

APPENDIX C - U.S. FOREST SERVICE PUBLICATIONS

SUGGESTED SEED MIXES FOR PIPELINE RIGHTS-OF-WAYS AND ASSOCIATED DISTURBANCES ON THE MONONGAHELA AND GEORGE WASHINGTON-JEFFERSON NATIONAL FORESTS

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Introduction

This document is meant to provide direction for assembling seed mixes to be used in reclamation and restoration of disturbed soils associated with pipeline installations and repairs/maintenance on the MNF and GW-Jefferson National Forests. Initially, the primary goal of seeding is to establish a vegetative cover to minimize surface erosion and sedimentation resulting from precipitation and surface flow. The secondary goal of these seeding guidelines is to assist with establishing an assortment of native species beneficial for wildlife and pollinators. All recommended species are commercially available.

Because this area possesses such diverse landscapes and microclimates, it is critical to deploy appropriate seed mixes in appropriate habitats. However, native plants that provide diverse wildlife benefits and structural diversity on the landscape often do not germinate or grow fast enough to provide initial erosion control. Therefore, fast-germinating, non-invasive, annual cover crops are recommended for the first round of seeding to stabilize exposed soil. Once those have established and erosion is no longer an immediate threat, native seed mixes tailored to site-specific conditions should be installed among the erosion control species where possible.

When using native seed, use as local an ecotype as is available, in the following order of preference:

- from within state
- from the mountain regions of an adjoining state
- from within 100 miles, as long as it is within the Appalachian mountain ecosystem

This document contains:

- Species recommendations for both temporary and permanent erosion control mixes
- Species recommendations for native mixes beneficial for wildlife and pollinators
- Site specific species recommendations for special site conditions (upland/high elevation, riparian, wetland, and dry low pH soils). Wetland indicator status codes are used to indicate species' soil moisture preferences. (USDA NRCS)

SPECIES FOR EROSION CONTROL

Temporary erosion control species:

To be applied

- wherever erosion control is needed outside of normal seeding seasons
- concurrent with permanent erosion control, and
- prior to permanent seeding with wildlife mixes, where such follow-up is appropriate.

Select at least two of the following species for temporary mixes, or suggest an existing erosion control seed mix containing at least some of these species but not containing anything that would act invasive at the site. Please describe how seed mixes will be adjusted to accommodate different slope classes (for example, 0-8%, 8-15%, 15-30%, 30-50%, etc.)

Table 1: Temporary erosion control species

Name	pH preference	Wetland Indicator Status
Annual Ryegrass (<i>Lolium multiflorum</i> (L. perenne var. italicum))	5.0-7.9	NI/moderate
German/Foxtail Millet (<i>Setaria italica</i>)	5.3-6.9	FACU
Cereal Rye (<i>Secale cereale</i>)	5.2-8.0	NI/damp
Browntop Millet (<i>Panicum ramosum</i>) (introduced in VA & south; possibly ok for WV?)	5.5-6.9	FACU

Permanent erosion control species:

To be applied

- only during normal seeding season in spring and fall
- on slopes too steep or inaccessible for planting equipment, or
- on areas planned to be left not in final grade for more than 1 year.

Select at least 5 of the following species for permanent mixes, or suggest an existing restoration seed mix containing at least some of these species but not containing anything that would act invasive at the site. Please also include at least one species from Table 1 or one non-native from Table 2 to provide quick cover and mulching/organic matter. Please describe how seed mixes will be adjusted to accommodate different slope classes (for example, 0-8%, 8-15%, 15-30%, 30-50%, etc.).

Table 2: Permanent erosion control species

Name	pH preference	Wetland Indicator Status
<i>Non-native</i>		
Hard Fescue (<i>Festuca ovina</i> var. <i>duriuscula</i> (F. longifolia))	4.5-8.5	NI/dry
Creeping Red Fescue (<i>Festuca rubra</i>)	5.8-8.0	FACU

Chewings Fescue (<i>Festuca rubra</i> ssp. <i>commutata</i>)	acid tol.	FACU
Redtop (<i>Agrostis alba</i>)	4.5-8.0	FACW
<i>Native</i>		
<i>Highly Preferred</i>		
Indiangrass, (<i>Sorghastrum nutans</i>)	5.0-7.8	UPL
Purpletop (<i>Tridens flavus</i>)	4.5-6.5	FACU
<i>Preferred</i>		
Autumn Bentgrass, (<i>Agrostis perennans</i>)	5.5-7.5	FACU
Canada Wildrye (<i>Elymus canadensis</i>)	5.0-7.9	FACU+
Creeping Red Fescue (<i>Festuca rubra</i>)	5.8-8.0	FACU
Deertongue (<i>Dichanthelium clandestinum</i>)	4.0-7.5	FAC+
Marsh (Dense) Blazing Star (Spiked Gayfeather), (<i>Liatris spicata</i>)	5.6-7.5	FAC+
New England Aster, (<i>Aster novae-angliae</i> (<i>Symphotrichum</i>))	?	FACW
Oxeye Sunflower, (<i>Heliopsis helianthoides</i>)	?	FACU
Panicledleaf Ticktrefoil, (<i>Desmodium paniculatum</i>)	6.0-7.0	FACU
Showy Ticktrefoil, (<i>Desmodium canadense</i>)	wide tol	FAC
Slender Bushclover, (<i>Lespedeza virginica</i>)	acid tol	NI/dry
Slender Mountainmint (<i>Pycnanthemum tenuifolium</i>)	?	FAC-FACW
Virginia Wildrye, (<i>Elymus virginicus</i>)	5.0-7.4	FACW-
Wild Bergamot, (<i>Monarda fistulosa</i>)	6.0-8.0	UPL
Wild Senna (<i>Senna hebecarpa</i> (<i>Cassia</i> h.))	circumn.	FAC
<i>Moderately preferred</i>		
Partridge pea (<i>Chamaecrista fasciculata</i>)	5.5-7.5	FACU
Blackeyed Susan, (<i>Rudbeckia hirta</i>)	6.0-7.0	FACU-
Grain Rye (<i>Secale cereale</i>)	5.2-8.0	NI
Switchgrass (<i>Panicum virgatum</i>)	4.5-8.0	FAC
Ticklegrass (Rough Bentgrass), (<i>Agrostis scabra</i>)	6.0-8.0	FAC

NATIVE SPECIES FOR WILDLIFE AND POLLINATORS

To be installed as permanent vegetation in areas accessible to necessary drill or other planting equipment. (Because native seed mixes need to be drilled or otherwise covered to enhance germination success, only areas accessible to the necessary equipment should be designated for follow-up native seeding.)

For each habitat type, pick at least five species, or suggest an existing restoration seed mix containing at least some of these species but not containing anything not native to the state, or anything that would act invasive at the site. A temporary cover crop will also likely be necessary to stabilize the site and protect overwintering seeds.

As with erosion control mixes, please describe how native seed mixes will be adjusted to accommodate different slope classes (for example, 0-8%, 8-15%, 15-30%, 30-50%, etc.).

Table 3: Native species for wildlife and pollinators (pH and Wetland indicator status left blank for duplicate species)

Name	pH preference	Wetland Indicator Status
<i>Dry Soils/Upland</i>		
Blackeyed Susan, (<i>Rudbeckia hirta</i>)	6.0-7.0	FACU-
Common Milkweed, (<i>Asclepias syriaca</i>)	calcareous	FACU
Indiangrass, (<i>Sorghastrum nutans</i>)	5.0-7.8	UPL
Oxeye Sunflower, (<i>Heliopsis helianthoides</i>)	?	FACU
Panicledleaf Ticktrefoil, (<i>Desmodium paniculatum</i>)	6.0-7.0	FACU
Partridge Pea, (<i>Chamaecrista fasciculata</i> (Cassia f.))	5.5-7.5	FACU
Showy Ticktrefoil, (<i>Desmodium canadense</i>)	wide tol	FAC
Switchgrass, (<i>Panicum virgatum</i>)	4.5-8.0	FAC
Virginia Wildrye, (<i>Elymus virginicus</i>)	5.0-7.4	FACW-
<i>High Elevation</i>		
Mountain Mint, <i>Pycnanthemum</i> spp.	?	FAC-FACW
Wild Bergamot, (<i>Monarda fistulosa</i>)	6.0-8.0	UPL
Virginia Wildrye, (<i>Elymus virginicus</i>)	5.0-7.4	FACW-
<i>Riparian</i>		
Autumn Bentgrass, (<i>Agrostis perennans</i>)	5.5-7.5	FACU
Big Bluestem, 'Niagara' (<i>Andropogon gerardii</i> , 'Niagara')	6.0-7.5	FAC
Boneset, (<i>Eupatorium perfoliatum</i>)	?	FACW+
Common Sneezeweed, (<i>Helenium autumnale</i>)	4.0-7.5	FACW+
Indiangrass, (<i>Sorghastrum nutans</i>)	5.0-7.8	UPL
Joe Pye Weed, (<i>Eupatorium fistulosum</i>)	4.5-7.0	FAC+
Maryland Senna (<i>Senna marilandica</i> (Cassia m.))	4.0-7.0	FAC+
New York Ironweed, (<i>Vernonia noveboracensis</i>)	4.5-8.0	FACW+
Partridge Pea, (<i>Chamaecrista fasciculata</i> (Cassia f.))	5.5-7.5	FACU
Spotted Joe Pye Weed, (<i>Eupatorium maculatum</i> (<i>Eupatoriadelphus maculatus</i>))	5.5-7.0	FACW
Swamp Milkweed (<i>Asclepias incarnata</i>)	5.0-8.0	OBL
Virginia Wildrye, (<i>Elymus virginicus</i>)	5.0-7.4	FACW-
Wild Senna (<i>Senna hebecarpa</i> (Cassia h.))	circumn.	FAC
<i>Wetland/Wet Soils</i> (pH indicators left blank in this section because the majority of “problem” acid soil sites are dry uplands. Wetland indicators left blank because all plants are appropriate for wetlands)		
Blue False Indigo, (<i>Baptisia australis</i>)		
Bottlebrush Grass, (<i>Elymus hystrix</i> (<i>Hystrix patula</i>))		
Canadian Anemone, (<i>Anemone canadensis</i>)		
Canadian Burnet, (<i>Sanguisorba canadensis</i>)		

Deertongue, 'Tioga' (<i>Panicum clandestinum</i> (<i>Dichanthelium</i> c.), 'Tioga')		
Fringed (Nodding) Sedge, (<i>Carex crinita</i>)		
Great Blue Lobelia, (<i>Lobelia siphilitica</i>)		
New York Ironweed, (<i>Vernonia noveboracensis</i>)		
Path Rush, (<i>Juncus tenuis</i> ,)		
Purple Node Joe Pye Weed, (<i>Eupatorium purpureum</i>)		
Redtop Panicgrass, (<i>Panicum rigidulum</i> (<i>P. stipitatum</i>))		
Soft Rush (<i>Juncus effusus</i>)		
Spotted Joe Pye Weed, (<i>Eupatorium maculatum</i> (<i>Eupatoriadelphus maculatus</i>))		
Squarrose Sedge, (<i>Carex squarrosa</i>)		
Swamp Milkweed (<i>Asclepias incarnata</i>)		
Switchgrass, 'Cave-In-Rock' (<i>Panicum virgatum</i> , 'Cave-In-Rock')		
Tussock Sedge, (<i>Carex stricta</i>)		
Wild Senna (<i>Senna hebecarpa</i> (<i>Cassia</i> h.))		
Woolgrass, (<i>Scirpus cyperinus</i>)		

Low pH (acidic) soils

Few of the species listed above would naturally grow well in acidic soils as defined in this project (pH less than 4.8) However, many of the species listed above would persist for several years following a lime addition with the initial seeding of soils. Blackberries and goldenrods do well in sunny, acid, dry soils, and ferns, lycopodiums, and mosses persist as vegetative cover in more shaded areas. The following are some suggestions of upland/dry site perennial species native to WV and VA, and the minimum pHs they can tolerate (all available from Ernst Seeds):

Table 4: Species for low pH soils

Name	pH preference	Wetland Indicator Status
Purpletop (<i>Tridens flavus</i>)	4.5-6.5	FACU
Purple lovegrass (<i>Eragrostis spectabilis</i> (Pursh) Steud.)	4.0-7.5	UPL
Virginia spiderwort (<i>Tradescantia virginiana</i>)	4.0-8.0	FACU
Common blackberry (<i>Rubus allegheniensis</i>)	4.6-7.5	FACU-
Canada goldenrod, (<i>Solidago Canadensis</i>)	4.8-7.5	FACU
Indian hemp (<i>Apocynum cannabinum</i>)	4.5-7.0	FACU
White avens, (<i>Geum canadense</i>)	4.5-7.5	FACU
Splitbeard bluestem (<i>Andropogon ternarius</i> var. Michx.) (native to VA & KY, & south; a warm season bunchgrass.)	4.0-7.5	FACU
Slender woodoats ((<i>Chasmanthium laxum</i> (<i>Uniola laxa</i>))	4.5-7.0	FAC

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SUGGESTED SEEDING TECHNIQUES FOR PIPELINE RIGHTS-OF-WAYS AND ASSOCIATED DISTURBANCES ON THE MONONGAHELA AND GEORGE WASHINGTON-JEFFERSON NATIONAL FORESTS

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Introduction

This document provides guidelines for erosion control seeding techniques in the reclamation and restoration of disturbed soils associated with pipeline installations and repairs/maintenance on National Forest lands. Erosion is an expected consequence of any soil disturbing activity that crosses variable and severe terrain. Therefore, a variety of short term and long term erosion control measures must be implemented. These include but are not limited to physical measures such as contouring; revegetation measures such as re-seeding and mulching; and follow up monitoring. This document specifically addresses seeding and mulching techniques.

The goal of this document is to assist contractors with designing projects so that projects are consistent with Forest Plan goals and objectives. Because every site is unique, guidelines are meant to be descriptive, not prescriptive. Specific proposals still need Forest Service approval. However, ensuring from the start that project designs are consistent with Forest Plan direction will facilitate both the review and implementation process.

Restoration objectives

The initial goal of seeding is to establish a vegetative cover to minimize surface erosion and sedimentation. The secondary goal of seeding is to assist with establishing an assortment of native species beneficial for wildlife and pollinators. Because native species often do not establish as easily nor spread as readily as species typically used for erosion control, it is important to use them in conjunction with erosion control species, and also to use techniques that maximize germination rates and likelihood of survival. This includes proper initial site stabilization, choosing appropriate site specific seed mixes, and using appropriate seeding techniques once the site has been stabilized. Follow-up monitoring and maintenance are also required so that site problems are dealt with immediately and treatments adjusted as needed.

This document includes guidelines for the following:

- 1) General erosion control and seeding
- 2) Seeding seasons
- 3) Nutrient additions
- 4) Mulch and binders

GENERAL DIRECTION FOR EROSION CONTROL AND SEEDING

Project plans must specify how each of these guidelines will be met.

- Placement of sequestered topsoil prior to seeding.
- Seed shall be Virginia or West Virginia certified seed (bag tags attached; seed certification shall meet each state's standards for their certified seed classification) or alternative seed sourced from approved distributors.
- USFS approval of treatments outside normal seeding seasons.
- All leguminous seed shall be either be pre-inoculated from a supplier, or mixed with inoculant specified for use on that particular seed according to manufacturer's directions. Inoculants shall be manually applied at double the manufacturer's rate. Inoculant shall be mixed with legume seed prior to mixing with other seeds. For hydro-seeding, use a minimum of five times the dry seeding rate of inoculant. (Flynn, 2015; Monsanto 2015)
- A minimum of 100 lbs/ac of seed will be applied when seeding for permanent erosion control (VA BMP) unless otherwise specified by the seed mix provider.
- A success standard/threshold, such as 70-85% ground cover, must be delineated, and provisions to monitor and report on site conditions. Please describe plans for implementing mitigation measures (in case of planting failures) to ensure planting success.
- Describe how subsoil will be tested for compaction, and loosened prior to topsoil replacement if necessary.
- Dry fertilizer and lime may need to be incorporated into the top 2-5 inches of soil after application, at rates indicated by the results of site-specific soil tests. Please describe plans for doing so. (FERC 2013, Virginia DEQ)
- All seeding must occur promptly after construction halts, either temporarily or permanently. Erosion control seed mixtures must be sufficient to stabilize sites for varying lengths of time, and seed mixes may need to vary depending on that timeframe. Please describe how quickly seeding will occur, and the decision thresholds for applying temporary versus permanent erosion control seed mixtures.
- Areas to be planted with species beneficial for wildlife after pipeline installation will be treated with temporary erosion control mix during a normal seeding season.
- Areas not to be treated with wildlife seed species will be treated with permanent erosion control seeding during a normal seeding season.
- Seeding rates should be doubled when hydroseeding (Steinfeld et. al., 2007)

NORMAL SEEDING SEASONS

Appropriate seasons for seeding can vary dramatically depending on elevation. Spring seeding can be conducted from March 15th – June 1st, and fall seeding can be done from August 15th – October 15th, but neither timeframe is appropriate in its entirety at all elevations. Please describe the timeframe in which seeding is proposed according to site specific elevations. Seeding windows should allow time for application, germination, and survival.

NUTRIENT ADDITIONS

In the absence of soil chemistry tests, the following guidelines can be used to develop fertilizer and liming rates. **Whenever possible, nutrient additions should be based on soil chemistry data in the interpretations provided with the order 1 soil survey.**

Fertilizer: 600-800 lbs/ac, 10-20-10 (Nitrogen, Phosphorous, Potassium), 400 lbs/ac 15-30-15, 800-1000 lbs/ac 10-10-10.

Lime: 1500-4000 lbs/ac (pelletized or dust), 4000 lbs/ac, Hydro Lime (2.5 gal container is equivalent to 1000 lbs limestone)—5-10 containers /ac.

MULCH AND BINDERS

Use of mulch materials and binders will be needed. Use of hay is prohibited on National Forest land due to invasive species concerns. Below are some guidelines that apply when selecting these materials for various sections of the ROW. Please describe how each of these issues will be addressed. All techniques must be appropriate for the % slope on which they will be applied. Please describe how mulching, seeding, and binding techniques will be adjusted to accommodate different slope classes (for example, 0-8%, 8-15%, 15-30%, 30-50%, etc.)

- Materials must be certified weed free or be accompanied by vendor's test results for noxious weed content.
- Seeded areas can be mulched with weed free straw at a rate of 2-4K lbs/ac, hand spread or blown, fiber mulch hydro-seeded at 1500-2000 lbs/ac., or other appropriate material.
- Natural biodegradable products are preferred. Materials must be demonstrated to be free of invasive species, including but not limited to plants, pests, and pathogens.
- Hydraulic erosion control products (HEPC) must be suitable for wildlife.
- If the use of stabilization netting is required/permitted, wildlife friendly geotextiles must be used. These products must either not contain netting, or netting must be made of 100% biodegradable non-plastic materials such as jute, sisal, or coir fiber. Plastic netting (such as polypropylene, nylon, polyethylene, and polyester), even if advertised as biodegradable, is not an acceptable alternative. Any netting used must also have a loose-weave design with movable joints between horizontal and vertical twines to reduce the chance for wildlife entanglement, injury, or death. (CA Coastal Commission, 2012)
- Avoid the use of silt fences reinforced with metal or plastic mesh.
- When no longer required, (after soils are stable and the vegetative cover is established), temporary erosion control and sediment control products should be promptly removed.
- Any products that require mixing with water need to have a Forest Service-approved water source. The source of water must not be contaminated with non-native invasive organisms that could spread into streams.

Hydroseeding

- Wood-fiber hydraulic mulches are generally short-lived and require a 24-hour period to dry before rainfall occurs.

- Wood fiber naturally has tackifying properties, but fiber alone may not be sufficient on steep slopes. In those cases the addition of a tackifier will help keep the seeds in contact with the soil. Describe plans to assess when this will be necessary, and describe the tackifier and application methods to be used.
- As wood chips, shredded woody materials, and other high-carbon materials decompose, they remove plant nutrients such as nitrogen from the soil. This can reduce soil fertility and make it difficult for grasses to grow. This should be taken into account when planning restoration seeding.

Binders

- The use of hydroseeding with binders will most likely be required in many areas on FS lands due to the steep terrain. Please describe site conditions where this will be used.
- The success of soil binders are somewhat dependent on the soil type present. If soil is compacted or high in clay and silt, soil binders may not penetrate soil surfaces.
- Whether short-life or long-life, soil binders should be non-toxic and organic based, such as guar, psyllium, or pitch and rosin emulsions. Please describe type of binder to be used under what circumstances, and specific application rates and methods.
- Materials or additives used as binders or emulsifiers cannot be toxic to soil organisms or otherwise prevent or inhibit seed germination.

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