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Suggested Planting Guidelines—Best Management Practices for Revegetation of Actively Used Training Lands in the Northeastern United States

Antonio J. Palazzo, Timothy J. Cary, Paul R. Salon, and Martin van der Grinten

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Final report

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Abstract

These guidelines were prepared to assist military land managers in the selection of appropriate seed mixtures for revegetation of actively used training lands located in the Northeast U.S. Recommending a seed mixture is complicated because of the great variety of land uses, soils, and plant selection goals. The goal was to keep the guidelines as simple as possible but still be able to recommend seed mixtures adapted for this region. A four-step process is presented that covers the important aspects of selecting a seed mixture that can meet revegetation goals on training ranges, airfields, and military operations in urban training (MOUT) sites. Tables are included to assist in the selection of species in seed mixtures for various soil types and characteristics, as well as land use. Characteristics of militarily important plants mentioned in this guide are included in the appendices that provide a summary table and individual plant description sheets.

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Preface

This report was prepared by Antonio J. Palazzo and Timothy J. Cary, Biogeochemical Sciences Branch, U.S. Army Engineer Research and Development Center (ERDC), Cold Regions Research and Engineering Laboratory (CRREL), Hanover, NH, and by Martin Vander Grinten and Paul R. Salon, United States Department of Agriculture—Natural Resource Conservation Service (NRCS)—Big Flats Plant Materials Center, Big Flats, NY.

The report was prepared under the general supervision of Dr. Terrence Sobecki, Chief, Biogeochemical Sciences Branch; Dr. Justin Berman, Division Chief; Dr. Lance Hansen, Deputy Director; and Dr. Robert E. Davis, Director, CRREL.

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At the time of report preparation, COL Kevin J. Wilson was the Commander of ERDC, and Dr. Jeffery P. Holland was the Director.

Unit Conversion Factors

Multiply	By	To Obtain
acres	4,046.873	square meters
feet	0.3048	meters
inches	0.0254	meters
pounds (mass)	0.45359237	kilograms

1 Introduction

1.1 Purpose of suggested guidelines

This document recommends herbaceous plant materials for Department of Defense (DoD) training land revegetation at military facilities located in the Northeast U.S. (Fig. 1). The suggestions in this guide fill a gap in knowledge of the science of military land management; heretofore, there have been no manuals for managing training-land revegetation of these unique pieces of public property. This publication complements a previously published work covering the Intermountain West area (Palazzo et al. 2009a). Most guidelines for land revegetation focus on lands with little traffic, are related to either pasture or conservation lands, and are based primarily on plant establishment. On pasture lands, animals selectively injure the plants, and the goal is to maintain stand persistence and production. On conservation lands, the sites are not disturbed to the same extent as military lands, and plants (usually native species) are allowed time to establish.

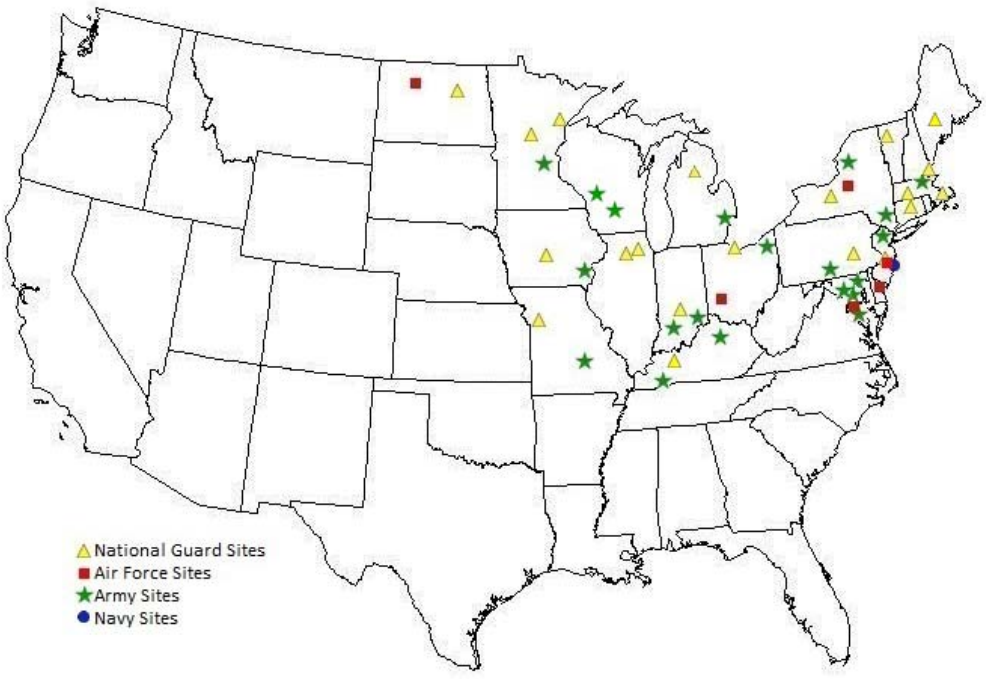

Figure 1. Northeast U.S. military facilities.

Unlike pasture and conservation lands, military lands experience varied causes of disturbance, and, in general, vegetation must be established as

quickly as possible, be more resilient to military training activities, and preferably be native. Two important characteristics of plants that contribute to their resiliency on military lands are rapid establishment and the ability of the plant to spread into disturbed areas without becoming invasive to adjoining lands, including private lands (Palazzo et al. 2009a).

1.2 Background

These guidelines are based in part on the results of extensive research conducted over 15 years at Fort Drum and West Point Military Academy, NY, Fort Indiantown Gap, PA, and on literature resources (Palazzo et al. 2009b, 1994). This research examined monoculture and mixture seeding trials. The scales of the demonstrations varied from small to large (Palazzo et al. 2009a,b, 2003). This guide also incorporates some of the extensive information gained from past research and demonstrations with plants by the U.S. Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) Plant Materials Center in Big Flats, NY (Salon and Miller 2012).

For the military research phase, our objective was to develop seed mixtures to create a stand of herbaceous vegetation, mainly grasses and legumes that is resilient to training activities and established easily on disturbed sites. Studies conducted primarily at Fort Drum provide information about the relationship between military training and plant injury, re-growth, and wear resistance. The mixtures were developed under the SERDP project *Identify resilient plant characteristics and develop a wear-resistant plant cultivar for use on military training lands* (CS-1103) (Palazzo and Hardy 1998; Palazzo et al. 2003). Selection criteria included early spring growth, increased seedling vigor, improved tiller and rhizome development after disturbance, and resistance to abiotic and biotic stresses.

Through SERDP and Army Basic Research (BT-25) funding, significant advances have been made in relating molecular markers to plant characteristics and in using DNA fingerprinting techniques to characterize genetic diversity. The use of markers to identify species and plants and to identify genetic diversity has provided the tools to assess genetic differences and similarities in commercial and naturalized seed sources of fine fescues and little bluestem (Huff and Palazzo 1998; Huff et al. 1998).

Research undertaken on the "ecological bridge" concept confirmed that seed mixtures consisting of native and introduced species establish more rapidly than all-native mixes. This allows for earlier training after the land is disturbed and ultimately leads to healthy and persistent stands of native plants (Palazzo et al. 2009a,b). Additional studies on this topic are described in the Intermountain West report (Palazzo et al. 2009a; Asay et al. 2001; Waldron et al. 2005, 2006a). Seed and equipment needed for ecological-bridge seeding are readily available, and the seeding can be done in one application, saving money. In the demonstration phase of the Intermountain West project, we evaluated plant materials developed for military training lands. The ecological-bridge seeding methods enhanced the ability of modified cultivars to establish viable native plant stands as rapidly as possible and to compete with invasive weeds. These modified seeding methods have proved successful on ranges in the eastern and western U.S. (Fort Drum, NY; Yakima Training Center, WA; and Fort Carson, CO).

1.3 Military facilities in the Northeast Region

As shown on the map in Figure 1, there were 48 military facilities (Table 1) in the Northeast U.S. at the time our research began in 2000. This included 28 facilities under the Army Command (ACOM, formerly FORSCOM, TRADOC, and AMC) and the National Guard Bureau, 9 Air Force facilities, and 2 Navy facilities. The total area is over 1,000,000 acres. Military facilities that contain fewer than 100 acres were not included in this list. For the most part, this area encompasses land north of the Mason-Dixon Line and east of the Mississippi River.

Table 1. Land areas of Army, National Guard Bureau, Navy, and Air Force bases in Northeastern U.S.that contain more than 100 acres.

State and Facility	Land Area (Acres)
Connecticut	
Bradley Air National Guard Base	2,000
Delaware	
Dover Air Force Base	3,900
Illinois	
Joliet Army Ammunition Plant	23,500
Marseilles Training Area	2,551
Indiana	
Crane Naval Warfare Center	62,473
Jefferson Proving Ground	1,033
Camp Atterbury	33,484

State and Facility	Land Area (Acres)
Iowa	
Iowa Army Ammunition Plant	19,300
Camp Dodge	4,300
Kentucky	
Blue Grass Army Depot	15,000
Fort Knox	101,197
Fort Campbell	105,068
Kentucky National Guard	8,500
Maine	
Maine National Guard	260
Maryland	
Aberdeen Proving Ground	72,500
Andrews Air Force Base	4,320
Blossum Point	1,600
Fort Detrick	1,229
Fort Meade	5,415
Massachusetts	
Devens Reserve Training Area	9,400
Massachusetts Military Range	22,000
Westover Air Force Range	2,500
Michigan	
Camp Grayling	147,000
Detroit Arsenal	341
Minnesota	
Camp Ripley	53,000
Duluth Air National Guard	153
Twin Cities Army Ammunition Plant	2,383
Missouri	
Fort Leonard Wood	63,000
Lake city Army Ammunition Plant	3,935
New Hampshire	
Pease Air Force Base	4,255
New Jersey	
Fort Dix	31,000
Lakehurst Naval Air Warfare Center	7,412
McGuire Air Force Base	3,596
Picatinny Arsenal	6,491
New York	
Fort Drum	107,265
Griffis Air Force Base	3,552
Seneca Army Depot Activity	10,587
West Point	16,000
North Dakota	
Camp Grafton	10,000
Minot Air Force Base	5,000

State and Facility	Land Area (Acres)
Ohio	
Camp Perry Military Reservation	640
Ravenna Army Ammunition Plant	16,164
Wright-Patterson Air Force Base	7,537
Pennsylvania	
Fort Indiantown Gap	18,000
Letterkenney Army Depot	12,000
Vermont	
Fort Ethan Allen	11,000
Wisconsin	
Badger Army Ammunition Plant	7,354
Fort McCoy	60,000
TOTAL ACRES	1,118,195

1.4 Using these suggested guidelines

Military lands are disturbed in many ways, making it a challenge to prepare a simple manual on land revegetation. The goals differ for the various climatic regions in the U.S. Military facilities in the northeast U.S. are very diverse and land repair can be managed by considering land use, plants, and soil. These factors were developed in part at a meeting with users held in August 2010 at the USDA-NRCS Plant Materials Center in Big Flats, NY. This meeting included personnel from ERDC/CRREL, AEC, Ft. Drum, US Army Engineer District, Philadelphia, Ft. Indiantown Gap, West Point, and the USDA-NRCS Big Flats Materials Center.

These guidelines describe the planning process and revegetation methods to be considered, but the primary focus is selecting species to be used in revegetation projects. A few other facilities have different types of areas that may also need to be repaired. Recent related information on revegetating these sites can be found in a report by Salon and Miller (2012). They include seeding wildflowers and forbs as well as planting woody materials. Equipment used in the planting process is not included in this guide. Information about this can be found elsewhere, including the website: http://reveg-catalog.tamu.edu/.

These guidelines are formatted to help the user to select plant materials for areas found on military facilities that commonly need to be reseeded. The recommended procedures for selecting plants use criteria that will

have a major impact on plant establishment and management in this region.

Section 2 contains information useful in the overall planning process, including site-specific needs, additional resources available to revegetation projects, requirements and funding, seed sources and quality, and other resources available to supplement the material in this document.

Section 3 provides information on selecting proper seed mixtures based on the following criteria developed at the users' meeting at Big Flats, NY:

- **Soil type**—two broad textural classifications of soil type are used: sand and silt/clay. See Section 3.1.
- **Soil pH**—soils are separated into two pH groups, either above or below pH 5.5. Soil below pH 5.5 is considered highly acidic and is usually not tolerant to legumes.
- **Soil moisture**—soils are divided into three moisture classes: excessively drained, moderately well drained, and poorly drained.
- **Land use**—training lands are divided into the broad categories of light/moderate use or severe/heavy use. A third category describes where low-growing vegetation is required. This includes such areas as roadsides, small-arms ranges, and military operations in urban training (MOUT) sites. See Section 3.3.
- **Mixture type**—depending on the vegetation goals, we recommend introduced-species mixtures, native-species mixtures, or ecological-bridge mixtures. The ecological-bridge mixtures combine introduced and native species to ultimately provide a native stand. See Section 3.4.

Areas that are locally unique are outside the scope of these guidelines. These include the development and protection of threatened and endangered species (T&E) habitats that require plant materials not commonly used in land restoration, relocation of T&E or other at-risk plants, and phytoremediation or phytostabilization of contaminated lands. Although restoration is outside the scope of these guidelines, land managers may find the manual useful in planning for the restoration process.

2 Overall Planning Guidelines and Resources

This section contains information helpful in the overall planning for a re-vegetation project. Included are a review of requirements and funding, questions to consider regarding the type of use and intensity of the use of the land being considered, important plant physiological characteristics, seeding requirements for native and introduced species, use of GIS maps, planting techniques, and determining when and if conducting a seeding is necessary

2.1 Requirements and funding

The first step in planning for plant selection should begin with a review of the Sikes Act (16 U.S.C. 670 et seq.) and the Integrated Natural Resources Management Plan (INRMP) process. The Sikes Act requires the Secretary of Defense to carry out a program providing for the conservation and rehabilitation of natural resources in support of the military mission on public lands set aside for military activities. Department of Defense (DoD) installations must develop an INRMP to implement this program. INRMPs are comprehensive plans coordinated among an installation, the U.S. Fish and Wildlife Service, and the state, and are the means by which installation natural resource programs are funded and implemented. In addition, Executive Order 13112 recommends that Federal agencies prevent the introduction of invasive species, control existing invasive populations in a cost-effective and environmentally sound manner, and, whenever possible, restore native species and habitat conditions in ecosystems that have been invaded.

Conventional procurement methods, as well as cooperative agreements in accordance with the Federal Grant and Cooperative Agreements Act (31 U.S.C. 6301-6308) and the Sikes Act, may be used to do work identified in installation INRMPs. In accordance with the Sikes Act, priority shall be given in contracting for the procurement of INRMP implementation and enforcement services, with Federal and state agencies having responsibility for the conservation or management of fish and wildlife (Section 101 (d)(2)).

An explanation of the Sikes Act as amended through 2003 can be found at http://www.fws.gov/habitatconservation/2004SikesAct%20NMFWA.pdf
Links to additional information and guidance on the Sikes Act are at http://www.denix.osd.mil/nr/LegislationandPolicy/LawsandStatutes/SikesAct.cfm
Links to information on the INRMP process are at http://www.dodbiodiversity.org/ch11/Chapter.11.INRMPs.pp154-163.pdf
Information about Executive Order 13112 may be found at http://www.invasivespeciesinfo.gov/laws/execorder.shtml

2.2 Preliminary questions for site-specific planning

When planning a seeding operation to develop a vegetated landscape, you should consider several questions about the type of use and the intensity of use of the land being considered. Answers to the following questions will facilitate the use of the seed selection guidelines in Section 3.

2.2.1 What are your land management goals?

Consider the types of vegetation (e.g., grasses, legumes, forbs) and the maximum plant height desired, as well as the percentage of ground cover needed for management goals. These goals could be military training, habitat for a threatened and endangered species, grazing by wildlife or domestic livestock, and recreation.

2.2.2 What are the expectations for the future level of land use or training (severe, moderate, or light)?

This is important. If training results in severe vegetation damage, more aggressive species that can rapidly establish and spread will be required to meet management goals of adequate ground cover.

2.2.3 Is revegetation necessary?

In some cases, reseeding may not be required. A resting period may allow the existing vegetation to recover when there are enough desirable plants present, the future training load on the property is light, and training exercises are deferred on this site for an appropriate period. See Section 2.7 for more information.

2.2.4 Are there any constraints on the establishment of site-specific plants?

Review the major environmental considerations of the site: soil type, the slope and aspect, and the amount and seasonal distribution of annual precipitation. These are important in plant selection, described in Section 3.

2.2.5 What desirable plant species currently exist on the site?

Conduct a quick survey of desirable plant species that are best adapted to the site. This information can then be correlated to the level and types of previous training events to determine the more resilient plant species present. Land managers can use these species to refine the seeding mixture that was selected in Section 3.

2.2.6 Which, if any, invasive plant species are present?

The species and frequency of invasive weeds affect revegetation strategies on training lands. If there is a high frequency of invasive weeds, such as spotted knapweed, a more aggressive revegetation species will be needed to compete with these invasive plants. Herbicides may also be used to retard their growth. Ecological-bridge seed mixtures, which include both native and introduced species, can be used to reduce the presence of the invasive weeds and eventually establish the desired native species.

2.3 Some plant physiological characteristics important to military training lands

It is important for military land managers to consider the morphological characteristics of plants. Appendix A provides a summary of characteristics of selected grasses. The morphological characteristics are described in the plant description sheets in Appendix B. When planning and selecting a seed mixture for a revegetation project, determine which of the following characteristics may be important on the site:

- **Low-growing vegetation**—This is a desirable characteristic for several reasons, but the three most popular are improved line of sight, low flammability, and use for lawn areas such as at MOUT sites. Examples include introduced species such as hard or sheep fescue.
- **Ability to spread**—To control soil erosion and reduce reseeding costs, include in the seed mixture one or more grasses or legumes that

can spread into damaged areas. A good example is the naturalized species Kentucky bluegrass, which has aggressive rhizomes.

- **Habitat development**—This is usually selected for a particular purpose, such as establishing an endangered species or managing game lands. Plant materials will consist largely of a mixture of native species. Little bluestem and big bluestem are examples of native species that can provide good habitat but will establish slowly.
- **Dust control**—This usually includes using vegetation for dust capture; tall vegetation is usually helpful. Examples of plants to include in the mixture are the native species switchgrass and the introduced species orchardgrass.
- **Rapid establishment**—The ability of a seedling to establish and survive on dry, disturbed sites is critical. Perennial ryegrass is an example of a species that may be included in a mixture.

2.4 Native vs. introduced species

Native and introduced plants have vastly different selection and seeding requirements. Both types of plants can produce a long-term, wear-resistant vegetative cover. Once you have determined the major goals for revegetation, the rates of plant establishment and maintenance should be considered. Differences between the two types of plants in establishment and maintenance are shown in Appendix B.

One question frequently asked is what is considered to be a native plant. A discussion of of the parameters to consider when defining a native species is given in Beard (2011). The Audubon Society also states that there are varying definitions: "Because early settlers in North America brought with them a variety of native European plants, some consider the plants that were growing prior to the arrival of Europeans to be native." A broader definition that is widely accepted is that offered by the Federal Native Plant Committee: "a native plant species is one that occurs naturally in a particular region, state, ecosystem, and habitat without direct or indirect human actions." (http://web4.audubon.org/bird/at_home/PlantNativeSpecies.html). Another website states that a "native species is one that occurs naturally with respect to a particular ecosystem, rather than as a result of an accidental or deliberate introduction into that ecosystem by humans. A species cannot be considered native to a particular geographic region or habitat in the United States merely because it occurs natively somewhere within the continental United States." http://definitions.uslegal.com/n/native-species/

Executive Order 13112 defines native plants as "'Native species' meaning that with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem."

Advantages of using introduced plant materials include: 1) lower cost and greater availability of seed, 2) greater number of months when seeding can be done, and 3) ease and rapidity of establishment. Introduced cool season species may be seeded in the spring and fall, whereas native warm season grasses can only be sown in the spring. Native cool season grasses, such as wildryes, arrostas perennae, and fowl bluegrass, can be planted prior to 1 September.

These factors are important because introduced cool season species are less costly and allow lands to be open for training more quickly. Introduced species also begin their growth period earlier in the spring than do native warm season species, resulting in greater protection from hydraulic soil erosion during the cooler months.

There are benefits from using native species. Most importantly is Executive Order 13112, which recommends that Federal agencies prevent the introduction of invasive species on public lands. Other advantages are as follows:

- The growing time for native plants is later in the spring than introduced plants. This can be important if mid-summer training events are scheduled.
- Native species require less fertilizer and lime than do introduced species.

Note that using native seeds is a relatively new practice compared to using introduced species. Some native seeds have a different shape that may require the use of a specialized seed drill. Also, as native warm season grass seeds take longer to establish, the increase in weed competition can destroy a seeding. Additionally, many native plants are tall and produce more biomass, which is a problem for line-of-sight seedings and where reducing the potential for fire is an issue. Most native plants grow 5 to 8 ft tall. However, native plants, once established, can provide a long-term, low-cost vegetative cover that is as equally wear resistant as introduced species.

It is important to define is what one considers to be a native plant. Native species must actually originate from the local area. This can be done by checking whether the plants selected in catalogs or on websites are native to your state or the lands you are trying to restore (Salon and Miller 2012); consult with the Natural Heritage Botany Program in your state or the Nature-Serve website http://www.natureserve.org/. Native plants can be grown outside of the area where they originated.

Some consider only seeding local ecotypes or only seeding plants collected from the local region. Using locally collected seeds of some species can be challenging because of high seed dormancy, poor seedling vigor, and lack of disease and insect resistance (Salon and Miller 2012). Seeds may be collected on site or propagated by local growers. (See Section 2.6.1 on seed quality before collecting or contracting out local seed collections.)

2.5 GIS maps

Selected sites can be identified, measured, and described using Geographic Information System (GIS) layers or the maps made from them. Such maps can be important planning tools when determining significant physical characteristics of the site. These maps can include data on soils, aspect, past and future training events, encroachment issues such as the location of endangered species, and other information important when managing a particular military installation. GIS can also be used to assist in determining the extent of damage, the location of previously seeded areas, and the size of area to be planted (this is needed when determining the amount of seed to be purchased).

2.6 Planting techniques

Seed quality, seedbed preparation, and time of seeding are all important to plant establishment. For introduced species, a good starting point for obtaining information would be your local university or common USDA-NRCS or local County Extension Service Guides for seeding hayland. A guide for seedbed preparation for native grasses in the Northeast is found in Dickerson et al. (2002).

2.6.1 Seed quality

Planting high-quality seed is important. Certified seed should be your first choice for any seeding project. With certified seed, you can be assured that

the seed purchased is the variety it is claimed to be. Otherwise, the effort and expense of site preparation, planting and management may be lost because of poor quality or poorly adapted seed. Refer to Appendix F for the example minimum germination and purity requirements of certified seed and Appendix M for the number of seeds in a pound. This will vary by state but will give an idea of what is considered good quality seed for the species listed.

At the time of purchase, the quality of the seed is listed on the label attached to each seed container. All seed must have a seed tag with germination and purity tests done by a certified seed lab according to state regulations. These tags indicate the seed lot associated with the seed test, including information on purity, germination, dormancy, and weed seeds. Seeding rates are frequently based on pure live seed (PLS). Pure live seed is the percentage by weight of the live seed in the seed lot. It subtracts all of the non-seed material, such as plant parts, soil particles, weed, non-crop seeds, and non-viable seed.

The seeds produced from native plants frequently have higher amounts of inert material (plant parts) and non-viable seed in the final product. This leads to greater variability among seed lots in germination and purity. This variability is attributable to the difficulty in growing, harvesting, and cleaning many native seeds.

Only live seed of the selected species is important when seeding; buying, selling, and seed recommendations are based on PLS is important. Pure live seed provides a basis for comparing seed lots that differ in purity and viable seed. The PLS content of a given lot can be calculated through information found on the seed tag, which contains data on the germination, dormant seed, and purity percentages of the bulk seed. The PLS is also used to adjust seeding rates to achieve the desired stand. Seeding rates based on PLS will ensure that the same amount of viable seed per acre will be planted, even though the quality of different seed lots and total amount of material (bulk) seeded per acre may vary considerably. The basic formula to calculate PLS is:

$$\%\ PLS = \frac{\%\ purity\ \times \%\ live\ seed}{100}$$

Where

% purity = 100% – % of all material in the seed lot that is not the desired seed
% live seed = % germinated + % dormant/hard seed; it does not include the non-viable seed in the lot.

Following is an example of an analysis label as described by the USDA-NRCS (2007):

"Rumsey" yellow indiangrass (*Sorghastrum nutans*)	
Net Weight: 25 lb	Pure Seed: 93.8%
Lot#: IB097	Other crop: 0.00%
Date tested: January 2006	Inert matter: 5.60%
Origin: PA	Weed seed: 0.60%
Noxious Weeds: 21 seeds/lb Giant Foxtail 15seeds/lb Wild Garlic	Germination: 32.00% Hard seed: 0.00% Dormant: 61.00%

For named cultivars, we recommend that certified seed be used. With certified seed, you can be assured that the seed purchased is the variety that it is claimed to be.

2.6.2 Seedbed preparation

Techniques for preparing a seedbed depend on the existing soil fertility as well as the texture and general knowledge of what is successful in your local area. A good example is the difference in seedbed preparation used by two training areas that have similar soils: Fort Drum, NY, and Fort Bragg, NC. In both sites, a portion of their facility contains soils with 90% sand texture. Tillage of the sand at Fort Drum has not led to successful establishment of plants. In contrast, there has been a high level of success at Fort Bragg where soil tillage is commonly used. This could be related to a difference in sand grain sizes between the two sites. In any event, using local knowledge can be beneficial.

Disking, usually to a soil depth of about 4 in., adequately prepares the soil for most types of lands considered in this planting guide. Liming is a common soil amendment because soils in the Northeast are frequently acidic. Fertilization with nitrogen, phosphorus, and potassium is common-

ly used in plantings of introduced species, while only phosphorus and potassium are mostly used for native species. Nitrogen is omitted in native plantings to reduce the weed competition in the sown area. However, if plant stands are good and the weeds are controlled, an application of nitrogen may increase plant stand density

Herbicides for weed control, especially for native plant seedings, may be beneficial when establishing new plants. Weedy annual broadleaf and grass species develop rapidly and compete aggressively for available soil water and nutrients with slower maturing perennial grasses, legumes, and forbs. Care should be taken when using herbicides. For example, some herbicide applications prior to seeding for broadleaf weed control in grasses will injure either existing legumes or forbs or hinder the establishment of young grasses. These guidelines are not intended to provide adequate information for application of herbicides. Before using any herbicides, read carefully and observe all directions, precautionary statements, and other information that are on the appropriate Environmental Protection Agency (EPA) registered product label.

Mulching after a seeding may be necessary, especially if the land is sloping and there is a chance that the seedbed will dry out. General seedings on military lands do not include a mulch because of cost, possible interference to training, and the introduction of invasive weeds. A guide to mulch materials and uses is shown in Appendix N.

2.6.3 Time of seeding

Planting seasons differ for native and introduced plant species. Native warm season grasses, alone or in mixtures with warm season grasses, should only be sown in the spring. Introduced plants in the upper northeastern regions of the U.S. can be sown in either the spring or fall, but in the more southern portions of this region they should only be sown in the fall. Seeding is not recommended during winter or summer. Recommended planting times for various plant hardiness zones in the Northeast is shown in Table 2. Similar information is found when reviewing the individual species plant guidelines available through the USDA- NRCS PLANTS Database website http://plants.usda.gov/.

Table 2. Recommended planting dates by hardiness zones for grasses and legumes (from the USDA-NRCS 1997).

Plant mixes	Plant Hardiness Zone		
	4	5	6
Cool-season mixes	15 Apr to 10 June 1 Aug to 1 Sep	1 Apr to 1 June 1 Aug to 5 Sep	15 Mar to 15 May 25 Aug to 1 Oct
Warm-season mixes alone or in combination with cool-season species	1 Apr to 1 June	1 Apr to 31 May	15 Mar to 15 June
Note: These are average planting dates for each hardiness zone and are to be used only as a guide. The dates may require adjustment to reflect local conditions, especially near the boundaries of zones. A table listing more detail in seeding times is in Appendix J.			

2.7 When is reseeding necessary?

Improving existing vegetation instead of reseeding can reduce vegetation management costs and downtime of the land. Also, new seedings usually scarify lands and leave them open to soil erosion or invasive plants until the new seeding is fully established; therefore, it makes sense to first consider improving the existing vegetation before reseeding. Reseeding in the Northeast primarily depends on either the amount of perennial grasses present or the soil texture. When some perennial grasses are present, it is a good to review whether reseeding is necessary. This can be determined by estimating the amount of desirable species present. We recommend reseeding when the percentage of perennial vegetative cover is below 50% on non-sloping soils. If the grasses are present in an area that is not highly used and where either self seeding rhizomatous and stoloniferous plants are present, then the minimum coverage can be as low as 40%. Wet, fine textured soils do not need to be re-sown as often. If the area is intensively used and is allowed time to rest, then the percentage of perennial vegetative cover can fall as low as 30%. Fertilization in place of reseeding can increase vegetative soil cover.

2.8 Source materials

These guidelines were developed with input from our research, experience, and from existing planting guidelines. Unfortunately, no manuals are available for selecting introduced and native grasses for military lands. The research used includes studies conducted by ERDC at Fort Drum, NY, that involved revegetating sandy soils with native and introduced plant materials using the ecological-bridge technique. The staff at Fort Indian-

town Gap has extensive knowledge of the use of native grasses. The USDA-NRCS has reported on native plants for both conservation and wildlife areas (Miller and Dickerson 1999; Gaffney and Dickerson 1987).

Some of the recommendations used in this document are a result of our 15-year research and demonstration programs at Fort Drum. The reference material for planting guidelines that we used are applicable to the various phases of military land revegetation. These references are:

Palazzo, A.J., S.E. Hardy, T.J. Cary, K.H. Asay, K.B. Jensen, and D.G. Ogle. 2009a. *Intermountain West Military Training Lands Planting Guide: Selecting seed mixtures for actively used military lands*. ERDC/CRREL TR-09-9.

Palazzo, A.J., L. Gatto, and W. Woodson. 1994. *Guidelines for managing vegetation on earth-covered magazines within the U.S. Army Materiel Command*. U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Report 94-6. This document was written for military land managers revegetating ammunition storage bunkers; it describes the planning process that military land managers can use.

Salon, P.R., and C.F. Miller. 2012. *A guide to: Conservation Plantings on Critical Areas for the Northeast*. Big Flats, NY: United States Department of Agriculture-Natural Resources Conservation Service. Plant Materials Center. http://plant-materials.nrcs.usda.gov/nypmc/

USDA-ARS Website http://plants.usda.gov provides general descriptions of some of the plant species recommended in this document. Appendix O summarizes relevant characteristics of the plants for military land revegetation. These characteristics include maximum plant height, tolerance to fire, and other factors of interest to military land managers. Also, Ogle et al. (2008b) reviewed basic questions to be considered before beginning any land improvement for pasture and range seedings in the Intermountain West and the information may be used to consider seedings in the Northeast.

Additional information on invasive weeds by state can be found at http://www.fs.fed.us/rm/boise/research/shrub/links.shtml

3 Selecting the Seed Mixture

The three biggest issues with plant establishment on military lands in the Northeastern U.S. are soil texture, moisture, and pH. The selection of seed mixture was partially decided at the Users' Meeting in Big Flats, NY (see Section 1.4).Soil texture on military installations can range from coarse to very fine silt or clay soils. Soil moisture is another important factor in military land revegetation and it usually is related in this region to the soils' lack of drainage. Soil pH is also important. Soils below 5.5 may hinder the establishment of all legumes and native grasses and forbs. Fertility is usually an issue for establishing introduced plant material, but not necessarily true for native plants.

We do not consider plant hardiness zones or ecoregions based on climate to be important factors in selecting plant materials whose germplasm originates in the Northeast or similar latitudes; we feel that there are insignificant differences in climate within the Northeast U.S. region that affect selecting herbaceous plants for military lands.

The aspect of the slopes can affect plant selection, establishment, and management. Slopes with north and northeast aspects can have lower air and soil temperatures and evapotranspiration than do level areas or slopes with other aspects. The lower temperatures can negatively affect warm-season grass plantings by slowing germination, establishment, and performance. In some instance, slope aspect can enhance snow cover because reduced thawing in the winter, which, in turn, can reduce frost heaving. Position on the slope can influence frost-free periods via frost pockets. Conversely, south facing slopes are generally hotter and drier, thereby influencing seed germination and seedling survival of warm and cool-season grasses as well as woody seedlings.

The tables in this section contain plant species that may be included in seed mixtures for various locations in the Northeast. Tables 3–6 provide a key to selecting the most adaptable seed mixture for the soil type and level of land use; the goal is to fit the plants to the land-use goals of the site. Recommended seeding mixtures for temporary and less frequently seeded sites are shown in Appendices L and M. To benefit most from these tables,

we recommend that you follow a five-step process in selecting seeds. Each step is described in detail below.

1. Describe the soil texture:

- Silt/clay.
- Sand.

2. Identify the training level:

- Light/medium.
- Severe.
- MOUT sites, airfields, roadsides, or small-arms ranges.

3. Soil drainage class:

- Excessively drained.
- Moderately well drained.
- Poorly drained.

4. Soil pH:

- Above pH 5.5.
- Below pH 5.5.

5. Select and refine the seed mixture:

- All native (N) mixes.
- All introduced (or naturalized) (I) mixes.
- Ecological-bridge (E) mixes containing both introduced and native species.

3.1 Describe the soil texture

Soil texture is a measure of the proportions of sand, silt, and clay. These guidelines relate only to two broad textural classifications: silt/clay or sand (Fig. 2). Texture can be more accurately defined and may be important to consider as these soil properties are closely associated with water movement in the soil profile and the ability of the soil to retain water. The important consideration here is the adaptability of the plants to

silt/clay or sandy soils. Tables 3 and 4 include choices for silt/clay or sandy soils within each ecosystem.

Soil surveys and associated maps produced primarily by the USDA-NRCS are valuable tools for identifying information about soil fertility, texture, drainage, and other soil characteristics.

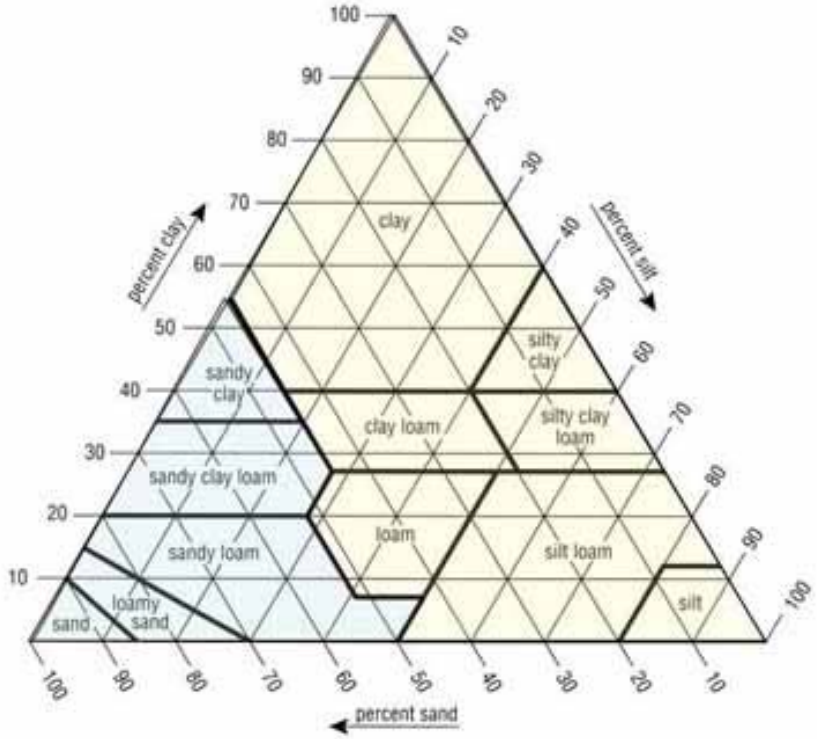

Figure 2. Soil texture classifications (from Soil Service Division Staff 1993). The colored areas indicate the two broad classifications used in this guide: sand (blue) and silt/clay (yellow).

Table 3. Suggested species to include in seed mixtures for plantings for moderately drained soils with different military land uses and soil types. To develop a seed mixture, select three or four of the species.

		Soil texture classification									
		Silt/clay					Sand				
		Level of training intensity									
		Light/medium			Severe		Light/medium			Severe	
		Mixture type									
		N**	I	E	I	E	N	I	E	I	E
Grasses	Low pH*							x	x		x
Red fescue	x							x	x		x
Hard fescue	x							x	x		x
Creeping fescue	x							x	x		x

		Soil texture classification									
		Silt/clay					Sand				
		Level of training intensity									
		Light/medium			Severe		Light/medium			Severe	
		Mixture type									
		N**	I	E	I	E	N	I	E	I	E
Chewings fescue	x							x	x		x
Sheep fescue	x							x	x		x
Kentucky bluegrass			x								
Canada bluegrass	x		x								
Perennial ryegrass	x		x	x	x	x					
Orchardgrass			x		x						
Timothy			x		x	x					
Annual ryegrass	x		x		x						
Creeping bentgrass	x		x		x						
Redtop	x				x						
Colonial bentgrass	x		x								
Switchgrass	x						x		x		x
Little bluestem	x						x		x		x
Big bluestem	x						x		x		x
Indiangrass							x		x		x
Buffalograss	x	x		x							
Deertongue	x	x									
Coastal panicgrass		x									
Hairgrass	x						x		x		x
Sand lovegrass							x		x		x
Oats	x				x	x				x	x
Cereal rye	x				x	x				x	x
Legumes†											
Birdfoot trefoil	x		x		x	x		x	x	x	x
Flatpea			x		x	x		x	x	x	x
Red clover			x		x	x		x	x	x	x
White clover			x		x	x		x	x	x	x

* Species recommended when soil pH is below 5.5 and soil liming is not planned.

** N = native, I = introduced, E = ecological bridge mixture

† Legume seeds should be inoculated prior to planting

Table 4. Suggested species to include in seed mixtures for plantings for somewhat poorly drained soils with different military land uses, soil types, and drainage classes. To develop a seed mixture, select three or four of the species.

		Soil texture classification									
		Silt/clay					Sand				
		Level of training intensity									
Soil moisture classification:		Light/medium			Severe		Light/medium		Severe		
		Mixture types									
Grasses	low pH*	N**	I	E	I	E	N	I	E	I	E
Red fescue	x							x	x	x	x
Hard fescue	x							x	x	x	x
Creeping fescue	x							x	x	x	x
Chewings fescue	x							x	x	x	x
Sheep fescue	x							x	x	x	x
Kentucky bluegrass			x	x	x	x					
Canada bluegrass	x		x	x	x	x					
Perennial ryegrass			x	x	x	x					
Orchardgrass			x	x	x	x					
Reed canarygrass			x	x				x	x		
Timothy			x	x				x	x	x	x
Annual ryegrass			x	x	x	x					
Creeping bentgrass			x	x	x			x			x
Redtop					x			x		x	
Colonial bentgrass			x	x				x		x	
Switchgrass	x	x		x		x	x		x		x
Cordgrass	x	x		x		x					
Virginia wildrye		x		x							
Buffalograss	x	x		x		x	x		x		x
Canada wildrye		x		x							
Deertongue	x	x		x		x	x		x	x	x
Sand love grass							x		x		x
Oats	x				x	x				x	x
Cereal rye	x				x	x				x	x
Legumes†											
Birdfoot trefoil	x		x		x	x		x	x	x	x
Flatpea			x		x	x		x	x	x	x
Red clover			x		x	x		x	x	x	x
White clover			x		x	x		x	x	x	x

* Species recommended when soil pH is below 5.5 and soil liming is not planned.

** N = native, I = introduced, E = ecological bridge mixture.

† Legume seeds should be inoculated prior to planting

3.2 Identify the drainage class

Three drainage classes (excessively drained, moderately well drained, poorly drained) are considered in this guide (from *NRCS Soil Survey Manual*, Ch. 3 http://soils.usda.gov/technical/manual/contents/chapter3.html#4c).

3.2.1 Moderately well-drained soils

Water is removed rapidly so that the soil is not wet for any significant amount of time.

3.2.2 Somewhat poorly drained soils

Water is removed slowly enough that the soil is wet for significant periods during the growing season.

3.2.3 Poorly drained soils

Water is removed from the soil so slowly that the soil is saturated periodically during the growing season or remains wet for long periods.

3.3 Identify the training level or land use

In Section 2.2, land use was divided into three categories, each requiring different types of seed mixtures. Here, we describe these use categories and the criteria for selecting the most appropriate seed mixture for the site.

3.3.1 Intensive land use on range and training areas

3.3.1.1 Description of site

These are sites where equipment or personnel have largely depleted the vegetation, resulting in reduced ground cover (about less than 25% vegetative cover). These sites could include heavily used training areas and bivouac sites. Desirable vegetation is limited under intensive use, and invasive weeds are most likely present.

3.3.1.2 Revegetation goals

The goals are usually to prevent soil erosion and stream sedimentation and to maintain topsoil that will support vegetation growth in the future.

This type of site requires plants that can either establish rapidly or are resilient to disturbance and the encroachment of weedy species.

3.3.1.3 Criteria or key words required from seed mixture

- Rapid plant establishment.
- Introduced species.
- Soil conservation.

3.3.1.4 Seed mixtures to consider

These sites will likely need to be reseeded often. Therefore, cost-effective, rapidly establishing plants are recommended. Components of the seed mixture often include introduced (naturalized) species, such as fine fescues in sandy soils and perennial ryegrass in silty soils, and easy-to-establish natives, such as big bluestem and switchgrass.

3.3.2 Light and moderate land use on range and training areas

3.3.2.1 Description of site

For these guidelines, moderately disturbed lands are defined as those disturbed by either equipment or personnel and where less than 50% of the desirable vegetation cover has been destroyed. Invasive weeds may be present. Light disturbance could be areas where less than 25% of the desirable vegetation is disturbed. The major difference in the two types of disturbance is the amount of recovery time required for the desirable plants to maintain their dominance within the plant community. The recovery time for the plants will differ among sites depending on the types of plants present (whether they spread vegetatively [rhizomatous or stoloniferous] or are seed producers) and annual rainfall amounts.

3.3.2.2 Revegetation goals

The goal is usually to establish native plants. In lightly used areas, the vegetation has time to establish. An ecological-bridge mixture should be considered on moderately used lands and on lightly used lands. If invasive weeds are a problem, then it would be difficult to use only native plants and selected introduced (naturalized) species should be considered.

3.3.2.3 Seed mixtures to consider

Moderately disturbed lands are excellent sites for native plants or an ecological-bridge seed mixture. An ecological-bridge seed mixture is more appropriate on dry sites and if invasive weeds are present.

3.3.3 MOUT sites, small-arms ranges, airfields, and roadsides

3.3.3.1 Description of site

Although these sites vary considerably in land use, they all require low-growing vegetation to maintain lines of site, provide a low-maintenance lawn, or serve as a firebreak. Low-growing areas usually do not require reseeding after initial establishment.

- *MOUT sites, airfields, and roadsides* usually require low-growing grasses around buildings and must be resistant to drought and invasive weeds as well as tolerant of mowing.
- *Small-arms ranges* usually include a level area and a sloping area. Vegetation on the level area must be low-growing, similar to the MOUT site vegetation. On the slopes, the grasses should also be low growing but slope aspect must be considered. South-facing slopes will require plants that are more tolerant of high temperature and drought than north-facing slopes. Another important goal is to select plants that are not susceptible to uptake of metals and organic contaminants. For example, the fine fescues are reported to take up less zinc on a contaminated site than do some other grasses (Palazzo et al. 2003). Rapid establishment and plant spread by rhizome development is a high priority on the sloping soils to prevent soil erosion.

3.3.3.2 Revegetation goals

Existing vegetation on these sites is usually not under intensive use. The revegetation goal is to establish a low-growing, dense vegetative cover that will persist. Except on sloping areas, rapid establishment is not a high priority because these sites are not intensively used.

3.3.3.3 Seed mixtures to consider

Desired plant materials include all or a majority of low-growing species that are tolerant to close mowing or require only a single mowing in a season. Because low growth is the primary concern, we have not divided these

recommendations into introduced, native, or ecological-bridge mixtures; choose those species that best meet the needs at your site. We recommend mowing these plants annually at the heading stage to remove seed stalks and reduce plant height.

3.4 Select and refine the seed mixture

We recommend planting seed mixtures (grasses, legumes, and forbs) to enhance biological diversity. Tables 3–6 contain appropriate plant species for mixes in each ecosystem, soil texture, and training level combination. X marks indicate whether a particular species is recommended for use in one of three mix types: all natives (N), all introduced or naturalized (I), or an ecological-bridge mixture (E) that combines native and introduced species. After you have developed the desired list of potential species, select the appropriate type of mix following guidelines given below and in Section 3.3. Appropriate seeding rates of various species if seeded alone are shown in Table 7. You may further refine the mix choices by referring to the summary information in Appendices M, N, and P.

We recommend three types of seed mixtures for their ability to establish and persist under training in different conditions. Note that all three mixtures are not appropriate for all land-use categories considered. Introduced species are not usually recommended for lightly or moderately used lands to be compliant with Executive Order 13112, which recommends control of invasive species and encourages the use native plants whenever possible. Under severe land use, natives are not recommended because the vegetation will be degraded frequently, and native seeds are usually more expensive, take longer to establish, and are not competitive with weedy species.

Because the recommended mixtures may not be appropriate for all land uses within the broader land-use categories, you should also review the general morphological characteristics of the individual species (see Appendices C, D, and E) in the mixtures to determine if their height is appropriate for the lands being reseeded. An example is plant height, which is why we have a separate section for MOUT sites and firing points.

Table 5. Suggested species to include in seed mixtures for plantings on poorly drained soils with different military land uses and soil types. Recommend selection of three or four of the species to make up a seed mixture.

		Level of training intensity				
Soil moisture classification		Light/medium			Severe	
Grasses	low pH*	N**	I	E	I	E
Kentucky bluegrass			x	x	x	x
Canada bluegrass	x		x	x	x	x
Perennial ryegrass			x	x	x	x
Orchardgrass			x	x	x	x
Reed canarygrass			x	x		
Timothy			x	x		
Annual ryegrass			x	x	x	x
Creeping bentgrass			x	x	x	
Redtop					x	
Colonial bentgrass			x	x		
Prairie cordgrass	x	x		x		x
Virginia wildrye		x		x		
Canada wildrye		x		x		
Oats	x				x	x
Cereal rye	x				x	x

* Species recommended when soil pH is below 5.5 and soil liming is not planned.
** N = native, I = introduced, E = ecological bridge mixture.

Table 6. Suggested low growing species to include in seed mixtures for low growth plantings for military operations in urban training (MOUT) or small arms sites. Recommend selection of three or four of the species to make up a seed mixture.

Grasses*	Permanent cover	Temporary cover
Red fescue (I)	x	
Hard fescue (I)	x	
Creeping fescue (I)	x	
Chewings fescue (I)	x	
Sheep fescue (I)	x	
Kentucky bluegrass (I)	x	
Perennial ryegrass (I)	x	x
Annual ryegrass (I)		x
Creeping bentgrass (I)	x	
Redtop (I)		x
Colonial bentgrass (I)	x	
Deertongue (N)	x	

Grasses*	Permanent cover	Temporary cover
Hairgrass (N)	x	
Oats (I)		x
Cereal rye (I)		x
Legume†		
Birdsfoot trefoil	x	
* I indicates introduced species and N indicates a native species. † Legume seeds should be inoculated prior to planting		

Table 7. Recommended seeding rates per acre for various species when seeded alone. Rates in pounds of pure live seed per acre.

Grasses	Rate (lb/acre)	Establishment rate*
Red fescue	60–100	Fast
Hard fescue	60–100	Fast
Creeping fescue	60–100	Fast
Chewings fescue	60–100	Fast
Sheep fescue	60–100	Fast
Kentucky bluegrass	40–80	Medium
Canada bluegrass	40–80	Medium
Perennial ryegrass	40–80	Very Fast
Orchardgrass	30–60	Medium
Timothy	30–60	Medium
Annual ryegrass	40–80	Very Fast
Creeping bentgrass	20–40	Medium
Redtop	20–40	Very Fast
Colonial bentgrass	20–40	Medium
Switchgrass	15–25	Slow
Little bluestem	15–25	Slow
Big bluestem	15–25	Slow
Indiangrass	15–25	Slow
Buffalograss	15–25	Slow
Deertongue	15–25	Slow
Coastal panicgrass	15–25	Slow
Hairgrass	15–25	Slow
Sand lovegrass	15–25	Slow
Oats	40–80	Very Fast
Cereal rye	40–80	Very Fast
Prairie cordgrass	5	Slow
Deertongue	20	Slow
Virginia wildrye	15	Slow

Grasses	Rate (lb/acre)	Establishment rate*
Legumes†		
Birdfoot trefoil	15	Fast
Flatpea	15	Fast
Red clover	15	Fast
White clover	15	Fast
* Very fast is less than 7 days, fast is 7 to 14 days, medium is 30 days, and slow is greater than 30 days. † Legume seeds should be inoculated prior to planting		

3.4.1 Seed mixtures dominated by or entirely of introduced species (I)

Introduced-species mixtures are mostly selected for lands that are intensively used and need to be reseeded often. They are the most cost-effective and establish most rapidly, thereby minimizing the establishment and dominance of invasive weeds. Lands can usually be used again 1 or 2 years after reseeding.

3.4.1.1 Best use

On intensively used land, easy-to-establish natives may sometimes be added to these mixes.

3.4.1.2 Drawback

They do not provide a native plant stand, and care should be taken to select species that are not overly aggressive and spread to other sites.

3.4.2 Seed mixtures dominated by or entirely of native species (N)

Seeding native mixtures helps comply with Executive Order 13112 that requires use of native plants whenever possible. These mixtures also provide low maintenance costs, habitat for threatened and endangered (TE) species, and good will with the public.

3.4.2.1 Best use

Best on lightly used lands.

3.4.2.2 Drawback

The seeds are more expensive and they are more difficult to establish, particularly on drier sites. A general rule is that 2 to 5 years are required to fully establish native stands; consequently, invasive weeds can be a problem.

3.4.3 Ecological-bridge mixtures (E)

These diverse mixtures contain both introduced and native seeds, and they are formulated to provide a plant community of primarily native plants within 5 years. They are easier to establish than native-only mixtures, thus allowing the land to be used relatively soon for moderate training. Ecological-bridge mixtures work as well as introduced-species mixtures in controlling invasive weeds.

3.4.3.1 Best use

Best employed on moderately used to lightly used lands with invasive weed problems and drier, lightly used lands.

3.4.3.2 Drawback

The major concern is selecting the right species to include in the mixture for the land to be revegetated. In these mixtures, the introduced species must establish rapidly to provide competition against invasive weeds and facilitate establishment of desired native species. *The key to a successful ecological-bridge mixture* is to adjust the seed mixtures to give the natives a much bigger advantage while still reducing erosion and providing competition with weeds.

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Appendix A: Summary of Characteristics of Selected Grasses†

	Plant height*	Seedling vigor	Method of spread	Spring growth	Summer growth	Shade tolerance
Grasses						
Red fescue	2	medium	tiller	high	low	high
Hard fescue	2	medium	tiller	high	low	high
Creeping fescue	2	medium	tiller	high	low	high
Chewings fescue	2	medium	tiller	high	low	high
Sheep fescue	2	medium	tiller	high	low	high
Kentucky bluegrass	3	low	rhizome	high	low	medium
Canada bluegrass	2	low	rhizome	high	low	medium
Perennial ryegrass	3	high	tiller	high	low	medium
Orchardgrass	4	medium	tiller	high	low	medium
Timothy	4	medium	tiller	high	low	medium
Annual ryegrass	3	high	tiller	high	low	medium
Creeping bentgrass	2	low	stolon	high	low	medium
Redtop	3	high	tiller	high	low	medium
Colonial bentgrass	2	low	stolon	high	low	medium
Switchgrass	5	low	tiller	low	high	medium
Little bluestem	5	low	tiller	low	high	medium
Indiangrass	5	low	tiller	low	high	medium
Buffalograss	2	low	stolon	low	high	medium
Deertongue	2	low	tiller	low	high	medium
Coastal panicgrass	4	low	tiller	low	high	medium
Hairgrass	2	low	tiller	low	high	medium
Sand lovegrass	4	low	tiller	low	high	medium
Oats	5	high	tiller	high	high	high
Cereal rye	5	high	tiller	high	high	high
Legumes						
Birdsfoot trefoil	2	high	stolon	high	low	medium
Flatpea	2	high	stolon	high	low	low
Red clover	2	high	stolon	high	low	low
White clover	2	high	stolon	high	low	low

* Rating of plant height: 5 = high, 1 = low
†Modified from Salon and Miller (2012)

Appendix B: Comparison Chart for Establishment and Maintenance of Warm Season vs. Cool season Grasses†

Topic	*Paired Table*	
	Warm season grasses	Cool season grasses
Establishment	Usually need a specialized seed drill to plant these grasses. Seed may be more expensive and less readily available than cool-season grasses. Usually don't need much lime or fertilizer. Tolerates poor soil conditions (i.e., nutrient-poor and low pH) better than cool-season grasses.	Plant with a conventional grass drill or cultipacker seeder. Can sometimes be planted with a grain drill. Relatively inexpensive, readily available seeds. Have higher nutrient requirements than warm-season grasses. Less tolerant of poor soil conditions. May need fertilizer maintenance.
	Seeds are slow to germinate Seedlings usually need 2 to 3 years to establish. Can only be seeded in the spring. Weed competition is often a problem during establishment, especially on the better soils.	Seeds germinate fairly quickly. Seedlings are usually well established 1 to 2 years after planting. Rapid seedling growth results in less weed competition during establishment. Can be seeded in spring or late summer. Can also be seeded with cool-season legumes.
	Seedlings and established stands are very drought tolerant. Good for sites with low moisture holding capacity (e.g., sand hills, rocky slopes).	Higher seedling mortality and thinning of established stands on dry sites or during drought periods, unless supplemental water is applied.
Maintenance	Maintained by using prescribed burning or, mowing to 6 in. tall, with residue removed on a 3 to 4-year rotation. Grasses are long-lived and usually do not need reseeding. Can be hayed or grazed with careful management. Selective herbicides may be used for weed control.	Maintained by mowing on a 2 to 3-year rotation, and by overseeding with legumes every 3 to 4 years. As stands mature, grasses may thin out and need to be reseeded. Easier to manage grazing and haying. Selective herbicides may be used for weed control.
Other Issues	Most species grow very tall (5 to 8 ft), and depending on where they are planted, can "block the view." This may be a benefit or a drawback, depending on what is nearby. Fire hazard on overwintered standing grass.	Tend to be low-growing (3 ft tall or less). *Agrostis gigantea* and reed canarygrassmay be invasive or competitive with native flora.

† Modified from Salon and Miller (2012)

Appendix C: Introduced Cool Season Perennial Grass Characteristics for Planning Conservation Plantings†

Scientific Name	*Bromus inermis*	*Festuca brevipila*	*Festuca rubra*	*Schedonorus phoenix*	*Poa pratensis*	*Alopecurus arundinaceus*[1]	*Phalaris arundinacea*[1]	*Bromus inermis*
Common Name	smooth brome	hard fescue	creeping red fescue	tall fescue	kentucky bluegrass	creeping meadow foxtail[1]	reed canarygrass[1]	smooth brome
Active Growth Period	Spring, Summer, Fall	Spring	Spring and Fall	Spring and Fall	Spring, Summer, Fall	Spring and Summer	Spring, Summer, Fall	Spring, Summer, Fall
Foliage Texture	Fine	Fine	Fine	Coarse	Fine	Fine	Coarse	Fine
Growth Form	Rhizomatous	Bunch	Rhizomatous	Rhizomatous	Rhizomatous	Rhizomatous	Rhizomatous	Rhizomatous
Growth Rate	Moderate	Slow	Moderate	Rapid	Moderate	Rapid	Rapid	Moderate
Height, Mature (feet)	2.5	0.5	2	3	1.5	3	5	2.5
Lifespan	Long	Moderate	Long	Moderate	Long	Moderate	Long	Long
Shape and Orientation	Erect	Semi-Erect	Decumbent	Semi-Erect	Erect	Erect	Erect	Erect
Adapted to Coarse Textured Soils	No	Yes	No	No	No	No	No	No
Adapted to Medium Textured Soils	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adapted to Fine Textured Soils	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Drought Tolerance	Medium	High	Medium	Medium	Low	Medium	Low	Medium
Fertility Requirement	High	Low	High	Medium	High	Medium	High	High
pH (Minimum)	5.5	4.5	5	5	5	5.5	5.5	5.5
pH (Maximum)	8	8.5	7.5	9	8.4	8.4	8	8
Root Depth, Minimum (inches)	12	10	12	12	10	12	14	12
Salinity Tolerance	Medium	None	Low	Medium	Low	High	Medium	Medium

Scientific Name	*Bromus inermis*	*Festuca brevipila*	*Festuca rubra*	*Schedonorus phoenix*	*Poa pratensis*	*Alopecurus arundinaceus*[1]	*Phalaris arundinacea*[1]	*Bromus inermis*
Common Name	smooth brome	hard fescue	creeping red fescue	tall fescue	kentucky bluegrass	creeping meadow foxtail[1]	reed canarygrass[1]	smooth brome
Seeds per Pound	142,880	591,920	454,087	205,720	1,389,840	786,064	537,920	142,880
Seedling Vigor	High	Medium	Medium	High	Low	Low	Low	High
Vegetative Spread Rate	Rapid	None	Rapid	Slow	Rapid	Rapid	Rapid	Rapid

Scientific Name	*Festuca ovina*	*Dactylis glomerata*	*Alopecurus pratensis*	*Lolium perenne*	*Lolium perenne ssp. multiflorum*	*Agrostis gigantea*	*Phleum pratense*
Common Name	sheep fescue	orchardgrass	meadow foxtail	perennial ryegrass	Italian ryegrass	red top	timothy
Active Growth Period	Spring	Spring and Fall	Spring and Summer	Spring and Fall	Spring and Summer	Spring and Summer	Spring and Summer
Foliage Texture	Fine	Fine	coarse	Fine	Fine	Fine	Fine
Growth Form	Bunch	Bunch	Rhizomatous	Bunch	Bunch	Rhizomatous	Bunch
Growth Rate	Moderate	Moderate	Rapid	Rapid	Rapid	Rapid	Rapid
Height, Mature (feet)	0.5	3	3	3.5	2.5	2	3
Lifespan	Long	Moderate	Long	Short	Short	Short	Moderate
Shape and Orientation	Semi-Erect	Erect	Erect	Erect	Erect	Decumbent	Erect
Adapted to Coarse Textured Soils	Yes	No	No	No	Yes	No	No
Adapted to Medium Textured Soils	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adapted to Fine Textured Soils	No	No	Yes	Yes	Yes	Yes	Yes
Drought Tolerance	High	Medium	Low	Low	Low	Low	Low
Fertility Requirement	Medium	Medium	High	High	Medium	Low	Medium

Scientific Name	***Festuca ovina***	***Dactylis glomerata***	***Alopecurus pratensis***	***Lolium perenne***	***Lolium perenne ssp. multiflorum***	***Agrostis gigantea***	***Phleum pratense***
Common Name	sheep fescue	orchardgrass	meadow foxtail	perennial ryegrass	Italian ryegrass	red top	timothy
pH (Minimum)	5.5	5	5.8	5	5	4.5	5
pH (Maximum)	7.5	7.5	8	8	7.9	8	7.8
Root Depth, Minimum (inches)	10	12	12	10	8	14	10
Salinity Tolerance	Low	Medium	Low	High	High	Low	Low
Seeds per Pound	530,320	427,200	406,880	240,400	217,000	4,851,200	1,163,200
Seedling Vigor	Medium	High	High	High	High	High	Medium
Vegetative Spread Rate	None	None	Slow	None	None	Rapid	None

[1] Species considered invasive or problematic, consider alternatives.

† Modified from Salon and Miller (2012)

Appendix D: Native Cool Season Perennial Grass and Sedges for Planning Conservation Plantings†

Scientific Name	*Agrostis perennans*	*Agrostis scabra*	*Bromus ciliatus*	*Calamagrostis canadensis*	*Poa palustris*
Common name	autumn bentgrass/ uplant bentgrass	rough bentgrass	brome, fringed	Canada bluejoint	fowl bluegrass
Active Growth Period	Spring, Summer, Fall	Spring	Spring and Summer	Spring	Spring and Summer
Foliage Texture	Medium	Fine	Fine	Medium	Fine
Growth Form	Rhizomatous	Bunch	Bunch	Rhizomatous	Bunch
Growth Rate	Moderate	Moderate	Moderate	Moderate	Moderate
Height, Mature (feet)	3.5	2.5	4	4.9	4
Lifespan	Short	Moderate	Long	Long	Moderate
Shape and Orientation	Decumbent	Erect	Erect	Erect	Erect
Adapted to Coarse Textured Soils	No	No	Yes	No	No
Adapted to Medium Textured Soils	Yes	Yes	No	Yes	Yes
Adapted to Fine Textured Soils	Yes	Yes	Yes	Yes	Yes
Drought Tolerance	Low	Low	Low	Low	Low
Fertility Requirement	Medium	Low	Low	Medium	Medium
pH (Minimum)	5.5	6.0	5.5	4.5	4.9
pH (Maximum)	7.5	8.0	7.5	8.0	7.5
Root Depth, Minimum (inches)	8	12	16	16	12

Scientific Name	*Agrostis perennans*	*Agrostis scabra*	*Bromus ciliatus*	*Calamagrostis canadensis*	*Poa palustris*
Common name	autumn bentgrass/ uplant bentgrass	rough bentgrass	brome, fringed	Canada bluejoint	fowl bluegrass
Salinity Tolerance	None	Low	Low	None	Low
Bloom Period	Mid Summer	Early Spring	Spring	Late Spring	Mid Spring
Seeds per Pound	8,000,000	5,000,000	236,000	3,837,472	1,900,000
Seedling Vigor	Low	Medium	Medium	Medium	Medium
Vegetative Spread Rate	Moderate	None	None	None	None

Scientific Name	*Elymus canadensis*	*Elymus riparius*	*Elymus virginicus*	*Carex scoparia*	*Carex vulpinoidea*	*Carex squarrosa*
Common name	Canada wildrye	riverbank wildrye	Virginia wildrye	broom sedge	fox sedge	squarrose sedge
Active Growth Period	Spring, Summer, Fall	Spring and Summer	Spring	Spring and Summer	Spring	Spring and Summer
Foliage Texture	Coarse	Coarse	Coarse	Medium	fine	Fine
Growth Form	Bunch	Bunch	Bunch	Bunch	Bunch	Bunch
Growth Rate	Rapid	Moderate	Moderate	Moderate	Moderate	Slow
Height, Mature (feet)	3	4.5	2.5	2.5	3.2	3
Lifespan	Short	Moderate	Short	Long	Long	Moderate
Shape and Orientation	Erect	Erect	Erect	Erect	Erect	Erect
Adapted to Coarse Textured Soils	Yes	Yes	Yes	No	No	No
Adapted to Medium Textured Soils	Yes	Yes	Yes	Yes	Yes	Yes
Adapted to Fine Textured Soils	Yes	Yes	Yes	Yes	Yes	Yes
Drought Tolerance	Medium	Low	Medium	None	Low	None

Scientific Name	*Elymus canadensis*	*Elymus riparius*	*Elymus virginicus*	*Carex scoparia*	*Carex vulpinoidea*	*Carex squarrosa*
Common name	Canada wildrye	riverbank wildrye	Virginia wildrye	broom sedge	fox sedge	squarrose sedge
Fertility Requirement	Medium	Medium	Medium	Medium	Medium	Medium
pH (Minimum)	5.0	4.5	5.0	4.6	6.8	5.6
pH (Maximum)	7.9	7.2	7.0	6.9	8.9	7.3
Root Depth, Minimum (inches)	16	10	16	8	16	8
Bloom Period	Late Spring	Mid Summer	Early Spring	Late Spring	Spring	Mid Spring
Salinity Tolerance	Medium	None	None	Low	None	None
Seeds per Pound	114,000	125,000	100,000	131,200	1,297,000	320,000
Seedling Vigor	High	High	Medium	Low	Medium	Low
Vegetative Spread Rate	None	None	None	Slow	None	Slow

Note: missing values not on plant database

† Modified from Salon and Miller (2012)

Appendix E: Warm Season Perennial Grass Characteristics for Planning Conservation Plantings†[1]

Scientific Name	*Cynodon dactylon*[1]	*Andropogon gerardii*	*Andropogon virginicus*	*Schizachyrium scoparium*	*Andropogon hallii*[2]	*Panicum amarum var. amarulum*[2]	*Spartina pectinata*	*Spartina patens*[2]
Common Name	Bermudagrass[2]	big bluestem	broomsedge bluestem	little bluestem	sand bluestem[1]	coastal panicgrass[1]	**prairie cordgrass**	saltmeadow cordgrass[1]
Active Growth Period	Spring, Summer, Fall	Summer	Summer	Summer and Fall	Summer	Summer	Spring and Summer	Spring and Summer
Foliage Texture	Fine	Medium	Medium	Medium	Coarse		Coarse	Medium
Growth Form	Stoloniferous	Bunch	Bunch	Bunch	Bunch		Coarse	Rhizomatous
Growth Rate	Rapid	Moderate	Slow	Moderate	Moderate		Rhizomatous	Moderate
Lifespan	Long	Long	Moderate	Long	Moderate		Long	Long
Height, Mature (feet)	1.4	6	3	3	6.1		Rapid	2
Shape and Orientation	Prostrate	Erect	Erect	Erect	Erect		8	Erect
Height, Mature (feet)	1.4	6	3	3	6.1		8	2
Lifespan	Long	Long	Moderate	Long	Moderate		Long	Long
Adapted to Coarse Textured Soils	Yes	Yes	No	Yes	Yes		Long	Yes
Adapted to Medium Textured Soils	Yes	Yes	Yes	Yes	No		Erect	Yes
Adapted to Fine Textured Soils	Yes	Yes	Yes	Yes	No		Yes	Yes
Drought Tolerance	Medium	High	High	High	High		Yes	Low
Fertility Requirement	High	Low	Low	Low	High		No	Medium
pH (Minimum)	5	6	4.9	5	5.6	4.5	Low	5.5

Scientific Name	*Cynodon dactylon*[1]	*Andropogon gerardii*	*Andropogon virginicus*	*Schizachyrium scoparium*	*Andropogon hallii*[2]	*Panicum amarum var. amarulum*[2]	*Spartina pectinata*	*Spartina patens*[2]
Common Name	Bermudagrass[2]	big bluestem	broomsedge bluestem	little bluestem	sand bluestem[1]	coastal panicgrass[1]	**prairie cordgrass**	saltmeadow cordgrass[1]
pH (Maximum)	8	7.5	7	8.4	8.4	7.5	Medium	7.5
Root Depth, Minimum (inches)	14	20	14	14	20		6	10
Salinity Tolerance	High	Medium	Low	None	Low		Low	High
Seeds per Pound	2,071,120	144,240	800,000	240,670	96,640	325,000	8.5	110,000
Seed Spread Rate	Slow	Slow	Slow	Moderate	Slow		18	None
Seedling Vigor	Low	Low	Low	Low	Medium		Low	Low
Vegetative Spread Rate	Rapid	Slow	None	None	Slow		638,863	Rapid

Scientific Name	*Spartina alterniflora*[2]	*Dichanthelium clandestinum*	*Tripsacum dactyloides*[1]	*Sorghastrum nutans*	*Tridens flavus*[2]	*Eragrostis trichodes*[1]	*Bouteloua curtipendula*[2]	*Panicum virgatum*
Common Name	smooth cordgrass[1]	deertongue	eastern gamagrass[1]	Indiangrass	purpletop tridens[2]	sand lovegrass[1]	sideoats grama[1]	switchgrass
Active Growth Period	Spring and Summer	Spring and Summer	Spring and Summer	Summer and Fall	Summer	Summer and Fall	Summer	Summer
Foliage Texture	Medium	Medium	Coarse	Coarse	Medium	Medium	Medium	Coarse
Growth Form	Bunch	Bunch	Bunch	Bunch	Bunch	Rapid	Moderate	Rhizomatous
Growth Rate	Moderate	Slow	Rapid	Moderate	Moderate			Rapid
Height, Mature (feet)	3.5	2	5	6	2.5	3.5	3	5
Lifespan	Moderate	Long	Long	Long	Short	Short	Moderate	Long
Shape and Orientation	Erect	Semi-Erect	Erect	Erect	Erect	Erect	Erect	Erect
Adapted to Coarse Textured Soils	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adapted to Medium Textured Soils	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

Scientific Name	*Spartina alterniflora*[2]	*Dichanthelium clandestinum*	*Tripsacum dactyloides*[1]	*Sorghastrum nutans*	*Tridens flavus*[2]	*Eragrostis trichodes*[1]	*Bouteloua curtipendula*[2]	*Panicum virgatum*
Common Name	smooth cordgrass[1]	deertongue	eastern gamagrass[1]	Indiangrass	purpletop tridens[2]	sand lovegrass[1]	sideoats grama[1]	switchgrass
Adapted to Fine Textured Soils	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Drought Tolerance	None	High	Low	Medium	High	High	Medium	Medium
Fertility Requirement	Medium	Low	High	Low	Low	Low	Medium	High
pH (Minimum)	5.4	4	5.1	4.8	4.5	6	5.5	4.5
pH (Maximum)	7	7.5	7.5	8	6.5	8.5	8.5	8
Root Depth, Minimum (inches)	12	16	20	24	10	16	12	12
Salinity Tolerance	High	Low	None	Medium	None	Low	Low	Medium
Seeds per Pound	20,000	350,000	7,200	174,720	465,000	1,625,680	159,200	259,000
Seed Spread Rate	Slow	Slow	Slow	Slow	Rapid	Rapid	Slow	Slow
Seedling Vigor	Low	Low	Low	Medium	High	High	Medium	Medium
Vegetative Spread Rate	Rapid	None	Moderate	Moderate	None	None	None	Slow

Note: Missing values not available

[1]Non-native to the U.S.

[2]Non-native to parts of the Northeast check with Nature Serve Exporer website or Natural Heritage Botanist

†Modified from Salon and Miller (2012)

Appendix F: Minimum Germination and Purity Requirements of Certified Seed†[1]

Species	Minimum Seed Purity (%)	MINIMUM SEED GERMINATION[2] (%)	Species	Minimum Seed Purity (%)	Minimum Seed Germination[2] (%)
Cool-Season Grasses			Warm-season Grasses		
Alkali saltgrass	85	80	Bluestem, Big	60	60
Barley	98	85	Little Bluestem, Broomsedge	55	60
Bentgrass, Creeping	95	85	Deertongue	95	75
Bluegrass, Canada	90	80	Indiangrass	60	60
Bluegrass, Kentucky	97	80	Lovegrass, Purple	--	--
Bluejoint, Canada	85	70	Millet, Foxtail	98	80
Bromegrass, Fringed	85	70	Switchgrass	95	75
Bromegrass, Smooth	95	85	Legumes/Forbs		
Cordgrass, Freshwater	85	70	Bushclover	80	50
Fescue, Creeping Red, Hard, Chewings, Sheep	97	85	Clover, Alsike	99	85

Species	Minimum Seed Purity (%)	MINIMUM SEED GERMINATION[2] (%)	Species	Minimum Seed Purity (%)	Minimum Seed Germination[2] (%)
Cool-Season Grasses			Warm-season Grasses		
Meadowgrass, Fowl	90	70	Flatpea	98	75
Oats	98	85	Groundnut	--	--
Orchardgrass	90	80	Pea, Partridge	98	70
Redtop	92	80	Tick trefoil	90	70
Rye, Cereal	98	85	Wild Indigo	--	--
Ryegrass, Annual or Perennial	97	85			
Wheat	98	85			
Wild Rye, Canada, VA, Riparian	85	70			

[1]All seed shall comply with State Seed Law [2] Germination = Live seed which includes the sum of germination, dormant and/or hard seed

‡Modified from Salon and Miller (2012)

Appendix G: Introduced Legume Characteristics for Planning Conservation Plantings†

Scientific Name	*Medicago sativa*	*Lotus corniculatus*[1]	*Trifolium hybridum*	*Trifolium ambiguum*	*Trifolium pratense*	*Trifolium repens*	*Melilotus officinalis*[1]
Common Name	alfalfa	birdsfoot trefoil[1]	alsike clover	kura clover	red clover	white clover	sweetclover, yellow[1]
Active Growth Period	Spring, Summer, Fall	Spring and Summer	Spring and Summer	Spring	Spring and Summer	Spring, Summer, Fall	Spring and Summer
Foliage Texture	RapidFine	Fine	Fine	Fine	Medium	Medium	Coarse
Growth Form	Single crown	Single crown	Single crown	Rhizomatous	Single Crown	Single Crown	Stoloniferous
Growth Rate	Rapid	Moderate	Rapid	Slow	Rapid	Moderate	Rapid
Height, Mature (feet)	2	2.4	2	1.5	2	0.5	6
Lifespan	Long	Moderate	Short	Moderate	Short	Moderate	Short
Shape and Orientation	Erect	Semi-Erect	Semi-Erect	Prostrate	Erect	Prostrate	Erect
Adapted to Coarse Textured Soils	No	Yes	No	No	Yes	No	No
Adapted to Medium Textured Soils	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adapted to Fine Textured Soils	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Drought Tolerance	High	Medium	Low	Medium	Low	Low	High
Fertility Requirement	High	Medium	Medium	Medium	Medium	High	High
pH (Minimum)	6	5	5.6	5.7	5.5	5.2	6.5
pH (Maximum)	8.5	8	7.5	7.4	7.6	8	8.2
Root Depth, Minimum (inches)	24	14	12	12	12	12	16

Scientific Name	*Medicago sativa*	*Lotus corniculatus*[1]	*Trifolium hybridum*	*Trifolium ambiguum*	*Trifolium pratense*	*Trifolium repens*	*Melilotus officinalis*[1]
Salinity Tolerance	Medium	High	Low	None	Low	Low	High
Bloom Period	Spring	Early Spring	Late Spring	Early Summer	Late Spring	Late Spring	Summer
Seeds per Pound	226,800	369840	680,400	152,212	272,160	711,867	258,560
Seedling Vigor	High	Low	Medium	Low	High	Low	High
Vegetative Spread Rate	Slow	None	None	Slow	None	Moderate	None
Note: Missing values are not in PLANTS Database.							
[1] Species considered invasive or problematic, consider alternatives. †Modified from Salon and Miller (2012)							

Appendix H: Native Legume Characteristics for Planning Conservation Plantings†

Scientific Name	Vicia americana	Astragalus canadensis	Baptisia australis	Baptisia tinctoria	Lespedza capitata	Lupinus perennis	Chamaecrista fasciculata	Dalea purpurea var. purpurea	Desmodium paniculatum	Desmodium canadense
Common Name	**American vetch**	**Canadian milkvetch**	**indigo, blue false**	**indigo, wild**	**lespedeza, roundhead**	**lupine, sundial perennial**	**partridge pea**	**purple prairie clover**	**ticktrefoil, panicledleaf**	**ticktrefoil, showy**
Active Growth Period	Spring and Summer	Spring, Summer, Fall		Summer	Summer	Spring and Summer	Spring	Spring and Summer	Spring and Summer	Summer
Leaf texture	Medium	Fine	Medium	Medium	Medium	Coarse	Medium	Coarse	Medium	Medium
Growth Form	Rhizomatous	Stoloniferous	Multiple Stem	Single Crown	Multiple Stem	Multiple Stem	Bunch	Multiple Stem	Single Crown	Multiple Stem
Growth Rate	Moderate	Moderate	Mo	Moderate	Slow	Slow	Rapid	Moderate	Moderate	Rapid
Height, Mature (feet)	1.3	0.5	4	2.5	2.6	1.5	2.4	3	3	4
Lifespan	Moderate	Short		Moderate	Long	Short		Moderate	Moderate	Moderate
Shape and Orientation	Decumbent	Pros	Erect	Erect	Erect	Erect	Erect	Erect	Erect	Erect

Scientific Name	Vicia americana	Astragalus canadensis	Baptisia australis	Baptisia tinctoria	Lespedza capitata	Lupinus perennis	Chamaecrista fasciculata	Dalea purpurea var. purpurea	Desmodium paniculatum	Desmodium canadense
Adapted to Coarse Textured Soils	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Adapted to Medium Textured Soils	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adapted to Fine Textured Soils	No	No		No	No	No	No	Yes	Yes	Yes
Drought Tolerance	High	Medium	High	High	High	High	Medium	Medium	Medium	Medium
Fertility Requirement	High	Medium	Low	Low	Low	Low	Medium	Medium	Low	Low
pH (Minimum)	5.9	6		5.8	5.7	5	5.5	6	6	5
pH (Maximum)	7.2	8		7	8.2	7	7.5	8	7	7.5
Root Depth, Minimum (inches)	10	10		16	18		14	16	6	not available
Salinity Tolerance	None	None		None	None		None	None	None	None

Scientific Name	Vicia americana	Astragalus canadensis	Baptisia australis	Baptisia tinctoria	Lespedza capitata	Lupinus perennis	Chamaecrista fasciculata	Dalea purpurea var. purpurea	Desmodium paniculatum	Desmodium canadense
Bloom Period	Late Spring	Mid Summer	Early summer	Mid Summer	Late Summer	Late Spring	Early Summer	Summer	Late Summer	Summer
Seeds per Pound	32,833	270,500	22,000	300,000	174,000	18,800	65,000	317,000	200,000	80,000
Seedling Vigor	Low	Medium	Low	Low	Low	Low	High	Medium	High	Low
Vegetative Spread Rate	Slow	Slow	Slow	None	None	None	None	None	None	None

Note: Missing values are not in PLANTS Database.
[1] Not all plants are native to the Northeast region refer to the Natural Heritage Botantist and Nature Serve Explorer website http://www.natureserve.org/explorer/, for state specific information.
‡Modified from Salon and Miller (2012)

Appendix I: Seeding Rate Calculator for Conservation Practices†

Common name	Scientific Name	seeds/lb	bloom time	wetland indicator	$/lb of bulk seed[1]	PLS lb/ac
ashy sunflower	*Helianthus mollis*	125,000	aug-sept	UPL	$180	0.25
gray-headed coneflower	*Ratibida pinnata*	625,000	july-aug	FAC	$48	0.25
early goldenrod	*Solidago juncea*	700,000	july-sept	UPL	$200	0.1
gray goldenrod	*Solidago nemoralis*	1,008,000	aug-oct	UPL	$240	0.05
hairy beardtongue	*Penstemon hirsutus*	2,000,000	july-aug	FACU	$240	0.1
marsh blazing star	*Liatris spicata*	100,000	july-aug	FAC+	$200	0.3
new england aster	*Symphyotrichum novae-angliae*	700,000	aug-oct	FACW	$220	0.2
partridge pea	*Chamaecrista fasciculata*	65,000	june-aug	FACU	$14	1.0
purple coneflower	*Echinacea purpurea*	115,000	july-oct	FAC	$28	1.0
spotted beebalm	*Monarda punctata*	1,440,000	july-aug	UPL	$180	0.1
tall white beard tongue	*Penstemon digitalis*	400,000	may-july	FAC	$96	0.25
Virginia mountain mint	*Pycnanthemum virginianum*	3,840,000	july-aug	FAC	$480	0.05
wild bergamot	*Monarda fistulosa*	1,200,000	june-july	UPL	$220	0.1
zigzag aster	*Symphyotrichum prenanthoides*	700,000	july-sept	FAC	$180	0.2
Canada wildrye	*Elymus canadensis*	114,000	june-july	FACU+	$7	1.0
Virginia wildrye	*Elymus virginicus*	73,000	june-july	FACW-	$6.50	1.0

[1]Cost estimates per species are on a bulk pound basis. Cost per PLS will increase. Availability and prices may vary yearly and by company.
[2]Default setting is for 100% PLS, which is the same as bulk rate, assuming 100% germination and 100% purity. Entering your actual seed tag information will calculate actual bulk rate which will increase the amount and cost of the mix.
[3] Default setting is for 100% PLS, which is the same as bulk rate, assuming 100% germination and 100% purity. Entering your actual seed tag information will calculate actual bulk rate which will increase the amount and cost of the mix.

†Modified from Salon and Miller (2012)

TOTAL FOR MIX PLS		
lb of PLS/Acre of Mix	6.0	6.0
lb Bulk Seed/Acre	6.0	6.0
Number of PLS seeds per ft^2	41.4	41.4
Total Price	$407	$407.00

For more information on each plant- PLANTS DATABASE
CLICK HERE TO FIND OUT HOW PLS IS CALCULATED
CLICK HERE FOR MORE DETAILED PLS INFORMATION
Note: Seed Calculator can be used for critical area and conservation seed mixes. Calculator is available on Plant Materials Website.

Appendix J: Seeding and Planting Dates by Plant Hardiness Zone and Plant Type†

Plant Type	Plant Hardiness Zones				
	7	6	5	4	3
Cool Season Grass-spring	3/1—5/1	3/20—5/20	4/1—6/1	4/15—6/10	4/25—6/20
Cool Season Grass-fall[1]	9/5—10/25	8/25—10/1	8/15—9/1	8/10—9/1	8/1—8/20
Warm Season Grass-spring	No later than 5/10[2] – 6/25	No later than 5/25[2] – 6/25	No later than 6/15	No later than 6/10	No later than 6/1
Warm Season Grass-dormant	After 12/1	After 11/15	not recommended at this time		
Bare Root Deciduous-spring[3]	To 4/15	To 5/1	To 5/15	To 6/1	To 6/10
American Beachgrass Culms-dormant	11/25—4/1	11/15—4/15	11/1—4/15	NA	NA

[1] When legumes are planted in late summer with grasses back up seeding dates by at least 2 weeks.
[2] Later planting dates of warm season grasses especially on well drained soils risk failure due to summer heat.
[3] Dormant stock required.
[4] Non-dormant stock may require irrigation.
[5] Conifers are vulnerable to winter desiccation on soils that will be frozen in the root zone.
[6] Later portion of date range assumes adequate cooler storage.

† Modified from Salon and Miller (2012)

Appendix K: Temporary Seeding for Site Stabilization†

Plant Species	Seeding Rate					Recommended Seeding Dates by Plant Hardiness Zone[3]		
	lbs/ac	Lb Per 1000ft[2]	Seed-ing Depth (inches)	lbs/bu	Seeds Per lb[2]	3 & 4	5	6 & 7a
Cereal Grains[1]								
Oats	96	2.2	3/4 to 1	32	16,900	Apr 1 to July 1 Aug 1 to Sept 1	Mar 15 to Jun 15 Aug 1 to Sept 15	Mar 1 to Jun 1 Aug 15 to Sept 30
Barley[4]	96	2.2	3/4 to 1	48	13,600	Apr 1 to July 1 Aug 1 to Sept 10	Mar 15 to Jun 15 Aug 1 to Sept 20	Mar 1 to Jun 1 Oct 5 to Oct 20
Wheat [5]	120	2.8	3/4 to 1	60	18,800	Aug 1 to Sept 20	Aug 1 to Oct 1	Aug 15 to Oct 30
Cereal Rye	112	2.6	3/4 to 1	56	19,900	Aug 1 to Sept 25	Aug 1 to Oct 5	Aug 15 to Oct 30

Nurse/Temporary Grasses							
Plant Species	Seeding Rate				Recommended Seeding Dates by Plant Hardiness Zone[3]		
	lbs/ac	Lb Per 1000ft^2	Seed-ing Depth (inches)	Seeds/lb[2]	3 & 4	5	6 & 7a
Annual Ryegrass	40	1	1/8 to 1/2	240,400	Apr 1 to May 31 Aug 1 to Sept 1	Mar 15 to May 31 Aug 1 to Sept 15	Mar 1 to May 31 Aug 15 to Sept 30
Perennial Ryegrass	40	1	1/8 to 1/2	217,000	Apr 1 to May 31 Aug 1 to Sept 1	Mar 15 to May 31 Aug 1 to Sept 15	Mar 1 to May 31 Aug 15 to Sept 30
Foxtail Millet (*Setaria italica)*	30	0.7	1/8 to 1/2	216,600	June 1 to July 15	May 15 to July 15	May 1 to Aug 5
Sorghum-sudangrass[6]	50	1	1/4 to 3/4	28,000	June 1 to July 15	May 15 to July 15	May 1 to Aug 5

[1] Reduce cereal grain seeding rate by 1/2 if used as a nurse crop for cool-season grasses. Increase seeding rate 1/3 if seeding alone toward end of range. For winter grains the last 2 weeks of the range extends only for zone 7a.
[2] Wide variability in reported seeds per pound.
[3] Seeding dates are based on PHZ averages, timing will vary based on location within zones, elevation, aspect and slope position. Midsummer dates subject to drought conditions.
[4] Use disease resistant varieties, use spring barley for the spring dates and winter hardy barley varieties for the late summer dates, barley is less winter hardy than wheat.
[5] If concerned about spreading Hessian fly to nearby wheat fields, do not plant until after Hessian fly-free date. Consult with Cooperative Extension; consider triticale or rye for earlier or later planting.
[6] Used for smother cropping prior to conservation planting will need one mowing if planted early.
[†]Modified from Salon and Miller (2012)

Appendix L: Recommended Permanent Seeding Mixtures by Purpose†

Recommended Seed Mixes (1-25) from Appendix M

Purpose of the Planting	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Comments
Roadsides, Steep Slopes		X	X		X	*	X				*	*	*	*	*			*	*	*			*			
Sand and Gravel Pits, Sanitary Landfills (droughty soils)		X	*	X	X							*	X	X				*								Use cool-season mixes only when fines exceed 20%
Mineland, Dredged Material, Spoil Banks, Greensands/Glauconitic soils (acid soils)					X		X		*	*	X	X	X	X					X				*			For low pH acid soils
Logging & Haul Roads,	*		X	*	X	*		*							X	X										Short lived, shade tolerant species
Utility Rights of Way					X		X				*	*			*											
Dikes, Dams, Ponds	*		X	*	X	*	X																			prefer mow tolerant grasses
Berms, Low Embankments (not on Ponds), Channelbanks	*		X	*	X	X	X	*	*	*	*	*		*	X			*								

Purpose of the Planting	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Comments
Riparian areas	*		*	*	X	*		X	X		X	*	*	*	X	*		*								Consider native mixes for areas not prone to high velocity flows
Grassed Waterways, Diversions, Terraces, Spillways, Streambanks	*	X	*		X	X	X																			
Bottom of Drainage Ditches, Swales, Detention Basins					*			X		*																Use No.10 if salt is also a concern
Cover for Orchards, Christmas trees & Woody buffers	*	X	X	X										X				X								less competitive good for wildflowers
Coastal plantings (Dunes, Shorelines																					*	X	X	X	X	For No. 24 only for great lakes not coastal
Recreation areas, Low maintenance areas/turf	X	X	X	X	*	*		*																		
Salt-affected areas								*		X									X	X	X					Use salt tolerant varieties
High Elevation, ski slopes																	X									Use short season hardy varieties

X Recommended mix for this purpose

* Alternative mix, depending on site conditions

† Modified from Salon and Miller (2012)

Appendix M: Seed Mixes and Associated Soil Drainage Class and Shade Tolerance†

Seed Mixture[1]	Rate[2] (lb/acre)	Pure Live Seed (PLS)	Soil Drainage Class3	Shade Tolerance[4]	Seeds/lb	Seeds/ft[2]	Seed Mix Total Seeds/ft[2]		comments
							Choice a	Choice b	
Low maintenance turf-like mixes and erosion control (mowing) (non-native species)									
1.KY blugrass	15		w-mw	g-f	1,389,840	479			Increase ratio of red fescue to Kentucky bluegrass and add hard fescue for shadier sites. For conventional lawns higher rates are used follow turf grass recommendations from Cooperative Extension.
Creeping red fescue	15				454,087	156			
Perennial ryegrass	5				240,400	28	663		
Whiteclover (optional)	4				711,867	65		700	
2. Creeping red fescue	15		w-swp	g-f	454,087	156			On swp drained sites increase ratio of tall fescue to red fescue and use redtop.
Tall fescue (turf-type)	15				205,720	71			
a. Perennial ryegrass or	5				240,400	28	255		
b. Redtop	2				4,851,200	223		450	

Seed Mixture[1]	Rate[2] (lb/acre)	Pure Live Seed (PLS)	Soil Drainage Class3	Shade Tolerance[4]	Seeds/lb	Seeds/ft[2]	Seed Mix Total Seeds/ft[2]		comments
							Choice a	Choice b	
White clover (optional)	4				711,867	65	320	515	
3. Creeping Red fescue	20		w-mw	g-f	454,087	208			For mix without tall fescue and there is concern for erosion.
Perennial ryegrass	5				240,400	28			
Redtop	2				4,851,200	223	459		
White clover (optional)	4				711,867	65		524	
4. Hard fescue	15		w-mw	g	591,920	204			Low growing mix, use at 1/3 rate or lower with wildflowers, add 10 lb/ac of sheep fescue on gravel areas.
Chewings fescue	15				350,000	121			
Creeping red fescue	15				454,087	156			
Perennial ryegrass (turf type)	5				240,400	28	508		
Waterways and general erosion control									
5a. Creeping red fescue	15		w-mw	p	454,087	156			In areas with variable drainage use redtop and add 15 lb/ac of tall fescue.
Smooth bromegrass	15				142,880	49			
a.Redtop **or**	2				4,851,200	223	428		
b.Perennial ryegrass	5				240,400	28		233	
Birdsfoot trefoil (optional)[5]	8				369,840	68	496	301	

Seed Mixture[1]	Rate[2] (lb/acre)	Pure Live Seed (PLS)	Soil Drainage Class3	Shade Tolerance[4]	Seeds/lb	Seeds/ft[2]	Seed Mix Total Seeds/ft[2]		comments
							Choice a	Choice b	
5b. Creeping red fescue	15		w-swp	p	454,087	156			Most commonly used mix on conservation structures.
Tall fescue[6]	15				205,720	71			
a.Redtop **or**	2				4,851,200	223	450		
b.Perennial ryegrass	5				240,400	28		255	
Birdsfoot trefoil (optional)	8				369,840	68	518	323	
6. KY bluegrass	15		w-mw	f	205,720	71			Use this mixture in areas which are mowed frequently.
Creeping red fescue	15				454,087	156			
Redtop	2				4,851,200	223			
Perennial ryegrass	5				240,400	28			
a. Birdsfoot trefoil **or**	8				369,840	68	545		
b.White clover	4				711,867	65		543	
7. Tall Fescue	30		w-swp	f	205,720	142			Use when high water velocities are expected. Produces a dense sod which can restrict volunteer vegetation. Good for utility right of ways. Tall fescue endophyte free and friendly forage varieites are available.
Perennial ryegrass	5				240,400	28	169		

Seed Mixture[1]	Rate[2] (lb/acre)	Pure Live Seed (PLS)	Soil Drainage Class3	Shade Tolerance[4]	Seeds/lb	Seeds/ft[2]	Seed Mix Total Seeds/ft[2]		comments
							Choice a	Choice b	
Wet areas (native)									
8.Virginia wildrye	15		swp-p	g	100,000	34			In areas where erosion is a concern increase fowl bluegrass and autumn bentgrass by an additional 2 lb each, this may out compete other species in the mix.
Riparian wildrye	15				125,000	43			
Fringed brome	5				236,000	27			
Fox sedge	2				1,297,000	60			
Fowl bluegrass[7]	2				1,900,000	87			
Autumn bentgrass[8]	1				8,000,000	184	435		
Carex scoparia (Optional)	0.5				1,312,000	15	450		
9.Deer tongue	3	pls			350,000	24			Use 'Hightide' switchgrass PHZ 5- north and use 'Kanlow' PHZ 6- south, If erosion is concern add fowl bluegrass, not for waterways or drainage ditches.
Switchgrass	3	pls	w-p	f-p	259,000	18			
Riparian wildrye	5				125,000	14			
Prairie cordgrass	1	pls			638,863	15	71		
Fowl bluegrass (optional)	1				1,900,000	44	115		
Wet, saline sites (roadside ditches)									
10.Alkali saltgrass	10		mw-swp	f	520,000	119			Use salt resistant turfgrass cultivars, for drier areas exclude alkali saltgrass.
Tall fescue (turf)	10				205,720	47			
Perennial ryegrass (turf)	5				240,400	28			
Creeping red fescue (turf)	10				454,087	104	298		

Seed Mixture[1]	Rate[2] (lb/acre)	Pure Live Seed (PLS)	Soil Drainage Class3	Shade Tolerance[4]	Seeds/lb	Seeds/ft[2]	Seed Mix Total Seeds/ft[2]		comments
							Choice a	Choice b	
Warm-season grass base mix									
11.Deer tongue	3	pls	mw-swp	f-p	350,000	24			Use prairie cordgrass on swp drained sites. If erosion is a concern increase Virginia wildrye to 10 lb/ac. Eastern gamagrass should be seeded at least 1 inch deep.
Switchgrass	3	pls			259,000	18			
Eastern gamagrass	2	pls			7,200	0.3			
Virginia wildrye	5				100,000	11	54		
Prairie cordgrass (optional)	1	pls			638,863	15	68		
12. Switchgrass	2	pls	w-mw	p	259,000	12			On drier sites substitute Canada wildrye. If erosion is a concern increase wildrye to 10 lb/ac.
Big bluestem	3	pls			144,240	10			
Indiangrass	2	pls			174,720	8			
Deertongue	2	pls			350,000	16			
Virginia wildrye	5				100,000	11	57		
Eastern gamagrass (optional)	2	pls			7,200	0.3	58		
Droughty areas (sand and gravels)									
13. Switchgrass	2	pls	ex	p	259,000	12			Increase each of the other warm-season grass by 1lb/ac if dropping optional species.
Coastal panicgrass	2	pls			325,000	15			
Big bluestem	2	pls			144,240	7			
Little bluestem	1	pls			240,670	6			
Canada wildrye	5				114,000	13	52		

Seed Mixture[1]	Rate[2] (lb/acre)	Pure Live Seed (PLS)	Soil Drainage Class3	Shade Tolerance[4]	Seeds/lb	Seeds/ft[2]	Seed Mix Total Seeds/ft[2]		comments
							Choice a	Choice b	
Sand lovegrass (optional)	2	pls			1,625,680	75	127		
Sand bluestem (optional)	2	pls			96,640	4	131		
Short native mix									
14. Little bluestem	4	pls	ex-mw	p	240,670	22			Short native mix, for wildflowers reduce deertongue by 1/2. Use purpletop zone PHZ6 and south.
Purpletop	2	pls			465,000	21			
Canada wildrye	5				114,000	13			
Deertongue	2	pls			350,000	16	73		
Sideoats grama (optional)	3	pls			159,200	11	84		
Native cool-season grasses (shaded sites, log landings)									
15. Virginia wildrye	5		w-swp	g	100,000	11			For erosion control increase autumn bentgrass and fowl bluegrass to 2 lb/ac, and increase wildryes to 10 lb/ac. For swp drained sites substitute riparian wildrye for Canada wildrye.
Canada wildrye	5				114,000	13			
Fringed brome	5				236,000	27			
Autumn bentgrass	1				8,000,000	184			
Fowl bluegrass	1				1,600,000	37	272		
Haul road/log landing mix with wildlife value, no woody plant suppression									
16.Orchardgrass	5		w-swp	g	427,200	49			Temporary cover allows for natural
Timothy	6				1,163,200	160			

Seed Mixture[1]	Rate[2] (lb/acre)	Pure Live Seed (PLS)	Soil Drainage Class3	Shade Tolerance[4]	Seeds/lb	Seeds/ft[2]	Seed Mix Total Seeds/ft[2]		comments
							Choice a	Choice b	
Creeping red fescue	3				454,087	31			succession
Redtop	1				4,851,200	111			
Ladino clover	1				860,000	20			
Red clover	2				272,160	12			
Alsike clover	2				680,400	31	415		
High elevation mix (2,500 ft. and higher, PHZ 5 and colder)									
17. Hard fescue	10		w-swp	p	591,920	136			Mix for erosion control in colder areas.
Chewings fescue	10				645,000	148			
Creeping red fescue	10				454,087	104			
Redtop	1				4,851,200	111			
White clover	2				711,867	33	532		
Birdsfoot trefoil (optional)	6				369,840	51	583		
Cover for Christmas trees, orchards, and woody buffers									
18. Hard fescue	15		w-mw	g	591,920	204			Good non-native mix for wildflowers.
Creeping red fescue	4				454,087	42			
Perennial ryegrass	3				240,400	17			
White clover	2				711,867	33	295		
Dredge disposal sites									
19.Alkali saltgrass	2		ex-mw	p	520,000	24			
Switchgrass	3	pls			259,000	18			

Seed Mixture[1]	Rate[2] (lb/acre)	Pure Live Seed (PLS)	Soil Drainage Class3	Shade Tolerance[4]	Seeds/lb	Seeds/ft[2]	Seed Mix Total Seeds/ft[2]		comments
							Choice a	Choice b	
Coastal Panicgrass	5	pls			325,000	37			
Deertongue	5	pls			350,000	40			
Canada wildrye	10				114,000	26			
Autumn bentgrass	1				8,000,000	184			
Partridge pea	4				65,000	6	335		
Alkaline soil conditions									
20.Alkali saltgrass	5		w-mw	f	520,000	60			Use barley as nurse crop if needed at 30 lb/ac.
Canada wildrye	5				114,000	13			
Hard fescue	10				591,920	136			
Sideoats grama **or**	3	pls			159,200	11	220		
Little bluestem	3	pls			240,670	17		236	
Dry, saline (coastal sites)									
21.Coastal panicgrass	5	pls	ex	p	325,000	37			
Switchgrass	5	pls			259,000	30			
Partridge pea	2				65,000	3	70		
Back dune plantings									
22.Coastal panicgrass	10	pls	ex	p	325,000	75			American beachgrass and saltmeadow cordgrass are
American beachgrass	12”-18”								

Seed Mixture[1]	Rate[2] (lb/acre)	Pure Live Seed (PLS)	Soil Drainage Class3	Shade Tolerance[4]	Seeds/lb	Seeds/ft[2]	Seed Mix Total Seeds/ft[2]		comments
							Choice a	Choice b	
Saltmeadow cordgrass	12"-18"								vegetatively planted.
ATLANTIC COAST-VEGETATIVE PLANTINGS (Vegetative)									
Foredunes, blowing sand areas									
23. American beachgrass	12-18" centers		ex	p					Relatively fast to establish cultivar 'Cape' available. Do not use around Great Lakes and lake Champlain.
Great Lakes, Lake Champlain									
24. American beachgrass	12-18" centers		ex	p					Slow to establish allows for natural revegetation, use local ecotypes for Great Lakes and Lake Champlain.
Tidal shoreline planting									
25. Smooth cordgrass	12"-18"			P					Smooth cordrass intertidal zone, saltmeadow cordgrass above mean high water.
Salt meadow cordgrass	12-18" centers			p					

[1] For information on varieties refer to discussion in Chapter 3. When available, It is a good practice to use more than one cultivar or ecotype of the species being sown for better diversity and adaptability.

[2] To convert from lb/ac to lb/1000ft^2 (lb/ac x.023 = lb/1000ft^2).

[3] Soil drainage classes: ex = excessively drained, w = well drained, mw = moderately well drained, swp = somewhat poorly drained, p = poorly drained.

[4] Shade tolerance: g = good, f = fair, p = poor.

[5] In lieu of birdsfoot trefoil substitute with 4 lb/ac of white clover on w to mw soils or alsike clover on swp soils.

† Modified from Salon and Miller (2012)

Appendix N: Guide to Mulch Materials, Rates, and Uses†

		Application Rates			
Mulch Materials	**Quality Standards**	**Per 1000 ft^2.**	**Per Acre**	**Depth of Application**	**Remarks**
Straw or Hay	Air-dried; free of undesirable seeds & coarse materials	90 - 100 lbs 2 - 3 bales	2 tons, 100 - 120 bales	Cover about 90% of surface	Use straw where mulch is maintained for more than three months. Subject to wind blowing unless anchored. This is the most commonly used mulching material. Best micro environment for germinating seeds. Do not use mulch hay in areas where weed seeds are a concern.
Wood chips or shavings	Green or air dried. Free from Objectionable coarse materials.	6 - 21 yd^3		2 – 7 in.	It is best to use composted wood chips, typically used as a mulch around ornamentals, small fruits & other nursery stock. Do not incorporate into the soil to avoid nitrogen deficiency during the breakdown of the organic matter and/or use 10 - 12 lb nitrogen/ton to offset the nitrogen deficiency. Resistant to wind blowing and decomposes slowly. Higher amounts in range are used

		Application Rates			
Mulch Materials	**Quality Standards**	**Per 1000 ft^2.**	**Per Acre**	**Depth of Application**	**Remarks**
					when not planting. 1 ft3 weighs approximately 18 lbs.
Sawdust green, or composted	Free from objectionable coarse material	3 - 18 yd^3		1 - 5 in.	Has about the same use and nitrogen deficiency concerns as wood chips. May require 30 - 35 lbs nitrogen/ton to offset potential nitrogen deficiency. 1 ft^3 weighs approximately 36 - 52 lbs.
Hydraulic mulches: wood fiber, cellulose, bonded fiber matrix and mechanically bonded fiber matrix	Dyed green. No growth inhibiting factors. Air-dried 30% fibers 3.7 mm or longer.	30 lbs	1500 lbs		Many products exist which includes cellulose, wood fiber, combination of the two and those which combine natural and synthetic materials. Apply at rates according to Manufacturer's specifications based on slope and other site characteristics. Tackifiers are usually needed to hold mulch on site.

		Application Rates			
Mulch Materials	**Quality Standards**	**Per 1000 ft^2.**	**Per Acre**	**Depth of Application**	**Remarks**
Leaves	No plastic bags, or household debris.	375 - 700 lbs	8 - 15 tons	3 - 6 in.	Must be spread within 7 days of delivery. Must be incorporated prior to next growing season. Spreading can be done with a manure spreader. Incorporation can be accomplished with chisel plow and disk. Distribution should be even. Obtain any necessary state and/or local permits.
Cornstalks, shredded or chopped	Air-dried, shredded into 8 in. to 12 in. lengths	150 - 300 lbs	4 - 6 tons		Effective for erosion control, relatively slow to decompose. Excellent for mulch on crop fields. Resistant to wind blowing.
Grass clippings	Unbagged, free of debris; minimal odor	700 - 1400 lbs	15 - 30 tons	1 - 2 in.	Obtain necessary permits. Must be spread within 24 hours of delivery. Observe buffer requirements. Incorporate with next tillage season for crop establishment.
Peat Moss	Dried, compressed free of coarse materials	200 ft^3	1/2 - 1 ton	2 - 4 in.	Most effective as a mulch around ornamentals. Subject to wind blowing unless kept wet. Bales weigh 6 - 8 lb/ft^3. Excellent moisture holding capacity.

		Application Rates			
Mulch Materials	**Quality Standards**	**Per 1000 ft^2.**	**Per Acre**	**Depth of Application**	**Remarks**
Gravel, Crushed Stone or Slag	Washed; Size 2B or 3A, 1.5 in.	9 yds^3		3 in.	Excellent mulch for short slopes and around woody plants and ornamentals. Use 2B when subject to foot traffic. Frequently used over black plastic for better weed control.
Jute Twisted Yarn	Undyed, unbleached plain	48 in. x 50 yds			Use without additional mulch. Tie down as in manufacturing specification.
	weave warp 78 ends/yd 60-90 lbs/roll	or 48 in. x 75 yds			
Excelsior Wood Fiber Mats	Interlocking web of excelsior fibers with Photodegradable plastic netting	48 in. x 100 in. 2 sided plastic			Use without additional mulch. Excellent for seed establishment. Tie down as per manufacturer specifications. Approximately 72 lbs/roll for excelsior with plastic on both sides. Use two sided plastic for centerline of waterways.
		48 in. x 180 in. 1 sided plastic			
Glass Fiber	1 /4 in. thick, 7/16 in. diameter holes on 1 in. centers; 56 lb rolls	72 in. x 30 yds.			Use without additional mulch. Tie down with T bars as per manufacturers specifications.
Plastic	2 - 4 mils	Variable			Use black for weed control. Effective moisture conservation and weed control for small fruits

		Application Rates			
Mulch Materials	**Quality Standards**	**Per 1000 ft^2.**	**Per Acre**	**Depth of Application**	**Remarks**
					ornamentals.
Filter Fabrics	Woven or Spun	Variable			
Straw or coconut fiber or combination	Photodegradable plastic net on one or two sides.	most are 6.5 ft x 83.5 ft	81 rolls		Designed to tolerate higher velocity water flow in centerlines of waterways. 60 yd^2 per roll.

Appendix O: Plant Description Sheets

Alfalfa	*Medicago sativa*
	Alfalfa is a long-lived perennial 1egume with a high drought tolerance. Alfalfa is harvested as hay which is processed or fed directly to livestock, or for seed production. It is also used in pellets as forage supplements. It is grown in combination with grasses in improved pastures. Alfalfa is an excellent food for wildlife and provides food and cover for many species of bird and small animals. Photo from Wikipedia
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_mesa.pdf http://www.hort.purdue.edu/newcrop/duke_energy/medicago_sativa.html
Mature height (ft):	2.0
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	12-65 in.
Minimum root depth (in.):	24
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No, vegetative spread slow
Ecological-bridge suitability:	
Additional notes:	This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Alkali saltgrass	*Distichlis spicata*
 Photo by William Skaradek USDA NRCS	Saltgrass is a native perennial grass from 15” to 35” in height. Plant growth is stiff, with branching wiry, gray-green leaves. It forms dense mats with rhizomes and sometimes stolons. It is a dioecious species with male and female reproductive parts on separate plants.It is a salt tolerant plant that thrives in fresh water conditions. In salty areas during dry weather you can see salt crystals on the underside of the leaves. The crystals become blackened. Saltgrass is found along estuaries and the troughs of back dune areas along the shorelines, brackish marshes, and in salt flats in planting zones 7,8,9,and 10.It inhabits upper/high marsh (irregularly flooded) areas, in which the water levels vary between 2 inches above the soil surface and 6 inches below the soil surface. It is also commonly present in the dry West, where it is one of the most drought-tolerant species. Saltgrass is located in both organic alkaline and in saline soils. The thick entangled roots of salt marsh plants acts as a guard between the ocean and the shore protecting the land from pollutants and other chemicals associated with runoff water. It is particularly useful in restoration of saline/alkaline wetlands.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_disp.pdf http://plants.usda.gov/plantguide/pdf/pg_disp.pdf
Mature height (ft):	1.1
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	Yes
Precipitation range (in.):	5-70 in
Minimum root depth (in.):	2
Aggressiveness (fast, medium, slow growth rate):	Slow
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, moderate vegetative spread rate
Ecological-bridge suitability:	
Additional notes:	High salinity tolerance

Alsike clover	*Trifolium hybridum*
 Photo by Margaret Williams. Courtesy of Nevada Native Plant Society.	Alsike clover is an introduced, short-lived, non-creeping perennial with a growth habit similar to red clover. It has smooth stems and leaves. Alsike clover is used for hay, pasture, and soil improvement, and is preferred where wetter or acid soils are encountered. It has low drought tolerance and it is generally out produced by other clover species. Alsike clover can be toxic to horses. Alsike clover is always seeded, or overseeded, with grass (timothy or brome grasses).
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_trhy.pdf http://plants.usda.gov/plantguide/pdf/pg_trhy.pdf
Mature height (ft):	2.0
Fire resistant (yes/no):	No
Fire tolerance:	Low
Low growing (yes/no):	No
Precipitation range (in.):	26-60
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	Slightly toxic, especially to horses. Alsike clover may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

American beachgrass	*Ammophilia breviligulata* Fern.
 Photo by C. Ford. USDA NRCS Cape May PMC	American beachgrass is a leafy, spreading, strongly rhizomatous grass, producing up to of 100 stems per clump annually. This cool season perennial grass species will grow to 2 or 3 feet tall, tolerating annual over-topping accumulations of sand up to a foot. This grass is a native of the mid-Atlantic coastal region from Maine to North Carolina and the Great Lakes. It will grow on sandy or other course textured soils on inland sites with or without high salinity, if supplemental fertilizers are applied. This grass does not tolerate much soil moisture before it begins showing signs of stress. American beachgrass is the predominant plant species utilized along the Atlantic and Great Lakes coastlines for initial stabilization of frontal sand dunes. It has also been utilized on extreme, non-dune sites, some having high salinity levels and droughty conditions, for erosion control and initial cover.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_ambr.pdf
Mature height (ft):	2 to 3 feet
Fire resistant (yes/no):	yes
Fire tolerance:	medium
Low growing (yes/no):	yes
Precipitation range (in.):	35 – 60 in
Minimum root depth (in.):	20 in
Aggressiveness (fast, medium, slow growth rate):	Fast - This cool season perennial grass species will spread up to 6-10 feet annually by subsurface rhizomes.
Wear tolerance for maneuver areas:	Pedestrian or vehicular traffic that bends or breaks the culms will seriously damage or kill the plants.
Spread by rhizomes (may tolerate munitions impacts):	yes
Ecological-bridge suitability:	
Additional notes:	Replanting stands of beachgrass where openings or voids have developed should be an annual maintenance procedure

American vetch *Vicia americana*

	American vetch is a native, perennial, drought-tolerant climbing vine that grows approximately 1 to 2 feet tall. Each plant has a single stem. Tendrils emerge from the end of the multiple leaflets to help secure the plant to the climbing structure. It fixes nitrogen in the soil and can be grown as a cover preceding late spring-planted crops. American vetch can be grown in disturbed sites to help restore roadsides, former coal mine sites and disturbed rangelands. Photo by Robert H. Mohlenbrock. USDA NRCS. 1992. *Western wetland flora: Field office guide to plant species*. West Region, Sacramento. Courtesy of USDA NRCS Wetland Science Institute.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_viam.pdf
Mature height (ft):	1.3
Fire resistant (yes/no):	No
Fire tolerance:	medium
Low growing (yes/no):	No
Precipitation range (in.):	9-50
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, slow vegetative spread
Ecological-bridge suitability:	
Additional notes:	This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Annual ryegrass *Lolium perenne* L. ssp. *multiflorum*

 Photo by Robert Soreng. Courtesy of Smithsonian Institution, Department of Systematic Biology-Botany	Also known as Italian ryegrass, annual ryegrass is quite similar to perennial ryegrass except it is an annual or biennial, depending on climate and/or length of growing season. Plants have a bunchy form, with numerous long, narrow, stiff leaves near the base of the plant. Annual ryegrass is primarily used for quick cover in erosion control plantings. These grasses have a wide range of adaptability to soils, but thrive on dark rich soils in regions having mild climates. They do not withstand hot, dry weather or severe winters. They will stand fairly wet soils with reasonably good surface drainage.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_lopem2.pdf
Mature height (ft):	2-3
Fire resistant (yes/no):	no
Fire tolerance:	low
Low growing (yes/no):	no
Precipitation range (in.):	18-65 in
Minimum root depth (in.):	8
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Autumn bentgrass/Upland bentgrass *Agrostis perennans*

	This native perennial bunchgrass grows in clumps without rhizomes or stolons. It has erect stems growing to a mature height of about 3 to 3.5 feet. It grows in fields, open woods, thickets, and along roadsides. The plant prefers light (sandy), medium (loamy) and heavy (clay) soils and requires well-drained soil. The plant prefers acid, neutral and basic (alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It requires dry or moist soil. Photo by Robert H. Mohlenbrock. USDA NRCS. 1995. *Northeast wetland flora: Field office guide to plant species*. Northeast National Technical Center, Chester. Courtesy of USDA NRCS Wetland Science Institute.
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=AGPE
Mature height (ft):	3.5
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	no
Precipitation range (in.):	32-56 in.
Minimum root depth (in.):	8
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, vegetative spread rate is moderate
Ecological-bridge suitability:	
Additional notes:	

Bermudagrass	*Cynodon dactylon*
 Photo by USDA NRCS National Plant Materials Center Beltsville, MD	Bermudagrass is a turf grass of probable Asian origin. It is a long-lived, warm season perennial that spreads by rhizomes, stolons, and seed. Bermudagrass is used for critical area planting for erosion control (including channels and pond banks), grassed waterways, and vegetated flumes. It also provides forage for livestock and wildlife. Its salinity tolerance is medium and it requires full sun and a minimum of 190 frost-free days.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_cyda.pdf
Mature height (ft):	1.4
Fire resistant (yes/no):	Yes
Fire tolerance:	high
Low growing (yes/no):	yes
Precipitation range (in.):	32-100 in
Minimum root depth (in.):	14
Aggressiveness (fast, medium, slow growth rate):	fast
Wear tolerance for maneuver areas:	Wear tolerant and has a high vegetative spread rate
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	This plant is considered noxious in several states and invasive by several sources.

Big Bluestem	*Andropogon gerardii* Vitman
	*Andropogon gerardii*, big bluestem, is a native, perennial, warm season grass that occurs from the short grass prairie region to the Atlantic Ocean. It is tufted, forms sod, and has short, scaly rhizomes. Big bluestem is tall, reaching a height of 6 to 8 feet on most sites where it is protected from grazing. It is very leafy at the base, with some leaves carried up on the stem. The seed heads normally have 3 spikelets that appear like a 'turkey foot.' Photo by J. Anderson @ USDA-NRCS Plants Database
Website and fact sheet (for more information):	http://plants.usda.gov/plantguide/pdf/pg_ange.pdf
Mature height (ft):	6.0
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	12 to 55
Minimum root depth (in.):	20
Aggressiveness (fast, medium, slow growth rate):	Moderate growth rate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	

Birdsfoot trefoil	*Lotus corniculatus*
	Birdsfoot trefoil is a moderately long-lived herbaceous perennial legume. It is generally used in areas that receive 20 inches of precipitation or more. It is suited to low and moderately fertile soils with relatively poor internal drainage but is usually less productive than alfalfa on fertile, deep, well-drained soils. It performs well on soils too shallow or too poorly drained for alfalfa. It is equal to alfalfa in tolerance to saline-alkaline soils and is adapted to soils of medium acidity. Birdsfoot trefoil is used along roadsides to control wind and water erosion. Photo by Robert H. Mohlenbrock, USDA NRCS 1989, Midwestern Wetland Flora @ USDA NRCS PLANTS
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_loco6.pdf
Mature height (ft):	2.4
Fire resistant (yes/no):	No
Fire tolerance:	high
Low growing (yes/no):	No
Precipitation range (in.):	16-65
Minimum root depth (in.):	14
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Blue wild indigo (False indigo) *Baptisia australis*

	Blue wild indigo, or False Indigo, is a native, perennial, warm-season legume which reproduces by seed or rhizomes. It makes good ground cover in sunny locations because of its bushy habit, deep and extensive root systems and perennial life form. It is a native legume, fixes nitrogen in the soil, and can be part of a good wildlife seed mixture when native grasses and forbs are seeded. Blue wild indigo is unlikely to become weedy or invasive in most regions or habitats and rarely displaces desirable vegetation. Blue wild indigo can be found along tree lines, bordering forested riparian areas and in open prairies or native hay meadows. It does not grow well in shaded habitats. Photo by William S. Justice. Courtesy of Smithsonian Institution, Dept. of Systematic Biology, Botany.
Website and fact sheet (for more information):	http://plants.usda.gov/plantguide/pdf/cs_baau.pdf
Mature height (ft):	5
Fire resistant (yes/no):	
Fire tolerance:	
Low growing (yes/no):	no
Precipitation range (in.):	Drought tolerant
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	yes
Ecological-bridge suitability:	
Additional notes:	Slightly toxic

Broom sedge	*Carex scoparia*
 Photo by Robert H. Mohlenbrock, USDA, SCS, 1989, *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln. Courtesy of USDA NRCS Wetland Science Institute	*Carex scoparia* is a species of sedge known by the common names broom sedge and pointed broom sedge. It should not be confused with the unrelated grass species known as "broom sedge," *Andropogon virginicus*. This native perennial sedge is 1½–2½' tall, forming tight bunches of flowering culms with alternate leaves. Vegetative shoots are relatively uncommon. Habitats include wet prairies, marshes, fens, gravelly seeps, margins of ponds and streams, and roadside ditches. This sedge has been found in a wide range of wetland habitats of varying quality.
Website and fact sheet (for more information):	http://plants.usda.gov/java/profile?symbol=CASC11 http://www.illinoiswildflowers.info/grasses/plants/pb_sedge.htm http://en.wikipedia.org/wiki/Carex_scoparia
Mature height (ft):	2.5
Fire resistant (yes/no):	no
Fire tolerance:	yes
Low growing (yes/no):	no
Precipitation range (in.):	22-55 in, drought intolerant
Minimum root depth (in.):	8
Aggressiveness (fast, medium, slow growth rate):	medium
Wear tolerance for maneuver areas:	Low
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	

Broomsedge bluestem	*Andropogon virginicus*
 Photo by Melinda Brakie, USDA NRCS East Texas Plant Materials Center.	Broomsedge bluestem is a native warm season, herbaceous, perennial bunchgrass. The grass is found in open areas such as abandoned fields, overgrazed pastures, cut-over timber sites, and rights of way, on the edges of forests and disturbed areas. . Broomsedge bluestem grows on a wide variety of soils, preferring loose, sandy, moist sites with low fertility and is an indicator of low phosphorus soils. It also is a shallow rooted plant. Broomsedge bluestem is not considered important cattle forage. Small birds utilize the seed in winter when other food supplies are limited. Broomsedge bluestem provides cover for ground nesting birds such as quail and turkeys. Broomsedge bluestem can be used for erosion control when other plants can not be found. It is not recommended to mix broomsedge bluestem seeds with cool season grass seeds.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_anvi2.pdf http://plants.usda.gov/plantguide/pdf/pg_anvi2.pdf
Mature height (ft):	3.0
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	no
Precipitation range (in.):	30-45 in
Minimum root depth (in.):	14
Aggressiveness (fast, medium, slow growth rate):	slow
Wear tolerance for maneuver areas:	No. It is a shallow rooted plant.
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Buffalograss *Buchloe dactyloides*

 Photo by Robin R. Buckallew. United States, OK, Edmond.	*Buchloe dactyloides,* buffalograss, is a perennial, native, warm-season grass. Leaf blades are 10 to12 inches long, but they fall over and give the turf a short appearance. Both male and female plants have stolons. This grass occurs naturally and grows best on clay loam to clay soils. It requires little mowing to achieve a uniform appearance. It has a low fertility requirement and it often will maintain good density without supplemental fertilization. Buffalograss is well suited for sites with 10 to 25 inches of annual precipitation as it has good drought tolerance. Buffalograss can also withstand heavy usage. It is not adapted to shaded sites. This is an important pasture grass. Buffalograss can be used for erosion control on areas that do not receive a lot of rain but are affected by wind erosion, such as roadside cuts.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_buda.pdf http://plants.usda.gov/java/charProfile?symbol=BUDA
Mature height (ft):	0.5
Fire resistant (yes/no):	no
Fire tolerance:	medium
Low growing (yes/no):	yes
Precipitation range (in.):	High drought tolerance, medium moisture use, 7-32 in.
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	Yes
Spread by rhizomes (may tolerate munitions impacts):	No, but vegetative spread is rapid
Ecological-bridge suitability:	
Additional notes:	

Canada bluegrass	*Poa compressa* L.
	Canada bluegrass is an introduced, perennial, rhizomatous grass. Canada bluegrass has naturalized throughout much of North America. It is found on wet sites, open meadows, and in open deciduous and coniferous forests as well as waste areas. It is a pioneer species on moderately acidic soils and on soils with poor fertility. Its primary use is for controlling erosion on disturbed sites such as roadsides, mine reclamation sites, heavy use recreation areas, and for low maintenance landscaping. It is palatable to livestock and wildlife. Photo by Robert H. Mohlenbrock. USDA SCS. 1989. *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln. Courtesy of USDA NRCS Wetland Science Institute.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/pg_poco.pdf
Mature height (ft):	2.0
Fire resistant (yes/no):	no
Fire tolerance:	low
Low growing (yes/no):	yes
Precipitation range (in.):	12-45 in
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	Yes. Tolerant of close grazing and heavy trampling.
Spread by rhizomes (may tolerate munitions impacts):	yes
Ecological-bridge suitability:	
Additional notes:	Canada bluegrass is listed as a potentially invasive species and is banned in Connecticut. This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Canada bluejoint	*Calamagrostis canadensis*
	Canada Bluejoint is a long lived, native perennial cool season grass with stout stems. This species spreads slowly (5 to 15 cm/year) by rhizomes forming a sod. This species is adapted to very acid to slightly alkaline soils (pH 3.5 to 8). Bluejoint is useful for wetland restoration and enhancement as well as shoreline and streambank stabilization. The rhizomatous root structure improves the plants ability to bind soil, especially along higher gradient streams and waterways. It is included in hydroseeding mixtures for drainage ditches designed to filter stormwater. Photo by Robert H. Mohlenbrock. USDA SCS. 1989. *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_caca4.pdf http://plants.usda.gov/plantguide/pdf/pg_caca4.pdf
Mature height (ft):	4.9
Fire resistant (yes/no):	no
Fire tolerance:	low
Low growing (yes/no):	no
Precipitation range (in.):	14-65
Minimum root depth (in.):	16
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	yes
Ecological-bridge suitability:	
Additional notes:	

Canada wildrye	*Elymus canadensis*
 Photo by Robert H. Mohlenbrock. USDA SCS. 1989. *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln. Courtesy of USDA NRCS Wetland Science Institute.	Canada wildrye is a native perennial, short-lived, cool-season bunchgrass that grows to 5 feet with erect or arching culms and flat, wide (up to 0.8 inches), waxy green, pointed leaves that grow from the base of the stem to the spike. Canada wildrye is found on sandy shores and dunes; wooded areas, especially along trails, rivers and streams; and other disturbed sites. It provides good forage quality for livestock during the early part of the grazing season and is beneficial to wildlife. Exceptional seedling vigor and rapid establishment make Canada wildrye an excellent species for use in erosion control and in seed mixtures where quick development and soil stabilization is needed.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_elca4.pdf http://plants.usda.gov/plantguide/pdf/pg_elca4.pdf
Mature height (ft):	2.5-5
Fire resistant (yes/no):	no
Fire tolerance:	low
Low growing (yes/no):	no
Precipitation range (in.):	20-45
Minimum root depth (in.):	16
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	

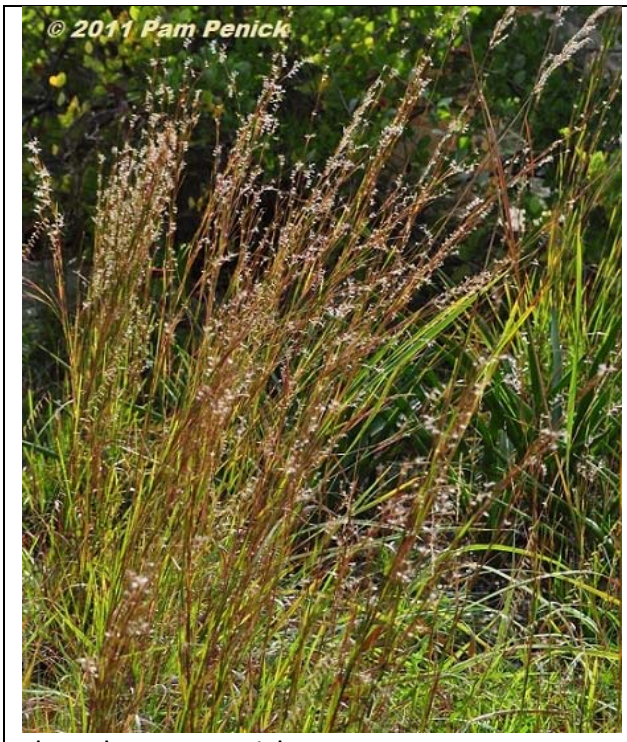
Canadian milkvetch *Astragalus canadensis*

 Photoby Thomas G. Barnes. Barnes, T.G., and S.W. Francis. 2004. *Wildflowers and ferns of Kentucky*. University Press of Kentucky.	Canadian milkvetch is a native, perennial legume with underground rhizomes. Plants of this species may be large and robust once established. Leaves are smooth or slightly hairy on the upper surface with stiff, short hairs on the underside. Canadian milkvetch is found naturally in moist prairies, open woodlands, roadsides, thickets, marshy grounds, streambanks and open or partly shaded ground. It is used for erosion control, forage, wetland restoration/enhancement, and for its wildlife habitat benefits.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_asca11.pdf http://plants.usda.gov/plantguide/pdf/pg_asca11.pdf
Mature height (ft):	5
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	20-50
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, slow vegetative spread. It has low tolerance of root disturbance
Ecological-bridge suitability:	
Additional notes:	Slightly toxic

Cereal rye	*Secale cereale*
	Cereal rye is an erect annual grass, with flat leaf blades and dense flower spikes. It is a commonly used winter cover crop in the northeastern U.S. because it can germinate and grow under cooler conditions than other covers. Photo by Martin van der Grinten. USDA NRCS Big Flats PMC.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_sece.pdf
Mature height (ft):	3.5
Fire resistant (yes/no):	No
Fire tolerance:	None
Low growing (yes/no):	No
Precipitation range (in.):	8-50 in.
Minimum root depth (in.):	8
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

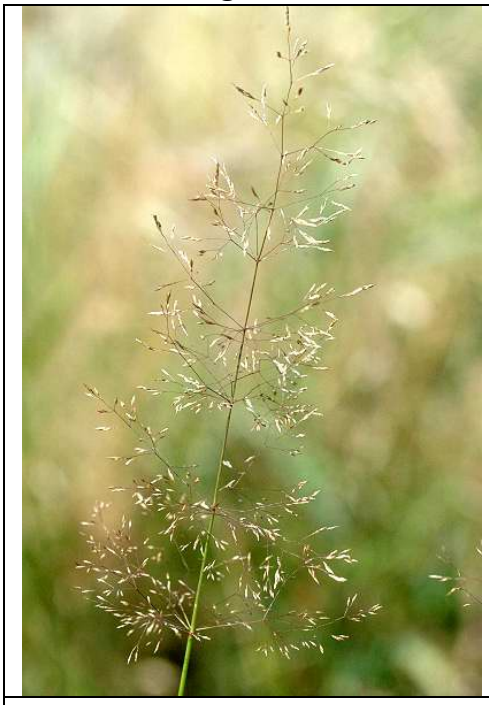
Chewings fescue	*Festuca rubra* L. ssp. *fallax*
	Chewings Fescue is a perennial bunch-type fescue with an upright growth pattern that resembles Tall Fescue grass while retaining the fine leaves of the fine fescues. Tolerant of shady conditions such as areas among large oak trees. Chewings fescue will establish faster than creeping red fescue. Well adapted to sandy, acidic and infertile soils, Chewings Fescue grows well in the cooler areas of the northern USA (CT, MA, ME, NH, RI, and VT) and Canada, and other areas where summers are cool. Photo by American Lawns
Website and fact sheet (for more information):	
Mature height (ft):	
Fire resistant (yes/no):	
Fire tolerance:	
Low growing (yes/no):	yes
Precipitation range (in.):	Drought tolerant
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	fast
Wear tolerance for maneuver areas:	Not as wear tolerant as other fescues
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	

Coastal little bluestem *Schizachyrium littorale*

 Photo by Pam Penick	Coastal little bluestem occurs almost exclusively along the coastal strip from southern New England to Texas. It is a short (1-2 foot) warm season bunch grass with coarse blue-green stems and basal leaves which often appear purplish. In the late summer to early fall a low sun slanting across the seed heads of this grass give the plant a frosty appearance. The entire plant has a reddish cast after frost. Coastal little bluestem is very well adapted to dry, well to excessively drained, infertile secondary dunes. It does not tolerate large amounts of sand accretion. This grass has excellent drought tolerance once established, some salt spray tolerance and poor flood tolerance. It grows preferentially on sites with pH 7.0 and slightly higher. Coastal little bluestem is useful for adding plant diversity to frontal back dune and secondary dune systems. It is especially well-suited for stabilizing back dune "blowout" areas. This plant provides cover for ground birds and small mammals.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_scli11.pdf
Mature height (ft):	2
Fire resistant (yes/no):	
Fire tolerance:	
Low growing (yes/no):	yes
Precipitation range (in.):	
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Coastal Panicgrass	*Panicum amarum* Ell. Var. *amarulum*
	This grass is deep rooted (+6 feet), robust, long lived where hardy, and grows to a height of 3 to 6 feet. This is a U.S. native grass. The stems may be as thick as 1/2 inch, with bluish green leaves from 8 to 20 inches long and 1/4 to 1/2 inch wide. Although coastal panicgrass grows faster than most warm season grasses, it is slower than cool season grasses. Producing short outwardly spreading rhizomes, it forms clumps or bunches. Like most other species in the genus *Panicum*, coastal panicgrass has a large terminal inflorescence. It is a tightly arranged, densely flowered cluster. There is an average of 350,000 seeds per pound. Photo by USDA-NRCS National Plant Materials Center @ Beltsville, MD
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_paama2.pdf
Mature height (ft):	6
Fire resistant (yes/no):	yes
Fire tolerance:	good
Low growing (yes/no):	no
Precipitation range (in.):	
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	
Wear tolerance for maneuver areas:	Coastal panicgrass has a deep fibrous root system which has made it a top choice for secondary sand dune stabilization in the mid-Atlantic states.
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	

Colonial bentgrass *Agrostis capillaris* L.

	*Agrostis capillaris,* also known as Common Bent, or Browntop, is a rhizomatous and stoloniferous perennial. This is a non-native species introduced from Eurasia. Colonial bent grows in moist grasslands and open meadows, and can also be found in agricultural areas, roadsides, and invading disturbed areas. It is found growing in neutral to acidic soils. It has a low tolerance for drought and has a high moisture requirement. It has a very fine texture and, like most bentgrasses, grows very dense. This species has been used on golf courses and sporting fields, but is only moderately wear-tolerant. Photo by J.K. Lindsey
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=AGCA5
Mature height (ft):	2.0
Fire resistant (yes/no):	no
Fire tolerance:	medium
Low growing (yes/no):	yes
Precipitation range (in.):	32-60
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	Somehat wear tolerant. Used on sporting fields.
Spread by rhizomes (may tolerate munitions impacts):	Yes, vegetative spread rapid
Ecological-bridge suitability:	
Additional notes:	

Common Barley *Hordeum vulgare*

	Barley is an annual bunching grass, and a major cereal grain. Hardy to Zone 4, barley likes to grow under cool conditions but is not particularly winter hardy. The plant is tolerant of most soil types but prefers light sandy, well-drained, moist soil. Barley is more tolerant of soil salinity than wheat. Barley requires full sun. It is also relatively drought and wind tolerant, but not maritime exposure. Photo by Robert Soreng. Courtesy of Smithsonian Institution, Department of Systematic Biology-Botany.
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=HOVU
Mature height (ft):	2.5
Fire resistant (yes/no):	No
Fire tolerance:	Low
Low growing (yes/no):	No
Precipitation range (in.):	12-100
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	The stems, after the seed has been harvested, have many uses. They are a source of fibres for making paper, a biomass for fuel, and they can be shredded and used as mulch.

Cordgrass	*Spartina* species
	See specific cordgrass species
Website and fact sheet (for more information):	
Mature height (ft):	
Fire resistant (yes/no):	
Fire tolerance:	
Low growing (yes/no):	
Precipitation range (in.):	
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	
Ecological-bridge suitability:	
Additional notes:	

Creeping bentgrass *Agrostis stolonifera*

	Creeping bentgrass is a perennial grass, stoloniferous and may form mats or tufts. The prostrate stems of this species grow to 1-3 ft long with 1-4-in long leaf blades and a panicle reaching up to 16-in in height. The leaves are tapering, often with a blue grey hue colour. It can be found growing in a variety of habitats including woodlands, grasslands and meadows, wetlands, riparian zones, and as a pioneer species on disturbed sites. Some of its species have adapted to contaminated conditions and can cope with heavy metals. It is native to Eurasia and North Africa. It is possible that it may also be to native to northern parts of North America, and has been widely introduced and naturalized in the United States. Photo by J.S. Peterson. USDA NRCS NPDC.
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=AGST2 http://en.wikipedia.org/wiki/Agrostis_stolonifera
Mature height (ft):	2.0
Fire resistant (yes/no):	no
Fire tolerance:	medium
Low growing (yes/no):	no
Precipitation range (in.):	32-60
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No, but vegetative spread by stolon production is rapid
Ecological-bridge suitability:	
Additional notes:	

Creeping fescue	*Festuca rubra* var. *rubra*
 Photo courtesy of UC-Davis (ucdavis.edu)	Creeping Red Fescue is a fine bladed grass with medium to dark green color. It is easily established from seed and spreads with rhizomes and stolons with a "creeping" growth habit. Creeping Red Fescue, like other fine fescues, is best adapted to cool areas from the transition zone, north and in shady areas of the transition zone. It is not as cold tolerant as Kentucky Bluegrass or Creeping Bentgrass. The major use for creeping fescue is for dry shaded areas as either a pure stand or as a mixture in other grass seed mixtures such as Bluegrass seed, creeping bent grass seed and Perennial Ryegrass seed. Even though it is one of the best grasses for use in shade, it will tolerate full sun conditions although this could require more water. Creeping Red Fescue is used extensively in all types of turf areas including parks, roadsides, lawns, fairways, cemeteries, airfields, and other turf areas. It grows best in well drained sites and in droughty, infertile soils. It does not tolerate wet soils or high fertilization rates, including highly fertile soils.
Website and fact sheet (for more information):	www.fescue.com/info/creepingred.html
Mature height (ft):	
Fire resistant (yes/no):	
Fire tolerance:	
Low growing (yes/no):	yes
Precipitation range (in.):	Drought tolerant in cool climates
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	slow
Wear tolerance for maneuver areas:	low to moderate tolerance for traffic.
Spread by rhizomes (may tolerate munitions impacts):	yes
Ecological-bridge suitability:	
Additional notes:	

Creeping meadow foxtail *Alopecurus arundinaceus*

 Photo by Lars Hedenäs	Creeping foxtail is a large, long-lived, rhizomatous, sod-forming, perennial grass introduced from Eurasia. Creeping foxtail is adapted to cold temperatures and wet conditions. It is extremely winter hardy. This species is well adapted to areas of high moisture typically too wet for good production of most forage grasses. It can be seeded in pure stands or with a legume and very well suited for pastureland or hayland. All manner of wildlife benefit from the forage and cover provided by creeping foxtail. Creeping foxtail has a good tolerance for high levels of fertilizer. It can be used in filter fields for liquid waste disposal, sewage treatment, food processing and livestock waste removal programs, and can also be used as an excellent silt trap Creeping foxtail has vigorous rhizome production and water tolerance that make it well suited to erosion control and stream bank stabilization and it can be used on earthen dams where water levels fluctuate. It survives in a broad range of pH, making it suitable for mine spoils, saline seeps, bogs and acidic roadways.
Website and fact sheet (for more information):	http://plants.usda.gov/plantguide/pdf/pg_alar.pdf
Mature height (ft):	3.0
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	18-70
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, rapid vegetative spread
Ecological-bridge suitability:	
Additional notes:	

Deertongue	*Dichanthelium clandestinum* (L.) Gould
 Photo by Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA SCS. 1989. Midwest Wetland Flora @ USDA NRCS PLANTS	Deertongue is a perennial, warm season grass native to the Eastern United States and Southeastern Canada. The midsummer growth can reach one to three feet. The leaf sheath and stem are hairy. Leaves are 0.5 to 1.25 inches wide and 4-8 inches long. In autumn culms form a very leafy rosette, 4-6 inches high. Deertongue produces short, strong rhizomes and two seed crops per year, with about 400,000 seeds per pound. Deertongue lodges over winter and forms a mat of vegetative cover. Some of the stems break off and are carried away by wind or water. Much of the seed is retained in the leaf sheaths of the old stems.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_dicl.pdf
Mature height (ft):	2.0
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	32 to 65
Minimum root depth (in.):	16
Aggressiveness (fast, medium, slow growth rate):	Slow growth rate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	

Eastern Gamagrass	*Tripsacum dactyloides* L.
	*Tripsacum dactyloides* L., Eastern gamagrass, is a native, warm season, perennial, sod-forming grass that is a distant relative of corn and is characterized by numerous short, well-developed rhizomes. This plant can reach a height of up to 8 feet. The leaves can be 3/8 to 3/4 inch wide and 12 to 24 inches long. They also have a well-defined midrib. Most of the leaves originate from the base of the plant. Seed is produced from June to September. The seed heads are 6 to 10 inches long and are made up of one to several spikes. Eastern gamagrass begins growing earlier in the spring than do the other native grasses such as big bluestem *(Andropogon gerardi)* or switchgrass *(Panicum virgatum)* and is an excellent source of forage during summer months when cool-season grasses, such as tall fescue, are relatively dormant. Photo by Nancy Staunton @ USDA-NRCS PLANT Database
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_trda3.pdf
Mature height (ft):	5.0
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	16 to 60
Minimum root depth (in.):	20
Aggressiveness (fast, medium, slow growth rate):	Fast
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	

Flatpea	*Lathyrus sylvestris* L.
 Photo by USDA NRCS National Plant Materials Center Beltsville, MD	Flatpea, or Everlasting pea, is an introduced perennial that closely resembles sweetpea and perennial pea. It climbs through the use of tendrils. A well-established stand forms a dense mat of vegetation. Flatpea is a long-lived erosion control plant that can grow on severely disturbed soil under acid conditions and begin the soil improvement process. It is drought tolerant with low moisture requirements and requires little input once established. Flatpea will inhibit the ability of other plants to invade the stand after it acheives full cover, and can be used to control woody plant encroachment on utility rights-of-way. Flatpea is considered toxic to some livestock but seeds are used by birds.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_lasy.pdf
Mature height (ft):	2.2
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	30-55
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes. Moderate rate of vegetative spread.
Ecological-bridge suitability:	
Additional notes:	Toxic to non-ruminant livestock This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Fowl bluegrass/Fowl meadowgrass *Poa palustris*

	Native, perennial cool-season grass used for erosion control and revegetation. Prefers moist conditions and full sun areas. Photo by Emmet J. Judziewicz
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=POPA2
Mature height (ft):	4.0
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	yes
Precipitation range (in.):	28-50 in
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	low
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	

Fox sedge	*Carex vulpinoidea*
	Fox sedge is a native perennial clumping grass that will naturalize when planted in locations that remain moist, near streams, springs, ponds, and moist woods. It is an excellent colonizer of wetland restoration sites and has a low tolerance for drought. The USDA hardiness zones for fox sedge are 3 to 7. It is a pioneer species that colonizes wet open sites soon after disturbance. Photo by Robert H. Mohlenbrock. USDA SCS. 1989. *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln. Courtesy of USDA NRCS Wetland Science Institute
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fpg_cavu2.pdf
Mature height (ft):	3.2
Fire resistant (yes/no):	yes
Fire tolerance:	low
Low growing (yes/no):	no
Precipitation range (in.):	12-65
Minimum root depth (in.):	16
Aggressiveness (fast, medium, slow growth rate):	Fast
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	Fox sedge spreads rapidly and may be weedy or invasive in some regions or habitats, displacing desirable vegetation.

Foxtail millet *Setaria italica*

	Foxtail millet is the second-most widely planted species of millet. Foxtail millet is an annual warm-season bunch grass with slim, vertical, leafy stems. It is hardy to Zone 6. Drought tolerance is low. It prefers well-drained soil. Photo by R.A. Howard. ©Smithsonian Institution. Courtesy of Smithsonian Institution, Richard A. Howard Photograph Collection. Canada, Montreal.
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=SEIT
Mature height (ft):	5.0
Fire resistant (yes/no):	No
Fire tolerance:	None
Low growing (yes/no):	No
Precipitation range (in.):	25-60 in.
Minimum root depth (in.):	8
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Freshwater cordgrass *Spartina pectinata*

	See Prairie cordgrass.
Website and fact sheet (for more information):	
Mature height (ft):	
Fire resistant (yes/no):	
Fire tolerance:	
Low growing (yes/no):	
Precipitation range (in.):	
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	
Ecological-bridge suitability:	
Additional notes:	

Fringed brome *Bromus ciliatus*

	Fringed brome ia native perennial, bunch grass with a well-developed root system. The leaves often have sparse long hairs. Fringed brome ocurs in a varieity of habitat types including forest, grassland, and riparian. It is commonly found in moist places such as wet meadows and along streams although it is tolerant of poorly drained or dry conditions. It grows best on loam, silty loam, and sand soil types. Fringed brome is highly palatable to livestock and wildlife as well as providing seeds and nesting cover. Its use for erosion control and short-term revegetation potential are rated medium, however its long-term revegetation potential is rated high. Photo byRuss Kleinman, Bill Norris, Karen Blisard, & Denise Friedrick, Georgetown Rd., Oct. 11, 2007
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=BRCI2 http://www.fs.fed.us/database/feis/plants/graminoid/brocil/all.html
Mature height (ft):	4.0
Fire resistant (yes/no):	No
Fire tolerance:	Medium
Low growing (yes/no):	No
Precipitation range (in.):	12-40
Minimum root depth (in.):	16
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Hairgrass, silver *Aira caryophyllea* L.

	An introduced grass, the stems arise from the base and it forms fibrous roots. Leaves are small and thin. Habitats include lawns as well as disturbed soils and roadsides. Photo by Robert Soreng. Courtesy of Smithsonian Institution, Department of Systematic Biology-Botany.
Website and fact sheet (for more information):	http://plants.usda.gov/java/profile?symbol=AICA&photoID=aica_003_ahp.tif
Mature height (ft):	0.5
Fire resistant (yes/no):	
Fire tolerance:	
Low growing (yes/no):	Yes
Precipitation range (in.):	
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	
Ecological-bridge suitability:	
Additional notes:	

Hard fescue *Festuca brevipila* Tracey

	Hard fescue is an introduced cool-season perennial bunchgrass used for stabilizing roadsides and ditch banks, farm tree plantings, cover in orchards, weed suppression, campsites and recreational areas, fairways for golf courses, farm landing strips, runway shoulders, logging roads, skid trails, ski slopes, dryland lawns and as cover for retired cropland. Photo by Clarence Kelley, USDA NRCS
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_febr7.pdf
Mature height (ft):	0.5
Fire resistant (yes/no):	no
Fire tolerance:	medium
Low growing (yes/no):	no
Precipitation range (in.):	12-26 in, high drought tolerance
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	slow
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	

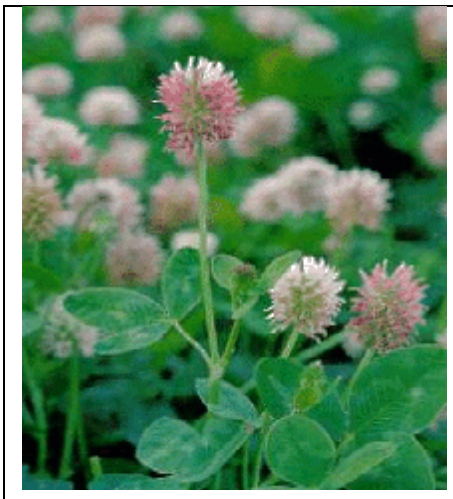
Horseflyweed (Yellow wild Indigo) *Baptisia tinctoria*

 Photo by Nelson DeBarros, United States.	Horsefly weed is an upright, multi-stemmed, warm season, shrubby perennial. It typically grows 2 – 3 feet tall. It is a member of the pea (Fabaceae) family which reproduces by seed or rhizomes. Horsefly weed is a good ground cover in dry sunny locations due to its shrubby habit, extensive root system and drought tolerance. It is a native legume, fixes atmospheric nitrogen in the soil and can be part of a good wildlife seed mixture where native grasses and forbs are seeded together. Horsefly weed prefers growing in dry, sunny locations in gravel, sandy or well-drained loamy soils. It has a high tolerance to acidic soils. It occurs on sand hills, pine flat woods, xeric woodlands, ridges and road banks.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_bati.pdf
Mature height (ft):	2.5
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	35-60
Minimum root depth (in.):	16
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes. Due to its extensive, thick, woody and deep root system; horsefly weed plants dislike root disturbances and should be left alone once established.
Ecological-bridge suitability:	
Additional notes:	Slightly toxic when ingested.

Indiangrass/Indian gamagrass	*Sorghastrum nutans*
	Indiangrass (*Sorghastrum nutans*) is a native, rhizomatous, perennial, warm-season grass. It is common in longleaf pine understory communities. Indiangrass is used for erosion control in critical areas, roadside cover and areas subject to wind erosion. It is moderately drought tolerant. Indiangrass is used in restoration of native prairie areas and longleaf pine understory sites. Growing singly, or in mixtures with other native grasses, Indiangrass provides livestock and wildlife forage on rangeland, pastureland, and hayland, as well as nest, brood and escape cover for bobwhite quail. Indiangrass seed is consumed by birds and small mammals. Photo by *Mike Owsley Jimmy Carter Plant Materials Center Americus, Georgia*
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_sonu2.pdf
Mature height (ft):	6.0
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	no
Precipitation range (in.):	11-45
Minimum root depth (in.):	24
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, moderate vegetative spread
Ecological-bridge suitability:	
Additional notes:	This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Kentucky bluegrass	*Poa pratensis*
	Kentucky bluegrass, is a perennial, cool-season, sod-forming grass native to Europe. Kentucky bluegrass is an excellent erosion control plant because of its dense, vigorous turf forming habit. It can be used in a mix with legumes or other grasses for erosion control in conservation cover, waterways, field borders, heavy use areas and critical areas such as steep banks and pond edges. This grass is palatable to livestock and wildlife. Photo by Robert H.Mohlenbrock , USDA NRCS 1989, Midwest Wetland Flora
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_popr.pdf
Mature height (ft):	1.5
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	yes
Precipitation range (in.):	24-65 in
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	Highly wear tolerant
Spread by rhizomes (may tolerate munitions impacts):	yes
Ecological-bridge suitability:	
Additional notes:	This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed..

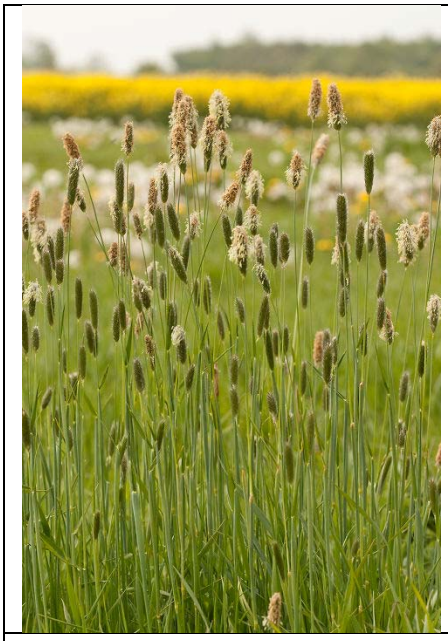
Kura clover *Trifolium ambiguum*

	Kura clover, or Honey clover, is an introduced perennial legume that spreads through rhizomes. It requires cross-pollination by bees (honey, bumble, alkali) to produce seeds. It is nutritious and persists many years in mixtures with grasses. Persistency is due in part to its heavy root biomass. It has seen limited use in the United States, primarily because of seed limitations. Kura clover is very cold hardy and performs best on well-drained fertile soil but can survive occaisional standing water and lower pH than other forage legumes. It does not seed well with other forage grasses because of low seedling vigor. Photo by C. Scheaffer, University of Minnesota, *Rhizobium* Research Laboratory
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=TRAM15 http://www.hort.purdue.edu/newcrop/cropfactsheets/kuraclover.html
Mature height (ft):	1.5
Fire resistant (yes/no):	No
Fire tolerance:	Medium
Low growing (yes/no):	No
Precipitation range (in.):	20-50
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Slow
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, slow vegetative spread
Ecological-bridge suitability:	
Additional notes:	Slight toxicity

Ladino clover	*Trifolium repens*
 Photo by Whitetail Institute	Ladino clover is a white clover cultivar of the large type. It spreads with prostrate solons. It is two to four times as large as common white clover. Ladino clover has, at diferent times, been designated as a variety, as an ecotype of white clover, and as a completely different kind of clover. White clovers will grow in soils considered too acid for red clover and alfalfa, but it is more productive if the soil pH is 5.5 or higher. It requires a high soil phosphate level and good management for maximum production. White or ladino clover is especially responsive to cool, moist conditions. Because of its shallow root system, it is not adapted to shallow, droughty soils. Ladino clover is widely used for forage, especially in pasture. It is high in protein digestibility, a heavy nitrogen fixer, easy to establish and moderately winter hardy. SEE WHITE CLOVER
Website and fact sheet (for more information):	http://extension.missouri.edu/p/G4639
Mature height (ft):	
Fire resistant (yes/no):	
Fire tolerance:	
Low growing (yes/no):	
Precipitation range (in.):	
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	

Little bluestem	*Schizachyrium scoparium*
 Photo by L. Glasscock. USDA SCS. 1991. *Southern wetland flora: Field office guide to plant species*. South National Technical Center, Fort Worth. Courte	Little bluestem is a medium height, perennial, warm season, bunchgrass with coarse stems and basal leaves. It is easily mistaken for common broomsedge. Little bluestem is one of the most widely distributed native grasses in North America. It will grow on a wide variety of soils but is very well adapted to well-drained, medium to dry, infertile soils. The plant has excellent drought and fair shade tolerance, and fair to poor flood tolerance. It grows preferentially on sites with pH 7.0 and slightly higher. It useful as a component of revegetation mixes, especially well-suited for use on thin upland range sites. Little bluestem is a fair forage species and is readily grazed by livestock, deer, and elk. Little bluestem seed is eaten by songbirds and upland gamebirds and the plant provides cover for ground birds and small mammals.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_scsc.pdf http://plants.usda.gov/java/charProfile?symbol=SCSC
Mature height (ft):	3.0
Fire resistant (yes/no):	no
Fire tolerance:	medium
Low growing (yes/no):	no
Precipitation range (in.):	12-45
Minimum root depth (in.):	14
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No vegetative spread
Ecological-bridge suitability:	
Additional notes:	

Meadow foxtail *Alopecurus pratensis*

	Meadow foxtail is an introduced perennial grass that spreads through rhizomes. The stems are erect and smooth. Leaves are narrow and hairless. This common plant is found on grasslands, especially on pH neutral soils. It prefers moist, fertile soils, but avoids water-logged, light or dry soils. It has alow drought tolerance. The species forms dense swards leading to low botanical diversi-ty. This species is widely cultivated for pasture and hay, and has become naturalised in many areas outside of its native range, including Australia and North America. Photo by www.davidkennardphotography.com
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=ALPR3
Mature height (ft):	3.0
Fire resistant (yes/no):	No
Fire tolerance:	Medium
Low growing (yes/no):	No
Precipitation range (in.):	18-60
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	No resprout ability
Spread by rhizomes (may tolerate munitions im-pacts):	Yes, vegetative spread slow
Ecological-bridge suitability:	
Additional notes:	

Oats, common — *Avena sativa L.*

	The common oat (*Avena sativa*) is an annual erect, bunchgrass grown for its seed. It has low drought tolerance. The seeds are a human food source as well as livestock feed. Photo by etc.usf.edu
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=AVSA
Mature height (ft):	2
Fire resistant (yes/no):	No
Fire tolerance:	None
Low growing (yes/no):	No
Precipitation range (in.):	25-100
Minimum root depth (in.):	8
Aggressiveness (fast, medium, slow growth rate):	Fast
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Orchardgrass	*Dactylis glomerata*
 Photo by Patrick J. Alexander.	Orchardgrass, is a persistent, cool season bunchgrass. Under dry land conditions, it usually develops distinct clumps and flower culms 15 to 18 inches tall. Leaves are usually less than 12 inches in height. When grown under irrigation or in more moist situations, it attains a much larger stature and grows together in a close stand. No vegetative spread has been observed. Orchardgrass is one of the earliest species to grow in the spring, making tremendous growth during cool conditions. Due to deep roots it also is capable of strong summer growth when conditions are favorable. Orchardgrass performs well on different textured soils ranging from clay to gravely loams and on shallow to deep soils. Because of its dense network of roots, orchardgrass provides good erosion control on those soils to which it is particularly adapted. It is also used in grass-legume mixes for nesting, broad rearing, escape and winter cover in upland wildlife and conservation plantings.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_dagl.pdf http://plants.usda.gov/plantguide/pdf/pg_dagl.pdf
Mature height (ft):	3.0
Fire resistant (yes/no):	no
Fire tolerance:	medium
Low growing (yes/no):	no
Precipitation range (in.):	32-65.
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	

Partridge pea	*Chamaecrista fasciculata*
 Photo by Clarence A. Rechenthin. Courtesy of USDA NRCS Texas State Office.	Partridge pea is an annual legume bearing many small, yellow-green leaflets which fold together when touched (common name is Sensitive Plant). Large, showy, yellow flowers arise from leaf axils. It grows on a wide range of soils that are slightly acid to moderately alkaline; however, it grows best on moderately lime, well drained soils. Partridge pea most commonly occurs as a pioneer or colonizer of disturbed areas. Partidge pea can be used along road banks and stream banks to control erosion. Partridge pea is considered an excellent species for planting on disturbed areas for erosion control and improving soil fertility. It establishes rapidly, fixes nitrogen, reseeds, and slowly decreases as other species in the seeding mix begin to dominate the site.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_chfa2.pdf http://plants.usda.gov/plantguide/pdf/pg_chfa2.pdf
Mature height (ft):	2.4
Fire resistant (yes/no):	No
Fire tolerance:	None
Low growing (yes/no):	No
Precipitation range (in.):	14-45
Minimum root depth (in.):	14
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	Slightly toxic

Perennial ryegrass *Lolium perenne*

	Perennial ryegrass grows from 1 to 2 feet tall with a bunchy form, and has medium longevity. There are numerous long, narrow, stiff leaves near the base of the plant. These grasses have a wide range of adaptability to soils, but thrive best on dark rich soils in regions having mild climates. They do not withstand hot, dry weather or severe winters. They will stand fairly wet soils with reasonably good surface drainage. Perennial ryegrass is a valuable forage and soil stabilization plant. Photo by media.web.britannica.com
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_lope.pdf
Mature height (ft):	2
Fire resistant (yes/no):	no
Fire tolerance:	low
Low growing (yes/no):	no
Precipitation range (in.):	30-65 in
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	

Prairie cordgrass	*Spartina pectinata*
 Photo by Jennifer Anderson. United States, IA, Scott Co., Davenport, Nahant Marsh. 2002.	Spartina pectinata is a species of cordgrass known by the common names prairie cordgrass, freshwater cordgrass, tall marshgrass, and sloughgrass. Prairie cordgrass is a tall, robust, native grass. Strong rhizomes separate this grass from the other desirable native warm season grasses. It is typically found on lower, poorly drained soils along roadsides, ditches, streams, marshes and potholes. It also occurs in floodplains, wet meadows and back dune areas. Prairie cordgrass grows well on seasonally dry sites, tolerates alkaline conditions and high water tables, but is intolerant of prolonged flooding. Prairie cordgrass is used for erosion control and to restore wetlands; it has a stiff stem and vigorous rhizomes that enable it to provide good shoreline cover, and contribute to wave energy dissipation. It can prevent erosion on earthfill dams, spillways and drainage channels and also acts as a windstrip barrier. It is not a forage resource; however prairie cordgrass forms thick stands around marshes, providing good cover for game birds, song birds and small mammals.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_sppe.pdf http://plants.usda.gov/plantguide/pdf/pg_sppe.pdf
Mature height (ft):	8
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	yes
Precipitation range (in.):	14-35
Minimum root depth (in.):	18
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, vegetative spread rapid
Ecological-bridge suitability:	
Additional notes:	This species has been investigated as a possible source of biofuel. This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Purple prairie clover *Dalea purpurea*

	Purple prairie clover is a native, warm-season, perennial, nitrogen-fixing legume. It is drought tolerant with low moisture usage and requires full sun. Purple prairie clover can be used in a mixture with grass and forbs to prevent soil erosion on dam structures, roadsides, and other critical erodible areas. This plant is highly palatable and nutritious. It is readily consumed by many types of wildlife and livestock but is deer resistant. The seed is consumed by birds and small mammals. The purple flowers also attract many different species of pollinators such as bees and butterflies. The plant does not tolerate continuous grazing or heavy overuse. Photo by Wynn Anderson. United States, NM, Valencia Co.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_dapup.pdf
Mature height (ft):	3.0
Fire resistant (yes/no):	No
Fire tolerance:	medium
Low growing (yes/no):	No
Precipitation range (in.):	16-24
Minimum root depth (in.):	16
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	No
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Purpletop/Purpletop tridens — *Tridens flavus*

	*Tridens flavus*, common name Purpletop, is a perennial, warm season bunchgrass with erect tufted culms. The seedhead is an open cluster, 8 to 14 inches long, spreading, pyramid -shaped, usually purple, but sometimes nearly black. Purpletop is consumed by all grazing livestock. With a high drought tolerance, it is well adapted to shallow, droughty, infertile soil and provides forage in the summer and on sites where cool season forages do not produce well. It can be planted alone or in mixes with other warm season grasses. Photo by Ted Bodner. James H. Miller and Karl V. Miller. 2005. *Forest plants of the southeast and their wildlife uses.* University of Georgia Press., Athens. Courtesy of University of Georgia Press.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_trfl2.pdf http://plants.usda.gov/java/charProfile?symbol=TRFL2
Mature height (ft):	2.5
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	17-61
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Red clover	*Trifolium pratense*
 Photo by Larry Allain. USGS NWRC	*Trifolium pratense*, red clover, is an introduced biennial or short-lived perennial legume growing from a single crown. Plants have hollow, hairy stems and branches. The taproot of red clover is extensively branched. Flowers grow in compact clusters or heads and are usually rose-pink in color. Seed pods are small, short, and contain kidney-shaped seeds that vary in color from yellow to deep violet. Red clover is primarily used for hay, pasture, silage, and soil improvement. It is a quick growing crop and easily established. It has low drought tolerance and grows best on well-drained loamy soils. It is shade tolerant. Red clover may be seeded in pure stands, but it is often mixed with cool season grasses such as orchardgrass, tall fescue, brome grasses and timothy. It can also be grown alone or with some warm season grasses such as dallisgrass and johnsongrass.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_trpr2.pdf http://plants.usda.gov/plantguide/pdf/pg_trpr2.pdf
Mature height (ft):	2.0
Fire resistant (yes/no):	No
Fire tolerance:	medium
Low growing (yes/no):	No
Precipitation range (in.):	18-65
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	Slightly toxic. This plant may become weedy or invasive in some regions or habitats and may displace other vegetation if not properly managed.

Red fescue	*Festuca rubra*
	Red fescue is a cool season, perennial, sod-forming grass. Leaves are bright green, wiry, and narrow. They are pressed together in a "V" shape and appear nearly round. Stems are usually bent at the reddish or purplish base and grow about 2 feet tall. The seedhead is contracted or narrow. Red fescue is an excellent soil stabilizer and is used extensively for stabilizing waterways, slopes, banks, cuts, and fills. This plant is tolerant of acid to slightly alkaline soil and some poorly drained soils. It is also somewhat tolerant of salt spray. Photo by Robert Soreng, courtesy of the Smithsonian Institution, Department of Systematic Biology-Botany,
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_feru2.pdf
Mature height (ft):	2 ft
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	yes
Precipitation range (in.):	30 – 70 in, considered drought resistant
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	medium
Wear tolerance for maneuver areas:	Hardy, wear resistant, shade tolerant, good for erosion control
Spread by rhizomes (may tolerate munitions impacts):	Yes, rapid vegetative spread
Ecological-bridge suitability:	
Additional notes:	

Redtop	*Agrostis gigantea*
	Redtop is a cool season rhizomatous perennial grass that makes a coarse but fairly dense turf. Redtop germinates very rapidly and develops an extensive root system. It is used for erosion control along riparian zones and wetlands. Its root system is well suited for holding soils on wetlands, waterways, ditchbanks and burned or cutover-timberland. Although it has a low drought tolerance, it is also found in pastures, used as a temporary grass in turf seedings and occasionally for hay. Redtop is used by wildlife. Redtop also performs well on acidic, low fertility soils. This species has been used to restore sites which are very acid to land affected with heavy metals and poor soil quality such as mine spoils. It has a higher tolerance of acidic soils than Kentucky bluegrass. Photo by Robert Soreng. Courtesy of Smithsonian Institution, Department of Systematic Biology-Botany.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_aggi2.pdf http://plants.usda.gov/plantguide/pdf/pg_aggi2.pdf
Mature height (ft):	2.0
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	yes
Precipitation range (in.):	28-60
Minimum root depth (in.):	14
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes – rapid rate of vegetative spread
Ecological-bridge suitability:	
Additional notes:	Redtop is an introduced species which can displace native vegetation under ideal conditions. It should not be planted in sites where revegetation of native species is desired. I

Reed canarygrass *Phalaris arundinacea*

	Reed canarygrass is a vigorous, productive, long-lived, perennial, sod- forming grass. It is a widespread species native to North America. The extensive, rhizomatous root system and dense growth of reed canarygrass provide excellent erosion control, especially along stream banks, shorelines and waterways. It is also well suited for use in seeding filter fields which collect wastewater from food processing industries, livestock operations, and sewage treatment plants. Reed canarygrass has good drought tolerance. Reed canarygrass is being cultivated in northern Europe as a biofuel Photo by Sheri Hagwood. Bureau of Land Management. United States, ID, Bureau of Land Management Jarbidge Resource Area. June 16, 2004.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_phar3.pdf http://plants.usda.gov/plantguide/pdf/pg_phar3.pdf
Mature height (ft):	2-9
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	no
Precipitation range (in.):	30-65
Minimum root depth (in.):	14
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	yes
Ecological-bridge suitability:	
Additional notes:	Slightly toxic. Reed canarygrass invades wet areas so its use along ditches, canals and drains can create maintenance problems; it can also be troublesome in wetland habitats. This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed

Riverbank wildrye	*Elymus riparius* Wiegand
	Riverbank wildrye is a native perennial, erect, cool-season bunchgrass with coarse foliage. It is used in river and streambank restoration and grows best in partial to full shade. It has a rhizomatous root system and is deer resistant. Riverbank wildrye is hardy in Zones 3-8. Photo by Robert H. Mohlenbrock. USDA NRCS. 1995. *Northeast wetland flora: Field office guide to plant species*. Northeast National Technical Center, Chester. Courtesy of USDA NRCS Wetland Science Institute.
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=ELRI
Mature height (ft):	4.5
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	no
Precipitation range (in.):	24-55
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	

Rough bentgrass *Agrostis scabra*

	*Agrostis scabra* is a common species of grass known by the common names rough bent grass and ticklegrass**.** It is a perennial bunchgrass growing mainly upright in form to heights around 2.5 feet. The leaves are rough with tiny hairs. It is native to much of North America, and widely known elsewhere as an introduced species. The tolerance of this grass to alpine climates makes it a good plant to use in revegetating disturbed land in such regions. It has a low tolerance for drought. It is known to spring up on sites where few other plants can grow, such as abandoned coal mines and soils polluted with sulfur, copper, and nickel. Photo byMax Licher.
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=AGSC5 http://swbiodiversity.org
Mature height (ft):	2.5
Fire resistant (yes/no):	no
Fire tolerance:	medium
Low growing (yes/no):	no
Precipitation range (in.):	14-60
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

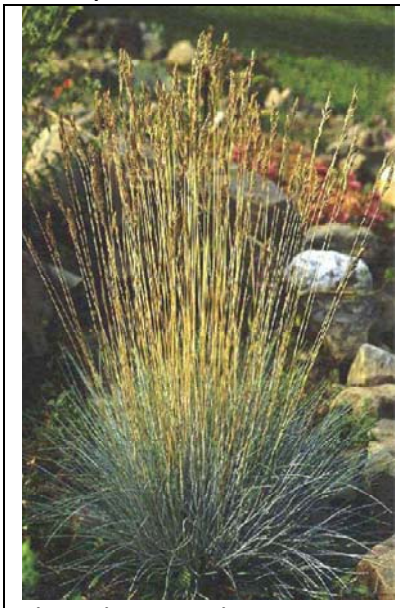
Roundhead Lespedeza	*Lespedeza capitata*
	Roundhead lespedeza is a native, perennial legume with stiff, erect stems that grow to a mature height of 2-3 feet. The plants have a deep and extensive root system that contributes to their drought tolerance. It is a desirable component in warm season grass mixtures; it fixes atmospheric nitrogen in the soil adding protein to the consumed forage, and is palatable and nutritious forage that is readily grazed by livestock. Roundhead lespedeza is recommended for use in plantings on critical areas, road right-of-ways, parks, and recreation areas for soil stabilization and beautification, wildlife habitat areas, and for prairie restoration. Photo byThomas G. Barnes.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_leca8.pdf http://plants.usda.gov/plantguide/pdf/cs_leca8.pdf
Mature height (ft):	2.6
Fire resistant (yes/no):	No
Fire tolerance:	high
Low growing (yes/no):	No
Precipitation range (in.):	19-45
Minimum root depth (in.):	18
Aggressiveness (fast, medium, slow growth rate):	Slow
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Saltmeadow cordgrass	*Spartina patens*
 Photo by Nelson DeBarros. United States.	This warm season, native, perennial grows from 1 to 4 feet tall, and spreads extensively by long slender rhizomes. Saltmeadow cordgrass is used for shoreline protection and tidal marsh restorations, and is often utilized for levee stabilization and dune stabilization plantings near coastal beaches and on barrier islands. Saltmeadow cordgrass is also an effective sediment stabilizer used on interior mudflats, dredge fill sites, and other areas of loose and unconsolidated soils associated with marsh restoration. In its natural state on the tidal marshes, dense stands of this grass cause suspended solids to settle out of floodwaters where it can then take up the available nutrients. Saltmeadow cordgrass also provides food and cover for many terrestrial and aquatic species of wildlife and is considered an important forage species to livestock producers along the gulf coast.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_sppa.pdf
Mature height (ft):	2.0
Fire resistant (yes/no):	yes
Fire tolerance:	high
Low growing (yes/no):	yes
Precipitation range (in.):	36-65 in.
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, rapid vegetative spread
Ecological-bridge suitability:	
Additional notes:	This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed.

Sand bluestem[2] *Andropogon hallii*

	Sand bluestem is a native, perennial, warm season bunch grass. It is tufted, forms sod, and has well-developed rhizomes. Sand bluestem is often recommended for erosion control plantings on sites which are sand, loamy sand or sandy loam. It has high drought tolerance and a moderate moisture requirement. Generally, it is planted as part of a mixture with other warm season grasses. Sand bluestem is a good to excellent forage for livestock and wildlife species. Upland birds eat the seeds. Because it frequently grows in large clumps and retains an upright vegetative structure throughout the winter it makes an excellent nesting habitat for many upland birds and small mammals. Photo by W.L. Wagner. Courtesy of Smithsonian Institution, Dept. of Systematic Biology, Botany.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_anha.pdf http://plants.usda.gov/plantguide/pdf/pg_anha.pdf
Mature height (ft):	6-7
Fire resistant (yes/no):	no
Fire tolerance:	low
Low growing (yes/no):	no
Precipitation range (in.):	10-32
Minimum root depth (in.):	20
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	yes, slow vegetative spread
Ecological-bridge suitability:	
Additional notes:	

Sand lovegrass	*Eragrostis trichodes*
	Sand lovegrass is a native, warm-season, short-lived, perennial bunch grass with a flat and narrow leaf blade. The blade will roll inward under dry conditions to conserve moisture; which gives the leaf blade a threadlike appearance. Sand lovegrass has a shallow, widely spreading root system. With a high drought tolerance, it is commonly found on sandy soil sites. Sand lovegrass is grazed by livestock and is sometimes cut for hay. Occasionally, it is included in range-seeding mixtures for quick cover and forage production. This grass is seldom a key management species. Photo by R. Alan Shadow, East Texas PMC, Nacogdoches, TX
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_ertr3.pdf http://plants.usda.gov/plantguide/pdf/pg_ertr3.pdf
Mature height (ft):	3.5
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	14-35
Minimum root depth (in.):	16
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Sheep fescue	*Festuca ovina* L.
 Photo by D. Ogle, NRCS, ID	Sheep fescue is an extremely variable cool season grass native to Europe, Asia and North America. In rangeland and pastureland plantings, sheep fescue is a competitive understory grass that controls erosion. The primary use of sheep fescue is ground cover because of its low growth form, low maintenance requirements and good drought tolerance. It is ideal for stabilization of disturbed soils because of its dense root system. It is commonly used to protect roadsides, airport landing strips, industrial and residential areas, ditch and canal banks, skid trails, clear cuts, ski hills, camp sites and other recreation areas from erosion. It provides excellent cover and erosion control in areas between trees rows of shelterbelts, windbreaks and tree farms.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/pg_feov.pdf
Mature height (ft):	0.5
Fire resistant (yes/no):	no
Fire tolerance:	medium
Low growing (yes/no):	no
Precipitation range (in.):	12-24
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	medium
Wear tolerance for maneuver areas:	Withstands moderate equipment traffic
Spread by rhizomes (may tolerate munitions impacts):	no
Ecological-bridge suitability:	
Additional notes:	

Sideoats Grama *Bouteloua curtipendula* (Michx.) Torr.

	*Bouteloua curtipendula*, sideoats grama, is a medium-sized perennial bunchgrass which can spread by rhizomes. This is the largest and coarsest of the grama grasses. It has a bluish-green color, sometimes with a purplish cast (especially in the spring), and cures to a reddish-brown or straw color. Leaves are coarser than other species of gramas, straight, comparatively stiff, and mostly basal. Ten to thirty small, non-comb-like spikes are borne mostly along one side of each central seed stalk. These spikes drop when mature, leaving a long zigzag stalk. Sideoats grama is found on rocky open slopes, woodlands, and forest openings up to an elevation of about 7,000 feet. It is a fair to good erosion control plant when mixed with the other plants naturally associated with it. Photo by Larry Allain
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_bocu.pdf
Mature height (ft):	3.0
Fire resistant (yes/no):	No
Fire tolerance:	Low
Low growing (yes/no):	Yes
Precipitation range (in.):	6 to 25
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Moderate growth rate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	It is currently listed as a threatened species in the state of Michigan.

Smooth brome	*Bromus inermis*
	*Bromus inermis*, smooth brome, is a leafy, sod-forming, perennial, cool season grass that spreads by rhizomes. This species is both native and introduced. It is resistant to drought and extremes in temperature. Smooth brome may be used for hay, pasture, or silage. It is compatible with alfalfa or other adapted legumes. Smooth brome can be used as a component in various upland wildlife and conservation cover mixes for nesting cover and food. Since the plant has a massive root system and is a sod former it can be used effectively for erosion control in critical areas and grassed waterways if the areas can be irrigated or where annual precipitation exceeds 20 inches. Photo by Larry Allain @USDA NRCS PLANTS Database
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_brin2.pdf http://plants.usda.gov/java/charProfile?symbol=BRIN2
Mature height (ft):	2.5
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	Yes
Precipitation range (in.):	18-60
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, rapid vegetative spread
Ecological-bridge suitability:	
Additional notes:	This species is no longer recommended for wildlife use in some states because of its aggressive and invasive nature.

Smooth cordgrass	*Spartina alterniflor*a
 Photo by USDA NRCS Golden Meadows PMC	Smooth cordgrass is a long-lived, warm season perennial that spreads extensively by long hollow rhizomes. It is the dominant emergent grass species found growing along tidal salt marshes of the Atlantic and Gulf coasts. It is utilized extensively for erosion control along shorelines, canal banks, levees, and other areas of soil water interface. Smooth cordgrass is an effective soil stabilizer used on interior tidal mudflats, dredge-fill sites, and other areas of loose and unconsolidated soils associated with marsh restoration. Under natural conditions on tidal marshes, vigorous stands of this grass will absorb wave energy and screen suspended solids from intertidal waters, while uptaking available nutrients in the sediments. It will also tolerate petroleum contaminated soils. Smooth cordgrass provides food and cover to a number of marsh birds and mammals and is an important forage species for livestock
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_spal.pdf http://plants.usda.gov/plantguide/pdf/pg_spal.pdf
Mature height (ft):	3.5
Fire resistant (yes/no):	no
Fire tolerance:	high
Low growing (yes/no):	yes
Precipitation range (in.):	40-100 in,
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, rapid vegetative spread
Ecological-bridge suitability:	
Additional notes:	Smooth cordgrass is considered an invasive species along the U.S. West Coast

Squarrose sedge	*Carex squarrosa*
	*Carex squarrosa* is a perennial sedge that forms a small tuft of leafy culms about 1¼-2½' tall. The root system is short, rhizomatous and fibrous. This sedge adapts to light shade or partial sun, wet to moist conditions, and soil containing loam, silt, sand, or gravel. Shallow standing water is tolerated if it is seasonal and temporary, rather than permanent but the plant is not drought tolerant. Squarrose sedge is used for erosion control and streambank restoration. Photo by Robert H. Mohlenbrock. USDA SCS. 1989. *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln. Courtesy of USDA NRCS Wetland Science Institute.
Website and fact sheet (for more information):	http://plants.usda.gov/java/profile?symbol=CASQ2 http://www.illinoiswildflowers.info/grasses/plants/sq_sedge.html
Mature height (ft):	3.0
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	34-55 in
Minimum root depth (in.):	8
Aggressiveness (fast, medium, slow growth rate):	Slow
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes. Slow vegetative spread.
Ecological-bridge suitability:	
Additional notes:	

Sudangrass	*Sorghum bicolor*
	Sudangrass is an annual or short-term perennial course, bunch grass. The leaves are broad and coarse, similar in shape to those of corn but shorter and wider; the blades are glabrous and waxy which helps conserve moisture within the plant. Sudangrass can grow in arid soils and can withstand prolonged drought. It has adapted to a wide range of soil types but does require good drainage. Photo by David E. Lemke, 2001, www.botany.cs.tamu.edu/
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=SOBID http://www.hort.purdue.edu/newcrop/duke_energy/Sorghum_bicolor.html
Mature height (ft):	2.5
Fire resistant (yes/no):	No
Fire tolerance:	None
Low growing (yes/no):	No
Precipitation range (in.):	17-40
Minimum root depth (in.):	9
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	Slightly toxic Used for biofuel production.

Sundial lupine (wild lupine, lupine) *Lupinus perennis*

 Photo by William S. Justice. Courtesy of Smithsonian Institution, Dept. of Systematic Biology, Botany.	Sundial lupine is a cool-season herbaceous perennial. Stalks are numerous, erect, striated, and slightly pubescent. Flowers can range from blue to pink, but are most often blue or bluish purple. The plant is able to fix atmospheric nitrogen in the soil, improving soil quality. Plants are drought tolerant and prefer dry sandy soils with good drainage, slightly acidic pH, and sun or part shade. Little information is available regarding other characteristics of wild lupine sites. Viable sundial lupine habitat is often difficult to maintain because it flourishes after fires and other forms of disturbance. One reason this occurs is that sundial lupine seed coats are so tough that only pressure changes due to rapid heating or abrasion are strong enough to allow water to penetrate and start germination. Moreover, fires, foraging, and mowing can improve habitat quality for established lupines by changing soil quality, vegetative structure, leaf litter depth. Sundial lupine is the only food for the larvae of the Karner Blue butterfly *(Lycaeides melissa samuelis).* Both fire suppression and habitat loss have contributed to the decline of the lupine and the butterfly.
Website and fact sheet (for more information):	http://plants.usda.gov/plantguide/pdf/cs_lupe3.pdf http://www.wildflower.org/plants/result.php?id_plant=LUPE3 http://www.fs.fed.us/database/feis/plants/forb/lupper/all.html
Mature height (ft):	2
Fire resistant (yes/no):	
Fire tolerance:	
Low growing (yes/no):	
Precipitation range (in.):	12-34
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	Considered rare, endangered or threatened in many Northeastern US States. This plant can be weedy or invasive. Seeds are toxic when ingested.

Sweetclover, yellow *Melilotus officinalis*

 *Photo by Russ Kleinman, Silver City, May 19, 2007. Western New Mexico University, Department of natural Sciences.*	Sweetclover is an annual to biennial introduced legume. The species is now widespread throughout North America in a broad array of habitats and plant communities. Sweetclover plants inhabit roadsides, riparian zones and other communities from low to middle elevations. Sweetclover is the most drought tolerant of the commercially available legumes Sweetclover provides food and cover to a variety of birds and animals and the flowers are attractive to bees and butterflies. Rapid growth and easy establishment make sweetclover a popular choice for reclamation seedings. Additionally, it works well in seed mixtures for road cuts, post-fire, mine spoils and other disturbed sites. Sweetclover, like other legumes, increases nitrogen in poor soils. The large taproot increases aeration and water absorption by opening the subsoil.
Website and fact sheet (for more information):	http://plants.usda.gov/plantguide/pdf/pg_meof.pdf http://www.pfaf.org/user/Plant.aspx?LatinName=Melilotus+officinalis
Mature height (ft):	5.0
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	17-60
Minimum root depth (in.):	32
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No.
Ecological-bridge suitability:	
Additional notes:	Moderate toxicity: Sweetclover plants contain coumarin. Sweetclover volunteers and spreads easily and can become an invasive species under optimum conditions.

Switchgrass	*Panicum virgatum* L.
	*Panicum virgatum*, switchgrass, is native to all of the United States except California and the Pacific Northwest. It is a perennial sod-forming grass that grows 3 to 5 feet tall and can be distinguished from other warm-season grasses, even when plants are young, by the white patch of hair at the point where the leaf attaches to the stem. The stem is round and usually has a reddish tint. The seed head is an open, spreading panicle. Photo by R. Mohlenbrock USDA-NRCS, Southern Wetland Flora @ plants.usda.gov
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_pavi2.pdf
Mature height (ft):	3 to 5
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	12 to 60
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes
Ecological-bridge suitability:	
Additional notes:	

Tall fescue

Schedonorus phoenix
Lolium arundinaceum

 Photo by Robert H. Mohlenbrock. USDA SCS. 1989. *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln. Courtesy of USDA NRCS Wetland Science Institute.	Tall fescue is a robust long-lived, comparatively deep rooted, bunchgrass. The leaves of forage types are broad, while turf types have been selected for narrow leaves. Tall fescue is adapted to cool and humid climates. It was widely used for forage and erosion control prior to the understanding of its endophyte status and implications. It is now recognized that the presence of the endophyte (in this grass and others) contributed to both the tough nature of the grass and the poor performance of grazing animals in the warmer months. It is suspected that this endophyte infected cultivar has been deleterious to wildlife as well. For these reasons, there are efforts by some groups to ban the use of tall fescue in some states.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_loar10.pdf http://plants.usda.gov/plantguide/pdf/pg_loar10.pdf
Mature height (ft):	3.0
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	Yes
Precipitation range (in.):	30-65
Minimum root depth (in.):	12
Aggressiveness (fast, medium, slow growth rate):	Rapid
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	Yes, slow vegetative spread
Ecological-bridge suitability:	
Additional notes:	Slight toxicity This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed. The user should be sure this grass will meet all the planting objectives and that there are not good alternative species before specifying its use.

Ticktrefoil, panicled leaf	*Desmodium paniculatum*
 Photo by Rick Mark.	Panicledleaf Ticktrefoil is a native, perennial, wildflower that grows in disturbed areas, in part shade. It is somewhat drought tolerant and its water use is low. It prefers clay or loam soils. This wildflower is a pioneer species that prefers some disturbance from wildfires, selective logging, and others causes. The sticky seedpods cling to the fur of animals and the clothing of humans and are carried to new locations. Panicledleaf Ticktrefoil attracts birds and is a good grazing and browsing plant for livestock and wildlife. Panicledleaf Ticktrefoil enriches the soil through nitrogen fixation.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_depa6.pdf http://www.wildflower.org/plants/result.php?id_plant=DEPA6
Mature height (ft):	3.0
Fire resistant (yes/no):	No
Fire tolerance:	none
Low growing (yes/no):	No
Precipitation range (in.):	45-90 in
Minimum root depth (in.):	6
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Ticktrefoil, showy *Desmodium canadense*

	Showy ticktrefoil is a tall native, perennial warm-season legume with clover-like leaves and showy pink flowers. The seed pods often break apart and adhere to clothing and to animals by means of small hooked hairs. Showy ticktrefoil occurs in prairies and wet meadows, along spring branches, and in open thickets. Showy ticktrefoil is used for wildlife food and cover (quail, pheasants, turkey, ground birds, and deer), and as a small component in seeding mixtures for prairie restoration. It is useful in mixtures with warm-season grasses. Photo by R. Alan Shadow USDA NRCS East Texas Plant Materials Center
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_deca7.pdf http://plants.usda.gov/plantguide/pdf/pg_deca7.pdf
Mature height (ft):	4
Fire resistant (yes/no):	yes
Fire tolerance:	high
Low growing (yes/no):	no
Precipitation range (in.):	
Minimum root depth (in.):	
Aggressiveness (fast, medium, slow growth rate):	Rapid seedling growth rate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Timothy	*Phleum pratense*
 Photo by James R. Johnson. USDA NRCS. 1992. *Western wetland flora: Field office guide to plant species*. West Region, Sacramento.	Timothy is a relatively short-lived, cool-season perennial that grows in stools or clumps and has a shallow, compact, and fibrous root system. Timothy is used for pasture and silage, but mostly for hay. It is palatable and nutritious. It also makes a good companion grass for alfalfa, trefoil, or clover as it is the grass least competitive with legumes. It is also used with legumes and/or other grasses in a mix for wildlife cover, as filter strips beside waterways, and other critical area applications. Timothy can also be used for erosion control on cut- or burned-over forestland. Timothy is shallow-rooted and should not be considered the primary species for erosion control plantings.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_phpr3.pdf http://plants.usda.gov/plantguide/pdf/pg_phpr3.pdf
Mature height (ft):	3.0
Fire resistant (yes/no):	no
Fire tolerance:	medium
Low growing (yes/no):	no
Precipitation range (in.):	30-65 in.
Minimum root depth (in.):	10
Aggressiveness (fast, medium, slow growth rate):	rapid
Wear tolerance for maneuver areas:	No. Timothy is shallow rooted
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Tufted hairgrass	*Deschampsia cespitosa*
 Photo by USDA NRCS Plant Materials Center, Corvallis, Oregon	Tufted hairgrass is a native perennial cool season species bunch grass. Stems are erect and the leaves are wide, flat or rolled, and mostly basal in a dense tuft. The seed head is upright to nodding, loosely branched, open, and 4 to 10 in. long. Tufted hairgrass is one of the most widely distributed grasses on earth, found in many arctic and temperate regions and from sea level to 14,000 ft in the mountains. Habitats include coastal terraces, upper tidal marshes, seasonally wet prairies, moist subalpine mountain meadows, open forests, and alpine areas above timberline. Plants commonly found growing with tufted hairgrass include sedges, rushes and bentgrass. It is not drought tolerant. Tufted hairgrass is useful for restoring moist to seasonally wet prairies and stabilizing disturbed sites, streambanks, canals, shorelines, and upper tidal marshes. Other applications include acid and heavy metal mine spoil reclamation, alpine and boreal revegetation work, and bio-filtration swales. As a range or pasture grass, it is a desirable, productive forage for cattle and sheep, particularly at higher elevations. Use by wildlife is variable; however it is valuable as a host plant for butterflies.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_dece.pdf
Mature height (ft):	3.4
Fire resistant (yes/no):	No
Fire tolerance:	High
Low growing (yes/no):	No
Precipitation range (in.):	14-24
Minimum root depth (in.):	14
Aggressiveness (fast, medium, slow growth rate):	Moderate
Wear tolerance for maneuver areas:	Varieties have been bred as wear resistant turf for golf courses, sports fields and other uses.
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	This grass spreads readily into newly disturbed areas, is a weed in certain forage crops, and can become a serious competitor with trees.

Virginia Wildrye	*Elymus virginicus*
	Virginia wildrye is a native, cool season, perennial bunchgrass which grows two to three feet in height. It reproduces by tillering and seed. Virginia wildrye self-fertilizes, but has been known to hybridize and introgress (outcrossing depression). It prefers moist soils, high soil fertility, and heavier soil textures and is shade tolerant. It can be found scattered on shaded banks, along fencerows and in open woodlands. Virginia wildrye can be used in range restoration as a cool-season grass, and in native range seed mixes. Photo by Larry Allain @ USDA-NRCS PLANTS Database
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_elvi3.pdf
Mature height (ft):	2.5
Fire resistant (yes/no):	No
Fire tolerance:	Medium
Low growing (yes/no):	No
Precipitation range (in.):	36 to 55
Minimum root depth (in.):	16
Aggressiveness (fast, medium, slow growth rate):	Moderate growth rate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

Wheat, common *Triticum aestivum*

	Common wheat is an annual erect bunchgrass with simple culms. It has a medium drought tolerance and low moisture use. It is a shade tolerant forage grass, important for livestock. Used for bread, beverage and industrial alcohol, livestock feeds and pastes. The straw is used for bedding, paper manufacture, and packing material. Photo by Robin R. Buckallew
Website and fact sheet (for more information):	http://plants.usda.gov/java/charProfile?symbol=TRAE http://www.hort.purdue.edu/newcrop/duke_energy/triticum_aestivum.html
Mature height (ft):	3.3
Fire resistant (yes/no):	No
Fire tolerance:	None
Low growing (yes/no):	No
Precipitation range (in.):	10-100
Minimum root depth (in.):	18
Aggressiveness (fast, medium, slow growth rate):	Fast
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions impacts):	No
Ecological-bridge suitability:	
Additional notes:	

White clover *Trifolium repens*

 Photo by Larry Allain. USGS NWRC	*Trifolium repens*, white clover, is an introduced perennial legume. It has a prostrate, stoloniferous growth habit. The leaves are composed of three leaflets, which may or may not have a "crescent" or "water mark" on the upper surface. Leaves and roots develop along the stolon at the nodes. The flower heads, each consisting of 40 to 100 florets, are borne on long stalks from the leaf axils. Florets are white but may have a pink hue. White clover thrives best in a cool, moist climate in soils with ample lime, phosphate, and potash. In general, white clover is best adapted to clay and silt soils in humid and irrigated areas. White clover is the most important pasture legume. It is highly palatable, nutritious forage for all classes of livestock as well as wildlife. White clover is commonly planted with orchardgrass, ryegrass, or tall fescue. White clover planted with orchardgrass produces the premier forage combination for intensive grazing systems in the Northeast. Solid stands of white clover form a good erosion control cover on moist fertile soils, but stands may be sparse or spotty on dry sites. Grass seedings benefit from the nitrogen fixed in the soil by the legume.
Website and fact sheet (for more information):	http://plants.usda.gov/factsheet/pdf/fs_trre3.pdf http://plants.usda.gov/plantguide/pdf/pg_trre3.pdf
Mature height (ft):	0.5
Fire resistant (yes/no):	Yes
Fire tolerance:	medium
Low growing (yes/no):	No
Precipitation range (in.):	24-70 in.
Minimum root depth (in.):	12
Aggressiveness—fast, medium, slow growth rate	Moderate
Wear tolerance for maneuver areas:	
Spread by rhizomes (may tolerate munitions	No but moderate vegetative spread by stolons.
Ecological-bridge suitability:	
Additional notes:	Slight toxicity. This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation.

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14. ABSTRACT

These guidelines were prepared to assist military land managers in the selection of appropriate seed mixtures for revegetation of actively used training lands located in the Northeast U.S. Recommending a seed mixture is complicated because of the great variety of land uses, soils, and plant selection goals. The goal was to keep the guidelines as simple as possible but still be able to recommend seed mixtures adapted for this region. A three-step process is presented that covers the important aspects of selecting a seed mixture that can meet revegetation goals on training ranges, airfields, and military operations in urban training (MOUT) sites. Tables include information to assist in the selection of species in seed mixtures for various soil types and characteristics, and land use. Characteristics of militarily important plants mentioned in this guide are included in the appendices that provide a summary table and individual plant description sheets.

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