

Green Forest Works for Appalachia



Appendices 1–7

*Prepared by the Science Team of the Appalachian
Regional Reforestation Initiative*



Table of Contents

Appendix 1: Green Forest Works for Appalachia (Detailed Proposal)	1
Introduction.....	3
Background.....	5
The Extent of the Problem in Appalachia.....	6
The Appalachian Regional Reforestation Initiative and the Forest Reclamation Approach.....	8
The Socio-Economic Condition of Appalachia.....	11
Success Stories for Planting Trees on Old Mine Land.....	13
The Green Forest Works Program: Organizational Structure.....	18
The Costs	28
Return on Investment.....	33
Conclusion	36
Literature Cited	36
Appendix 2: Letters of Endorsement and Editorials of Support	40
Appendix 3: ARRI's Statement of Mutual Intent	56
Appendix 4: ARRI's Forestry Reclamation Advisory No. 4	59
Appendix 5: Pilot Projects by Community Volunteers	63
Appendix 6: Green Forest Works for Appalachia: Second Year Pilot Project Proposal	70
Appendix 7: Cost Analysis of Green Workers	76

Appendix 1: Green Forest Works for Appalachia (Detailed Proposal)

Introduction

The **Green Forest Works for Appalachia** program (hereinafter called **Green Forest Works**) is intended to establish high-quality forested land on coal surface mines that were reclaimed after passage of the Surface Mining Control and Reclamation Act of 1977 (i.e., post-SMCRA) using practices that were not conducive to effective reforestation. **The Green Forest Works** program is intended to reforest post-SMCRA mine sites as a means of achieving societal benefits that include:

- 1) putting American citizens “back to work” to revive the economy,
- 2) restoring the landscape’s capacity to produce forest products for future use in manufacturing and energy production,
- 3) restoring an “environmental infrastructure” -- ecosystem processes and services provided by native forests -- to coal mined Appalachian landscapes, and
- 4) building a human-resource capacity and infrastructure via private and non-profit sectors to restore forests on former mine sites that will generate jobs and economic activity, even decades after the program’s completion.

Although coal provides a low-cost energy source, use of woody biomass for energy production has gained much attention recently, not only for its potential to serve as an inexpensive and domestic supply of power, but also for the possible environmental and rural development benefits it offers. Woody biomass can be used to generate electric power, and new and emerging technologies allow conversion of biomass materials to liquid fuels (Aden, 2009). US Departments of Energy and Agriculture envision a sustainable supply of biomass sufficient to displace 30% or more of the country’s present petroleum consumption by 2030, thus creating a new domestic industry that will grow and convert biomass products, offsetting US capital outflows for purchase of petroleum imports (Perlack et al., 2005). Research at Virginia Tech (Fields-Johnson et al., 2008) and University of Kentucky (Stringer and Carpenter, 1986) demonstrates the potential of reforested coal mine sites to support woody biomass crops with average growth rates far exceeding those of native hardwoods on un-mined land, with potential for harvest as energy crops on rotations as short as 10-15 years. Establishment of biomass plantations on favorably configured and located coal mine sites will support jobs, and can potentially create additional jobs by meeting capacity for feedstock production that will attract cellulosic biorefinery investors to the Appalachian region.

If carbon-emission restrictions become law, it is likely that coal-burning electric-power producers will be called upon to offset carbon emissions to the atmosphere. Planting trees on productive post-mined soils is a way to produce a measurable carbon sink (Amichev et al., 2008). Forests growing on good quality mine sites can sequester 3 to 5 times more

carbon than the grasslands that were established through the original reclamation (Burger and Zipper, 2009). Reforestation of older mine sites can sequester carbon that can be used to offset US carbon emissions from fossil fuels.

Society at large also benefits from restoration of productive forests, as they constitute an “environmental infrastructure” that produces ecosystem services of tangible value to the nation and to Appalachian communities. For example, forested landscapes help to maintain clean water in rivers and streams, an ecosystem service that is of significant value throughout Appalachia and beyond. This service is of special value in those Appalachian streams that, although affected by coal mining, continue to support exceptional biodiversity in the form of rare, threatened, or endangered aquatic species, including fish and mollusks. The reestablishment of forests will also aid in restoring watershed protection services to streams draining Appalachian landscapes, such as reduction of the peak flows that can cause flooding and the maintenance of water flows during dry weather periods. Flooding causes millions of dollars in damages in coal mined areas of the Appalachian region each year; restoration of native forests within extensively mined but non-reforested watersheds would reduce the intensity and frequency of flooding impacts downstream. Targeted reforestation can also reduce forest fragmentation that has been caused by mining (Wickham et al., 2007), as needed to restore habitat for wildlife species that depend on large expanses of unbroken forest, including rapidly declining bird species such as the Cerulean Warbler (*Dendroica cerulea*) and for species that depend on successional forest habitat. Reforestation with native species will also improve landscape aesthetics, thus enhancing the capacity of communities in coal mined areas to serve as tourist destinations and to support tourism-related businesses and jobs.

Perhaps the most essential outcome of the **Green Forest Works** program will be the creation of the capacity to continue reforesting the coal-mined Appalachian landscape beyond this program’s lifespan. **Green Forest Works** will be structured to engage managers and contractors at the local level; reforestation efforts will be guided by ARRI and conservation scientists, enabling local personnel to gain the knowledge and experience that will contribute to continuation of successful mined-land reforestation activities after completion of the **Green Forest Works** program. Landowners will experience successful reforestation outcomes, and may be encouraged to continue reforestation of their lands using their own funds as a result. Our analyses indicate that, when conducted on favorable sites, establishment of bioenergy plantations approach profitability using conventional economic measures (Sullivan et al., 2005). As the carbon-emissions offset functions of bioenergy plantations become more highly valued in the marketplace, the profitability of such enterprises will improve. It is anticipated that this will lead landowners to engage in similar mined-land conversions independently which will produce jobs beyond the duration of the **Green Forest Works** program. Nonprofits and landowners may target reforestation efforts in environmentally sensitive areas, as The Nature Conservancy’s Virginia Chapter has done as a pilot application within the biodiversity-rich Clinch-Powell River watershed (TNC, 2008).

We propose a strategic process to locate sites where native forest would be re-established through the **Green Forest Works** program in areas where such benefits would be maximized. Factors to be considered in selecting program sites could include:

- the extent and rate at which individual mine sites are reforesting naturally without the interventions proposed by the **Green Forest Works** program;
- presence and proximity of rare and valued aquatic species within the waters fed by site drainage;
- the extent to which hydrologic benefits due to reforestation of mined lands within a given watershed would be likely to reduce risks of flood damage to streamside residents lower in the watershed;
- the extent to which successful reforestation of such lands would eliminate forest fragmentation and thus would create viable habitat for species that depend on large expanses of non-fragmented forest, such as the Cerulean Warbler;
- site contours, road access, and other attributes that would contribute to the economic viability of converting a mine site to a high-volume woody biomass production facility should fast-growing, highly productive woody species be established on the mine site, after mitigation of soil properties through the **Green Forest Works** program;
- proximity to local mining communities to potentially provide a viable workforce.

Background

After many years of congressional debate and several presidential vetoes, Congress passed the Surface Mining Control and Reclamation Act (SMCRA) (Public Law 95-87 Federal Register 3 Aug 1977, 445-532). When President Jimmy Carter signed SMCRA into law on August 3, 1977, he called it a disappointing and watered down measure. Nonetheless, the act was historic; its benefits far outweighed its drawbacks. The enactment of the law climaxed a 10-year struggle over the surface mining of coal and created the first uniform Federal environmental control on surface mining. Until that point, such control was a prerogative of state governments.

SMCRA challenged the coal industry and regulators to adopt a different mindset regarding reclamation than what existed prior to the law. It required surface mine operators to restore the approximate original contour (AOC) of disturbed land, eliminate highwalls by backfilling and grading them, replant trees and grass, and prevent the pollution and sedimentation of streams. Working in tandem with the AOC and highwall elimination stipulations was the prohibition of placing spoil (the broken rock and soil generated by mining) on the downslope (the mountain slope below the coal seam). In the decades prior to the federal law, gravity transport of spoil was common as it was pushed or cast upon the downslope by surface mine operators. Although the spoil placement that resulted from this practice created a loose rooting medium that was conducive to the growth of trees, these areas were more likely to experience slumps and landslides. Landslides, massive slumping of spoil, serious erosion and sedimentation, and the endangerment of coal field citizens were commonplace in many areas on pre-SMCRA surface mines. SMCRA improved the landforms created by surface mining by increasing

stability, thus improving water quality and enhancing human safety in the Appalachian region, compared to the results of pre-SMCRA mining. However, SMCRA's implementation has not been accompanied by widespread replacement of forests disturbed by mining (Burger and Torbert, 1992).

SMCRA created the Office of Surface Mining and Reclamation Enforcement (OSM) to implement the federal law beginning on May 3, 1978. Many of the newly hired federal inspectors were former state inspectors from the steep-sloped Appalachian coal states who had extensive experience with landslides, unstable backfills, massive erosion, and sedimentation. Because of this orientation, federal regulators focused on the stability of landforms and water quality created by mining at the expense of restoring forest land capability. Also, the booming prices for coal during the early implementation of SMCRA attracted the interest of many highway construction companies that were accustomed to the highly controlled and regulated placement and compaction of earthen material. This regularly resulted in excessive compaction of soil and subsequent planting of aggressive ground covers. Furthermore, both regulators and mine operators were challenged by the technical complexities of implementing SMCRA in the years following its passage. As a result, reforestation of mined sites during reclamation was largely ignored. Lastly, some early efforts by mine operators to reforest under SMCRA proved problematic, in part because these efforts were conducted without the benefit of scientific knowledge that is available today. As a result, mine operators and regulators came to believe that post-mining land uses such as hay and pasture land were easier and cheaper to achieve bond release than a post-mining land use of forestry. These factors and others contributed to a significant loss of forests due to mining across Appalachia (Angel et al., 2005; Wickham et al., 2007).

The Extent of the Problem in Appalachia

Eastern US lands that have been mined for coal and reclaimed under SMCRA constitute a significant land resource. Since 1930, approximately 6 million acres have been disturbed by surface mining in the US (Paone et al., 1978; Plass, 2000). The vast majority of surface mined land in Appalachia was forested before mining. However, since the implementation of SMCRA in 1978, most surface mined land has been reclaimed to a "pasture and hay land" or "wildlife habitat" post-mining land use (Plass, 1982; 2000). Most of the "wildlife habitat" prescriptions were designed to benefit game species (deer, turkey, rabbits, and more recently elk) that are habitat generalists – they can use a mix of open grasslands, thick non-native plants, unnatural pine thickets, etc. The "wildlife habitat" option was not designed to benefit the habitat specialists (Cerulean Warblers, amphibians, bats, etc.) that rely on large tracts of contiguous, native, diverse, forests. A conversion of the pre-mining land use from forestry to a post-mining land use of "pasture and hay land" or "wildlife habitat" is acceptable under SMCRA and is economically viable when the site is maintained with fertilizer, lime, and forage removal. But problems develop if these agronomic practices are neglected because the high-maintenance forages can quickly collapse and revert to a barren, eroded landscape of weedy and undesirable species (Skousen et al., 2009). Such sites can remain in a state of

arrested natural succession for decades, if not centuries. A series of unproductive, and often mostly non-native, plant communities will persist until hardwood species ultimately re-invade the sites (Gorman et al., 2001; Groninger et al., 2007; Potter et al., 1951; Zeleznik and Skousen, 1996).

Zipper et al. (2007) estimated that the quantity of post-bond released mined lands in Appalachia that could be available for reforestation and carbon sequestration is on the order of 741,316 acres. This estimate was derived assuming approximately ½ of lands mined and reclaimed under SMCRA could be made available for reforestation and carbon sequestration. The 741,316 acre figure is slightly less than half of the total Phase III and recent Phase I (2001-2005) bond released acreage tallied by OSM (Table 1)¹. These acreages, however, include some double-counting due to re-mining of lands that were mined previously under SMCRA, but no estimate of such double-counted acreages is available. Zipper et al. (2007) estimated that about 50% of available acreage could be made available under the right incentive structure considering several factors. First of all, some of the post-SMCRA mined lands are already in beneficial uses, such as livestock grazing, and various forms of development. The researchers reported that no data to allow an estimate of such a quantity was available, but experience indicates that mined land already in beneficial uses to be very small, far less than 50%.

Table 1. Eastern US coal-mined land areas reclaimed in acres under SMCRA, 1978-2005¹.

State	Phase III Released	Phase I Released (2001-2005) ²	Total
E KY ³	601,785	64,480	675,262
MD	13,275	292	13,566
OH	183,271	23,463	206,731
PA	231,464	33,013	264,477
TN	36,972	7,280	44,249
VA	91,617	2,782	94,399
WV	231,503	28,847	260,350
Total	1,398,887	160,157	1,559,034

¹ Including the interim SMCRA program. Source US OSMRE “20th Anniversary of the Surface Mining Law” (<http://www.osmre.gov/annivrep.htm>) and annual reports to Congress.

² As reported by states to OSMRE; these figures overestimate total affected areas due to double-counting of areas that were both mined and re-mined under SMCRA.

³ Estimated from total Kentucky areas, as proportionate to the east-west distribution of surface coal tonnage.

¹ Bond release actions may occur at the completion of three distinct phases of reclamation. Phase I bond release may occur upon the completion of backfilling, regrading (which may include the replacement of topsoil) and drainage control. Phase II bond release may occur after replacement of topsoil (if not part of Phase I), after vegetation has been established, and when there are no contributions of suspended solids to stream flow or runoff outside the permit area. Phase III, or final bond release and termination of jurisdiction, may occur at the successful completion of all reclamation activities.

Second, Zipper et al. (2007) speculated that some land owners may not wish to make their lands available for reforestation and carbon sequestration even if additional incentives were offered. If mineral owners believe that future marketplace changes will make it profitable to mine such properties again, so as to extract coals that could not be exploited economically when past mining was occurring, most would consider potential returns from future mining as likely to far outweigh potential returns from reforestation. The researchers did not expect a majority of landowners to fall into this category.

A third factor considered concerns the status of the vegetative communities on mine sites at present. Assuming soil properties are equally favorable, reforestation will be most feasible where mine sites are not occupied by invasive woody vegetation (such as the autumn olives (*Elaeagnus umbellata*) that are proliferating in mining areas throughout Appalachia) or by low-value species with poor timber-production and low carbon-sequestration potentials that may have been planted after mining (such as black locust (*Robinia pseudoacacia*), which has been used commonly for reclamation in Appalachia) (Zipper et al., 2007). If such species are present and have advanced to the point where they would hinder reforestation success, they must be eliminated if the site is to be successfully reforested; this can only occur at some cost. Although currently planted species do accumulate carbon on mine lands, and can accumulate it rapidly during the first 10-20 years after reclamation, those accumulations are generally not harvested and converted to sequestrable forms such as building products (Zipper et al., 2007). As time passes, it is likely that many mine sites that are not currently occupied by invasive or low-value species in advanced growth stages eventually will be colonized by such species, and such sites' potential for reforestation will decline as a direct result (Zipper et al., 2007). Therefore, the **Green Forest Works** program is timely.

This estimate of 741,316 acres of mined land eligible for reforestation and C sequestration in Appalachia can be considered a very conservative estimate. When abandoned mine lands (those coal mine sites that predate SMCRA), other drastically disturbed lands like brownfields, abandoned hardrock quarries and mine sites, and degraded agricultural fields are added to the area of land needing intervention in order to restore the Appalachian forest, more than a million acres could possibly be available for this program.

The Appalachian Regional Reforestation Initiative and the Forest Reclamation Approach

The Appalachian Regional Reforestation Initiative (ARRI) was created in 2004 in an effort to address the problems associated with reforestation of surface mines. ARRI is a cooperative effort between the states of the Appalachian region, OSM, and other partners to encourage restoration of high quality forests on reclaimed coal mines in the eastern US. ARRI's goals are to communicate and encourage mine reforestation practices that (1) plant more high-value hardwood trees on reclaimed coal mined lands in Appalachia;

(2) increase the survival rates and growth rates of planted trees; and, (3) expedite the establishment of forest habitat through natural succession. No funding has ever been provided for ARRI. Dedicated ARRI team members are those who facilitate and coordinate the coal industry; landowners; university researchers; watershed coalitions, environmental and conservation groups; and State and Federal government agencies that have an interest in creating productive forestland on reclaimed mined lands (Figure 1) (Angel et al., 2005).



Figure 1. ARRI coordinates a multitude of partnerships to achieve mined land reforestation on both active mine sites and on land where the reclamation performance bonds have been released and the mining companies no longer have any legal responsibility under the federal and state reclamation laws.

ARRI created a Core Team that includes members from each OSM Field Office and members from each state regulatory authority in the Appalachian region. The Core Team has the responsibility to develop reforestation partnerships, promote ARRI, and work to eliminate the cultural, technical, and regulatory barriers that exist for reforestation of surface mines. Realizing the value of current and past research for reforestation, the ARRI Core Team formed the Science Team in 2005. The Science Team, which works with the Core Team to improve the science supporting ARRI, is comprised of about 30 scientists, forestry researchers, and reforestation experts from the following universities, government agencies, and one non-government organization:

- Indiana University of Pennsylvania
- Ohio University
- Ohio State University
- Pennsylvania State University
- Purdue University
- Southern Illinois University
- University of Kentucky
- University of Maryland

- University of Tennessee
- Virginia Polytechnic Institute
- West Virginia University
- West Virginia State University
- Wilkes University
- US Forest Service
- US Geological Survey
- The American Chestnut Foundation
- Office of Surface Mining

The biggest contribution of the Science Team was the development of the Forestry Reclamation Approach (FRA), which is a methodology for reclaiming surface mined land to forest under SMCRA. The FRA is consensus science that is based on knowledge gained from both scientific research and experience (Burger et al., 2005). Furthermore, OSM and the Appalachian region states have determined that the FRA is an appropriate and desirable method for reclaiming surface mined land to support forested land uses under current state and federal regulations. It can achieve cost-effective regulatory compliance for coal operators while creating productive forests that generate value for their owners and provide watershed protection, wildlife habitat, and other environmental services.

To help achieve its goals, ARRI recognized the need to inform all stakeholders of the benefits of reforestation. The Core Team developed a Statement of Mutual Intent (SMI) to explain the purposes of the initiative and solicit support. The number of signatories to the SMI demonstrates the depth and diversity of the support for ARRI. ARRI currently has 678 signatories which represent 206 different organizations including:

- 182 Individual volunteers
- 59 Industry organizations
- 51 Government agencies
- 24 Environmental groups
- 20 Citizen volunteer groups
- 17 Academic institutions
- 17 Watershed volunteer groups
- 11 Other volunteer groups
- 7 International groups

The cooperation of such diverse groups, all pursuing the same agenda, i.e., planting trees, is unprecedented and unique. Groups traditionally with opposing goals have found common ground and are working together with OSM and the states to promote forestry on mined land. See Appendix 3 for ARRI's Statement of Mutual Intent. For a list of signatories that have pledged their support for the reforestation of mined land, visit the homepage of ARRI's website at <http://arri.osmre.gov/> and locate the Statement of Mutual Intent in the menu bar.

Developed by ARRI scientists, the Forestry Reclamation Approach is a proven methodology for reestablishing forests on active surface mine sites. The FRA can be summarized in five steps:

- 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 1 to create a non-compacted soil growth medium;
- 3) Use native and non-competitive 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; and,
- 5) Use proper tree planting techniques.

The FRA is a method of reclamation for active surface mines that are currently returning the land back to a forest post-mining land use. For those older mine sites that have already been reclaimed, where the mine soils have been compacted and aggressive grasses cover the site, a modified version of the FRA, using a technique called ripping, is required. Ripping of soil with a ripper blade or deep plow attached to a bulldozer can alleviate most soil compaction effects on mine sites and is considered a modified version of Step 2 of the FRA (Dunker et al., 1995; Dunker and Barnhisel, 2000; Conrad et al., 2002; Sweigard et al., 2007). Appendix 4 provides detailed guidance on the mitigation of compacted mine soils to prepare it for tree planting. Although research has shown that ripping can increase tree growth (Burger et al., 1998; Probert, 1999; Burger and Zipper, 2002), this is an unnecessary expense that can be avoided by limiting compaction during final grading as described in Step 2 of the FRA. ARRI is working very hard to get the surface mining industry to use the FRA on current and future reclamation efforts, and has made substantial progress towards its goals. The number of trees being planted on active mine sites is currently estimated to be approximately 12.8 million trees per year. These are trees that would otherwise not be planted if it were not for the efforts of ARRI. ARRI's reforestation efforts throughout the Appalachian Mountains were recognized through the prestigious "Cooperative Conservation Award" presented in 2007 by the U.S. Department of Interior.

The Socio-Economic Condition of Appalachia

Appalachia, as defined by the Appalachian Regional Commission, is a 205,000-square-mile region that follows the Appalachian Mountains from southern New York to northern Mississippi (ARC, 2009). Of the 13 states that make up Appalachia, the following 8 have extensive post-SMCRA mined lands and would be the primary focus of the **Green Forest Works** program: Alabama, Kentucky, Maryland, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. About 24.8 million people live in the 420 counties of the Appalachian Region; 42 percent of the Region's population is rural, compared with 20 percent of the national population.

With the discovery of coal in Appalachia, the region's economy became almost exclusively synonymous with the coal industry. Coal remains an important economic resource, but it is not a major provider of jobs. With mechanization and the recent halving of coal prices in just a year (EIA, 2009), coal mining has become an increasingly less significant employer.

“In 1997, the coal mining industry in the Appalachian coal-producing region employed slightly more than 60,000 people...this large number of employees only represents about two percent of the entire workforce in these counties. Likewise, earnings from the coal mining industry totaled \$4.03 billion in 1997 but represented only about 3.3 percent of total earnings across all industries. These figures illustrate that coal mining jobs have higher wages than the typical job in the economy” (Berger and Thompson, 2001). In certain counties in Appalachia, 60% of the work force is part of the coal industry in some way.

Urbanization of larger cities has increased incomes and decreased poverty throughout Appalachia. Much of the poverty that remains below the national level exists in small pockets, usually situated in rural areas that are far from industry and other economic provisions. “More than three-fifths of the Appalachian population lives in metropolitan areas... One-sixth of the region’s population—mostly in southern Appalachia—lives in one of the 76 counties that grew at least 20 percent during the 1990s. And more Appalachian residents live in counties that are economically on par with the nation as a whole than do residents in Appalachian areas under major economic stress, while seven Appalachian counties have been losing population *every decade* since 1950, with the population in those counties shrinking from 804,000 to 574,000, or 29 percent” (Pollard, 2002).

Hertzenberg et al. (2005) seconds the above argument, “The last 30 years have seen overall improvements in many economic and social indicators in Appalachia, but varied changes within different parts of the region. Southern Appalachia has become less poor and more educated, but has a larger concentration of manufacturing making it more vulnerable to pending swings in manufacturing employment. Northern Appalachia weathered significant manufacturing losses in the 1980s and 1990s, but has retained pockets of high-wage manufacturing jobs. Northern Appalachia also has gone from a poverty rate lower than the national average to one higher. It may have fewer manufacturing jobs to lose than Southern Appalachia, but has not fully recovered from previous restructuring. Central Appalachia remains the region with the highest poverty levels and the lowest levels of education”.

With the loss of natural resources, such as declines in coal production, and massive loss of timber over the years, many areas in Appalachia are dependent upon a tourism industry easily affected by economic downturns. So, challenges still remain when it comes to making poverty/education/income levels even with the rest of the US. Imaginative, visionary programs such as the **Green Forest Works** are required to create jobs with longevity in Appalachia - jobs that can combine the strengths and richness of its culture with innovative ideas that improve its weaknesses and actually give the

Appalachian people the tools and training to fix these problems themselves. With the jobs provided by the **Green Forest Works** program, the Appalachian people can then write their *own* fascinating history in a brighter, more positive light.

People have been in search of jobs, dignity, and a bountiful land within the spine of the Appalachian Mountains from the colonial days to the present. The discussion of exactly where they can find those treasures is not limited to the realm of social scientists, economists, and politicians. For decades, noted artists, musicians, poets, and writers, have contributed to the search. Harry Caudill, Wendell Berry, Silas House and many other noted writers have framed their work as urgent appeals to the American conscience for the land and people of Appalachia. Erik Reece, author of “Lost Mountain: A Year in the Vanishing Wilderness” recently wrote: “We need a New Deal for Appalachia that would expand the Appalachian Regional Reforestation Initiative, or create a similar program, to finally return some of the region’s lost wealth in the form of jobs and trees, rebuilt topsoil and resuscitated communities. Financing should come from a carbon tax on Appalachian coal bought and burned by utility companies across the country — a tax that would also discourage the wasteful emissions of greenhouse gases. Such a project would educate and employ an entire generation of foresters and forest managers, who would be followed by locally owned wood-product industries and craftsmen...” (Reece, 2007).

Success Stories for Planting Trees on Old Mined Land

Pilot tree planting projects by community volunteers in 2009:

To demonstrate the potential for the **Green Forest Works** program, the Appalachian Coal Country Watershed Team (ACCWT, www.accwt.org) and ARRI partnered for the first time in the spring of 2009 by bringing together the science of mined land reforestation, VISTA, and community tree planting volunteers. Volunteers from coal field watershed groups were organized to plant trees at 8 events throughout the Appalachian coal region (See Figure 2).



Figure 2. Tree planting volunteers at a Boone County, West Virginia, event organized by ACCWT, OSM/VISTA volunteers, and ARRI foresters. The tree planters included local coal company employees and volunteers from environmental groups. (Photo by Luke Elser).

This effort was to ‘test the waters’, and to learn how to conduct large scale, simultaneous tree planting projects across the region. Despite the lack of available funding, ACCWT and ARRI shared the successes of the OSM/VISTA workers, citizens, and industry volunteers who planted 27,500 tree seedlings on 36.1 acres of post-bond released mined land along with the following volunteer watershed groups and organizations:

- ACCWT – Boone County, WV
- Appalachian Forest Heritage Area – Webster County, WV
- Cumberland River Watershed Group – Williamsburg, KY
- Friends of Russell Fork – Haysi, VA
- Guest River – Coeburn, VA
- Headwaters, Inc. – Carcassonne, KY
- Little Beaver Creek Land Foundation – Lisbon, OH
- Schuylkill Conservation District – Minersville, PA

ARRI provided the science of mined land reforestation and ACCWT provided the volunteers and public engagement. The sites chosen to be ripped and planted were formerly mined and reclaimed. All of the sites were characterized by excessive soil compaction and competitive grasses and they were essentially scrublands with little chance of growing into healthy productive forests through natural succession. The soil compaction was mitigated by ripping it with a D-9 bulldozer to a depth of four feet. In one case, the local OSM/VISTA volunteer successfully petitioned an area coal company to donate the ripping. In other instances, the OSM/VISTA volunteer raised money from the community to pay for the ripping.

On the day of the tree planting event, preparations were made and supplies were set up prior to the arrival of the volunteers. Depending on the site, from eight to twelve different species of native hardwood trees were planted at each site to provide the future forest with as much bio-diversity as possible. The volunteers were transported to the planting site, instructed as to proper planting methods, outfitted with trees and planting equipment, and assigned to small groups with an ARRI forester supervising the planting. At several of the events, volunteers from a local coal company and environmental groups planted trees side by side. The events were widely covered by the press and attracted considerable regional, national, and international attention. Children from Colombia, South America, sent pen-pal letters of support to Appalachian coal field children involved in the events, and the United Nations Environmental Program's (UNEP) seven billion tree campaign sent representatives from New York and San Francisco to Letcher County, Kentucky, to celebrate the success of this regional effort. The number of volunteers who participated in these events ranged from 25 to 150 and included:

- conservation clubs
- coal company representatives/employees
- environmental groups
- industry associations
- church groups
- state natural resources agencies
- soil and water conservation districts
- local high schools and elementary schools
- the Boy and Girl Scouts of America
- local merchants and businesses such as Wal-Mart, Giant Eagle, banks, etc.
- members of the community

OSM/VISTA volunteers and ARRI foresters had no funding available to do any of these projects. Everything was contributed: in-kind services, money, and labor, and those contributions were leveraged and parlayed into successful tree planting projects. Appendix 5 provides more details and photographs of all the pilot tree planting events. Due to the efforts of the citizen/watershed groups and the momentum created during the spring of 2009, it is apparent that the volunteer tree planting movement will be an integral part of any mined land reforestation program in the future. A proposal to fund a second year (2010) of the ACCWT/ARRI pilot projects can be found in Appendix 6.

Reforestation research and pilot tree planting projects in Virginia:

Virginia Polytechnic Institute and State University's (VT) Powell River Project (PRP) is a cooperative program of Virginia Tech, other educational institutions serving southwestern Virginia's coalfield counties, and southwestern Virginia's natural resource industries. The Powell River Project mission is to conduct research and education programs to enhance restoration of mined lands. The Powell River Project's Research and Education Center in Wise County, VA, is a unique educational resource which attracts

visitors from throughout Virginia, other parts of the US, and overseas.

Established in 1980, PRP's reforestation research program, which is led by Dr. James Burger, has developed reforestation methods which reduce reclamation costs, improve regulatory compliance, and increase post-mining timber productivity in comparison to conventional mine reforestation. The current research emphasis is reforestation with hardwood species. A number of long-term research activities are ongoing at the Project's Research and Education Center, which is also used to conduct coal mine reforestation training programs for personnel from agencies and industry.

A number of experimental mine-reclamation methods have been pioneered and demonstrated at PRP. These include the landform alteration mining technique used at the "Amos Ridge Experimental Practice", a demonstration of the potential to create new, more-productive land forms through mining which was conducted Amos Ridge Coal between 1984 and 1988. Red River Coal Company utilized similar landform reconstruction procedures in a re-mining operation which improved the land use potential of several hundred acres in the mid-late 1980s. Approximately 150 acres were reclaimed using composted sewage sludge in 1989 and 1990; today, these areas are productive pastures. Currently, Red River Coal Co. is mining and reclaiming lands adjacent to the PRP for future use as pastures and forests; areas to be forested are being reclaimed using the Forestry Reclamation Approach with direct involvement by Powell River Project personnel. Mine reforestation experimental and demonstration sites have also been established on the acreage being mined and reclaimed by Red River Coal. Project personnel also work cooperatively with other coal companies, including Alpha Natural Resources and Teco Energy, to advise and assist their reforestation activities.

The Nature Conservancy's Virginia Chapter and PRP collaborated on a pilot ripping and tree planting project on the Flint Gap surface mine in Southwest Virginia (TNC, 2008). The former mine site was reclaimed in the conventional manner and was characterized by excessive mine soil compaction and an aggressive herbaceous cover. The site was typical of post-bond released mined land across the Appalachian region, having been in a state of arrested natural succession and likely to remain so for many years. The project was designed to restore approximately 86 acres of native Appalachian forest by mitigating soil compaction with ripping, then planting trees, thereby increasing the absorption of carbon dioxide (See Figure 3). Other partners and supporters include: The Virginia Department of Mines and Mineral Energy, The Forestland Group, The American Bird Conservancy, Dominion Resources, and the US Environmental Protection Agency. The diverse support and funding base for this project illustrates the broad level of interest in this type of project.



Figure 3. D-9 dozer ripping compacted mine soils at The Nature Conservancy's and Virginia Tech's Flint Gap ripping and tree planting project in southwestern Virginia (Photo by Richard Davis).

Large-scale mined land reforestation pilot projects in Kentucky:

In close coordination with the Appalachian Regional Reforestation Initiative (ARRI), the University of Kentucky (UK) has conducted large-scale pilots project in Kentucky, developing a reforestation program that employs a holistic approach, relying on an interdisciplinary group (forestry, engineering, economics, geology, chemistry, wildlife biology, and policy) to plan and implement projects, and perform integrative studies to benefit all stakeholders. UK has teamed up with the Kentucky Department of Natural Resources, U.S. Department of Interior Office of Surface Mining Reclamation and Enforcement (OSM), several coal companies, U.S. Department of Agriculture Forest Service, U.S. Department of Energy, and numerous local communities to reforest current mining operations and post-bond release mines that were reclaimed without the benefit of the FRA.

In the mid-1990s, UK received \$5.4 million in Federal grants to develop reforestation research and demonstration areas. Coal industry partners followed suit and provided \$1.7 million of in-kind services (material handling, site development, spoil ripping, oversight etc.). As a result of this support, over 1.9 million tree seedlings were planted on nearly 2,900 acres of mined land in Kentucky. Over 5,000 individuals have participated in workshops, tours, and demonstrations held at these research and demonstration areas (i.e.,

outdoor classrooms) and since 2003, UK has matriculated 2 Ph.D. and 14 M.S. students, all researching various aspects of mined land reclamation. From this group, 7 have received national recognition for their projects. Other outreach efforts include creation of a DVD entitled *Together We Can: The Importance of Partnerships* (produced by the U.S. Department of Interior) that highlighted efforts by Kentucky's partnership, and a DVD and Teacher's Guide entitled *Reclaiming the Future: Reforestation in Appalachia* to highlight UK's reforestation program. Appalachian Fuels, a Kentucky-based company, received the 2007 OSM "Excellence in Reforestation Award" for their Bent Mountain mine reforestation project. This site has hosted over 3,000 people from across the nation with an interest in ARRI's efforts. High value native tree species planted by UK are performing well ($\approx 75\%$ survival) on mined lands that use the FRA. This is significant from both an economic and ecological standpoint. Research has shown that the reforested species exhibit a similar growth trajectory as those on non-mined Eastern Kentucky forests. Use of ARRI's FRA has resulted in savings of approximately \$2,000 per acre over traditional reclamation practices. Lands reclaimed to forest sell for as much as 20% higher than those reclaimed to 'wildlife habitat' (i.e., mostly non-native grasses and low-value species of trees). UK has measured carbon sequestration rates as high as 2.9 metric tons per hectare per year on reforested mines. Carbon capture may provide many economic opportunities, and an alternative post-mining land use.

Professional tree planting businesses:

Three major professional tree planting businesses currently operate in the coal fields of Appalachia. These private companies are contracted primarily by coal companies to plant bare root tree seedlings by hand on active mine sites where the coal has been extracted, final backfilling and grading has been completed, seeding of grasses and legumes has been completed, and the site has been prepared for tree planting. Although these businesses cater to the active mining industry and concentrate their efforts on newly reclaimed land, they serve as models for planting trees on post-bond released mined land that is the focus of this proposal.

The Green Forest Works Program: Organizational Structure

This section describes the proposed organizational structure for implementing the **Green Forest Works** program. The authors believe that this model, or something similar, could be implemented effectively and efficiently in Appalachia. The program would have a three-leveled structure. It would be composed of an upper-level *Managing Entity*, three to eight mid-level *Implementing Entities*, and numerous bottom-level *Contracting Entities*:

The Managing Entity:

The Managing Entity (ME) would be an established regional non-governmental organization and ARRI serving jointly as the umbrella organization to ensure the **Green Forest Works** program is implemented on a regional basis, in a fiscally and environmentally sound manner (Figure 4). The ME would accept the funds on behalf of ARRI and channel them to the second tier for distribution to contractors. The ME would ensure the program is guided by science and implemented with the best management practices. ARRI would establish operating standards and performance measures, and provide on-the-ground oversight of the program's implementation. As explained earlier in this document, the ARRI infrastructure has been well-developed and is currently operating on a regional basis with surface mine reforestation experts in the field where the funding for the **Green Forest Works** program would be spent.

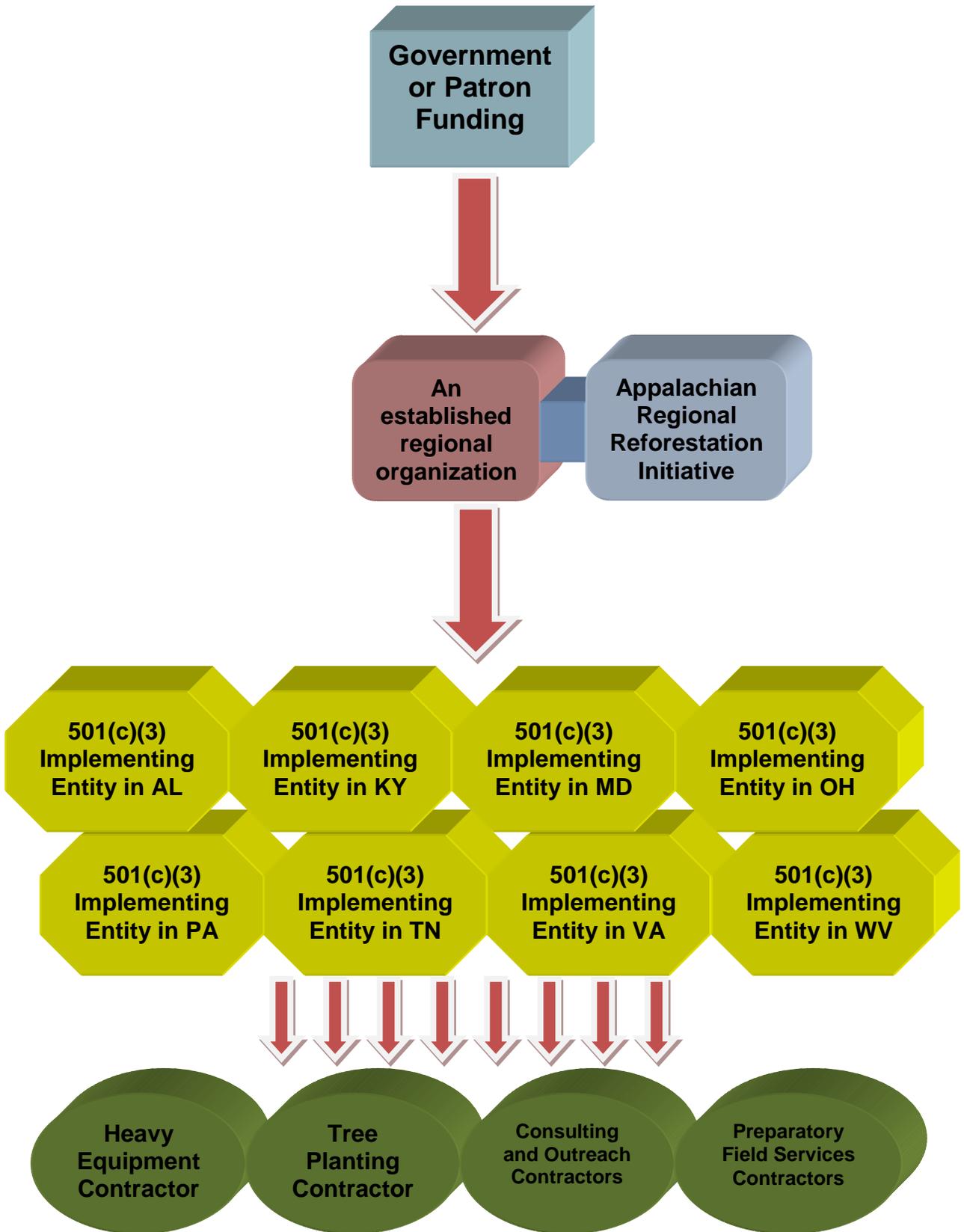


Figure 4. The three-tiered structure of the **Green Forest Works** program. The number of Implementing Entities can range from three to eight.

The Implementing Entities:

We estimate three to eight Implementing Entities (IEs) would be needed for the **Green Forest Works** program. The number and jurisdiction of IEs would be based on the following:

- Each state in the Appalachian coal fields is unique in terrain and in mining methods. For example, post-SMCRA coal surface mines reclaimed in Kentucky are usually very different than those in Pennsylvania;
- Each state has its own regulatory authority and abandoned mine lands reclamation program, so dissimilarities exist in how information, maps, resources, etc., relating to older mine sites are accessible to the public and other agencies;
- Differences in latitude of the eight Appalachian coal states account for differing tree planting times in the spring. The southern coal states start and finish their planting seasons earlier than the northern coal states;
- In those states where the coal fields are extensive (West Virginia, for example) or where there are two separate coal fields (such as Pennsylvania), two IEs may be necessary to perform the requirements of the program; and,
- In those states where the coal fields are relatively small (Alabama, Maryland, Ohio, and Tennessee), one IE could conceivably cover a combination of several adjacent states.

The three to eight IEs would consist of existing non-profit 501(c)(3) organizations that have experience in and proven ability to: (1) manage multiple contracts conducting natural resource management; (2) maintain a staff of competent natural resource management professionals in the service area; (3) effectively partner with other non-government organizations, state and federal agencies, and business entities; and, (4) find non-confrontational, pragmatic solutions to conservation challenges. The IEs would be chosen on the basis of their capacity to implement the **Green Forest Works** program. Each potential candidate organization would be carefully evaluated against specific criteria to ensure success so the very best fit for the program would be chosen. This would include evaluation of mission statements or organizational objectives to ensure compatibility with the goals of the **Green Forest Works** program. Operating budgets for the IEs would be commensurate to the amount of land that is within their jurisdiction (see Table 1). Non-profit organizations who have expressed interest in applying as potential candidate IEs include:

American Bird Conservancy (ABC) – ABC is a 501(c)(3), not-for profit organization whose mission is to conserve native wild birds and their habitats throughout the Americas. ABC advances bird conservation through direct action and by finding and engaging the people and groups needed to succeed, regardless of their political, economic, or social point of view. ABC seeks innovative, fair solutions to difficult issues. As a strong ARRI partner, ABC has actively advocated the reforestation of post-SMCRA coal surface mines as an effective conservation technique to benefit neo-tropical migratory songbirds, such as the Cerulean Warbler. The Cerulean Warbler is a small, migratory songbird that breeds throughout the central and eastern US; however, an

estimated 80% of all Ceruleans breed in Appalachia, relying on the large tracts of mature deciduous hardwood forests that once covered the region. Cerulean populations have been declining steadily, by three percent per year since 1966, nearly leading to its listing under the Endangered Species Act this decade. Forest fragmentation attributed to surface mining and large-scale timber harvests in Appalachia have contributed to the decline of Ceruleans. ABC and ARRI have been actively facilitating partnerships between the coal industry and other conservation groups by addressing habitat needs through reforestation. ABC has provided funding to assist ARRI partners with two reforestation projects: one in southeastern Ohio and one in southwestern Virginia (i.e., The Nature Conservancy's and Virginia Tech's Flint Gap project described earlier). ABC manages numerous contracts concerning natural resource management, maintains a staff of competent resource management professionals and contracting specialists, and employs the Appalachian Mountains Joint Venture Coordinator to oversee an all-bird conservation partnership guided by state and federal resource agencies and based in science. [www.abcbirds.org]

The American Chestnut Foundation (TACF) – The goal of TACF is to restore the American chestnut (*Castanea dentata*) to its native range within the woodlands of the eastern US, using a scientific research and breeding program developed by its founders. As part of the restoration process, the American chestnut, one of the fastest-growing native hardwoods in North America, is being planted with other high-value hardwood tree species on mined lands in the Appalachian coal fields. These plantings are part of the TACF/ARRI partnership, which identifies old mine sites appropriate for establishing experimental plots and demonstration sites. Through a program called Operation Springboard, ARRI and TACF scientists have teamed up with OSM/VISTA volunteers and watershed groups to evaluate planting protocols and techniques needed when TACF's disease-resistant chestnuts will be available in mass quantities. Also, the scientists are evaluating the potential for using reclaimed abandoned surface mines as springboards for re-establishing TACF's chestnuts into Appalachian forests. [www.acf.org]

The Appalachian Coal Country Watershed Team (ACCWT) – ACCWT is an innovative partnership between OSM, which is concerned with environmental reclamation and safety, and AmeriCorps*VISTA, which focuses on poverty and community groups affected by environmental degradation. The Team was founded in response to requests from small, community volunteer-based watershed groups throughout coal country, and targets problems associated with the legacy of pre-regulatory coal mining in Appalachian watersheds. The ACCWT places determined, college graduate OSM/VISTA workers into Appalachian communities in need of the skills and commitment those volunteers can bring to a year or two of full-time service. OSM/VISTAs address not only immediate and pressing water quality problems; they support their local communities in the longer, more hard-fought struggles of community sustainability, job stability, and successful futures for citizens in rural America. In the spring of 2009, ACCWT and ARRI successfully sponsored and organized eight tree planting events throughout the Appalachian coal region, planting 27,500 tree seedlings on 36.1 acres of previously mined lands (See Section IV a (2)). [www.accwt.org]

The Nature Conservancy (TNC) – TNC is a leading non-profit conservation organization working around the world to protect ecologically important lands and waters for nature and people. TNC uses a science-based approach aided by their 700+ staff scientists as they pursue non-confrontational, pragmatic solutions to conservation challenges. TNC and other partners have undertaken an effort to reforest a former surface mine by mitigating the compaction and planting trees (see Section VII a (3)). [www.nature.org]

Other potential IEs – All existing non-profit 501(c)(3) organizations that meet the criteria required by the **Green Forest Works** program would be invited to apply as an IE.

Primary activities which the IEs would oversee, include:

- Site selection and prioritization: This process would utilize geospatial data and site visits, and is further described below.
- Site characterization: This process would also utilize geospatial data and site visits, and would also include environmental sampling as needed to develop an effective reforestation strategy for each mine site selected.
- Identifying and dealing with landowners to secure site access permissions and cost-share payments.
- Site preparation: To include weed control, soil amendments for fertility and soil chemistry modification, and/or deep tillage, with individual site preparation practices being applied only where needed.
- Tree species selection: To be individualized for selected sites and areas, keeping in mind landscape features such as slope, aspect, and soil conditions – as well as landowner goals – and societal benefits.
- Acquisition and planting of the trees.
- Contracting professional tree planters who have 1) the knowledge for successfully planting trees on mined land, 2) the needed equipment and infrastructure, and 3) the willingness to employ people who meet the criteria of the **Green Forest Works** program.
- Follow-up weed control.
- Monitoring and documentation: locations and practices used on each site would be documented, and the success of trees planted on each site would be monitored at specified points following planting. All information concerning the plantings (site locations, characteristics, practices used, success indicators) would be maintained in a unified database that would enable analysis of factors contributing to the success or failures of the reforestation practices. Such analysis would enable replication of the program in other areas at some future date.
- Managing, accounting, and documenting all program funds and in-kind support.

The Contracting Entities:

The Contracting Entities (CEs) would be companies, businesses, professionals who would actually perform the work in the field (See Figures 2 and 3). They would conduct their operations using their own staff and equipment. This is where the vast majority of the funding will be injected into the local economy under the **Green Forest Works** program. Contracts would specify that workers must be American citizens and would be carefully written to ensure compensation was sufficient to attract the green job workers. Contractors could include:

- Heavy equipment operators, needed to conduct site preparation activities, such as scalping off scrub vegetation and ripping the site to mitigate compaction. Since many analysts are predicting a continued weakening coal demand in the future, it is anticipated that heavy equipment operators in the coal fields would be readily available to perform the services needed for the **Green Forest Works** program, helping to revive another sector of the economy.
- Natural resource management professionals, needed to perform preparatory field services, such as aerial reconnaissance and satellite imagery, site selection, soil sampling, laboratory analysis, GPS work, mitigation prescriptions, right of entry acquisition, etc.
- Professional tree planting companies, who would employ the bulk of the field workers to plant tree seedlings, perform herbicide application, conduct timber stand improvement on established forest stands, etc.
- University personnel, such as members of the ARRI Science Team, who would provide technical consulting services.
- Outreach and information specialists/publicists, who would utilize all forms of media throughout Appalachia, to spread the word about available green jobs and the benefits of abandoned mined land reforestation to recruit both workers and landowners.

Critical Program Elements:

The authors of this document consider the following elements to be critical to the success of the **Green Forest Works** program:

Job Creation and Education: While a lack of infrastructure and disperse population limited economic development in days past, this is no longer the case. A desire for quality handmade goods and the global economy of the internet has resulted in a resurgence of cottage industry and growing consortia from which these goods are marketed. A quick look at magazines and building supply catalogs shows the high demand for quality hardwood products, from cabinetry and fine furniture to small

household items. Rural Appalachia has a long history of quality craftsmanship and talent, but decades of poverty have left the majority of the population without the means to purchase needed equipment, without the ability to use technological advances to market products, and without the education needed to manage a small business. An infusion of education and guidance is needed to assist rural populations in developing a sustainable forestry industry in this region.

The main goal of the **Green Forest Works** program is to strengthen the economy of Appalachia by creating gainful employment for local residents, and the training and guidance needed to establish economically sustainable industries in the future. Forests are a renewable resource. By recreating forests where no forests currently exist, the economic opportunities provided by this program will not only meet the needs of the Appalachian people today but will put those lands on a trajectory that will preserve the right of future Appalachians to meet their economic needs. 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. By providing forestry and conservation training, educational opportunities, guidance and career development for its workers, and by facilitating low-interest small business start up loans, the **Green Forest Works** program will grow a skilled green workforce to restore, protect, and manage this natural resource that is so vital to the region's current and future prosperity.

A career guidance professional would be retained in each region for the duration of the project. This professional would be familiar with the challenges, resources and opportunities in each region and would assist participants in career development. The guidance professional would travel throughout the region to meet with each forestry technician at least once a year to assess their skills and interests, assess educational needs, and assist in finding resources needed to further participants career goals. A portion of the total salary paid to forestry technicians would be in the form of a scholarship. These scholarships would cover tuition costs up to \$1500 per year at any institution including state and private colleges and universities, and private institutes offering academic, vocational, and continuing education as well as technical certification courses that work toward the goal of sustainable use of the woodlands that have been planted, and would aid the establishment of small business and cottage industry. Examples could include woodworking, furniture making, beekeeping, tourism, computer applications, and small business management. After completing 400 hours of training, and on presentation of a business plan, participants would be eligible for small business start-up loans up to \$10,000 from local banks, guaranteed by the program.

For those who opted to begin their own business, participants could meet the requirements for a loan in 18 months taking courses in the fall or in the evenings. Participants entering the program in the first three years would have the security of employment by the program, and the support of the career counselor while working part-time in the establishment of their own business. Participants entering the program in the final two years of the program would be mentored by those from past years who had successfully transitioned from employment by the program to self-sufficiency.

Site Selection and Prioritization: Per-acre costs of reforesting post-SMCRA mined lands are expected to exceed the per-acre benefits – but only if those benefits are narrowly defined as the discounted revenues expected from eventual harvest of the wood products. This expectation is essential to the program’s genesis; otherwise, it is probable that landowners would invest their own capital to enhance the productive capacity and resource value of these coal-mined lands. This expectation is based on the experiences of ARRI Science Team members in developing pilot applications of the concept, their work with corporate owners of mined lands, and analyses conducted by ARRI Science Team specialists (Sullivan et al., 2005). With a full and comprehensive accounting, societal benefits can be expected to exceed potential harvest revenues and exceed reforestation costs of the **Green Forest Works** program. Societal benefits can be maximized through purposeful site selection and prioritization using Landsat satellite data. An ongoing research program in Virginia has acquired and processed a multi-year sequence of annual Landsat images of the central Appalachian coalfield (1984 through 2008). The program is using this sequence to identify the coal mined areas in the Virginia coalfield and to characterize current land cover on those lands. These data could be combined with complementary geospatial data and used to select and prioritize coal-mined sites for reforestation and other green uses such as wind and solar farms across the region through the **Green Forest Works** program. Additional factors which could be considered in selecting program sites include:

- the extent to and rate at which individual mine sites are reforesting naturally without the interventions proposed by the **Green Forest Works** program;
- presence and proximity of rare and valued aquatic species within the waters fed by site drainage;
- the extent to which hydrologic benefits due to reforestation of mined lands within a given watershed would be likely to reduce risks of flood damage to streamside residents lower in the watershed;
- the extent to which successful reforestation of such lands would eliminate forest fragmentation and thus would create viable habitat for species that depend on large expanses of non-fragmented forest, such as the Cerulean Warbler;
- the extent to which reforested wildlife corridors could be designed;
- site contours, road access, and other attributes that would contribute to the economic viability of converting a mine site to a high-volume woody biomass production facility should fast-growing, highly productive woody species be established on the mine site after mitigation of soil properties through the **Green Forest Works** program;
- the extent to which sites could be used for other green uses such as solar and wind farms.

Biomass/bioenergy plantations: The **Green Forest Works** program will be focused on the development of all potential uses for the utilization and enhancement of reforested mine lands to include the location of biomass and bioenergy plantations. The

Appalachian states rely heavily upon fossil fuels such as coal for energy production. Even though coal provides us with a very low-cost energy source, reserves of this non-renewable resource are diminishing and alternative fuels need to be identified. Use of woody biomass for energy production has gained much attention recently, not only for its potential as an affordable supply of power, but also for the possible environmental and rural development benefits it offers. Notwithstanding, utilization of a US derived energy source is of great importance for offsetting our dependence on foreign fuels. Somewhere between three-quarters and one million acres of degraded mine lands could benefit from reforestation, some of which could potentially be utilized as biomass feedstock plantations. Establishment of biomass plantations on rehabilitated mined lands would reduce the rate of CO₂ buildup in the atmosphere by sequestering carbon and decreasing use of non-renewable fossil fuels such as coal and oil; mitigate emissions and local impacts from fossil fuel power generation; facilitate restoration of degraded mine lands; reduce social outrage at harvesting of mature hardwood stands on existing forests; and create quality jobs. ARRI scientists believe that post-bond released surface mined lands reclaimed without the benefit of proper reforestation, present an ideal location for establishing biomass/bioenergy plantations in Appalachia and research on maximizing productivity on these sites via intensive forestry management practices will demonstrate this capacity.

Landowner Participation: Owners of lands affected by the reforestation program have the potential to receive significant economic benefits from the success of the program. Throughout Appalachia, such owners include corporate entities that own assets with considerable market value. Such owners would be asked to contribute a cost-share match to supplement the **Green Forest Works** program funds. The requested cost-share match would be calculated using an estimate that takes into account the increase in property values affected by successful reforestation. Negotiations with landowners would consider their willingness to provide the cost-share match, which would in essence allow the **Green Forest Works** program to be extended to a larger acreage than if it were to be conducted solely with sponsor funds, and the non-market benefits likely to be achieved if a given tract were to be reforested successfully.

Incident Command System: The Incident Command System (ICS) is the recommended management protocol for the Managing and Implementing Entities of the **Green Forest Works** program. ICS is a standardized, on-scene, incident management concept originally designed for emergency management agencies in the US. ICS is based upon a flexible, scalable response organization providing a common framework within which people can work together effectively. These people may be drawn from multiple agencies that do not routinely work together, and ICS is designed to give standard response and operation procedures to reduce the problems and potential for miscommunications.

Quality Assurance / Quality Control: We see quality assurance and quality control as essential to the **Green Forest Works** program. Both funders and landowners will likely require that reforestation activities provide a reasonable likelihood of success. In the authors' experiences, successful reforestation of mined sites will require a multi-step

process that assures quality execution at each step in the process. In order for the **Green Forest Works** program to achieve its goals:

- sites should be selected purposefully;
- planted trees must be species well suited to the landscapes and soils into which they are placed;
- trees must be planted properly;
- competition by herbaceous vegetation must be controlled; and,
- appropriate soil nutrients must be provided.

In addition, all contractors, vendors, and participants will be screened prior to their participation in the **Green Forest Works** program by OSM's Applicant Violator System (AVS). This screening would determine whether they own or control mining operations that have unabated or uncorrected violations anywhere in the US.

The Costs

Forest Technicians, Foresters (Crew Foremen), and Assistant Crew Foremen:

The estimated cost for a contractor to employ one green worker under this program for the first year is \$113,196 per year. Appendix 7 shows the calculations for the estimated contractor's cost considering three categories of work during the year:

- During the tree planting season when good weather allows planting
- During the tree planting season when foul weather prevents planting
- During the summer and fall when "other" green work will be performed (For the period of the tree planting 'off-season')

The **Green Forest Works** program would require that each green worker earn a minimum of \$150.00 per day plus a \$20.00 per day food allowance, a total of \$170.00 per day (\$44,200 annual salary)².

The number of green workers that we can employ to plant trees during the first tree planting season (2010/2011) is dependent upon (1) the number of trees that will be available exclusively for this program from state and private nurseries in the eastern US in the fall of 2010, (2) the rate at which local green workers can be expected to plant trees per day, and (3) the number of planting days available during the planting season. Based on interviews with managers of all the nurseries in the eastern US, the projected number of trees that will be available for this program is approximately 4 million seedlings. A

² Applying a standard 5-day workweek and 8-hour workday for a 40 hour workweek with no overtime (260 workdays and 52 workweeks in a year).

reasonable production goal for each green worker is to plant 680 trees per day, which is equivalent to one acre on a planting grid pattern of eight feet by eight feet. The tree planting season lasts for approximately four months, starting on or about December 15 and ending somewhere around April 10. However, based on interviews with managers of professional tree planting companies, actual planting occurs only on an average of 64 days during the season due to foul weather. Therefore, we can create 92 jobs for green workers planting trees during the 2010/2011 tree planting season³.

At the end of the tree planting season in April of each year, the green workers will commence other green projects in Appalachia which will occupy them through the summer and fall until the next tree planting season starts again in December. The green workers will be provided regular educational opportunities in forest conservation, forest ecology, forest management, conservation management, environmental science, etc. to expose them to other potential career and vocation opportunities. These training opportunities will occur when foul weather prevents the performance of regular field work. Thus, the yearly cycle of tree planting in the spring and other green projects and training during the rest of the year allows for continued green job employment through the calendar year. Other green projects will include:

- Tree nursery work and tree seed gathering⁴
- Solar farm site preparation/maintenance
- Wind farm site preparation/maintenance
- Biomass site preparation/maintenance
- Carbon verification
- Outreach and technical transfer to landowners
- Herbicide application
- Invasive species eradication
- Highway beautification (planting ball & bur-lapped trees)
- Timber stand improvement
- Multi-use trail maintenance and development
- Park maintenance
- Roadside cleanup
- Fire control
- Site preparation
- Riparian improvement/cleanup
- Wildlife habitat improvement
- Other green job opportunities

Although the green worker's primary goal will be to plant trees and restore healthy, productive forests on old mine sites, we will refer to them as "Forest Technicians" from this point forward in this document because of the multiple green projects that they will be engaged in throughout the year.

³ Based on the following calculation: $4,000,000/680/64 = 91.9$

⁴ This program will increase the demand for seedlings from state and private tree nurseries in the eastern US. Substantially more tree seed will need to be gathered and tree nurseries will need to increase their production of seedlings. This will generate additional need for green workers.

Professional Foresters (Crew Foremen) and Assistant Crew Foremen will be needed to supervise the Forest Technicians at a ratio of 1 Crew Foreman and 1 Assistant Crew Foreman for every 18 Forest Technicians⁵. For example, in the first tree planting season (2010/2011), contractors will need to provide five Crew Foremen and five Assistant Crew Foremen to supervise the 92 Forest Technicians. Under this program, the estimated total cost for a contractor to employ one Forester and one Assistant Crew Foreman for the first year is \$136,762 and \$76,684, respectively (See Appendix 7). Of those amounts, this program would require that each Forester would earn a salary of \$55,000 per year and each Assistant Crew Foreman would earn a salary of \$50,000 per year⁶.

The exact rate of growth of the **Green Forest Works** program can be determined in accordance with available funding. For purposes of this proposal however, we will calculate the costs as if it will grow by doubling each year for five years until it reaches a sustained level of operations. The total costs for each year for Forest Technicians, Foresters, and Assistant Crew Foremen can be found in Table 2.

Table 2. Numbers and cost of Forest Technicians, Foresters, and Assistant Crew Foremen for five years¹

Year	Forest Technician ²		Foresters (Crew Foremen) ³		Assistant Crew Foremen ⁴	
	No.	Cost	No.	Cost	No.	Cost
2010	92	\$10,414,026	5	\$683,808	5	\$383,419
2011	184	\$21,244,612	10	\$1,394,968	10	\$782,176
2012	368	\$43,339,007	20	\$2,845,734	20	\$1,595,638
2013	736	\$88,411,580	40	\$5,805,297	40	\$3,255,102
2014	1472	\$180,359,626	80	\$11,842,806	80	\$6,640,409
5-yr total	1472	\$343,768,851	80	\$22,572,613	80	\$12,656,744

¹ Using a standard 5-day workweek and 8-hour workday for a 40 hour workweek with no overtime (260 workdays and 52 workweeks in a year). Costs adjusted for COLA of 2% per year.

² Cost includes first year annual salary of \$44,200 plus benefits and contractor overhead (including trees).

³ Cost include first year annual salary of \$55,000 plus benefits and contractor overhead.

⁴ Cost include first year annual salary of \$50,000 plus benefits and contractor overhead.

Bulldozer Operators and Service Professionals:

We based the following calculations for dozer operators on region wide data obtained from the spring 2009 ACCWT/ARRI pilot projects, the TNC/VT Flint Gap pilot project,

⁵ Based on the experience of professional tree planting companies, an efficient tree planting crew is governed primarily by the number of workers that 2 foremen can supervise and by the mode of transportation to the work site. The passenger capacity of vans used by professional tree planting companies is 18 people.

⁶ Beginning foresters with a master's degree in the U.S. Forest Service generally earn a starting annual salary between \$37,390 and \$45,239. However, professional tree planting companies are paying experienced professional foresters about \$55,000 per year to serve as Crew Foremen. Assistant Crew Foremen are paid about \$50,000 per year. This proposal will use this same rate of pay.

and field experiences described in ARRI's Forest Reclamation Advisory No. 4 (see Appendix 4).

During the summer and fall of the first year (2010) of the **Green Forest Works** program, approximately 5,888 acres will need to be ripped by D-9 bulldozers to prepare for 92 Forest Technicians planting for approximately 64 days at the rate of one acre per day⁷. A D-9 dozer can rip one acre of compacted mine soils in about one hour and the average contracting rate for a D-9 dozer is \$150.00 per hour (Sweigard et al., 2007). Thus, approximately 5,888 hours of bulldozer work can be anticipated to be contracted out at a cost of approximately \$883,200, in the first year⁸. The number of bulldozer operators needed to accomplish this is based on the estimated average size of the mine sites required to be ripped (25 acres) and the estimated average time it takes to transport the bulldozer to and from the sites. The following scenario can be used as a rough guide in the calculation of the number of bulldozer jobs that would be created under this program: the bulldozer would be transported to and from a work site on the first and last days of a typical work week (Monday and Friday) and the ripping of the 25 acres would be performed during the middle of the week (Tuesday, Wednesday, and Thursday). At this rate, roughly 236 "bulldozer weeks" would be required to rip 5,888 acres⁹. ARRI scientists advise that it is best to rip when the ground is dry because dry soils fracture much better than damp or moist soils; this is especially important for clayey mine soils (Sweigard et al., 2007). Ripping operations during late summer or fall take advantage of the relatively dry seasonal conditions, while allowing mine soils enough time prior to tree planting to "season", that is, to dispel excess soil air created during the ripping process which is detrimental to tree roots. During this 16 week period during the fall months, 15 dozer operators would be needed to prepare the ground¹⁰. If the size of the mine sites is at least 25 acres, additional charges related to mobilization costs should not be expected. Therefore, we are proposing the creation of 15 bulldozer operator jobs in the first year at a cost of \$883,200 (Table 3).

Service professionals include additional staff for the ME and the three to eight IEs (the upper and mid-levels of the program's structure), as well as additional professional consultants at the bottom tier or CEs level. Professional consultants would include natural resource management professionals, needed to perform preparatory field services, such as aerial reconnaissance and satellite imagery, site selection, soil sampling, laboratory analysis, GPS work, mitigation prescriptions, right of entry acquisition, etc. Professional consultants would also include university personnel, such as ARRI Science Team members, who would provide technical consulting services. Finally, professional outreach and information specialists and publicists would be needed to recruit green workers and landowners for planting sites. This document proposes the creation of 45 green job service professionals with an average annual salary of \$50,000. The total cost in the first year would be \$2,250,000 (Table 3). Each year the number of green job service professionals would increase by 5.

⁷ Based on the following calculation: $92 \times 64 = 5,888$

⁸ Based on the following calculation: $5,888 \times \$150.00 = \$883,200$

⁹ Based on the following calculation: $5,888/25 = 235.52$

¹⁰ Based on the following calculation: $236/16 = 14.75$

Table 3. Numbers and costs of bulldozer operators and service professionals for five years¹

Year	Bulldozer operators ²		Service professionals ³	
	Number	Cost	Number	Cost
2010	15	\$883,200	45	\$2,250,000
2011	30	\$1,801,728	50	\$2,550,000
2012	60	\$3,675,525	55	\$2,861,100
2013	120	\$7,498,071	60	\$3,183,624
2014	240	\$15,295,988	65	\$3,517,905
5-yr total	240	\$29,154,512	65	\$14,362,629

¹ Costs adjusted for COLA of 2% per year.

² Calculations based on ripping 5,888 acres in the first year at a rate of \$150.00 per acre and doubling that amount each year.

³ Calculations based on first year average annual salary of \$50,000.

Conservative estimates place the extent of post-SMCRA mined land in Appalachia that is available for reforestation at nearly three-quarters of a million acres. When abandoned mine lands (those coal mine sites that predate SMCRA), other drastically disturbed lands like brownfields (abandoned industrial sites), abandoned hardrock quarries and mine sites, and degraded agricultural fields are added to the acreage of land needing intervention in order to restore the Appalachian forest, over a million acres are likely to be available for this program.

The amount of funding requested for the **Green Forest Works** program for the first year is \$14,614,453 (Table 4). The program will grow in size for five years until its annual budget is \$217,656,734. At that point the program will have reached its operational capacity and will be fully functional.

Table 4. Cost of the **Green Forest Works** program over five years

Year	Cost of program
2010	\$14,614,453
2011	\$27,773,484
2012	\$54,317,004
2013	\$108,153,674
2014	\$217,656,734
5-yr total	\$422,515,349

Return on Investment

The creation of green jobs and revitalized forests:

The **Green Forest Works** program proposes the hiring of 92 Forest Technicians, 10 foresters/crew foremen, 15 bulldozer operators, and 45 service professionals in the first year (see Tables 2 and 3). This is a total of 162 green jobs that otherwise would not exist. Each year thereafter, the program would grow exponentially, i.e., each year will see a doubling of positions over the previous year until a total of 1,937 new direct green jobs in five years would be created in Appalachia (Table 5). Indirect employment opportunities, sparked by the creation of these green jobs, will further enhance the economic vitality of the region and will help to address the 9.4% unemployment rate in the 8 eastern coal states (BLS, 2009).

Table 5. Number of direct new green jobs created over five years

Year	Number of direct new green jobs
2010	162
2011	284
2012	523
2013	996
2014	1,937

The number of Forest Technicians proposed for the first year will accomplish the planting of over 4 million trees on 5,888 acres of land in Appalachia (Table 6). Each year thereafter, the acres planted will increase exponentially, i.e., each year will see a doubling of trees planted over the previous year until over 124 million trees in five years would be planted on 182,528 acres of old mined land in Appalachia.

Table 6. Number of trees and acres planted by the **Green Forest Works** program over five years

Year	Number of trees	Number of acres
2010	4,003,840	5,888
2011	8,007,680	11,776
2012	16,015,360	23,552
2013	32,030,720	47,104
2014	64,061,440	94,208
5-yr total	124,119,040	182,528

It should be noted that the numbers of trees planted under the **Green Forest Works** program are in addition to the trees being planted on active mine sites which has been currently estimated to be approximately 12.8 million trees per year.

Forestland benefits:

Productive forestland enriches us all by providing numerous environmental and economic benefits. Forestland is also a renewable resource. The environmental benefits derived from **Green Forest Works** include:

- Increased plant diversity through natural succession of native forest plants
- Habitat for endangered species and other wildlife
- Soil and water conservation
- Watershed improvement
- Carbon sequestration

Reforestation provides a wide range of economic benefits to landowners, the local community, and coal mining companies:

Landowner

- Increased timber value
- Tax incentives
- Leasing for recreational areas
- Carbon sequestration credits

Community

- Jobs for the local economy
- Local sales tax revenue

Ecological Assets from Reforestation:

Ecological asset refers to a tradable credit that reflects the economic value public or private sector stakeholders have assigned to an environmental “service”. For example, a utility concerned about future carbon dioxide (CO₂) regulations may be willing to “lease” a forest’s ability to remove carbon from the atmosphere, or a lumber company required to relocate an endangered species may wish to purchase the forest’s value as a habitat.

For landowners faced with the challenge of improving post-bond released mined land from scrubland to a healthy, productive forest, the emerging ecological asset markets may provide new economic incentives to restore terrain to its original state. In particular, reforestation projects offer the potential for concurrent development of ecological asset value and select timber harvesting.

There are several emerging ecological asset types that may have application to coal surface mines reclaimed using practices not conducive to effective reforestation. These

include “carbon credits” for the sequestration of atmospheric carbon and mitigation credits granted by state and federal agencies for the protection, enhancement, restoration, or creation of wetlands, riparian stream buffers, and habitat for endangered, threatened, or rare species. With the possible exception of carbon credits, all these ecological assets are compatible with select timber harvesting.

Climate change considerations:

Large quantities of carbon dioxide (CO₂) and other infrared-absorbing “greenhouse” gases (GHGs) are being emitted to the atmosphere globally by fossil-fuel combustion for energy utilization and other activities. Scientific observations indicate atmospheric GHG concentrations are rising steadily, creating potential influence on climate and consequent negative impacts on the global environment and economy (McCarthy et al., 2001).

Given the dependence of current living standards in industrialized nations on energy usage, growing populations, increasing energy utilization in emerging economies, and the limitations to fossil-fuel alternatives as energy sources available for near-term and widespread implementation, many have called for measures to reduce energy-related CO₂ and other GHG emissions to the atmosphere while offsetting (or sequestering) some portion of those GHG emissions continuing to occur. While the long-term solution to global climate problems is likely to include technologies such as carbon capture from fossil-fuel combustion and geologic storage (IEA, 2004; IPCC, 2005), these technologies remain under development. In contrast, sequestration methods that rely on management of agricultural and forested systems (terrestrial sequestration) can be implemented with current technologies. Planting trees on productive mine soils after mining is a way to produce a measurable carbon sink (Amichev et al., 2008). Forests growing on good quality mine sites can sequester 3 – 5 times more carbon than grassland. If carbon-emission restrictions become law at a future time, it is likely that coal-burning electric-power producers will be called upon to offset carbon emissions to the atmosphere. On those previously mined lands where forests were not restored, ripping and tree planting operations like the one that we propose in this document could increase the land’s carbon storage potentials through reforestation and can be used by the power producers to help meet their carbon-emission offset requirements.

Zipper et al. (2007) investigated the potential for post-bond released mined lands to accumulate carbon if actively reforested. Should such reforestation occur, results would also include ancillary benefits as environmental services, such as enhanced watershed protection and timber products. The researchers reported that if 50% of the lands mined for coal and reclaimed under SMCRA in the eastern US were to be reforested, estimated rates of carbon accumulation on such sites are in the range of 0.8 – 1.6 Tg carbon yr⁻¹, on the order of 0.2% of US carbon emissions from coal combustion (Zipper et al., 2007). Although potential carbon accumulation and sequestration quantities are not great relative to potential national needs (should energy-related carbon-emissions offsets become a requirement at some future date), these lands are available and are unused for other economically valued purposes, while many possess soil and site properties well-suited to

reforestation. As time passes, their collective potential for reforestation can be expected to decline due to the influence of continued proliferation and growth of low-value woody species with minimal carbon sequestration potentials, including non-native invasive species that were often planted during former (and routinely) planted during reclamation under SMCRA on coal surface mines.

Conclusion

Appalachia's mixed mesophytic forest ecoregion represents one of the most biologically diverse areas in the temperate region of the world. For over thirty years, surface mining has created a significant regional threat via forest loss and fragmentation. Since 1977, over 1.2 million acres of Appalachian forest have been impacted by surface mining, producing significant economic, environmental and ecological challenges. Successful reestablishment of the hardwood forest ecosystem that once dominated these sites, made possible by the **Green Forest Works** program, will provide a renewable, sustainable multi-use resource that will create economic opportunities while enhancing the local and global environment. Over a period of five years, the **Green Forest Works for Appalachia** program will create permanent employment for approximately **2,000 local residents** from rural coalfield communities planting more than **125 million trees on over 175,000 acres**.

Literature Cited

- Aden, A. 2009. The Current State of Technology for Cellulosic Ethanol. U.S. Department of Energy, National Renewable Energy Laboratory.
http://www1.eere.energy.gov/biomass/pdfs/aden_20090212.pdf
- Amichev, B., J. Burger, and J. Rodrigue. 2008. Carbon sequestration by forests and soils on mined land in the Midwestern and Appalachian coalfields of the U.S. *Forest Ecology and Management* 256 (2008) 1949–1959.
- Angel, P.N., V. Davis, J. Burger, D. Graves, and C. Zipper. 2005. The Appalachian regional reforestation initiative. U.S. Office of Surface Mining. Forest Reclamation Advisory No.1. 2 p. Available online at <http://arri.osmre.gov> (Verified 20 July 2009)
- Appalachian Regional Commission (ARC). 2009. The Appalachian Region.
<http://www.arc.gov/index.do?nodeId=2> (Verified 20 July 2009)
- Berger, M., and E. Thompson. 2001. A study on the current economic impacts of the Appalachian coal industry and its future in the region. www.arc.gov.
- Bureau of Labor Statistics (BLS). 2009. Local area unemployment statistics – Unemployment rates for States. U.S. Department of Labor.
<http://www.bls.gov/web/laumstrk.htm> (Verified 20 July 2009)

- Burger, J.A., and J.L. Torbert. 1992. Restoring forests on surface-mined land. Virginia Coop. Ext. Publ. 460–123. Virginia Tech., Blacksburg.
- Burger, J.A., D. Kelting, and C. Zipper. 1998. Maximizing the value of forests on reclaimed mined land. Virginia Cooperative Extension Publication No. 460-138. Available online at <http://www.cses.vt.edu/PRP/VCE Pubs.html> (Verified 20 July 2009)
- Burger, J.A., D. Graves, P.N. Angel, V. Davis, and C. Zipper. 2005. The forestry reclamation approach. U.S. Office of Surface Mining. Forest Reclamation Advisory No. 2. 4 p. Available online at <http://arri.osmre.gov/> (Verified 20 July 2009)
- Burger, J.A. and C.E. Zipper. 2002. How to restore forests on surface-mined land. Reclamation guidelines for surface-mined land in Southwest Virginia. Powell River Project. Virginia Cooperative Extension Publication No. 460-123. 19 p. Available online at <http://www.cses.vt.edu/PRP/VCE Pubs.html> (Verified 20 July 2009)
- Burger, J.A., and C.E. Zipper. 2009. Restoring the Value of Forests on Reclaimed Mined Land. Virginia Cooperative Extension Publication 460-138.
- Conrad, P.W., R.J. Sweigard, J. Yingling, D.H. Graves, and J.M. Ringe. 2002. Use of ripping to alleviate excessive compaction on reclaimed surface mined land. *Transactions of SME* 312:159-165.
- Dunker, R., C. Hooks, S. Vance, and R. Darmody. 1995. Deep tillage effects on compacted surface-mined land. *Soil Sci. Soc. Am. J.* 59:192-199.
- Dunker, R., and R. Barnhisel. 2000. Cropland reclamation. p. 323-369. *In* R. Barnhisel, R. Darmody, W. Daniels (ed.) *Reclamation of drastically disturbed lands*. No. 41. American Society of Agronomy, Madison, WI.
- Energy Information Administration (EIA). 2009. Official Energy Statistics from the U.S. Government. <http://www.eia.doe.gov/> (Verified 20 July 2009)
- Fields-Johnson, C., C. E. Zipper, D. Evans, T.R. Fox, and J.A. Burger. 2008. Fourth-Year Tree Response to Three Levels of Silvicultural Input on Mined Lands. *In*: Proceedings, 2008 National Meeting of the American Society of Mining and Reclamation.
- Gorman, J., J. Skousen, J. Sencindiver, and P. Ziemkiewicz. 2001. Forest productivity and minesoil development under a white pine plantation versus natural vegetation after 30 years. p. 103–111. *In* Proc. of the 18th Annual Meet., Albuquerque, NM. 2–7 June 2001. Am. Soc. for Mining and Reclamation, Lexington, KY.

- Groninger, J., J. Skousen, P. Angel, C. Barton, J. Burger, and C. Zipper. 2007. Mine reclamation practices to enhance forest development through natural succession. U.S. Office of Surface Min. Forest Reclam. Advisory No. 5. 5 p. Available online at <http://arri.osmre.gov> (Verified 20 July 2009)
- Herzenberg, S., S. Teegarden, and H. Wial. 2005. Creating regional advantage in Appalachia: Towards a strategic response to global economic restructuring. Keystone Research Center. Final Report under ARC Contract No: CO-12884T-03 Assessment of workforce displacement and adjustment policies in Appalachia's labor markets. www.arc.gov.
- Intergovernmental Panel on Climate Change (IPCC). 2005. Carbon Dioxide Capture and Storage. Cambridge University Press. 431 p.
- International Energy Agency (IEA). 2004. The Prospects for CO₂ Capture and Storage. Organization for Economic Cooperation & Development, Paris. 252 p.
- McCarthy, J.J., O.F. Canziani, N.A. Leary, D.J. Dokken, and K.S. White (eds). 2001. Climate Change 2001: Impacts, Adaptation, and Vulnerability. Published for the Intergovernmental Panel on Climate Change, Cambridge University Press. http://www.grida.no/climate/ipcc_tar/wg2/index.htm (Verified 20 July 2009)
- Paone, J., P. Struthers, and W. Johnson. 1978. Extent of disturbed lands and major reclamation problems in the United States. p. 11–22. *In* F. Schaller and P. Sutton (ed.) Reclamation of drastically disturbed lands. 1st ed. ASA, CSSA, and SSSA, Madison, WI.
- Perlack, R.D., L.L. Wright, A.F. Turhollow, R.L. Graham, B.J. Stokes, and D.C. Erbach. 2005. Biomass as feedstock for a bioenergy and bioproducts industry: The technical feasibility of a billion-ton annual supply. US Departments of Energy and Agriculture. http://www1.eere.energy.gov/biomass/pdfs/final_billionton_vision_report2.pdf (Verified 20 July 2009)
- Plass, W.T. 1982. The impact of surface mining on the commercial forests of the United States. p. 1–7. *In* C.A. Kolar and W.C. Ashby (ed.) Postmining productivity with trees. Southern Illinois Univ., Carbondale, IL.
- Plass, W.T. 2000. History of surface mining reclamation and associated legislation. p. 1–20. *In* R.I. Barnhisel et al. (ed.) Reclamation of drastically disturbed lands. 2nd ed. Agron. Monogr. 41. ASA, CSSA, and SSSA, Madison, WI.
- Pollard, K.M. 2002. Population growth and distribution in Appalachia: New realities. Population Reference Bureau. www.arc.gov (Verified 20 July 2009)

- Potter, S.H., S. Weitzman, and G.R. Trimble, Jr. 1951. Reforestation of stripmined land in West Virginia. Pap. 43. USDA Forest Serv., Northeastern Forest Exp. Stn., Broomall, PA.
- Probert, T. 1999. Reforestation constraints, experiences, trends, and needs: A landowner's perspective. *In Proc. of the Enhancement of Reforestation at Active Coal Mines*. U.S. Office of Surface Mining.
- Reece, Erik. 2007. A beautiful mine. *The New York Times*. Available online at http://www.nytimes.com/2007/05/05/opinion/05reece.html?_r=1 (Verified 20 July 2009)
- Skousen, J., J. Gorman, E. Pena-Yewtukhiw, J. King, J. Stewart, P. Emerson, and C Delong. 2009. Hardwood tree survival in heavy ground cover on reclaimed land in West Virginia: Mowing and ripping effects. *J. Environ. Qual.* 38:1400-1409.
- Stringer, J.W., and S.B. Carpenter. 1986. Energy yield of black locust biomass fuel. *Forest Sci.* 32(4): 1049-57.
- Sullivan, J., J. Aggett, G. Amacher, and J. Burger. 2005. Financial viability of reforesting reclaimed surface mined lands, the burden of site conversion costs, and carbon payments as reforestation incentives. *Resources Policy* 30: 247-258. Susmita Sen, Geospatial Environmental Analysis, Virginia Tech. Ph.D. research and dissertation in preparation, planned for completion in 2010. Major advisors are R.H. Wynne and C.E. Zipper.
- Sweigard, R., J. Burger, D. Graves, C. Zipper, C. Barton, J. Skousen, and P.N. Angel. 2007. Loosening compacted soils on mine sites. U.S. Office of Surface Min. Forest Reclam. Advisory No. 4. 4 p. Available online at <http://arri.osmre.gov> (Verified 20 July 2009)
- The Nature Conservancy (TNC). 2008. The Nature Conservancy, Virginia DMME, and Virginia Tech Establish an Innovative Mined Land Reforestation Project. <http://www.nature.org/wherewework/northamerica/states/virginia/press/press3406.html> (Verified 20 July 2009)
- Wickham, J.D., K. H. Riitters, T. G. Wade, M. Coan, and C. Homer. 2007. The effect of Appalachian mountaintop mining on interior forest. *Landscape Ecology* 22:179-187.
- Zeleznik, J., and J. Skousen. 1996. Survival of three tree species on old reclaimed surface mines in Ohio. *J. Environ. Qual.* 25:1429-1435.
- Zipper, C.E., J.A. Burger, J.M. McGrath, and B. Amichev. 2007. Carbon accumulation potentials of post-SMCRA coal-mined lands. *In Proc. of the Annual Meet., Gillette, WY. 2-7 June 2007*. Am. Soc. for Mining and Reclamation, Lexington, KY.

Appendix 2: Letters of Endorsement and Editorials of Support

Representative Endorsements and Support for the Green Forest Works for Appalachia Proposal

 KCC	Kentucky Conservation Committee PO Box 1152 Frankfort, KY 40601
2009 Board of Directors	August 17, 2009
Vicki Holmberg, President Lexington 859 539 5231	Van Jones White House Council on Environmental Quality 722 Jackson Place, NW Washington, DC 20530
Jack Wilson, Vice President Lexington	Dear Mr. Jones:
Pam Wood, Secretary Mercer County	The Board of Directors of the Kentucky Conservation Committee has evaluated the benefits of "Green Forest Works for Appalachia," and supports the proposal.
Ramesh Bhatt, Treasurer Lexington	While the Board strongly favors halting deforestation and primary source control of emissions, including carbon dioxide; reforestation would provide a means of offsetting emissions, erosion control and watershed protection.
Russ Barnett Lawrenceburg	Other benefits of reforestation may include increased local employment, development of income from sustainable forestry practices; increases in real estate values and tourism opportunities.
Ray Barry Lexington	Proper planting, with attention to the use of native species, avoiding monoculture stands, can foster and restore biodiversity and important biological services to human populations.
Horace Brown Bagdad	Large scale planting can provide crucial large scale carbon offsetting, with each acre absorbing six tons of carbon dioxide and producing four tons of oxygen per year. It also facilitates entry of water into the ground, recharging water tables.
Bill Bryant Lawrenceburg	KCC strongly recommends vigorous oversight, high quality standards and implementation strategies for the Green Forest Works proposal, while recognizing reforestation is not a substitute for addressing the underlying causative problems contributing to deforestation and global climate change.
Susan Bush Anderson County	Sincerely,
Greg Kuhns Louisville	Vicki H. Holmberg President
Bill Martin Lexington	cc: Patrick N. Angel, Ph.D., Office of Surface Mining Reclamation and Enforcement, Appalachian Regional Office Rick Clewett, Cumberland Chapter, Sierra Club
Andy McDonald Frankfort	
Bruce W. Scott Frankfort	
David Wicks Louisville	
Legislative Agent: Bruce Williams 859 221 1132	

Appendix 2: (continued)

Representative Endorsements and Support for the Green Forest Works for Appalachia Proposal

STEVEN L. BESHEAR GOVERNOR		LEONARD K. PETERS SECRETARY
ENERGY AND ENVIRONMENT CABINET OFFICE OF THE SECRETARY 500 MERO STREET 12 TH FLOOR, CAPITAL PLAZA TOWER FRANKFORT, KY 40601 TELEPHONE: (502) 564-3350 FACSIMILE: (502) 564-3354 www.eec.ky.gov		
August 19, 2009		
<p>Van Jones, Special Advisor for Green Jobs White House Council on Environmental Quality 722 Jackson Place, NW Washington, DC 20530</p>		
<p>I am writing in support of the "Green Forest Works for Appalachia" proposal being submitted by the Appalachian Regional Reforestation Initiative. Kentucky's Department for Natural Resources has been actively engaged in working with the ARRI for many years to encourage reforestation on formerly mined sites in the Commonwealth. The "Green Forest Works for Appalachia" will employ local residents and will provide significant near- and long-term environmental and economic benefits to the region.</p>		
<p>Research conducted in Kentucky and other Appalachian states over the past decade has shown very promising results for growing high-value hardwood trees on formerly mined lands. Kentucky alone has more than 500,000 acres of mined land, and the region as whole has more than 1.2 million acres of mine land. Reforestation of these sites helps to re-establish significant habitats for plant and animal species that are native to the region; enhances protection of water resources; and restores the natural beauty of the land.</p>		
<p>I encourage your approval of the ARRI "Green Forest Works for Appalachia" proposal to help stimulate the Appalachian economy, create much-needed jobs, and protect the environment.</p>		
<p>Sincerely yours,  Leonard K. Peters Secretary</p>		
LKP:wh		

Appendix 2: (continued)

Representative Endorsements and Support for the Green Forest Works for Appalachia Proposal



**SIERRA
CLUB**
FOUNDED 1892

Cumberland Chapter

Serving over 5,000 members across
The Commonwealth of Kentucky

Since 1967

Van Jones
Special Advisor for Green Jobs, Enterprise and Innovation
White House Council on Environmental Quality
722 Jackson Place, NW
Washington, DC 20503

August 17, 2009

Dear Mr. Jones:

On behalf of our 5,000 members in the Commonwealth of Kentucky, the Cumberland Chapter of the Sierra Club endorses the *Green Forest Works for Appalachia* proposal to plant 125 million trees on reclaimed coal mine sites in Appalachia.

In May of this year, we saw severe flash flooding in the coalfields of eastern Kentucky, where hundreds of thousands of acres of mountains have been strip-mined by mountaintop removal and surface mining methods. Hundreds of homes in Pike, Breathitt, and Floyd counties were destroyed or heavily damaged when floodwaters from a heavy rainfall washed off the barren grasslands left behind after coal mining.

In a healthy, mature forest, trees soak up 75 percent of the rainfall, according to the Federal Office of Surface Mining Reclamation and Enforcement (OSMRE).

We have learned that hardwood trees have been grown successfully in piles of loosely-dumped spoil at ARRI test plots in Kentucky, including native trees such as white oak, tulip poplar and black walnut. We believe that loosely-dumped piles of mine spoil, or ripped land that has been previously compacted, will also improve the quality of water running off the site, while reducing the peak flows that have caused flash flooding for the people of Eastern Kentucky living in the valleys below mine sites.

The Sierra Club Cumberland Chapter supports the *Green Forest Works* proposal to create 2,000 new green jobs in the economically-challenged coalfields of eastern Kentucky with this shovel-ready project. We feel that it is important to diversify the economy of eastern Kentucky.

In addition, we believe that the re-introduction of trees on reclaimed mine sites will act as a carbon sink, while providing wildlife habitat for non-game, and threatened and endangered species such as the Cerulean Warbler and Indiana Bat.

The Cumberland Chapter of the Sierra Club sees *Green Forest Works* as a win-win proposal for Appalachia that will create jobs, reduce flooding and create a carbon sink.

Sincerely,



Joey Shadowen, Chair
Cumberland Chapter of the Sierra Club

Appendix 2: (continued)

Representative Endorsements and Support for the Green Forest Works for Appalachia Proposal



Joe Manchin III
Governor

Charles R. Dye
Director/State Forester

DIVISION OF FORESTRY
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-0180
(304) 558-2788 Fax: (304) 558-0143
www.wvforestry.com

September 2, 2009

Van Jones
Special Advisor for Green Jobs
White House Council on Environmental Quality
722 Jackson Place, NW
Washington, DC 20530

Dear Mr. Jones:

Please consider this letter as full support for the "Green Forest Works for Appalachia" project, which is being proposed by the Appalachian Regional Reforestation Initiative (ARRI). We are very familiar with ARRI, support its mission, and have been involved with them for a number of years.

As you are no doubt aware, West Virginia is the only state whose boundaries are fully within the Appalachian area and we have literally thousands of acres of mined lands that are in urgent need of hardwood reforestation. In addition to the obvious environmental and natural resource benefits of this proposal, there are also significant employment and economic benefits.

I encourage your timely approval of this project, which I am sure will enjoy the full support of the West Virginia Congressional delegation.

Thank you for your consideration.

Sincerely,

A handwritten signature in black ink that reads "C. Randy Dye".

C. Randy Dye
Director/State Forester

CRD:DBK:plc

Appendix 2: (continued)

Representative Endorsements and Support for the Green Forest Works for Appalachia Proposal

Lexington Herald-Leader Editorial

Sunday, Sep. 20, 2009

Support reforestation proposal

Only God can make a tree.

But 2,000 workers, earning \$18.75 an hour, could make a forest from the barren wastelands left by the coal industry in Central Appalachia.

This vision of reforesting a region and replenishing watersheds, while reviving local economies and creating sources of renewable energy, is not pie in the sky.

It's a near "shovel ready" plan developed by scientists at the University of Kentucky and Virginia Tech and by government reclamation experts who have mud on their boots from 30 years of inspecting strip mines.

All that stands between their vision and reality: \$422 million.

This is a worthy mission that deserves support from Congress, the Obama administration, state governments and the coal industry.

The Appalachian Regional Reforestation Initiative is also a perfect fit for President Barack Obama's vision of retooling the economy by developing renewable energy to achieve energy independence and reverse global warming.

In the process, green jobs would be created in a region that desperately needs any kind of jobs.

ARRI (say aerie) is not just proposing to reforest 125,000 acres of parched grassland over five years by planting 125 million trees.

People would also be put to work preparing and maintaining sites for solar, wind and biomass farms; measuring carbon dioxide sequestered by the new forest; working with landowners, and developing trails and tourism.

One obvious vehicle for supporting ARRI is the American Clean Energy and Security Act which has come to be identified with one of its components, a cap-and-trade system that requires industries to reduce the output of heat-trapping gases from burning coal and oil.

The energy bill cleared the House along a party-line vote and is awaiting consideration in the Senate.

Senate Republican Leader Mitch McConnell steered federal dollars into UK research that developed techniques for turning the monocultures and parking-lot-hard soil left by mountaintop mining back into one of the richest hardwood forests on Earth. Reforestation also purifies water damaged by mining and reduces runoff, erosion and flooding.

We hope McConnell won't disown the initiative now just because it fits so well into a Democratic president's agenda. And we hope the president won't punish Kentucky and West Virginia just because of their red state leanings.

It would be thrilling to hear Obama tell the Climate Change Conference in Copenhagen in December that the U.S. is launching a project in Appalachia that could serve as a global model for restoring disturbed areas with carbon-absorbing forests.

Working with ARRI, the coal industry has reclaimed 87,000 acres as forest, planting 60 million trees since 2004.

Virginia Tech scientists estimate the coal industry has left another 750,000 to 1 million acres of tightly compacted soil, sewn in exotic grasses. In other words, prime real estate for reforesting.

State and federal regulators should never have allowed the coal industry to cut costs by reclaiming stripped land the cheapest way possible, not when federal law required restoring it to its original or a better use. Going forward, the industry should be required to reclaim stripped land as forest unless there is a compelling and credible reason for doing otherwise.

Appendix 2: (continued)

Representative Endorsements and Support for the Green Forest Works for Appalachia Proposal

The Mountaintop Removal Road Show
608 Allen Ct
Lexington KY 40505



For the past 6 years I have been travelling across America educating people about the issue of mountaintop removal coal mining in Appalachia, using the enclosed DVD. I believe that the ARRI's *Green Forest Works for Appalachia* proposal to plant 125 million trees on reclaimed coal mine sites in Appalachia deserves support from the Obama Administration, and I urge you to fund this proposal.

I have visited the ARRI test plot in Perry County Kentucky, and this year I participated in a tree-planting on a reclaimed mine site in Knott County, Kentucky. I have learned that the native hardwood tree seedlings we planted in compacted land that has been ripped by a bulldozer have successfully taken root, including chestnut trees and other hardwoods.

I also worked to repair homes damaged by the May 2009 flash flooding in Pike County KY and Mingo County, West Virginia. I have seen firsthand the heartache and devastation to the good people of Appalachia when water runs too quickly off of deforested mine sites into the hollows. In a healthy, mature forest, trees soak up 75 percent of the rainfall, according to OSMRE. Reforesting these reclaimed mine sites will also help cool the planet, while soaking up carbon dioxide.

I support the *Green Forest Works* proposal to create 2,000 new green jobs in the economically-challenged coalfields of eastern Kentucky. This is a win-win proposal for the economy, the people, the water, and the wildlife of Appalachia.

Sincerely,

David S. Cooper
The Mountaintop Removal Road Show

Appendix 2: (continued)

Representative Endorsements and Support for the Green Forest Works for Appalachia Proposal

The Huffington Post

GREEN FOREST WORKS FOR APPALACHIA: A WIN-WIN-WIN FOR JOBS, FORESTS, AND BIRDS

Dr. George H. Fenwick, President of American Bird Conservancy

Posted: August 31, 2009 04:25 PM

In a June 2009 entry to the **Huffington Post**, Jeff Biggers listed ten reasons why President Obama, CEQ chief Nancy Sutley, and EPA head Lisa Jackson must visit Appalachia and launch a war for green jobs. If this Administration truly wants to win the hearts and minds of the region's residents, environmentalists, and green economists in Appalachia, they would do well to take a close look at a proposal called Green Forest Works for Appalachia.

The Appalachian region is a land of contrasts, abounding with natural resources, yet troubled by poverty and slow economic growth. Appalachian forests support some of the highest biological diversity in the world's temperate region, including a rich variety of migratory songbirds, but extraction of the area's abundant coal reserves has dramatically altered the landscape. With the Green Forest Works for Appalachia program, the Obama Administration now has an opportunity to address economic, environmental, and ecological challenges simultaneously.

Since passage of the Surface Mine Control and Reclamation Act (SMCRA) of 1977, more than 1.2 million acres of Appalachian forest have been impacted by surface mining. Where mature native forest once stood, compacted soils and mostly non-native, aggressive grasses and shrubs now remain, left behind by coal operators in fulfillment of reclamation requirements. Reclamation of mined lands since 1977 has improved soil stability, but the impacts to Appalachia's diverse forests and species of wildlife that depend on intact forests have been dramatic.

Thanks to the Appalachian Regional Reforestation Initiative (ARRI), a cooperative effort among state, federal, and non-profit entities and universities of the Appalachian region, the bold and innovative Green Forest Works for Appalachia program is being put forward to employ thousands of local residents of rural coalfield communities in re-establishing high quality,

diverse forests on these formerly mined lands.

A Lasting Economic Return

Despite its wealth of natural resources, Appalachia has offered its residents little in the way of economic opportunity. Unemployment now averages 9.4% for the eight main coal states in Appalachia (Bureau of Labor Statistics, June 2009, www.bls.gov/web/laumstrk.htm). Coal mining and the forest products industry provide some of the few opportunities for rural employment in the region, but historically, both have come at a high cost to the environment.

Accounts of Appalachia's near-complete removal of its expansive forests in the late 1800s and early 1900s are well-documented. However, the forest products industry has made tremendous strides towards economic and environmental sustainability in recent decades, allowing it to remain a viable enterprise in rural Appalachia for years to come.

In contrast, recent analyses have shown coal jobs to be waning as a result of falling coal prices and increased mechanization. Ultimately, this non-renewable resource will become too costly to extract, process, and "clean" to remain profitable, and what job opportunities exist today will dwindle further.

Mining continues to contribute to the deterioration of watersheds and water quality, disfigurement of the landscape, and loss of potentially productive and diverse hardwood forests. Since enforcement of SMCRA began in 1978, until recently (when new forest reclamation techniques emerged from ARRI), nearly all existing reclaimed lands have severely compacted soils, making them incapable of growing diverse forests without intervention-- possibly for centuries. Remediation of the compacted soils through reforestation to combat aggressive vegetation on these formerly mined lands is the focus of Green Forest Works.

The Green Forest Works proposal would employ more than 2,000 local residents to plant more than 125 million trees on approximately 175,000 acres of formerly mined lands by 2014. Beyond the creation of those initial jobs, this initiative would provide a renewable, sustainable, multi-use resource that will create long-term economic opportunities while enhancing the local and global environment through the restoration of diverse hardwood forests.

A Significant Environmental Benefit

Appalachian forests provide ecosystem services of tangible value to local communities, the nation, and the world. For example, forested landscapes create natural buffers to watersheds that are significant in both maintaining clean water supplies to Appalachian communities fed by their headwater streams, and in regulating river flows to prevent the extremes of both flooding and the drying up of river beds.

The Appalachian forests are also a major source of carbon sequestration in the battle against global warming, and home to globally significant numbers of declining, rare, threatened, and endangered fish, mussels, salamanders, mammals, and birds. Many of these species, such as the Cerulean Warbler, require large expanses of forest to thrive.

The rehabilitation of formerly mined lands through the Green Forest Works proposal would address environmental issues such as watershed protection, forest fragmentation, and carbon sequestration, while improving landscape aesthetics to enhance the capacity of communities in coal-mined areas to serve as tourist destinations, and to support tourism-related businesses and jobs. Additionally, ARRI's techniques for restoring formerly mined lands and reclaiming current and future mines are "transferable" globally; the species planted in Wyoming or Illinois, or even China or Australia would change, but the techniques would essentially be the same. This program can serve as a global example, with potentially staggering environmental benefits.

What's Good for Birds is Good for Appalachia

American Bird Conservancy applauds the Green Forest Works proposal for its abundant potential benefits to our nation's birds, green jobs, and focus on communities in Appalachia. Restoration of native deciduous forest will provide declining songbirds such as the Cerulean Warbler (whose population has fallen by 70 percent in the last 40 years) with increased breeding, foraging, and migratory stopover habitat. Reforestation will also help reduce the impacts of the Brown-headed Cowbird, a nest parasite that has thrived in the wake of forest fragmentation caused by mining activities. Stable or increasing populations of native bird species will also help maintain overall health of the forest ecosystem: many species disperse seeds of native trees, others help control forest pests, and all are important components of a complex food web.

Birds are sensitive indicators of general environmental health--they can serve as canaries in our coal mines long after those mines have been reclaimed. Bird declines across Appalachia reflect a broader environmental problem, and demonstrate the need to restore healthy forests and watersheds for the benefit of all of the region's biodiversity and its human residents.

Birds also provide tremendous direct economic benefit to local communities. A recent study by the U.S. Fish and Wildlife Service (Birding in the United States: A Demographic and Economic Analysis), revealed that birds are a \$36 billion dollar-per-year national industry, generating state tax revenue from the purchase of birding equipment, and boosting local economies through birding tourism. Appalachia's natural beauty and the watchable wildlife opportunities it affords will only be enhanced by the Green Forest Works proposal.

Giving Back to Appalachia's Local Communities

People have been in search of jobs, dignity, and a bountiful land along the spine of the Appalachian Mountains from colonial days to the present. The discussion of exactly where they can find those treasures has not been limited to the realm of social scientists, economists, and politicians. For decades, noted artists, musicians, poets, and writers have contributed creative thoughts, opinions, and ideas to the search. Harry Caudill, Wendell Berry, Silas House, and many other noted writers have framed their work as urgent appeals to the American conscience on behalf of the land and people of Appalachia. Erik Reece, author of "Lost Mountain: A Year in the Vanishing Wilderness", wrote an Op-Ed for The New York Times on May 5, 2007, in which he said: "We need a New Deal for Appalachia that would expand the Appalachian Regional Reforestation Initiative, or create a similar program, to finally return some of the region's lost wealth in the form of jobs and trees, rebuilt topsoil, and resuscitated communities."

Waning job prospects in the mining industry, combined with tremendous interest in restoring Appalachia's majestic native forests, will allow this program to succeed. In five years, the Green Forest Works for Appalachia program will provide secure, good paying jobs for thousands of Appalachian citizens, and jump-start the reforestation process on approximately 15 percent of the formerly mined lands in the region. This is an opportunity for us to give something back to Appalachia!

An army of outsiders has gone to Appalachia in the past to try to understand and solve the region's problems without much success. The Green Forest Works proposal can triumph because it was designed by smart Appalachians for their own region and their own people. It presents the Obama Administration with a wonderful opportunity to give the people of Appalachia a chance to address their environmental and economic problems in their own way in a win-win-win scenario for jobs, ecosystems, and birds.

Appendix 2: (continued)

Representative Endorsements and Support for the Green Forest Works for Appalachia Proposal

Lexington Herald-Leader Opinion – Op- Ed

Monday, Aug. 31, 2009

A watershed for economic security

By Erik Reece

At issue | Herald-Leader news story Aug. 16: "The plan: Plant 125 million trees; group wants to reforest E. Ky. mining sites."

Last February, when actress Ashley Judd addressed hundreds of Kentuckians concerned about mountaintop removal strip mining from the state Capitol steps, she offered some helpful advice: Don't just tell your representatives what you're against; tell them what you're for.

Bill Estep's profile of the Appalachian Regional Reforestation Initiative's effort to plant 125 million trees on former strip mine sites, creating 2,000 jobs, is an excellent example of what we should be for.

But it is also a reminder that we must continue to be very clear about what we are against: leveling Eastern Kentucky's mountains in the name of cheap energy.

ARRI's coordinator, Patrick Angel, has vision and integrity. He, with the University of Kentucky forestry's Chris Barton and Don Graves, should be commended for their research into reforesting mine sites.

However, one can easily see the coal industry co-opting this effort as justification to continue stripping the tops off mountains and burying streams with the toxic debris. We who support ARRI's work must remain adamant that mountaintop removal strip mining be stopped. There are 1.5 million acres of former mountains that have already been stripped; we need not add one acre more.

Reforestation could be important in sequestering carbon and creating jobs, but it will not bring back the thousands of miles of streams that have been buried by mountaintop removal. It will not restore the original contour of the mountain, as stipulated by the Surface Mining Control and Reclamation Act of 1977. It will not prevent the damage to wells and groundwater associated with blasting, and it will not prevent slurry ponds from breaking or leaking black water.

Having said all that, I would also like to say this: Angel has offered us a glimpse of a new, clean-energy economy that could replace coal's dangerous monopoly.

Reforestation alone cannot do it. But it is part of a new economic paradigm that Kentucky must quickly adopt in the face of climate change and dwindling natural resources.

What's more, the model for such an economy exists right here — the watershed. Consider this: A strip mine is a direct cause of erosion, flooding, species loss, toxic streams and the carbon dioxide production that is driving our climate crisis. By contrast, an intact watershed — such as Robinson Forest — prevents erosion and flooding, provides wildlife habitat and sequesters huge amounts of carbon. A watershed provides, for free, all the natural services that a strip mine cannot. It is diverse, decentralized, self-sufficient and conservative. It is a model not only for the economy, but for survival.

Some very bright minds are at work applying the principles of what the University of Vermont's John Todd calls "ecological design." Todd recently won the Buckminster Fuller Challenge Award for plans to build Agro Eco-Parks on former strip mines throughout Appalachia.

Todd's model begins with reforestation (though I am convinced by Angel that UK scientists have a better reforestation plan), then manages hardwood trees for carbon sequestration and wildlife habitat, while producing fast-growing trees to create the renewable biofuels that would ultimately replace coal as the region's source of energy.

Like the diverse watershed, these parks could also offer diverse and decentralized sources of energy. Photovoltaic panels mounted on Eastern Kentucky's many south-facing valley fills could generate more energy than mountaintop removal provides. Energy from these panels, coupled with biofuel and some wind power, could be carried far beyond Kentucky on a direct-current "smart grid."

The ultimate effect of this new economy would be to take power — political and financial — away from large, absentee corporations and return it to the people of the region in the form of new energy cooperatives.

Who will pay for the start-up? Certainly some money will come from the federal stimulus package. But beyond that, we must continue to tax what is harmful. We've raised taxes on cigarettes and alcohol. It's time to raise the severance tax on coal — the most dangerous element of our economy.

But since most state legislators don't have the nerve to do that, I'll praise my representative, Congressman Ben Chandler, for voting for a federal cap-and-trade bill. It could stave off ecological catastrophe and generate profits that I trust Chandler to steer back into Kentucky's new, renewable economy.

Erik Reece, of Lexington, is a writer-in-residence at the University of Kentucky.

Appendix 2: (continued)

Representative Endorsements and Support for the Green Forest Works for Appalachia Proposal

The Mountain Eagle Whitesburg, Kentucky March 04, 2009 Editorial

It's time for a new CCC

Last week in this space we wrote about Diane Sawyer's recent ABC News documentary, "A Hidden America: Children of the Mountains," and the need to do more than dramatize the grim but all-too-familiar problems of Appalachia. We noted that we had been struck by something that Kentucky historian Ron Eller said about the need for fresh thinking about the region's future. "We just need to be willing to dream," he told ABC.

He's right. And there hasn't been enough of that lately. Forty-some years ago, a smattering of hopeful Kentuckians and other like-minded Americans dreamed the War on Poverty into being. It never became more than a half-hearted war, partly because the other war of that era – Vietnam – robbed it of resources. But, largely through the efforts of the Appalachian Regional commission, it did at least channel some funds to the region to build modern highways and other infrastructure improvement. Without those basic changes, it's hard to imagine how eastern Kentucky would survive today.

Still, when we get to dreaming about how to help change the lives of young men and women who are living without much hope today – stuck in poverty, nothing to look forward to, no obvious reason to stay in school, not much chance of finding a job, dealing and doing drugs because that's what their peers are mostly doing – we don't look back to the War of Poverty. We look back further, dreaming of a time when the federal government acted boldly and decisively to help millions of Americans who were down on their luck, and we dream about whether something like that could happen again.

By the time Franklin Delano Roosevelt took the oath of office as president in 1933, the Great Depression was already in its third full year. The nation's banking system had failed; its mines, mills and factories had largely fallen silent; and one of every four Americans was jobless. All over the country, young men who had grown up expecting to find places in the workforce (which was then still largely male) discovered that nobody was hiring. Millions of the jobless young were poorly educated and without skills. They faces a future of poverty and despair – much like the future faces by many of today's young eastern Kentuckians, male and female alike, whose lack of hope, education, skills, and self-respect greases the skids that plummet them into dependence on drugs and welfare. Roosevelt acted fast. He didn't believe in the dole, and within days he set up a temporary work-relief program that provided useful, paying jobs to millions of laid-off workers who desperately needed to be able to support their families. And in

less than six weeks – 37 days from enactment to implementation – he had a program under way that was uniquely geared to meeting the needs of jobless young people while also spurring the restoration of forests and farmlands that had been stripped and eroded by the heedless timbering and plowing practices of the greed-driven past.

FDR called this new program the Civilian Conservation Corps (CCC), and he was fully aware that the name had a double meaning. Civilians would do valuable conservation work – and learning to work together as part of a corps would also conserve civilians, turning them into productive members of a society that would soon need and appreciate them. Although nominally under the direction of a civilian head, the CCC at the outset was actually under the direction of the Army – because the Army was the only branch of the federal government that knew how to rapidly organize and oversee the hundreds of new camps that would soon become home to thousands of enrollees. What started out as an expedient way to get the program up and running turned out to be an ideal model for the long run: semi-military camps where young people from impoverished families could count on getting three square meals a day, becoming physically fit, learning essential skills and taking education courses in return for working hard and putting up with the indignities of military life such as reveille, roll call, and chowing down at community tables.

Those indignities were a small price to pay for a chance at a whole new life, and from 1933 until 1945 that is what the CCC offered to the more than 3 million young Americans who served in its ranks. Official histories tend to emphasize the billions of trees they planted, the millions of eroded acres they reclaimed, the trails and shelters and fire roads they constructed in thousands of national and state parks, and the CCC's many other tangible legacies. But just as important, if not more so, is the fact that you will never hear of a CCC veteran – and there are still a few of them among us – who didn't consider his experience in "the C's" to have been life-changing. Without that experience, the vets often said, they couldn't imagine what would have happened to them – and they spoke of their service to their country with tremendous pride. For many, it was followed by leadership roles in the armed forces during World War II – and as combat leaders they suffered disproportionately high casualties. For that we owe them a deep debt of gratitude. Fast-forward to 2009. In many parts of the country, including eastern Kentucky, it's getting hard to detect the difference between "recession" and "depression." We have a crisis on our hands, and not much of the just-enacted economic stimulus seems aimed directly at rural Appalachia. Regional joblessness is rampant, and thousands of young men and women are on the slippery slope of hopelessness. Could a new CCC help? We'll never know unless we try. Plenty of regional projects that are either planned or under way could be scaled up. To take just one example, the Appalachian Regional Reforestation Initiative and the Appalachian Coal country Watershed Team are cooperating in the launch of a demonstration project in Letcher County to reforest old strip mines – a project that could be replicated on the more than 7000,000 acres of old mined lands in the Appalachian coalfields that have never been properly reclaimed. There's a lot of talk these days about creating green jobs and sequestering carbon. Planting trees, CCC-style, does both.

Look around. National and state parks have been underfunded for 25 years, and they're showing the stress from heavy wear and tear. There are thousands of shovel-ready improvements on administrators' wish lists. Walk the 1,200-mile-long Appalachian Trail: you'll see that many if

not most of the shelters are in disrepair. Explore our hollows; streams need to be restored, back-road bridges rebuilt, trash picked up, the homes of the elderly weatherized – there's more than enough work to be done. We just need the will.

Finally, this hard thought: Would you rather invest your hardearned tax money in the \$50,000 to \$75,000 it takes to incarcerate a drug-buyer for a year – knowing that when he or she gets out, the odds of a repeat are high – or would you like to invest in seeing that person given a decent shot at a decent life through participation in a program that benefits everyone?

This isn't a question of liberalism or conservatism, it's a question about the future of our country.

And the answer? It's time for a new CCC.

Appendix 3: ARRI's Statement of Mutual Intent

The Appalachian Regional Reforestation Initiative's Statement of Mutual Intent



STATEMENT OF MUTUAL INTENT

for the

APPALACHIAN REGIONAL REFORESTATION INITIATIVE

The States of Appalachia including the Regulatory Authorities in Kentucky, Maryland, Ohio, Pennsylvania, Virginia, and West Virginia; the Office of Surface Mining, including the Tennessee Federal Program; and all other parties of this Statement of Mutual Intent desire to work together to promote and encourage planting more trees on active and abandoned coal mined lands. We will increase efforts, cooperate and partner among ourselves to plant economically viable trees, while using current Forestry Reclamation Approach (FRA) technology. This technology will increase survival rates and growth rates of crop trees, increase overall productivity, and promote natural invasion and succession of plant and animal communities.

FRA technology is a five-step reclamation process that has been proven by forestry research to increase tree survival and tree productivity. The five steps in the FRA are:

1. Create a suitable rooting medium for good tree growth that is no less than four 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.

Reforestation of coal mined land using the FRA will provide multiple environmental and economic benefits:

Environmental Benefits of Reforestation

- Increased diversity of plant succession
- Natural succession of native forest plants
- Reduced potential for establishment of invasive species

Appendix 3 (continued)

The Appalachian Regional Reforestation Initiative's Statement of Mutual Intent

- Enhanced wildlife habitat
- Soil and water conservation
- Recovery of the hydrologic balance
- Improvement of overall water quality
- Carbon sequestration

Economic Benefits of Reforestation

- Increased timber value
- Landowner tax reduction
- Recreational areas
- Jobs for the local economy
- Local tax revenue
- Reforestation provides an economically viable post mining land use option for both the landowner and the mining company

I. OBJECTIVES

- A. Establish and implement a reforestation program within each of the seven Appalachian Region States that promotes the FRA during reclamation of active coal mining operations and abandoned mined lands projects.
- B. Raise the awareness level of government agencies, private organizations, and general public on economic and environmental benefits associated with planting quality trees using FRA technology.
- C. Work with Federal, State, and local government agencies, mining companies, environmental groups, industry groups, academia and other public and private organizations to identify landowners and mining companies that will utilize the current FRA technology in reclamation.
- D. Provide a forum to transfer technology and other information concerning the creation of highly productive forestland and related environmental assets and cooperate as a clearinghouse to share data and information as it relates to current FRA technology.
- E. Apply FRA technology for growing quality trees while supporting the development of new technologies.
- F. Prepare periodic reports to describe the current status, success and increased productive tree planting efforts of projects using the FRA technology by all parties to the Statement of Mutual Intent.
- G. Promote the establishment of native forest species.

Appendix 3 (continued)

The Appalachian Regional Reforestation Initiative's Statement of Mutual Intent

II. ACCOMPLISHMENTS (or SUCCESSES)

- Provide FRA training to State and Federal regulatory personnel for active and abandoned coal mined lands.
- Achieve public outreach and FRA training to the coal industry located in the States represented by this Statement of Mutual Intent.
- Achieve public outreach and FRA training to all other interested parties located in the States represented by this Statement of Mutual Intent.
- Increase the number of trees planted using FRA technology in the States represented by this Statement of Mutual Intent.
- Identify incentives to promote reforestation on coal mined lands.

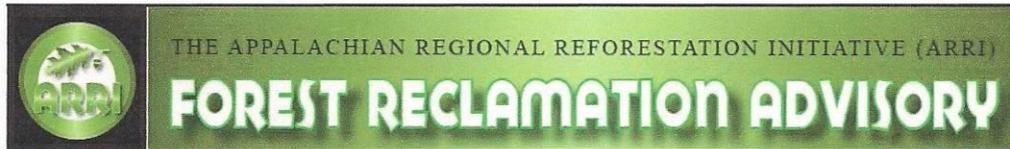
III. GENERAL PROVISIONS

- A. We will carry out all activities in this Statement of Mutual Intent in full compliance with applicable State and Federal laws and regulations.
- B. Any party may withdraw from this Statement of Mutual Intent by notifying the other parties in writing.

IV. SIGNATURES (Attached)

Appendix 4: ARRI's Forestry Reclamation Advisory No. 4

ARRI's Forest Reclamation Advisory No. 4



Forest Reclamation Advisory No. 4

July 2007

LOOSENING COMPACTED SOILS ON MINED SITES

R. Sweigard, J. Burger, D. Graves, C. Zipper, C. Barton, J. Skousen, P. Angel

Because successful surface-coal mining businesses must move earth materials efficiently, mining operations today use large and heavy equipment. Track dozers and haul trucks used for mining can weigh in excess of 100 tons each, while wheel loaders and loaded haul trucks often exceed 200 tons. It is becoming well known within the mining industry that successful reforestation of reclaimed sites requires loose and uncompacted surface materials, but some areas become compacted due to machinery operation, traffic, and storage that is necessary for the mining business to be successful.



Figure 1. Even when empty, haul trucks can weigh 50-100 tons or more; this weight exerts force where tires meet the land surface, causing severe compaction of mine soils. Loaders, dozers, and other heavy mining equipment also cause compaction that hinders tree growth when operated on surface soils.

Trees require deep, loose mine soils to survive and grow into healthy, productive forests. Such forests can support viable forest-products' businesses, protect the watershed, store carbon, and serve as wildlife habitat. This advisory describes procedures that can be used to loosen soils that have become compacted by mining equipment in order to restore land capability for forests.

Avoiding Soil Compaction

The best way to deal with compaction on mine sites is to avoid compacting the soil in the first place. Uncompacted conditions suitable for trees can be created using techniques that cost less than traditional smooth-surface "tracked in" reclamation. Loose dumping of surface materials, combined with the minimum grading necessary to shape the land, creates loose soils and rough surfaces, increases

rainwater infiltration, and increases the survival and growth of trees. Throughout Appalachia, coal operators are finding these techniques to be a cost-effective successful method for establishing forests and achieving timely bond release when used with the Forestry Reclamation Approach (Burger and others 2005).

Coal operators can minimize equipment use on the final surface but there will often be areas that become compacted, generally the flatter areas and sites used for equipment storage. Many Appalachian and midwestern mine sites reclaimed under SMCRA have become compacted due to excessive equipment operation (Angel and others 2005). In order for such lands to support a forested postmining land use, soils must be loosened prior to reforestation.

What Can Be Done to Loosen Compacted Soil?

Ripping of the soil with a ripper blade or a deep plow attached to a dozer can alleviate most soil compaction effects on mine sites (Figure 2).



Figure 2. A dozer is ripping to loosen soils and produce soil conditions favorable to successful reforestation in a former roadway.

Subsurface ripping was first used for reclamation on prime farmlands disturbed by mining in the Midwest. In years following SMCRA's passage, rubber-tired equipment was often used to replace the subsoil and topsoil on prime farmland sites. Such practices compacted soils and created lands that could not produce the required crop yields.

Appendix 4 (continued)

ARRI's Forest Reclamation Advisory No. 4

Various deep plows were developed and used to overcome compaction in prime farmland reclamation, and research studies have shown that their use helps to restore soil productivity (Dunker and others 1995, 2000). More recently, similar methods have been used to alleviate soil compaction on post-SMCRA sites (Conrad and others 2002).

The choice of ripping device and procedure depends on site conditions. Available ripping devices include single, double, and triple shank rippers, with and without plow attachments.



Figure 3. A single-shank ripper is capable of ripping the soil to a depth suitable for forest trees when attached to a large dozer.

In areas where topsoil is lacking and surface spoils contain large boulders, a single shank ripper (Figure 3) will generally produce the best results. As the shank encounters boulders, they are lifted and rotated which has the effect of loosening the material around and above the boulders (Figure 4), which increases the operation's effectiveness. With this type of ripper in rocky soil, it is usually adequate to rip in only one direction.

When ripping is done on mined land with thick soil that is relatively free of boulders, a deep plow will do a better job of loosening the soil than a straight-shank ripper. In this case the plow's shape is important because, without boulders to be pulled up, the subsurface blade must lift and fracture the soil. A plow-like attachment has been used successfully on a single shank ripper blade (Figure 5). Such devices cannot withstand the stresses of moving large boulders and are not recommended where boulders are present.

If soils have a high clay content, ripping in two perpendicular directions ("cross-ripping") is recommended, as ripping in only one direction in clayey soils tends to cut a narrow trench without shattering the surrounding soil. The tree roots tend to grow only in the direction of the trenches, which makes them susceptible to being blown over by wind after they develop a crown.

Since forest trees require at least 4 feet of uncompacted rooting medium to achieve their growth potential, compacted mined land being prepared for trees should be ripped to a depth of at least 4 feet. Although 4 feet will be an effective ripping depth on most sites, deeper is better. In order to rip a compacted mine site to 4 feet, a dozer size equivalent to a Cat D-9 or larger is generally required. Use of shorter (less than 4 feet) rippers can be beneficial in areas where surface soils have been compacted but deeper soils remain loose. If a shorter single-shank ripper (less than 4 feet) is used, the entire area should be crossed-ripped to ensure adequate loosening of the surface. Using a triple shank ripper should eliminate the need to cross-rip because it loosens most of the total surface area. Unless a very large dozer is used, however, a triple-shank ripper may not reach as great a depth as a single-shank ripper.



Figure 4. A ripping operation has brought large boulders to the surface, thus loosening the surrounding soil materials on this Appalachian surface mine. Note that the ripping has reduced ground cover density near the ripped channel, which will help tree seedlings planted over that channel to survive and become established.

When ripping is done on nearly level ground, the direction of ripping is not critical. However, when ripping is done on slopes, it is advisable to rip along the contour to minimize erosion.

In all cases, it is best to rip when the ground is dry because dry soils fracture much better than damp or moist soils; this is especially important for clayey mine soils. Ripping operations during late summer or fall take advantage of the relatively dry seasonal conditions while allowing soil settling for early-spring tree planting.

Appendix 4 (continued)

ARRI's Forest Reclamation Advisory No. 4



Figure 5. This ripper with a plow attachment can be used to loosen soils that do not contain large rocks and boulders. The "wings" on the ripper blade will loosen soils located beside ripping trench.

Is Ripping Needed?

On Appalachian surface mines it is common for relatively flat areas to be more compacted than steeper slopes, especially if those areas have been used for equipment storage, maintenance, and operations; such heavily compacted soils will require ripping to produce commercially valuable trees. In contrast, soils on steeper slopes often remain relatively loose because they are not affected by equipment operations after grading.

It is relatively easy to determine whether or not soils have been compacted to an extent which makes ripping necessary to ensure satisfactory tree growth. A common hand spade or a drain spade

shovel can be used to estimate the extent of compaction by putting a modest amount of foot pressure (50 pounds) on the spade while rocking its tip to by-pass coarse fragments (if a rock big enough to block the spade is encountered, move to another spot). The depth of spade penetration will be affected by the degree of compaction and is an indicator of forest site quality (Table 1). For example, a highly compacted soil could be penetrated with a spade to a depth of 1 to 3 inches. Without ripping, the site would be classified as "fair" and would be capable of growing oaks only 50 feet tall at age 50. Trees growing at this rate would have little value except as firewood so the land would have little or no value as a forest-products investment. Ripping the site would improve the soil by 1 to 3 site-quality classes, depending on the type and quality of the ripping practice (This assumes other soil properties are suitable for growing trees, and good forestry practices are applied after the area is ripped.). Note that return on investment doubles when site quality is improved by one class.



Figure 6. A spade can be used to estimate mine soil density and the need for ripping. Depth of penetration when applying foot pressure and a rocking motion is an indicator of soils' capability to support trees that will survive and grow into commercial products (see Table 1). This long-nosed drain spade was able to penetrate spoil easily; this area should be able to grow trees successfully without being ripped.

Relationships between soil compaction, soil physical properties, and tree growth (Table 1) have been worked out in research studies. The term "bulk density" refers to a technical measure of soil density that is often used in such studies. A low bulk density indicates a loose soil that allows

Table 1. The relationship among degree of compaction, spade penetration depth, forest site quality, and relative return on a forestry investment (after Burger and others 1998, 2002; and Probert 1999). Forest site quality is an indicator of the soil's ability to support growing trees.

Soil Density Condition	Very Dense	Dense	Moderately Compacted	Slightly Compacted	Loose
Spade penetration	0-1 inches	1-3 inches	3-6 inches	6-9 inches	9-12 inches
Site Quality Class	V (poor)	IV (fair)	III (medium)	II (good)	I (excellent)
Oak site index ^a	40	50	60	70	80
Use for wood products	None	Firewood	Railroad ties	Saw timber	Veneer
\$ /1000 board ft stumpage value ^b	-	Less than \$100	\$200	\$500	\$2000
Relative return on investment	-2%	0%	2%	4%	8%

^a Approximate height in feet of a white or red oak growing at age 50. These ratings assume that all other factors (other mine soil properties, ground cover, seedling quality, etc.) affecting productivity other than soil density are optimum.

^b As of 2/07. J. Hayek, Timber Blog. Univ. of Illinois Extension Div. <http://web.extension.uiuc.edu/forestry/blogs/eb94/>

Appendix 4 (continued)

ARRI's Forest Reclamation Advisory No. 4

rainfall to infiltrate easily, which helps to prevent erosion, and will not impede root extension by growing trees. Bulk density can be measured in different ways including specialized field sampling methods. Research has found that, in rocky spoil, dry bulk density should be less than 100 pounds per cubic foot at a depth of 2 inches, which correlates with relatively deep shovel penetration.

Figure 7.
A tractor-mounted cone penetrometer is being used to evaluate soil density on a Kentucky surface mine.



Another way of evaluating soil density conditions is with a cone penetrometer, a common geotechnical testing device that drives a steel cone into the ground with a hydraulic ram. To ensure good tree growth in rocky spoil, the cone should be able to penetrate at least one foot into the ground. This is an average value that can vary based on soil type and rock content.

Has Ripping Been Effective?

Our experience shows that a deep and thorough ripping of very dense mine soils can improve the soil by as many as 3 or 4 site quality classes (Table 1). Even a moderately compacted site can be greatly improved because the economic value of trees increases disproportionately on the high end of the site-quality gradient due to improved wood product class (e.g., veneer has a much greater value than saw timber – Table 1) as well as faster growth rates.

Is Ripping Cost-Effective?

Ripping should be considered a practice of last resort. It is far less expensive to avoid compaction during reclamation than to correct it once it has occurred. Loose grading costs less than the excessive grading that compacts soils because loose grading requires less dozer time – and loose-graded sites can grow trees successfully without the expense of ripping. Nonetheless, it is difficult to avoid all surface compaction on an active mine site; the pre-mining capability to grow trees cannot be restored on areas that have been compacted by repetitive equipment traffic unless such areas are ripped prior to planting.

Experience has shown that it takes about an hour to rip one acre with a D-9 dozer or equivalent with a single-shank ripper. In 2006 using contract

equipment, the cost was approximately \$150 per acre. The type of ripper used will also affect the per-acre cost. For example, a triple-shank ripper would require a larger tractor and more time.

Conclusions

The Forestry Reclamation Approach (FRA) is a way of reclaiming active surface mines to maximize reforestation potentials (Burger and others 2005). A non-compacted growth medium is essential to FRA reclamation. Soil conditions suitable for trees can be created by placing materials on the surface loosely, and minimizing surface grading. On areas that do become compacted, soil conditions suitable for trees can be restored through deep ripping. Although ripping may not produce land that is as desirable as land that has been loosely graded from the outset, it can alleviate soil compaction so that reforestation can be successful and restore land capability to pre-mining levels.

References

- P. Angel, V. Davis, J. Burger, D. Graves, C. Zipper. 2005. The Appalachian Regional Reforestation Initiative. U.S. Office of Surface Mining. Forest Reclamation Advisory No. 1. <http://arri.osmre.gov/fra.htm>
- J. Burger, D. Kelting, C. Zipper. 1998. Maximizing the value of forests on reclaimed mined land. Va Coop. Extension Pub. 460-138. http://www.cses.vt.edu/PRP/VCE_Pubs.html
- J. Burger, D. Mitchem, D. Scott. 2002. Field assessment of mine site quality for establishing hardwoods in the Appalachians. p. 226-240. In: Proceedings, American Soc. Mining & Reclamation.
- J. Burger, D. Graves, P. Angel, V. Davis, C. Zipper. 2005. The Forestry Reclamation Approach. U.S. Office of Surface Mining. Forest Reclamation Advisory No. 2. <http://arri.osmre.gov/fra.htm>
- P. Conrad, R. Sweigard, J. Yingling, D. Graves, J. Ringe. 2002. Use of ripping to alleviate excessive compaction on reclaimed surface mined land. Transactions of SME 312:159-165.
- R. Dunker, C. Hooks, S. Vance, R. Darmody. 1995. Deep tillage effects on compacted surface-mined land. Soil Science Society of America Journal. 59: 192-199.
- R. Dunker, R. Barnhisel. 2000. Cropland reclamation. p. 323-369, in: R. Barnhisel, R. Darmody, W. Daniels (editors). Reclamation of Drastically Disturbed Lands. American Society of Agronomy.
- T. Probert. 1999. Reforestation constraints, experiences, trends, and needs: A landowner's perspective. In: Proceedings. Enhancement of Reforestation at Active Coal Mines. U.S. Office of Surface Mining.

Acknowledgements

Scientists from Ohio University, Ohio State University, Pennsylvania State University, Purdue University, Southern Illinois University, University of Kentucky, University of Maryland, University of Tennessee, Virginia Tech, West Virginia University, and U.S. Forest Service contributed. Authors are: Richard Sweigard (rsweigard@engr.uky.edu), Don Graves (dgraves@uky.edu), and Christopher Barton (barton@uky.edu), University of Kentucky, Lexington.

James Burger (jburger@vt.edu) and Carl Zipper (czip@vt.edu), Virginia Tech, Blacksburg.

Jeff Skousen, West Virginia University, Morgantown. jskousen@wvu.edu

Patrick Angel, Office of Surface Mining Reclamation and Enforcement, U.S.D.I., London Kentucky. pangel@osmre.gov

PRINTED ON RECYCLED PAPER

Appendix 5: Pilot Projects by Community Volunteers

ACCWT/ARRI Partnership: Pilot Tree Planting Projects by Community Volunteers in 2009

Planting Trees for Appalachia's Future

Spring 2009

An ACCWT/ARRI Partnership



According to the EPA, 3.5 million people in Appalachia live within a mile of an Abandoned Mine Land site.

The heritage of Appalachia has been rooted in the coal industry for over 100 years, and mining carved the way for the industrialization of America. Problems related to pre-regulatory mining and the lack of historic reclamation has brought partners together to reforest much of Appalachia's frontier that was reclaimed as grass- or pastureland.

The mountains of Appalachian Coal Country are one of the most beautiful, culturally rich regions in America, yet it has experienced many hardships related to poverty and environmental degradation.

This spring, the Appalachian Coal Country Watershed Team (ACCWT) and the Appalachian Regional Reforestation Initiative (ARRI) partnered for the first time and successfully sponsored and organized eight tree planting events throughout the Appalachian coal region. The ACCWT and ARRI share the successes of the citizens and industry volunteers that planted 27,500 tree seedlings on 36.1 acres of previously mined lands. Together, we are re-establishing the former eastern hardwood forest cover and creating future economic opportunity.



Appendix 5 (continued)

ACCWT/ARRI Partnership: Pilot Tree Planting Projects by Community Volunteers in 2009

An ACCWT/ARRI Partnership

Page 2

Our Partnership

The Appalachian Coal Country Watershed Team (ACCWT) is an innovative partnership between the Office of Surface Mining, concerned with environmental reclamation and safety, AmeriCorps*VISTA, concerned with poverty, and local community groups. The ACCWT attempts to draw connections between environmental degradation and impoverished localities. The Team was founded in response to requests from small, community volunteer-based watershed groups throughout coal country, and targets problems associated with the legacy of pre-regulatory coal mining in Appalachian watersheds. The ACCWT co-sponsors determined, college graduate OSM/VISTAs with local watershed groups in Appalachian communities in need of the skills and commitment those Volunteers can bring to a year or two of full-time national service. OSM/VISTAs address not only immediate and pressing water quality problems; they support their local communities in the longer, more hard-fought struggles of community sustainability, job stability, and successful futures for citizens in rural America. For more information about the ACCWT, please visit: www.accwt.org.



Dr. Allan Comp, OSM/VISTA Teams Coordinator, and Dr. Patrick Angel, OSM Soil Scientist, mix a mud slurry to protect seedlings roots from drying out before being planted at the Prenter, WV event.

The Appalachian Regional Reforestation Initiative (ARRI), formed in 2004, is a cooperative effort by the States of the Appalachian Region with the Office of Surface Mining to encourage restoration of high quality forests on reclaimed coal mines in the eastern USA. ARRI's goals are to communicate and encourage mine reforestation practices that:

- plant more high-value hardwood trees on reclaimed coal mined lands in Appalachia;
- increase the survival rates and growth rates of planted trees; and
- expedite the establishment of forest habitat through natural succession

ARRI's collaboration efforts includes over 300 partners, like: watershed and environmental groups, industry, State and Federal government, coal field communities, landowners, and private citizens to enlist their efforts and support. For more information about the ARRI, please visit: <http://arri.osmre.gov>.

Why Reforestation is Needed

Virtually all of the land in Appalachia was once forested. Many areas have been reclaimed after use to pastureland and are no longer being utilized for such a purpose. Reclaimed sites are stable, there are no landslides, erosion is controlled, and they are acceptable under SMCRA. However, where we once had a forest, we now see much of this land in a state of arrested natural succession and the potential to return to a productive forest is minimal. 80% of such sites are now being reforested successfully, many of them with the Forestry Reclamation Approach.

The Forestry Reclamation Approach (FRA)

A major problem for growing trees on historic and now reclaimed surface mines is compaction. Another serious challenge is competition from the aggressive grasses and legumes typically planted on mine sites. To address these issues, ARRI created the Forestry Reclamation Approach (FRA). The FRA is a method for reclaiming coal-mined land to forest, and is based on knowledge gained from both scientific research and field experience. The five steps of the FRA include:

- 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
- Loosely grade the topsoil or topsoil substitutes established in step one to create a non-compacted growth medium
- Use ground covers that are compatible with growing trees
- Plant two types of trees – 1) early succession species for wildlife and soil stability, and 2) commercially valuable crop trees
- Use proper tree planting techniques

The FRA is designed to restore forest land capability. Using this method allows for forest land productivity to be equal to or better than that which preceded mining.



Appendix 5 (continued)

ACCWT/ARRI Partnership: Pilot Tree Planting Projects by Community Volunteers in 2009

Page 3

An ACCWT/ARRI Partnership



High school students secure a seedling into the ground in Haysi, Va. Over 100 students from three area high schools attended the planting event.

Haysi, Va.

March 5, 2009

Friends of Russell Fork

Haysi, located in Dickenson County, in SW Va., is an area with a strong history of mining. The estimated population of Haysi is 179.

Most sites were ripped with a D9 Dozer and ripping bars, the Haysi site used an excavator to loosen and churn the soil because a D9 could not make it down the road to the site. This method provided excellent substrate for plant-

ing and will allow the seedlings to thrive.

OSM/VISTA Chris Eberly and his supervisor Gene Counts worked with three area high schools; over 100 students were bussed to the site. Students were placed into one of eight groups, four groups planted in the morning while the remaining rotated through four learning stations. Stations included: ARRI and the FRA planting method, natural forest succession/forest ecosystems, soil properties and soil science, and the

American Chestnut. After lunch, the groups traded so those who had been in learning sessions were able to plant.

Planting was conducted in groups with students in pairs, each group was supervised by a teacher, member of the OSM/VISTA Team or a Forester from the Va. Department of Forestry. The event ran from 10 am to 2 pm. Students completed the day with much excitement and a great sense of accomplishment.

Highlights

Haysi, Va.:

- 1,900 trees planted
- 1.9 acres
- 140 volunteers
- Landowner: Forestland Group, LLC
- Major contributors: Va. Department of Forestry; ArborGen; Forestland Group; JWT Well Services

Dr. Patrick Angel, Senior Forester/Soil Scientist for the Office of Surface Mining, teaches high school students about the ARRI project and the Forest Reclamation Approach to planting. With over 100 students attending the event, they were split into 8 groups, 4 groups planted while the other rotated through 4 learning stations. Other station topics included: the American Chestnut, natural forest succession, and soil properties.



OSM/VISTA Kat Bawden plants a seedling in Coeburn, Va.

Coeburn, Va.

March 17, 2009

Guest River Restoration Project

Coeburn, located in Wise County in SW Va., was established in 1894 and has a strong history of mining.

The planting site in Coeburn was once a waste coal pile, now reclaimed, that had been cleared of mining materials in 1980 by the Department of Mines Minerals and Energy, Division of Mined Land Rec-

lamation. The DMLR, who has been maintaining the property, handled reclamation of the site. The land was finalized in the summer of 2008 and is now being reforested. There was no need to rip the land prior to planting at the Coeburn site, the soil was not compacted and planting was possible.

OSM/VISTA Claire Donley worked with Richard Davis of DMLR to coordinate the

planting event. Volunteers from Job Corps, Wise County Litter Control, the Virginia Forestry Department, and ACCWT OSM/VISTAs from other areas attended to plant seedlings.

The Coeburn event ran from 10 am through 1 pm. Volunteers were happy to have attended and pleased with the results of their hard work on St. Patrick's Day.

Appendix 5 (continued)

ACCWT/ARRI Partnership: Pilot Tree Planting Projects by Community Volunteers in 2009

An ACCWT/ARRI Partnership
Page 4



Tim Brehm with the Office of Surface Mining plants seedlings on a reclaimed gob pile in Coeburn, Va.

Highlights

Coeburn, Va.:

- 2,000 trees planted
- 2 acres
- 30 volunteers
- Landowner: Forestland Group
- Major contributors: Virginia Forest Service; Dept of Mine Minerals and Energy; Dept. of Mined Land Reclamation



A White Pine seedling, one of several tree species planted in Coeburn, Va.

Carcassonne, KY

March 21, 2009

Headwaters, Inc.

Carcassonne, located in Letcher County, KY, is found in the Eastern Coal Field region of the state.

The planting site in Carcassonne, KY is a reclaimed mine site, the event was coordinated by OSM/VISTAs Sam Adams and Reuben Liebe. The land is now privately owned.

Volunteers from the mining industry and the Sierra Club worked side by side to plant trees; all agreed the event was a success.

At a celebration event the following week a representative from the United Nations Environmental Programme presented local Spanish teachers with letters from students in Northern South America. These letters will be given to local students to launch a pen pal program. The link between the US and South America is the Cerulean Warbler, a small endangered bird with a narrow habitat range. The bird winters in the broad-leaved forests of South America and migrates to habitat throughout the eastern US to use tall deciduous trees and open understory areas as breeding grounds. Planting volunteers and community members attended to celebrate the work done, and watch the letter exchange ceremony.

Highlights

Carcassonne, KY:

- 4,200 trees planted
- 5 acres
- 54 volunteers
- Landowner: William V. and Gina Bates
- Major contributors: James River Coal; ArborGen; University of Kentucky; the American Chestnut Foundation; Letcher County Conservation District; Tour Southern and Eastern Kentucky



Volunteers from the community, the mining industry and the Sierra Club line up for seedlings and tree planting supplies. Trees of multiple species and supplies were lined up and distributed by Office of Surface Mining and Department of Forestry staff so that questions could be answered as volunteers picked up their items.



Top: Volunteers plant seedlings.



Bottom: Jeff Hill of ArborGen instructs volunteers on planting methods

66

Appendix 5 (continued)

ACCWT/ARRI Partnership: Pilot Tree Planting Projects by Community Volunteers in 2009

Page 5

An ACCWT/ARRI Partnership

Prenter, WV

March 27, 2009

The Appalachian Coal Country Watershed Team

Prenter, located in Boone County, W. Va., has a very strong historical and current mining presence.

The site outside Prenter, WV is currently owned by Patriot Coal. The event was coordinated by the ACCWT support staff office in Beckley, WV.

The ACCWT worked closely with Patriot Coal during the planning and event process. The Prenter event is

the only 2009 event involving coal industry owned land. Patriot has met and exceeded reclamation efforts on their own for the release of this land. The coal company partnered with the ACCWT and ARRI to go beyond what was required and enhance the land and their efforts with additional tree planting. The land is to be used as wildlife habitat. The ACCWT worked directly with Patriot to influence the way reclamation progresses.

Volunteers from the ACCWT OSM/VISTA Team,

Patriot Coal, the Citizens Conservation Corps of West Virginia, the National Park Service and area watershed groups participated in the event. Even though the day was overcast and chilly in the morning, volunteers worked hard and enjoyed the event. An ambulance unit was on hand in case of emergency and even the EMTs were excited about the work and helped plant seedlings while they were there. With over 3,500 trees planted, volunteers left happy and satisfied with their accomplishment.



Employees of Patriot Coal volunteer to plant trees at the site outside of Prenter, WV. Patriot Coal donated much time, effort and in-kind donations, including: the land, the ripping of the site, company volunteers (planning and planting), trees and lunch during a celebration day on June 19, 2009.



OSM/VISTA Joe Campbell plants seedlings.

Highlights

Prenter, WV:

- 3,650 trees planted
- 4 acres
- 33 volunteers
- Landowner: Patriot Coal
- Major contributors: Patriot Coal; ArborGen; The American Chestnut Foundation; the Citizens Conservation Corps of West Virginia; Friends of Coal Ladies Auxiliary



OSM/VISTA Scott Fanello leads volunteers through the supply line.

Lisbon, OH

April 18, 2009

Little Beaver Creek Land Foundation

Lisbon, located in Columbiana County in NE OH, was established in 1803 and currently has a large farming population.

OSM/VISTA Ben Shapiro organized a very successful event on a reclaimed mine site in Lisbon, OH.

Many volunteers at this site

were from local church youth groups and boy scout troops. Shapiro attends a different church each Sunday to introduce himself, his projects and his organization. For the tree planting event he did the same and successfully got the Lisbon Community interested and involved in the planting event.

Over 80 volunteers attended the event and were able to plant the seedlings very

quickly on the afternoon of the 18th.

The Ohio Department of Natural Resources was very involved in the planting event as well.

Kids worked in small groups with adults while planting. Volunteers were happy to be doing such "great work" and hope to be able to visit the land again when tree growth occurs to see the accomplishments of the day.



Community volunteers plant several species of seedlings in Lisbon, OH.

Appendix 5 (continued)

ACCWT/ARRI Partnership: Pilot Tree Planting Projects by Community Volunteers in 2009

An ACCWT/ARRI Partnership
Page 6



Tom Butch of ODNR helps volunteers from Huntington Bank plant American Chestnut trees.

Highlights

Lisbon, OH:

- 3,500 trees planted
- 3.1 acres
- 84 volunteers
- Landowner: Columbiana County Parks District
- Major contributors: Ohio State U.; Oxford Mining; Columbiana Co. Federation Conservation Club; American Chestnut Foundation; Fish and Water Life; Mineral Resources; Soil and Water Conservation District



Community volunteers from AmeriCorps, church youth groups, members of Boy Scouts, bank associates and independent volunteers attending the tree planting.

Minersville, PA

May 1, 2009

Schuylkill Conservation District

Minersville, located in Schuylkill County, is a very active mining community.

OSM/VISTA Mike Myers with Schuylkill Conservation District, organized 30 community volunteers who donned gardening gloves and rain ponchos and wielded dibbles, a hand-held planting

tool, to plant seedlings on land owned by Schuylkill County and leased by Mountaintop Coal Mining Inc., Elysburg. The volunteers completed the planting in four hours.

Mountaintop Coal, which leased the land from the county for a strip mine operation, donated time and equipment to prepare the land for the project. Mountaintop had reclaimed the land prior to release, but wished to partner with the county to plant additional trees to further enhance the area.

OSM/VISTA Myers also organized a media/celebration day that took place the following week on May 7th. Minersville area high school students attended the celebration event, were given a tour of an active portion of the mine site by representatives of Mountaintop Coal, and had the chance to ceremoniously plant several additional American Chestnut trees in the planting area.



The Schuylkill County Commissioners, Pennsylvania Game Commission, Schuylkill County Conservation District, and Schuylkill Headwaters Association receive an Excellence in Reforestation Award for their project and the exemplary performance using the Forestry Reclamation Approach. The award was given by ARRI.

Highlights

Minersville, PA:

- 2,500 trees planted
- 2 acres
- 30 volunteers
- Landowner: Schuylkill County
- Major contributors: Mountaintop Coal Mining, Inc.; Wal-Mart Distribution Center; PA Game Commission; The American Chestnut Foundation



Top: Students arrive at the planting sight.



Bottom: Students are given a tour of an active mine sight before planting.

68

Appendix 5 (continued)

ACCWT/ARRI Partnership: Pilot Tree Planting Projects by Community Volunteers in 2009

An ACCWT/ARRI PartnershipPage 7

Additional Tree Plantings
The ACCWT/ARRI partnership included two sites that have not previously partnered with either organization before:

- Cumberland River Restoration Project, Williamsburg, KY
- The Appalachian Forest Heritage Area, Elkins, WV

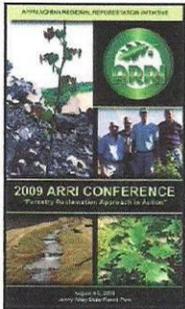
These sites added an additional:

- 14,000 trees
- 18 acres
- 150 volunteers

Our 2009 Total
In our first year of partnership, the Appalachian Coal Country Watershed Team and the Appalachian Regional Reforestation Initiative successfully:

- **Planted 27,500 trees;**
- **Covered 36.1 acres with seedlings;**
- **and got 520 community volunteers involved in a widespread reforestation initiative!**

The Future



Members of the ACCWT and its Watershed Partners attended the 2009 ARRI Conference to learn about the Forestry Reclamation Approach in action and to begin thinking about local projects for the spring of 2010.

This conference allowed for personalized training for new groups getting involved in a planting event next year and time for groups having created an event in 2009 to discuss both the successes and hardships of their projects.

Recently, the ACCWT has had the opportunity to place an OSM/VISTA with ARRI representative, Patrick Angel. This placement represents the full time dedication that the ACCWT has given to creating many successful tree planting events and the dedication of creating a bigger and better success in 2010.

The ACCWT and ARRI are already in the process of planning tree planting events for 2010 with the goals of increasing the number of sites hosting an event, increasing the number of acres and trees planted, and succeeding in greater community involvement!



Appendix 6: Green Forest Works for Appalachia – Second Year Pilot Projects Proposal

ACCWT/ARRI Proposal to Fund the Second Year of Pilot Projects by Community Volunteers: Reforestation as Social Investment

Who we are: A proven coalition of Appalachian residents – community improvement groups, college-trained OSM/VISTA Volunteers, scientists, foresters, retirees, local leaders, and many others, working to improve watersheds and the places we call home. Our proposal, **Green Forest Works**, is powered by two separate programs: the *Appalachian Regional Reforestation Initiative (ARRI)* and the *Appalachian Coal Country Watershed Team (ACCWT)*. *ARRI* is a cooperative effort between the states of the Appalachian region with the Department of Interior's Office of Surface Mining (OSM) to encourage restoration of high-quality forests on active and reclaimed coal mine sites. *ACCWT* is formed of community improvement/watershed groups in 30+ locations across the 8 states of the Appalachians, serving communities impoverished by environmental degradation. Each *ACCWT* group hosts one, or more, full-time OSM/VISTAs. Together, *ARRI* and *ACCWT* have the proven science, the “on-the-ground” connections, and the local experience to propose a sustainable initiative centered on planting trees on hundreds of thousands of acres where they once stood, but which coal companies re-vegetated as grassland after surface mining over the last three decades – engaging communities in their own improvement, strengthening local redevelopment and flood prevention efforts, and building a base for an expanding green-jobs economy.

What we propose: **Green Forest Works** can re-establish high-quality forests on the more than half-million acres of old coal surface mines. These mountaintop mines converted large blocks of Appalachian forest to grassland. We can transform these old surface mines from barren scrublands to productive forests and create green jobs for the people of the mountains in the process. This effort can:

- Engage at least 20 communities in their own improvement
- Reestablish healthy, productive forests on areas that are in a state of arrested natural succession
- Reconnect forest habitat, enhancing wildlife diversity and species migration
- Construct wetlands, enhancing habitat and biodiversity
- Create a comprehensive biomass research and resources list
- Intensely reforest strategic watersheds to significantly reduce flood damage
- Build on EPA efforts to locate sites eligible for solar/wind/geothermal projects
- Work with local contacts for right of entry and land agreements
- Renew/revive the traditional Appalachian forest economy – and the tourism that can strengthen and diversify that economy.

Equally important, we can bridge the gap between a new green-jobs economy and Appalachian culture. We know from experience the **Green Forest Works** alliance will:

- Increase civic engagement
- Enhance community capacity
- Foster economic redevelopment
- Create a sustainable system capable of perpetuating continued volunteer and community involvement

Appendix 6 (continued)

ACCWT/ARRI Proposal to Fund the Second Year of Pilot Projects by Community Volunteers: Reforestation as Social Investment

These are the deliverables, the proven results of decades of *ARRI* research and development, 10 years of *ACCWT* partnerships with Appalachian communities and their OSM/VISTAs, and 8 *ACCWT/ARRI* community tree-planting pilot projects successfully completed in five states last spring. THIS IS A TESTED AND PROVEN APPROACH.

Where this will happen: Eastern US lands mined for coal under Federal and State laws constitute a significant land resource and the potential for a diversified, sustained green-jobs economy. Estimates of the quantity of post-bond released mined lands in Appalachia available for reforestation and carbon sequestration range from half-million to one-million acres. From Pennsylvania to Alabama, the people of the coal fields of Appalachia can come together to restore both the economy and the ecology of their home lands and watersheds – indeed, they have already begun.

New Mines: Due to the hard work of *ARRI*, the coal industry and regulatory authorities are changing the standards of surface mine reclamation. Today, forestry is the preferred post-mining land use choice. Since the start of *ARRI* in 2004, approximately 60 million trees have been planted and 88,235 acres restored to forests on mined land. *ARRI* is ‘forward looking,’ working hard to get the active mining industry to plant trees as they mine and reclaim new ground. It is the mined land planted in grasses over the past three decades that need to be addressed.

Old Mines: When the Surface Mining Control and Reclamation Act was implemented in 1978, regulators focused on severe erosion, sedimentation, and landslides. As a result, excessive compaction quickly became the accepted reclamation approach, creating fast-growing grasslands which led to significant forest fragmentation and loss of productivity across the coalfields of Appalachia. **Green Forest Works** will focus specifically on compacted mined land now covered with unproductive grasses and scrub.

New Hope: *ARRI*'s Science Team developed scientifically proven methods to meet the challenges of reforesting compacted minelands. It takes unique partnerships to address the past in a way that creates a better future. The *ACCWT* has the community-based coalitions that bring the volunteers, community support, and local credibility to the **Green Forest Works** program. *ACCWT*'s input is critical in gaining access to privately-owned lands through its diverse array of community watershed partners.

Proof: In a clear demonstration of the potential for **Green Forest Works**, the *ACCWT* and *ARRI* partnered in the spring of 2009 to combine the science of mined land reforestation with a network of community watershed organizations and their OSM/VISTAs, local coal operators, and hundreds of community tree-planting volunteers. The two organizations successfully:

- Conducted a tree planting pilot program throughout the Appalachian coal region
- Combined *ARRI* science with *ACCWT*'s volunteers and public engagement capabilities
- Learned how to execute large scale, simultaneous tree planting projects across the region and **shared the accomplishments of the OSM/VISTAs, citizens, and industry volunteers who completed eight projects in five states, planting 27,500 trees on 36.1 acres engaging 520 volunteers**

Appendix 6 (continued)

ACCWT/ARRI Proposal to Fund the Second Year of Pilot Projects by Community Volunteers: Reforestation as Social Investment

2010 Proposal

We seek sufficient funding for at least 20 projects of about 10 acres each in the following Appalachian coal states: Alabama, Kentucky, Maryland, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. Each community watershed organization will receive the minimal funding required to make a 10-acre project happen, as outlined below. Every dollar of community or in-kind support developed by that organization will result in a dollar of income for them, thus planting trees and building communities simultaneously. We have the experience of last spring to guide our efforts and are building off the knowledge and skills we gained from this to further engage our communities and volunteers in meaningful leadership work in 2010. First, we must seek this step in order to engage our communities and volunteers in meaningful leadership work in 2010.

Deliverables in FY 2010	
<i>Acres Reforested</i>	200
<i>Trees Planted</i>	150000
<i>Volunteers Engaged</i>	500
<i>Wetlands Constructed</i>	40
<i>Communities Mobilized</i>	20
<i>NCCC Teams Employed</i>	2
<i>Green Jobs Created</i>	7

The ACCWT, in partnership with ARRI, will provide overall coordination, consistent scientific methodologies and community engagement across the Appalachian states (Figure 1). The ACCWT will receive funding to hire a forester, well versed in ARRI's Forestry Reclamation Approach, who will work primarily coordinating tree plantings, and will be reimbursed for travel and field expenses. The project proposes to provide support to existing conservation Non-Governmental Organizations (NGOs) who are already working with ARRI and ACCWT. The NGOs will provide technical assistance to the Appalachian communities undertaking projects (Figure 1). Funds are also included for research on the real potential for wind, solar, and biomass; training for watershed group personnel; a documentary film; tree-planting supplies; a full-time ACCWT coordinator; and a grant writer to pursue future support, OSM/VISTA funding, and Arts and Humanities grants to help reclaim the cultural connections between Appalachians and their forests. The project allows for the employment of an AmeriCorps National Civilian Community Corps (NCCC) team for projects large enough to require additional volunteer tree planters. NCCC teams spend 6-8 weeks working on intensive service projects. The teams need to be housed and provided kitchen access. This will be provided by participating watershed organizations. Costs for the creation of wetlands are based on US Forest Service research and experience. Some of the OSM/VISTAs and their watershed organizations have experience in working with the Forest Service constructing wetlands projects.

Appendix 6 (continued)

ACCWT/ARRI Proposal to Fund the Second Year of Pilot Projects by Community Volunteers: Reforestation as Social Investment

Budget:

Tree Planting Events (Costs Per 10 Acre Plot):	
<i>Herbicide</i>	\$500.00
<i>Ripping</i>	\$2,000.00
<i>Trees</i>	\$3,000.00
<i>Planting</i>	\$3,000.00
<i>Identifying Site</i>	\$1,000.00
<i>Obtaining Landowner Agreement</i>	\$500.00
<i>Food – Support – Transportation</i>	\$2,500.00
<i>Outreach (Media – Flyers – Printing)</i>	\$3,500.00
<i>Wetlands</i>	\$4,000.00
<i>Total</i>	\$20,000.00

Total Proposal:	
<i>Tree Planting Events (200 Acres)</i>	\$400,000.00
<i>Film</i>	\$50,000.00
<i>Solar/Wind (6 projects, \$10,000 each)</i>	\$60,000.00
<i>Biomass Research</i>	\$30,000.00
<i>Training and Education</i>	\$25,000.00
<i>ACCWT Employee (1)</i>	\$40,000.00
<i>NCCC Support</i>	\$30,000.00
<i>Forester (1) plus travel/field work expenses</i>	\$100,000.00
<i>Half Salaries for NGOs (4)</i>	\$160,000.00
<i>Supplies</i>	\$40,000.00
<i>Grant writer salary</i>	\$40,000.00
<i>Administrative Costs (10%)</i>	\$97,500.00
<i>Total</i>	\$1,072,500.00

Long-Term Sustainability: This 2010 proposal is only a first step. The success of last spring is already generating demand for more volunteer commitment to plant trees this year. We are certain a strong 2010 season will garner even more engagement and, we hope, more funding to support that engagement. We think of **Green Forest Works** as a significant infrastructure-investment project, reconnecting forest habitats and people to their land and region. We also understand the importance for this initiative be self-sustaining. We think the persistence of green jobs in four key areas can be used as a source of continued funding:

1. **Tourism:** Possibly the most beautiful in the world and certainly among the most diverse, the Appalachian forest is one of the region’s most valuable assets and has played an integral part in the rich cultural heritage of the mountain people. A reforested Appalachia will serve as an excellent tourist destination and capture an expanding sector of the US economy. Some portion of tourism taxes should be diverted back to **Green Forest Works**.

Appendix 6 (continued)

ACCWT/ARRI Proposal to Fund the Second Year of Pilot Projects by Community Volunteers: Reforestation as Social Investment

2. Solar and Wind Farms: EPA studies show high potential on old mined lands for such farms. Solar panels and wind turbines will not only need to be constructed but also maintained. These jobs will demand skilled labor and provide Appalachia with the opportunity to strengthen its human capital. Lease payments should include an allocation to the **Green Forest Works** initiative to enable continued funding.
3. Biomass/Bioenergy Plantations: Research regarding biomass on old mine sites continues. As the establishment of biomass plantations on rehabilitated mined lands becomes a possibility, benefits would include: reduced rates of CO₂ buildup in the atmosphere; mitigation of emissions and local impacts from fossil fuel power generation; creation of permanent, quality jobs; and a potential source of income for **Green Forest Works**.
4. Carbon Sequestration Credits: Based on research conducted by ARRI Science Team members, we know reforestation will create the opportunity for carbon credits, particularly on lands that are not currently planted in trees. Agreements with landowners should include a portion of the carbon credits from the tree-plantings organized and funded by the initiative to create an opportunity for **Green Forest Works** to sell the credits for continued funding.

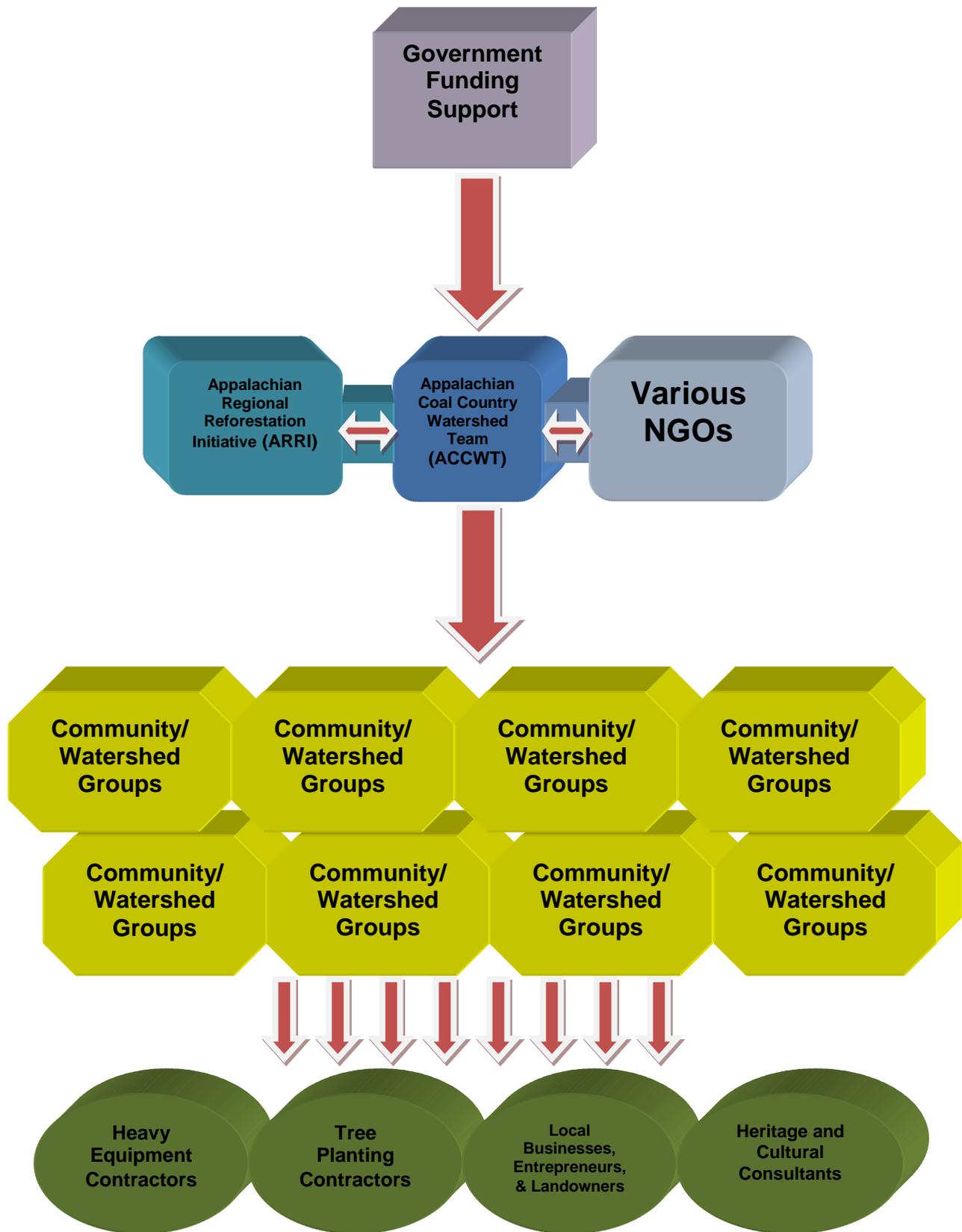


Figure 1. Structure of the second year of community volunteers pilot projects.

Appendix 7: Cost Analysis of Green Workers

Cost Analysis for Forest Technicians, Foresters (Crew Foremen), and Assistant Crew Foremen

Worksheet for one Forest Technician: During tree planting season when good weather allows planting				
Operating expense	Weekly amount	Weekly billable amount	Annual billable amount	Comments
Worker wages	\$750.00			Based on 40 hr/wk at \$18.75/hr
Payroll costs	\$165.00			Calculated at 22%
Meal allowance	\$140.00			\$20.00/day
Vehicle expense	\$51.25			Cost to provide transportation
Motel	\$210.00			Calculated at 2 persons per room. Total cost per room = \$420
Van driver	\$14.00			Additional wages payable to van driver
Management	\$61.92			Cost covers 2 managers, logistics coordinator, and office manager
Trees	\$1,020.00			680 trees/day x 5 days x \$0.30 per tree cost = \$1,020.00
Total	\$2,412.17			Total of weekly amount
		\$3,256.43		Weekly billable amount based on 135% of weekly amount
			\$41,682.30	Annual billable amount for 12.8 weeks of good weather in spring suitable for tree planting ¹¹

¹¹ Based on interviews with managers of professional tree planting companies, actual planting occurs only on an average of 64 days (or 12.8 work days) during the 80 day tree planting season due to foul weather.

Appendix 7 (continued)

Cost Analysis for Forest Technicians, Foresters (Crew Foremen), and Assistant Crew Foremen

Worksheet for one Forest Technician: During tree planting season when foul weather prevents planting				
Operating expense	Weekly amount	Weekly billable amount	Annual billable amount	Comments
Worker wages	\$250.00			Based on 40 hr/wk at \$6.25/hr
Payroll costs	\$165.00			Calculated at 22%
Meal allowance	\$140.00			\$20.00/day
Vehicle expense	\$51.25			Cost to provide transportation
Motel	\$210.00			Calculated at 2 persons per room. Total cost per room = \$420
Van driver	\$14.00			Additional wages payable to van driver
Management	\$61.92			Cost covers 2 managers, logistics coordinator, and office manager
Trees	-0-			
Total	\$892.17			Total of weekly amount
		\$1,204.43		Weekly billable amount based on 135% of weekly amount
			\$3,854.17	Annual billable amount for 3.2 weeks of foul weather in spring unsuitable for tree planting ¹²

¹² Based on interviews with managers of professional tree planting companies, foul weather prevents actual planting on an average of 16 days (or 3.2 work days) during the 80 day tree planting season.

Appendix 7 (continued)

Cost Analysis for Forest Technicians, Foresters (Crew Foremen), and Assistant Crew Foremen

Worksheet for one Forest Technician: During summer and fall when “other” green work will be performed (tree planting off-season)				
Operating expense	Weekly amount	Weekly billable amount	Annual billable amount	Comments
Worker wages	\$750.00			Based on 40 hr/wk at \$18.75/hr
Payroll costs	\$165.00			Calculated at 22%
Meal allowance	\$140.00			\$20.00/day
Vehicle expense	\$51.25			Cost to provide transportation
Motel	\$210.00			Calculated at 2 persons per room. Total cost per room = \$420
Van driver	\$14.00			Additional wages payable to van driver
Management	\$61.92			Cost covers 2 managers, logistics coordinator, and office manager
Total	\$1,392.17			Total of weekly amount
		\$1,879.43		Weekly billable amount based on 135% of weekly amount
			\$67,659.46	Annual billable amount for 36 weeks during summer and fall performing other green work (non-tree planting season)

Appendix 7 (continued)

Cost Analysis for Forest Technicians, Foresters (Crew Foremen), and Assistant Crew Foremen

Worksheet for one Forester (Crew Foreman) for full year				
Operating expense	Weekly amount	Weekly billable amount	Annual billable amount	Comments
Worker wages	\$1,100.00			Salaried wages
Payroll costs	\$242.00			Calculated at 22%
Health Insurance	\$110.00			
IRA	\$33.00			Based on 3% matching contribution
Meal allowance	\$140.00			\$20.00/day
Vehicle expense	\$51.25			Cost to provide transportation
Motel	\$210.00			Calculated at 2 persons per room. Total cost per room = \$420
Management	\$61.92			Cost covers 2 managers, logistics coordinator, and office manager
Total	\$1,948.17			Total of weekly amount
		\$2,630.03		Weekly billable amount based on 135% of weekly amount
			\$136,761.53	Annual billable amount for 52 weeks

Appendix 7 (continued)

Cost Analysis for Forest Technicians, Foresters (Crew Foremen), and Assistant Crew Foremen

Worksheet for one Assistant Crew Foreman during tree planting season				
Operating expense	Weekly amount	Weekly billable amount	Annual billable amount	Comments
Worker wages	\$961.54			Salaried wages
Payroll costs	\$211.54			Calculated at 22%
Health Insurance	\$110.00			
IRA	\$28.84			Based on 3% matching contribution
Meal allowance	\$140.00			\$20.00/day
Vehicle expense	\$51.25			Cost to provide transportation
Motel	\$210.00			Calculated at 2 persons per room. Total cost per room = \$420
Management	\$61.92			Cost covers 2 managers, logistics coordinator, and office manager
Total	\$1,775.09			Total of weekly amount
		\$2,396.37		Weekly billable amount based on 135% of weekly amount
			\$76,683.89	Annual billable amount for 32 weeks during tree planting season