Deep-Till/Tree Seeding for Forest Restoration/Wildlife Habitat on AML Projects in Northeast PA[1]

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Abstract

The Pennsylvania Department of Environmental Protection (PADEP) Bureau of Abandoned Mine Reclamation Wilkes-Barre District Office has been using a "deep-till/tree seeding" technique for establishing wildlife habitat and accomplishing forest restoration on several abandoned mine land projects since 2009. This technique incorporates the District's standard construction methods and equipment used for the reclamation of these sites. Deep-till tree seeding (utilizing early-successional and some later-successional tree seeds) can be completed at any time during the reclamation project, usually concurrent with other seeding, aiding construction management.

In these projects, natural native growth surrounding the AML features is retained. Native trees from the clearing and grubbing of the grading area create stock for brush barriers, which are placed to create wildlife habitat corridors across the reclaimed meadowlands. The brush barriers are built 10 feet wide and 6 feet high to the designated length. Generally the deep-till/tree seeding area is constructed outward from the brush barriers for 50 feet in all directions, ripped with a dozer or other equipment which the contractor has available to accomplish the reclamation, to a minimum depth of 2 feet. Ripping is started next to the brush barrier and proceeds in ever-expanding ovals outward to the nominal 50 foot limit. After ripping is completed, the smaller type tree seeds are hydro-seeded onto the tree-seed area. Larger tree seed is broadcast manually to prevent damage to the seed. When seed planting is completed, the area is mulched to hold seed in place and provide moisture retention.

Projects have been monitored since 2011. The Deep-till/Tree Seeding "method" has been a success. Growth has varied on the projects, and this presentation includes a discussion of possible reasons for this - as well as results and details of the design and construction of the deep-till/tree-seed plots.

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Deep-Till/Tree Seeding for Forest Restoration/Wildlife Habitat

The Pennsylvania Department of Environmental Protection (PADEP) Bureau of Abandoned Mine Reclamation (BAMR) Wilkes-Barre District Office has been using a "deep-till/tree seeding" technique for establishing wildlife habitat and accomplishing forest reclamation on several abandoned mine land (AML) projects since 2009. This technique incorporates key essentials for habitat corridor construction and tree growth while using standard construction techniques with equipment normally available on AML reclamation sites. The deep-till method utilizing broadcast seeding is about half the cost of root stock planting when all site and seed bed preparation costs are considered. Because the deep-till seeding is concurrent with other seeding that occurs within the normal contract time frames, construction management is facilitated by allowing the final work orders to be completed in a timely manner.

ARRI and FRA vs. Deep-Till/Tree Seeding

The Appalachian Regional Reforestation Initiative (ARRI) is a cooperative effort among Kentucky, Maryland, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia; the Office of Surface Mining Reclamation and Enforcement (OSM); the coal industry; environmental organizations; academia; and private landowners. ARRI works to restore forests on coal mined lands in the eastern United States, advocating a technique known as the Forestry Reclamation Approach (FRA) to plant trees on reclaimed coal mined lands.

The Five Steps of FRA:

1. Create a suitable rooting medium for good tree growth that is no less than 4 feet deep and comprised of topsoil, weathered sandstone, and/or the best available material
2. Loosely grade the topsoil or topsoil substitutes established in step one to create a non-compacted growth medium
3. Use ground covers that are compatible with growing trees
4. Plant two types of trees – early succession species for wildlife and soil stability, and commercially valuable crop trees
5. Use proper tree planting techniques.

BAMR is using deep-till/tree seeding on these projects because of the following:

- Deep-till/Tree Seeding specifies ripping the compacted soils to more than 2 feet deep. Few of the abandoned mine land (AML) projects in Northeastern Pennsylvania (NEPA) utilize truck haulage, so that "hummocky"- dumped piles cannot easily be built as a part of the reclamation process. Nor do these jobs have large dozers (that can rip 4 feet deep) as part of their reclamation equipment compliment.

- Landowners, especially the PA Game Commission, are looking for varied habitats, rather than tree lots on their properties leading to the smaller habitat area applications.
- The tree-seed areas amount to less than 10 percent of the acreage of the project sites, also justifying not requiring contractors to supply special equipment/handling to till the FRA's full 4-foot recommendation.
- Thin layers of original topsoil, weathered sandstones and any other "topsoil substitutes" have been thoroughly mixed with grey sandstones, shale, black siltstone, and carbonaceous and pyritic materials.
- Cost of Deep-till/tree-seed is less than half of standard ARRI construction. Recent cost (average bids) per acre on seedling projects was $6,200/acre, vs. $2,500/acre on seed projects.
- On AML project areas where there has not been a lot of compaction like sloped areas, early successional species grow and create soils for later development of crop trees.

Habitat Corridors

A wildlife habitat corridor is an area of habitat connecting wildlife populations separated by human activities or structures (such as roads, mining, development, or logging). They are narrow strips of land that differ in dominant vegetation from the larger area around it. Fence rows, stream buffers, and roadside brush are common habitat corridors in many rural areas. The main purpose of a localized wildlife corridor is connecting remnant patches of woods, gullies, wetlands, ridgelines, etc. - two separate areas of habitat, while providing a variety of food and shelter. Strips of land aid in the movement of various animal species and movement of pollen and seed dispersal, which is an added benefit. When insects carrying pollen or birds carrying seeds travel to another area, plant species also get transported.

Edge habitats constructed with brush pile cores; along field borders, fence rows or riparian areas; provide cover and travel lanes for wildlife to access the corridors. Habitats can be simply brush piles, but are more effective when thickets, trees and shrubs accompany brush pile development, providing more valuable cover and food resources. A minimum corridor width of 50 feet and a maximum width of 200 feet provides adequate habitat for animals using the corridor as travel lanes or for food, nesting or escape cover. Edge habitats with a 50-foot thicket/berry/wildflower planting between grasslands and fields provide good transitions.

One of the goals of Pennsylvania's Wildlife Action Plan is to conserve Pennsylvania's native wildlife and its habitat by implementing strategies including enhancing connectivity and native plant best management practices for habitat restoration and enhancement projects. "Specialized" habitats and habitat mosaics that are in decline and need restoration are grasslands, thickets and early-

successional habitats. Many AML projects have pits, piles, and other hazardous features separated by wooded areas, and these projects are now designed to keep the growth between features, and attempt to affect only the footprint of the AML features. Reclamation of these features to grasslands, with wildlife habitat corridors of brush and early-successional trees, help to support these wildlife conservation strategies. A good discussion of wildlife habitat can be found in *Wildlife-Habitat Relationships*, a publication of the Penn State College of Agricultural Sciences Extension Service, http://extension.psu.edu/natural-resources/wildlife/habitat-management/wildlife-habitat-relationships.

Wildlife Habitat Tree Plots

Wildlife habitat tree plots, with seeded-tree and volunteer-tree growth, have been constructed on AML reclamation projects in several NEPA counties, including Schuylkill, Lackawanna, and Northumberland during the past six years.

These plots attempt to accomplish the following:

1. "Dispose" of the clearing and grubbing without mulching/burning/burial,
2. Create wildlife corridors,
3. Add additional erosion and sedimentation controls with plots along contours and in gullies,
4. Create early-succession/ thicket habitat, and
5. Provide ARRI-type benefits.

The habitat tree-seed areas vary in acreage to accommodate the project's individual characteristics, but are generally shaped like big hotdogs, approximately 110 feet wide by various lengths.

Tree-Seed Planting Areas

Brush barriers consisting of larger trees with root wads on the bottom and smaller shrubs and brush on the top are constructed in the center of the tree-seed area. Natural growth, downed timber, logs, trees, poles, roots, stumps and brush cleared and grubbed from the grading areas are placed in brush piles as erosion and sedimentation controls and wildlife habitats. The piles are the core units of tree-seed planting areas. The brush barriers are constructed nominally 10 feet to 12 feet wide and 4 feet to 6 feet high to various lengths. Half of the soil amendments are spread on the tree-seed area, and the area 50 feet outward in all directions from the brush barrier is ripped with a dozer or other similar method to a minimum depth of 2 feet starting next to the brush barrier in ever expanding circles outward, tilling the area out to the 50 feet limit of planting (Figure 1). After deep-tilling is completed, the other half of the soil amendments and the smaller type tree seeds are hydro-seeded onto the tree-seed area, in order to prevent soil compaction from equipment. Finally larger tree seed is broadcast manually to prevent damage to the seed and the area is mulched to hold seed in place and retain moisture.

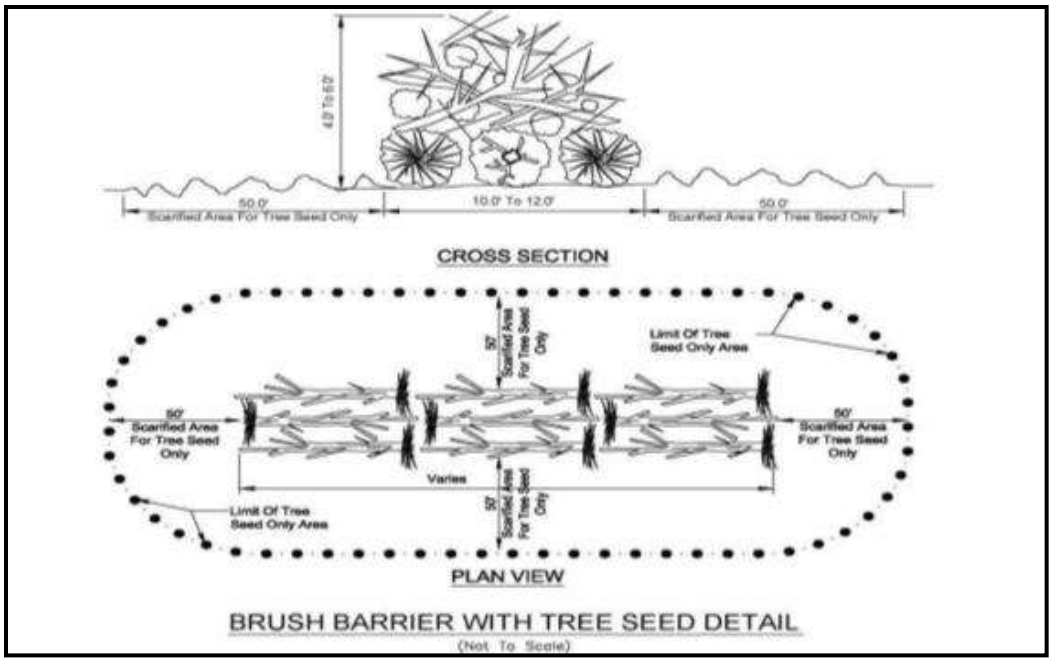

Figure 1: Typical Tree-seed Planting Area

Tree Selection

Factors including the type of soils, soil pH, dominant native species, and landowner preferences are considered in the selection of tree seed. Early-successional forest seed selections important to soil stabilization, birds and small animals, included aspen, birch, black locust, maples, pines, and a variety of shrubs such as alders, dogwoods, and shining sumac. Other higher value hardwood seeds planted included oak, hickory, cherry, and sycamore that provide for a self-regenerating overstory of the reclaimed area. Selections are adjusted to incorporate available seeds. Considerations also should include germination characteristics, as some seeds require one or two periods of cold stratification while others do not.

Temporal shrub/thicket and early-successional habitats in Pennsylvania are in decline, with regenerating clear-cuts, reclaimed surface mines and AML reclamation providing habitats that mimic natural shrub communities. Again, selection of the shrubs and early–successional species are important to reinforce this restoration.

Best Times for Planting

The deep-till method can be completed at any time during the reclamation project; however, project success reviews indicate that winter and very early spring are the best times for planting. Additionally, a deep frost cycle of the soil may aid in seed ground contact, leading to better germination with seeds broadcast onto the soil, as opposed to tilled-in seed.

Importance of Brush Barrier

Initial volunteer growth is promoted by placement of the brush barrier, as it spreads some of the dormant seed entrapped in them. As the brush barriers decay they promote additional volunteer growth from dormant seed entrapped within, and plants sprout from the root wad material. The brush barrier acts as wildlife habitat that encourages bird and wildlife travel through the tree-seed areas, further promoting volunteer tree growth by the seeds dropped by these animals.

The Pennsylvania Game Commission Food and Cover Corps crews routinely build brush piles to provide refuge for wildlife in inclement weather and a quick retreat for small mammals from predators, and we've even had a few bears den up beneath brush piles. They are not only good for wildlife cover, but the brush also protects new tree growth, making it harder for deer to get at them.

The reclaimed tree-seed areas have little forest floor humus and consist of relatively barren soils. Tree-root wads in the brush may contribute to reintroduction of mycorrhiza fungi to the surrounding newly planted tree-seed areas, promoting better root development and viability. The placement of the tree-seed areas with brush barriers parallel to contours also aids in erosion and sediment controls in the early life of the AML project. Having learned the hard way, brush piles are no longer placed by homes or on coal refuse or other carbonaceous material – people burn brush piles and start refuse fires.

Results

The projects monitored for this presentation were:

OSM 54(3639)102.1 Branchdale East	January 2009	4.2 acres
OSM 54(3649)102.1 Newtown South II-2	April 2012	7.4 acres
OSM 49(3237)101.1 Boyers Knob Lookout	spring 2013-spring 2014	13.5 acres

OSM 54(3639)102.1 Branchdale East AML Project

Two tree-seed areas were planted in January 2009, totaling 4.2 acres. Ten-foot wide by six-foot high brush piles were constructed to various lengths in each area, and the surface was ripped to approximately 2 feet deep, extending out 50 feet from the brush piles in all directions. Soil nutrients and tree seed were hydro-seeded to prevent compaction of the area, and then mulched from outside the ripped area.

Figure 2: 2012 photos of Branchdale East Tree-Seed Plots

The seeding was completed in the winter with very cold, frozen ground conditions. When the area was ripped by the dozer, large chunks of frost were displaced (Figure 3).

Figure 3: Branchdale Plot after Ripping – January 2009

The seeding sub-contractor at Branchdale elected to use straw as mulch, which may have been a factor in reduced competing weeds and grasses in the tree-seed area. The area surrounding the tree-seed plots were seeded with a hydro-seeder which may have reduced wind drift of the grass seed mixture to the tree-seed areas.

BRANCHDALE EAST TREE SEED AREAS (PLANTED JANUARY 2009)										
PLANTED SEED						VOLUNTEER GROWTH				
SEED TYPE PLANTED	LB/ACRE	OBSERVATION				TREE TYPE	OBSERVATION			
		Sep-12	May-13	Aug-14	Aug-14		Sep-12	May-13	Aug-14	Aug-14
SHINING SUMAC	0.25	FAIR <4'	FAIR <4'	SPARSE <4'	SPARSE <4'	ASPEN	GOOD <4'	GREAT <12'	FAIR-GOOD <12'	FAIR-GOOD <12'
EASTERN WHITE PINE	0.20	ONE 3"	NONE	NONE	SPARSE <4½'	GRAY BIRCH	GOOD <8'	GOOD <8'	GOOD <12'	GOOD <13'
BLACK LOCUST	2.00	GREAT <12'	GREAT <12'	EXCELLENT <16'	EXCELLENT <25'	ALDER	POOR <6'	POOR <7'	SPARSE <7'	SPARSE <16'
FLOWERING DOGWOOD	0.20	NONE	NONE	NONE	NONE	WHITE OAK	ONE	ONE <1'	NONE	NONE
						CATALPA	FAIR <6'	GOOD <8'	GOOD <8'	FAIR-GOOD <15'
						BLACK CHERRY	POOR <8'	FAIR <8'	SPARSE <8'	SPARSE <10'

Figure 4: Tree Growth - Branchdale Plots

In 2012, results showed that the seeded black locust, volunteer grey birch, aspen and catalpa from the corridor-linked wooded areas all had healthy populations. The two-year and three-year results of the tree plots at Branchdale encouraged further development, additional project designs, and implementation of more deep-till/tree-seed habitats in our rural projects.

Figure 5: Aerial of Branchdale Tree-Seed Areas

The Branchdale planting has become primarily a seed-planted black locust stand with good growth of volunteer gray birch. Volunteer aspen and catalpa populations seem to have diminished somewhat from previous years as the black locust growth has overtaken them in many areas.

Figure 6: 2015 photos of Branchdale East Tree-Seed Plots

OSM 54(3649)102.1 Newtown South II-2 AML Project

Seven tree-seed areas were planted in April 2012, totaling 7.4 acres within the four grading areas of the project, and utilizing the methods from Branchdale. Tree seed types at Newtown did not include black locust which showed best growth of the seeds sown at the Branchdale project, but did include aspen which showed good volunteer growth at Branchdale. Neither seeded nor volunteer-tree growth at Newtown has been as robust in volume nor quality as the growth at Branchdale. This is probably due to time-of-year tilling and planting, deer browse, and weed/grass competition.

Seeding was completed in spring with very wet conditions as opposed to mid-winter, frozen ground conditions at the Branchdale project, which likely caused better germination at Branchdale. Planting seeds in the spring (for beginners) isn't a good idea. The "natural way" to germinate tree seeds is to allow nature to take its course. Most seeds, when sown in the fall without any pre-treatment, will begin to sprout the following spring. With some seed varieties germination may spread over two or three years.

Most of these tree species originated in cooler climates where seeds drop to the ground and are covered by leaves in the fall. Over the winter, the seeds remain bedded in this cool moisture environment. As the warm spring weather arrives the seeds begin to germinate. For many types of seeds, the embryo inside the seeds is unable to germinate until it matures in this manner. In a natural forest, if seeds germinated immediately upon falling to the ground in late summer or fall, the tender seedlings would die off during the cold winter.

Most tree seed requires cold stratification to aid germination, and in the case of Common Persimmon and Cockspur Hawthorne, two cold stratification periods are required for germination. At Newtown, Persimmon and Cockspur Hawthorne have continued to sprout and increase after three winter seasons. Volunteer Red Maple and Scarlet Oak growths are also noteworthy.

NEWTOWN SOUTH II-2 TREE SEED AREAS (PLANTED APRIL 2012)										
PLANTED SEED						VOLUNTEER GROWTH				
SEED TYPE PLANTED	LB/ACRE	OBSERVATION				TREE TYPE	OBSERVATION			
		Sep-12	Aug-13	Jul-14	Jul-15		Sep-12	Aug-13	Jul-14	Jul-15
QUAKING ASPEN	0.2	SPARSE <18"	GOOD <18"	GOOD <48"	GOOD <54"	SHINING SUMAC	SPARSE-FAIR <18"	FAIR-GOOD <18"	ABUNDANT <48"	ABUNDANT <36"
COMMON PERSIMMON	1	SEVERAL <12"	SEVERAL <12"	SPARSE <12"	FAIR <24"	SMOOTH SUMAC	SPARSE <18"	SPARSE <18"	SPARSE <18"	SPARSE -
RUSSET BUFFALOBERRY	0.25	ONE 8"	NONE -	NONE -	NONE -	SASSAFRAS	SPARSE-FAIR <12"	SPARSE-FAIR <12"	SPARSE <36"	SPARSE <36"
FLOWERING DOGWOOD	0.2	NONE -	NONE -	NONE -	NONE -	BLACK BIRCH	SPARSE <12"	SPARSE <12"	SPARSE <12"	SPARSE <24"
EASTERN WHITE PINE	0.2	NONE -	NONE -	NONE -	NONE -	CATALPA	SPARSE <18"	SPARSE 12"-24"	SPARSE <30"	SPARSE <36"
COCKSPUR HAWTHORNE	0.2	NONE -	NONE -	NONE -	SPARSE -	BLACK CHERRY	SPARSE <18"	SPARSE 12"-24"	SPARSE 12"-24"	SPARSE <24"
AMERICAN FILBERT	1	NONE -	NONE -	NONE -	NONE -	SCARLET OAK	SEVERAL -	SEVERAL <12"	SEVERAL <12"	SEVERAL <60"
						RED MAPLE	NONE -	NONE -	SPARSE-FAIR <36"	FAIR-GOOD <84"

Figure 7: Tree Growth – Newtown South Plots

Figure 8: Tree-Seed Plots at Newtown

Deer browsing was notable on most species, heavy in spots, resulting in growth stunting. Note that in Figure 7, the tallest sumac observed in 2015 was a foot shorter than those observed in 2014. In April 2015, twenty chestnut tree saplings were planted at one of the tree-seed plots at Newtown, protected by tree-tubes. Tops of the chestnuts were browsed off as they emerged from the tree tubes. It is evident that the brush barriers provide protection from deer browsing as evidenced by taller trees (Red Maple, aspen and Scarlet Oak) growing within the brush.

Figure 9: Seven-Foot Aspen and Maple in Brush Barriers at Newtown

Hay mulch was used at Newtown, as opposed to straw at the Branchdale project, perhaps the cause of more competing weeds/grasses at Newtown. The area surrounding the tree-seed plots was seeded with a broadcast cone spreader, as opposed to a hydro-seeder used for surrounding areas at the Branchdale project, probably resulting in larger amounts of competing grass seed in Newtown tree-seed areas due to wind drift. Seeding was completed is spring with very wet conditions as opposed to the mid-winter, frozen ground conditions at the Branchdale project. This may account for some of the lesser tree growth and greater weed growth at Newtown. Several of the Newtown tree-seed areas have significant amounts of sweet fern and other weed growth.

OSM 49(3237)101.1 Boyers Knob Lookout

The tree seeding consisted of 38 plots totaling 13.5 acres in six grading areas of the project. Tree-seed areas were planted in spring 2013, summer/fall 2013, and in spring 2014. Nine wildlife habitats with brush piles as described above, and 29 areas with no brush pile core were planted with tree seed by the contractor. Three additional plots totaling 1.8 acres were planted by others with hybrid American Chestnut seed provided by The American Chestnut Foundation (TACF).

Areas with brush barriers at Boyers were planted utilizing the same method as at Branchdale and Newtown. The areas without brush barriers and areas planted by TACF were also prepared and planted in a similar manner. In the American Chestnut areas, tree seeds were individually planted by hand, with tree tubes for rodent protection. No mulch was applied on the areas, and the chestnut areas were also enclosed with deer fencing.

BOYER'S KNOB LOOKOUT TREE SEED AREAS (PLANTED EARLY 2013-2014)						
PLANTED SEED				VOLUNTEER GROWTH		
SEED TYPE PLANTED	LB/ACRE	OBSERVATION		TREE TYPE	OBSERVATION	
		Sep-14	Aug-15		Sep-14	Aug-15
AMERICAN SYCAMORE	0.1	EXCELLENT <18"	EXCELLENT <36"	ASPEN	GOOD-EXCELLENT <30"	GOOD-EXCELLENT <96"
EASTERN WHITE PINE	0.2	FAIR-GOOD <3"	GOOD <12"	BLACK CHERRY	SPARSE <12"	FAIR <60"
SPECKLED ALDER	0.1	SPARSE <6"	GOOD <24"	SWEET BIRCH	FAIR-GOOD <6"	GOOD <18"
SHAGBARK HICKORY	2.0	NONE -	NONE -	BLACK LOCUST	GOOD-EXCELLENT <18"	EXCELLENT <48"
SUGAR MAPLE	2.0	NONE -	SPARSE <12"	SASSAFRAS	SPARSE <12"	SPARSE <12"
WHITE OAK	3.0	NONE -	NONE -	SUMAC	SPARSE <12"	SPARSE <12"
AMERICAN CHESTNUT (planted by TACF)		GOOD <20"	VERY GOOD <48"	LARCH		SPARSE <12"
				SCARLET OAK	SEVERAL <10"	NONE OBSERVED -
				AILANTHUS	SPARSE <24"	NONE OBSERVED -
				AMERICAN CHESTNUT	ONE <8"	NONE OBSERVED -

Figure 10: Tree Growth – Boyers Knob Lookout Plots

Overall tree growth was successful in most tree-seed areas with brush barriers located on the slopes, with good variety and growth. Most of the lower/bottom-site tree-seed areas contained significant amounts of grasses and other weed growth constraining the variety and amount of tree growth found on the slope areas. The most prevalent species in the bottom areas were black locust and gray birch and speckled alder, but in lesser volumes than on the slopes.

Figure 11: Tree-Seed Plots at Boyers Knob Lookout

Some deer browsing was evidenced by comparison of the overall tree heights in the fenced American Chestnut areas to the other areas outside. The brush barriers provide some browsing protection, again shown by the taller growth from trees growing within the brush barriers, as is shown in Figure 11.

More Ideas for Wildlife Habitats and ARRI

The Xerces Society partners with the native seed industry to produce wildflower seed mixes to provide foraging and nesting resources for a diversity of pollinators. Ernst Conservation Seeds, of Meadville, PA, is one of those partners, whose "Pennsylvania Pollinator Conservation Seed Mix" includes high quality native perennial wildflowers that are highly attractive to pollinators, and a native bunch grass that provides nesting habitat for bumble bees and other beneficial insects.

ERNST POLLINATOR/GROUND NESTING BIRD MIX			
% of Mix	Latin Name	Common Name	Cultivar/ Ecotype
30	Elymus canadensis	Canada Wildrye	Any
54	Schizachyrium scoparium	Little Bluestem	FIG (PA)
2	Asclepias syriaca	Common Milkweed	PA
1	Aster novae-angliae	New England Aster	PA
1	Desmodium canadense	Showy Tick Trefoil	PA
1	Desmodium paniculatum	Panicled Tick Trefoil	PA
4	Heliopsis helianthoides	Ox-Eye Sunflower	PA
1	Lespedeza frutescens	Shrubby Bushclover	MD
1.5	Monarda fistulosa	Wild Bergamot	FIG (PA)
1	Penstemon digitalis	Tall White Beardtongue	PA
0.3	Pycnanthemum tenuifolium	Narow Leaved Mountain Mint	PA
3	Rudbeckia hirta	Black Eyed Susan	Any
0.2	Solidago canadensis	Canada Goldenrod	PA

Figure 12: ARRI-Compatible Pollinator/Ground Nesting Bird Mix (1)

Working with Ernst, BAMR is working on several "ARRI-Compatible Pollinator/ Ground Nesting Bird Mixes" (including Common Milkweed, of course) which should add to the habitat while not competing with the tree growth. BAMR will be trying these in one-acre sites during the fall 2015 and spring 2016 seasons. Two of these are shown in Figures 12 and 13.

ERNST/RMC POLLINATOR/WILDLIFE MIX			
% of Mix	Latin Name	Common Name	Cultivar/ Ecotype
31	Elymus canadensis	Canada Wildrye	Any
37	Schizachyrium scoparium	Little Bluestem	FIG (PA)
14	Andropogon virginicus	Broomsedge	MO
4	Asclepias syriaca	Common Milkweed	PA
0.5	Aster novae-angliae	New England Aster	PA
1	Desmodium canadense	Showy Tick Trefoil	PA
0.5	Desmodium paniculatum	Panicled Tick Trefoil	PA
0.5	Symphyotrichum laeve	Smooth Blue Aster	NY
3	Rudbeckia triloba	Browneyed Susan	WV
1	Monarda fistulosa	Wild Bergamot	FIG (PA)
1	Penstemon digitalis	Tall White Beardtongue	PA
2	Solidago juncea	Early Goldenrod	VA
3	Solidago nemoralis	Gray Goldenrod	VA
1	Helenium autumnale	Common Sneezeweed	VA
0.5	Apocynum cannabinum	Indianhemp	PA
1	Pycnanthemum tenuifolium	Slender Mountainmint	PA
0.5	Baptisia australis	Wild Indigo	PA
0.5	Senna marilandica	Maryland Senna	VA/WV
0.5	Zizia aurea	Golden Alexanders	PA
2	Agrostis perennans	Autumn Bentgrass/Albany Pine Bush	NY

Figure 13: ARRI-Compatible Pollinator/Wildlife Mix (2)

National Pollinator Strategy

In June 2014, the White House issued a memorandum entitled, "Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators." This memorandum created a task force composed of numerous departments and agencies to research and expand awareness of pollinator decline, and to develop and implement plans to improve pollinator habitat on managed lands. The Presidential Memorandum was issued in response to declines in certain butterfly and insect pollinator populations. The Task Force was to create a "Strategy to Promote the Health of Honey Bees and Other Pollinators" within 180 days. In May 2015, the Task Force released its strategy, with three 'overarching' goals:

1. Reduce Honey Bee colony losses to economically sustainable levels;
2. Increase Monarch Butterfly numbers to protect the annual migration; and
3. Restore or enhance millions of acres of land for pollinators through combined public and private action.

As their part of the strategy, OSM promotes the provision of wildlife habitats through ARRI, a partnership-based program for the restoration of former mine lands to native forests. "In addition to the chestnuts that have been planted on reclaimed mine lands in cooperation with TACF, many of the native trees and shrubs ARRI plants, including maples, black cherry, yellow poplar, eastern redbud, various dogwoods, black locust and others are staples for butterflies, honey bees and native pollinators." OSM plans to continue sponsoring this

program and training "state regulatory authorities to promote the use of native tree and ground-cover species, thereby increasing native habitat for the benefit of pollinating species".

OSM's goals over the next two years (FY2015-2016) are to continue promoting habitat on reclaimed minelands through ARRI, specifically:

a. Develop a pollinator species-specific Forestry Reclamation Advisory, which will enhance species selection to be used in reclamation per locality or region (FY2015).
b. Increase the number of trees planted by 10 percent.
c. Increase the number of acres planted in trees and pollinator-friendly species by 10 percent.
d. Increase the number of partners engaged in pollinator-friendly species plantings on both active and legacy mine sites.

Conclusions

The Deep-till/Tree Seeding "method" has been a success. In projects completed over the past six years, 70 acres of forest restoration, mostly for wildlife habitat, have been constructed and are thriving. Besides the three projects in this discussion, eight other projects utilizing some variation of the deep-till tree seeding method have been built, amounting to 39 acres and one deep-till-using-seedlings project for one acre. Five additional AML projects are in construction and a number in design. Deep-till/Tree Seeding may not be an alternative to ARRI and FRA, but it does provide an economical method of creating early-successional habitat.

Comments/Recommendations

- We're going to keep doing it, at least to give the deer something to eat.
- Black Locust, Quaking Aspen, and Grey Birch seed grow. The locust seems to want to take over, and they and aspen and birch seem to be the most active volunteers. Butterflies, bees, and other pollinators love the beautiful white puffs of Black Locust flowers and their intense, sweet fragrance. Black Locust is a nitrogen-fixing pioneer tree on disturbed sites. Its flowers and seed pods appear after the fifth year, and they spread from root shoots. It will colonize abandoned coal mines and other very poor sites and enrich the soil for other species, but Black Locust takes over pastures very quickly and is hard to control, and those little spikes hurt when you bump into them. Limit the amount of Black Locust in the seed mix, it will volunteer anyway.
- Straw mulch is better than hay mulch for weed growth. Many farmers who sell their extra bales use the term 'straw' whether the bale in question is straw or hay. If hay is used for mulch, with seed heads intact, the grain and weed seeds will sprout and compete with the trees. Consider rice straw for mulch if

it's available locally. However, hay will enrich the soil, and straw won't. If possible, let hay bales set out for a year before using them.

- When hydroseeding near the tree-seed plots, remember the wind. Just like spray painting in a parking lot, there will be collateral damage.
- Make sure to broadcast tree seeds INTO the brush piles. It makes it harder for the deer to get at the little trees, and they get a chance to grow.
- Deep till and plant in the winter. It breaks up the ground better when it's frozen and makes deeper holes for the seeds, and it is the best time to plant milkweed – see "More Ideas".
- OSM and ARRI should consider utilizing "ARRI-Compatible Pollinator/Ground Nesting Bird Mixes," compatible with Xerces Society "recommended" regional pollinator mixes similar to those DEP is working on with Ernst, as part of their "pollinator species-specific Forestry Reclamation Advisory" development.