuga canadensis*	Low	High	Low	Low	High	4.6-6.5	Low	SHL	
Holly, American *Ilex opaca*	Low	High	High	Med	Low	4.5-6.5	High	DPL	
Pine, Loblolly *Pinus taeda*	High	Low	Med	Med	Low	4.0-7.0	Med	SHL	TAP Root in seedling stage
Pine, Pitch *Pinus rigida*	Low	Low	High	Med	Low	4.6-6.5	Med	TAP	
Pine, Shortleaf *Pinus echinata*	Low	Low	Med	Low	Low	4.0-6.0	Med	TAP	
Pine, Virginia *Pinus virginiana*	Low	Low	High	Low	Low	4.5-7.5	Med	TAP/SHL	
Pine, White *Pinus strobus*	Low	Med	Med	Low	Med	4.5-6.5	Low	SHL	Shade tolerance decreases with age
SPRUCE, RED *Picea rubens*	Med	High	Med	Low	Low	4.0-5.8	Low	SHL	
Spruce, Norway *Picea abies*	Low	med	Med	Low	Low	5.0-7.0	Med	SHL	
SPRUCE, WHITE *Picea glauca*	Med	Low	Med	Low	Low	4.7-6.5	Low	SHL	
Shrubs									
Alder, Smooth *Alnus serrulata*	High	Low	Low	Low	Med	5.0-7.0	Med	DPL	

TABLE 4.9: Tree and Shrub Tolerances									
Plant Names	**Flooding / Inundation Tolerance[1]**	**Shade Tolerance[2]**	**Drought Tolerance[3]**	**Salt Tolerance[4]**	**Deer Browse Preference[5]**	**pH**	**Soil Compaction Tolerance[6]**	**Rooting Type[7]**	**Remarks**
Alder, Speckled (Gray) *Alnus incana*	High	Med	Low	Low	Med	5.0-7.0	Med	DPL	
Arrowwood *Viburnum dentatum*	Med	Med	Low	Low	Med	4.5-7.3	Med	SHL	
Azalea, Pinxter *Rhododendron periclymenoides*	Med	High	Med	Low	Low	4.3-5.5	Med	SHL	
Azalea, Swamp *Rhododendron viscosum*	Med	High	Med	Low	Low	4.0-7.0	Med	SHL	
Bayberry, Northern *Morella pensylvanica (Myrica pensylvanica)*	Low	Low	High	Med/High	Low	5.5-7.0	High	DPL/SHL	
beachplum *Prunus Maritima*	Low	Low	High	Low	Med	5.8-7.7	Med	DPL/SHL	
Bladdernut, American *Staphylea trifolia*	Med	High	Med	Low	Med	6.0-7.5	Med	SHL	
Blackberry, Allegheny *Rubus allegheniensis*	Low	Med	High	Low	High	4.6-7.5	Med	SHL	
Blackberry, Sand *Rubus cuneifolius*	Low	Med	Low	Low	High	5.0-7.0	Med	SHL	
Black-Haw *Viburnum prunifolium*	Low	High	Med	Low	Low	4.8-7.0	Med	DPL/SHL	
Blueberry, Highbush *Vaccinium corymbosum*	High	High	Low	High	Low	3.5-7.0	Med	SHL	
Blueberry, lowbush *Vaccinium angustifolium*	Low	High	High	Low	Low	4.0-7.5	Med	SHL	
Bush, High Tide (Groundsel) *Baccharis halimifolia*	High	Med	Low	High	Low	505-7.8	High	SHL	
Bush, High Tide (Marsh-Elder) *Iva frutescens*	High	Low	Low	High	Low	5.0-7.5	Med	SHL	

TABLE 4.9: Tree and Shrub Tolerances									
Plant Names	**Flooding / Inundation Tolerance[1]**	**Shade Tolerance[2]**	**Drought Tolerance[3]**	**Salt Tolerance[4]**	**Deer Browse Preference[5]**	**pH**	**Soil Compaction Tolerance[6]**	**Rooting Type[7]**	**Remarks**
Buttonbush *Cephalanthus occidentalis*	High	High	Med	Med	Low	4.7-8.5	Med	SHL	
ChINkAPIN *Castanea pumila*	Low	Med	High	Low	High	4.5-6.8	Med	DPL/SHL	
Chokeberry, black *Aronia melanocarpa*	Med	Med	Med		Med	4.4-6.5	Low	SHL	
CHOKEBERRY, RED *Aronia arbutifolia*	Med	Low	Low	Med	Low	5.1-7.5	High	SHL	
CHOKEcherry *Prunus virginiana*	Med	Low	Med	Med	Low	5.2-8.4	Low	DPL	
Cranberry bush, American *Viburnum trilobum*	Med	Low	Low	Low	Low	5.5-7.5	Med	SHL	
Currant, American (Wild) Black *Ribes americanum*	Med	High	High	Low	Med	5.0-7.8	Med	SHL	
dewberry, bristly *Rubus hispidus*	Low	Low	Med	Low	Low	4.5-7.0	High	SHL	
dewberry, common *Rubus flagellaris*	Low	Med	Low	Low	Low	5.0-7.0	High	SHL	
Dogwood, aLTERNATE LEAF *Cornus alternifolia*	Low	High	low	Low	Med	4.8-7.3	Low	SHL	
Dogwood, Gray *Cornus racemosa*	Low	Med	Med	Low	Med	4.8-8.5	Med	SHL	
Dogwood, Redosier *Cornus sericea*	High	Low	Low	Low	High	4.8-8.5	High	SHL	
Dogwood, Silky *Cornus amomum*	Med	Med	Med	Low	Med	5.0-8.5	High	SHL	
Elderberry *Sambucus nigra* (*Sambucus canadensis)*	Med	Low	Med	Low	Med	5.0-8.9	Med	SHL	

TABLE 4.9: Tree and Shrub Tolerances									
Plant Names	**Flooding / Inundation Tolerance[1]**	**Shade Tolerance[2]**	**Drought Tolerance[3]**	**Salt Tolerance[4]**	**Deer Browse Preference[5]**	**pH**	**Soil Compaction Tolerance[6]**	**Rooting Type[7]**	**Remarks**
Fetterbush *Eubotrys racemosa* *(Leucothoe racemosa)*	High	High	Low	Low	Low	4.5-6.0	High	SHL	
Hazelnut (American Filbert) *Corylus americana*	Low	Med	Med	Low	Med	5.0-7.5	Low	SHL	
Hazelnut, beaked *Corylus cornuta*	Low	High	Med	Low	Med	4.8-7.5	Low	SHL	
Huckleberry, black *Gaylussacia baccata*	Low	High	High	Low	Low	4.5-6.5	Low	SHL	
Huckleberry, blue (DANGLEBERRY) *Gaylussacia frondosa*	Low	High	High	Low	Low	3.8-5.5	Low	SHL	
Indigo, False (Indigo bush) *Amorpha fruticosa*	Low	Med	High	Med	Low	5.0-8.5	High	TAP	
Inkberry *Ilex glabra*	High	Low	Low	Med	Low	4.5-7.0	High	SHL	
Maple-leaf viburnum *Viburnum acerifolium*	Low	High	High	Low	Med	4.8-7.5	Low	SH	
meadowsweet, white *Spiraea alba*	Med	Med	Low	Low	Low	4.3-6.8	High	SHL	
Nannyberry *Viburnum lentago*	Med	High	Low	Low	Low	5.0-7.0	High	SHL	Some references indicate moderate salt tolerance
Ninebark, Common *Physocarpus opulifolius*	Low	Low	Med	Low	Low	4.5-8.1	High	SHL	Some references indicate moderate salt tolerance
Pepperbush, Sweet *Clethra alnifolia*	Med	Med	Low	Low	Low	4.5-7.0	Low	SHL	
Raisin, Wild *Viburnum nudum* var. *cassinoides*	Low	High	Med	Low	High	4.9-7.0	Med	SHL	
Raspberry, Black *Rubus occidentalis*	Low	Med	Med	Low	High	5.2-7.5	High	SHL	

TABLE 4.9: Tree and Shrub Tolerances									
Plant Names	**Flooding / Inundation Tolerance[1]**	**Shade Tolerance[2]**	**Drought Tolerance[3]**	**Salt Tolerance[4]**	**Deer Browse Preference[5]**	**pH**	**Soil Compaction Tolerance[6]**	**Rooting Type[7]**	**Remarks**
Rhododendron *Rhododendron maximum*	Low	High	High	Low	Low	4.0-5.5	Med	SHL	
Rose, carolina *Rosa carolina*	Low	Low	High	Med	Med	4.0-8.5	Med	SHL	
Rose, Swamp *Rosa palustris*	Med	High	Low	Low	Low	4.0-7.0	Med	SHL	
Rose, virginia *Rosa virginiana*	Low	Med	Med	Med	Low	5.0-7.0	Med	SHL	
serviceberry, canadian *Amelanchier canadensis*	Med	High	Low	Med	Low	5.5-7.5	Low	SHL	
serviceberry, common *Amelanchier arborea*	Med	High	Low	Low	Low	4.8-7.5	Low	SHL	
Spicebush *Lindera benzoin*	Med	High	Low	Med	Low	4.5-6.5	Med	DPL	
Steeplebush *Spiraea tomentosa*	Low	Low	Med	Low	Low	4.5-7.0	High	SHL	
Sumac, smooth *Rhus glabra*	Low	Low	Med	Med	Low	5.3-7.0	Low	SHL	
Sumac, staghorn *Rhus typhina*	Low	Low	High	Med	Low	4.5-7.2	Low	SHL	
sumac, winged *Rhus copallinum*	Med	Low	Med	Med	Low	5.3-7.5	Med	SHL	
Sweetspire, Virginia *Itea virginica*	High	High	Low	Low	Low	4.0-7.5	Med	SHL	Some references indicate moderate salt tolerance
Waxmyrtle, Southern *Morella cerifera* *(Myrica cerifera)*	Med	Low	Med	Med	Low	5.4-9.1	Med	SHL	
Willows *Salix spp.*	High	Low	Med	Med	Med	5.0-7.0	High	SHL	
Willow, Purpleosier *Salix purpurea* 'Streamco'	High	Low	Low	Low	Low	5.5-7.5	High	SHL	Some references indicate moderate salt tolerance

TABLE 4.9: Tree and Shrub Tolerances

Plant Names	Flooding / Inundation Tolerance[1]	Shade Tolerance[2]	Drought Tolerance[3]	Salt Tolerance[4]	Deer Browse Preference[5]	pH	Soil Compaction Tolerance[6]	Rooting Type[7]	Remarks
Willow, Pussy *Salix discolor*	High	Med	Low	Med	Med	4.0-7.0	High	SHL	
Winterberry *Ilex verticillata*	Low	Med	Low	Low	Low	4.5-8.0	High	SHL	Some references indicate moderate salt tolerance
Witch-Hazel *Hamamelis virginiana*	Low	High	Med	Med	Low	4.5-7.0	High	DPL	

[1] Flood Tolerance: High = able to survive flooding or soil saturation for more than 30 consecutive days; Med = able to survive flooding or soil saturation for a few days or weeks; Low = unable to survive more than a few consecutive days of flooding during the growing season.

[2] Shade Tolerance: High = able to survive and grow under low light conditions – typically referred to as "tolerant"; Med = able to survive and grow under partial shade – typically referred to as "intermediate"; Low = requires overhead exposure to sunlight for survival and growth.

[3] Drought Tolerance: High = can grow on xeric sites or survive extended periods without significant precipitation; Med = resistant to occasional dry periods during the growing season; Low = unable to survive without consistent soil moisture.

[4] Salt Tolerance: High = can survive periodic exposure from ocean storm surge or road salt; Med = can survive occasional exposure from salt spray or road salt; Low = sensitive to any salt exposure.

[5] Deer Palatability: High = foliage is highly palatable and desired by deer; Med = foliage is palatable but if deer pressure is low or other more desirable options are present, browse damage will be minimal; Low = foliage is unpalatable and will only be browsed when other food options are unavailable.

[6] Soil Compaction: High = resistant to soil compactions or adapted to growing in fine soil texture; Med = intermediate sensitivity to soil compaction; Low = very sensitive to soil compaction.

[7] Root Type: SHL = shallow lateral, DPL = deep lateral, TAP = taproot

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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.

SECTION 5 TABLE OF CONTENTS

SELECTING SPECIES AND ESTABLISHING PLANTINGS 107
TABLE 5.1: CHARACTERISTICS OF WOODY PLANTS FOR STREAMBANK AND SHORELINE STABILIZATION 108
TABLE 5.2: CHARACTERISTICS OF COMPANION GRASSES 1 FOR WOODY BIOENGINEERING PLANTINGS 111
TABLE 5.3: CHARACTERISTICS OF GRASSES AND GRASS-LIKE PLANTS FOR TIDAL SHORELINE STABILIZATION 114
SECTION 5 REFERENCE 117

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.
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.

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**
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.
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.

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**

[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 1 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).	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 turf-types[6]	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.

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, 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.
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.

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**

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.

6. Refer to Rutgers Turfgrass Proceedings published annually by Rutgers University, the Center for Turfgrass Science, Rutgers Cooperative Extension, and the New Jersey Agricultural Experiment Station in cooperation with the New Jersey Turfgrass Association for the most current perennial ryegrass cultivar selection guidance (2021 trials).

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.

Section 5 Reference

[All online citations accessed October 8, 2021]

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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.

SECTION 6 TABLE OF CONTENTS

SELECTING SPECIES AND ESTABLISHING PLANTINGS 118

TABLE 6.1: RECOMMENDED TREES, SHRUBS AND WOODY VINES FOR WETLANDS (SEE SECTION 4 FOR DETAILED SPECIES INFORMATION) 119

TABLE 6.2: RECOMMENDED HERBACEOUS MIXES FOR WETLANDS 124

TABLE 6.3: CHARACTERISTICS OF HERBACEOUS WETLAND PLANTS 127

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 contain 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]							Toxic to Livestock	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			
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*	■	■	■	■	■	■	■			■		■	■	■		■
Maple, Silver *Acer saccharinum*	■			■	■	■	■			■		■	■			■
Oak, cherrybark *Quercus pagoda*		■			■	■	■		■				■	■	■	
Oak, Overcup *Quercus lyrata*		■		■	■	■	■		■		■		■	■		■
Oak, Pin *Quercus palustris*	■	■		■	■	■	■		■				■	■	■	

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			
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*		■		■	■	■	■			■		■				■
Willow, Black *Salix nigra*	■	■		■	■	■	■					■	■			■
EVERGREEN TREES																
Cedar, Atlantic White *Chamaecyparis thyoides*	■	■		■	■	■	■	■		■			■			■
Hemlock, Eastern *Tsuga canadensis*	■	■	■	■		■	■	■		■			■		■	
Holly, American *Ilex opaca*	■	■	■	■	■	■	■	■		■		■	■		■	
Pine, Loblolly *Pinus taeda*		■		■	■	■	■	■		■			■		■	

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			
SPRUCE, RED *Picea rubens*	■		■	■		■	■	■		■			■		■	
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*	■	■		■	■	■	■	■	■		■	■	■		■	
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*		■			■	■	■			■	■		■		■	

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			
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, blue *Gaylussacia frondosa*	■	■	■	■	■	■	■	■	■		■	■	■		■	
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*	■	■		■	■	■	■	■	■		■	■				■

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			
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*	■	■		■	■	■	■	■	■			■	■		■	
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.) Suitable for seasonally saturated wetlands and adjacent somewhat poorly drained areas. Tolerates dry conditions and brief periods of inundation after establishment.
	Virginia Wildrye *Elymus virginicus*	Common	4 - 6				
2	**ADD ALL OF THE FOLLOWING:**						
	Virginia Wildrye *Elymus virginicus*	Common	2 - 3				
	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	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. Fowl Meadowgrass may be short-lived on the Coastal Plain, especially on drier sites in full sun.
	Deertongue *Dichanthelium clandestinum*	Tioga	2 - 4				
	AND ADD:						
	Partridge Pea *Chamaecrista fasciculata*	Common	1				
3	**ADD ALL OF THE FOLLOWING:**						
	Rough Barnyard Grass *Echinochloa muricata*	Common	2 - 4				
	Fowl Meadowgrass *Poa palustris*	Common	2 - 4				
	Virginia Wildrye *Elymus virginicus*	Common	2 - 4	All	3 - 4	Warm & cool season grasses	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. 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:						
	Partridge Pea *Chamaecrista fasciculata*	Common	1				

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**
	Beggar Ticks *Bidens frondosa*	Common	1				Fowl Meadowgrass may be short-lived on the Coastal Plain, especially on drier sites in full sun.
	Smartweed *Polygonum pensylvanicum*	Common	0.5 - 1				
	Swamp Milkweed *Asclepias incarnata*	Common	2				
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				

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**
5	**ADD ALL OF THE FOLLOWING:**						
	Rough Bentgrass *Agrostis scabra*	Common	4 - 6				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.
	Fowl Meadowgrass *Poa palustris*	Common	4 - 8	All	1 - 2	Cool season grasses	

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.
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.

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**
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.	Riverbanks and floodplains. Prefers moist soils; tolerates dry sites. Re-seeding annual with yellow flowers. Native to central and western US.
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 riverbanks. Cool-season grass.
WildRye, Virginia *Elymus virginicus*	All	Statewide; common	■	m - »	<3 ft.	Fast	Foliage eaten by wildlife in early spring.	Wet meadows and riverbanks. 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.

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**
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.
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.

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**
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.
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.

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, 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.
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.

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**
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 134

TABLE 7.1: COMMON FORAGE CHARACTERISTICS AND TOLERANCES 136

TABLE 7.2 GRASS AND LEGUME GRAZING AND HARVESTING CHARACTERISTICS 139

TABLE 7.3: FORAGE AND HAY SEEDING RATES AND NOTES 142

TABLE 7.4: GRAZING SPECIES PREFERENCE FOR LEGUMES 145

TABLE 7.5 GRAZING SPECIES PREFERENCE FOR GRASSES 148

TABLE 7.6 GRAZING SPECIES PREFERENCE FOR FORBS 150

SECTION 7 REFERENCES 152

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.
- Table 7.4 – Table 7.6: Desirable Grasses/Legumes/Forbs by Grazing Species – Use these tables to determine if the existing vegetation is suitable for the grazing species. This table directly relates to the Pasture Condition Score (PCS) and can be used to support in-field scoring. These tables should be used to appropriately plan for new forage seedings to support the grazing plan.

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 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[z/] *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.								

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**				
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
LEGUMES									
Alfalfa	High	Bunch	Low	High	Medium	Long	High	High	6.0-8.5

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**				
Medicago sativa									
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

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**
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	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**
Phleum pratense								
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*	High	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.

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**

[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*	15	5	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.

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**
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 its 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.
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 its 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.

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**
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.

TABLE 7.4: Grazing Species Preference for Legumes

Species	Family	Lifespan	Functional Group	Preference [1,2]				Note
				Cattle	Sheep	Goat	Horse	
Alfalfa *Medicago sativa*	Fabaceae	Perennial	Legume	D	D	D	D	Intolerant of frequent grazing
Alfalfa, Branched Root *Medicago sativa*	Fabaceae	Perennial	Legume	D	D	D	D	
Alpine sweetvetch *Hedysarum alpinum*	Fabaceae	Perennial	Legume	D	I	I	U	Slightly toxic
American licorice *Glycyrrhiza lepidota*	Fabaceae	Perennial	Legume	D	D	D	I	
Birdsfoot trefoil *Lotus corniculatus*	Fabaceae	Perennial	Legume	D	D	D	D	Glycosides possible
Black medic *Medicago lupulina*	Fabaceae	Perennial	Legume	I	I	I	I	Very short so low yield, may not persist
Clover, alsike *Trifolium hybridum*	Fabaceae	Perennial	Legume	D	D	I	U	Undesirable for horses (poisonous), may cause problems in high volume for other species
Clover, arrowleaf *Trifolium vesiculosum*	Fabaceae	Annual	Legume	D	D	D	D	
Clover, ball *Trifolium nigrescens*	Fabaceae	Annual	Legume	D	D	D	D	
Clover, crimson *Trifolium ambiguum*	Fabaceae	Annual	Legume	D	D	D	D	Used as a cover crop

Species	Family	Lifespan	Functional Group	Preference [1,2]				Note
				Cattle	Sheep	Goat	Horse	
Clover, field *Trifolium campestre*	Fabaceae	Biennial	Legume	I	I	I	I	
Clover, hop *Trifolium aureum*	Fabaceae	Biennial	Legume	I	I	D	I	
Clover, kura *Trifolium ambiguum*	Fabaceae	Perennial	Legume	D	D	D	D	
Clover, rabbitsfoot *Trifolium arvense*	Fabaceae	Annual	Legume	I	I	I	I	Low production
Clover, red *Trifolium pratense*	Fabaceae	Perennial	Legume	D	D	D	I	Short-lived, but can reseed. May cause reproductive problems in sheep.
Clover, springbank *Trifolium wormskioldii*	Fabaceae	Perennial	Legume	D	D	D	D	
Clover, subterranean *Trifolium subterraneum*	Fabaceae	Annual	Legume	D	D	D	D	
Clover, white *Trifolium repens*	Fabaceae	Perennial	Legume	D	D	I	D	Multiply by 0.5 for dry matter biomass
Lespedeza, Roundhead *Lespedeza Capitata*	Fabaceae	Perennial	Legume	D	D	D	I	
Lespedeza, Slender *Lespedeza Virginica*	Fabaceae	Perennial	Legume	D	D	D	I	
Sweetclover	Fabaceae	Biennial	Legume	D	D	D	I	Stems avoided, can cause bloat in high volumes

Species	Family	Lifespan	Functional Group	Preference [1,2]				Note
				Cattle	Sheep	Goat	Horse	
Melilotus officinalis								
Ticktrefoil, showy *Desmodium canadense*	Fabaceae	Perennial	Legume	I	D	D	I	
Vetch, American; American deervetch; purple *Vicia americana*	Fabaceae	Perennial	Legume	D	D	D	D	
Vetch, common *Vicia sativa*	Fabaceae	Annual	Legume	D	D	D	I	
Vetch, crown *Securigera varia*	Fabaceae	Perennial	Legume	I	D	I	U	Can be invasive
Vetch, hairy or winter *Vicia villosa*	Fabaceae	Biennial	Legume	D	D	D	I	

1. Preferences are based on definitions from the Pasture Condition Score (PCS)
2. D = Desirable, I = Intermediate, U = Undesirable

Table 7.5 Grazing Species Preference for Grasses

Common Name	Family	Lifespan	Functional Group	Preference [1,2]				Note
				Cattle	Sheep	Goat	Horse	
Agrimony *Agrimonia*	Rosaceae	NA	Forb	I	D	I	U	
Camelina *Camelina sativa*	Brassicaceae	Biennial	Forb	D	D	D	I	
Canola/rapeseed, forage *Brassica napus*	Brassicaceae	Annual	Forb	D	D	D	I	
Buckwheat *Fagopyrum esculentum*	Polygonales	Annual	Forb	I	D	D	U	
Burdock *Arctium lappa*	Asteraceae	Biennial	Forb	I	I	I	U	Grazed well, but persistent burs
Chicory *Cichorium intybus*	Asteraceae	Perennial	Forb	D	D	D	D	Forage varieties available
Daisy, ox-eye *Leucanthemum vulgare*	Asteraceae	Annual	Forb	I	I	I	I	
Dandelion *Taraxacum officinale*	Asteraceae	Perennial	Forb	I	I	I	I	Grazed well, low yield, sign of winterkill
Dock, broadleaf *Rumex obtusifolius*	Polygonaceae	Perennial	Forb	U	I	I	U	Leaves palatable, stems avoided
Dock, curly *Rumex crispus*	Polygonaceae	Perennial	Forb	I	I	I	U	Leaves palatable, stems avoided
Horseweed; marestail *Conyza canadensis*	Asteraceae	Annual	Forb	I	D	D	I	Toxic when small
Kale/Collards *Brassica oleracea*	Brassicaceae	Annual	Forb	D	D	D	I	
Lambsquarters *Chenopodium album*	Chenopodiaceae	Annual	Forb	I	D	D	I	
Lettuce, prickly *Lactuca serriola*	Asteraceae	Biennial	Forb	D	D	D	I	Palatable when young, older plants become bitter
Milkweed, common *Asclepias syriaca*	Asclepiadaceae	Perennial	Forb	U	I	I	I	Toxic in large doses, pollinator plant
Mouse-ear chickweed *Cerastium fontanum*	Caryophyllaceae	Perennial	Forb	I	I	D	I	
Mustards (any) *Brassicas*	Brassicaceae	Biennial	Forb	I	D	D	I	Yellow rocket, garlic mustard, etc.
Orach *Atriplex patula*	Chenopodiaceae	Annual	Forb	I	D	I	U	

Common Name	Family	Lifespan	Functional Group	Preference [1,2]				Note
				Cattle	Sheep	Goat	Horse	
Plaintain, broadleaf *Plantago major*	Plantaginaceae	Perennial	Forb	I	I	I	I	Indicates surface compaction
Plaintain, narrowleaf *Plantago lanceolata*	Plantaginaceae	Perennial	Forb	I	I	I	I	Leaves grazed, stems avoided, low persistence
Pennycress, field *Thlaspi arvense*	Brassicaceae	Annual	Forb	I	D	D	I	Can cause off-flavors in milk of dairy cows
Pepperweed, field *Lepidium campestre*	Brassicaceae	Biennial	Forb	I	I	D	U	Toxic to horses, palatable when young
Pepperweed, Virginia *Lepidium virginicum*	Brassicaceae	Biennial	Forb	I	I	D	U	Toxic to horses, palatable when young
Radish, (Oil Seed) *Raphanus sativus*	Brassicaceae	Biennial	Forb	D	D	D	I	
Radish, wild *Raphanus raphanistrum*	Brassicaceae	Biennial	Forb	I	D	D	I	
Ragweed, annual *Ambrosia artemisiifolia*	Asteraceae	Annual	Forb	I	D	D	I	
Starwort; Stichwort *Stellaria graminea*	Caryophyllaceae	Perennial	Forb	I	I	I	I	Chickweed family
Sunflower *Helianthus annuus*	Asteraceae	Annual	Forb	D	D	D	I	
Turnip, forage *Brassica rapa*	Brassicaceae	Annual	Forb	D	D	D	I	
Wild carrot *Daucus carota*	Apiaceae	Biennial	Forb	I	I	I	I	
Yellow rocket; wintercress *Barbarea vulgaris*	Brassicaceae	Biennial	Forb	I	D	D	I	

1. Preferences are based on definitions from the Pasture Condition Score (PCS)
2. D = Desirable, I = Intermediate, U = Undesirable

Table 7.6 Grazing Species Preference for Forbs

Common Name	Family	Lifespan	Functional Group	Preference [1,2]				Note
				Cattle	Sheep	Goat	Horse	
Agrimony *Agrimonia*	Rosaceae	NA	Forb	I	D	I	U	
Camelina *Camelina sativa*	Brassicaceae	Biennial	Forb	D	D	D	I	
Canola/rapeseed, forage *Brassica napus*	Brassicaceae	Annual	Forb	D	D	D	I	
Buckwheat *Fagopyrum esculentum*	Polygonales	Annual	Forb	I	D	D	U	
Burdock *Arctium lappa*	Asteraceae	Biennial	Forb	I	I	I	U	Grazed well, but persistent burs
Chicory *Cichorium intybus*	Asteraceae	Perennial	Forb	D	D	D	D	Forage varieties available
Daisy, ox-eye *Leucanthemum vulgare*	Asteraceae	Annual	Forb	I	I	I	I	
Dandelion *Taraxacum officinale*	Asteraceae	Perennial	Forb	I	I	I	I	Grazed well, low yield, sign of winterkill
Dock, broadleaf *Rumex obtusifolius*	Polygonaceae	Perennial	Forb	U	I	I	U	Leaves palatable, stems avoided
Dock, curly *Rumex crispus*	Polygonaceae	Perennial	Forb	I	I	I	U	Leaves palatable, stems avoided
Horseweed; marestail *Conyza canadensis*	Asteraceae	Annual	Forb	I	D	D	I	Toxic when small
Kale/Collards *Brassica oleracea*	Brassicaceae	Annual	Forb	D	D	D	I	
Lambsquarters *Chenopodium album*	Chenopodiaceae	Annual	Forb	I	D	D	I	
Lettuce, prickly *Lactuca serriola*	Asteraceae	Biennial	Forb	D	D	D	I	Palatable when young, older plants become bitter
Milkweed, common *Asclepias syriaca*	Asclepiadaceae	Perennial	Forb	U	I	I	I	Toxic in large doses, pollinator plant
Mouse-ear chickweed *Cerastium fontanum*	Caryophyllaceae	Perennial	Forb	I	I	D	I	
Mustards (any) *Brassicas*	Brassicaceae	Biennial	Forb	I	D	D	I	Yellow rocket, garlic mustard, etc.
Orach *Atriplex patula*	Chenopodiaceae	Annual	Forb	I	D	I	U	

Common Name	Family	Lifespan	Functional Group	Preference [1,2]				Note
				Cattle	Sheep	Goat	Horse	
Plaintain, broadleaf *Plantago major*	Plantaginaceae	Perennial	Forb	I	I	I	I	Indicates surface compaction
Plaintain, narrowleaf *Plantago lanceolata*	Plantaginaceae	Perennial	Forb	I	I	I	I	Leaves grazed, stems avoided, low persistence
Pennycress, field *Thlaspi arvense*	Brassicaceae	Annual	Forb	I	D	D	I	Can cause off-flavors in milk of dairy cows
Pepperweed, field *Lepidium campestre*	Brassicaceae	Biennial	Forb	I	I	D	U	Toxic to horses, palatable when young
Pepperweed, Virginia *Lepidium virginicum*	Brassicaceae	Biennial	Forb	I	I	D	U	Toxic to horses, palatable when young
Radish, (Oil Seed) *Raphanus sativus*	Brassicaceae	Biennial	Forb	D	D	D	I	
Radish, wild *Raphanus raphanistrum*	Brassicaceae	Biennial	Forb	I	D	D	I	
Ragweed, annual *Ambrosia artemisiifolia*	Asteraceae	Annual	Forb	I	D	D	I	
Starwort; Stichwort *Stellaria graminea*	Caryophyllaceae	Perennial	Forb	I	I	I	I	Chickweed family
Sunflower *Helianthus annuus*	Asteraceae	Annual	Forb	D	D	D	I	
Turnip, forage *Brassica rapa*	Brassicaceae	Annual	Forb	D	D	D	I	
Wild carrot *Daucus carota*	Apiaceae	Biennial	Forb	I	I	I	I	
Yellow rocket; wintercress *Barbarea vulgaris*	Brassicaceae	Biennial	Forb	I	D	D	I	

1. Preferences are based on definitions from the Pasture Condition Score (PCS)
2. D = Desirable, I = Intermediate, U = Undesirable

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.

SECTION 8 TABLE OF CONTENTS

SELECTING AND ESTABLISHING PLANTINGS 153

TABLE 8.1: GENERAL COVER CROP CHARACTERISTICS 155

TABLE 8.2: GRAZING AND FORAGE CHARACTERISTICS 159

TABLE 8.3: SOIL HEALTH CHARACTERISTICS 162

TABLE 8.4: WEED MANAGEMENT 164

TABLE 8.5: ENVIRONMENTAL TOLERANCES 166

TABLE 8.6: ESTABLISHMENT INFORMATION AND CHARACTERISTICS 169

TABLE 8.7: TERMINATION CHARACTERISTICS 171

TABLE 8.8: ACCEPTABLE COVER CROPS FOR VARIOUS EC THRESHOLDS 174

TABLE 8.9: GENERAL COVER CROP NOTES 175

SECTION 8 REFERENCES 181

Selecting and Establishing Plantings

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.

Table 8.1: General Cover Crop Characteristics. Includes: active growth period, length of growing window, potential dry matter production (lbs./ac/yr.), root structure, rooting depth, growth orientation, flowering trigger, potential n supplied (lbs./ac./year) and nutrient scavenging potential.

Table 8.2: Grazing and Forage Characteristics. Includes: general suitability as a forage, forage value for grazing and mechanical harvest, potential toxicity issues, and early spring grazing potential.

Table 8.3: Soil Health Characteristics. Includes: ability to control erosion during fall and spring, residue persistence, ability to enhance soil aggregation, ability to treat surface compaction, ability to treat plan pan compaction, mycorrhizae support, and ability to enhance soil organic matter.

Table 8.4: Weed Management. Includes: abilities for weed suppression, seed persistence in soil, potential for volunteer establishment, and soil moisture use.

Table 8.5: Environmental Tolerances. Includes: tolerances to drought, flooding, heat, low fertility, salinity, shade, soil textures, pH, drainage class, minimum germination temperature, and potential for overwintering in New Jersey.

Table 8.6: Establishment Information and Characteristics. Includes: establishment ease and speed, ability to frost seed, ability for aerial or interseeding, seeding dates, seeding rates, and seeding depth.

Table 8.7: Acceptable Cover Crops for EC Thresholds. This table includes acceptable cover crops to be used for soils with ≤ 4 dS m^{-1} and ≤ 8 dS m^{-1}.

Table 8.8: General Cover Crop Notes. This table includes general planning information and considerations for each cover crop in this section.

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: General Cover Crop Characteristics

	Active Growth Period	Length of Growing Window	Potential Dry Matter Production (lbs./ac/yr.)	Root Structure	Rooting Depth	Growth Orientation	Flowering Trigger	Nutrient Management	
								Potential N Supplied (lbs./ac./year)[1]	Nutrient Scavenging Potential[2]
Warm Season Grasses									
Sorghum – Sudan (*Sorghum bicolor x S. bicolor* var. *Sudanese*) Also called Sudex or Sudax	summer	short	4,000 – 8,000	fibrous	medium	erect	plant size	N/A	4
Pearl/Proso Millet (*Pennisetum glaucum*)/ (*Panicum miliaceum*)	summer	short	3,000 – 7,000	fibrous	medium	erect	plant size short days	N/A	5
Warm Season Non-leguminous forbs									
Buckwheat (*Fagopyrum esculentum*)	summer	very short	1,500 – 2,500	fibrous	medium	erect semi-erect	plant size	N/A	3 esp. P & Ca
Sunflower (*Helianthus annuus*)	summer	very long	200 – 5,000	tap	deep	erect	plant size long days	N/A	3
Warm Season Legumes									
Cowpea (*Vigna unguiculata*)	summer	medium	2,500 – 4,500	tap	deep	climbing semi-erect	plant size	50 – 100	
Sunn Hemp (*Crotalaria juncea*)	summer	short	1,000 – 8,000	tap	medium	erect	intermediate days	0 – 100	
Cool Season Grasses									
Annual Ryegrass	fall – summer	short	1,000 – 6,000	fibrous	deep	erect	long days	N/A	4 esp. N

	Active Growth Period	Length of Growing Window	Potential Dry Matter Production (lbs./ac/yr.)	Root Structure	Rooting Depth	Growth Orientation	Flowering Trigger	Nutrient Management	
								Potential N Supplied (lbs./ac./year)[1]	Nutrient Scavenging Potential[2]
(*Lolium multiflorum*)									
Rye (*Secale cereale*)	spring – summer	medium	1,000 – 4,000	fibrous	medium	erect	vernalization	N/A	4
Rye (*Secale cereale*)	fall – spring	long	1,000 – 8,000	fibrous	medium	erect	vernalization	N/A	5 esp. N
Barley (*Hordeum vulgare*)	fall – spring	medium	2,000 – 5,000	fibrous	medium	erect	vernalization	N/A	4
Wheat (*Triticum aestivum*)	winter – spring	long	2,000 – 5,000	fibrous	medium	erect	vernalization	N/A	5 esp. N
Triticale (*Triticale hexaploide*)	winter – spring	long	2,000 – 5,000	fibrous	medium	erect	vernalization	N/A	5 esp. N
Oats, Spring Planted (*Avena sativa*)	spring – summer	short	1,000 – 4,000	fibrous	medium	erect	long days	N/A	3
Oats, Fall Planted *(Avena sativa)*	fall	short	2,000 – 6,000	fibrous	medium	erect	long days vernalization	N/A	3
Cool Season Non-leguminous forbs									
Radish (*Raphanus sativus*)	fall – spring spring – summer	short	1,200 – 3,000	tap	deep	erect	long days	50 – 200	3
Turnip *(Brassica rapa)*	fall - spring	medium	800 – 3,300	tap	medium	erect	vernalization		3

	Active Growth Period	Length of Growing Window	Potential Dry Matter Production (lbs./ac/yr.)	Root Structure	Rooting Depth	Growth Orientation	Flowering Trigger	Nutrient Management	
								Potential N Supplied (lbs./ac./year)[1]	Nutrient Scavenging Potential[2]
Rapeseed/Canola (*Brassica rapa) /* (*Brassica napus)*	fall - spring	medium	2,000 – 5,000	tap	deep	erect	vernalization	40 – 160	4
Mustards (*Brassica hirta/* *Brassica juncea)*	fall – spring spring – summer	short	500 – 2,000	tap	medium	erect	plant size long days	30 – 120	3 esp. N, P, Ca
Phacelia (*Phacelia tanacetifolia*)	fall - spring	medium	2,000 – 4,000	fibrous	deep	erect	plant size		3
Cool Season Legumes									
Red Clover (*Trifolium pratense*)	fall – summer	long	2,000 – 5,000	tap	deep	erect	vernalization	70 – 120	
White Clover (*Trifolium repens*)	fall – summer	medium	2,000 – 6,000	tap	medium	erect	long day plant size	80 – 200	
Crimson Clover (*Trifolium incarnatum*)	fall – summer	medium	3,500 – 5,500	tap	medium	erect semi-erect	vernalization	70 – 130	
Hairy Vetch (*Vicia villosa*)	fall – spring	medium	1,800 – 5,000	tap	medium	climbing	long days	80 – 160	
Sweetclovers (*Melilotus sp.*) Yellow Sweetclover and White Sweetclover	summer	very long	3,000 – 5,000	tap	deep	erect	vernalization	90 - 170	
Austrian winter pea	fall – spring	medium	1,000 – 2,500	tap	medium	climbing	plant size	50 – 150	

	Active Growth Period	Length of Growing Window	Potential Dry Matter Production (lbs./ac/yr.)	Root Structure	Rooting Depth	Growth Orientation	Flowering Trigger	Nutrient Management	
								Potential N Supplied (lbs./ac./year)[1]	Nutrient Scavenging Potential[2]
(Pisum sativum)						semi-erect			
Spring pea *(Pisum sativum)*	spring - summer	short	1,000 – 2,500	tap	medium	climbing semi-erect	plant size	40 – 100	

Notes:

[1] N supplied by plants can be from direct nitrogen fixation or by the release of stored N in the plant. The amount of N released by the plan is dependent on any or all of the following: soil conditions, plant genetics, inoculation, plant biomass, and/or time of the year.

[2] Nutrient scavenging potential of the crop is ranked on the plants ability to take up, mine, and or/store nutrients within the roots. Cover crops are ranked based on the following: 1 = poor scavenging/storage ability 2 = fair scavenging/storage ability 3 = good scavenging/storage ability 4 = very good scavenging/storage ability, and 5 = excellent scavenging/storage ability. If a cover crop is especially good at mining and/or storing a specific nutrient, it will be noted in this column.

Table 8.2: Grazing and Forage Characteristics

	General Suitability as a Forage[1]	Forage Value[2]		Toxicity Issues[3,4]	Early Spring Grazing Potential[5]
		Grazing	Mechanical Harvest		
Warm Season Grasses					
Sorghum – Sudan (*Sorghum bicolor x S. bicolor* var. *Sudanese*) Also called Sudex or Sudax	4	4	5	Yes. Grazing can cause prussic acid (hydrogen cyanide) poisoning. The highest risk comes when grazing events occur in quick succession on the same stand and when grazed or mechanically harvested after periods of stress such as a frost or a drought.	
Pearl/Proso Millet (*Pennisetum glaucum*)/ (*Panicum miliaceum*)	4	4	4	Yes. Nitrate poisoning can be caused by grazing and feeding stored forages. Millet haylage has less potential of nitrate poisoning than dry millet hay. When grazing, millet should be allowed to grow to at least 24-30 inches before the first grazing and every successive grazing.	
Warm Season Non-leguminous forbs					
Buckwheat (*Fagopyrum esculentum*)	1	1	2	Yes. Buckwheat produces the fagopyrin toxin which can cause photosensitivity in livestock. Grazing and feeding green buckwheat forage carries a higher risk than feeding dry buckwheat hay, although both will contain the toxin.	
Sunflower (*Helianthus annuus*)	2	3	2	Yes. Nitrate poisoning in livestock can occur when grazing sunflowers. Nitrate poisoning is highest following a period of cool cloudy days and when plant stems are eaten.	
Warm Season Legumes					
Cowpea (*Vigna unguiculata*)	3	4	3	No, but cowpeas are a legume and can cause bloat along with other conditions based on management. See table notes.	
Sunn Hemp (*Crotalaria juncea*)	4	4	2	Yes. Sunn hemp seeds contain pyrrolizidine alkaloids. Grazing younger plants that have not gone to seed will mitigate potential toxicity issues.	
Cool Season Grasses					
Annual Ryegrass (*Lolium multiflorum*)	5	5	4		3

	General Suitability as a Forage[1]	Forage Value[2]		Toxicity Issues[3,4]	Early Spring Grazing Potential[5]
		Grazing	Mechanical Harvest		
Rye, Spring Planted (*Secale cereale*)	4	5	3	No specific chemical toxicity issues, but see table notes for more information on potential management-based problems arising from spring and fall grazing of these plant species.	
Rye, Fall Planted (*Secale cereale*)	4	5	5		5
Barley (*Hordeum vulgare*)	3	4	4		4
Wheat (*Triticum aestivum*)	4	4	4		4
Triticale (*Triticale hexaploide*)	5	4	5		4
Oats, Spring Planted (*Avena sativa*)	5	5	5		
Oats, Fall Planted *(Avena sativa)*	4	4	3		3
Cool Season Non-leguminous forbs					
Radish (*Raphanus sativus*)	4	4	1	Yes. Grazing turnips can cause hemolytic anemia, polioencephalomalacia, pulmonary emphysema, and/or bloat.	
Turnip *(Brassica rapa)*	3	5	1	Yes. Brassicas contain glucosinolates and sulfur based amino acids that can cause a variety of problems for livestock, including death. Grazing young tender plants will have the greatest risk. Brassicas should be mixed with other non-toxic forages or grazed with free access to supplemental feeds/hay.	
Rapeseed/Canola (*Brassica rapa) /* (*Brassica napus)*	3	3	1		
Mustards (*Brassica hirta) /* *Brassica juncea)*	1	1	1		
Phacelia (*Phacelia tanacetifolia*)	4	4	2	Yes. Phacelia is a good accumulator of nitrates, so while the plant does not produce toxins under certain conditions it does have the ability to accumulate them. If grazed, phacelia should be included in a mix of other non-toxic plants.	
Cool Season Legumes					
Red Clover (*Trifolium pratense*)	4	4	4	Yes. Red clover contains higher amounts of phytoestrogens, which have been known to cause breeding issues in sheep. Clovers that house the *Rhizoctonia leguminicola* fungus can cause excess slobbers in horses. While this is possible in all clovers, red	4

	General Suitability as a Forage[1]	Forage Value[2]		Toxicity Issues[3,4]	Early Spring Grazing Potential[5]
		Grazing	Mechanical Harvest		
				clovers carry the highest risk. The “slobbers” is not life threatening but is often undesirable for equine owners. Red clover is also a legume and carries a bloating risk.	
White Clover (*Trifolium repens*)	2	2	2	White clover is a legume and carries a bloating risk.	2
Crimson Clover (*Trifolium incarnatum*)	4	5	5	Crimson clover is a legume and carries a bloating risk.	4
Hairy Vetch (*Vicia villosa*)	2	2	3	Yes. Compounds in hairy vetch plants can cause hemoglobinuria when ingested in large quantities. Hairy vetch is also a legume and carries a bloating risk.	3
Sweetclovers (*Melilotus sp.*) Yellow Sweetclover and White Sweetclover	4	2	4	Yes. Sweet clover poisoning is not caused by toxins produced by the plant, but by a variety of fungi that may grow on the plant under the right conditions. These fungi cause a conversion in the body that produces high levels of dicoumarol which can cause both severe internal and external hemorrhaging. Sweet clover is also a legume and carries a bloating risk.	3
Austrian winter pea *(Pisum sativum)*	3	3	4	Pea is a legume and carries a bloating risk.	3
Spring pea *(Pisum sativum)*	3	4	4	Pea is a legume and carries a bloating risk.	

Notes:

[1] Suitability is ranked based on palatability, persistence, and nutritional value. Suitability is ranked 1 = poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent

[2] Suitability is based on either dry forage or wet forage. Some forages are better harvested wet rather than dry. Dry and wet stored forages require different handling equipment, which should be discussed with the producer. Suitability is ranked as 1 = poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent

[3] Toxicity towards a herd is dependent on the amount of potentially toxic plant consumed, condition of the animal, weather factors, and individual susceptibility to the particular plant/toxin.

[4] Toxicity related to animal handling and management rather than direct plant-chemical interactions can occur with any of the cover crops listed. Examples of these instances include grass tetany and acute bovine pulmonary emphysema (ABPE) or "fog fever.”

[5] The ranking for early spring growth is a relative number based on the expected forage growth from overwintering species. Species are ranked using the following: 1 = little early spring growth expected, 2 = fair amount of early spring growth expected, 3 = good amount of spring growth expected, 4 = high amount of early spring growth expected, 5 = very high amount of early spring growth expected.

Table 8.3: Soil Health Characteristics

	Ability to Provide Erosion Control		Residue Persistence	Ability to Enhance Soil Aggregation	Ability to Treat Surface Compaction	Ability to Treat Plow Pan	Supports Mycorrhizae	Enhances Soil Organic Matter
	Fall	Spring						
Warm Season Grasses								
Sorghum – Sudan (*Sorghum bicolor x S. bicolor* var. *Sudanese*) Also called Sudex or Sudax	5	3	5	5	5	2	4	5
Pearl/Proso Millet (*Pennisetum glaucum*)/ (*Panicum miliaceum*)	4	2	3	4	5	2	3	3
Warm Season Non-leguminous Forbs								
Buckwheat (*Fagopyrum esculentum*)	1	1	1	2	3	1	4	1
Sunflower (*Helianthus annuus*)	2	2	2	2	1	4	3	2
Warm Season Legumes								
Cowpea (*Vigna unguiculata*)	1	1	1	2	3	1	3	1
Sunn Hemp (*Crotalaria juncea*)	2	2	2	3	3	3	3	2
Cool Season Grasses								
Annual Ryegrass (*Lolium multiflorum*)	5	5	3	4	5	2	4	4
Rye, Spring Planted (*Secale cereale*)	4	4	4	4	5	3	5	3
Rye, Fall Planted (*Secale cereale*)	5	5	5	5	5	3	5	5
Barley (*Hordeum vulgare*)	5	5	4	3	5	2	3	4
Wheat (*Triticum aestivum*)	4	5	5	4	5	2	3	4
Triticale (*Triticale hexaploide*)	5	5	5	5	5	2	4	4

	Ability to Provide Erosion Control		Residue Persistence	Ability to Enhance Soil Aggregation	Ability to Treat Surface Compaction	Ability to Treat Plow Pan	Supports Mycorrhizae	Enhances Soil Organic Matter
	Fall	Spring						
Oats, Spring Planted (*Avena sativa*)	2	3	3	4	5	1	5	3
Oats, Fall Planted *(Avena sativa)*	5	2	3	3	5	2	5	4
Cool Season Non-leguminous Forbs								
Radish (*Raphanus sativus*)	3	1	1	3	3	5	1	3
Turnip *(Brassica rapa)*	2	1	2	2	3	3	1	2
Rapeseed/Canola (*Brassica rapa) / (Brassica napus)*	4	2	3	2	3	3	1	3
Mustards (*Brassica hirta) / (Brassica juncea)*	3	3	2	2	2	1	1	3
Phacelia (*Phacelia tanacetifolia*)	2	2	2	3	3	1	4	2
Cool Season Legumes								
Red Clover (*Trifolium pratense*)	3	4	2	3	3	3	4	3
White Clover (*Trifolium repens*)	3	3	2	2	4	2	3	2
Crimson Clover (*Trifolium incarnatum*)	1	4	2	3	3	1	3	3
Hairy Vetch (*Vicia villosa*)	4	1	2	3	3	2	3	2
Sweetclovers (*Melilotus sp.*) Yellow Sweetclover and White Sweetclover	2	3	2	4	4	4	4	4
Austrian winter pea (Pisum sativum)	1	3	1	2	2	1	3	1
Spring pea *(Pisum sativum)*	1	3	1	2	2	1	3	1

Notes:

All characteristics are ranked on a scale from 1 to 5. Those with a rating of 5 have the greatest ability to treat and/or improve the soil health concern and those with a ranking of 1 a very low to no ability to treat the soil health concern.

Table 8.4: Weed Management

	Weed Suppression[1]			Seed Persistence in Soil[2]	Volunteer Establishment[3]	Soil Moisture Use
	Direct Suppression of Winter Annuals	Direct Suppression of Summer Annuals	Summer Annuals Suppression from Residues			
Warm Season Grasses						
Sorghum – Sudan (*Sorghum bicolor x S. bicolor* var. *Sudanese*) Also called Sudex or Sudax	2	5	2	2	2	high
Pearl/Proso Millet (*Pennisetum glaucum*)/ (*Panicum miliaceum*)	2	5	2	3	3	low
Warm Season Non-leguminous Forbs						
Buckwheat (*Fagopyrum esculentum*)	2	5	1	1	5	low
Sunflower (*Helianthus annuus*)	1	3	1	3	4	medium
Warm Season Legumes						
Cowpea (*Vigna unguiculata*)	2	3	2	4	2	high
Sunn Hemp (*Crotalaria juncea*)	2	3	2	4	2	high
Cool Season Grasses						
Annual Ryegrass (*Lolium multiflorum*)	5	4	2	1	5	medium
Rye, Spring Planted (*Secale cereale*)	4	4	4	1	5	high
Rye, Fall Planted (*Secale cereale*)	5	3	5	1	5	high
Barley (*Hordeum vulgare*)	4	3	4	2	5	medium

	Weed Suppression[1]			Seed Persistence in Soil[2]	Volunteer Establishment[3]	Soil Moisture Use
	Direct Suppression of Winter Annuals	Direct Suppression of Summer Annuals	Summer Annuals Suppression from Residues			
Wheat (*Triticum aestivum*)	4	3	4	1	5	medium
Triticale (*Triticale hexaploide*)	5	3	5	1	5	medium
Oats, Spring Planted (*Avena sativa*)	2	4	4	1	5	medium
Oats, Fall Planted *(Avena sativa)*	3	3	4	1	5	medium
Cool Season Non-leguminous forbs						
Radish (*Raphanus sativus*)	4	4	1	2	2	medium
Turnip *(Brassica rapa)*	4	3	1	2	2	high
Rapeseed/Canola (*Brassica rapa) /* (*Brassica napus)*	3	3	2	1	5	medium
Mustards (*Brassica hirta) /* (*Brassica juncea)*	4	4	1	1	5	medium
Phacelia (*Phacelia tanacetifolia*)	2	2	1	4	2	medium
Cool Season Legumes						
Red Clover (*Trifolium pratense*)	3	3	2	5	5	medium
White Clover (*Trifolium repens*)	3	2	1	4	1	high
Crimson Clover (*Trifolium incarnatum*)	3	2	1	1	1	medium
Hairy Vetch (*Vicia villosa*)	3	2	3	5	5	medium
Sweetclovers (*Melilotus sp.*) Yellow Sweetclover and White Sweetclover	3	2	2	1	2	medium
Austrian winter pea *(Pisum sativum)*	2	2	2	1	5	medium
Spring pea *(Pisum sativum)*	2	3	2	1	5	medium

	Weed Suppression[1]			Seed Persistence in Soil[2]	Volunteer Establishment[3]	Soil Moisture Use
	Direct Suppression of Winter Annuals	Direct Suppression of Summer Annuals	Summer Annuals Suppression from Residues			

Notes:

1. Weed suppression characteristics are ranked on a scale from 1 to 5. Those with a rating of 5 have the greatest ability for the identified weed management strategy and those with a ranking of 1 have a very low to no ability to help with the identified weed management strategy.
2. Seed persistence in soil is ranked from 1 to 5. Those with a rating of 5 have a high persistence in soil and those with a ranking of 1 have a very low persistence in soil. Covers with a higher rating could become weedy in future crop years if not managed correctly.
3. Volunteer establishment is ranked on a scale from 1 to 5. Those with a rating of 5 have a high chance of establishing in future crops if a seed bank is left from the original planting. Those with a rating of 1 have a very low potential to establish in future crops.

Table 8.5: Environmental Tolerances

	Drought	Flood	Heat	Low Fertility	Salinity	Shade	Texture[1]	pH	Drainage (not suitable)[2]	Min. Germination Temp (F)	Overwintering Potential
Warm Season Grasses											
Sorghum – Sudan (*Sorghum bicolor x S. bicolor* var. *Sudanese*) Also called Sudex or Sudax	5	3	5	4	2	1	all	5.0 - 8.0	VP, P, SM	65	never
Pearl/Proso Millet (*Pennisetum glaucum*)/ (*Panicum miliaceum*)	5	2	5	4	2	1	all	4.5 – 8.0	VP, P	65	never
Warm Season Non-leguminous forbs											
Buckwheat (*Fagopyrum esculentum*)	3	2	4	4	2	2	all	6.0 – 8.4	VP, P, SE, E, SM	50	never

	Drought	Flood	Heat	Low Fertility	Salinity	Shade	Texture[1]	pH	Drainage (not suitable)[2]	Min. Germination Temp (F)	Overwintering Potential
Sunflower (*Helianthus annuus*)	5	2	5	3	2	1	all	5.5 - 7.8	VP, P, SM	65	never
Warm Season Legumes											
Cowpea (*Vigna unguiculata*)	5	2	5	5	2	3	all	6.0 – 8.0	VP, P, SP, SM	58	never
Sunn Hemp (*Crotalaria juncea*)	4	2	5	4	2	2	all	5.0 – 8.4	VP, P, SM	68	never
Cool Season Grasses											
Annual Ryegrass (*Lolium multiflorum*)	2	4	3	2	2	4	all	6.0 – 8.0	VP, E	40	expected
Rye, Spring Planted (*Secale cereale*)	4	3	4	4	2	3	all	4.5 – 8.2	VP, P, E	34	seldom
Rye, Fall Planted (*Secale cereale*)	4	3	4	4	2	3	all	4.5 – 8.2	VP, P, E	34	expected
Barley (*Hordeum vulgare*)	3	3	3	4	3	3	all	6.0 – 8.5	VP, P, SP, E	38	expected
Wheat (*Triticum aestivum*)	3	2	3	3	2	3	all	5.5 – 8.0	VP, P, E, SM	38	expected
Triticale (*Triticale hexaploide*)	3	3	3	3	2	3	all	5.5 – 8.0	VP, P, SM	38	expected
Oats, Spring Planted (*Avena sativa*)	3	3	4	3	2	2	all	5.3 – 8.5	VP, P, SM	38	seldom
Oats, Fall Planted *(Avena sativa)*	3	4	1	3	2	3	all	5.3 – 8.5	VP, P, SM	38	seldom
Cool Season Non-leguminous forbs											
Radish (*Raphanus sativus*)	2	2	3	2	1	3	all	6.0 – 8.0	VP, E, SM	45	seldom
Turnip *(Brassica rapa)*	2	2	2	2	2	3	all	5.3 – 6.8	VP, P, SM	45	seldom
Rapeseed/Canola (*Brassica rapa) /* (*Brassica napus)*	3	2	2	2	1	3	F, M	5.5 – 8.0	VP, P, SM	41	expected
Mustards (*Brassica hirta) /* (*Brassica juncea)*	3	2	3	3	2	3	F, M	6.0 – 7.2	VP, P, E, SM, WDM	40	seldom
Phacelia (*Phacelia tanacetifolia*)	3	3	3	3	1	2	all	6.4 – 8.6	VP, SM	38	seldom

	Drought	Flood	Heat	Low Fertility	Salinity	Shade	Texture[1]	pH	Drainage (not suitable)[2]	Min. Germination Temp (F)	Overwintering Potential
Cool Season Legumes											
Red Clover (*Trifolium pratense*)	3	2	4	3	1	4	all	6.0 – 7.2	VP, E, SM, WDM	41	expected
White Clover (*Trifolium repens*)	3	4	3	3	2	4	F, M	6.0 – 7.2	SE, E, SM, WDM	40	expected
Crimson Clover (*Trifolium incarnatum*)	3	2	3	3	1	4	all	5.5 – 7.2	VP, P, E, SM	42	expected
Hairy Vetch (*Vicia villosa*)	3	2	3	2	1	3	all	6.0 – 7.5	VP, P, E, SM	50	expected
Sweetclovers (*Melilotus sp.*) Yellow Sweetclover and White Sweetclover	5	4	4	5	3	3	F, M	6.5 – 8.0	VP, SM	42	expected
Austrian winter pea *(Pisum sativum)*	3	2	1	4	1	2	C, M	6.0 – 7.5	VP, P, E	42	expected
Spring pea *(Pisum sativum)*	3	2	3	4	1	2	C, M	6.0 – 7.5	VP, P, SM	42	never

Notes:

* All characteristics that have a numerical rating are ranked on a scale from 1 to 5. Those with a rating of 5 have the greatest ability to treat and/or improve the soil health concern and those with a ranking of 1 a very low to no ability to treat the soil health concern.

1. F = fine textured soils, C = coarse textured soils, M = medium textured soils
2. VP = very poorly drained, P = poorly drained, SP = somewhat poorly drained, MW = moderately well drained, W = well drained, SE = somewhat excessively drained, E = excessively drained, SM = saturated muck, WDM = well drained muck

Table 8.6: Establishment Information and Characteristics

	Establishment[1]		Frost Seed[2]	Spring Aerial or Interseed Seed	Fall Aerial or Interseed	Seeding Dates (by Plant Hardiness Zone)		Seeding Rate (lbs./ac. PLS)		Seeding depth (inches)
	Ease	Speed				6	7, 8	Drill	Broadcast	
Warm Season Grasses										
Sorghum – Sudan (*Sorghum bicolor x S. bicolor* var. *Sudanese*) Also called Sudex or Sudax	4	3	NR	NR	NR	5/15 – 7/15		35	53	0.5 – 1.5
Pearl/Proso Millet (*Pennisetum glaucum*)/ (*Panicum miliaceum*)	3	4	NR	NR	NR	5/1 – 7/15	5/15 – 7/15	14	21	0.5 – 1.0
Warm Season Non-leguminous forbs										
Buckwheat (*Fagopyrum esculentum*)	4	5	NR	NR	NR	6/1 – 7/30		50	75	0.5 – 1.0
Sunflower (*Helianthus annuus*)	3	3	NR	NR	NR	5/15 – 7/31	5/1 – 7/31	5	8	1.0 – 1.5
Warm Season Legumes										
Cowpea (*Vigna unguiculata*)	1	3	NR	NR	Yes	6/1 – 7/15	5/15 -7/15	50	NR	1.0 – 1.5
Sunn Hemp (*Crotalaria juncea*)	2	3	NR	NR		6/1 – 7/31		10	15	0.5 – 1.0
Cool Season Grasses										
Annual Ryegrass (*Lolium multiflorum*)	3	3	Yes	Yes	Yes	4/1 – 5/31 8/15 – 9/30	3/15 – 6/15 8/20 – 10/15	20	30	0.25 – 0.5
Rye, Spring Planted (*Secale cereale*)	5	3	NR	Yes		3/1 – 5/15	2/15 – 4/15	70	105	0.75 – 1.5
Rye, Fall Planted (*Secale cereale*)	5	4	NR		Yes	8/15 – 10/31	9/1 – 10/31	90	135	0.75 – 1.5
Barley (*Hordeum vulgare*)	3	3	NR	Yes	Yes	8/1 – 9/31	8/15 – 10/15	95	143	0.75 – 1.5
Wheat (*Triticum aestivum*)	3	4	NR	Yes	Yes	8/1 – 10/31	9/1 – 10/31	110	165	0.75 – 1.5

	Establishment[1]		Frost Seed[2]	Spring Aerial or Interseed Seed	Fall Aerial or Interseed	Seeding Dates (by Plant Hardiness Zone)		Seeding Rate (lbs./ac. PLS)		Seeding depth (inches)
	Ease	Speed				6	7, 8	Drill	Broadcast	
Triticale (*Triticale hexaploide*)	4	4	NR	Yes	Yes	8/15 – 10/15	9/1 – 10/31	90	135	0.75 – 1.5
Oats, Spring Planted (*Avena sativa*)	3	4	NR	Yes		3/15 – 5/15	3/1 – 5/15	70	105	0.75 – 1.5
Oats, Fall Planted *(Avena sativa)*	5	4	NR		Yes	8/1 – 10/15	9/1 – 10/31	90	135	0.5 – 1.0
Cool Season Non-leguminous forbs										
Radish (*Raphanus sativus*)	4	4	NR	Yes	Yes	8/1 – 9/15	9/1 – 10/1	6	9	0.25 – 0.75
Turnip *(Brassica rapa)*	4	5	NR	Yes	Yes	5/15 – 7/15* 8/1 – 9/15	5/1 – 7/1* 9/1 – 10/1	8	12	≤ 0.25
Rapeseed/Canola (*Brassica rapa) /* (*Brassica napus)*	3	4	NR	Yes	Yes	8/15 – 9/15	9/1 – 10/1	5	7.5	0.25 – 0.75
Mustards (*Brassica hirta) /* (*Brassica juncea)*	3	4	NR	NR	NR	7/15 – 9/1		12	18	0.25 – 0.75
Phacelia (*Phacelia tanacetifolia*)	4	5	NR	NR	NR	4/15 – 6/15	3/15 – 5/15	7	NR	0.25
Cool Season Legumes										
Red Clover (*Trifolium pratense*)	4	3	Yes	Yes	Yes	8/15 – 9/15	9/1 – 10/1	10	15	0.25 – 0.5
White Clover (*Trifolium repens*)		3	Yes	Yes	Yes	8/15 – 9/15	9/1 – 10/1	6	10	0.25 – 0.5
Crimson Clover (*Trifolium incarnatum*)	4	3	Yes	Yes	Yes	8/15 – 9/15	9/1 – 10/1	15	23	0.25 – 0.5
Hairy Vetch (*Vicia villosa*)	1	2	NR	NR	Yes	8/1 – 9/15	9/1 - 10/1	20	30	0.5 – 1.5
Sweetclovers (*Melilotus sp.*) Yellow Sweetclover and White Sweetclover	4	3	NR	NR	NR	8/1 – 9/15	8/15 – 10/1	10	15	0.25 - 1
Austrian winter pea *(Pisum sativum)*	2	2	NR	NR	NR	8/15 – 9/30		70	105	1.0 – 1.5

	Establishment[1]		Frost Seed[2]	Spring Aerial or Interseed Seed	Fall Aerial or Interseed	Seeding Dates (by Plant Hardiness Zone)		Seeding Rate (lbs./ac. PLS)		Seeding depth (inches)
	Ease	Speed				6	7, 8	Drill	Broadcast	
Spring pea *(Pisum sativum)*	2	2	NR	NR	NR	3/1 – 5/31	2/15 – 4/30	50	75	1.0 – 1.5

Notes:

[1] The ease and speed of establishment are ranked from 1 – 5 with 1 being the slowest and/or hardest to establish and 5 being the easiest or fastest to establish.

[2] Frost seeding occurs in late winter/early spring when the ground is subject to freeze-thaw action, helping to incorporate the seed into the ground. Ratings reflect typical use across the state. NR = not normally recommended, Yes = has been successfully planted using this method in this region.

[3] Interseeding refers to planting a cover crop in between cash crop rows. Corn is normally interseeded in the spring between the V5 and V7 stages. Ratings reflect typical use across the state. NR = not normally recommended, Yes = has been successfully planted using this method in this region.

*indicates forage varieties

Table 8.7: Termination Characteristics

	Chemical		Freezing		Roller Crimp at Flowering Stage	Tillage		Hardy to temp over winter (°F)[1]
	Flowering	Vegetative	Flowering	Vegetative		Flowering	Vegetative	
Warm Season Grasses								
Sorghum – Sudan (*Sorghum bicolor x S. bicolor* var. *Sudanese*) Also called Sudex or Sudax	5	5	5	5	1	1	1	NH
Pearl/Proso Millet (*Pennisetum glaucum*)/ (*Panicum miliaceum*)	5	5	5	5	5	2	2	NH
Buckwheat (*Fagopyrum esculentum*)	5	5	5	5	5	5	5	NH
Sunflower (*Helianthus annuus*)	5	5	5	5	1	1	1	NH

	Chemical		Freezing		Roller Crimp at Flowering Stage	Tillage		Hardy to temp over winter
	Flowering	Vegetative	Flowering	Vegetative		Flowering	Vegetative	(°F)[1]
Warm Season Legumes								
Cowpea (*Vigna unguiculata*)	5	5	5	5	1	5	5	NH
Sunn Hemp (*Crotalaria juncea*)	5	5	5	5	5	1	1	NH
Cool Season Grasses								
Annual Ryegrass (Lolium multiflorum)	3	3	4	2	1	1	1	0
Rye, Spring Planted (Secale cereale)	5	5	5	3	5	1	1	NH
Rye, Winter Planted (Secale cereale)	5	5	3	1	5	1	1	-30
Barley (Hordeum vulgare)	5	5	3	2	5	1	1	15-20
Wheat (Triticum aestivum)	5	5	2	1	5	1	1	-20
Triticale (Triticale hexaploide)	5	5	2	1	5	1	1	-20
Oats, Spring Planted (Avena sativa)	5	5	4	4	5	1	1	25
Oats, Fall Planted (Avena sativa)	5	5	3	3	5	1	1	25
Cool Season Non-leguminous Forbs								
Radish (Raphanus sativus)	3	3	5	4	1	3	3	15-20
Turnip (Brassica rapa)	4	4	4	3	1	3	3	10-15
Rapeseed/Canola (Brassica rapa) / (Brassica napus)	3	3	4	2	3	4	4	10-15
Mustards (Brassica hirta) / (Brassica juncea)	3	3	5	3	3	4	4	25
Phacelia (Phacelia tanacetifolia)	5	5	5	5	1	1	1	20-25

	Chemical		Freezing		Roller Crimp at Flowering Stage	Tillage		Hardy to temp over winter (°F)[1]
	Flowering	Vegetative	Flowering	Vegetative		Flowering	Vegetative	
Cool Season Legumes								
Red Clover (*Trifolium pratense*)	5	3	1	1	3	1	1	-20
White Clover (*Trifolium repens*)	4	5	1	1	1	3	5	0
Crimson Clover (*Trifolium incarnatum*)	5	5	1	2	5	5	4	-10
Hairy Vetch (*Vicia villosa*)	5	4	4	1	3	1	1	-20
Sweetclovers (*Melilotus sp.*) Yellow Sweetclover and White Sweetclover	5	5	4	2	1	1	1	-20
Austrian winter pea *(Pisum sativum)*	5	5	5	2	3	4	4	-10
Spring pea *(Pisum sativum)*	5	5	5	2	3	4	4	-10

Notes:

* All characteristics with a numerical rating are ranked on a scale from 1 to 5. Those with a rating of 5 will respond positively to the indicated termination method and those with a ranking of 1 have the lowest potential to respond to the indicated termination method.

1. Hardy winter temperatures are typical of the species. Varieties may be chosen that are more or less winter hardy. NH = not hardy and typically do not withstand overwintering conditions in New Jersey.

Table 8.8: Acceptable Cover Crops for Various EC Thresholds

Table 4: Acceptable Cover Crops for Various EC Thresholds	
Acceptable cover crops for soils ≤ 4 dS m^{-1}	**Acceptable cover crops for soils ≤ 8 dS m^{-1}**
Barley	Barley
Triticale	Triticale
Wheat, durum	Wheat, durum
Sorghum	
Ryegrass, perennial	
Cowpea	
Sudangrass	
Vetch, common	
Fescue, Tall	

Table 8.9: General Cover Crop Notes

	Notes
Warm Season Grasses	
Sorghum – Sudan (*Sorghum bicolor x S. bicolor* var. *Sudanese*) Also called Sudex or Sudax	• 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. • Supports the reproduction of some root-knot nematode species
Pearl/Proso Millet (*Pennisetum glaucum*)/ (*Panicum miliaceum*)	• Millet is drought tolerant and adapted to areas that have poor soil quality. • Millet can grow to be 7 or more feet tall, depending on the species and variety; residue management may be a problem.
Warm Season Non-leguminous Forbs	
Buckwheat (*Fagopyrum esculentum*)	• Great 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 and 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 is very frost sensitive and does not grow well on heavy limestone soils. • Buckwheat may become a weed if not terminated 7 to 10 days after flowering begins.
Sunflower (*Helianthus annuus*)	• Sunflower tap roots can grow as deep as 6.5 feet. • Sunflowers grow well in mixtures with other warm season species and offer an aesthetic value.
Warm Season Legumes	
Cowpea	• Best to mix with sorghum-sudangrass and millets so the cowpea have structure to climb.

	Notes
(*Vigna unguiculata*)	• Cowpea will excel during times of heat and moisture and has the ability to provide weed suppression under the right growing conditions. In New Jersey, cowpea should be mixed with another cover crop if weed suppression is desired to mitigate for uncertain weather conditions. • 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. • Host for sting and stubby root nematodes; moderately resistant to root-knot nematode.
Sunn Hemp (*Crotalaria juncea*)	• 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.
Cool Season Grasses	
Annual Ryegrass (*Lolium multiflorum*)	• 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*)	• 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.

	Notes
Barley (*Hordeum vulgare*)	• 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. • Barley requires a higher pH than other small grains for optimum performance. • 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*)	• 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*)	• 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. • Triticale can provide an excellent source of supplemental grazing forage in the spring, especially when mixed with ryegrass.
Oats (*Avena sativa*)	• 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. • Oats make a great nurse crop for fall seedings. They will winterkill in NJ, providing quick growth and protection in the fall for more tender crops and will die off in winter, allowing those crops to excel in the spring.
Cool Season Non-leguminous Forbs	
Radish (*Raphanus sativus*)	• 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, if allowed sufficient time to grow. • 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

	Notes
Turnip *(Brassica rapa)*	• Best to mix with other brassicas, small grains, and crimson clover • Will die-off once temperatures reach about 25° F. • The use and goals of the turnip will dictate which variety of turnip should be chosen during the planning process. Forage varieties can be used for late spring/summer grazing and will regrow throughout the grazing season. These varieties are bred for leaf production rather than root production. Non-forage varieties will favor round root production and are not bred to regrow once grazed or mowed. In our region most forage turnips will not overwinter while production varieties have a greater chance of overwintering. • Supports reproduction of some root-knot nematode species/races.
Rapeseed/Canola (*Brassica rapa) /* (*Brassica napus)*	• 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. • In NJ, canola is a variety that is mostly used for oil production whereas rapeseed varieties are more commonly used for cover crops.
Mustards (*Brassica hirta/* *Brassica juncea)*	• 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.
Phacelia (Purple Tansy) (*Phacelia tanacetifolia*)	• Though phacelia has a shallow root system, the plant can improve soil structure and aggregation within the top two inches of the profile. • This is a fast-growing crop that can grow up to 4 feet tall and is loved by pollinators. The plant also produces ample amount of nectar and attracts beneficial parasitoids. • Phacelia is a stiff, upright growing plant. While the plant has shown promise for cover between vegetable rows, injury from the sturdy stems could be a hazard if growing during picking season.

	Notes
Cool Season Legumes	
Red Clover (*Trifolium pratense*)	• 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.
White Clover (*Trifolium repens*)	• 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.
Crimson Clover (*Trifolium incarnatum*)	• 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.
Hairy Vetch (*Vicia villosa*)	• 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.
Sweetclovers (*Melilotus sp.*) Yellow Sweetclover and White Sweetclover	• 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.
Pea	• Best to mix with wheat, rye, triticale, or barley.

	Notes
(Pisum sativum)	• 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.

Section 8 References

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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 systems to reduce soil erosion and improve water quality (McGregor and Dabney, 1993).

SECTION 9 TABLE OF CONTENTS

SELECTING AND ESTABLISHING PLANTINGS 182

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 - Agroforestry

Agroforestry is the intentional combination of agriculture and forestry to create productive and sustainable land use practices. These practices take advantage of the interactive benefits from growing trees and shrubs together with crops and/or livestock (USDA NAC, 2025). Agroforestry is separated into five distinct but related practices. This section contains guidance for landowners and planners who are interested is using the five NRCS conservation practices that correspond with nationally recognized agroforestry categories.

SECTION 10 TABLE OF CONTENTS

RIPARIAN FOREST BUFFER (391) 184

TABLE 10.1: SPACING AND DENSITIES FOR RIPARIAN FOREST BUFFERS 188

WINDBREAKS AND SHELTERBELTS (380) 188

TABLE 10.2: RELATIVE RESPONSIVENESS OF VARIOUS CROPS TO SHELTER PROVIDED BY WINDBREAKS 191

TABLE 10.3: DENSITIES FOR WINDBREAKS AND SHELTERBELTS 192

TABLE 10.4: SPACING FOR WINDBREAKS AND SHELTERBELTS 194

ALLEY CROPPING (311) 195

FOREST FARMING (379) 196

SILVOPASTURE (381) 198

CREATING SILVOPASTURE IN FORESTLAND 199

CREATING SILVOPASTURE IN EXISTING PASTURELAND 201

TREE PROTECTION 202

SECTION 10 REFERENCES 204

Riparian Forest Buffer (391)

A Riparian Forest Buffer is a planned combination of trees, shrubs, and herbaceous ground cover that is primarily used to mitigate land use effects on a water body or wetland. Aside from water quality protection, riparian buffers can be multifunctional and include managed areas where farm crops are produced. The layout and width of a buffer will vary depending on the intended purpose and site constraints within the flood plain or stream corridor, but whenever possible, wider buffers are usually better. Figure 1 shows recommended buffers widths based on different objectives. CPS 391 should be referenced to determine minimum required buffer widths for each purpose.

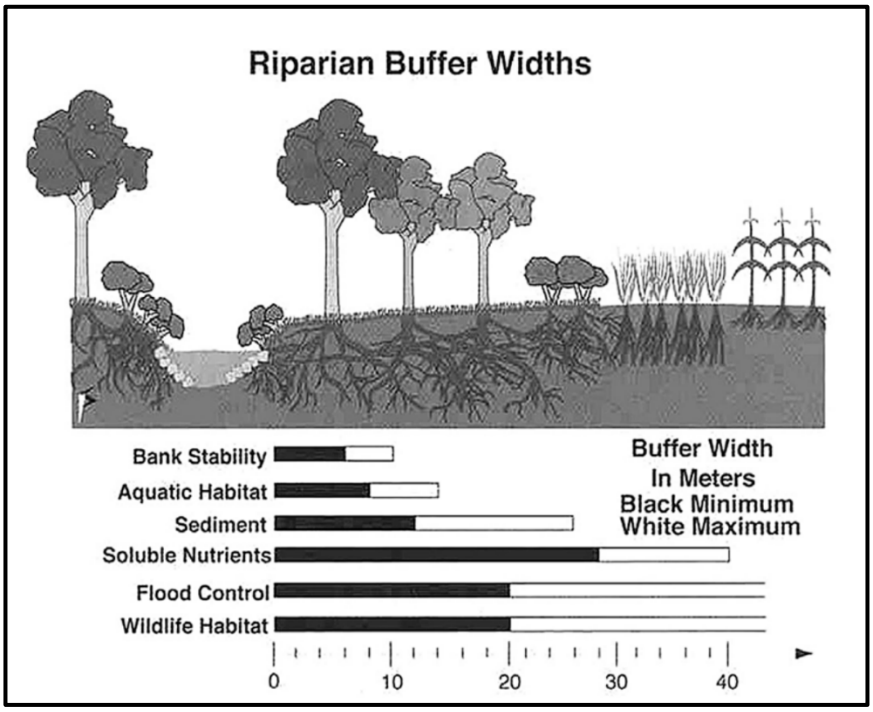


Figure 1: Riparian buffer widths by various sections (Shultz et. al. 2009)

The most effective riparian buffers consist of three Zones positioned adjacent to and up-gradient from the waterbody, with each Zone serving a different function (Figure 2). Note that on non-incised streams where damage to soils and banks is of little concern, Zones 1 and 2 are sometimes combined and management becomes more closely aligned to that of Zone 2 (Schultz et al. 2009).

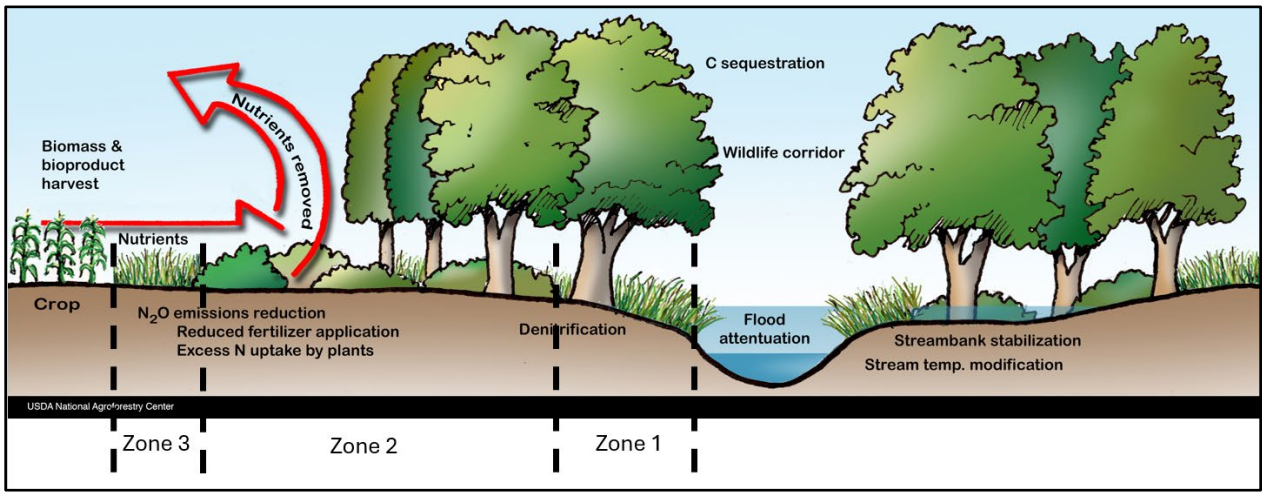


Figure 2: Illustration of riparian buffer zones adapted from the USDA National Agroforestry Center

Zone 1 is a narrow area directly adjacent to the water body that is at least 15 feet wide. It may or may not have trees but otherwise contains a mixture of native vegetation including shrubs and herbaceous plants that are adapted to

floodplain hydrology. The primary purpose of this zone is to provide aquatic shade, insect habitat, bank stability and woody debris. Recreational activities, equipment use and management for resource production are excluded in Zone 1. Trees and shrubs grown in this zone are typically bottomland species that can tolerate flooding and grow fast to stabilize the bank, and they are allowed to mature and fall into the waterbody to provide structure.

Zone 2 is a wider area of forest adjacent to Zone 1 that is at least 20 feet wide but preferably much wider if space permits. Where possible, the combined width of Zones 1 and 2 should be at least 100 feet or 30 percent of the active flood plain. Dominant vegetation in this zone will consist of trees and shrubs that can tolerate occasional flooding and are suited to the intended purpose. Fast growing trees are preferable on the side closest to Zone 1 to provide nutrient uptake, capture pesticides and slow the erosional forces of floodwater. Zone 2 also provides a travel corridor and habitat for wildlife. In multi-purpose buffers, this zone can be managed for additional income from nuts, berries, woody floral products and wood products provided the buffer purpose is not compromised.

Zone 3 is adjacent to and up-gradient from Zone 2. This zone consists primarily of herbaceous ground cover that functions to trap sediment and nutrients leaving crop fields, grazing lands, or developed areas. It can be managed for hay or combined with low growing woody plants to produce nuts, berries, and floral products provided the buffer purpose is not compromised. This Zone should be a minimum 10 feet in width if slopes are less than 1 percent. For slopes greater than 1 percent, add 1-1/2 feet for each degree of slope increase.

Example calculation for Zone 3 with a 13% slope: 10’ minimum width + (13 x 1.5’) = 29.5’ width

Figures 3 and 4 show alternate configurations for Riparian Buffers

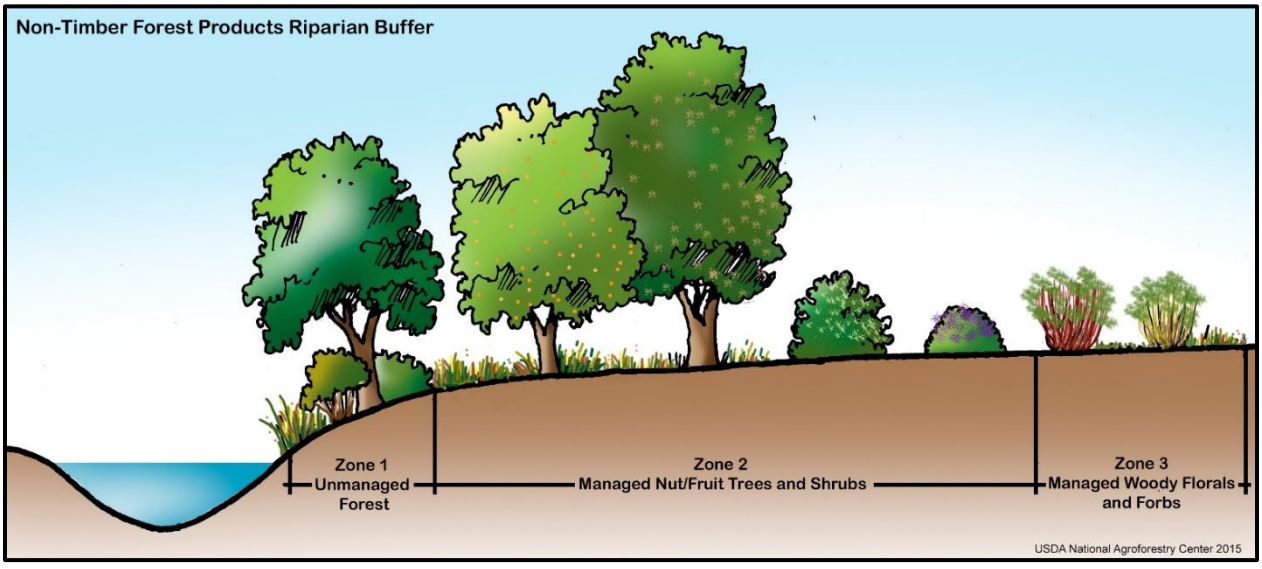


Figure 3: Example configuration for a riparian buffer

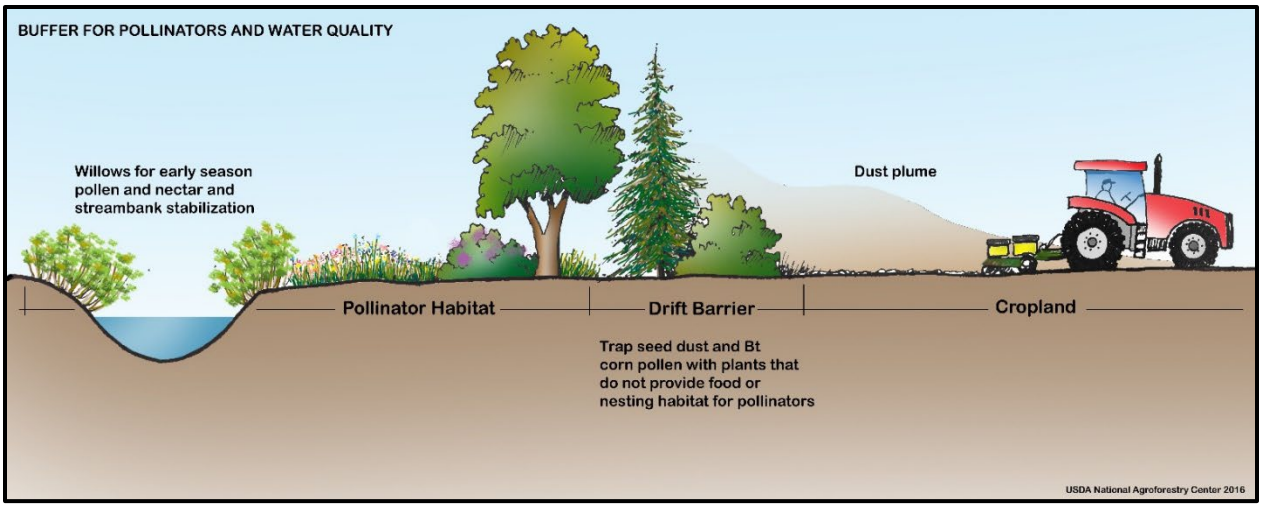


Figure 4: Second example configuration for riparian buffers

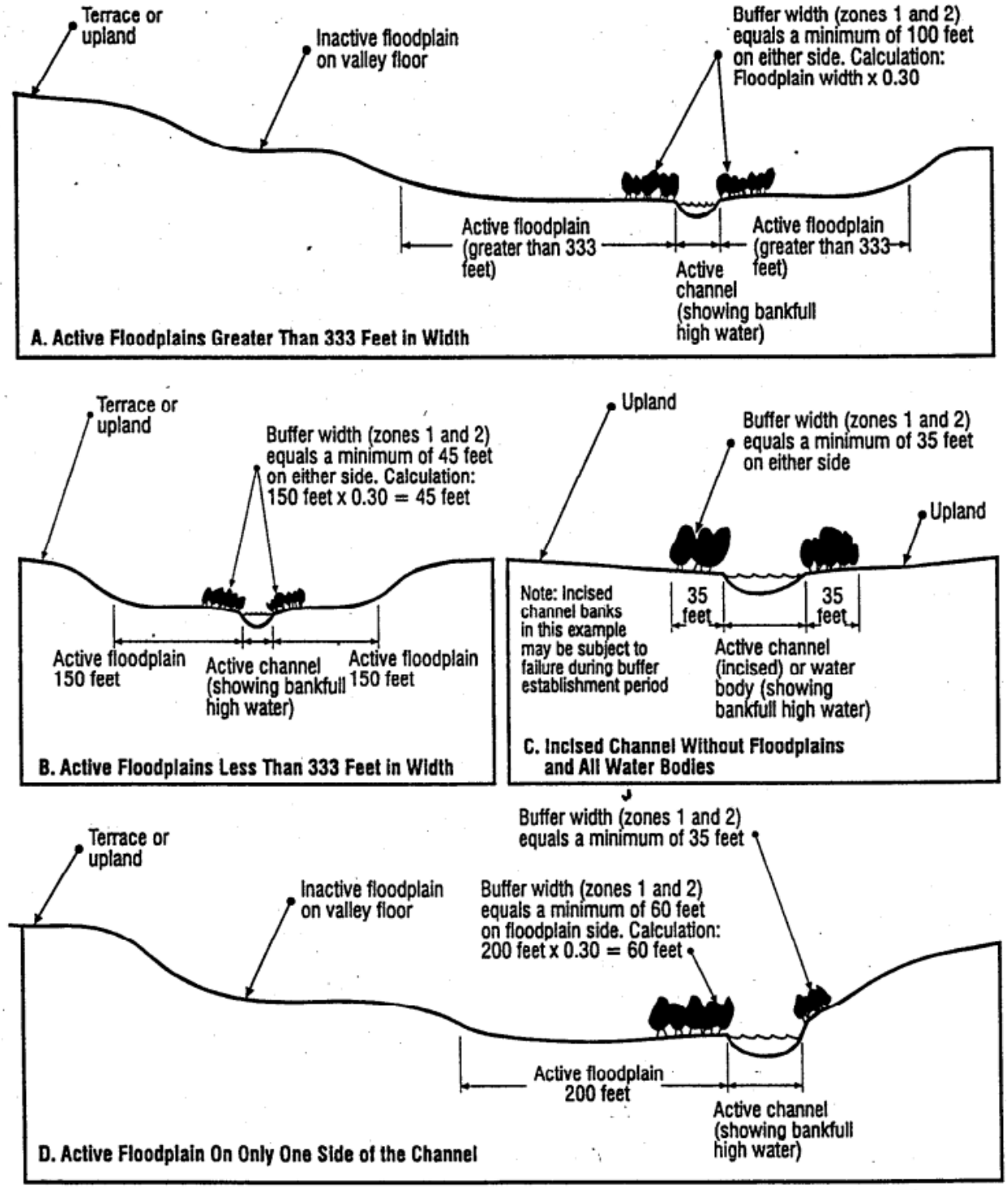


Figure 5: Examples of riparian buffer width calculations for water courses and water bodies

Table 10.1: Spacing and Densities for Riparian Forest Buffers

Table 10.1: 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 (including columnar trees)	5 – 8
Trees, greater than 25 feet	8 – 15
A minimum planting density is 200 trees and shrubs per acre. * Greater spacing between trees and shrubs is acceptable in Zone 2 if early successional habitat is desired, or when large debris entanglement is likely in a floodplain.	

Windbreaks and Shelterbelts (380)

A Windbreak, also known as a Shelterbelt, is a linear planting designed to modify airflow entering or leaving an area. Windbreaks may include a combination of trees, shrubs and permanent ground cover that provide multiple environmental or economic benefits.

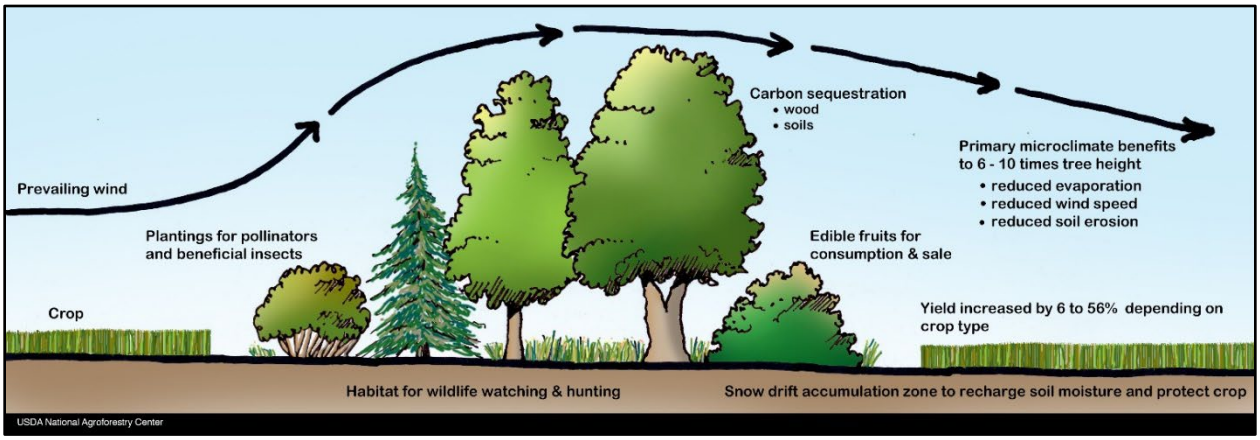


Figure 6: Windbreak schematic

Factors that determine the effectiveness of a windbreak include:

- Height
- Length
- Orientation
- Density
- Continuity

Height (referred to as "H") is the most important factor determining the downwind (leeward) distance of protection. For planning purposes, "H" is the expected height of the tallest row of plants in the windbreak at the base age of 20.

1 Narratives and pictures for each Factor are adapted for New Jersey NRCS from USDA NAC, 2025.

The wind speed reduction within the downwind protected area is directly proportional to the H, so

a 20-foot-tall windbreak will have the same windspeed reduction at 4H (or 80 feet downwind) as a 60-foot windbreak at 4H (or 240 feet downwind).

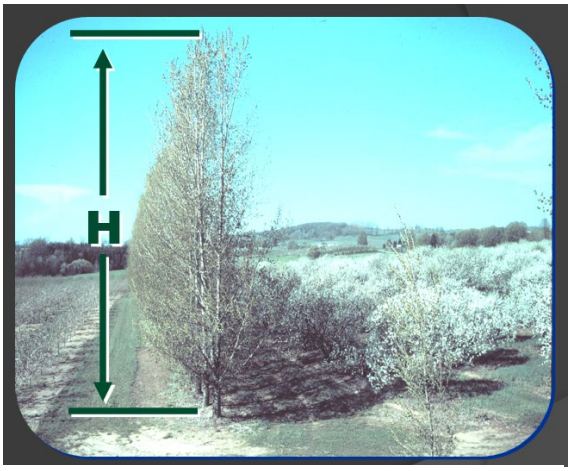


Figure 7: Measuring (H) for windbreaks

The most effective wind speed reduction will occur within 10 times the height (10H) on the downwind side of the break. There is also a measurable wind speed reduction within 2 times the height (2H) on the upwind (windward) side due to increased air pressure building up against the break that redirects the airflow up and over the break (Brandle & Finch, n.d.). When planning a windbreak, the leeward distance in need of protection must be equal to or less than 10H. Select planting stock from *Table 4.11: Characteristics of Trees, Shrubs, and Woody Vines* that have the appropriate H value. When multiple windbreaks are installed over large areas, the maximum interval between breaks should be 12H.

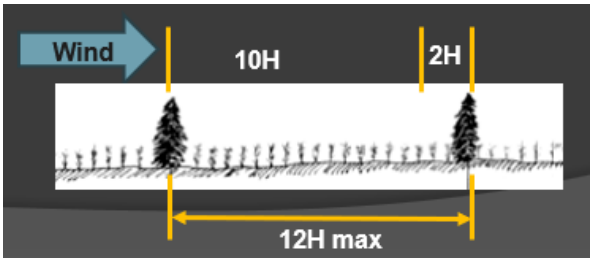


Figure 8: Using (H) to measure effective distance

Length and Orientation although the height of the windbreak determines the extent of the protected area downwind, the orientation and length of a windbreak determine the amount of total area receiving protection. The best orientation for each windbreak depends on the objective, but windbreaks are most effective when oriented at right angles to prevailing winds. However, wind rarely blows exclusively from one direction, and as the wind changes direction and is no longer blowing directly against the windbreak, the protected area decreases. For full protection, the windbreak needs to extend past the width of the area needing protection to account for changing wind directions. Doubling the length of a windbreak will generally increase the area protected by 4 times. Where wind direction is variable, planning "L" or "U" shaped windbreaks can improve protection. Data from local weather stations, landowner observations, and NOAA Wind Rose charts (https://www.climate.gov/maps-data/dataset/wind-roses-charts-and-tabular-data) are effective tools for determining prevailing wind directions. Wind roses graph the frequency and velocity of winds during a specified period of time, usually a month or a single day.

Figure 9: Windbreak in relation to planned area of protection

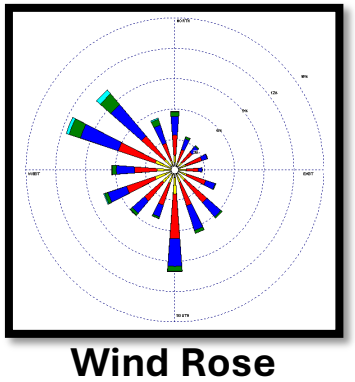


Figure 10: Wind Rose Diagram

Density and Continuity density is the ratio of the solid portion of the windbreak to the total area of the barrier. Wind flows through the open portions of a windbreak, thus the more solid the windbreak, the less wind passes through. High density windbreaks have maximum wind reduction but protect a shorter distance because of a "recirculation bubble" created on the leeward side that directs vertical air flow back towards the ground. In contrast, low density windbreaks will have less wind reduction, but the effects will be realized over a longer wind shadow. So, different plant materials (deciduous trees versus conifers) and different spacing arrangements (rows of different plants, staggered spacing, etc.) can be used to manipulate the density and airflow pattern to affect the protection zone. For example, a dense windbreak will deposit heavy snow relatively close to the windbreak within the zone of protection, which may be undesirable. A low-density break will result in more even distribution of snow across a field to help with soil moisture management.

Figure 11: Examples of windbreak densities

Table 10.3 provides required windbreak densities for different purposes.

Table 4.8 lists the density for individual plant species.

Table 10.4 lists the spacing within and between rows for windbreaks and shelterbelts.

Continuity of a windbreak is important because gaps not only reduce the effectiveness but also create a "funnel effect" that generates higher winds passing through the gap. Wind velocity through a gap can accelerate to 120% of open wind speed resulting in crop damage or snow drift problems (Brandle & Finch, n.d.). Access lanes through a windbreak should be avoided whenever possible. Figure 13 illustrates Windspeed effect through a windbreak gap (Brandle & Finch, n.d.).

Figure 12. Windbreak gap

A common concern for producers when considering a windbreak is the area lost for crop production, however, a well-designed windbreak can increase crop yield in the remaining field sufficiently to overcome production losses depending on the crop and how much area is devoted to windbreaks. Primary mechanisms for better yields come from reduced soil erosion and plant evapotranspiration, which has a positive effect on the availability of soil nutrients and moisture for plant growth. For succulent vegetables and fruits, there is also less wind-induced physical damage between plants and damage from wind-blown particle abrasion that affects fruit quality (Andreu et. al. 2008, Smith et.al. 2021). A general rule-of-thumb to balance this tradeoff is having no more than 5% of the field in windbreaks. A single row windbreak can be used to reduce the footprint while still realizing significant benefits.

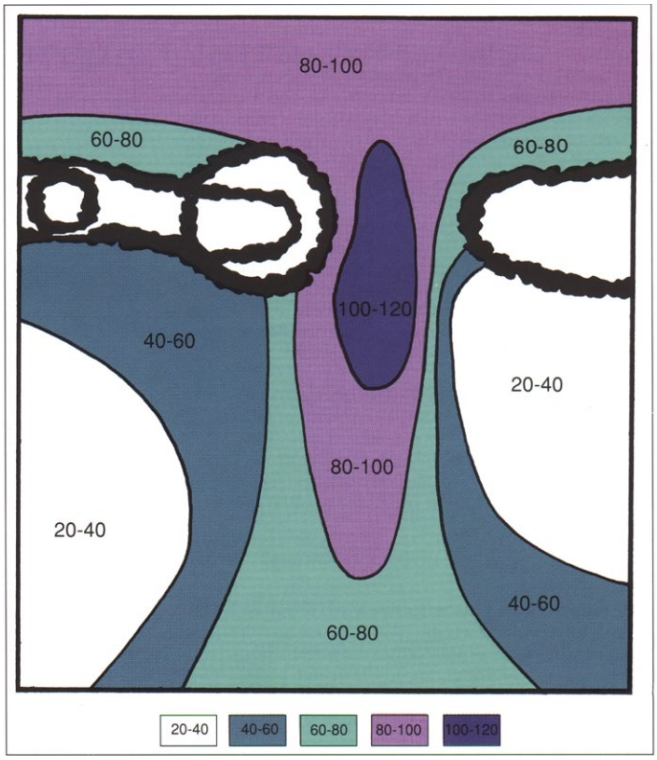


Figure 13: Windspeed effect through a wind gap

Table 10.2: Relative responsiveness of various crops to shelter provided by windbreaks

Smith et.al. 2021

Relative responsiveness of various crops to shelter provided by windbreaks.

Crop	No. of field-years	Mean yield increase (%)
Oats	48	6
Spring wheat	190	8
Maize	209	12
Soybeans	42	16
Rye	39	19
Grass hay	14	20
Winter wheat	146	22
Barley	30	25
Raspberry	2	27
Tomatoes	3	29
Plum	2	34
Snap beans	2	40
Millet	18	44
Strawberry	3	56

TABLE 10.3: Densities for Windbreaks and Shelterbelts

TABLE 10.3: 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 on staggered spacing. If year-round protection is needed, use at least one row of evergreens.
Improve air quality entering an area (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. Use staggered spacing on multiple rows.
Improve air quality leaving an area (reduce airborne particulates, chemicals, odors)	At least 65%; downwind and within 10H of the source area	Plant two rows of medium and/or high-density species on staggered spacing. If year-round protection is needed, use at least one row of evergreens.
Noise screens	At least 65%; as close to the noise source as possible	Plant two rows of medium and/or high-density species on staggered spacing. Select species with a mature height 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 for even distribution across a field or area.	25 to 50%; maximum interval between windbreaks is 20H	Plant one row of low or medium density species. A density near 25% will yield more uniform snow distribution than 50% density.
Manage snow to protect an area from accumulation.	At least 50%; upwind and best protection from snow accumulation is between 2H – 8H	In New Jersey, most snow deposition and accumulation occurs within 100' of the leeward (downwind) side of the windbreak), Plant at least one row using medium and/or high-density evergreen species or two rows of low-density species on staggered spacing .

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. Refer to Table 4.11 for mature height at 20 years of age for different species. **2.** For higher levels of protection (at a density ≥50%), use at least three rows of trees and shrubs, with at least one row being evergreen trees. Refer to Table 4.11 for the summer and winter densities of each species. **3.** 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.		

TABLE 10.4: Spacing for Windbreaks and Shelterbelts

TABLE 10.4: 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 – 6	3 - 6	2 - 5	2 - 5	5 - 10
Deciduous Trees Smaller than 25' at maturity	5 – 12	10 - 15	5 - 8	8 - 10	10 - 15
Deciduous Trees Larger than 25' at maturity	12 – 15	12 - 20	8 - 12	12 - 15	15 - 20
Evergreen Trees (columnar form)	5 – 8	6 - 10	3 - 5	4 - 8	10 - 15
Evergreen Trees (conical & broad forms)	8 – 15	8 - 20	6 - 8	6 - 12	10 - 20

Alley Cropping (311)

Alley cropping is the planting of rows of trees and / or shrubs to create alleys where agricultural or horticultural crops are grown. The parallel rows of trees or shrubs are called “sets”, and the sets can function much like windbreaks and provide many of the same benefits but unlike windbreaks, sets are intended to yield a crop or wood product at some point. Since sets are planted closer together than windbreaks, the woody plants must be sufficiently compatible with the annual crops grown in alleys so that the entire field is being used for both annual and perennial production. Sets of trees or shrubs may yield an annual harvest of nuts, berries or biomass, or they may be cultivated to produce high value lumber products in the future. For this reason, alley cropping is attractive to producers interested in diversifying their yield by growing multiple crops on the same acreage.

The width of alleys are adjusted depending on the compatibility of the crops being grown and the spacing requirements of equipment that might be used in the alleys. Forage, cereal grains, and other row crops may require alleys greater than 100’ wide, while specialty nuts, fruits, vegetables, horticultural products, and biomass products might be grown in narrower alleys. The spacing between trees or shrubs within sets will also vary depending on the objectives and growing space requirements of the plants being grown. Each set typically consists of a single row of trees or shrubs, but multiple row sets may be appropriate depending on objectives.

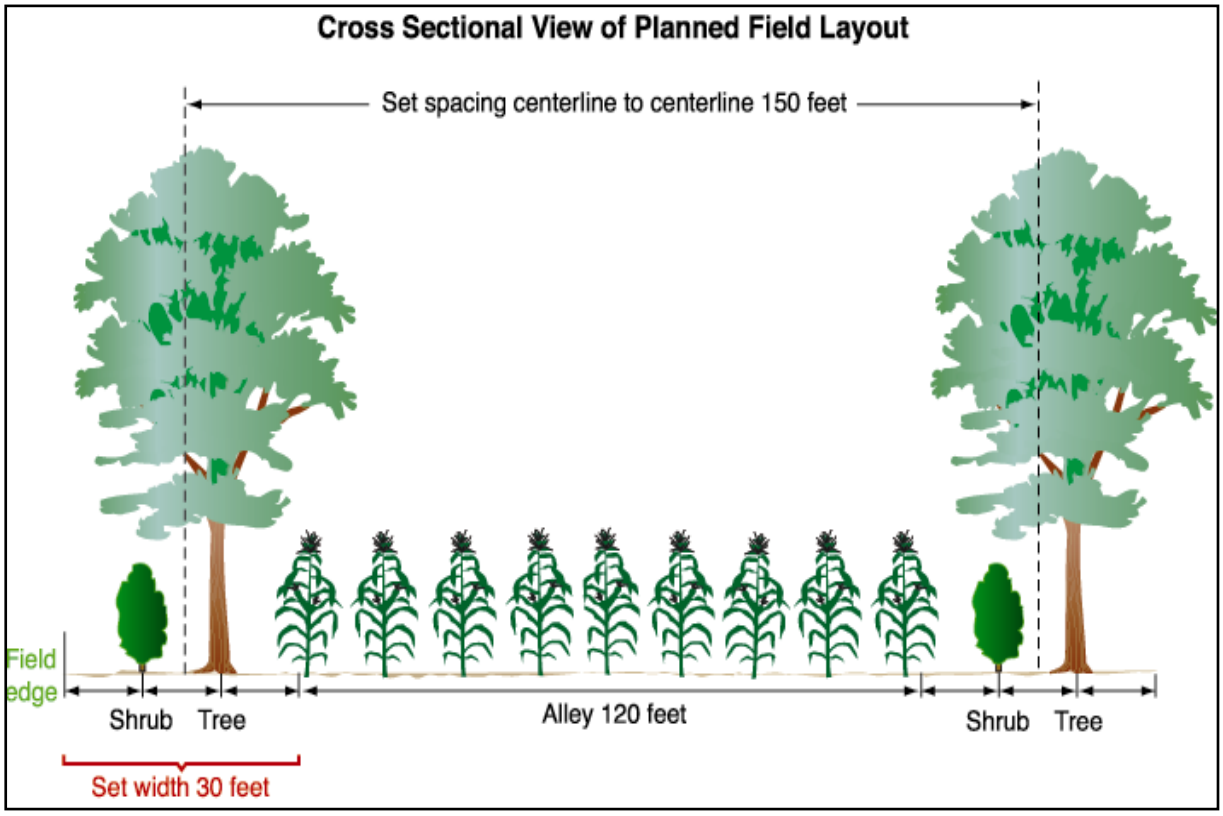


Figure 14. Typical Alley Cropping Design, USDA NAC, 2025

Important considerations for trees and shrubs used in sets include:

Canopy Density and Orientation tree species with dense foliage cast more shade upon alley crops, so sets should be oriented to minimize shading on the alleys as the sun travels across the sky each day. Sets can also be oriented along slope contours to help reduce soil erosion.

Canopy Size at Maturity species that exhibit a wide growth form may interfere with crops and equipment use within alleys. This can usually be managed through pruning, but consideration of size at maturity is important during the planning stage.

Rooting Habit most trees establish deeper root systems than field crops, so they access moisture and nutrients that have passed through the root zone of crops. However, some species have shallow surface rooting habits that may interfere with crops in the alleys. Periodic root pruning can be done to mitigate for this.

Plant Interactions trees and shrubs that release allelopathic compounds - like juglone produced from black walnuts - may not be compatible with certain crops. Some tree species (particularly pines) may alter soil pH over time, which might be beneficial or detrimental to certain alley crops. Nitrogen fixing trees and shrubs may help improve soil fertility for alley crops.

Some benefits of Alley Cropping Include:

- Trees and shrubs recycle nutrients and organic matter back to the soil through annual leaf drop.
- Permanent and diverse root systems help to reduce erosion and improve soil health. Microbial communities associated with root systems can improve crop development.
- Protection from direct sunlight and wind can conserve plant and soil moisture to improve the microclimate for crops.
- Diversified crop yield.
- Improved habitat for wildlife, pollinators, and beneficial insects.

Figure 15. Alley Cropping Hay and Nut Trees

Some challenges of Alley Cropping Include:

- More complex field management and weed control. May complicate pesticide and herbicide applications.
- Producers may not be familiar with tree biology, care, and compatibility with crops.
- Woody plants can take years to establish and mature before a significant return on the investment is realized.

Forest Farming (379)

Forest Farming is the practice of managing or establishing woodland vegetation to produce a sustainable supply of non-timber forest products (NTFPs) within a forest, and in most cases, NTFPs are usually high value specialty crops cultivated in the understory. Forest farming is practiced in many different forms throughout the world under different names, ranging from permaculture systems that are highly complex with many species and levels, to simplistic operations that have a single NTFP like shade grown coffee under a timber crop. What distinguishes forest farming from opportunistic harvesting of NTFPs is the management of trees and shrubs to cultivate favorable growing conditions for NTFPs. In some cases, the desired NTFPs may already be present in the forest, and the goal is to manage

competition and light to address plant productivity and health, while in other situations, NTFPs may be introduced and cultivated under the managed tree canopy to improve structure and composition. Planners need to carefully consider how this practice is being implemented because some forest farming operations are only focused on production, and the proposed activities do nothing to address resource concerns. A forest management plan is required to guide the implementation of this practice in all cases except when a forest farm is being established on bare ground.

Forest farming can be divided into three general strategies that may be used singularly or in combination depending on objectives and the existing conditions:

- Managed Wild Population
- Wild-simulated
- Woods Grown

Management of a wild population is the least intensive approach. This normally involves some control of competing vegetation in the lower canopy or understory, and possibly upper canopy thinning to improve light conditions. Traditional agronomic practices such as fertilization and pesticides are rarely used so associated costs and annual inputs are relatively low, but annual yields are not always dependable. Examples of wild management include thinning a forest to increase fruit production from wild berries in the understory, or crop tree management to enhance nut production.

Photo Credit: BrighterBlooms.com

Where natural populations of NTFPs do not exist but site conditions are conducive, a wild-simulated approach can be used to establish crops that have the appearance and quality of wild-grown products so they fill a similar ecological role and may command similar value as a crop. Aside from canopy management, this normally involves low-intensity site preparation activities to expose soil and sow seeds or plant plugs, shrubs, or trees that are then left to grow under natural conditions without the use of fertilizers and pesticides. Initial inputs can be high to establish plants, but aside from some periodic cultivation like weeding, long term maintenance costs are relatively low. Fruits, berries, woody florals, and medicinal herbs are examples of plants that are sometimes grown under wild-simulated conditions.

The most intensive approach is sometimes called woods-grown, whereas more extensive understory clearing is done to control competing vegetation and maximize the available planting area, and then commonly used agronomic practices such as tillage, fertilization, weeding, and disease control are employed to maximize yields. High value crops like ginseng and other medicinal herbs are sometimes grown this way. Woods-grown cropping is he strategy that planners need to be most mindful of to ensure that new resource concerns are not being created during the implementation.

Photo Credit: colwellsginseng.com

Silvopasture (381)

Silvopasture is the integration of carefully planned livestock grazing with the cultivation of trees to provide a variety of conservation benefits. An important aspect that distinguishes this practice from biological brush management is that grazing must be managed so that forage is sustained over time, and the intentional management of tree density to promote forage growth is what differentiates Silvopasture from simply putting animals in the woods. For NRCS purposes, Silvopasture must be established and maintained to meet the minimum conditions of being a forest, which is defined as being at least 10% stocked with trees or single stemmed shrubs that will be at least 13' tall at maturity. Canopy cover greater than 50% should be avoided because light penetration will be low and will usually result in unacceptable forage growth. Since canopy cover will increase as trees grow, managers also need to be mindful of how canopy structure may change over time while planning this practice.

A Silvopasture system requires a grazing plan that includes rotational movement of the animals to different containment areas to provide recovery periods for grazed forage. Recovery periods can vary depending on the site productivity, seasonal weather conditions, animal units, available acreage, and tree density. Generally, smaller Silvopasture systems or those being managed at maximum animal unit densities require lower tree stocking to facilitate quicker forage recovery, while larger systems can be managed with higher tree stocking because grazing pressure tends to be more dispersed across the pasture.

There are many inherent benefits that trees contribute to a Silvopasture system but a driving factor for adopting this practice is usually for shading livestock to reduce heat stress and increase productivity. This is especially true for large animals like cattle that begin experiencing heat stress when temperatures exceed 80°. Although the benefits vary depending on several factors, research done at the University of Kentucky showed that when artificial shade was provided to cattle in the spring and early summer, beef cows increased their body weight by 1.25 lbs. per day, steer increased by 0.89 lbs. per day, and calves increased by 0.41 lbs. per day. Furthermore, researchers at the University of Arkansas found that shade from trees was even more effective than artificial shade (i.e., structures). In their study,

cows that were shaded by trees had on average 40% more daily weight gain than cows that only had access to artificial shade. Other university research has shown similar increases for milk production and fertility when shade was introduced; specifically, milk production can be increased by 10-19% and conception rates increased by about 19% for cows with shade.

There are two pathways for creating Silvopasture: by adding trees to an existing pasture or by establishing forage in an existing forest. Both strategies have challenges for successful implementation that are discussed below.

Creating Silvopasture in Forestland

When creating Silvopasture in an existing forest, light management via canopy manipulation is the most critical aspect for success, so a forest management plan is needed to guide implementation. This pathway also requires careful assessment of the site to make sure it is appropriate for Silvopasture because introducing livestock to a woodland can have detrimental effects on the ecology and cause new resource concerns. Wetlands, riparian buffers, and other sensitive areas containing rare species or complex native understory composition should be excluded. Forests with depauperate understory conditions or those degraded from invasive plant populations may present the best opportunities where Silvopasture can help address existing resource concerns. Silvopasture in a forest may also be a good option when open woodland conditions are the management objective. There is mounting evidence that much of the eastern oak biome was historically maintained as open woodlands through Native American burning practices, and since these habitats are now rare and prescribed burning isn't always feasible, animal grazing might be suitable alternative to emulate the effects of fire.

Photo Credit: Brett Chedzoy, Cornell Cooperative Extension

Since most unmanaged forest stands in New Jersey are even-aged and contain more than 100 sq. ft. of basal area, in most cases, a reduction in tree cover will be necessary to facilitate the growth of desirable forage. This will be accomplished using a forest stand improvement technique known as thinning. Depending on the forest type, thinning should be implemented to a target residual stocking density that is below the "B" line and preferably near the "C" line using an appropriate stocking guide for the forest type. Managing to a level below the "B" line is necessary to ensure that subsequent canopy ingrowth will not result in closed canopy conditions during the practice lifespan that will significantly impair forage development. Depending on the objectives and forest type, this will normally translate to a residual canopy density between 25-50%. The lower end of this range should be targeted when livestock production is the main priority and increased forage productivity is needed. Where timber production is a dual priority, the upper end of the range will be preferable so that more growing space is allocated to tree growth and timber quality is maintained. Higher residual density may yield acceptable forage growth in stands containing tall trees or trees with small live crown ratios because of increased horizontal light penetration. To the extent practical, residual stocking should be uniformly distributed throughout the

Silvopasture so that shade and forage growth will be uniform, thus keeping animals from congregating in any given area. A professional forester should be consulted to help with stocking and ingrowth estimates for planning purposes.

It is worth noting that some tree species are susceptible to "thinning shock" when heavy thinning occurs, which is a temporary period of stress response to the altered site conditions. During this time, residual trees may be at increased risk from stressors like insects or disease that are normally not problematic. Also, mature forests and dense conifer stands may be susceptible to increased windthrow after heavy thinning. Where these issues are a concern, it may be beneficial to implement Silvopasture thinning in two or more lighter passes through the stand with multi-year adjustment periods between treatments, but this approach may not be compatible with NRCS programs.

Care should be taken during any thinning operation to minimize heavy equipment use within the drip-line of retention trees, which is a vertical downward projection of area equal to the tree's canopy. Soil compaction or root damage within the drip-line can irreparably damage or kill trees, and since it is common for roots from one tree to grow into and graft with adjacent trees, removal of nearby stumps should be avoided to minimize collateral root damage on residual trees.

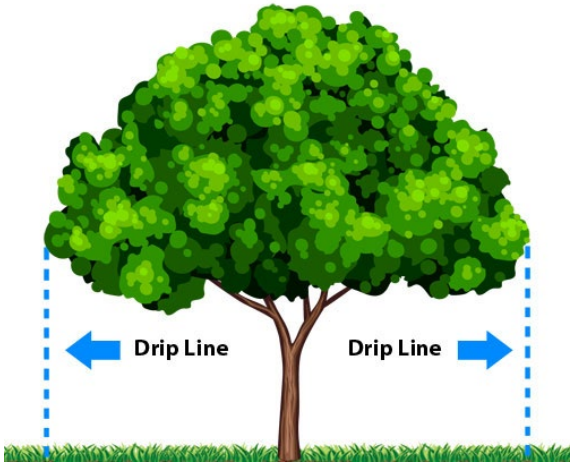


Figure 16. Drip-line illustration

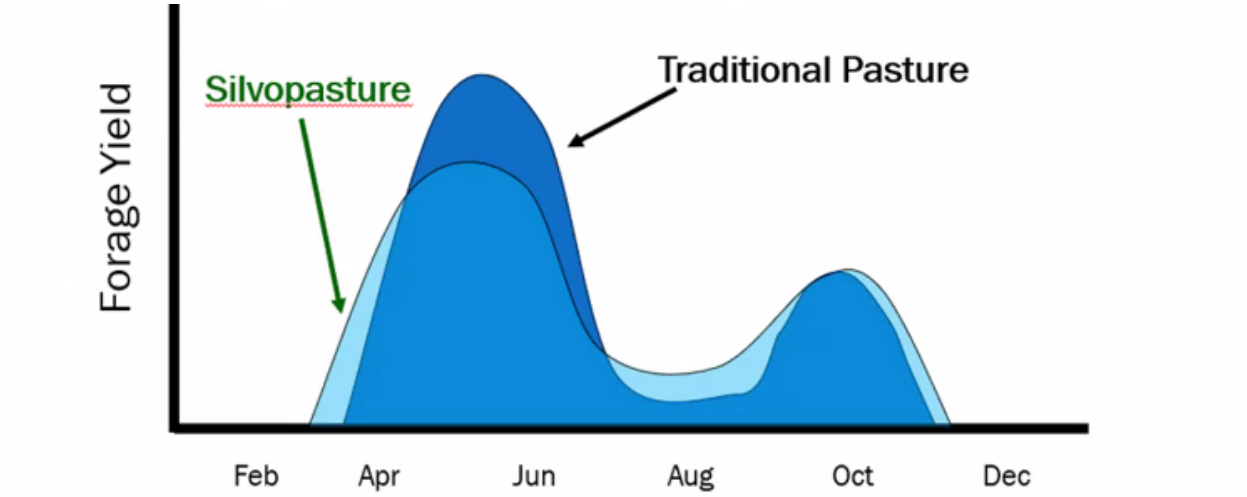
In previously unmanaged stands, thinning should initially focus on culling suppressed and poor-quality intermediate stems from below the codominant canopy class, and when additional tree removal is needed to attain desired spacing and density goals, then less desirable co-dominant stems can be removed. The residual trees in a Silvopasture should be vigorous, well-formed specimens of species that are well-suited to the site and are expected to live at least 15 years. The silvicultural strategy for selecting retention trees should emulate the approach used for crop tree management. Always ensure that trees being favored in thinning operations are not toxic to livestock by checking credible resources like state extension services, and when possible, consider retaining tree species that also provide supplemental food for livestock (e.g., hard and soft mast, seeds, etc.) or wildlife and pollinator habitat. CPS 384 Woody Residue Treatment may be helpful for treating slash generated from thinning operations and CPS 314 Brush Management may be needed to control understory vegetation that will interfere with grazing and forage establishment.

Forage requirements will be guided by a grazing plan but most closed canopy forests in New Jersey have inadequate forage present to support the nutritional needs of livestock, so supplemental seeding will probably be needed. This may not be necessary in woodlands that have regenerated on old farm fields because remnant cool season grasses may be present and rapidly recolonize the ground after thinning. On sites that had never been farmed, supplemental seeding will usually require some type of site preparation to ensure good germination. These activities need to be modified from traditional tilling and drilling methods so that root damage on residual trees is minimal, otherwise, tree decline or delayed mortality may occur. Mature trees and those with shallow rooting habits are especially sensitive to root disturbances. In most cases, light raking is all that is needed to expose mineral soil and promote good seed-to-soil contact. Typical seed drills may not be effective for delivering seed in forest settings because of ground surface irregularities and obstacles, so manual broadcasting using a shoulder spreader may be necessary.

On sites that do not have pre-existing invasive plant problems, seeding should be done as soon as possible after thinning to minimize the likelihood of undesirable species becoming established, but when invasive plants are already present, it might be better to delay seeding until after the first growing season to control any regrowth occurring from the seedbank. Since opening the canopy to grow forage will also improve conditions for many undesirable plants, landowners should be aware of this potential. Integrating different livestock like goats that prefer browse may be a compatible alternative to herbicides for managing woody encroachment into the system. Goats are also a good option where heavy coppice growth is expected after thinning. If herbicides are used to control undesirable brush and weeds, producers should select a chemical that does not have flashback or soil mobility to avoid uptake by Silvopasture trees, and animal re-entry restrictions need to be followed in accordance with the herbicide label instructions. In all cases, livestock introduction should be delayed until forage is well-established.

Creating Silvopasture in Existing Pastureland

When establishing Silvopasture on existing pastureland, most producers are concerned about reduced forage production from tree shading, which can be an issue during the peak forage growth period in early summer. However, the thermal protection provided by trees can make up for the peak season losses by boosting forage growth during the hottest part of the summer when open pasture growth slows, and by protecting against early and late season freezes to extend the length of the growing season.



Graphic adapted by the USDA Forest Service courtesy Rob Kallenbach, University of Missouri.

Tree planting designs must consider site functionality, maintenance needs, the size of the planting stock, and what type of protection from physical animal damage will be used. It is usually best to use the largest planting stock available that is practical to install because larger trees reduce the exposure period when foliage is within reach of browsing animals, and they have better root systems that are less susceptible to planting stress and mortality. Bare root whips that are several feet tall may be less expensive to purchase and ship than containerized plants, so they provide a good balance between size and cost-effectiveness, but bare root trees have a narrow planting window compared to containerized stock. The minimum establishment rate using 1-gallon potted material or 3' tall bare root whips is 70 trees per acre, which if distributed evenly, represents 25' x 25' spacing. If smaller bare root planting stock is used, the minimum establishment rate should be increased by approximately 40% (i.e., 100 per acre on 20' x 20'

spacing) to account for higher expected mortality. Although uniform tree distribution is preferred so that forage growth is uniform and animals do not congregate in some locations for shade, uniform distribution presents the most challenges for protecting and maintaining trees. Alternate layouts may be preferable to facilitate easier maintenance and the installation of animal protection measures like electric fencing, but these designs still need to have an element of uniformity to prevent animal congregation in portions of the pasture. One example is to plant rows with 12' between trees within rows and 40' between rows (minimum 4 rows/ac = 70 trees/acre). Depending on the landowner's objectives and the rotation age of the trees, it may be desirable to start by planting a higher number of stems than is desired and periodically thin some as they increase in size. This method will encourage faster height growth and promote better form but will increase the logistical challenges for grazing. The species used will vary depending on site conditions and landowner objectives, but generally, faster growing species with sparse foliage are desirable traits. Tree form (including rooting habit) and drought tolerance are also important considerations. Trees with deep-root morphology are desirable because they are usually more drought tolerant and provide less competition for forage.

If providing livestock shade is the primary purpose of the trees, it is best to use sparse foliage hardwoods like honey locust (*Gleditsia triacanthos*) and black walnut (*Juglans nigra*). These examples provide diffuse shade that improves mid-summer forage growth, and their leaves emerge later in the spring and drop earlier in autumn which benefits forage growth during cooler periods when shade is less critical for animals. Additionally, the leaves are small and break down rapidly so they do not interfere with forage unlike some large leaved species like red oak (*Quercus rubra*) that decay slowly and may act more like a mulch.

Aside from providing livestock shade, other common dual purposes of Silvopasture trees include wood production, animal fodder, and pollinator or wildlife habitat. When growing wood products is an objective, the use of fast-growing conifers or high value hardwoods are typically chosen. Selected species should be those that naturally exhibit strong apical dominance and are not prone to pest damage on the terminal leader (e.g., white pine).

Tree Protection

All newly planted and naturally growing young trees will require protection from livestock damage (and possibly white-tailed deer). Tree damage can occur from browsing foliage, bark stripping or from rubbing against stems, so protective measures should be tailored for each operation based on livestock breeds and their typical behavior. The

Photo Credits: Savana Institute https://www.youtube.com/watch?v=IK-1tWdt420

likelihood of damage will increase if too many animals are contained in a grazing block, or when animals are not rotated through an area quickly enough and forage becomes less available. Protective measures include rigid wire fencing or cages, plastic tree tubes, and various electric fencing options. Even when well-staked, individual cages and plastic tree tubes are rarely sturdy enough to withstand rubbing and physical damage from large animals like cattle, so these options are mostly limited for use with sheep and possibly goats. Electric fencing is the most effective option. Installation configurations will vary but one novel approach is to run a strand of high-tensile electric wire elevated more than 6' above the tree row and drop leads of electrified poly wire that are wrapped around plastic tree tubes and held in place with plastic zip ties. This system allows animals to pass under the overhead wire and graze between trees while protecting them from physical damage and browsing on low foliage. For this system to work well, tree tubes should be at least 60" tall.

Trees that are greater than 2" diameter at breast height (measured at a point 4.5' above ground level) generally have foliage above the reach of most animals and are rigid enough to withstand some moderate physical contact from most livestock, so they may not require protective devices. However, species that have aromatic bark like those in the Rosaceae, Salix, Populus, and Juniperus families, may be prone to bark stripping even on large trees.

Requirements for permanent containment fencing and portable electric fence used to partition the Silvopasture for rotational grazing will be guided by the grazing plan.

Other NRCS Practices That May Be Helpful When Establishing Silvopasture

CPS 314 Brush Management	*CPS 512 Pasture and Hay Planting*
CPS 315 Herbaceous Weed Treatment	*CPS 592 Feed Management*
CPS 382 Fence	*CPS 614 Watering Facility*
CPS 384 Woody Residue Treatment	*CPS 660 Tree/Shrub Pruning*
CPS 484 Mulching	*CPS 805 Amending Soil Properties with Lime*
CPS 490 Site Preparation	*CPS 810 Annual Forages for Grazing Systems*

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

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.

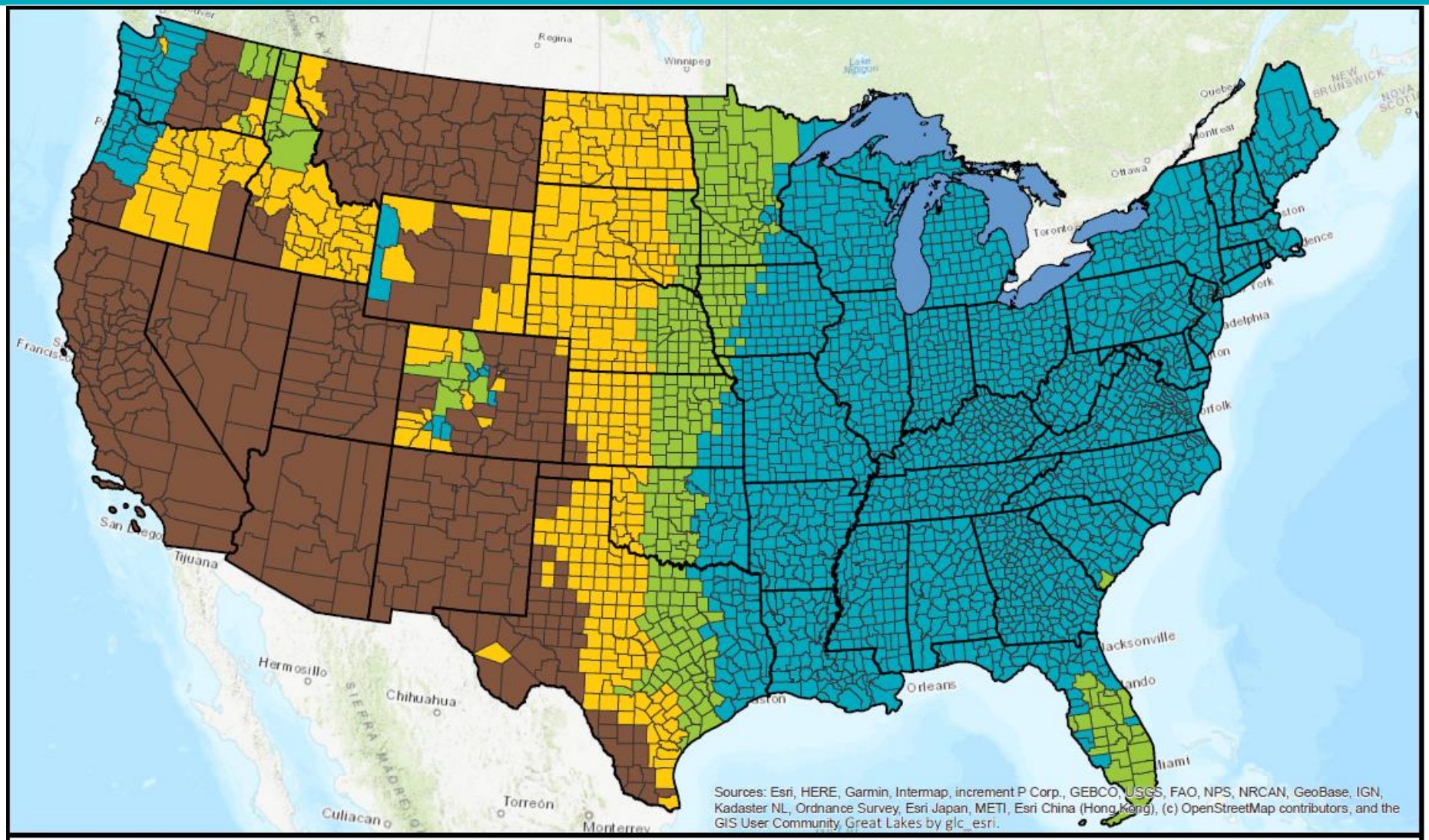
These Guidelines[1] are not intended as a substitute for best locally adaptive management for cover crop termination timing that optimizes water use efficiency, erosion control, soil health improvement, weed and pest control, allelopathy, habitat for beneficial organisms, nutrient cycling, and water 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/plantmaterials/natpmtn13722.pdf

United States Department of Agriculture

Natural Resources Conservation Service

Plant Materials Program
Washington, D.C.

July 2021

Plant Materials Technical Note 6

Selecting, Planting, and Managing Grasses for Vegetative Barriers

Acknowledgements

Issued July 2021

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The technical note benefitted from review by other NRCS technical staff.

Suggested citation:

NRCS National Plant Materials Program. 2021. Plant Materials Technical Note 6: Selecting, Planting, and Managing Grasses for Vegetative Barriers. USDA Natural Resources Conservation Service, Washington, D.C.

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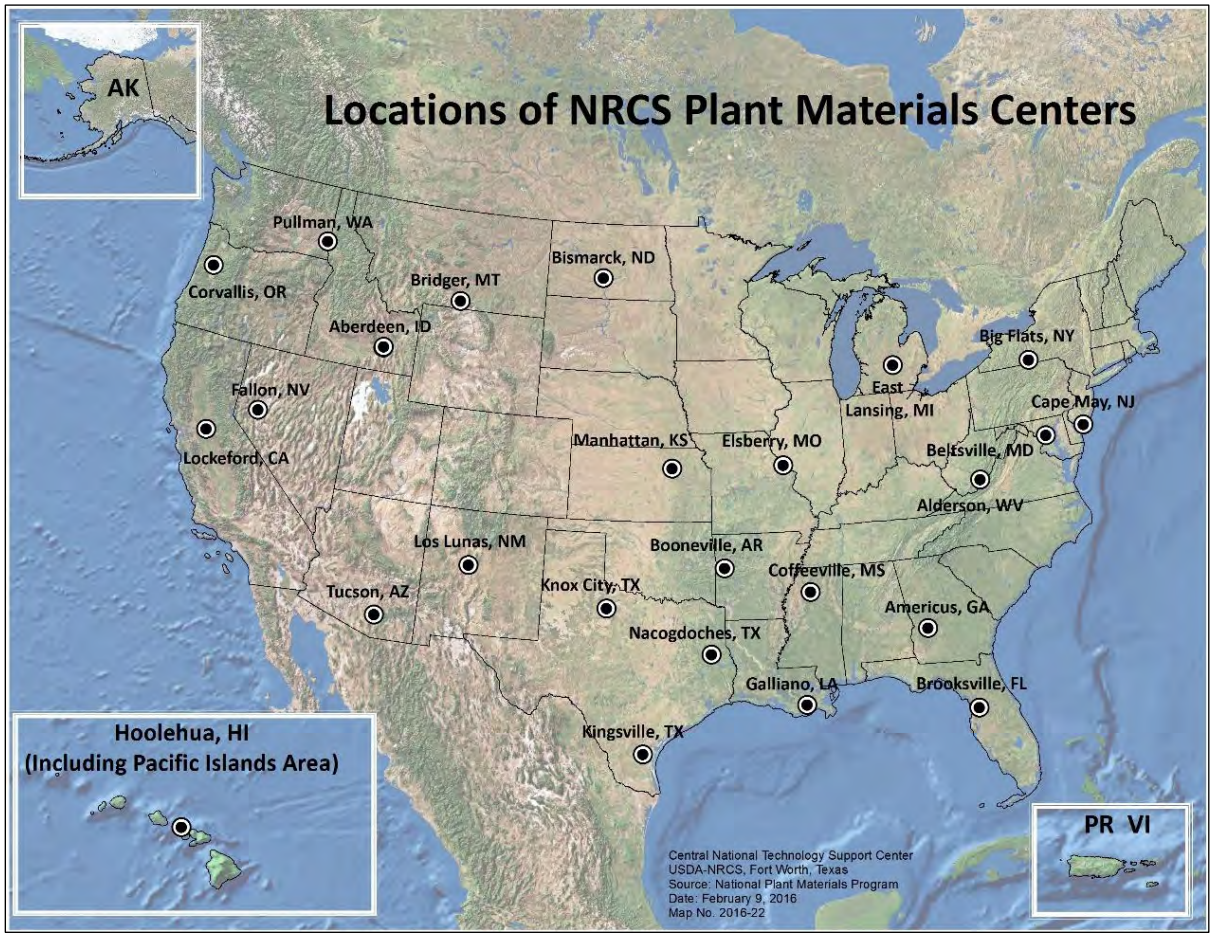
Preface

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 https://plants.sc.egov.usda.gov/home or contact the nearest Plant Materials Center or plant materials specialist at https://www.nrcs.usda.gov/wps/portal/nrcs/main/plantmaterials/contact/directory/ that serves the State. Additional technical resources are on the National Plant Materials Program website 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).

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

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.

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

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*

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
Manska	*Thinopyrum intermedium*	pubescent wheatgrass	Bismarck, ND

Cultivar/Pre-varietal Germplasm	Scientific Name	Common Name	PMC where stem attributes were measured
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

Appendix C - A Simplified Guide to Understanding Seed Labels

https://www.nrcs.usda.gov/plantmaterials/mdpmctn7615.pdf

United States Department of Agriculture
NRCS Natural Resources Conservation Service Plant Materials Program

USDA-NRCS National Plant Materials Center, Beltsville, MD
Maryland Plant Materials Technical Note No. 2 August 2007

A Simplified Guide to Understanding Seed Labels

Introduction

One of the most important parts of establishing cover for any conservation practice is making sure that the correct species, variety, and amount of seed is planted. With many conservation species, it is essential to know and properly interpret what is in the bag. Understanding the seed label will allow proper decision making when planning and installing a seeding.

Components of the Seed Label

The law requires that each seed lot offered for sale must be truthfully labeled. This is regulated by the Federal Seed Act as well as state seed laws. In addition, all state certification agencies comply with the minimum requirements and standards of the Association of Official Seed Certification Agencies (AOSCA) to insure uniform testing methods and minimum standards of seed quality. The format of seed labels may be variable, but all labels will have some semblance of the following as required by the Federal Seed Act for seed in interstate commerce.

- Variety and Kind – Cultivar/release name, species, and common name;
- Lot number – a series of letters or numbers assigned by the grower for tracking purposes;
- Origin – where the seed was grown;
- Net weight – how much material is in the container;
- Percent pure seed (purity) – how much of the material is actually the desired seed;
- Percent inert matter – how much of the material in the bag is plant debris or other materials that are not seed;
- Percent other crop seeds – other non-weed seeds;
- Percent weed seeds – seeds considered weed species;
- Name of restricted noxious seed (with number per pound of seed). Noxious weed species vary by state. There are 2 types of noxious weeds – retricted and prohibited. Restricted weeds are listed as seeds per pound of material in the bag. There should be no prohibited weeds;
- Percent germination (germ) – how much of the seed will germinate readily;
- Hard seed – seed which does not germinate readily because of a hard seed coat;
- Dormant seed – seed which does not germinate readily because it requires a pre-treatment or weathering in the soil. (Some suppliers may combine hard and dormant seed on the label.);
- Germination test date – date should be within 12 months of the planned date for using the seed;
- Name and address of company responsible for analysis (seller or grower).

You may also see the following additional information on the label:

- Total Viability/Germination – this may or may not be stated. Add Germination + Hard Seed + Dormant Seed. Total Viability may not equal 100%. This just means that some of the seed is not viable and will not germinate.

Figure 1. A typical seed label.

Reliable Seed Company
123 Production Way
Seedville, VA 12345 USA
Phone: (123) 456-7890

'Rumsey' yellow indiangrass
Sorghastrum nutans

NET WEIGHT:	25 lbs	PURE SEED:	93.80%
LOT #:	IB097	OTHER CROP:	0.00%
DATE TESTED:	January 2006	INERT MATTER:	5.60%
ORIGIN:	PA	WEED SEED:	0.60%
		GERMINATION:	32.00%
NOXIOUS:	21/lb Giant Foxtail	HARD SEED:	0.00%
	15/lb Wild Garlic	DORMANT:	61.00%

In addition to the seed analysis label, there may be a second label indicating the certification class of seed. The most typical second label would be blue and would indicate it as CERTIFIED SEED. Certified seed is the progeny of seed that has been handled to maintain genetic identity and purity and has been approved by a state certifying agency. Certified seed should be the first choice for any seeding project, especially when cultivars are used.

Using the Seed Label

- The total of Pure Seed, Other Crop, Inert Matter and Weed Seed should always equal 100%.
- If the purity or germination is very low, you may not want to use the seed;
- If there are noxious weeds, you should know what they are and whether they will be a problem on your planting site;
- Always purchase and use seed based on Pure Live Seed (PLS). PLS is the amount of seed which will germinate and can be calculated using numbers from the seed label.

First, determine total viability

Viability = germination + hard seed + dormant seed

Viability is the percent of seed which will germinate, though it may not all germinate the first season. In our example, total viability = 93.00%

Next, calculate the amount of Pure Live Seed (PLS)

$$PLS = \frac{\%\ Purity \times \%Viability}{100}$$

In our example: PLS = (93.8 x 93)/100 = 87.23%

- PLS can be used for calculating the amount of seed you will need to buy for a planting or when calibrating the output of a drill.

$$\text{Bulk seed/acre} = \frac{\text{lbs. PLS recommended/acre}}{\text{Percent PLS}}$$

If we want to seed 10 acres at 8 lbs. PLS/acre., then

$$\frac{\text{8 lbs. PLS/acre}}{.8723 \text{ PLS}} = 9.17 \text{ lbs. bulk/acre} \times 10 \text{ acres} = 91.7 \text{ lbs. bulk seed needed}$$

- Most native plant seed is sold on a PLS basis because germination and purity can be so variable. Always specify buying seed by the PLS pound to make sure you get the amount of seed you need. Some of the cool-season turf-type grasses (fescues, orchardgrass) and agronomic seed (oats, rye) are sold on the basis of bulk pounds only because germination and purity is typically very high and minimums are regulated by the Federal Seed Act.

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This document should be cited as:

Englert, J.M. 2007. A Simplified Guide to Understanding Seed Labels. Maryland Plant Materials Technical Note No. 2. USDA-NRCS National Plant Materials Center, Beltsville, MD. 3p.

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Appendix D - Technical Tuesday – Seed Tags

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