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Journal of the American Society of Mining and Reclamation

The Journal of the American Society of Mining and Reclamation **(JASMR)** promotes the exchange of basic and applied solutions for the reclamation, restoration, and revitalization of landscapes impacted by the extraction of natural resources—including, but not limited to coal, minerals, gas, and oil. Contributions reporting original research, case studies, field demonstrations, or policy dealing with some aspect of ecosystem reclamation are accepted from all disciplines for consideration by the editorial board.

Contributions to JASMR

The Journal of the American Society of Mining and Reclamation publishes contributions under the headings Research Papers, Case Studies, Demonstrations, Policy Papers and Review articles. All papers are peer reviewed. Manuscripts may be volunteered, invited, or coordinated as a symposium.

Research Papers: Emphasis is given to the understanding of underlying processes rather than to monitoring. Applying these principals to specific, replicated laboratory, glasshouse, and field problems dealing with reclamation are encouraged. These reports are grouped into the following ASMR defined groups: ecology, forestry and wildlife, geotechnical engineering, land use planning and design, international tailings reclamation, soils and overburden, and water management.

Case Studies: Papers in this category report on reclamation activities over spatial or temporal scales. Monitoring of the response of ecosystem components (water, soil, and vegetation) to innovative practices are the basis for these case study reports.

Demonstration Studies: Papers in this category report on reclamation activities that do not necessarily include projects where significant amounts of data are collected. These may consist of largely photographic evidence of before and after some reclamation technique is applied. These may be observations that practicing reclamationists have observed that have changed how they continued to enhance the process of returning disturbed landscapes to a more desirable condition.

Policy or Review Papers: Submission of papers dealing with regulatory and procedural issues is welcomed. These papers emphasize changing approaches to the science and technology of landscape revitalization.

Other: Letters to the Editor are accepted, and Book Reviews may be invited by the Editor-in Chief.

Paper Submission to JASMR

Printed copies: Although this Journal is an online Journal, copies are available at the cost of printing with an ink-jet or color laser printer. Contact asmr@twc.com for cost of current and back issues.

Manuscripts are submitted electronically to Dr. Richard Barnhisel at asmr@twc.com.

Style Guide for Authors: Manuscript preparation guide is available at: http://www.asmr.us/Publications/Journal/Manuscript%20Guidelines%20Journal.pdf or use https://www.agronomy.org/publications/style

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ABSTRACTS OF PAPERS

RESEARCH PAPER

BATS ASSOCIATED WITH INACTIVE MINE FEATURES IN SOUTHEASTERN ARIZONA[1]

Angela M.D. Barclay[2]

Abstract. The purpose of this study was to determine whether inactive mine features on privately owned lands and lands administered by the Bureau of Land Management (BLM) in Pima County, in southeastern Arizona (the study area), were being used by bats. External pre-screening surveys of 60 inactive mine features were completed in March 2012, and it was determined that 23 of these sites had the potential to provide roosts for bats. Passive external portal acoustic and visual surveys of these 23 features were completed using AnaBat acoustic detectors and infrared trail cameras from May through mid-October 2012. Acoustic survey data were analyzed, and 10 species of bats were identified. Bat species were acoustically detected at all 23 sites but were only visually detected at two sites.

Acoustically, bat activity and species richness were highest in the spring and lowest in the fall. The two most common species, canyon bat (*Parastrellus hesperus*) and Mexican free-tailed bat (*Tadarida brasiliensis*), accounted for more than 50% of all the survey data. Ten sites accounted for more than 75% of all bat activity. Species richness was highest at two sites, with seven species detected at each site, and was lowest at two sites, where only one or two species were detected. Two species identified as species of concern under the Endangered Species Act (ESA) – western small-footed myotis (*Myotis ciliolabrum*) and Yuma myotis (*M. yumanensis*) – were acoustically detected at 15 and three sites, respectively. Two BLM-sensitive species (also identified as species of concern under the ESA) – Townsend's big-eared bat (*Corynorhinus townsendii*) and cave myotis (*M. velifer*) – were acoustically detected at 10 sites (seven of which are on BLM lands) and seven sites (three of which are on BLM lands), respectively.

Although no bats were detected in any photos or videos, when biologists visually monitored each site, bats occasionally were seen flying in the study area around sunset, but only one bat was seen exiting from an inactive mine site. Townsend's big-eared bats were observed roosting in two adits on BLM-administered lands during the fall. No major bat roosts or no threatened or endangered bat species (e.g., lesser long-nosed bats [*Leptonycteris curasoae yerbabuenae*]) were detected through these surveys.

Additional Key Words: activity, adit, shaft, species richness.

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[1] Paper presented at the 2014 National Meeting of the American Society of Mining and Reclamation, Oklahoma City, OK ***Exploring New Frontiers in Reclamation*** June 14–20, 2014. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 3 Issue 2/Barclay-AZ.pdf

VEGETATION AND SOIL DEVELOPMENT IN PLANTED PINE AND NATURALLY REGENERATED HARDWOOD STANDS 48 YEARS AFTER MINING[1]

J. Frouz[2] and J.A. Franklin[2]

Abstract. Restoration activities at the time of stand initiation can have lasting effects on subsequent recovery of stand structure and function. Here we compared several metrics, with an emphasis on soils, of structure and function in forest stands that had been planted with pine or remained unplanted, and had undergone primary succession over 48 years on mine spoils. These were also compared to reference sites in the adjacent forest, to test the hypothesis that the development of forest functional processes will differ between planted and unplanted sites. Areas planted to pine had a lower basal area, and lower soil and microbial respiration rates than did unplanted areas. Basal area of unplanted sites was comparable or higher than that of reference sites, suggesting that the natural succession of hardwood may lead to better long-term recovery than planting of pine. Differences in root biomass, along with corresponding differences in soil respiration, suggest that below-ground biomass production recovers more slowly than does above-ground productivity. Mined sites had a greater stock of phosphorus than did reference sites. The greater presence of earthworms on mined sites may speed up nutrient cycling, as indicated by faster cellulose decomposition.

Additional keywords: carbon, mining, nitrogen, phosphorus, *Pinus*

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[1] Paper submitted to JASMR, 2014. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 3 Issue 2/Frouz-TN.pdf

INFLUENCE OF TREE SHELTERS AND WEED MATS ON GROWTH AND SURVIVAL OF BACKCROSSED CHESTNUT SEEDLINGS ON LEGACY MINELANDS IN EASTERN KENTUCKY[1]

Kenton Sena[2], Hannah Angel, and Chris Barton

Abstract. Surface mining for coal has contributed to wide-scale deforestation and forest fragmentation in the eastern United States. Over the last thirty years, mine reclamation practices involving heavy compaction and introduction of non-native vegetation have produced large areas of reclaimed land, which exist in a state of arrested natural succession, termed legacy sites. These sites were reclaimed to standards of the day, which usually involved compaction of the surface material and seeding an aggressive ground cover to control erosion. These sites are typically dominated by non-native grasses and legumes (e.g., tall fescue and lespedeza) and are often colonized by invasive and undesirable woody shrubs (e.g., autumn olive). Interest in restoring native hardwood forest on these sites has grown over the past decade. The development of techniques to mitigate the unfavorable soil and vegetative conditions on these legacy sites is essential to forest restoration in Appalachia. In addition to representing a good opportunity for native hardwood reforestation in Appalachia, legacy sites present a unique opportunity to reintroduce improved blight resistant American chestnut across much of its native range. This study investigated the impacts of tree shelters and weed mats on the growth and survival of planted American chestnuts on legacy mine sites in eastern Kentucky. Shelters significantly reduced browse pressure from deer and therefore improved growth and survival in most instances. Weed mats did not significantly influence tree growth or survival and were unpredictable in their effect on herbaceous biomass. This study demonstrates that properly prepared legacy mine sites can support the establishment of improved American chestnuts.

Keywords: Forestry Reclamation Approach, reforestation, compaction mitigation

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[1] Paper submitted to JASMR, 2014. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 3 Issue 2/Sena-KY.pdf

COMMON SENSE SOLUTIONS FOR MANAGEMENT OF GLOBAL CARBON EMISSIONS[1]

Kimery C. Vories[2] and Joshua D. Vories

Abstract: On April 13, 2012 and January 8, 2014, the U.S. Environmental Protection Agency (USEPA) proposed new regulations that amounted to a prohibition on the Best Technologies Currently Available for constructing new coal-fired power plants. USEPA first proposed in 2012, that new coal power plants must not produce more carbon dioxide (CO_2) than a natural gas power plant. Then in 2014, it revised the standard to require that unless a coal-fired power plant met the same CO_2 emission levels as achievable with power plants utilizing Integrated Gas Combined Cycle (IGCC) combustion technology and in addition provide permanent sequestion of at least 25% of the CO_2 produced, it could not be built. This effectively changes the proposed standard from 454 to 499 grams/kilowatt-hour of CO_2 emissions in order to construct a new coal-fired power plant. The U.S. Energy Information Administration (EIA), however has calculated the construction cost for such technology at $6,599/kW which is signifcantly more costly that the construction of a nuclear power plant at $5,530/kW and not remotely affordable compared to a natural gas power plant at $971/kW. This prohibition, like the historic prohibition of alcohol, is more likely to have negative rather than positive consequences.

This paper focuses on facts concerning fossil fuel utilization and its impacts upon global climate, the global economy, and the world population. It contrasts the impacts of current popular notions in the media and the regulations that govern our nation, that fossil fuels are an evil that must be stopped, versus the utilization of common sense to assess how to best use and advance currently available science and technology. It highlights best available control technology (BACT) that could reduce the manmade contribution of CO_2 in the atmosphere in a way that does not bankrupt the global economy and jeopardize the global population. It will assess the growth of renewable energy and project the number of generations that would be required to have them replace fossil fuel as an energy source.

The paper will highlight the historical relevance of the impacts of the prohibition of alcohol in the United States from 1920-1933 that contributed to the rise of organized crime funded by the illegal trade in alcoholic beverages. It will examine this historic precedent on alcohol prohibition and contrast it with the probable result of government actions that seek to prohibit the production and use of fossil fuels. It will conclude that if existing proven technologies, such as those that are currently available for improving the efficiency and environmental performance of coal-fired power plants were utilized worldwide, then coal-power plant fuel efficiency would increase by 40% and the production of CO_2 would be reduced by another 40% for the remaining coal that is burned.

Additional Key Words: Fossil Fuels, Utilization Efficiency, Environmental Protection.

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[1] Paper was presented at the 2014 National Meeting of the American Society of Mining and Reclamation, *Exploring New Frontiers in Reclamation*, Oklahoma City, OK, June 14 - 19, 2014. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 3 Issue 2/Vories-IL.pdf

ABOUT THE AUTHORS

Hannah Z. Angel, B.S. is a graduate student at Stephen F. Austin State University in Texas pursuing a Master of Science degree in Forestry. She works as a teaching assistant for forest dendrology. In her research, Hannah is interested in contributing to the advancement of the science of surface mine reforestation by applying basic forestry and soil techniques to improve forest growth and productivity. Hannah graduated from the University of Kentucky in 2014 with a Bachelor of Science degree in Forestry. As an undergraduate, she worked on a research project dealing with the survival and growth of advanced backcross American chestnut seedlings planted on post-bond release surface mines in eastern Kentucky. She also has planted trees for the Appalachian Regional Reforestation Initiative and Green Forests Work on unused, post-bond release surface mines. Her long-term objective is to work as a professional forester in the field conducting forestry reclamation and other aspects of ecological restoration.

Angela M.D. Barclay is the Wildlife, Fish, and Rare Plants Program Manager for the Coronado National Forest in Tucson, Arizona. Prior to her employment at the U.S. Forest Service, she worked as an environmental consultant conducting field surveys, environmental compliance, and permitting for mining, transportation, development, utility, and flood control projects in Arizona, California, and New Mexico for nearly 20 years. She received a B.S. and a M.S. from the University of Arizona in Wildlife and Fisheries Sciences.

Christopher D. Barton, Ph.D. is a Professor of Forest Hydrology and Watershed Management in the Department of Forestry at the University of Kentucky. As a Research Hydrologist with the USDA Forest Service, Savannah River (1999 – 2003), his work focused on hydro-chemical processes associated with restoration and remediation of disturbed and/or contaminated ecosystems. Dr. Barton is currently working in the areas of ecosystem restoration, reforestation and remediation primarily in stream and wetland habitats and mined lands. In addition, improved methods for preventing water quality degradation from logging and mining activities are currently being examined. Dr. Barton is an Associate Editor for the International Journal of Phytoremediation and the International Journal of Mining, Reclamation and Environment. Dr. Barton is also currently serving as the co-Team Leader of the Appalachian Regional Reforestation Initiative's Science Team and co-founder of its Green Forests Work program.

Jennifer A. Franklin is an Associate Professor in the Department of Forestry, Wildlife and Fisheries, at the University of Tennessee, in Knoxville. She received a Ph.D. from the University of Alberta in Renewable Resources, specializing in tree physiology, and has been conducting research on reforestation of reclaimed mines for the past 15 years.

Jan Frouz is a Professor at the Institute for Environmental Studies, Charles University, in Prague, Czech Republic. He also continues to work with the Institute of Soil Biology in České Budějovice, Czech Republic, where he spent 20 years researching successional communities of soil fauna, with much of this work focused on the recovery of soil organisms on European mine spoils.

Kenton Sena is pursuing a Ph.D. in Integrated Plant and Soil Sciences at the University of Kentucky. As a M.S. student, he examined the effects of surface mine reforestation on water quality, hydrology and natural succession in Appalachia. In 2014 he was awarded a NSF EAPSI fellowship to examine techniques for the detection of human pathogens from wastewater in Brisbane, Australia. His current research is focused on the detection of forest pathogens in stream water. This work will aid efforts to return the American chestnut to its native range and will also be an important tool for preventing spread of invasive pathogens. In the long-term, he hopes to build a research program in ecological restoration and conservation.

Joshua D. Vories is a Graphics designer and Videographer.

Kimery C. Vories is with E-Ternion: Energy, Environment, and Economy is a mine reclamation ecologist who has been actively employed in issued related to energy and the environment since the 60's. He holds a BA & MA in Biology/Geology from Western State College of Colorado with an additional 3 years Post MA Graduate work in Ecology and Reclamation at the University of Massachusetts and Colorado State University. He has been professionally employed in coal mining and reclamation since 1979 with over 75 related publications. He retired from the USDOI Office Surface Mining in 2014 and is now working on developing methods for advancing the understanding of the integration of energy, environment, and the economy on a global scale.