Reforesting Unused Surface Mined Lands by Replanting with Native Trees

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Abstract: More than 600,000 ha (1.5 million ac) of mostly forested land in the Appalachian region were surface mined for coal under the Surface Mining Control and Reclamation Act. Today, these lands are largely unmanaged and covered with persistent herbaceous species, such as fescue (*Festuca* spp.) and sericea lespedeza (*Lespedeza cuneata* [Dum. Cours.] G. Don,) and a mix of invasive and native woody species with little commercial or ecological value. Some landowners and surrounding residents would like to restore native forests on some of these lands for the valuable products and services they provided prior to mining. Research and experience shows that native tree species can be reestablished on these lands through replanting with seedlings, but interventions are needed if those planted trees are to survive and thrive. For these lands to become productive forests, it is necessary to loosen compacted mine soils, correct chemical or nutrient deficiencies, and control the current vegetation as cultural practices to aid survival and growth of planted seedlings. Reforestation guidelines to restore native forests on mined lands that are unoccupied, unmanaged, and unproductive were developed. Practices include land clearing, mine soil tillage, fertilization, tree planting, weed control, and monitoring. Under leadership provided by the Appalachian Regional Reforestation Initiative, a group formed by the Office of Surface Mining and seven state regulatory authorities, these procedures have been adopted and applied by watershed improvement groups, forestry and fish/wildlife agencies, coal companies, environmental groups, and an electrical generating company pursuing carbon credits..

Keywords: Appalachian coal fields, ecosystem restoration, mine reforestation, ARRI, tree planting, Office of Surface Mining

Introduction

More than 600,000 ha (1.5 million ac) of mostly forested land in the Appalachian region were surface mined for coal under the Surface Mining Control and Reclamation Act (SMCRA, Public Law 95-87). Most of this land was reclaimed using practices intended to stabilize the surface, prevent erosion, and establish vegetation suitable for domestic livestock or wildlife. Today, these lands are largely unmanaged and covered with persistent herbaceous species, such as fescue (*Festuca* spp.) and *sericea lespedeza* (*Lespedeza cuneata* [Dum. Cours.] G. Don,), and a mix of invasive and native woody species with little commercial or ecological value. Some landowners and adjacent publics would like to restore native forests on some of these lands for the valuable products and services they provided prior to mining. Re-establishing productive forests on otherwise unused and non-productive mined lands will generate economic value for landowners and communities. This will also enhance environmental quality by accelerating restoration of ecosystem services – such as watershed protection, water quality enhancement, carbon storage and wildlife habitat – that are typically provided by native forests on non-mined landscapes.

Today, lands being actively mined in several Appalachian states are often reclaimed using the Forestry Reclamation Approach (FRA) (Burger and Torbert 1992; Burger and others 2005), which establishes productive forest as a post-mining land use in accord with SMCRA. In 2004, the Office of Surface Mining, United States Department of Interior (OSM) and the seven state regulatory authorities in Appalachia created the Appalachian Regional Reforestation Initiative (ARRI) to advocate and promote the use of this FRA to reestablish healthy, productive forest habitat

in the eastern coal fields (Angel and others 2005; Burger and others 2005). The reforestation guidelines in this publication are intended for lands mined and reclaimed without the FRA that are not forested and not under active management. They are intended for application on *unused* mined land, including those lands mined since 1980, reclaimed to satisfy SMCRA guidelines, bond released, and now under landowner control. Land mined before 1980, some of which has been identified as "abandoned mined land" could also be reforested using these guidelines. For these lands to become productive forests, intervention is needed to loosen compacted mine soils, correct chemical or nutrient deficiencies, and replace the current vegetation.

This purpose of this paper is to 1) describe a set of practices that can be applied to restore native forests on *unused* mined lands that are unoccupied, unmanaged, and unproductive; and 2) show the extent to which these reforestation guidelines have been adopted and applied on mined sites by ARRI foresters and various partnering organizations and landowners.

Reforestation Guidelines for Unused Mined Land

Forest restoration on unused mined lands typically requires a sequence of steps or procedures over several years. In a Virginia Tech Cooperative Extension Bulletin, Burger and Zipper (2011) describe the process within the context of "four Ps" - "Plan, Prepare, Plant, and Protect" as follows:

1) Assess site conditions and develop a forest restoration *Plan*;
2) *Prepare* the site to make it more favorable for forest establishment;
3) *Plant* a combination of valuable, native trees or plantation species;
4) *Protect* the site and new planting with follow-up management, including weed control, fire prevention, and animal and human trespass.

Each of these steps are described below.

Develop a Reforestation Plan

Step one entails assessing site conditions and writing a reforestation plan. Based on this assessment and written plan, contractors or other entities can be sought for completing the needed reforestation operations. In consultation with the landowner, the plan should include a detailed map of the site, a vegetation survey, a test and evaluation of mine soil physical and chemical properties, the forest type and species to plant, weed control methods to be used, and procedures for monitoring post planting conditions and success.

A GIS map or an aerial or satellite photo is useful to determine area and to record the assessment survey, as well as a record of all reforestation procedures applied. Aerial imagery that is freely available on internet mapping sites can be used to prepare a base map and to estimate areas. Herbaceous plants and woody shrubs, many of them non-native and invasive, often dominate reclaimed post-SMCRA mine sites (Zipper and others 2007). Successful reforestation requires that existing vegetation be eliminated or controlled. Thus, the reforestation plan must include a strategy to control competing vegetation. The site should be surveyed in advance of reforestation to determine where deep tillage is needed and how it will be applied. Deep tillage of dense mine soils produces a favorable soil condition where roots can extend easily and access needed water, nutrients, and air. Sampling mine soils and sending the samples to a state or private testing lab for chemical analyses can provide information on soil chemical properties to determine if corrective measures are needed. The site map can show where specific tree species mixes will be planted. Tree species selection should be based on landowner objectives and the capability of the site. In most cases, mined land is suitable for mixed native hardwoods.

Prepare the Mined Site for Planting

Preparing the mined site for planting usually requires three steps: 1) removing and controlling existing undesirable vegetation; 2) improving the mine soil's chemical properties by adding lime and fertilizer; and 3) improving the mine soil's physical properties by deep tilling with a dozer to alleviate mine soil compaction and consolidation.

It is essential that the pre-existing vegetation be controlled because it will otherwise compete for sunlight, water, and nutrients needed by tree seedlings to survive and grow. Because the pre-existing vegetation has well-established rooting and physical stature, it has an advantage over newly planted seedlings. If pre-existing vegetation is not controlled, it will quickly overtop and out-compete planted tree seedlings, and those seedlings will not survive. Woody stems that will interfere with reforestation operations should be killed and removed prior to soil preparation. Herbicides should be applied to control herbaceous vegetation both before and after planting tree seedlings.

Soil fertility is essential to the planted trees' growth, and soil pH affects plant availability of soil P. In the short term, access to essential nutrients enables quick, early growth of planted seedlings; this is desirable because post-planting herbicide applications can cease once the planted seedlings overtop their competition. Over the longer term, adequate fertility is essential to forest productivity. Apply lime and fertilizer if necessary to improve the mine soil's fertility and chemical properties. Lime is usually easy to apply with standard, commonly available equipment. However, fertilizers must be applied strategically to restrict availability to the planted trees only and prevent stimulation of competition by undesirable vegetation.

When mine soils have become compacted, soil loosening is needed to allow normal rooting, water infiltration, drainage, and movement of air into the soil profile, all of which are required for productive tree growth. A recent study showed significant increases in survival and growth of native hardwood species when planted in ripped or loose-dumped soil (Michels and others 2007). Compacted mine soils can be loosened with a soil ripper, sub-soiler, or other specialized tillage device. Because forest trees require at least 1.2 m (4 ft) of rooting depth for adequate growth, ripping compacted mined sites to at least 1 m (39 in) is recommended. This deep tillage operation typically requires a large dozer (Figure 1), but the equipment should be transportable via public roads. Application of deep tillage to active mines is described by Forest Reclamation Advisory No. 4 (Sweigard and others 2007); these practices can be adapted for use on older mined sites.

Figure 1. Single shank ripping with a D9 dozer on an abandoned surface mine site near White Oak, Tennessee.

Plant the Site with Selected Tree Species

Over many decades, native hardwoods are likely to re-establish on unused Appalachian mined lands through natural processes, but these processes are hindered by the vigorous, non-forest vegetation that occurs on most mine sites. Natural invasion by heavy-seeded tree species – including oaks (*Quercus* spp.) and hickories (*Carya* spp.)– occur even more slowly, especially on larger mine sites, because these species' seeds are not carried by wind or birds. Plant tree species suited to reforestation goals. If the goal is to reestablish the native forest, plant a mix of native hardwoods. These trees should be commercially viable hardwoods that will provide multiple benefits including wood products, carbon sequestration, wildlife habitat, and watershed control.

Protect and Survey the Site and Trees

Young, planted trees are vulnerable to a variety of hazards, especially through their first year. Competing vegetation prevents seedlings from accessing the sunlight, water, and nutrients they need to survive. Perhaps not so obvious, rodents such as voles, will use a heavy sod cover for winter shelter and de-bark the tree seedlings for a winter food source, thereby killing the trees. Control of competing vegetation with herbicides is essential to reforestation success on virtually all reforested mine sites.

Stocking surveys are needed to determine success of the reforestation effort. To foresters, the term "stocking" means the number of living trees per unit area at a given point in time, and is usually expressed as trees/hectare. A planting rate for mixed hardwoods on mine soils is commonly 1700 trees/ha (680 trees/ac). Expected average survival in the region is 80% at the end of the first growing season and should level off at 70% by the end of the second growing season when trees should be fully recovered from transplanting shock and growing freely without excessive competition. At this stage, minimum stocking should be approximately 1200 trees/ha (480 trees/ac). If stocking is inadequate after the first growing season from poor survival due to droughty summer conditions or other factors, additional planting can be done the following winter.

In September of the planted trees' first year, assess tree survival and stocking by determining the number of trees/ha still living. Mid-summer of the trees' first growing season is their most critical period; trees that survive the mid-summer heat and drought will generally make it through the fall and winter and into the next growing season. Assess site stocking (trees/ha) after the mid-summer heat has passed but while the trees still have their leaves, so living trees are easy to identify.

When the guidelines described above are applied appropriately, productive Appalachian forests can be restored on unused mined lands. Detail on how to apply these guidelines is provided in Virginia Tech Cooperative Extension Bulletin 460-144 (Burger and Zipper 2011).

Application and Adoption of Reforestation Guidelines for Unused Mined Land

In 2004, OSM and the seven state regulatory authorities in Appalachia created ARRI to reestablish healthy, productive forest habitat on active and abandoned mine lands in the eastern coal fields (Angel and others 2005). ARRI's goals are to plant more high-value hardwood trees on surface mines, increase the survival rates and growth rates of those trees, and expedite the establishment of forest habitat through natural succession. The ARRI Core Team was created to facilitate and coordinate among the coal industry; landowners; university researchers; the watershed, environmental and conservation groups; and State and Federal government agencies that have an interest in creating productive forestland on reclaimed mined lands. The ARRI Science Team was established to ensure that the methods ARRI promotes are based on proven science and research, and to guarantee the continued scientific research into forestry reclamation. See the following website for more information about the reforestation initiative in Appalachia: http://arri.osmre.gov/

To promote proper mine land reforestation on active mine sites, ARRI advocates using a set of best management practices called the Forestry Reclamation Approach (FRA). The FRA is a 5 step process that includes: 1) Create a suitable rooting medium for good tree growth that is no less than 1.2 m (4 ft) 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 soil growth medium; 3) Use minimally competitive ground covers that are compatible with growing trees; 4) Plant two types of trees – early successional species for wildlife and soil stability and commercially valuable crop trees; and, 5) Use proper tree planting techniques.

Focused efforts by ARRI are beginning to change the way surface mines are being reclaimed by the coal industry and regulatory authorities currently operating in Appalachia. Since the start of ARRI in 2004, approximately 70 million trees have been planted and approximately 41,683 ha (103,000 ac) restored to forests on newly mined land. ARRI is 'forward looking,' diligently working to educate and train the active mining industry and regulatory personnel about the FRA in order to reclaim new surface mine disturbances to forests from this point forward.

ARRI is also 'looking backward' at the estimated 300,000 ha (741,000 ac) of non-forested, unused, post-bond release mined lands that could be available for reforestation in the Eastern US. The reforestation guidelines for unused mined land (Burger and Zipper 2011) have been applied by ARRI to selected mined sites for restoring unused mined land to native forests. In 2009, 2010, and 2011, ARRI partnered with state and federal agencies, watershed groups, coal operators, conservation groups, environmental organizations, faith-based groups, and numerous universities, colleges, and high schools to coordinate 45 volunteer tree planting projects/events throughout Appalachia. These events involved 241 ARRI partner organizations (Table 1) and 4,163 ARRI volunteers and resulted in the planting of approximately 644,000 trees on about 372 ha (919 ac) of previously reclaimed mine sites where reforestation was not attempted, or where the results were undesirable. ARRI's role in these endeavors is to facilitate communication, provide technical assistance, and to match funding sources with suitable mined land and volunteer groups. ARRI foresters coordinated site selection and evaluation, herbicide treatments, ripping activities, species selection, tree planting, and follow-up surveys.

This post-reclamation reforestation effort has the additional benefit of outreach and awareness that is being created for proper mine land reforestation with the public, industry, and regulatory authorities. Ripping and tree planting partnerships with several mining companies on some of their previously reclaimed mine lands have led them to embrace the FRA on their active mining operations. Many state and federal regulators involved in the volunteer tree-planting projects have expressed positive attitudes for the forestry post-mining land use and employing the FRA on the 'front-end' of the reclamation process instead of as an 'after the fact' process.

On all ARRI planting sites, disease-resistant American chestnut (*Castanea dentata* [Marsh.] Borkh.) trees are planted along with all the other hardwood seedlings. Most of the chestnuts planted are classified as 15/16 backcrosses. The backcrosses are 15/16 American for form and functionality, and 1/16 Chinese for blight resistance. All chestnuts are protected with tree tubes, stakes, and weed mats.

Locations are established using GPS. Scientists with The American Chestnut Foundation and several ARRI Science Team researchers will continue monitoring these plantings.

ARRI foresters return to each planting site after planting to measure survival, productivity, and natural regeneration, and to see what can be learned from the projects to improve the success of future projects. Initial observations show that ripping a site (Figure 2) prepares a seedbed for natural succession. Succession on most sites had been heretofore arrested or substantially slowed because of the mine soil compaction and aggressive herbaceous competition. An immediate response in plant community succession on ripped tree planting sites has been observed. Early successional species such as red maple (*Acer rubrum* L.), sycamore (*Platanus occidentalis* L.), cottonwood (*Populus deltoides* Bartram ex Marsh.), dogwood (*Cornus florida* L.), black locust (*Robinia pseudoacacia* L.), big tooth aspen (*Populus grandidentata* Michx.) are frequently observed volunteers. ARRI foresters have also noted vigorous colonization of non-woody plants and native and non-native forbs such as, horseweed (*Conyza canadensis* [L.] Cronquist), ragweed (*Ambrosia artemisiifolia* L.), aster (*Aster* L.), goldenrod (*Solidago canadensis* L.), lambsquarter (*Chenopodium album* L.), wild carrot (*Daucus carota* L.), and coltsfoot (*Tussilago farfara* L.). The biodiversity on the planting sites increases rapidly; instead of 2-3 dominant non-native grasses and legumes, there is an invasion of myriad native plant species due to the site preparation conducted for each project. For planted trees, there was 83% survival for the first year on sites planted in 2009 and 2010. Second-year survival on sites planted in 2009 remained at 83%. Although initial survival is very promising, reforestation success on these sites is a function of the trees' ability to grow freely above the competing vegetation, avoid hazards including animal browse and rodent damage, and tolerate adverse mine soil conditions that could not be ameliorated. After only three years of experimentation, it is too early to determine the overall success of these forest establishment efforts. ARRI foresters continue to monitor these sites in an attempt to test and refine the reforestation methodologies established by Virginia Tech for previously reclaimed sites (Burger and Zipper 2011).

Long-Term Outlook

After three years of piecing together tree planting projects with donated trees, in-kind services, volunteer tree planters, and very limited funding, the ARRI tree planting events are now evolving into large-scale projects funded by grants, cost share programs, utility companies seeking carbon credits, and corporate donations. Most of this funding is used for site preparation and purchasing seedlings. In many situations, volunteer tree planters will still be needed. In response to the growing interest in planting trees on old mine sites, the ARRI Science Team created a non-profit organization called Green Forests Work (GFW). The GFW program is an economic development plan for Appalachia styled after the Civilian Conservation Corps of the 1930s. The GFW program will focus on restoring ecosystem services on mine-scarred lands and creating jobs in the process. Successful reestablishment of the hardwood forests that once dominated these lands will provide a renewable, sustainable multi-use resource that will create economic opportunities while enhancing the local and global environment. The jobs would include everything from nursery jobs, equipment operators, tree planters, forest managers, and wildlife biologists to those that may manage these sites for renewable energy and climate change mitigation.

Forests are a renewable resource. By recreating forests where no forests currently exist, the economic opportunities provided by this program will not only provide for the Appalachian people today but will put those lands on a trajectory that will ensure that a forest is available for use by future Appalachian citizens. The Appalachian forest is one of the most beautiful in the world, is one of the region's most valuable assets, and has played an integral part in the rich cultural heritage of the mountain people. As support for the program grows, GFW can proceed in developing a skilled green workforce to restore, protect, and manage this natural resource that is so vital to the region's current and future prosperity. For more information on GFW see www.greenforestswork.org.

Figure 2. A single shank ripper pulled by a D11 was used on this gently sloping area to a depth of ≈ 2 m on the University of Kentucky's Bent Mountain Reforestation Research Complex in Pike County, Kentucky. Surface water retained in the rips reduces runoff, erosion, and sedimentation.

Conclusions

There is an opportunity to reforest thousands of acres of unused mined land in the Appalachian region to restore the products and services the original forests provided prior to removal by surface mining. Most of these unused land areas are covered with non-native and exotic vegetation that provide few products and services to landowners and surrounding communities. ARRI is actively working with various landowners, conservation groups, and financial sponsors to restore native forests. Reforesting these sites is challenging due to the nature and condition of these mined lands. Burger and Zipper (2011) developed specific procedures that are being applied by ARRI and its cooperators on various sites throughout the Appalachian coalfields. The first attempts to restore native forests on unused mined sites appears to be successful, but they showed that aggressive control of competing vegetation and strategic application of nutrients to stimulate height growth by planted trees while minimizing stimulation of competition are important components of the unused mined lands' reforestation strategy.

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Table 1. ARRI Partners on Tree Planting Projects on Post-Bond Released Mine Lands in Appalachia in 2009, 2010, and 2011.

Alabama Division of Forestry
Allegany Coal and Land Company
Allegany County Career and Technical Center
Alpha Natural Resources
American Forest Hertitage
American Municipal Power
AmeriCorp National Civilian Community Corp
Anderson County LEARN Center
Appalachia – Science in the Public Interest
Appalachian Coal Country Watershed Team
Appalachian Regional Reforestation Initiative
Appalachian School of Law
Appalachian State University
Appalshop
Arbor Day Foundation
ArborGen
Arizona State University
Armstrong Conservation District
Army Corps of Engineers
Barnesville Area Reforestation Kommittee
Bates, Dr. Artie Ann (landowner)
Bates, William Van (landowner)
Beaver Local High School Environmental Club
Berea College
Bereans for Appalachia
Birch River Elementary
Blue Mountain Area High School
Boy Scouts of America, Grantsville, MD
Boy Scouts of America, Hazard, KY
Boy Scouts of America, Port Carbon, PA
Bryant, Lee (landowner)
Buckanan County Industrial Development Authority
Buffalo Middle School
Burch Middle School
Cabot Oil and Gas Corporation
Camp Dawson National Guard
Camp Robert C Webb
Campus Christian Center
Carter Caterpillar
Central Appalachian Spruce Restoration Initiative
Central Michigan University
City College of New York
Clairfield Elementary School
Claude Worthington Benedum Foundation
Cliffs Natural Resources, Inc.
Clintwood Elementary
Clintwood Elkhorn Coal Company
Coal Creek Watershed Foundation
Coal Heritage Highway Authority
Coldwell Timber Consulting
Columbiana County Federation of Conservation Clubs
Columbiana County Park District
Columbiana Soil and Water Conservation District
Conservation Services, Inc
Cowan Creek Mountain Music School
Crystal, Denny and Merrill (landowners)
Cub Scouts of America, Grantsville, MD
Delaware Valley Earthforce
Dickenson County School System
Dominion
Drew University
DriWater, Inc
Duke Energy
Eastern Coal Regional Roundtable
Eastern Kentucky Environmental Research Institute
Eastern Kentucky University
Eastern Kentucky University Arts & Humanities Collab
Flatwoods Job Corps
Flying Roster Farm
Food City of Wise, VA
Foundation for Pennsylvania Watersheds
Friends of Cheat River
Friends of Coal, Ladies Auxiliary
Friends of the Russell Fork
Frostburg Pizza Hut
Frostburg State University
Garrett County Watershed Association
GenOn Energy, Inc
Geo/Environmental Associates, Inc.
Georgetown University
Girl Scouts of America
Glade Creek Elementary
Glade Middle School
Green Forest Works
Green Peace
Groundwork Wyoming County
Guest River Restoration Project
Headwaters, Inc
Highlandtown Wildlife Area
Hill Creek Nursery
Huntington Bank
Hutchinson, Chad (AFLAC agent)
Indiana University of Pennsylvania
Interfaith Youth Core
International Coal Croup Eastern, LLC
James River Coal Company
Jeffco Resources, Inc
Jenkins High School
JTW Gas Well Service
JW Adams Elementary
Ken and Coy
Kent State University
Kentucky Department of Fish and Wildlife Resources
Kentucky Division of Abandoned Mine Lands
Kentucky Division of Conservation
Kentucky Division of Forestry
Kentucky Division of Mining Reclamation Enforcement
Kentucky Riverkeepers
Kiski Realty Company, Inc
Kopper Glo Fuel, Inc.
Letcher County Central High School
Let's Move Outdoors
Lexington Christian Academy Beta Club
Little Beaver Creek Land Foundation
Lonesome Pine Soil and Water Conservation District
Longs Fork Elementary
Lowe's Home Improvement – Beckley, WV
Loyola University
Marquis Development of Williamson, WV
Maryland Dept of the Environmt, Water Mgmt Adm
Maryland Forest Service
Maxxim Shared Services
McClure River Restoration Project
McFall Excavating
Meadow Mountain Boys Camp
Michigan State University
Miller, Mary (Sierra Club)
Missouri State University
Morehead State University
Mountain Association for Community Economic Dev.
Mountain Ridge High School
Mountaintop Mining
Mullens, Alcieberry (landowner)
Mullens Ministerial Association
National Park Service
Natural Resources Conservation Service
Natural Res Conser Serv, Appalachia Plant Mat Cntr
Norfolk Southern Foundation
Northern Kentucky University
Northern West Virginia Brownfields Assistance Center
Notre Dame University
Oakbrook Church, Reston, VA
Office of Surface Mining, USDI
Ohio Department of Natural Res, Div of Res Mgmt
Ohio State University
Oxford Mining
Paramont Coal Company Virginia, LLC
Patriot Coal Company
Penn's Corner RC&D Council
Pennsylvania Dept of Consv & Nat Res, BAMR
Pennsylvania Dept of Consv & Nat Res, BOF
Pennsylvania Dept of Consv & Nat Res, Sproul Forest
Pennsylvania Dept of Environmental Protection
Pennsylvania Game Commission
Pennsylvania State University, Schuylkill
Perry County Future Farmers of America
Personal Responsibility in A Desirable Environment
Pine Branch Coal Company
Pine Grove Area High School
Pine Mountain Grill
Pine Mountain Settlement School
Plum Creek Timberlands, LP
Premier Elkhorn Coal Company
Reading Anthracite
Richwood High School
River City Drum Corp
Roaring Run Watershed Association
RPM Ecosystems LLC
Ruffed Grouse Society
Rural Appalachian Improvement League
RW Combs Elementary
Saddleback College
Samara of Berea College
Sara Lee, Inc
Savage River Watershed Association
Saylor, Doug (Consulting Forester)
Scenic Rivers Program
Schuylkill Conservation District
Schuylkill County Commissioners
Schuylkill Headwaters Association
Shavers Fork Coalition
Shelby Valley High School
Shell Heirs (landowners)
Sierra Club – Bluegrass Chapter
Sizemore, Judy (Writer and Arts Consultant)
Starbucks
Stone Forestry Services, Inc
SUNY at Geneseo, NY
Tampa Electric Company
Tennessee Mining Association
Tennessee Valley Unitarian Universalist Church
Terra Tech Engineering of Grundy, VA
Texas A&M University
The American Chestnut Foundation
The Baum Foundation
The Forest Management Company
The JOBS Project
The Nature Conservancy
Union Concrete, Division of RBS Inc
Unitarian Church of Knoxville
Unitarian Universalist Fellowship of Cumberland
United Nations Environmental Programme
United States Army Corp of Engineers
United States Fish and Wildlife Service
United States Forest Service, Daniel Boone Natl Forest
United States Forest Service, Monongalia Natl Forest
United States Forest Service, Northern Research Station
Union Concrete, Division of RBS Inc
University of Kansas
University of Kentucky
University of Notre Dame
University of the Cumberlands
University of Vermont
Upper Guyandotte Watershed Association
Upper Tennessee River Rountable
Vaughan Bassett Furniture Company
Virginia Cooperative Extension
Virginia Department of Mines Minerals and Energy
Virginia Division of Forestry
Virginia Mining Association
Virginia Tech
Wal-Mart (Frostburg, MD)
Wal-Mart (Minersville, PA)
Wal-Mart (Schuylkill, PA)
Webster County High School
Wes-Mon-Ty Resource Conservation & Development
Western Kentucky University
Western Maryland RC&D Council
West Virginia Department of Environmental Protection
West Virginia Department of Natural Resources
West Virginia Division of Forestry
West Virginia National Guard, Camp Dawson
West Virginia University
Wheelock College
White Oak Elementary School
Williams Forestry & Associates
Woman's Club of Morgan County, KY
Woodland Community Land Trust
Wyoming County Board of Education
York, Larry (landowner)
Young Men's Club of America
Young Professionals of Eastern Kentucky, Inc.

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