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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

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

AILANTHUS ALTISSIMA INTERFERS WITH BENEFICIAL SYMBIONTS AND NEGETIVELY IMPACTS OAK REGENERATION[1]

Jenise M. Bauman[2], Caitlin Byrne and Shiv Hiremath

Abstract: The invasion of Tree-of-Heaven (*Ailanthus altissima*) has been documented in disturbed landscapes leading to biodiversity loss and degradation of ecosystem function. *Ailanthus* interferes with the restoration of native species by its aggressive growth habit, alteration of nutrient cycles, and allelopathic chemical production. Recent studies suggest that allelopathy has a negative effect on the growth of red oak (*Quercus rubra),* possibly by interfering with the symbiosis of beneficial ectomycorrhizal fungi (ECM). This fungal symbiont is essential for healthy tree growth and the unavailability of these fungi may impede the success of seedling regeneration. This study investigated the effects of *Ailanthus* on biomass production and ectomycorrhizal fungal (ECM) colonization of red oak (*Q. rubra)* seedlings on a reclaimed coal mine site in eastern Ohio. Six plots were designated in an existing riparian buffer zone in a wetland at The Wilds Conservation Center in Muskingum County. Three of the plots were in an area where mature *Ailanthus* was present. The other three plots were located in the same riparian zone that was without *Ailanthus.* Naturally regenerating two-year-old red oak seedlings were selected for study (10 seedlings per plot, 60 seedlings total). The oak seedlings were sampled for biomass (g) and ECM root colonization. Two-year-old oak seedlings growing among mature Tree-of-Heaven produced significantly less biomass, specifically in root production, than the oaks growing without the invasive tree (P = 0.02). There was a decrease in ECM colonization (P = 0.001) and a shift in ECM community composition in plots where the Tree-of-Heaven was present (P = 0.0004). The increase in root biomass and ECM colonization may aid in the plant's competitive ability for belowground resources, important for reestablishment. These data suggest that areas impacted by the invasion of Tree-of-Heaven may require restoration with plant species less reliant on ECM colonization when planting in soils immediately following invasive species removal.

Additional Key Words: native tree generation, riparian buffer restoration.

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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. 1, 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 1/Bauman-OH.pdf

RESEARCH PAPER

YIELD OF SWITCHGRASS ON RECLAIMED SURFACE MINES[1]

Carol Brown[2], Jeff Skousen, and Tom Griggs

Abstract: Growing crops for biofuel production on agricultural land has caused conflict between choosing biomass crops for fuel instead of food for a growing world population. This has increased interest in growing biofuel feedstocks on marginal lands. Switchgrass (*Panicum virgatum* L.), a warm-season perennial grass, has been shown to be a viable bioenergy crop because it produces high yields on marginal lands under low water and nutrient conditions. From previous studies, switchgrass yields on marginal croplands varied from 5,000 to 10,000 kg ha^{-1}. West Virginia contains immense acreages of reclaimed surface mine lands and could offer enough area for the production of switchgrass as a feedstock for a biofuel industry. For reclaimed lands, yield targets of 5,000 kg ha^{-1} were established by researchers as the yield necessary for economic feasibility for landowners. This study was established in 2008 to determine switchgrass yields of different cultivars on mine sites in West Virginia. Three varieties of switchgrass were tested on two mine sites, Hampshire Hill and Hobet. The Hampshire Hill mine site, which was reclaimed in the early 1990's using top soil and treated municipal sludge, consistently had the highest yield of the two sites with a fifth year yield of 9,066 kg ha^{-1} averaged across varieties. Cave-in-Rock variety produced 15,600 kg ha^{-1} of biomass which was more than the other two varieties, Shawnee and Carthage, at 8,600 and 3,000 kg ha^{-1}. The other mine site, Hobet, was prepared using crushed, unweathered sandstone in 2008. Yields of switchgrass were 890 kg ha^{-1} for the fifth year of production, with Cave-in-rock producing the most biomass at 1,275 kg ha^{-1}. The two sites had different physical soil characteristics. While both sites had low contents of % fines and high rock fragment contents (material >2mm in size) Hobet had significantly lower % fines than Hampshire Hill. The type and quality of soil and the variety of switchgrass selected for seeding should be considered when the goal is chiefly high yields of switchgrass for biofuel production.

Additional Key Words: bioenergy, biofuel crops, reclaimed mined lands

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[1] Poster paper was presented at the 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. 1, 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 1/Brown-WV.pdf

RESEARCH PAPER

POTENTIAL USE OF WEATHERED SANDSTONES TO CONSTRUCT A LOW PERMEABILITY BARRIER TO ISOLATE PROBLEMATIC COAL MINE SPOILS[1]

Mariana da Rosa[2], Carmen T. Agouridis, and Richard C. Warner

Abstract. Specific conductance and selenium (Se) are two water quality parameters of emerging concern in the Appalachian coalfields. Isolation of high specific conductance and Se producing spoils from environmental water flows using a low permeability barrier is one method of minimizing the leaching of these constituents from coal mine spoils. Ideally, the material used to form the barrier should be readily accessible, have low levels of specific conductance and Se, and be capable of achieving a low permeability with the proper moisture adjustment. Brown and gray weathered sandstones are often readily available at mine sites in the Appalachian coalfields. Spoil samples and water quality samples from the University of Kentucky Bent Mountain Research Complex near Pikeville, Kentucky indicated that these spoil types hold promise in meeting the criteria of being a low specific conductance producing material. However, these sandstones tend to have higher sand contents than those typically used in compacted barriers or liners in landfills. The objective of this study was to assess the potential of using brown and/or gray weathered sandstones to create a low permeability barrier. To meet the objective of the study, a total of four spoil samples (identified as M1-M4) were collected in 2012. Each spoil sample was obtained from a different mine in eastern Kentucky. Samples M1 and M2 consisted of brown sandstone; sample M3 was gray sandstone; and sample M4 was a mixture of brown and gray sandstones. Each spoil sample was screened and analyzed for soil texture. Spoil moisture content-density relationships and spoil saturated hydraulic conductivity-moisture content relationships were developed for each sample using double ring permeameters. Maximum saturated hydraulic conductivity values ranged between a low of 5.9×10^{-8} cm s^{-1} to a high of 3.1×10^{-7} cm s^{-1} in the laboratory for the <2mm fraction. These saturated hydraulic conductivity values were comparable to soils used to construct liners in landfills, particularly in instances where the percentage of fines in the spoils were about 50% or greater. When in the field, however, it is expected that these saturated hydraulic conductivity values will typically be 1-3 orders of magnitude higher due to rock fragments. These results demonstrate that brown sandstone, with its higher fines content, is likely a more suitable media than gray sandstone for constructing a low permeability barrier to isolate high specific conductance producing and/or Se generating spoils. Based on these laboratory results, field assessments of brown weathered sandstones for this application are recommended.

Additional Key Words: Proctor density, hydraulic conductivity, water quality.

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[1] Oral 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. 1, 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 1/da Rosa-KY.pdf

RESEARCH PAPER

SURVEY FOR THE PRESENCE OF *PHYTOPHTHORA CINNAMOMI* ON RECLAIMED MINED LANDS IN OHIO CHOSEN FOR RESTORATION OF THE AMERICAN CHESTNUT[1]

Shiv Hiremath[2], Kirsten Lehtoma, and Jenise M. Bauman

Abstract. We have been planting blight resistant American chestnut seedlings on reclaimed coal mined areas in Southeastern Ohio, which was once within the natural range of the American chestnut. Towards the goal of restoring the American chestnut, we are testing suitable sites that can aid survival, growth and establishment of planted seedlings pre-inoculated with ectomycorrhizal fungi. Prior to the arrival of the chestnut blight fungus, pathogens of the genus *Phytophthora* were introduced in the USA that were responsible for the "ink disease" or "root-rot" resulting in wide-spread death of chestnut trees in southern states. Although these pathogens were not observed elsewhere, recent reports indicate their presence in some northern states, including Ohio. We have been testing each location targeted for chestnut plantings for the presence of *Phytophthora*, specifically *P. cinnamomi*. The work reported here shows results obtained from seven different sites in southeastern Ohio where reclamation was done 3-20 years ago. Soil was collected at a depth of 4-5" at several locations within each site. A positive control containing ~4 cfu/10 g soil was used in the analysis. We used two different techniques for identifying the pathogen: 1. Direct isolation of the pathogen from the soil using selective media; 2. Using chestnut leaves as a baiting technique followed by selection on plates. In both cases, final identification was done by DNA isolation and sequencing using Phytophthora-specific primers. Our results showed that, at least in the locations we tested, *P. cinnamomi* was not detected. Because most of these lands were only recently reclaimed, it is possible that the pathogen may not have established there yet. However, samples from locations that were reclaimed more than 2 decades ago also showed absence of this fungus. Results suggest that this pathogen is either not as wide-spread in Ohio as in southern states or mined sites are not favorable for its existence and spread.

Additional Key Words: root colonization of fungi, chestnut restoration.

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 1/Hiremath-OH.pdf

REPLICATING SPECIES BASED FRACTAL PATTERNS FOR RECLAIMING NORTHERN MICHIGAN WASTE ROCK PILES[1]

Wade J. Lehmann[2], Jon Bryan Burley, Cyril Fleurant, Luis Loures, and Andrew McDowell

Abstract. Landscape planners and designers are interested in replicating natural landscape patterns to reclaim degraded landscapes to blend with existing conditions. One approach that shows promise is the use of fractal geometry to create natural landscape patterns. While the measurement of the actual fractal dimension of an object is difficult, the box-counting method (developed at Agrocampus Ouest, Angers, France) approximates the fractal dimension of an object. This process is illustrated by measuring and replicating a stand of trees in the Upper Peninsula of Michigan and applying the method for a planting plan on a Northern Michigan surface mine. The estimated fractal dimensions for the tree species are calculated: 0.329 for *Tsuga canadensis* Carrière, 0.674 for *Thuja occidentalis* L., 0.607 for *Acer rubrum* L, 0.345 for *Acer saccharum* Marshall, 0.442 for *Pinus strobus* L., and 0.359 for *Picea glauca* (Moench) Voss. and were applied in the design of a revegetation plan.

Additional Key Words: landscape architecture, landscape metrics, landscape ecology, environmental design, GPS, mine reclamation.

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 1/Lehmann-MI.pdf

RESEARCH PAPER

RESTORATION OF IRONSTONES OUTCROPS DEGRADED BY IRON MINNING ACTIVITY IN MINAS GERAIS STATE-BRAZIL[1]

Lina A. Lobo de Rezende[2], Luiz E. Dias, Igor R. de Assis, Ramon Braga, Mauro Lobo Rezende

Abstract: The properties of the soils and underlying substrates of "canga" (ironstones outcrops) in central Brazil have a number of restrictions for the establishment of plant species, and the high specialization of local vegetation contributes to a high rate of endemic adaptations. The close association between the mining of iron and the need for locally adapted vegetation presents a special condition of vulnerability. This study evaluated varied approaches to the restoration of "canga" fields considering technical and economic aspects related to the application of topsoil, re-introduction of plants from local sources and their regeneration. We set up a field experiment on one overburden pile of Capão Xavier iron mine (mined by the Vale Company), composed of eight treatments formed from combinations of two thicknesses of "canga" and associated salvaged soils (20 and 40 cm) and four levels of fertilization. In each plot, we planted the same number of seedlings following the same spatial arrangement. The evaluation of the treatments was made at 10 and 42 months after planting for survival of the planted species. There was no significant difference among the average survival of seedlings planted for the different thicknesses of substrate and fertilization levels. The development of programs for ecological restoration of ferruginous fields should therefore consider, among other factors, the complex soil x vegetation mosaic commonly found in natural settings and thus carry out the "canga" material soil reconstruction sequence in order to reproduce this scenario. Furthermore, in view of the possible reduction in the number of plant individuals over time, there must be a satisfactory amount of individual species selected for reintroduction.

Additional Key Words: revegetation, ecological reclamation.

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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. 1, 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 1/Rezende-Brazil.pdf

RESEARCH PAPER

RECLAMATION OF MINED LAND WITH SWITCHGRASS, MISCANTHUS, AND ARUNDO FOR BIOFUEL PRODUCTION[1]

Jeff Skousen[2], Travis Keene, Mike Marra, and Brady Gutta

Abstract: Use of biomass to supplement the nation's energy needs for ethanol production and green fuel for power plants has created a demand for growing reliable feedstocks. Switchgrass (*Panicum virgatum* L.), miscanthus (*Miscanthus x giganteus)*, and giant cane (*Arundo donax* L.) are possible biofuel crops because they produce large amounts of biomass over a wide range of growing conditions, including marginal and reclaimed land. West Virginia's climate and large acreage of available reclaimed mine land provide a land base to generate high amounts of biomass for a biofuel industry. The purpose of this study was to determine the yield of three biomass crops on reclaimed mined land in central West Virginia. A 25-year-old reclaimed site near Alton, WV was prepared using herbicides to eliminate all existing cool-season vegetation on a 5-ha area. Twenty-three plots of 0.4-ha in size were established. Mine soil samples showed an average pH of 7.5 and adequate supplies of plant nutrients. Two switchgrass varieties (Kanlow and BoMaster) were randomly assigned to 10 plots (five replications) and seeds were drilled into the killed sod at a rate of 11 kg ha^{-1}. Two types of miscanthus (sterile public and private varieties) were randomly assigned to 10 plots and planted with seedling plugs on 0.8-m centers. Giant cane was assigned to three plots and rhizomes were planted on 1.5-m centers. Yield measurements were taken in September the second and third years after planting. Yields for Kanlow switchgrass varied from an average of 4,000 kg ha^{-1} in 2011 to 4,900 kg ha^{-1} in 2012. BoMaster switchgrass was lower at 2,750 kg ha^{-1} in 2011 and 3,981 kg ha^{-1} in 2012. The public variety of miscanthus showed yields 7,500 kg ha^{-1} in 2011, but decreased to an average of 4,900 kg ha^{-1} in 2012. The private miscanthus variety was much greater at 21,880 kg ha^{-1} in 2011 and 15,500 kg ha^{-1} in 2012. Giant cane yields were low with an average yield of 515 kg ha^{-1} in 2012. Survival and growth of giant cane was hindered by weed competition and poor establishment. Target yields for reclaimed lands, as established by the WV Department of Environmental Protection of 5,000 kg ha^{-1} for switchgrass and 15,000 kg ha^{-1} for miscanthus were not attained with switchgrass and the public variety of miscanthus, but was achieved with the private variety of miscanthus. More time may be needed for these yield goals to be achieved as stands continue to develop over time.

[1] Oral 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. 1, 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 1/Skousen-WV.pdf

CASE STUDIES

CASE STUDY: MATURE SUBALPINE TREE & SHRUB TRANSPLANTING AT THE CLIMAX MINE, CLIMAX, CO[1]

R. F. Bay[2], K. E. Carlson, and A. Hilshorst

Abstract: As part of reclamation activities, 1,459 trees and shrubs were transplanted on the Climax Mine property during the summers of 2005, 2006 and 2007. The majority of transplants were Engelmann spruce (*Picea engelmannii*), the dominant tree species on the Climax property. Other transplanted species included subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*), several willow species (*Salix* spp.), shrubby cinquefoil (*Dasiphora fruticosa*), dwarf birch (*Betula nana*), and currant species (*Ribes* spp.). Trees and shrubs with 32 – 60-in root balls were harvested using a tree spade within the mine's affected area and placed in burlap-lined cages for transport and temporary storage before planting in reclaimed areas. Transplants were placed in holes deep enough to cover to the root crown, backfilled with a mixture of topsoil, old woodchips, and composted biosolids (4:1:1), and mulched with woodchips. All transplants were watered in within 2 days of planting and treated with a general mycorrhizal inoculant.

Each transplanted tree and shrub was monitored for survival and growth in 2005, 2006, 2007, 2008, 2010 and 2012. Overall, transplanting was relatively successful with 68% total survival as of 2012. Shrubs were more successful than trees with 96% of shrubs surviving compared to only 63% of trees. Survival was greater for spruce trees (64%) than fir trees (41%). Also, survival was greater in shorter (<6 ft tall) trees with 72% still alive in 2012 compared to only 56% of taller trees. Tree survival dropped substantially between 2010 and 2012 from 71% to 63%, likely due to drought conditions and heavy elk damage. Elk damaged 25% of the trees, but only 26% of damaged trees died. There was also a significant difference in survival for different planting locations and soil types. The goal for this project was 50% survival after the first growing season. Thus, survival is better than expected and the goal has been surpassed after several growing seasons.

Additional Key Words: Mine reclamation, revegetation, shrub, spruce, willow

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[1] 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. 1, 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 1/Bay-CO.pdf

CASE STUDY: THE CONTRIBUTION OF ACTIVE SURFACE MINES IN THE CONSERVATION OF LICHEN COMMUNITIES IN THE SOUTH WALES COALFIELD, UNITED KINGDOM.[1]

R. N. Humphries[2]

Abstract: The overwhelming perception of surface mining is that it has significant adverse long term effects on the conservation of flora and fauna, and that there is typically a net loss in biodiversity, particularly those which have been identified as Biodiversity Action species and habitats under the Convention on Biological Diversity (CBD). These are enshrined in UK legislation and policy as to their protection, enhancement and promotion.

The mining legacy of the coal and iron industrial revolution in the coalfields of South Wales is thousands of spoil tips scattered across the landscape and dating from the early 1800s. Many of these have vegetation and habitats that are now recognized to be of importance for biodiversity and even have their own action plan for preservation. In particular, it is recognized that the tips in South Wales are important for lower plants (lichens, bryophytes, and fungi) species. Some tips are of such national importance they have been given statutory protection as nationally important Sites of Special Scientific Interest (SSSI).

The issue of their conservation in South Wales became topical in the mid to late 2000s with several studies being commissioned by the regulating authority, the Countryside for Wales. In cases of particularly rich assemblages on old tips, these have the potential for and have actually halted a number of future surface mine prospects.

In the case of lichens, these delicate pioneer assemblages are not only under threat from agriculture, forestry, and public pressures, but also from vegetation development and succession. Without intervention many high quality sites are likely to be lost through competition and shading by grasses, bracken, heather, bilberry, scrub, and woodland.

As a result of surveys undertaken in 2012 we have found that colonization of new coal mine wastes is relatively rapid resulting in equivalent lichen assemblages (to those found on the 150-year-old tips) establishing within 20 years. It is argued that new surface mines provide a means of sustainably conserving the assemblages by the creation of new lichen heath habitat through the commissioning of new mines.

Additional Key Words: lichens, overburden, soil mounds, sustainability

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http://www.asmr.us/Publications/Journal/Vol 2 Issue 1/Humphries-UK.pdf

CASE STUDY: FIELD TRIAL OF A PULSED LIMESTONE DIVERSION WELL[1]

P. L. Sibrell[2], C. Denholm and M. Dunn

Abstract: The use of limestone diversion wells to treat acid mine drainage (AMD) is well-known, but in many cases, acid neutralization is not as complete as would be desired. An engineered version of the diversion well has also been developed and tested in the field. The so-called pulsed limestone bed process has shown good acidity and metal removal, but requires electrical and chemical inputs. We have developed and evaluated a pulsed diversion well that retains the passive operation of the traditional diversion well, but with improved operating characteristics based on concepts used in the pulsed limestone bed process. In the new pulsed diversion well, a sand-size distribution of limestone (0.1 to 4.0 mm) was used so as to allow fluidization of the limestone bed, and to increase the reactivity of the limestone. Also, water flow was regulated through the use of a dosing siphon, so that consistent fluidization of the limestone sand could be achieved. The pulsed diversion well was tested in the field at the Jennings Environmental Education Center, near Slippery Rock, Pennsylvania. Initial system performance during the 2010 field season was good, with over 80% removal of influent acidity. However, further test results showed a decrease in acidity removal over the course of the study. Subsequent observations indicated that the hydraulics of the system had been compromised by the formation of iron oxides in the pipe leading to the limestone bed, which affected water distribution and flow through the bed. Although results from the field trial were mixed, it is believed that without the formation of iron oxides and plugging of the pipe, better acid neutralization and treatment may have occurred. Further tests are being considered using a different hydraulic configuration for the limestone sand fluidized bed, or alternatively, at a site with lower metal loadings.

Additional Key Words: acid mine drainage; water treatment; passive treatment

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[1] Oral 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. 1, 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 1/Sibrell-WV.pdf

CASE STUDY: GEOMORPHIC RECLAMATION OF ABANDONED COAL MINES NEAR RATON, NEW MEXICO DESIGN AND CONSTRUCTION OVERSIGHT[1]

R. Spotts[2], M. Brennan, R. Wade, K.J. Malers, K.E. Carlson and Z. Isaacson

Abstract. In order to address hazards and environmental detriments associated with historic coal mining, the New Mexico Abandoned Mine Land Program contracted with Water & Earth Technologies, Inc. Construction for the Swastika Mine and Dutchman Canyon Reclamation Project took place over a six-month period in 2012. The geomorphic reclamation approach coupled hydrologic and hydraulic engineering analyses with geomorphic design tools to stabilize and reclaim the significantly altered landscape. Coal waste piles, a straightened and incised half-mile-long reach of the Dillon Canyon stream channel, and existing wetland features proved to be challenging design elements of this award winning project. The geomorphic landform accommodated nearly 200,000 cu. yds. of coal waste that had been abandoned in unstable piles that were degrading the adjacent stream physically and chemically. The stream reconstruction restored meanders and a functional floodplain to the impaired system. In Dutchman Canyon, road and embankment improvements were designed to allow seepage from closed mine adits to hydrate a constructed salt-tolerant wetland.

In addition to the geomorphic landform and the sinuous stream, a realigned access road was constructed through the narrow valley. Valuable ecological and cultural features including mature trees, wetland areas, utility poles, and over 200 identified archaeological features were preserved. Geomorphic designs were modified as required during construction to accommodate additional archeological discoveries. Geomorphic design was accomplished using Natural Regrade™ with Geofluv™ to incorporate stable drainage and topographic variety into the reconstructed stream and landform. The design used geomorphic criteria developed from measurements of nearby, undisturbed portions of the valley, mimicking stable landforms and stream characteristics that have developed naturally in response to the topographic relief, soils, vegetation, and climate in the project area. The project created an aesthetically pleasing valley with an ecologically rich riparian corridor integrated into a stable landform composed of reclaimed coal waste.

Additional Key Words: Geomorphic reconstruction, stream reconstruction, mine reclamation, GeoRiparian Restoration

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[1] Oral 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. 1. 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 1/Spotts-CO.pdf

CASE STUDY: UTILIZING PASTE TECHNOLOGY FOR RECLAMATION OF THE UTE ULAY UPPER TAILINGS IMPOUNDMENTS, LAKE CITY, COLORADO[1]

Tara Tafi[2] and David Lazorchak

Abstract: The Ute Ulay Mining complex, located approximately five miles west of Lake City, CO, is an inactive Ag, Au, and Zn mining/milling operation that operated from the 1880's until the 1970's, and sporadically into the mid 1990's. During operation, milled tailings were pumped upstream from the mine/mill site in a sluice box and deposited into five tailings impoundments. The tailings impoundments comprised 13,000 yd^3, on 6 acres of public lands managed by the Bureau of Land Management (BLM). Prior to reclamation, windblown tailings from the impoundments exposed the public to potentially harmful dust, the tailings from the lowest pond washed into Henson Creek during high flow, and Zn, Pb and Cd leached into groundwater through the unlined tailings ponds. The objective of the reclamation was to mitigate the risk of human exposure to air-borne dust, and to protect surface and groundwater sources from further contamination from the tailings impoundments. Reclamation of the mine and mill waste materials was completed using cementatious paste technology. All waste materials were screened and separated on-site, and the fine-grained waste materials were mixed with cement and water to form the paste. The repository was constructed using a layered design, with paste forming the base and cap, and coarse waste materials placed as a middle layer within the enclosing paste. Following repository completion, the site was graded, drainage channels were constructed, groundwater-monitoring wells were installed, and six acres were revegetated. Reclamation was completed in October, 2009, with maintenance in 2011. Following three growing seasons, the vegetation community is healthy, with minimal weedy species, and no noxious weeds. The surface water quality in Henson Creek indicates a slight reduction in Zn and Cd levels, and other metal concentrations in the groundwater have declined by over an order of magnitude.

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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, 2013and accepted for the online Journal of The American Society of Mining and Reclamation, Volume 2, No. 1, 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 1/Tafi-CO.pdf

Demonstration Papers

DEMONSTRATION STUDY: CONSERVING AN S1/G5/T2 MUSTARD AT A SOUTHCENTRAL MONTANA COAL MINE THROUGH NURSERY PROPAGATION AND TRANSPLANTING[1]

G. L. Johnson[2] and R. A. Prodgers

Abstract. Protected rare plants can hinder mine development if not conserved. Spring Creek Coal Mine (SCCM) in southcentral Montana adopted a proactive conservation/propagation program for an uncommon but not formally protected variety of perennial mustard found in a topsoil-stripping area. The objective is to reestablish a self-sustaining population of *Physaria didymocarpa* (Hook.) A. Gray var. *lanata* A. Nelson, woolly twinpod, in reclamation and elsewhere within the permit area. This recognized variety is rated S1 in Montana (at risk, imperiled); the G5 (common, secure) global designation refers to generic *Physaria didymocarpa* (common twinpod), whereas T2 (less imperiled than S1, it occurs also in WY) refers to the trinomial (var. *lanata*). In the wild, fruits aren't produced every year and empty capsules are common, hence prospects for collecting seed appeared dim. Fifty mature plants were collected from the nexus of the population, transplanted, and used for tissue culturing (cloning) and later for seed collection. Between 500 and 1,000 plants annually were transplanted into the mine permit area beginning in fall 2008. In addition to the problems inherent to a stenotopic functional annual of very limited competitive ability, these limitations have manifested in the transplant program:

- Windblown dust accumulation in the foliage inhibited plant survival. The epithet "lanate" refers to long, tangled, woolly hairs.
- The fresh scoria into which transplants were planted in a few months became a dense sward of 5 dm tall kochia (*Bassia scoparia*) with a scattered twinpod understory. Kochia was more successful in capturing water, nutrients, and light.
- Disturbed or placed scoria subsequently becomes a magnet for yellow sweetclover (*Melilotus officinalis*), a tall nitrogen-fixing legume and copious seeder that overtopped and apparently competed with twinpod, the growth and survival of which did not appear to be assisted by increased mineral N, if present.
- Herbivory from ungulates and insects.

Spring transplanting is now performed into both mined and unmined areas. While transplants survive, a self-sustaining population is not yet assured. Further transplanting and adaptive practices continue at the mine. These lessons may guide others similarly engaged.

Additional Key Words: rare plant conservation, tissue culture propagation, outplanting, habitat, competition.

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[1] 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 2013 and accepted for the online Journal of The American Society of Mining and Reclamation, Volume 2, No. 1, 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 1/Johnson-MT.pdf

DEMONSTRATION STUDY: TREATMENT OF HEAP LEACH PAD DRAIN DOWN SOLUTION: PROOF-OF-PRINCIPLE BENCH STUDY[1]

A.M. Moderski[2], J.J. Gusek, C. Bucknam, C. Hager, and T.R. Wildeman

Abstract. A 20-week bench-scale study was conducted by Golder Associates to determine whether passive treatment could effectively remove weak and dissociable (WAD) cyanide and NO_3 from the drain down solution emanating from a decommissioned gold heap leach pad. An anaerobic treatment scenario was chosen and three different substrates were chosen. Limestone at 10% by weight was in all three reactors, two of the reactors had between 80 and 90% hay/straw, and a third reactor had 45% hay/straw and 45 % potato mash. These are local agricultural products and by-products. Because the historic concentration of nitrate-N ranged from 142 to 297 mg/L, the flow rate into the reactors was based on the hydraulic retention time needed to remove nitrate-N down to 10 mg/L, and this was determined to be 20 days. All three substrates were effective at removing WAD cyanide and nitrate-N to below 0.04 mg/L and 1.0 mg/L, respectively. In the effluents, other constituents that could be the products of cyanide and nitrate-N degradation were analyzed and only ammonia-N was detected at concentrations from 5 to 10 mg/L. The most recent regulatory reference value has been set at 10 mg/L N for the total N in all nitrogen species. Under this monitoring requirement, the sum of nitrate-N and ammonia-N would be below the 10 mg/L N reference value.

Additional Key Words: Anaerobic bioreactor, nitrate, nitrite, WAD cyanide, ammonia.

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[1] Oral 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. 1, 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 1/Moderski-CO.pdf

Book Review

John B. Comer (ed.) Effects of abandoned mine land reclamation on ground and surface water quality: Research and case histories from Indiana. p.351. Indiana Geological Survey, Special Report 72.

ASMR received a book to review a few months ago and after the Volume 1 had been placed online. This book may be ordered on the Indiana Geological Bookstore on-line http://IGS.Indiana.edu and also includes a CD. There are 13 articles in this publication including an overview of environmental challenges and goals of the Indiana abandoned mine lands program by Bruce Stevens. The following articles are included:

1) Licia A. Shaffer, Indiana's coal mine information system.

2) Nelson R. Weber, Reuses of mined land

3) Denver Harper, Greg A Olyphant, and Tracy D Branam, Direct revegetation and the sustainability of reclaimed mine lands: The story of the Friar Tuck Site, Indiana.

4) Tracy D. Branam, Denver Harper, Ronald T. Smith and Shawn C. Naylor, Effectiveness of emerging reclamation methods at an abandoned mine land site in Pike County, Indiana.

5) Mark A. Stacy, Impacts of abandoned mine land reclamation on water quality within the South Fork Patoka River watershed.

6) Paul T. Behum, Dan R. Hause, Mark A. Stacy, and Tracy D Branam. Passive tratment of large-flow, net acid mine drainage: The Enos reclamation project, Indiana.

7) John B. Comer, Ronald T. Smith, Margaret V. Ennis, and Tracy D Branam. Effects of reclamation on the water quality of Augusta Lake and Mill Creek, Pike County, Indiana.

8) Ronald T. Smith, Metals removal in acid mine drainage wetlands.

9) Jeanette K. Pope, E. Randell Bayless, Greg A. Olyphant and Tracy D Branam. The role of efforescent sulfate salts in Indiana's mine water quality.

10) Sandra S. Brake, and Stephen T. Hasiotis. Potential metal attenulation by eukaryote-dominated biofilm communities in acid mine in the drainage at the Green Valley coal mine site, Indiana.

11) Adam E. Flege, J. Barry Maynard, and Erika R. Erswick. Sulfur isotopes as indicators of remediation efficacy in constructed wetlands receiving acid mine drainage.

12) Paul T. Behum, Passive treatment of low-pH, high-alumium acid mine drainage: A critical review of sulfate-reducing bioreactor technology.

ABOUT THE AUTHORS

Carmen Agouridis is an Assistant Professor in the Biosystems and Agricultural Engineering Department and is the Director of the Stream and Watershed Science Graduate Certificate at the University of Kentucky. A licensed professional engineer in Kentucky and West Virginia, Dr. Agouridis has expertise in stream restoration and assessment, riparian zone management, hydrology and water quality of surface waters, and low-impact development. Having received training in Rosgen Levels I-IV along with courses at the North Carolina Stream Restoration Institute and various other workshops, she teaches Introduction to Stream Restoration, which is a senior-level and graduate-level course at the University of Kentucky.

Igor Rodrigues de Assis is a Professor at the Federal University of Viçosa, working in the areas of Soil Physics and Land Reclamation. He has 9 years of applied and research experience with acid mine drainage and revegetation. Igor is Agricultural and Environmental Engineer and he has an D.S. degree in Soil Science and Plant Nutrition, with an emphasis in Land Reclamation from the Federal University of Viçosa, Brazil.

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.

Robin F. Bay is a Sr. Environmental Scientist at Habitat Management, Inc. a natural resource and environmental consulting company based in Colorado. She has 13 years of applied and research experience with revegetation planning and implementation, baseline vegetation data collection and assessments, reclamation success evaluations, weed ecology and control, and wetland surveys and creation in a wide variety of ecosystems from high alpine to arid lands and riparian areas. She has an M.S. degree in Biological Science with an emphasis in plant ecology from the University of Denver and a B.A. in Biology from the Colorado College.

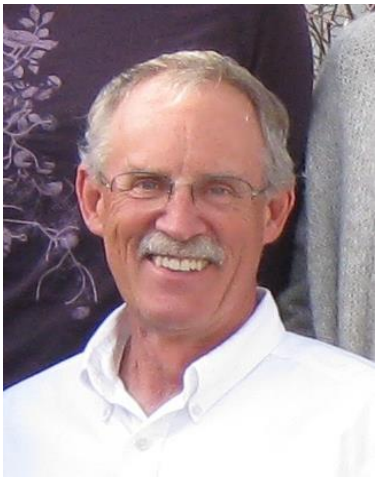
Ramon Braga is Agronomist and works at Environmental Department of Vale Company in Belo Horizonte, Minas Gerais State. Brazil

Carol Brown received a Bachelor of Science in Food, Agricultural, and Biological Engineering at The Ohio State University in 2011. Currently she is attending West Virginia Un iversity in the Plant and Soil Science division for a Master's degree in Soil Science. Under the advising of Dr. Jeffery Skousen, her Master's thesis is on the growth of switchgrass for biofuel production on reclaimed surface mines in West Virginia.

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.

Charles Bucknam Bio and photo is not available

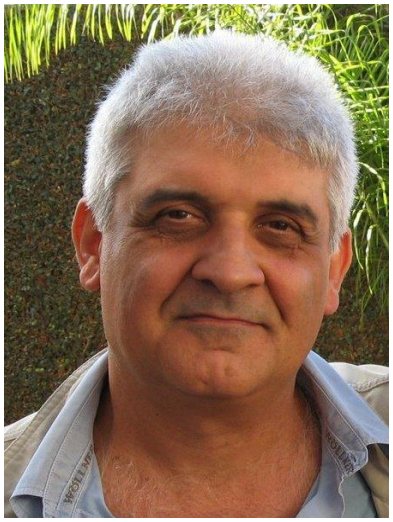
Caitlin Byrne is a graduate of the Department of Biology at Bowling Green University, Ohio. After graduation she was an intern at The Wilds, an innovative non-profit conservation organization located on 3,700 hectares of reclaimed mine land in Cumberland, Ohio. Currently, she is the Conservation Science Technician at The Wilds Conservation Science Training Center.



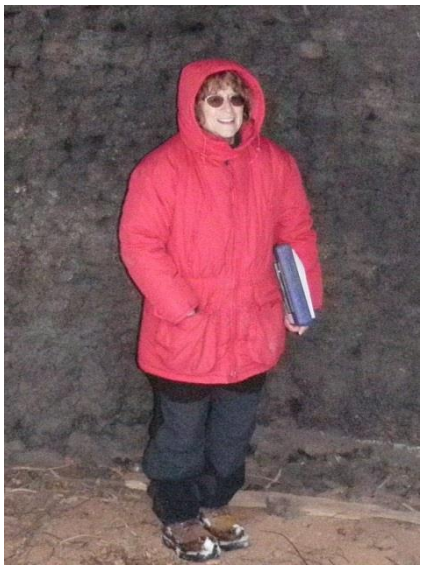
Kenneth E. Carlson is the Principal Soil Scientist and Owner of Habitat Management, Inc. a natural resource and environmental consulting company based in Colorado. He is a Certified Professional Soil Scientist with over 30 years of environmental permitting and operational experience in the mining, electric utility, waste disposal and land development industries specializing in environmental resource issues and projects including RCRA-equivalent soil covers, baseline data collection and assessments, EIS, reclamation success evaluations, closed mine management, reclamation liability releases, noxious weed control, and environmental compliance and audits. Ken hold an M.S. degree from Colorado State University in Agronomy and Soil Science with a concentration in disturbed land reclamation and B.A. in Biology from St. Olaf College.

Mariana da Rosa is an undergraduate student in the Agricultural and Environmental Engineering Department at the Federal University of Viçosa (UFV), Minas Gerais, Brazil. As a participant in the Brazilian *Science Without Borders* program, she studied abroad at the University of Kentucky for one year where she made the Dean's List each semester. Mariana is the recipient of the American Society of Mining and Reclamation 2013 Outstanding Undergraduate Oral Presentation.

Cliff Denholm is an Environmental Scientist with Stream Restoration Incorporated, a non-profit organization as well as with BioMost, Inc., a for-profit environmental design and construction company. Cliff is also an active member of the Slippery Rock Watershed Coalition. For the past 12 years, Cliff has been dedicated to assisting watershed organizations to restore streams impacted by abandoned coal mines through land reclamation practices and the installation and operation & maintenance of passive treatment systems. He is focused on developing and improving water treatment technology, resource recovery of metal treatment sludge, providing technical assistance to watershed organizations and education and outreach for people of all interest levels. Cliff is also an administrator and co-developer of the website Datashed (www.datashed.org), which provides a free, GIS-enabled, database for passive treatment system information.

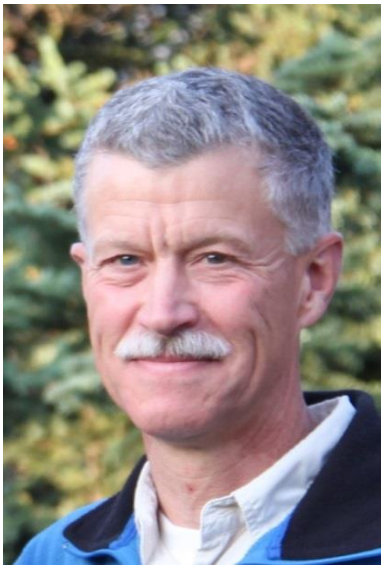


Luiz Eduardo Dias is a Professor at the Federal University of Viçosa. He is Agronomist and he has an D.S. degree in Soil Science and Plant Nutrition. Luiz has collaborated in the implementation of post-graduation programs in other institutions. Main focus of research is Land Reclamation, with emphasis on environmental recovery of areas degraded by mining. Other lines of research are nutrition of forest species, arsenic dynamics in soil-plant system, selection of species for phytoremediation of arsenic contaminated areas, mitigation of acid mine drainage from sulfides substrates and agricultural use of industrial waste.



Margaret Hensley Dunn, P.G., C.P.G. is a co-founder and President of BioMost, Inc. and founder of the nonprofit, Stream Restoration Incorporated. With over three decades of experience in mining and reclamation, Margaret has been dedicated to the development and implementation of sustainable approaches relating to abandoned mine water treatment for the last 15 years. These efforts have resulted in the issuance of four US Patents. Project efforts also include the recovery and commercial use of metal-bearing material (sludge) from passive treatment systems with all profits returned to small watershed groups and the use of treatment system effluent for micro-hydropower generation. Margaret received degrees in geology from Florida State University (BS) and Virginia Polytechnic Institute (MS).

Cyril Fleurant has an undergraduate degree in applied geology from the University of Bordeaux. He has a Master degree and a D.Phil. on quantitative hydrology and hydrogeology from MinesParisTech (Paris). He held several teaching and research positions at University of Nantes, Ecole des Mines de Nantes and AgroCampus Ouest. Since 2012 he has been a full professor at the University of Angers (France) - Department of Geography. Prof. Fleurant's research is pluridisciplinary within the research group Coast - Environment - Remote Sensing - Geomatics (UMR CNRS 6554) and involves projects on geomorphology, hydrology and hydrogeology. In recent years, he focused on specific themes: landscape evolution model models, rainfall-runoff model, and modeling relationships between landforms and biophysical flux.



Thomas C. Griggs is involved in forage and grassland management research and teaching as Assistant Professor of Agronomy at West Virginia University. His interests include plant-animal interactions in pastures, forage quality evaluation, pasture botanical composition, extended-season grazing to reduce hay-feeding costs, winter and early-season grazing impacts on pasture productivity, root responses to pasture management, bioenergy feedstock production and composition, and the broad range of ecosystem services that grassland agriculture provides. Tom grew up in Vermont and has also been active in forage and grassland management research, teaching, and Extension in Idaho, Utah, and Washington.

James Gusek Bio and photo is not available

Brady Gutta Bio and photo is not available

Charlene Hager Bio and photo is not available

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Photo is not available.

Shivanand Hiremath is a research molecular biologist in the "Genetics, Biological Control, and Management of Invasive Species" unit in Delaware, OH. His primary research focuses on understanding the molecular mechanisms mediating the formation and functioning of ectomycorrhizae. His work involves identification and utilization of suitable mycorrhizal fungi in restoration of the American chestnut and reforestation of reclaimed mined lands. He received his PhD from the National Chemical Laboratory, India, and a BSci in chemistry from the Karnatak University, India. He joined the Forest Service in 1988.

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.

Zoe Isaacson is a Project Manager and Reclamation Specialist with the Abandoned Mine Land Program of New Mexico. She has a B.S. in Land Rehabilitation from Montana State University and is currently finishing her M.S. in Water Resources from the University of New Mexico. Zoe has worked with the AML Program since 2009, and continues to manage projects throughout the State of New Mexico.

Gabe L. Johnson is an Environmental Engineer working at the Cloud Peak Energy Spring Creek Mine in Decker Montana and has been working there since 2006. He received his Bachelors of Science degree in Environmental Engineering from Montana Tech in Butte Montana. His interest areas are mine reclamation and ecology restoration. He is active in the Montana Coal Council working with other Montana coal mines and the Montana Department of Environmental Quality to improve reclamation techniques.

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Wade Lehmann has a Bachelor of Landscape Architecture and a Master of Art in Environmental Design from Michigan State University. Wade's graduate thesis involved using fractal equations for replicating natural tree stand patterns for a reclaimed surface mine in northern Michigan. He is currently working as a landscape designer in southeast Michigan specializing in landscape construction and native planting. Wade has always had a special relationship with nature and enjoys working in a profession, which allows him to connect the built and natural environment.

Kirsten Lehtoma is a biological technician with the Northern Research Station of the USDA Forest Service. She is working on introducing ectomycorrhizae t o potentially blight-resistant American chestnut hybrids to improve their success on reclaimed mined land. She previously worked on cloning gypsy moth genes and a human growth factor gene. She holds an M. S. in Zoology from Miami University and a B. A. in biology from Hiram College.

Luís Loures is a Landscape Architect, Professor both at the Polytechnic Institute of Portalegre and at the University of Trás-os-Montes e Alto Douro, who holds a Ph.D. in Urban Planning. Since he graduated he has published several per reviewed papers at the national and international levels and he has been a guest researcher/lecturer at different Universities as is the case of Michigan State University (USA), University of Toronto (Canada), Letterkenny Institute of Technology (Ireland), among others. He is a researcher both at the CIEO - Research Centre for Spatial and Organizational Dynamics – University of Algarve, and the C3I - Interdisciplinary Coordination for Research Innovation - Polytechnic Institute of Portalegre, where he collaborates with scholars and practitioners on financed research projects focusing subjects connected with urban planning, urban redevelopment, landscape architecture, public participation, and sustainable development.

Kate Malers, PE is a project engineer at Water & Earth Technologies, Inc. in Fort Collins, Colorado. She specializes in surface water assessment, monitoring and modeling and has worked on mining, reclamation and flood detection and response projects in the U.S. and in Latin America. She has conducted engineering analyses of hydrologic data, modeled natural channels as well as design channels and hydraulic structures, assessed watershed characteristics, optimized hydropower operations and provided project documentation and technical writing for permits, impact assessments, flood response plans and Users' manuals. She has B.S. and M.S. degrees in Civil Engineering from Colorado State University.

Mike Marra Bio and photo is not available

Andrew McDowell is a landscape architect, having received his degree from Michigan State University in 2009, and more recently, his professional certification as a Licensed Landscape Architect in February 2013. Currently, he works for Cardno JFNew, an ecological design firm specializing in sustainable storm water management, native plant design and installation, ecological restoration, and environmental conservation. In addition to the challenges he pursues at work, Andy enjoys participating on several committees promoting landscape architecture and ecological solutions. His contributions include standing editor of SITES (a quarterly publication of the Michigan Chapter of the American Society of Landscape Architects); and committee member of the Belle Isle Conservancy's (BIC) Island Stewardship Environmental Conservation Committee (ISECC).

Anna Moderski works as an environmental process engineer for Golder Associates, Inc in Denver, CO. She received her BS in environmental engineering with a major concentration in water and wastewater treatment from Rutgers University. Her previous experience includes passive and active water treatment projects. Ms. Moderski has worked on projects that have encompassed a variety of contaminate types including metals, inorganic compounds, high dissolved solids, oil and grease and organic compounds. She has experience developing process solutions for complex water management problems, including bench and pilot plant studies, including the evaluation of processes and economics for treatment of industrial, hazardous, and radioactive waste. She is active in research and outreach concerning treatment of water, and water resource management and protection.

Richard Prodgers Bio and photo is not available

Lina Andrade Lobo de Rezende is Forest Engineer, graduated at the Universidade Federal de Viçosa (UFV). Has a master's degree by Soils and Plant Nutrition Program of UFV in environmental impacts caused by land use and their remedies. She is currently a doctoral student in the same program and develops research in recovery and ecological restoration of altered habitats by mining activity.

Mauro Lobo Rezende is a Forest Engineer, graduated at the Universidade Federal de Viçosa (UFV) and works at Environmental Department of Vale Company in Belo Horizonte, Minas Gerais State. Brazil.

Philip L. Sibrell is a research engineer with the U.S. Geological Survey, at the Leetown Science Center in Kearneysville, WV. He is currently investigating limestone-based remediation of acid mine drainage and application of acid mine drainage residuals to removal of phosphate from wastewater. Prior to his employment with the USGS, Dr. Sibrell worked at the U.S. Bureau of Land Management, the U.S. Bureau of Mines, and in the mining industry, as an engineer conducting research in resource recovery and environmental restoration. He received his B.S. from the Colorado School of Mines, and M.S. and Ph.D. from the University of Utah, all in Metallurgical Engineering.

Jeff Skousen received his B.S. and M.S. from Brigham Young University and PhD from Texas A&M University. He is a professor of soil science and reclamation specialist at West Virginia University. He served as President of ASMR in 1991 and 2004, organized the 1990 and 2004 ASMR annual meetings, and edits the Society's Reclamation Matters magazine. He has published over 150 articles on reclamation and acid mine drainage, teaches a course in reclamation and has advised over 30 graduate students.

Richard Spotts, P.E. is the Principal Engineer and Owner of Water & Earth Technologies, Inc. in Fort Collins, Colorado. He has more than 35 years of experience in surface and ground water hydrology, water quality and quantity monitoring, and environmental impact assessment. He has provided technical and managerial support on several hundred projects involving natural resources throughout the U.S. and overseas. His areas of expertise include conceptual and physical water quality modeling, physical hydrology, soil erosion/conservation, sedimentology, mined land reclamation and mine road construction. Mr. Spotts has used numerous modeling tools to evaluate reclamation and closure scenarios for surface-mined lands, heap-leach and tailings facilities, waste rock and overburden dumps, pit backfills, landfills, and other types of land disturbance and reclamation. He received his B.S. in Civil Engineering from Colorado State University.

Tara Tafi earned a BS in Geology, Colorado State University, 2001 and a MS Land Rehabilitation, Montana State University, 2006. She works at Colorado Division of Reclamation, Mining, and Safety Environmental Protection Specialist/Project Manager 2008-present. Previous work included environmental consulting in Bozeman, Montana, and GIS work for the Big Sky Water and Sewer District in Big Sky Montana.

Ryan Wade, P.E. is a project engineer at Water & Earth Technologies, Inc. who specializes in geomorphic landform design and channel restoration. He has expertise with engineering analysis and design for sediment and hydraulic control structures as well as experience installing and maintaining hydro-meteorological monitoring instrumentation. He has worked on projects in the U.S., Central and South America and Australia. He received his B.S. in General Engineering, Civil Option from Montana Tech.

Richard Warner is an Extension Professor in the Biosystems and Agricultural Engineering Department at the University of Kentucky. His applied research program encompasses hydrology and sedimentology of large-scale land disturbance with an emphasis on cost-effective passive and active control systems that are synergistically integrated to achieve sustainable environmental results. As an advisor to major international mining firms he has been instrumental in reducing business risk through applications of this systems approach.

Dr. Tom Wildeman has been teaching, doing research, and consulting for over 45 years and is currently professor emeritus of Chemistry and Geochemistry at the Colorado School of Mines. He and Jim Gusek from Sovereign Consulting have been developing passive treatment systems for 25 years. Both have published many papers in ASMR Proceedings. Along the way, they have twice been awarded the Colorado and National award from the Consulting Engineers Council in the environmental engineering division for work on passive treatment. In 2006, Tom was awarded Researcher of the Year by the American Society of Mining Reclamation. In this study, they have teamed with Charles Bucknam from Newmont to determine whether passive treatment will work on the nitrogen species contained in a drain down solution from a heap leach pad.