

## **Appendix 3: Planting and Seeding Guidelines**

### **Planting and Seeding Guidelines on State Forestlands**

#### **Background**

Supplemental planting on state forestland is a common practice for activities such as re-vegetating a log landing after harvest, erosion and sedimentation control, forage and cover habitat in wildlife openings, and restoration in gas development areas. The Bureau of Forestry (BOF) oversees the Wild Plant Program in Pennsylvania and encourages the use of native species in supplemental plantings whenever possible. Native species are especially appropriate in areas that support populations of species of concern, contain wetlands, or have a pristine character. However, native species do not always fully support the purpose of the planting and non-native species may be preferred and justified. For example, many native grass species do not rapidly colonize a site for two growing seasons, which may not satisfy erosion and sedimentation plan requirements. To ensure ecologically-sound use of non-native plants, these guidelines were developed to assist foresters and land managers in deciding the appropriate use of non-native plantings on state forestlands.

According to the federal Executive Order 13112 of February 3, 1999, "An 'invasive species' is defined as a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health." In the sustainable management of forest ecosystems in Pennsylvania, plants classified as 'invasive' are likely to cause environmental harm through decreasing native biodiversity, hindering regeneration process, altering wildlife habitat, or threatening natural processes. Not all non-native plants that become naturalized in PA forests cause environmental harm, and therefore, are not considered invasive.

While DCNR has determined several species to be invasive due to experience, on-going research or other factors, not enough information has been compiled on other non-native species to consider their potential 'invasiveness'. However, some non-native species used on state forestland may be deemed invasive in surrounding states or have similar characteristics as invasive species, but have not been fully assessed for invasive potential in PA. The purpose of these guidelines is to determine parameters around which non-native plants are examined for 'invasive potential' and subsequently permitted or barred for use on state forestland. These guidelines will change over time, as monitoring results inform land managers on the consequences of using particular non-native species in forest management.

The BOF administers state forests in Pennsylvania, which are certified with the Forest Stewardship Council (FSC). In doing so, we are committed to the sustainable use of state forestlands, which includes protecting and conserving native plant communities and making wise decisions about state forest management. As part of the FSC requirements, the BOF will

track, justify, and monitor the use of non-native species on state forestlands through these guidelines. In addition, these planting guidelines may extend beyond state lands to other state and private lands, including programs that encourage environmentally-sound forest management practices, such as the Forest Stewardship Program.

### **Planting of non-native species**

Non-native plant species fit into three categories for use on state forestland:

1. Determined invasive. Do not plant.
2. Potentially invasive (need more information). May plant with caution and monitoring.
3. Not invasive. May plant with particular specifications noted.

### ***Deemed Invasive: Do Not Plant***

Any plant classified as a **noxious weed** by the Pennsylvania Department of Agriculture is barred for planting use on state forestland. It is illegal to cultivate, sell, transport, or plant any species classified as a noxious weed in PA. For a complete list of plants classified as noxious weeds in PA, visit [Natural Resource Conservation Service Invasive and Noxious Weeds List](#) . This includes *Sorghum bicolor* cv. *drommundii* (shattercane) and *Sorghum halepense* (Johnsonweed). Often, seed distributors do not list the particular species of sorghum they sell. To reduce the risk of introducing a noxious weed on state forestland, do not plant *any* sorghum species. Some sorghum species may also be toxic to wildlife.

For the purposes of these planting guidelines, plant species are deemed invasive if they are found on the DCNR Invasive Plant list ([DCNR Invasive Plant Tutorial for Land Managers](#)). Some of these species may have been planted on state forestland in the past. However, current standards forbid the use of these plants on state forestland. *Do not plant* any of these species without a waiver from Ecological Services. Species on the DCNR 'Watch' list (e.g. *Miscanthus sinensis*, Chinese silvergrass or *Poa trivialis*, rough bluegrass) are also considered on the *do not plant* list because their invasive qualities in natural situations have been documented in these species in PA.

Some of the plant species DCNR now considers undesirable and invasive have a long history of being planted on state forestlands. Autumn olive (*Elaeagnus umbellata*), Japanese barberry (*Berberis thunbergii*), and Oriental bittersweet (*Celastrus orbiculatus*) were popular plantings in wildlife openings, rights-of-way, and around building facilities. However, after a few decades on the landscape, these species did not remain confined to where they were planted and spread to forestlands and other habitats, directly competing with native flora and decreasing wildlife habitat quality. Recently (past 5 years), the following species have been planted on state forestland, but are now considered invasive by DCNR or should be watched for invasiveness:

- a. European alder (*Alnus glutinosa* – now deemed invasive)

- b. Tall fescue (*Festuca elatior* – now deemed invasive)
- c. Rough bluegrass (*Poa trivialis* – watch list)

**Plant with caution and monitoring (Monitoring List)**

Many plants have been used in seed mixes on state forestland with relative success and little signs of aggressiveness. However, more information may suggest that some of these species may become invasive or jeopardize native plant communities or wildlife habitat. These species may continue to be planted on state forestland, but need to be monitored to assure they are not becoming invasive (see attached protocol).

| Common name                         | Scientific name                                | Rare*? | Species of Concern (PNDI)   | Rationale   | Potential habitats where aggressive   |
|-------------------------------------|--|--------|---|---|---|
| Bird's-foot trefoil                 | <i>Lotus corniculatus</i>                      |        |   | Invasive in VA, TN, MO, IL, WI, MN, WA, OR, CA.   | Prairies, disturbed areas, roadsides, high seed production in burned areas. |
| Kentucky and other exotic Bluegrass | <i>Poa pratensis</i><br><i>P. spp.</i>         | Yes    | <i>Poa autumnalis</i><br><i>P. languida</i><br><i>P. paludigena</i> | Any bluegrass should be avoided in plantings unless native and from native seed source.   | Meadows, fields, and semi-open woods; more mesic to rich soils.             |
| Bristly locust                      | <i>Robinia hispida</i><br>var. <i>fertilis</i> |        |   | Native to southern US, but not PA. Monitor for now.   | May act aggressively, similar to black locust.                              |
| Chufa sedge, yellow nutsedge        | <i>Cyperus esculentus</i> (all varieties)      |        |   | Classified as a noxious weed in many western states. Mentioned as a 'serious weed' in Plants of PA.   | Wet or moist soils.   |
| Creeping red fescue seed            | <i>Festuca rubra</i>                           |        |   | Native to US, but not PA. Seems like a 'shady lawn' species and should be avoided. All fescues should be avoided unless native to PA and from native seed source. | Threat to native prairies and other open habitats.                          |
| Korean lespedeza                    | <i>Kummerowia stipulacea</i>                   | No     |   | Invasive in KY and TN.  | Threat to native prairies and other open habitats.                          |
| Norway spruce                       | <i>Picea abes</i>                              |        |   | On many 'watch' lists. Will naturalize along with native vegetation, perhaps not show invasive characteristics, but should document this.                         | In and surrounding areas where planted.                                     |

| Common name       | Scientific name  | Rare*? | Species of Concern (PNDI) | Rationale  | Potential habitats where aggressive  |
|-------------------|--|--------|---------------------------|--|--|
| Orchard grass     | <i>Dactylis glomerata</i>                                    | No     |                           | Clumping and recommended in our leases, but listed as invasive in: MD, VA, TN, VA, SD, WY, CO, UT, AZ, WA, OR                          | Threat to native prairies and other open habitats. Areas where native warm season grasses are preferred. |
| Perennial rye     | <i>Lolium perenne</i> ssp. <i>Perenne</i>                    |        |                           | Similar to annual rye but should remain on monitoring list. The perennial is known to be more aggressive.                              | Disturbed ground, permanent openings, etc.   |
| Rape              | <i>Brassica rapa</i> , <i>B. campestris</i> spp. <i>rapa</i> |        |                           | Considered noxious weed in MI and with USCOE. Known to poison livestock, Inv: MD, VA, TN, TX. <i>B. napus</i> does not need monitored. | Threat to native prairies and other open habitats.   |
| Redtop            | <i>Agrostis gigantea</i>                                     |        |                           | Very fast growth, not recommended at high seed rates. Inv: NY, VA, TN, OR.   | Wet to moist soils in open areas, open riparian areas.   |
| Sawtooth oak      | <i>Quercus acutissima</i>                                    |        |                           | Invasive in MD, VA, TN, SC. Discourage planting, but may with thorough monitoring. Suggest scrub oak as an alternative.                | Food plots and other open areas adjacent to forest land. Potentially in dry forest land.                 |
| Sericea lespedeza | <i>Lespedeza cuneata</i>                                     | No     |                           | Noxious weed in CO, KS. Spread throughout the eastern US.  | Threat to native prairies and other open habitats.   |

\*Members of genus are rare, but may not be the species used in plantings. Avoid or consult with Ecological Services when planting rare species.

Currently, this document does not contain a protocol for monitoring. Please consult with monitoring botanists in Ecological Services and the Inventory Section for a specific protocol. At this time, the protocol is being developed as part of the state-wide monitoring efforts.

A species on the Potentially Invasive list may be moved to the Not Invasive list when they have been adequately monitored to determine that the species is not expanding past the original seeded/planted site and jeopardizing native plant communities or wildlife habitat. Conversely, a species on this list may be moved to the 'Invasive: Do not plant' list if it consistently exhibits invasive qualities by becoming established beyond the originally intended seeded/planted site and posing a threat to native plant communities or wildlife habitat. A species may be restricted from planting only in particular situations, but allowed in most plantings based on the results

(e.g. a species may not be planted in a geographic region of the state due to its distinct behavior in this region compared to the rest of the state).

The final determination to move species off the ‘Potentially Invasive’ list will be determined by Ecological Services as a result of the monitoring and other information. Ecological Services will notify the districts of any species changes among these lists.

**Not Invasive: May plant with particular specifications noted.**

The following list of plants has been planted on state forestland in the past. Some are native to Pennsylvania, some are not native. However, there is little to no evidence to suggest these species will have invasive tendencies. Until further documentation is presented to suggest otherwise, these species may be planted on state forestland. No monitoring is necessary; however, records should be kept that includes the rate and location of **all** species planted on state forestland.

| Common name         | Scientific name  | Native? | Species of Concern (PNDI)                              | Rationale for no monitoring   |
|---------------------|--|---------|--|---|
| Alfalfa             | <i>Medicago sativa</i>   | No      |  | Not listed in nearby states, minor in Canada, no longevity on site, shade intolerant.   |
| Alsike white clover | <i>Trifolium hybridum</i>  | No      |  | Not listed as invasive in neighboring states. Not drought hearty, shade intolerant. A lot of input required to maintain clover where planted. |
| Annual rye**        | <i>Lolium perenne</i> ssp. <i>Multiflorum</i> , <i>Lolium temulentum</i> |         |  | 'Lesser threat' in KY, concerns on invasiveness in HI, AK, OR, CA. Need monitoring results.   |
| Asters              | Many genera  | Yes/No  | Several species in different genera (see PNHP website) | Do not plant PNDI species, unless of local genetic origin. Please consult with Ecological Services if interested in planting asters.          |
| Austrian winter pea | <i>Pisum sativum</i>   | No      |  | No evidence to suggest invasive.  |
| Autumn bentgrass    | <i>Agrostis perennans</i>  | Yes     |  |   |
| Barley              | <i>Hordeum vulgare</i>   | No      |  | No evidence to suggest invasive. ID only state to list as invasive.   |
| Big bluestem        | <i>Andropogon gerardii</i>   | Yes     |  |   |
| Blackeyed susan     | <i>Rudbeckia</i>   | Yes     | <i>Rudbeckia fulgida</i>                               | Avoid planting <i>R. fulgida</i> unless from local genetic origin.  |

| Common name               | Scientific name                  | Native? | Species of Concern (PNDI)   | Rationale for no monitoring   |
|---------------------------|----------------------------------|---------|---|---|
| Bottlebrush grass         | <i>Elymus hystrix</i>            | Yes     |   |   |
| Buckwheat                 | <i>Fagopyrum esculentum</i>      | No      |   | Known to exude allelopathic chemicals. Low rating from Weed Risk Assessment for Hawaii.   |
| Chinese chestnut          | <i>Castanea mollissima</i>       | No      |   | Not listed as invasive on any lists. UFL notes 'little, if any invasive potential at this time'.  |
| Crabapples, apples        | <i>Malus</i> spp.                | No      |   | Should not act aggressively. May escape and naturalize, but not become invasive.  |
| Crimson cover             | <i>Trifolium incarnatum</i>      | No      |   | Not listed as invasive in neighboring states. Not drought hearty, shade intolerant. A lot of input required to maintain clover where planted. |
| Deer-tongue grass         | <i>Dicanthelium clandestinum</i> | Yes     |   |   |
| Flat pea                  | <i>Lathyrus sylvestris</i>       | No      |   | Not listed on any invasive species lists, except 'potentially invasive' on NRCS website.  |
| Fox sedge                 | <i>Carex vulpinoidea</i>         | Yes     |   |   |
| Goldenrod                 | <i>Solidago</i> spp.             | Yes     | <i>Solidago erecta,</i><br><i>S. curtisii,</i><br><i>S. rigida,</i><br><i>S. roanensis,</i><br><i>S. simplex,</i><br><i>S. speciosa,</i><br><i>S. uliginosa</i> | Be careful to not plant species of concern, unless of local genetic origin.   |
| Hairy wild rye            | <i>Elymus villosus</i>           | Yes     |   |   |
| Hawthorns                 | <i>Crataegus</i> spp.            | Yes/No  |   | No monitoring needed if using species specified on list as OK (see below). Do not plant near species of concern in same genus.                |
| Japanese larch            | <i>Larix kaempferi</i>           | No      |   | Not listed as invasive on any lists. SFL plantings have not expanded beyond their original boundaries.  |
| Kale                      | <i>Brassica oleracea</i>         | No      |   | No evidence to suggest invasive.  |
| Ladino/Dutch white clover | <i>Trifolium repens</i>          | No      |   | Not listed as invasive in neighboring states. Not drought hearty, shade intolerant. A lot of input required to maintain clover where planted. |
| Medium red clover         | <i>Trifolium pratense</i>        | No      |   | Not listed as invasive in neighboring states. Not drought hearty, shade intolerant. A lot of input required to maintain clover where planted. |

| Common name                           | Scientific name  | Native? | Species of Concern (PNDI)   | Rationale for no monitoring   |
|---------------------------------------|--|---------|---|---|
| Milkweed                              | <i>Asclepias</i> spp.                                  | Yes     | <i>Asclepias rubra</i> ,<br><i>A. variegata</i>   | Just be careful to not plant species of concern, unless of local genetic origin.  |
| Millet                                | <i>Milium</i> or<br><i>Panicum</i>                     | Yes/No  | <i>Panicum amarum</i> var.<br><i>amarulum</i> , <i>P. flexile</i> , <i>P. longifolium</i> | <i>Panicum</i> may be native and OK (SOSC in surrounding states). Little evidence of <i>Milium</i> being invasive in eastern US.                    |
| Oats                                  | <i>Avena fatua</i>                                     | No      |   | Will escape on disturbed/waste grounds, but annual species and should not act aggressively.   |
| Partridge pea                         | <i>Chamaecrista fasciculata</i>                        | Yes     |   | Good substitute for trefoil.  |
| Pennsylvania sedge                    | <i>Carex pensylvanica</i>                              | Yes     |   | Good native species to use in shaded conditions.  |
| Pitch x loblolly pine hybrid          |  | No      |   | Not preferred if native pure pitch pine will suffice, but may be planted if deemed a need.  |
| Rape, turnip, swede, dwarf essex rape | <i>Brassica napus</i>                                  | No      |   | Little evidence of invasive tendencies and not on invasive plant lists in US. <i>B. rapa</i> on monitoring list, however.                           |
| Red pine                              | <i>Pinus resinosa</i>                                  | Yes/No  |   | Not native in all the places it is planted in the state, but OK to plant. Does not frequently escape or expand its range.                           |
| Riverbank wild rye                    | <i>Elymus riparus</i>                                  | Yes     |   |   |
| Rye seed                              | <i>Secale cereale</i>                                  | No      |   | Inv: WA, OR. Annual winter cover crop. Likely OK.   |
| Side oats gramma                      | <i>Bouteloua curtipendula</i>                          | Yes     | <i>Bouteloua curtipendula</i>   | Use genetically local source when planting this species. Please consult with Ecological Services for more information.                              |
| Switchgrass                           | <i>Panicum virgatum</i>                                | Yes     |   |   |
| Virginia wild rye                     | <i>Elymus submuticus</i> ,<br><i>Elymus virginicus</i> | Yes     |   |   |
| White spruce                          | <i>Picea glauca</i>                                    | No      |   | Not native to PA, but little invasive potential and useful in many plantings. Do not allow to over take the importance of planting native conifers. |
| Wild rye                              | <i>Elymus</i> spp.                                     | Yes     | <i>Elymus trachycaulus</i>  |   |
| Winter Wheat                          | <i>Triticum aestivum</i>                               | No      |   | Only inv in Death Valley, CA. Annual grass. Good cover crop.  |

## **Additional Planting Guidelines**

In addition to the above restrictions on specific species/genera, the following planting guidelines are to be followed on state forestlands:

- a. Species with rare, threatened or endangered status (PNHP species of concern) are generally not planted unless we have a species recovery plan for that species. In general these plans specify that genetic stock originate from as close to the planting site as possible. If it is not possible to obtain local genetic material, selections are made from ecologically similar environments. Special exceptions may be made within the framework of research agreements. Please consult with Ecological Services when planting a species of concern.
- b. Native tree species with no special status (PNHP species of concern) may be planted. Pennsylvania stock is preferred and cultivars should be generally avoided. Use Penn Nursery as the primary supplier of seedling stock, which is grown from open pollinated district sources on SFL or from our own seed orchards.
- c. Currently, the BOF does not allow planting of non-natives in Natural or Wild Areas, though this judgment is under review due to the loss of hemlock. Please consult with Ecological Services if interested in using a non-native species in a Natural or Wild Area.
- d. Former plantations of exotic species (after recent harvests of lands with vegetation typing indicating plantation) may be replaced by the same species if deemed important for local reasons. Conversion to natural native stands is encouraged unless there is a special local attachment to the plantation area (e.g. CCC plantation surrounding picnic area). These historical and replacement plantings need not be monitored if the historical significance is documented.
- e. Species not used before (experimental plantings) are approved on a case by case basis and logged and monitored as a research agreement. Please consult with Ecological Services if interested in planting a species that was not used before.
- f. Make every effort to use weed-free seed, dirt, gravel, and mulch in plantings. This will significantly decrease the likelihood invasive species are accidentally introduced in the materials used. Where possible, encourage the use of straw over hay to reduce the likelihood of weed seed. In the past, some foresters have inspected farm fields to verify the source stock does not contain weeds. The resulting dense timothy seen on some log landing sites is suspected to have been from the mulch (straw/hay) used on the seed, not the seed mix itself, so weed-free mulch is also important.

- g. The species found in this document were researched based on past use on state forestland. Other species other than those included on the above lists may be included in plantings on state forestland. If you are aware of another species that is commonly used on your district, but was not found in this document, please contact Carrie Gilbert, 717-783-0383, [cagilbert@state.pa.us](mailto:cagilbert@state.pa.us) or Chris Firestone, 570-724-8149, [cfirestone@state.pa.us](mailto:cfirestone@state.pa.us). Likewise, if you are interested in using a species that is not mentioned in this document, contact Ecological Services for more information.
- h. For some additional suggestions on alternatives to invasive species, visit [Ohio's Division of Wildlife suggestions](#).

### **Planting Suggestions**

- Use species representative of the area.
- Native species may not require lime and fertilizer inputs.
- Cool season grasses should be mixed in with warm season grasses for quicker perennial cover.
- Although the optimum time to seed natives is in April, mid-November through April may also be successful.
- Do not expect immediate cover of warm season grasses, as these take time to mature.
- Fall may be the best time to purchase seed for its use in spring.
- Native legumes may provide good cover and nitrogen fixation on poorer sites.

Revegetation and restoration of temporarily disturbed areas should be blended back into the surrounding forestland. The resulting plant communities and structure should be representative of pre-disturbance conditions, support long-term landscape management objectives, and provide for a variety of native flora and fauna. The actual seed mixes, shrub plantings, and wildlife habitat improvement options are decided upon by foresters and other district personnel on a case-by-case basis. Some vegetation choices may have implications on plant and animal species of concern, and assistance from botanists and biologists in Ecological Services (BOF) is encouraged in determining appropriate revegetation and restoration goals.

In many cases, it may be suitable to restore areas back to their original composition before disturbance. In addition, disturbed areas may be converted to permanent herbaceous openings, successional openings of shrubs or trees, coniferous groupings, or a combination, depending on the pre-disturbance character of the land and long-term management objectives.

Conifers may be used as screens or thermal cover plantings and can be utilized on the disturbed side of a work/construction area when it parallels an existing opening and on both/all sides when work/construction areas do not parallel an existing opening (e.g. when pipeline ROWs

parallel and existing ROW, conifers should be planted on the side adjacent to the undisturbed forest). Conifers should not be planted near rock piles constructed for timber rattlesnake basking areas.

The following seed mixtures are simply suggestions for use on state forestland. They have been developed for and used in other projects. The seeding rates are rough and may be amended for each situation. Lime and fertilizer rates may be determined by site requirements at the discretion of the forester. If you have a question about a species or mix that may not be on this list, feel free to contact Ecological Services for more information. In all plantings on state forestland, please attempt to use native seed mixes whenever possible. Many of these species are available through [Ernst Conservation Seeds](#), and Ecological Services is working towards developing more local seed mix sources for the districts.

In order to establish a quick cover for stabilization and reduce the chance for invasive species to establish, a cover crop may be mixed in with any of the mixes. The cover crop will either be oats if the seeding takes place in the spring (prior to June 15<sup>th</sup>) or grain rye if the seeding takes place in the fall (after June 15<sup>th</sup>). This can be applied at the same time with the mixes below and can be done with the hydro seeder. The cover crop should be applied at one (1) bushel/acre. Seeding needs to be completed as soon as possible. Optimum seeding times are before mid-April or after mid-September, if possible, for the best chance of successful established cover. No permanent seeding should be conducted between June 30<sup>th</sup> and August 31<sup>st</sup>. Annual rye grass may be substituted for cover crop, but this species needs to be monitored.

### **Native grass and forb mix suggestions**

Percentages are given below instead of rates to account for different environmental situations. For native grasses, a lower rate should be adequate over time for establishment (15-30lb per acre). Many of the warm season grasses are much larger in stature at maturity and to maintain their wildlife component, some space between individuals should be allowed where slope is not an issue. For erosion control and on poorer sites, higher rates may be necessary to achieve desired conditions. In addition, rates may need to be higher when broadcast seeding as opposed to using plugs.

#### ***General Native Seed Mix\****

- 15% Indian Grass (*Sorghastrum nutans*)
- 10% Big Bluestem (*Andropogon gerardii*)
- 15% Little Bluestem (*Schizachyrium scoparium*)
- 10% Switchgrass (*Panicum virgatum*)
- 5% Deertongue (*Dicanthelium clandestinum*)
- 30% Bottlebrush grass (*Elymus hystrix*)

- 15% Spring Oats (*Avena fatua*) or Grain Rye (*Secale cereale*)  
OR Annual Rye (*Lolium perenne* ssp. *multiflorum* or *L. temulentum*)

\*This mix was developed by the National Park Service in West Virginia for reseeding along a gas transmission line. It has not been tested on State Forest lands, but may be successful for ROW vegetation establishment.

**Native Grass and Herb Mix**

- 20% Little Bluestem PA ecotype (*Andropogon scoparius*)
- 10% Big Bluestem variety “Niagra” (*Andropogon gerardii*) (genetic origin is NY)
- 15% Virginia Wild Rye PA ecotype (*Elymus virginicus*)
- 10% Indiangrass PA ecotype (*Sorghastrum nutans*)
- 10% Deertongue variety “Tioga” (*Panicum clandestinum*)
- 5% Switchgrass variety “Shelter” (*Panicum virgatum*) (genetic origin is WV)
- 5% Partridge Pea PA ecotype (*Chamaecrista fasciculata*)
- 3% Showy Tick Trefoil PA ecotype (*Desmodium canadense*)
- 5% Ox-eye sunflower PA ecotype (*Heliopsis helianthoides*)
- 2% Autumn bentgrass PA ecotype (*Agrostis perennans*)
- 2% Woolgrass PA ecotype (*Scirpus cyperinus*)
- 3% Soft Rush PA ecotype (*Juncus effusus*)
- 5% Pennsylvania smartweed PA ecotype (*Polygonum pensylvanicum*)
- 5% Common Milkweed PA ecotype (*Asclepias syriaca*)

**General Native Erosion and Sedimentation Seed Mix**

- 30% Virginia Wild Rye PA ecotype (*Elymus virginicus*) or Switchgrass variety “Shelter” (*Panicum virgatum*) (genetic origin is WV)
- 30% Autumn bentgrass (*Agrostis perennans*) or ticklegrass (*A. scabra*) (both will tolerate more shade)
- 20% Partridge Pea PA ecotype (*Chamaecrista fasciculata*)
- 20% Spring Oats (*Avena fatua*) or Grain Rye (*Secale cereale*)  
OR Annual Rye (*Lolium perenne* ssp. *multiflorum* or *L. temulentum*)

**Areas with higher moisture and shade**

- 20% Virginia wild rye (*Elymus virginicus*)
- 20% Riverbank wild rye (*Elymus riparius*)  
Canadian wild rye (*Elymus canadensis*) may be used in place of riverbank wild rye at the same rate on drier soils
- 20% Pennsylvania sedge (*Carex pensylvanica*)
- 15% Tioga deer tongue (*Panicum clandestinum*)

- 10% Redtop (SPECIFY THIS SPECIES: *Panicum rigidulum*)
- 15% Spring Oats (*Avena fatua*) or Grain Rye (*Secale cereale*)  
OR Annual Rye (*Lolium perenne* ssp. *multiflorum* or *L. temulentum*)

**Wetland areas, waters edges and areas with normal high water flow**

- 40% Virginia wild rye (*Elymus virginicus*) or Riverbank wild rye\* (*Elymus riparius*)
- 40% Fox sedge (*Carex vulpinoides*)
- 20% Redtop (SPECIFY THIS SPECIES: *Panicum rigidulum*)

Topsoil from disturbed wetlands should be stock piled until construction is complete. Topsoil should be replaced on the disturbed area and allowed to reseed naturally by surrounding vegetation when conditions allow. Seed mixes on wetland areas may be used when there is a need to stabilize soil, revegetate quickly, or deter invasive species establishment. It is important for district personnel to review proposed seed mixes for use near wetland areas, waters edges, or areas with normal high water flow because many suggestions by contractors or consultants have included the use of invasive wetland species (e.g. reed canary grass and tall fescue).

**Native/non-native grass and legume mix**

These seed mix suggestions may be used when all-native mixes are not deemed the most appropriate for the situation.

**Slopes greater than 15%**

|  |                       |
|--|-----------------------|
| Timothy ( <i>Phleum pretense</i> )   | 6 lbs. per acre       |
| Canada wild-rye ( <i>Elymus canadensis</i> ) *   | 6 lbs. PLS per acre   |
| Little bluestem ( <i>Schizachyriukm scoparium</i> )**                                      | 3 lbs. PLS per acre   |
| Big bluestem ( <i>Andropogon gerardii</i> )  | 3 lbs. PLS per acre   |
| Indian grass ( <i>Sorghastrum nutans</i> )**   | 3 lbs. PLS per acre   |
| Switchgrass ( <i>Panicum virgatum</i> )  | 2 lbs. PLS per acre   |
| White clover ( <i>Trifolium repens</i> )   | 8 lbs. PLS per acre   |
| Deer tongue ( <i>Panicum clandestinum</i> )  | 5 lbs. per acre       |
| Showy tick-trefoil ( <i>Desmodium canadense</i> )<br>or senna ( <i>Senna hebecarpa</i> )** | 2 lbs. PLS per acre   |
| Partridge pea ( <i>Chamaecrista fasciculata</i> )  | 1 lbs. PLS per acre   |
| Black-eyed Susan ( <i>Rudbeckia hirta</i> )  | 0.5 lbs. PLS per acre |

**Slopes less than 15%**

|                                    |                 |
|------------------------------------|-----------------|
| Timothy ( <i>Phleum pretense</i> ) | 4 lbs. per acre |
|------------------------------------|-----------------|

|  |                       |
|--|-----------------------|
| Virginia wild-rye ( <i>Elymus virginicus</i> ) *   | 6 lbs. PLS per acre   |
| Little bluestem ( <i>Schizachyrium scoparium</i> )**                                       | 2 lbs. PLS per acre   |
| Big bluestem ( <i>Andropogon gerardii</i> )  | 2 lbs. PLS per acre   |
| Deer tongue ( <i>Panicum clandestinum</i> )  | 4 lbs. PLS per acre   |
| White clover ( <i>Trifolium repens</i> )   | 8 lbs. per acre       |
| Showy tick-trefoil ( <i>Desmodium canadense</i> )<br>or senna ( <i>Senna hebecarpa</i> )** | 2 lbs. PLS per acre   |
| Partridge pea ( <i>Chamaecrista fasciculata</i> )  | 1 lbs. PLS per acre   |
| Black-eyed Susan ( <i>Rudbeckia hirta</i> )  | 0.5 lbs. PLS per acre |

\*Riverbank wild-rye (*Elymus riparius*) or bottlebrush grass (*Elymus hystrix*) may be substituted for either wild-rye species in more mesic to wet and shady situations.

\*\*These species may be limited in the very northern counties in the state. This does not mean they will not be successful here, but they are not known to commonly naturally occur in this area.

### **Conifer/Shrub Groups**

Pockets of shrubs may be planted in construction areas no longer being used and may be planted intermittently along ROWs where disturbance had taken place. These plantings can vary in size, but should be at least 200 square feet (10'x20'). Below represents shrub group suggestion that may be used depending on conservation or management objectives. Shrub groups should be alternated along right of ways with each group selected by the District Forester/Park Manager. These plantings should be fenced to protect from damage by browsing herbivores but fencing may be waived by the District Forester/Park Manager or designee.

#### **a. Group 1: Conifer group**

- White Pine (*Pinus strobus*)
- Pitch Pine (*Pinus rigida*)
- Virginia Pine (*Pinus virginiana*) – south of route I-80
- Red Pine (*Pinus resinosa*) – north of route I-80

#### **b. Group 2: Hawthorn/Crabapple group**

- Washington Hawthorn (*Crataegus phaenopyrum*)
- American Sweet Crabapple (*Malus coronaria*)
- Cockspur Hawthorn (*Crataegus crus-galli*)
- Large-seed Hawthorn (*Crataegus macrosperma*)
- Frosted Hawthorn (*Crataegus pruinosa*)
- Dotted or White Hawthorn (*Crataegus punctata*)

**c. Group 3: Serviceberry Group**

- Shadbush (*Amelanchier arborea*)
- Smooth/Allegheny Shadbush (*Amelanchier laevis*)
- Low Shadbush (*Amelanchier stolonifera*)

**d. Group 4 : Mast Producing Group**

- Black Locust (*Robinia psuedoacacia*)
- American Mountain Ash (*Sorbus americana*)
- Black Haw Viburnum (*Viburnum prunifolium*)
- American Hazelnut (*Corylus americana*)
- Dwarf Chinquapin Oak (*Quercus prinoides*)
- Scrub Oak (*Quercus ilicifolia*)

**e. Group 5: Blackberry/Raspberry Group**

- Common Blackberry (*Rubus allegheniensis*)
- Sawtooth Blackberry (*Rubus argutus*)
- Smooth Blackberry (*Rubus canadensis*)
- Black Raspberry (*Rubus occidentalis*)
- Red Raspberry (*Rubus idaeus*)

**f. Group 6: Host Group**

- Black-haw (*Viburnum prunifolium*)
- Nannyberry (*Viburnum lentago*)
- Highbush Blueberry (*Vaccinium corymbosum*)
- New Jersey Tea (*Ceanothus americanus*)
- Black Chokeberry (*Photinia melanocarpa*)
- Bush Honeysuckle (*Diervilla lonicera*)
- Pinxter-flower (*Rhodendron periclymenoides*)
- Staghorn Sumac (*Rhus typhina*)
- Scrub Oak (*Quercus ilicifolia*)

The Bureau of Forestry expects a minimum of 75% survival rate for the first year for tree and shrub seedlings. Replacements will be planted the following spring of the year. Attached are tree planting notes that will help to ensure success.

### **Non-native legume mix for food plots**

A non-native legume mix or native grass and herb mix can be used in revegetating disturbed work areas. These areas are to be located at the discretion of the wildlife forester or district personnel with input from Ecological Services. The non-native legume plots should be three to five acres in size and not to exceed one food plot per 8 miles of ROW. Many food plots already exist on state forestland, and non-native legume plots should only be used when it is determined there is a need on a landscape-scale.

### ***Non-Native Legume Mix for Herbivores***

- 15% Ladino Clover (*Trifolium repens*)
- 15% White Dutch Clover (*Trifolium repens*)
- 15% Alsike Clover (*Trifolium hybridum*)
- 40% Birdsfoot trefoil\* (*Lotus corniculatus* var. *norcen*)  
\*This species would need to be monitored. May replace with partridge pea for similar wildlife value.
- 15% Spring Oats (*Avena fatua*) or Grain Rye (*Secale cereale*)  
OR Annual Rye (*Lolium perenne* ssp. *multiflorum* or *L. temulentum*)

### **Stream crossings**

Streams impacted by management activities may be planted for canopy coverage with trees and shrubs or just shrubs. Plant material should be from stock native to the Allegheny Ridge and Valley Region (central Pennsylvania), the Allegheny Plateau Region (western Pennsylvania). These plantings may need to be protected from browsing herbivores with an eight (8) foot woven wire fence. The use of tree shelters is discouraged, but when used, netting should be placed over the opening to avoid mortality of cavity nesting birds. Below are a few species suggestions for stream crossings.

### ***Species for Stream Crossings***

|                  |                                    |
|------------------|------------------------------------|
| Black Willow     | ( <i>Salix nigra</i> )             |
| Black Chokeberry | ( <i>Aronia melanocarpa</i> )      |
| Winterberry      | ( <i>Ilex verticillata</i> )       |
| Silky Dogwood    | ( <i>Comus amomun</i> )            |
| Red Maple        | ( <i>Acer rubrum</i> )             |
| Yellow Birch     | ( <i>Betula alleghaniensis</i> )   |
| White Oak        | ( <i>Quercus alba</i> )            |
| Tulip Poplar     | ( <i>Liriodendron tulipifera</i> ) |
| Eastern Hemlock  | ( <i>Tsuga canadensis</i> )        |
| Arrow-wood       | ( <i>Viburnum dentatum</i> )       |

Other species may be listed in these guidelines. However, it is best to check with Ecological Services that the species is not Endangered, Threatened, or of ecological concern for another reason (e.g. the species is a host for a disease that adversely affects another species).