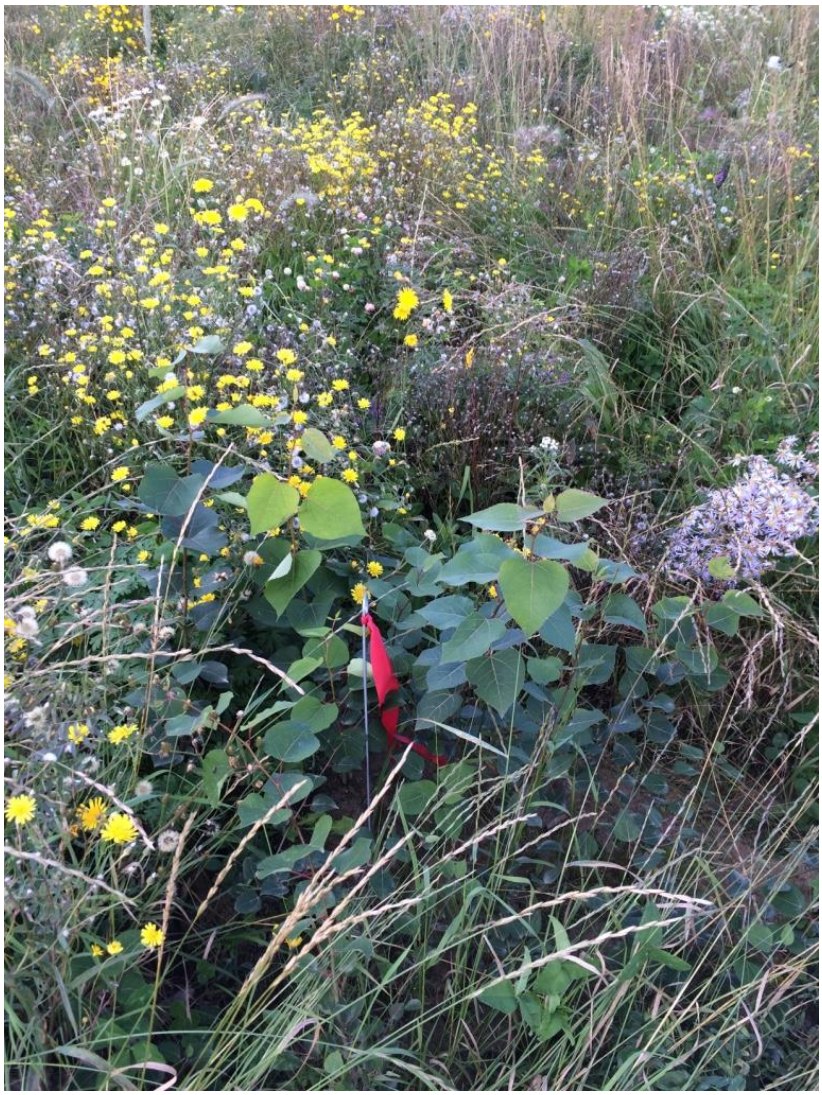
Journal of The American Society of Mining and Reclamation (JASMR)



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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 are welcome. These papers emphasize changing approaches to the science and technology of landscape revitalization. We strive to have them reviewed within 6 weeks.

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

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

Cover photo is curtesy of Dr. Amanda Schoonmaker with the Northern Alberta Institute of Technology showing the effect of cluster treatments with significantly greater aspen cover

Manuscripts are submitted electronically to Dr. Richard Barnhisel at asmrjournal@twc.com or r.barnhisel@twc.com

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ABSTRACTS OF PAPERS
RESEARCH PAPERS

SULFATE REMOVAL IN BIOCHEMICAL REACTORS AND SCRUBBERS TREATING NEUTRAL LOW-METAL CONCENTRATION MIW[1]

Guadalupe Fattore,[2] James Gusek,[3] Thomas Clark,[4] and Lee Josselyn[3]

Abstract. Sulfate and metals are commonly found in mining influenced water (MIW). A biochemical reactor (BCR) is an established technology that can remove sulfate and metals. Three organic mixtures were bench-tested for approximately six months to decrease sulfate concentration in a circum-neutral pH MIW containing low metal concentrations. Organic materials included wood pellets, oat straw, biochar, and manure as an inoculum. These were blended with limestone-dolomite sand. Additionally, sulfide polishing units (SPUs), which were charged with native soil from the site, zero valent iron (ZVI), or magnetite, were evaluated for removal of dissolved sulfide discharged from each of the BCRs. Median MIW influent contained about 3000 mg/L of sulfate and very low concentrations of metals. The flow rates varied from 144 to 1,231 mL/day. Among all the BCRs tested, the hydraulic retention times varied from 5 to 75 days. All BCRs demonstrated similar removal rates of about 1.3 (BCR 1), 1.4 (BCR 2), and 1.6 (BCR 3) mol SO_4^{-2}/m^3-day during the last week of testing. While the SPUs removed dissolved sulfide from the BCR effluents as expected, they removed sulfate as well. Dissolved organic carbon in the BCR effluents promoted sulfate-reducing microbial activity in the SPUs where the inorganic materials functioned as a solid support for the microbial community. The magnetite was not an effective medium for post-BCR sulfate removal. Sulfate removal efficiencies in the BCRs were 55% (BCR 1), 57% (BCR 2), and 67% (BCR 3) during the final week of the bench-scale testing. Sulfate removal in the SPUs (from the BCRs effluents) was 35% and 37%, for SPU 1 and SPU 2, respectively. Novel reactor charging configurations in single units may therefore be much more effective and efficient than approaches exclusively using lignocellulosic or inert supports. Sulfate reducing microbial populations were still increasing when the test was concluded.

Additional Key Words: BCR; Sulfate; Organic Mixture.

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[1] Paper presented at the 2017 National Meeting of the American Society of Mining and Reclamation, Morgantown, WV ***What's Next for Reclamation*** April 9-13, 2017. R.I. Barnhisel (Ed.) Published by ASMR, 1305 Weathervane, Champaign, IL 61821

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Click below for full paper or on the DOI.

http://www.asmr.us/Publications/Journal/Vol 6 Issue 2/Fattore-CO.pdf

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GEOMORPHIC LANDFORM DESIGN PRINCIPLES APPLIED TO AN ABANDONED COAL REFUSE PILE IN CENTRAL APPALACHIA[1]

Leslie C. Hopkinson[2], Jeffrey T. Lorimer, Jeffrey R. Stevens, Harold Russell, Jennifer Hause, John D. Quaranta, Paul F. Ziemkiewicz

Abstract. Geomorphic landform design is a reclamation technique that may offer opportunities to improve aspects of mine reclamation in Central Appalachia. The design approach is based on constructing a steady-state, mature landform condition and takes into account the long-term climatic conditions, soil types, terrain grade, and vegetation. Geomorphic reclamation has been applied successfully in semi-arid regions but has not yet been applied in Central Appalachia. This work describes a demonstration study where geomorphic landforming techniques are being applied to a coarse coal refuse pile in southern West Virginia, USA. The reclamation design includes four geomorphic watersheds that radially drain runoff from the pile. Each watershed has one central draining channel and incorporates compound slope profiles similarly to naturally eroded slopes. Planar slopes were also included to maintain the impacted area. The intent is to reduce infiltration rates which will decrease water quality treatment costs at the site. The excavation cut and fill volumes balanced to approximately 250,000 yd^3. This volume is comparable to those of more conventional refuse pile reclamation designs. If proven successful then this technique can be part of a cost-effective solution to improve water quality at active and future refuse facilities, abandoned mine lands, bond forfeiture sites, landfills, and major earthmoving activities within the region.

Additional Key Words: demonstration site, channel design, short paper fiber

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[1] Paper presented at the 2017 National Meeting of the American Society of Mining and Reclamation, Morgantown, WV ***What's Next for Reclamation*** April 9-13, 2017. R.I. Barnhisel (Ed.) Published by ASMR, 1305 Weathervane, Champaign, IL 61821.

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http://www.asmr.us/Publications/Journal/Vol 6 Issue 2/Hopkinson-WV.pdf

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CLUSTER PLANTING: EARLY ENHANCEMENT OF STRUCTRUAL DIVERSITY IN A RECLAIMED BOREAL FOREST [1]

Bradley D. Pinno, [2] Amanda Schoonmaker, Çağdaş Kera Yücel, and Robert Albricht

Abstract: Planting trees is an important step in re-establishing functioning forest ecosystems after industrial land disturbances. Conventional planting practices create forests with evenly spaced trees, at low density, which maximizes individual tree growing space but delays the time until crown closure, potentially for decades. In this study, the first operational cluster planting trial for reclaimed boreal forest, we examined first year tree growth and vegetation competition results of a cluster planting trial in which trembling aspen (*Populus tremuloides*) trees were planted in clusters of 4, 10, or 20 trees with an internal spacing of 0.25 m along with non-clustered controls. Clustering of aspen seedlings had a measurable impact on the relative proportions of tree and competing vegetation cover with increased tree cover and decreased forb cover in the 10 and 20 seedling clusters compared to the controls. Average seedling height and first year height growth were similar across all cluster treatments but tended to be higher in the clusters, likely due to the suppression of competing vegetation. Operationally, there are still many questions to be answered before this practice can be implemented in a large scale across the landscape. However, based on our initial results, we believe that cluster planting has the potential to become a valuable tool for reclamation practitioners.

Keywords: trembling aspen, oil sands reclamation, Alberta, spatial patterns, plant competition

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[1] Poster presentation at the 2017 Paper presented at the 2017 National Meeting of the American Society of Mining and Reclamation, Morgantown, WV ***What's Next for Reclamation*** April 9-13, 2017. R.I. Barnhisel (Ed.) Published by ASMR, 1305 Weathervane, Champaign, IL 61821.

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ADVANCEMENTS IN GEOMORPHIC MINE RECLAMATION DESIGN APPROACH, WYOMING ABANDONED MINE LAND, LIONKOL COAL MINING DISTRICT, SWEETWATER COUNTY, WYOMING[1]

Harold J. Hutson,[2] and Robert W. Thoman

Abstract: Following the successful pioneering of Natural Regrade™ technology for geomorphic surface mine reclamation efforts in WY in 2007, the Wyoming AML Division and their Project Engineer, BRS, Inc. of Riverton, WY, applied this surface reclamation approach to the Lionkol Project located near Rock Springs, WY, in Sweetwater County.

The Lionkol Project is located within a historic coal mining district that was extensively mined underground from the early 1900's through the 1940's, then followed by open pit mining that continued into the early 1970's. The project was completed in four phases over a 6-year period, with the final phase completed in the fall of 2013. The project reclaimed 320 acres of intensely disturbed mine lands including 5 miles of degraded mainstream drainages.

The Lionkol Project fully implemented methods in geomorphic mine land reclamation to achieve a sustainable reclaimed landscape that blends with native topography and provides for long-term erosional stability. The project addressed hazards and environmental degradation related to historic surface and underground coal mining while preserving historic features. Design challenges, modifications in design approach, and innovations are discussed as well as performance evaluations of the channels and a summary of lessons learned for future efforts.

Additional Key Words: Natural Regrade, erosion, channel stability

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[1] Presented at the 2013 National Meeting of the American Society of Mining and Reclamation, Laramie, WY. **Reclamation Across Industries** June 1 - 6, 2013. R.I. Barnhisel (Ed.) Published by ASMR, 1305 Weathervane Dr., Champaign, IL 61821.

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GEOCODING LOCATIONS OF HISTORIC RECLAMATION RESEARCH SITES USING GOOGLE EARTH[1]

Ruopu Li[2] and Kaitlyn Holtsclaw

Abstract: The American Society of Mining and Reclamation (ASMR) has been publishing conference proceedings and journal articles on land reclamation and the protection of soil and water resources for more than three decades. Much of the technical work presented in the ASMR conferences and journals contain specific mining sites that are associated with geographic locations. However, the geographic contexts of these articles were often not made directly available to the readers. This deficiency affects the abilities of related professionals to explore the technical reclamation knowledge in terms of its geographic background. Therefore, it is critical to develop quality-assured geographic references to the papers published by ASMR. This study used Google Earth and ArcGIS software to create a series of placemarks that link past ASMR technical articles to the actual locations. These placemarks can be freely distributed and integrated into the website for web map display.

Key Words: ASMR, geocoding, ArcGIS, placemark, and Google Earth

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[1] Paper submitted to JASMR for work done for the ASMR in geocoding locations of historic reclamation research sites that had been presented separately to the ASMR between 1988 and 1997.

[2] Ruopu Li, Ph.D., Assistant Professor, Department of Geography & Environmental Resources Southern Illinois University-Carbondale, IL 62901; and Kaitlyn Holtsclaw, Department of Plant Biology, Southern Illinois University- Carbondale, IL 62901.

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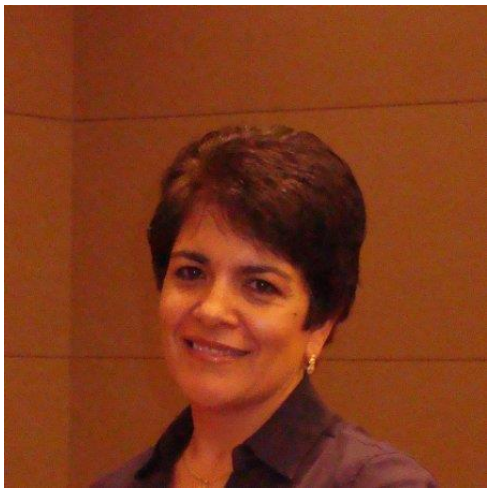
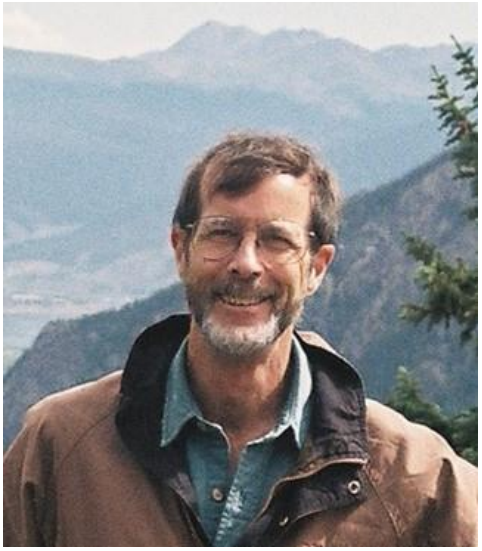
Thomas R. Clark, Ph.D. completed his doctoral degree in Biology in 1991 at Rensselaer Polytechnic Institute in Troy, New York. Dr. Clark has almost 25 years of experience directly related to metal sulfide biooxidation in applications such as feedstock desulfurization, extraction of base metals, pretreatment of refractory ores or concentrates containing precious metals and source control in acid mine drainage. He is co-inventor on patents for microbial production of epoxide chemical feedstocks, molybdenum sulfide biooxidation and biofuel production. For five years, he has been Owner and Director of Solfatara Laboratories LLC in Golden, Colorado, USA.



Ms. Guadalupe Fattore, is a Senior Engineer with Sovereign Consulting Inc. and is based in Lakewood Colorado. She graduated from the Instituto Tecnológico de Chihuahua, Chih., Mexico in 1987 with a B.Sc in Chemical Industrial Engineering and she received her master's degree in Environmental Science and Engineering from the Colorado School of Mines in 2004. Her expertise includes acid rock drainage prediction, evaluation, and treatment (with passive treatment technologies) along with geochemical speciation and geochemical characterization of waste rock, pits, and tailings facilities. Her most recent experience includes working on about 15 projects throughout the U.S. and internationally that encompassed the design of passive treatment systems and ARD prevention. She is fluent in Spanish, English and Italian



Mr. James Gusek P.E. is a chief engineer with Sovereign Consulting Inc. and is based in Lakewood, Colorado. He graduated from the Colorado School of Mines in 1973 with a B.Sc. in Mining Engineering. He specializes in the design of passive treatment systems for mine influenced water. Since 1987, his work with acid rock drainage prevention and passive water treatment systems has included about 85 projects throughout the U.S. and internationally. He is on the steering and mitigation committees of the Acid Drainage Technology Initiative - Metal Mining Sector (ADTI-MMS).

He is honored to have been recognized as the ASMR Reclamationist of the Year in 2008 and the ASMR Researcher of the Year in 2014. He is a founding member and former president of the Denver Professional Chapter of Engineers Without Borders.

Mr. Lee P. Josselyn is a civil/environmental professional engineer, project and office manager for Sovereign Consulting Inc. in Lakewood, CO. A graduate of Colorado School of Mines (MS) and Colorado State University (BS) with over 30 years of experience in all phases of design, construction, and operation and maintenance (O&M) for water treatment and environmental projects. His career started in the Civil Engineer Corp with the US Navy on Guam and included a tour in the Gulf War. He has been the lead engineer and/or manager for several multi-million-dollar projects including design-build, facility upgrades/optimizations, plant controls/commissioning, and O&M services. Mr. Josselyn is a fourth generation Colorado native who owns cabins in the Arapahoe National Forest listed on the National Historic Register, an outdoor enthusiast and father of two.

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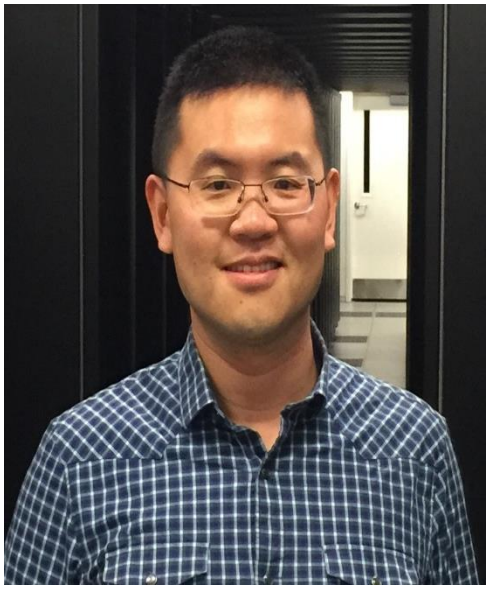
Mr. Harold J Hutson is a senior project engineer with BRS, Inc., a natural resources consulting firm located in Riverton, Wyoming. Mr. Hutson holds a Bachelor of Science in geological engineering from the Colorado School of Mines and is a Professional Engineer and Professional Geologist registered in Wyoming. Mr. Hutson is a Registered Member of the US Society of Mining Engineers (SME) and a Qualified Person as defined by Canadian National Instrument 43-101. Mr. Hutson has 22 years' experience in mine land reclamation, mine permitting, and geological engineering.

Dr. Ruopu Li is an assistant professor in the Department of Geography and Environmental Resources at Southern Illinois University-Carbondale. He received his Ph.D. degree in Natural Resources Science from the University of Nebraska-Lincoln in 2012. He teaches undergraduate and graduate courses on Geographic Information Systems (GIS). His research interests include spatial analysis and modeling, water resource planning and management, and land use modeling



Jeff Lorimer, P.E. is a Fuel and Water Resources Engineer at Tri-State Generation & Transmission. Prior to his current position, he worked as a graduate research assistant in Civil and Environmental Engineering at West Virginia University and studied the application of geomorphic reclamation in West Virginia. He received his B.S. in Civil Engineering, B.S. in Mining Engineering, and M.S. in Civil Engineering at West Virginia University.

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Dr. Harold Russell is a Civil Engineer with West Virginia University performing slope stability research. He earned his B.S., M.S., and Ph.D. in Civil Engineering at West Virginia University.

Dr. Amanda Schoonmaker obtained a BSc in Forest Sciences from the University of British Columbia in 2006 and completed a PhD in Forest Biology and Management at the University of Alberta in 2013. She joined the Northern Alberta Institute of Technology in 2011 as a Reclamation Field Research Coordinator. In 2015, she was awarded a 5-year renewal federal research chair grant by the National Sciences and Engineering Research Council (NSERC). Her research program is focused on methods and practices of reclamation and reforestation of upland landscapes. This includes testing methods of soil adjustment and preparation, developing appropriate sequencing of vegetation management options, and testing suitability of herbaceous cover crops and deployment of woody species.

Mr. Jeffrey R. Stevens is a Civil Engineer with the USACE Southwestern Division Dam Safety Production Center in Tulsa, OK. He received his B.S. in Civil Engineering, B.S. in Mining Engineering, and M.S. in Civil Engineering at West Virginia University.

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Dr. Paul F. Ziemkiewicz is the Director of the West Virginia Water Research Institute at West Virginia University. Dr. Ziemkiewicz's responsibilities focus on addressing high priority environmental issues by developing research opportunities, assembling and managing research teams, and responding to the needs of sponsors. In addition to his research roles, Dr. Ziemkiewicz serves on both state and federal policy advisory committees focusing on energy and water. He holds a Bachelor's in Biology and a Master's in Range Ecology from Utah State University, and Doctorate in Forest Ecology from the University of British Columbia.