

Income Opportunities on Reclaimed Mine Lands



Darrell Sears of WV National Guard holding apple seedling at Muddlety Site



Stone Crusher Demonstration at Mine 22 to make mine soils for agriculture



Chestnut growth on reclaimed mine lands at Arch Coal near Summersville, WV



Students enrolled in the Green Mining Model Business Program at Lavender site



Refresh Appalachia Agriculture Project at Mine 22 is demonstrating livestock production with 60 hogs, 200 chickens and 20 goats

Sponsored by:



Income Opportunities on Reclaimed Mine Lands in West Virginia

Surface coal mines prior to 1950 in the U.S. were generally left without any reclamation. As government regulations advanced, mine operators were required to backfill the area and plant grasses or trees. After the federal Surface Mining Control and Reclamation Act (SMCRA) was passed in 1977, mine operators were required to conduct pre-mining analyses of the site and designate a land use that could be achieved after mining.

Reclamation on today's American surface coal mines is fully integrated with the mining operation. A suitable and effective post-mining land use that is sustainable for future generations is crucial to the long-term success and profitability of the mining business and to the future economic benefits of the landowner. Post-mining conditions should provide ecosystem services and produce lands capable of supporting societal needs in the future.

Post-mining land uses in Appalachia are

- 1) hay land and pasture,
- 2) agriculture,
- 3) biofuel crops,
- 4) forestry,
- 5) wildlife habitat, and
- 6) building site development.

Establishing agricultural enterprises on mined lands has recently gained attention because of the large acreages of flat or gently rolling reclaimed land that is available. While about six percent of the land area of West Virginia has been mined (about 900,000 acres), much of this land, especially in past decades, has been reclaimed to herbaceous species for grassland and hay land.

The use of reclaimed land for agriculture and crop growth has only been practiced on a few sites and on relatively small acreages due to much of the reclaimed land having steep slopes and unsatisfactory soil conditions. But, it is estimated that as much as 25 percent of this reclaimed land area may be suitable for agricultural crops such as livestock production, vegetables, grains, and specialty crops. Specialty crops include lavender, hemp, apples and other tree fruits, Christmas tree plantations, and horticultural crop production in greenhouses. Soils are a key component and are necessary for site quality and productivity of the crop grown.

The purpose of this workshop is to provide an overview of a few income opportunities available to those who own, or have access to, reclaimed surface mined lands with favorable surface characteristics in West Virginia.

Income Opportunities on Reclaimed Mine Lands

January 29, 2018
Room 202
Charleston Civic Center

Sponsored by:
West Virginia Coal Association
West Virginia University

- 1:00 pm **“Opening Remarks and Introduction”**
Bill Raney, President, WV Coal Association, Charleston, WV
- 1:15 pm **“Building Southern West Virginia’s Economic Opportunities”**
Representative Evan Jenkins, WV 3rd District, Beckley, WV
- 1:40 pm **“Patriot Gardens, Development of an Apple Industry in WV”**
Sargent Major Darrell Sears, WV National Guard, Charleston, WV
- 2:00 pm **“WV National Guard Armories for Agriculture Production”**
Melissa Stewart, WV National Guard, Charleston, WV
- 2:40 pm **“The Mine 22 Agricultural Project”**
Nathan Hall, Reclaim Appalachia, Huntington, WV
- 3:00 pm **Break**
- 3:20 pm **“The Bechtel Summit National Boy Scout Camp”**
Matt Monroe, Boy Scouts of America, Beckley, WV
- 3:45 pm **“The Green Mining Model Business Program”**
James Ross, GMMBP, Charleston, WV
- 4:00 pm **“Bioenergy Crops on Reclaimed Lands”**
Jeff Skousen, West Virginia University, Morgantown, WV
- 4:15 pm **“Growth and Uses of Hemp in WV”**
Louis McDonald, West Virginia University, Morgantown, WV
- 4:30 pm **“Rare Earth Elements from Reclaimed Lands”**
Paul Ziemkiewicz, West Virginia University, Morgantown, WV
- 4:45 pm **“High Tunnels for Horticulture Crops on Reclaimed Lands”**
Greg Stone, NRCS, Morgantown, WV
- 5:00 pm **Wrap-up**
Bill Raney, WV Coal Association, Charleston, WV

Income Opportunities on Reclaimed Lands in West Virginia: “Building Southern West Virginia’s Economic Opportunities”

Representative Evan Jenkins

WV 3rd District, Beckley, WV

Congressman Evan Jenkins is honored to serve the people of the Third Congressional District of West Virginia in Congress.



A native of Huntington, Evan is proud to call West Virginia his home and has long been dedicated to helping its residents. He has served the area as a member of the West Virginia House of Delegates and the West Virginia Senate before being elected to the U.S. House of Representatives in 2014. He serves on the House Appropriations Committee.

Evan has a Bachelor of Science in business administration from the University of Florida and a Juris Doctor from the Cumberland School of Law at Samford University. He previously served as the executive director of the West Virginia State Medical Association and taught business law at Marshall University.

Evan and his wife, Elizabeth, live in Huntington with their three children.

Income Opportunities on Reclaimed Lands in West Virginia: “Patriot Gardens, Development of an Apple Industry in WV”

Darrell Sears

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Patriot Gardens is an initiative of the West Virginia National Guard (WVNG), the West Virginia State University (WVSU) Extension Service, the Governor’s Office, the United States Department of Agriculture (USDA) Appalachian Fruit Research Station (AFRS), and the West Virginia Department of Agriculture (WVDA) with a mission to align landowners, operators, experts, resources and infrastructure to facilitate agricultural economic development opportunities for West Virginia and create employment opportunities for West Virginia veterans, members of the West Virginia Guard and citizens. The goals of Patriot Gardens is to establish AGRI-Parks; reuse West Virginia National Guard Armories as training/transition centers; and facilitate Veterans Agri-entrepreneur development activities.



The first goal is the development of AGRI-Parks in several locations across the state. This will involve the planting of one million apple trees over a ten-year period with the collaborative assistance of the Patriot Gardens’ partners and private-sector entities. Apple production will be utilized to attract processing and food manufacturing to the park and surrounding areas. The park will also include other indigenous and local agricultural endeavors to allow for multiple levels of revenue for sustainability and long-term economic/employment benefits.

The first AGRI-Park, which will involve 100,000 trees, is being established on an AML site in the Clay-Nicholas County area of West Virginia and is designated at the “Muddlety Site.” Other high-value agriculture commodities will also be planted such as nut trees, berries, root crops, mushrooms, and hydroponic fruits/vegetables. Future AGRI-Park locations are being considered.



Income Opportunities on Reclaimed Lands in West Virginia: WV National Guard Armories for Agriculture Production

Melissa Stewart

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A West Virginia National Guard initiative, called Patriot Guardens, is striving to provide agricultural economic development opportunities for the state of WV and was created in response to the social and economic calamity marked by generational drug dependency, extreme poverty, and residential flight. The mission of the project is to align landowners, operators, experts, resources and infrastructure to facilitate agricultural economic development opportunities for West Virginia and create employment opportunities for West Virginia veterans, members of the West Virginia Guard and citizens. This initiative is designed to bolster rural specialty crop industries and create agricultural job opportunities for West Virginians, particularly veterans, by strategically aligning mine land landowners/operators, agricultural and economic experts, resources and infrastructure to facilitate agricultural commodity production. To date, the initiative has focused on the delivery of agricultural outreach and education, identified research needs, and established an innovative agricultural production concept on post coal mine (mountain-top removal) lands. A decommissioned armory within Welch, WV, in partnership with WVSU Extension Service, was converted into the first Agricultural Transition Center. This facility was designed to provide hands-on agricultural education opportunities through workshops as well as access to program resources. This location includes two high tunnels, one established for education on hydroponic production with the second focused on aquaponics research. In addition, several other armories around the state are being transitioned to include small fruit and hops production. Programs held out of the main West Virginia National Guard Headquarters at Coonskin Armory have provided 17 hands-on workshops over the past year on topics ranging from small fruits to cultivated mushroom production. Over 70 veterans and guard members have participated in these opportunities, expressing interest in learning more about specific topics and developing future opportunities on their own land.



Melissa Stewart is the Education and Grants Coordinator for the West Virginia National Guard. She received her BSA in Horticulture and a BSA in Environmental Protection from West Virginia University and her MS in Environmental Science from Marshall University.

Melissa has more than 20 years of experience in the horticultural industry. In her previous role as the Assistant Program Director for the CARD Program Area for the West Virginia State University Extension Service, she specialized in hydroponic and aeroponic production systems as well as agricultural education and outreach. During her time at West Virginia State University she assisted in the Bioplex Research Project which revolved around the thermophilic anaerobic digestion of poultry litter and the end use of the byproducts as a fertilizer.

Mrs. Stewart's primary focus is coordinating education of West Virginia veterans, members of the West Virginia Guard and citizens on agricultural production of specialty crops through a network of

program partnerships. Additionally, she has been task to assist in the development of innovative approaches to post mine land use that harness environmental stewardship, sustainable small-scale agriculture and economic development.

NOTES:

Income Opportunities on Reclaimed Lands in West Virginia: Mixed-Use Agriculture, Forestry, and Solar

Nathan Hall

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West Virginia is home to about 400,000 acres of land that has been affected by coal mining in some form, but only a small percentage of that land has been converted into active post-mining development. Some of this land is suitable for standard commercial development, while much of it is not because of distance from population centers, lack of infrastructure, etc. Nathan Hall, president of Reclaim Appalachia, will present efforts to convert post-mining lands into innovative uses that can be replicated throughout the region, even when sites are not conducive for standard commercial development. These include mixed agroforestry utilizing rotationally grazed livestock and orchard plants, aquaponics, and utility-scale solar. His presentation will address active project sites that Reclaim Appalachia has played a role in developing, upcoming Reclaim Appalachia efforts, projects he has been affiliated with in the past, and relevant historical projects that he has researched.



Nathan Hall is the president of Reclaim Appalachia, an enterprise within the Coalfield Development non-profit umbrella. Reclaim Appalachia is focused on developing innovative projects on mining impacted lands in southern WV that create jobs, benefit ecosystems, and generate profitable returns.

Originally from a small town near Prestonsburg in Eastern Kentucky, he has spent the past six years working on various forms of agriculture and forestry projects on surface mined lands throughout Appalachia. He spent three years as the Reforestation Coordinator for Green Forests Work, restoring native hardwood trees on surface mined lands throughout Appalachia (2012-2014). He has also grown hemp on reclaimed mined lands in eastern KY, and played a leading

role in starting two innovative agriculture projects on post-mining lands in Mingo County WV.

He holds a BA in Sustainable Agricultural & Industrial Management from Berea College and a Master of Environmental Management/MBA from Yale University. While at Berea, he wrote his bachelor's thesis on an agroforestry system for bioenergy production on Appalachian post-mining lands (2009). During his time at Yale, he focused his studies on financial management of natural resource businesses, and wrote his capstone thesis on a diversified agroforestry business model on Appalachian mined lands that could be profitably scaled throughout the region (2016). His current work with Reclaim Appalachia is focused on developing a pilot version of that agroforestry model in Mingo County WV, pioneering innovative mine soil prep techniques that will vastly improve the agricultural usability of these sites, and developing other innovative projects such as aquaponics and utility scale solar.

Income Opportunities on Reclaimed Lands in West Virginia: “The Bechtel Summit National Boy Scout Camp”

Matt Monroe

Boy Scouts of America, Beckley, WV

The Summit Bechtel Family National Scout Reserve opened in 2013. Envisioned as the location to bring Scouting into the 21st Century, the Summit Bechtel Reserve (SBR) features an exciting combination of adventure sports venues and camping facilities in the heart of the New River Gorge. Every four years, SBR hosts the National Scout Jamboree, which provides camping and programs over 30,000 people for ten days in July. In 2019, SBR welcomes the World Scout Jamboree with over 150 countries and 45,000 participants expected to attend. In other years, SBR provides outstanding high adventure, Scout camps, and training conferences for BSA members across the country.

SBR also works with other organizations to provide outstanding outdoor experiences for youth and young adults. Program partners to date include the Girl Scouts, 4H, FFA, and the West Virginia Governors School. Additionally, SBR partners with West Virginia University and West Virginia University Institute of Technology for activities and programs that include research projects, student internships, student orientation activities, and intercollegiate athletics.

In addition to serving the Scouting community, SBR has the capacity to host large events. In 2017, the Spartan Games held first major non-Scouting event was held at SBR, which was televised on NBC.



Matt Monroe is the Director of Program at the Summit Bechtel Reserve. He received a B.S. in Sociology from Brigham Young University and an MBA from Western Governors University.

Matt has more than 20 years of experience managing camping facilities and programs for the Boy Scouts of America. Prior to his work at the Summit Bechtel Reserve, Matt manage multiple BSA camping facilities across the Intermountain West. He has extensive experience operating recreational programs on federal and state land. In his current role, he focuses on program development, risk management, and building partnerships. Matt was the Lead Site Planner for the 2017 National Scout Jamboree and is currently serving in the same role for the 2019 World Scout Jamboree.

Income Opportunities on Reclaimed Lands in West Virginia: “The Green Mining Model Business Program”

James Ross

Training Coordinator
GMMBP

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James Ross currently serves as the Training Coordinator for Green Mining Model Business Program located in the West Virginia Regional Technology Park, South Charleston, WV. Recently retiring from the United States Army, serving 27 years in various leadership and operational capacities, he uses his training experience to develop and conduct training to support GMMBP’s objectives.



James has Bachelor of Science in commercial aviation from Salem International University and is currently enrolled at Ohio Christian University where he is completing his MBA. A native of Cross Lanes, WV, James and his wife Carrie have settled on their free-range organic farm in the Clendenin, WV area.

By reclaiming abandoned mine sites and other acreage throughout the region, our vision is to grow and harvest lavender while recreating jobs for our miners and their families through training and continued resources. With our state of the art facilities and team of PhD chemists, we can produce the highest-grade oils available on the market. By supporting existing businesses and setting a foundation for new business, regions hit the hardest will

begin to flourish once again with sustainable businesses like poultry, plant farming, chemical processing, engineered soils, fertilizers, and water purification and treatment systems. These industries, in turn, create further job growth in the production of nutritional supplements, fragrances, flavors and other lavender - based products to be sold to manufactures and consumers.

This program is based at the West Virginia Regional Technology Park, which is a state-of-the-art chemical processing and commercialization center with essential intellectual capital and facilities. The Park is capable of supporting surface mine agricultural sites anywhere in the Appalachian Region. Businesses partnering with the Green Mining Model Business Program are the WV National Guard, several mine land property owners and operators, chemists, WV Department of Agriculture, and faculty and students from WV State University.

Income Opportunities on Reclaimed Lands in West Virginia: Bioenergy Crops

Jeff Skousen

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West Virginia provides an abundance of reclaimed surface mine lands that can be used for a variety of uses such as pasture, hay, agricultural products, wildlife habitat, timber, and bioenergy crops. Bioenergy crop candidates are Switchgrass and Miscanthus, both warm-season perennial grasses, because they produce high yields on marginal lands under low fertility conditions. At two West Virginia mine sites, field experiments were established in 2008 to determine yields of three switchgrass cultivars. One site was reclaimed with topsoil and annual yields were 8 tons/ac for Cave-in-Rock switchgrass after the sixth year, almost double the varieties Shawnee and Carthage, at 4 and 2.3 tons/ac, respectively. Switchgrass yields on another site with no topsoil were less than 1 ton/ac after the sixth year, and no cultivar differences.

In another study established in 2010, two varieties each of switchgrass and Miscanthus were planted in 1-ac plots with five replications. This site was reclaimed in 1985 with 15 cm of soil being placed over mixed overburden. Miscanthus yields after the 5th year averaged 9 tons/ac for Private and 6 tons/ac for Public. Switchgrass yields after five years averaged 5 tons/ac for Kanlow and for BoMaster, which approaches the yields of switchgrass on agricultural soils in the region. With these recorded biomass yields, switchgrass and Miscanthus are able to provide alternative, more sustainable energy sources, whilst providing a more profitable post-mining land opportunity for surface mined land owners.

Jeff Skousen is a Professor of Soil Science and the Land Reclamation Specialist at West Virginia University. He received his Ph.D. from Texas A&M University, and M.S. and B.S. degrees from Brigham Young University.





Jeff has more than 35 years of experience in coal mining and reclamation. He teaches courses in soil science, environmental science, and reclamation of disturbed soils. Dr. Skousen's primary research topics are reclamation of disturbed lands and improvement of water quality. His work includes acid mine drainage control and treatment, overburden and soil analyses, oil and gas site reclamation, revegetation, reforestation, native plant restoration, biomass for bioenergy, and post-mining land use development.

He has published over 275 articles in journals, proceedings, books, and extension publications. He works with other faculty, directs graduate student research, publishes results in journals and proceedings, and presents findings at professional meetings.

He also directs the annual Acid Mine Drainage Task Force Symposium, conducts seminars and workshops on mined land reclamation, and consults with state and federal agency personnel, landowners, coal operators, and consultants. He travels overseas to work on land reclamation issues in Asia and Europe.

Income Opportunities on Reclaimed Lands in West Virginia: Growth and Uses of Hemp in WV

Louis M. McDonald

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Industrial hemp (*Cannibus sativa*) is an emerging biomass and specialty crop that may be suitable for reclaimed mine soils. The 2014 U.S. Farm Bill allowed the production of industrial hemp for research purposes by universities and state departments of agriculture. In 2015 West Virginia passed legislation to allow WV Department of Agriculture to issue licenses to grow industrial hemp.

I will briefly describe the process to become a licensed grower in WV, the opportunities and challenges of industrial hemp as a crop for reclaimed mine soils and the status of our on-going research at WVU.



Louis McDonald is a Professor, Environmental Soil Chemistry and Soil Fertility in the Division of Plant and Soil Sciences at West Virginia University. He earned a Ph.D from the University of



Kentucky, an M.S. from Louisiana State University and a B.S. from California Polytechnic State University, San Luis Obispo, CA. His research interests are the geochemistry of acid mine drainage and the remediation of disturbed and metal-contaminated soils.

Income Opportunities on Reclaimed Mine Lands: Rare Earth Elements from Reclaimed Lands

Paul Ziemkiewicz

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Rare Earth Elements (REE) are essential for advanced technologies from smart phones and robots to top-secret national defense systems. The rare earth metals have remarkable chemical properties but are so evenly dispersed throughout the earth's crust that economically attractive concentrations, easily minable ore veins for example, are extremely rare. As a result, the U.S. imports nearly all of its rare earth elements from China, which supplies about 89 percent of the world's rare earth needs. India and Russia provide most of the world's balance of these strategically important materials.



In support of Federal initiatives to develop domestic REE supplies, researchers at West Virginia University found a source of rare earth elements, or REEs, much closer to home acid mine drainage (AMD). The WVU research team found that metal precipitates resulting from AMD treatment contain readily recoverable REEs with concentrations up to 2,200 g/t, averaging 430 g/t (ppm) on a dry weight basis (figure 1).

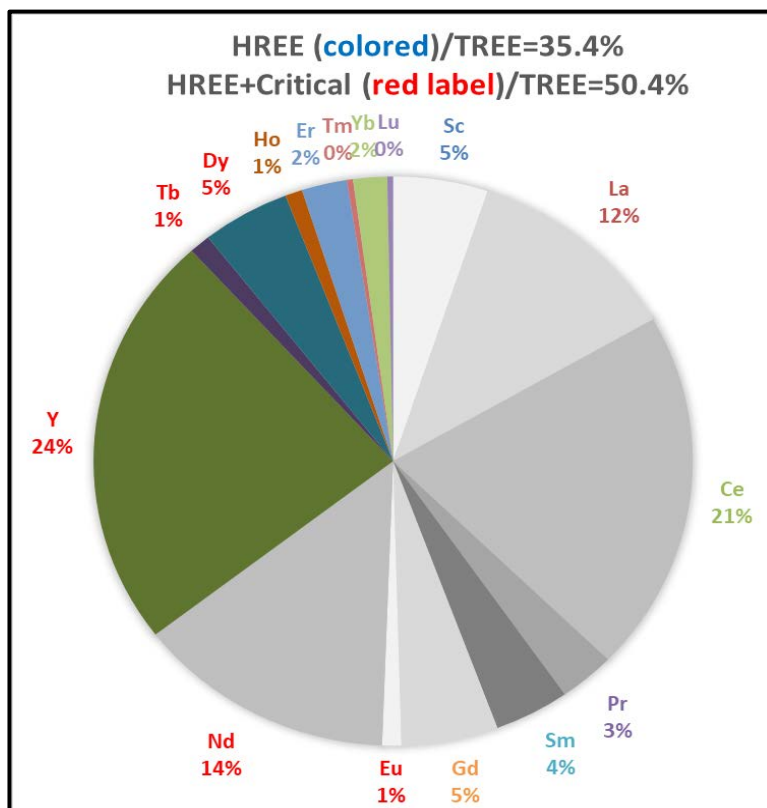
Figure 1. Typical AMD precipitation cell at a coal mine. The orange material is enriched with rare earth elements. After the metals precipitate, clear water in the far cell is discharged via a regulated discharge point.

Our sampling at 152 sites across the northern and central Appalachian Coal Basins found that total REE concentrations at 75% of AMD treatment sites exceeded 565 g/t on a dry weight basis. WVU's refining technology has produced an initial product with a TREE concentration of 4.6% dry mass basis. In laboratory tests during FY17, we achieved over 90% recovery of feedstock REE mass and we will begin testing our continuous recovery system by Spring 2018. REEs derived from AMD precipitates have a high proportion of heavy (HREE) and critical elements. The latter ratio is 35%. Combined with critical REEs, the ratio increases to nearly 50% (figure 2).

Reserve estimates of available REE from AMD in the Appalachian Basin range from 612 to 2,700 t/year with in-situ values estimated between \$233MM to \$1,300MM/year

The bench scale process is expected to segregate REEs into light and heavy fractions with possible elemental selectivity. Products are expected to approach 95% purity. Additionally, using a nominal 500 g/t feedstock, a preliminary techno-economic analysis for a commercial refining facility estimated a payback period of 2.5 operating years with an 37% internal rate of return.

Figure 2. Distribution of heavy and critical rare earth elements in AMD precipitates.



Paul Ziemkiewicz, PhD. Director, Water Research Institute
 West Virginia University

Dr. Ziemkiewicz, a native of Pittsburgh has a PhD from the University of British Columbia and an MS and BS from Utah State University in the biological sciences. After graduation, he worked for ten years with the Alberta Department of Energy before coming to West Virginia University in 1988 to serve as director of the Water Research Institute. The Institute develops and carries out environmental research projects in the region and nationally. Research focus areas include management and treatment of waste streams from coal mining and oil and gas development. Major programs include acid mine drainage, critical minerals recovery, brownfields development, coal mine reclamation, water treatment and watershed restoration.

The Water Research Institute currently has a staff of 15 and manages 36 research projects worth \$5.6MM.



Income Opportunities on Reclaimed Mine Lands: High Tunnels for Horticulture Crops on Reclaimed Lands

C. Gregory Stone

USDA-Natural Resources Conservation Service

High Tunnels, by their nature, extend and intensify many production variables. For that reason, high tunnels can take advantage of better soil conditions where they exist on reclaimed mine land and not have to deal with poorer areas of larger production blocks which can be more problematic to traditional systems. High tunnels can be great alternatives for production of high value crops on reclaimed mine lands.



The Rev. Greg Stone holds a Bachelor of Science in Agriculture Degree from West Virginia University and a Masters of Divinity from Pittsburgh Theological Seminary. He is a 37-year employee of the USDA-Natural Resources Conservation Service and has served in multiple locations in West Virginia and Ohio. Greg currently works as the Assistant State Conservationist for Field Operations in the Southern half of WV.

List of Attendees

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