Journal of The American Society of Mining and Reclamation (JASMR)

An Official Online Publication of the American Society of Mining and Reclamation

ISSN Number 2328-8744

Volume 2, Number 2

Fall: 2013

The Journal of the Society of Mining and Reclamation will be published quarterly online on the Society's website: www.asmr.us

Page charges are d $10 US /page for non-members, payable prior to placement in the web Journal.

All manuscripts are peer reviewed. Authors will be kept anonymous from the reviewers.

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

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

UNDERSTANDING AND DELIVERY OF THE COMPONENTS OF STRUCTURE, DIVERSITY, AND FUNCTION IN THE RESTORATION OF ECOSYSTEMS ON MINED LAND: WORKING TOWARDS A PRACTICAL METHODOLOGY[1]

R. N. Humphries[2]

Abstract: With the full implementation of the Convention on Biological Diversity (CBD) by 2020, surface mining and other industries in the UK will have to embrace the concept of ecosystems and ecosystem services, and be ready to deliver satisfactory schemes with all the necessary elements where important natural vegetation and habitats are involved.

It is debatable whether there is sufficient understanding of the ecosystems being considered and clarity in what needs to be achieved leaving practitioners and regulators with little guidance when faced with designing a mining proposal or evaluating the success of restoration schemes.

This paper introduces and examines a measurable and workable methodology based on the Tansley concept of vegetation communities (being the basic unit of ecosystems) and the application of the national monitoring standards (CSM) for the key requisite ecosystem structural elements. These are encompassed in the proposed Canopy-Age-Regeneration-Genetic-Indicator–Exotic design and assessment model.

It is argued that the Joint Nature Conservancy Council (JNCC) derived CARGIE Model is applicable to the restoration of ecosystems in the UK. It could enable better design and evaluation of the restoration of ecosystems and their services, and the mining industry to meet the challenges posed by CBD and the new and emerging legislation and policies.

Additional Key Words: biological diversity, ecosystem services, vegetation classification, plant community traits

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[1.] Paper presented at the 2013 National Meeting of the American Society of Mining and Reclamation, Laramie, WY Reclamation Across Industries, June 1 - 6, 2013 and accepted for the online Journal of The American Society of Mining and Reclamation, Volume 2, No. 2, 2013. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 2/Humphries-UK.pdf

NATIVE TREE SURVIVAL AND HERBACEOUS ESTABLISHMENT ON AN EXPERIMENTALLY RECLAIMED APPALACHIAN COAL MINE[1]

S.C. Koropchak[2], C.E. Zipper, J.A. Burger, and D. M. Evans

Abstract: On a surface coal mine in southern West Virginia, the forestry reclamation approach was applied while quantifying the effects of substrate type and seeding prescription on survival and growth of native tree species and herbaceous vegetation. Four substrates were used: weathered sandstone (brown), unweathered sandstone/shale mix (gray), mixture of weathered and unweathered rock (mixed), and a mixture of the soil solum and unconsolidated soil parent material (soil). Each substrate treatment was split into two subplots; one seeded with a tree-compatible herbaceous seed mixture and one unseeded. Trees were planted in March 2012, measured for initial height in June 2012, and measured for height and survival in late October 2012. Herbaceous groundcover and species richness were measured during the growing season. After one growing season, mean percent survival and growth of planted trees differed among tree species and seeding treatments. There were no differences in tree survival among substrate treatments. Of planted tree species, survival was higher for hawthorn and black cherry (~85%) than for most other species and lowest for Eastern white pines (25.3%) and shagbark hickory (24.3%). Unseeded treatments had higher tree survival (70.4%) than seeded treatments (56.4%). Of the trees which survived the first growing season, black cherry, red oak, sugar maple, and white oak showed differences in height growth related to experimental treatments. Black cherry and red oak trees grew more in the unseeded treatment, compared to the seeded treatment. White oaks grew the most in the brown sandstone treatment. Sugar maples grew the most in the seeded mixed treatment. Gray and soil substrate treatments had the highest total herbaceous richness and the soil treatment had the highest volunteer richness. Seeded treatments had less bare ground and higher mean herbaceous species richness than unseeded subplots. Leaving the landscape unseeded facilitated tree establishment, but the impact of seeding on the future understory community remains unclear. Soil appears superior to rock spoils for re-establishing a diverse understory. We expect that the influence of substrate and seeding treatments will become clearer after additional growing seasons.

Additional Key Words: Forestry reclamation approach; seeding; tree establishment.

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[1] Oral paper was presented at the 2013 National Meeting of the American Society of Mining and Reclamation, Laramie, WY ***Reclamation Across Industries,*** June 1 – 6, 2013 and accepted for the online Journal of The American Society of Mining and Reclamation, Volume 2, No. 2, 2013. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 2/Koropchak-VA.pdf

CASE STUDY: KERBER CREEK RESTORATION PROJECT: EMPLOYING STATISTICAL TECHNIQUES TO ANALYZE EFFECTS OF RESTORATION ACTIVITIES, SAGUACHE, CO[1]

T. I. Klein[2], L. Archuleta, J. Willis, N. Tedela, B. Sanchez

Abstract: The Kerber Creek watershed, located in Saguache County, CO has been undergoing restoration since 1991 to address the impacts of historic mining activities in the upper watershed. These efforts have produced reasonable, albeit limited, quantities of data on stream morphology, water quality, fish, macroinvertebrate populations, and vegetation cover within the watershed. However, to date there has not been a concentrated attempt to evaluate the effects of restoration on these variables. The objectives of this case study are to employ robust statistical techniques to analyze the effects of restoration on sinuosity in the Kerber Creek watershed and to assess the validity and feasibility of using these statistical methods as project evaluation tools. Sinuosity was measured at five restored sites using National Agricultural Imagery Program one-meter resolution aerial imagery from 2005, 2009, and 2011. The phytostabilization index was used to represent the extent to which the floodplain was restored at each site through in-situ treatment of mine waste deposits, termed phytostabilization. Repeated measures analyses of variance were subsequently performed to evaluate the effects of time (i.e., natural channel evolution) within sites and the extent of restoration among sites on changes in sinuosity. Simple linear regression analysis was then employed to elucidate the nature of the relationship between extent of phytostabilization and within-sites sinuosity means. No treatment was found to have a significant effect on sinuosity at the 0.05 or 0.10 levels of significance. Similarly, the regression coefficient for the phytostabilization index was not significant ($p > 0.20$), and the correlation coefficient was relatively low ($r^2 = 0.357$). Although these results indicate that restoration activities in the Kerber Creek watershed have not significantly improved sinuosity, a number of methodological issues, including the suitability of statistical models and the phytostabilization index, lack of sufficient data, and the presence of outliers, require cautious interpretation. Most importantly, this case study reveals the necessity for intensive monitoring regimes to accurately analyze project results and identifies numerous variables that must be considered when designing a statistically valid restoration project evaluation technique.

[1] Paper presented at the 2013 National Meeting of the American Society of Mining and Reclamation, Laramie, WY ***Reclamation Across Industries*** June 1 - 6, 2013 and accepted for the online Journal of The American Society of Mining and Reclamation, Volume 2, No. 2, 2013. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 2/Klein-CO.pdf

CASE STUDY: PRIORITIZATION STRATEGIES FOR REFORESTATION OF MINELANDS TO BENEFIT CERULEAN WARBLERS[1]

Molly E. McDermott[2], Matthew B. Shumar, and Petra Bohall Wood

Abstract. The central Appalachian landscape is being heavily altered by surface coal mining. The practice of Mountaintop Removal/Valley Fill (MTRVF) mining has transformed large areas of mature forest to non-forest and created much forest edge, affecting habitat quality for mature forest wildlife. The Appalachian Regional Reforestation Initiative is working to restore mined areas to native hardwood forest conditions, and strategies are needed to prioritize restoration efforts for wildlife. We present mineland reforestation guidelines for the imperiled Cerulean Warbler, considered a useful umbrella species, in its breeding range. In 2009, we surveyed forest predicted to have Cerulean Warblers near mined areas in the MTRVF region of West Virginia and Kentucky. We visited 36 transect routes and completed songbird surveys on 151 points along these routes. Cerulean Warblers were present at points with fewer large-scale canopy disturbances and more mature oak-hickory forest. We tested the accuracy of a predictive map for this species and demonstrated that it can be useful to guide reforestation efforts. We then developed a map of hot spot locations that can be used to determine potential habitat suitability. Restoration efforts would have greatest benefit for Cerulean Warblers and other mature forest birds if concentrated near a relative-abundance hot spot, on north- and east-facing ridgetops surrounded by mature deciduous forest, and prioritized to reduce edges and connect isolated forest patches. Our multi-scale approach for prioritizing restoration efforts using an umbrella species may be applied to restore habitat impacted by a variety of landscape disturbances.

Additional Key Words: Birds, Central Appalachians, Kentucky, Mountaintop mining, Reclamation, *Setophaga cerulea*, Surface mining, West Virginia

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1. Article submitted to the Journal of the American Society of Mining and Reclamation for consideration in Volume 2 Issue 2, and subsequently accepted R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

2. Molly E. McDermott, corresponding author, and Matthew B. Shumar, School of Environment and Natural Resources, Ohio State University, Columbus, OH. West Virginia Cooperative Fish and Wildlife Research Unit, Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV. Petra Bohall Wood, U.S. Geological Survey, West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University.

http://www.asmr.us/Publications/Journal/Vol 2 Issue 2/McDermott-WV.pdf

CASE STUDY: RESTORING REMNANT HARDWOOD FOREST IMPACTED BY INVASIVE TREE-OF-HEAVEN *(AILANTHUS ALTISSIMA)*[1]

C. M. Peugh[2], J.M. Bauman, and S. M. Byrd

Abstract: Tree-of-heaven (*Ailanthus altissima)* is a fast growing tree native to China. Introduced as an ornamental plant, *A. altissima* has spread throughout North American landscapes, imposing a threat to the biodiversity of native ecosystems. Recommended control methods include basal bark treatments using herbicide with an oil-based carrier around the base of *Ailanthus* stems. Land managers value application methods that maximize efficiency while also reducing environmental impacts when applied over landscape scales. The focus of this study was to assess the efficiency of herbicide concentrations and carriers on the mortality of *A. altissima.* This study was conducted in a 105 hectare hardwood forest at *the Wilds* Conservation Center in Cumberland, OH. The forest is directly adjacent to areas mined for coal and reclaimed in the 1980s. Twenty-five plots were established consisting of 732 target trees. Two carriers (AX-IT™ basal oil and diesel fuel) mixed with Garlon® 4 Ultra herbicide were tested at two different concentrations: 1) 10% Garlon® in 90% diesel fuel carrier, 2) 20% Garlon® with 80% diesel carrier, 3) 10% Garlon® with 90% AX-IT™ carrier, and 4) 20% Garlon® with 80% AX-IT™ carrier. Basal bark treatments were applied using a backpack sprayer. After one year, treatments were similar (89-100% mortality) with one exception, the 10% Garlon® in 90% diesel treatment was least effective (69% mortality; $P < 0.0001$). This was more apparent as the DBH increased ($P < 0.0001$). When canopy dieback was compared across treatments, AX-IT™ basal oil remained more effective regardless of the DBH or concentration. Cost comparisons show 10% Garlon® solution in AX-IT™ oil base can be the most economically and ecologically beneficial treatment when applied on a large scale. Long-term monitoring will determine the occurrence of re-sprouts (via seed and root sprouting) and the impact each treatment has on the plant communities within this forest system.

Additional Key Words: Garlon® 4 Ultra, triclopyr, diesel fuel, AX-IT™ basal oil, basal spray, invasive species, herbicide control, allelopathy.

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[1] Poster paper was presented at the 2013 National Meeting of the American Society of Mining and Reclamation, Laramie, WY ***Reclamation Across Industries,*** June 1 – 6, 2013 and accepted for the online Journal of The American Society of Mining and Reclamation, Volume 2, No. 2, 2013. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 2/Peugh-OH.pdf

CASE STUDY: FITNESS MORE THAN DIVERSITY GUIDES VEGETATIONAL RECOVERY[1]

R. A. Prodgers[2]

Abstract. Three case studies document vegetational recovery that hinged on a single species. Unassisted improvement of cheatgrass-infested revegetation at the Decker Coal Mine (DCM) in southeast Montana hinges upon a single grass, a single cultivar: *Rosana* western wheatgrass (*Pascopyrum smithii* (Rydb.) A. Love). Species groupings, or guilds such as "native perennial grasses" or even "cool-season rhizomatous grasses," fail to capture the species-specific nature of the recovery process, in which diversity plays no role. Numerous fields seeded between 1999 and 2002 failed to qualify for Phase 2 bond release, which requires effective seeding, but a sprinkling of seeds established. Years of revegetation-monitoring reports documented sporadic improvement but emphasized the prevalence of annual bromes. Then, in a few short years, incremental improvement was replaced by full-blown transformation. Most of those seedings qualified for Phase 2 bond release for the first time in 2010 because western wheatgrass replaced annual introduced bromes. While present, bunchgrasses (e.g., green needlegrass), sod-formers (e.g., blue grama), and shrubs (e.g., big sagebrush) played no such role. Due to individualistic species responses to environmental conditions (Prodgers, 1988), a dynamic equilibrium is assured, and field appearance will vary through time, but about one decade after seeding, western wheatgrass had supplanted cheatgrass on more than 250 hectares. Western wheatgrass also is pioneering the recovery process on some land at a Clark Fork River Superfund site that was contaminated by heavy metals in irrigation water. In another case study, a different strongly rhizomatous grass, this one naturalized (*Agrostis stolonifera* L.), is playing much the same role in smelter-contaminated uplands (historic SO_2 fumigation and heavy metal deposition) near Anaconda, MT. While a variety of adapted taxa may be desirable, the fitness of a single linchpin species can be far more instrumental in vegetational recovery than a collection of also-rans. That effective taxon may have originated locally or an ocean away.

Additional Key Words: vegetative spread, cheatgrass, western wheatgrass, rhizomes, habitat, adaptations, vegetational development.

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[1] Paper presented at the 2013 National Meeting of the American Society of Mining and Reclamation, Laramie, WY ***Reclamation Across Industries*** June 1-6, 2013 and accepted for the online Journal of The American Society of Mining and Reclamation, Volume 2, No. 2, 2013. R.I. Barnhisel (ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 2/Prodgers-MT-1.pdf

CASE STUDY: EFFECTIVENESS OF COMMERCIAL COMPOST SOIL AMENDMENT IN MONTANA UPLAND AND RIPARIAN REVEGETATION

R. A. Prodgers

Abstract. When using borrow dirt as cover-soil, revegetation often stagnates or declines in one decade or less, especially in cold, semiarid climates, due to infertility and lack of nutrient cycling. Fresh cover-soil is dirt; *soil* is distinguished by the organisms living in and on it. Compost amendment is intended to speed the conversion of dirt to soil by initiating an incipient soil food web. Compost provides microorganisms capable of degrading a wide variety of organic substances and the carbon and nutrients to sustain them until vascular plants provide fresh substrates and eventually a diverse array of food sources from root exudates to microbial cells. Or so it was thought when the two reclamation projects discussed in this paper began, one a Superfund remediation on Silver Bow Creek and the other waste dump reclamation at the Golden Sunlight Mine. The two projects are on opposite sides of the Continental Divide in southwest Montana. Applying and incorporating compost along Silver Bow Creek was easy; steep slopes at the gold mine limited both application and incorporation. One decade after seeding, microbiological analyses of composted and uncomposted soils failed to demonstrate greater diversity in composted cover-soils at the riparian Superfund site. Neither were short-term microbiological effects of compost amendment detectable at the hard-rock mine. Vascular plant cover likewise did not show a significant difference between composted and uncomposted treatments at the riparian site. This raises the question of whether introduced soil microbes drive revegetation or vice-versa, the vascular plants lead and soil microbiology follows. The microbiological activity that matters may be restricted mainly to the rhizosphere, at most a few percent of the bulk soil. Thermophilic microorganisms in moist compost simply may not survive in soils that dry and freeze. Soil biology may be one aspect of the recovery process that cannot be expedited using biologically active organic amendment. Compost specifications also are discussed.

Additional Key Words: nutrient cycling, soil microbiology, microbial diversity, compost specifications, reverse fertilization, rhizosphere.

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[1] Paper presented at the 2013 National Meeting of the American Society of Mining and Reclamation, Laramie, WY ***Reclamation Across Industries, June 1-6***, 2013 and accepted for the online Journal of The American Society of Mining and Reclamation, Volume 2, No. 2, 2013. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 2/Prodgers-MT-2.pdf

CASE STUDY: POST-MINING LAND-USE PLANNING AND DESIGN: AN OVERVIEW AND MICHIGAN

Yun Wang[2], Jon Bryan Burley, and Shawn Partin

Abstract. Planners, designers, scientists, governmental authorities, non-governmental organizations, and citizens are interested in the thoughtful use and protection of the environment, including surface mined lands. Surface mining is a temporary use of the landscape, leading to a post-mining environment. In the 1960s, the late Ken Schellie was a pioneer in understanding how to create a productive and valuable post-mining environment. The creation of a successful post-mining environment begins with understanding the nature of the deposit and the extraction/processing methods, as this insight leads to opportunities to create productive land through the mining process with little additional costs. Often the post-mining landscape is more valuable than the land before mining. In addition, creating post-mining environments requires knowledge of the current regulation requirements. Being trained in the planning and design processes and having experience and knowledge across the spectrum of potential land uses from urban to wilderness are essential to professionally create post-mining environments. Today the ideas and knowledge gained from post-mining land-use planning and design is influencing other types of reclamation activities such as post-industrial reclamation and reclaiming urban areas. We illustrate the process of post-mining land-use planning and design with a case study from the Upper Peninsula of Michigan and show how portions of the design are assessed with landscape metrics.

Additional Key Words: landscape architecture, environmental design, surface mining, planning, reclamation, recreation resources.

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[1] Article submitted to the Journal of the American Society of Mining and Reclamation for consideration in Volume 2 Issue 2, and subsequently accepted R.I. Barnhisel (ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 2/Wang-MI.pdf

Demonstration Papers

DEMONSTRATION STUDY: APPROACHING OIL AND GAS PAD RECLAMATION WITH DATA MANAGEMENT: A FRAMEWORK FOR THE FUTURE[1]

Michael F. Curran,[2] Benjamin J. Wolff, and Peter D. Stahl

Abstract: A database framework was constructed with the purpose of creating a restoration decision management tool by compiling oil and gas pad reclamation data to identify successful restoration practices. Pre-existing data were secured from public and private databases from two Wyoming production fields in the Greater Green River Basin: Jonah Infill and Moxa Arch. The framework includes tables for measurements of reclamation practices (e.g., soil handling methods and amendments, seeding mix and timing, and weed management), geographical and climate data (e.g., precipitation, slope, aspect, elevation, and temperature) and monitoring data (e.g., vegetation composition and structure along with soil analysis and grazing). Microsoft Access and ESRI ArcGIS were employed to build the reclamation database for consistent and reliable data storage, manipulation, and retrieval. Short-term goals of the project were to quantify disturbance and reclamation efforts and to evaluate the reclamation status of individual well pads. Long-term goals of the project are to deliver (1) an operational framework to analyze and isolate trends leading to reclamation success and failure, (2) a strong decision management tool for limiting uncertainty and estimating associated risk under variable environmental conditions, (3) to evaluate regulatory standards for reclamation, and (4) to offer a flexible and sharable database that allows for additional data input from diverse sources. Database performance was found to be dependent on data consistency and validity. Querying populated data along with uniting imported data has revealed multiple strengths and weaknesses with the database framework.

Additional Keywords: environmental decision management, database

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[1] Oral paper was presented at the 2013 National Meeting of the American Society of Mining and Reclamation, Laramie, WY ***Reclamation Across Industries,*** June 1 – 6, 2013 and accepted for the online Journal of The American Society of Mining and Reclamation, Volume 2, No. 2, 2013. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.

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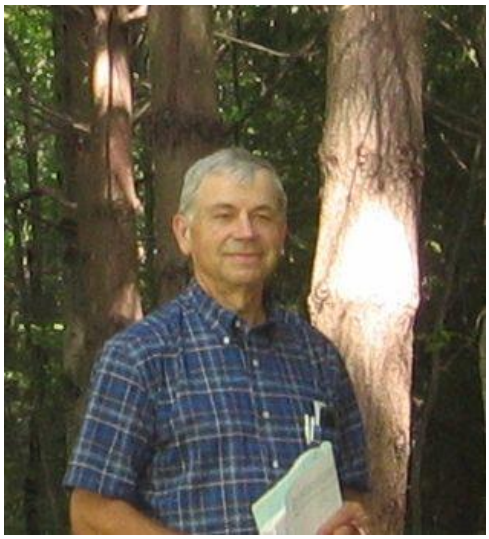
http://www.asmr.us/Publications/Journal/Vol 2 Issue 2/Curran-WY.pdf

ABOUT THE AUTHORS

Laura Archuleta is an Environmental Contaminants Specialist with the US Fish & Wildlife Service, Colorado Ecological Services Field Office. She has over 15 years of experience working throughout the state, with numerous partners, on various projects including abandoned mine land reclamation, water quality issues, natural resource damage assessment, habitat and watershed restoration, hazardous materials spill response, and pesticide contamination. Laura has a B.S., cum laude, from Colorado State University in wildlife biology and in her "spare time" raises Nigerian Dwarf dairy goats.

Jenise M. Bauman is a professor at Miami University in Ohio and a research collaborator with the U.S. Forest Service. She earned her Ph.D. from Miami University, M.S. from West Virginia University, and B.S. at Eastern Kentucky University. Her research couples planting methods with molecular techniques to better understand seedling establishment in disturbed soils. Research foci include belowground interactions of beneficial fungi during restoration, impact of invasive species on plant-fungal mutualisms, and plant pathology within forest restoration.



James A. Burger is Professor Emeritus, Forestry and Soil Science, at Virginia Tech. He received his Ph.D. in soil science from University of Florida. His interest areas are forest soil productivity and quality, plantation silviculture, restoration ecology, and agroforestry. He is an active cooperator in reclamation research and outreach that concerns mined land reforestation in the Appalachian coalfields, working collaboratively with colleagues; and he serves as a consultant to mining firms and other entities in the USA and internationally.

Jon Bryan Burley is a registered landscape architect (Minnesota), an associate professor in the School of Planning, Design, and Construction at Michigan State University, and a Fellow in the American Society of Landscape Architects, with life memberships in the Ecological Society of America and the American Society of Mining and Reclamation. He has accomplished professional planning and design work in the United States, Canada, France and Nepal. Dr. Burley has published nearly 300 articles and abstracts related to landscape architecture and edited one book in reclamation planning and design. Jon has won numerous teaching, design, and research awards, including a Fulbright to Portugal in 2003, the 2005 ASMR Reclamation Researcher of the Year Award by the American Society for Mining and Reclamation, and a 2011-2012 Invited Pre-eminent Researcher Award in France.

Shana Byrd has been a natural resource educator and restoration practitioner for the past 13 years, specializing in conservation of prairies, wetlands and woodlands. As Director of the Restoration Ecology Program at the Wilds conservation center, she oversees habitat management and research on the 10,000 acre preserve, while promoting ecological awareness and personal action in conservation. In 2001, she received her Bachelor of Science degree in Environmental and Plant Biology with a specialization in Field Botany from Ohio University. She earned a Master of Arts in Zoology degree in the Global Field Program at Miami University with a focus on environmental stewardship and holds an Adjunct Faculty Appointment with the Department of Biology at Muskingum University.

Michael F. Curran received Bachelor's Degrees in Biological Science, Geography and Ancient Greek and Roman Studies from University of Delaware in 2008. After working at a large plant nursery for two years post-graduation, Michael decided to pursue a career in land reclamation and was accepted into the Master of Science program in Rangeland Ecology & Watershed Management at University of Wyoming. For two or more years, Michael has worked closely with BP America Production Company (BP), Conservation, Seeding and Restoration, Inc. (CSR), and Wyoming Reclamation and Restoration Center (WRRC) to develop a database framework and conduct data analyses of BP's reclamation efforts in southern Wyoming. As part of his M.S. Program, Michael is obtaining a graduate certificate in Reclamation Ecology. While finishing his M.S., Michael is transitioning into his Ph.D. at University of Wyoming.

Daniel M. Evans is a research associate in the Crop and Soil Environmental Sciences Department at Virginia Tech. He has also worked in the Forest Resources and Environmental Conservation Department and Fisheries and Wildlife Conservation Department at Virginia Tech. He studied at Oregon State University where he has published work on nutrient dynamics in riparian zones. He has also published research in riparian zone disturbance ecology, forest health, and mine land reclamation. Currently, he is working on projects addressing total dissolved solids in streams below surface mining and valley fill operations.

Dr R. Neil Humphries is currently the Environmental Co-Coordinator for Celtic Energy's coal mining operations in the UK, whilst still practicing as an independent consultant for other mineral resource companies. He is a chartered biologist and soil scientist who specializes in the reconstruction of ecosystems and the development of reclamation practices, a Fellow of the Institute of Quarrying and holds a Visiting Professorship at Cranfiled University's National Soil Research Institute. His 40 years of practical and research achievements was recently recognized by his receipt of ASMR's William T Plass Award 2013.

Trevor Klein served as the Western Hardrock Watershed Team Office of Surface Mining / AmeriCorps Volunteer in Service to America coordinator for the Kerber Creek Restoration Project from August, 2012 to August, 2013 in Saguache, CO. There, he was responsible for a wide variety of duties, including technical editing, data management, data collection, and project coordination. Trevor holds a B.S. degree in environmental sciences from the University of Virginia and has prior experience in experimental design and data analysis. He is currently pursuing an M.S. degree in geology at Temple University in Philadelphia, where he plans to specialize in hydrogeology and groundwater-surface water interactions.

Sara C. Koropchak is a research associate in the Crop and Soil Environmental Sciences Department at Virginia Tech. She studied in the Department of Plant Biology at Southern Illinois University Carbondale where she published research on the use of a pioneer sedge species in boreal peatland reclamation after oil sands mining. She has also published work related to plant salinity tolerance, peatland formation, and invasive species in peatland reclamations. Currently, her primary focus is field-testing transgenic and traditionally bred varieties of American Chestnut trees for blight resistance and survivability on coal mines.

Molly McDermott is a Ph.D. candidate in Environment and Natural Resources at the Ohio State University, studying Neotropical migrant overwintering habitat use in the Colombian Andes. She earned her B.S. at the Pennsylvania State University and M.S. at West Virginia University in Wildlife and Fisheries Science. Her research focuses on the impacts of mining, timber harvesting, agriculture, and other landscape changes on the conservation of bird communities.

Shawn Partin is a Project Manager at Daniel S. Natchez and Associates, Inc., an environmental waterfront design and consulting company located in New York, and holds a M.A. in Environmental Design and a Bachelor of Landscape Architecture from Michigan State University. Shawn has published works in topics of design, planning and 3D modeling and continues ongoing research involving 3D modeling.

Corine Peugh earned her Bachelor of Science from Ohio University in wildlife and conservation biology. She is the Restoration Ecology Project Manager at the Wilds, an innovative non-profit conservation organization located on 3,700 hectares of reclaimed mine land in Cumberland, Ohio, where she has been involved in ecological research for the past three years.

Rich Prodgers has monitored and advised revegetation at coal and hardrock mines in Montana for more than thirty years and works on three Superfund projects. He specializes in revegetation prescriptions: soil amendments, seed mixes, and seeding implementation as well as transplanting

Brian C. Sanchez is an Environmental Contaminants Specialist with the U.S. Fish and Wildlife Service's (FWS) Colorado Field Office in Lakewood. He has worked for the FWS for four years and is primarily focused on investigating known or suspected contaminant threats to endangered species, migratory birds, and National Wildlife Refuges. Brian holds a Ph.D. in Ecotoxicology from Purdue University, an M.S. in Wildlife Biology from New Mexico State University, and a B.S. in Biology from the University of New Mexico.

Matthew Shumar is a research associate at the Ohio State University and is the coordinator of the Second Atlas of Breeding Birds in Ohio. His research interests include avian ecology and conservation, landscape ecology, and in particular, anthropogenic effects on Neotropical migrant songbirds. He received his B.S. from Pennsylvania State University and a M.S. from West Virginia University, both in Wildlife and Fisheries Science.

Pete Stahl (B.S. Oklahoma State University, 1978; M.S. and PhD, University of Wyoming, 1989) is a professor of soil ecology in the Department of Ecosystem Science and Management and director of the Wyoming Reclamation and Restoration Center. Dr. Stahl's current research activities include investigation of ecosystem recovery on lands impacted by natural resource extraction and improved methodologies for restoration of disturbed landscapes. He teaches Reclamation of Drastically Disturbed Lands, Soil Microbiology, Soil Biogeochemistry, and a Land Reclamation Seminar. Dr. Stahl is a former president of the Western Society of Soil Science, Chair of the Ecology Technical Division of the American Society of Mining and Reclamation and member of the High Altitude Revegetation Committee.

Negussie Tedela is Hydrologist for the US Department of the Interior, Bureau of Land Management, Monte Vista, Colorado, where he's responsible for soil, water, and air programs. He received his B.S. in Agricultural Engineering, Master of Engineering Science in Soil and Water Engineering, and PhD in Hydrology from Alemaya University, National University of Ireland, and Georgia University, respectively. He has many years of experience in research, teaching, extension, and field works related to his area of specialization.

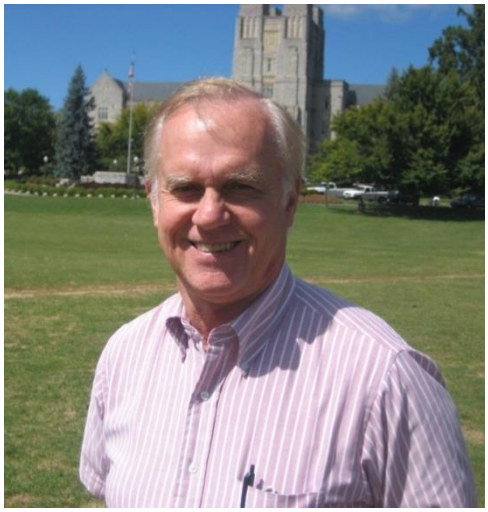
Yun Wang has earned a Masters of Arts in Environmental Design at Michigan State University and a Bachelor of En gineering in Urban planning from Inner Mongolia University of Technology. She is currently an Assistant Instructor in the Forestry College of Inner Mongolia Agricultural University.

Jason B. Willis is the Mine Restoration Field Coordinator for Trout Unlimited based in Salida, Colorado. He has received a B.S. in Plastics Engineering Technology from Penn State Behrend and an M.S. in Civil and Environmental Engineering from the University of Pittsburgh. Prior to coming to TU, Jason worked for 4 years at various engineering firms in the disciplines of structural, geotechnical, environmental, and civil engineering. He began working as a contractor for TU in 2011 for nine months on the Kerber Creek Restoration project in Colorado. Jason was brought on full-time to Trout Unlimited in October 2012, and focuses on restoration of mining impacted areas, in-stream enhancement, soil and water chemistry, as well as channel morphology and river dynamics.

Benjamin Wolff Graduated from University of Wyoming with a BS in Agroecology and a minor in Entomology in 2006. Became interested in wildland reclamation/restoration during undergraduate studies from courses taught by Peter Stahl Ph.D and Steven Williams Ph.D. Worked for Fehringer Agriculture Consulting in Billings, MT from 2006 – 2007. Spent a good deal of time working with oil and gas industry soil conducting sampling and soil fertility analysis. Started graduate program at MSU Bozeman in 2008 studying reclamation/ restoration of damaged wild lands with an emphasis in the coal industry. Passion for reclamation was further fueled by MSU professors Doug Dollhopf, Ph.D and Tim McDermott Ph.D. Transferred to University of Wyoming to finish graduate program in Soil Science and Environment and Natural Resources (ENR). Graduate studies focused primarily reclamation in the oil and gas industry across Wyoming.

Photo not available

Petra Wood Since 1992 she has been employed as a Research Wildlife Biologist with the US Geological Survey WV Cooperative Fish and Wildlife Research Unit. She is an Adjunct Professor in the Division of Forestry and Natural Resources at West Virginia University. Her primary research activities focus on how anthropogenic habitat changes (timber harvesting practices, surface mining, oil and gas development) affect wildlife populations, particularly songbirds. Petra earned her Ph.D. and M.S. degrees from the University of Florida in Wildlife Ecology and her B.S. in Wildlife and Forest Management from Purdue University.



Carl E. Zipper is a Professor in the Department of Crop and Soil Environmental Sciences at Virginia Tech. He has been a member of the Virginia Tech faculty since 1986, when he received his Ph.D. in Agronomy from Virginia Tech with an emphasis on soil science. He serves as Director of the Powell River Project, a Virginia Tech program that conducts research and education programs to enhance environmental restoration on coal-mined lands. He is active in research and outreach concerning mined land reclamation, forest restoration on coal mined areas, and water resource management and protection