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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.

Cover photo are courtesy of Mr. Eric E. Cavazza, Director, Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation, Harrisburg, PA 17106

Manuscripts are submitted electronically to Dr. Robert Darmody, University Illinois at rdarmody@illinois.edu

Style Guide for Authors: Manuscript preparation guide is available at:
<http://www.asrs.us/Publications/Journal/Manuscript%20Guidelines%20Journal.pdf> Which is preferred or
<https://www.soils.org/files/publications/style/chapter-01.pdf>

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Click below for full paper.

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Eric E. Cavazza², John J. Stefanko, and Richard L. Beam

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Eric E. Cavazza², John J. Stefanko, and Richard L. Beam.

Click below for full paper.

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ABSTRACTS OF PAPERS
Research Papers

**SOIL BASED VEGETATION PRODUCTIVITY MODELS FOR
RECLAIMING NORTHERN MICHIGAN LANDSCAPES: A
MONOGRAPH¹**

Dustin L. Corr², Jon Bryan Burley, Bert Cregg, and Robert Schutzki

Abstract. Scholars, governmental agencies, and concerned citizens are interested in developing empirical predictive models to quantitatively assess the vegetative productivity potentials of reconstructed soils (neo- sols). This research presents equations for a northern Michigan mining region in the Upper Peninsula of Michigan, based on data derived from the National Resources Conservation Service. We employed principal component analysis to develop models to predict the vegetative productivity of corn, corn silage, oats, alfalfa/hay, Irish potatoes, red maple (*Acer rubrum* L.), white spruce (*Picea glauca* [Moench] Voss), red pine (*Pinus resinosa* Aniton), eastern white pine (*Pinus strobus* L.), jack pine (*Pinus banksiana* Lamb.), and lilac (*Syringa vulgaris* L.). Soil attributes that were examined in this research include: available water holding capacity, moist bulk density, % clay, % rock fragments, hydraulic conductivity, % organic matter, soil reactivity, % slope, and topographic position. Four predictive equations based on landscape topography have been developed and are described as an all-mesic woody plant and crop equation, a xeric equation, an equation specific to jack pine, and a wet environment equation. The models were highly significant ($p < 0.0001$) and explained 87.93%, 74.52%, 65.33%, and 87.68% of the variation in site productivity of the respective landscape setting. These equations are intended to assist in efforts to assess the vegetative productivity potentials of reconstructed soils on post-mined landscapes and other disturbed landscapes.

Additional Key Words: environmental design, forestry, soil science, landscape architecture, agronomy, horticulture.

¹ Manuscript was submitted for consideration for publication in JASMR R.I. Barnhisel (Ed.) Published by ASRS, 1305 Weathervane, Champaign, IL 61821

² Dustin Corr is a landscape architect in the firm of Nederveld, Grand Rapids, Michigan 49594; Dr. Jon Bryan Burley is an Associate Professor, Landscape Architecture, School of Planning Design and Construction, Michigan State University, E. Lansing, Michigan 48824; Dr. Bert Cregg is a Professor of Horticulture, Michigan State University, E. Lansing, Michigan 48824; Dr. Robert Schutzki is an Associate Professor of Horticulture, Michigan State University, E. Lansing, Michigan 48824.

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THREE-DIMENSIONAL SEEPAGE ANALYSIS OF A COAL REFUSE PILE RECLAMATION¹

Iuri Lira Santos², Leslie C. Hopkinson, John D. Quaranta, and Paul F. Ziemkiewicz

Abstract. A coal refuse pile located in Greenbrier County, West Virginia was studied to restrict generation of acid mine drainage through the use of a cap and cover system. This paper presents results of a finite element method seepage analysis on a proposed reclamation design. The proposed reclamation incorporates a cap and cover system with a 0.3-m thick surface vegetation cap layer over a 0.6-m thick low permeability layer. The low permeability layer is directly above the coal refuse. Unsaturated soil mechanics was utilized, adopting the Fredlund and Xing equation for soil-water characteristic curve (SWCC) estimation. SWCC fitting parameters were calculated using the Zapata and the Hernandez estimation techniques. Different precipitation events were used to evaluate seepage throughout the reclamation area and assess the effectiveness of the cap and cover system. A steep area (>4H:1V) and a flat area were considered. The water balance analysis showed a 50% to 88% reduction in water volume at the coal refuse layer and a reduction in the time for the refuse to return to initial water content due to the cap and cover system implementation. Moisture detainment was observed in the growth layer and is important for supporting vegetation persistence.

Additional Key Words: Water balance covers, finite element modeling, unsaturated soil mechanics

¹ Paper presented at the 2019 National Meeting of the American Society of Mining and Reclamation, Big Sky, MT, *The Land of Reclamation Pioneers* June 3 - 7, 2019. R.I. Barnhisel (Ed.) Published by ASMR, 1305 Weathervane, Champaign, IL 61821.

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Case Studies

PENNSYLVANIA'S ABANDONED MINE LAND (AML) EMERGENCY PROGRAM¹

Eric E. Cavazza², John J. Stefanko, and Richard L. Beam.

Abstract. The Pennsylvania Department of Environmental Protection's Bureau of Abandoned Mine Reclamation (BAMR) implements an Abandoned Mine Land (AML) Emergency Program to address high-priority, abandoned mine land (AML) problems that suddenly occur throughout Pennsylvania's coal fields. BAMR maintains two field offices: one in eastern Pennsylvania (Anthracite Region) in Wilkes-Barre and one in western Pennsylvania (Bituminous Region) in Ebensburg. Both field offices maintain in-house construction crews with significant equipment available to respond to and address many small AML Emergencies (hazards) such as pothole (or cavehole), subsidences, and mine drainage breakouts. For larger AML Emergencies such as subsidence events causing structural damage to homes, businesses, and roads; mine fires; coal refuse fires; landslides; or other large-scale or complex AML problems, projects are completed by outside contractors. Project designs are completed by BAMR engineering staff. The contractors are then hired through solicitation of bids or proposals with very short timeframes between bid issue and bid opening. Since October of 2010, BAMR has addressed nearly 800 AML Emergencies which equates to approximately 80 AML Emergency projects each calendar year. The average construction cost to address those emergencies was just over \$3.25 million per year. Due to the increased precipitation over the Commonwealth the last several years, that number has increased to an average of 86 AML Emergency projects over the last five (5) years (2015–2019) with a record number of 127 addressed in calendar year 2018. The average cost to address those AML Emergency projects over that five-year period was \$4.66 million per year. This paper will provide some background on Pennsylvania's AML Emergency Program, some summary statistics including the annual number and types of projects completed including costs, and also highlight through both photos and video links some typical projects recently completed by the program.

Additional Key Words: Mine Subsidence

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² Eric E. Cavazza, P.E., Director, Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation, Harrisburg, PA 17106; John J. Stefanko, Deputy Secretary, Pennsylvania Department of Environmental Protection, Office of Active and Abandoned Mining Operations, Harrisburg, PA 17106; and Richard L. Beam, P.G., Professional Geologist Manager, Pennsylvania Department of Environmental Protection, Bureau of Abandoned Mine Reclamation, Harrisburg, PA 17106.

Click below for full paper. <https://www.asrs.us/Portals/0/Documents/Journal/Volume-9-Issue-4/Cavazza-PA-1.pdf>

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PENNSYLVANIA'S ENVIRONMENTAL GOOD SAMARITAN PROGRAM¹

Eric E. Cavazza², John J. Stefanko, and Richard L. Beam.

Abstract. Pennsylvania enacted an Environmental Good Samaritan Act (PA EGSA) in 1999. The law is intended to encourage landowners and others to reclaim abandoned mineral extraction lands and abate water pollution caused by abandoned mines or orphaned oil and gas wells. The law protects landowners, groups and individuals who volunteer to do such projects from civil and environmental liability under Pennsylvania law. Prior to the PA EGSA, anyone who voluntarily reclaimed abandoned lands or treated water pollution for which they were not liable could be held responsible for treating the residual pollution under Pennsylvania law. This dissuaded people and groups from pursuing these types of projects.

Only projects approved by the Pennsylvania Department of Environmental Protection (PA DEP) prior to construction are eligible for protections under the PA EGSA. PA DEP has developed a project proposal form for participants and landowners. Each proposal must identify the project participants and landowners, describe the location of the project and the environmental problems that will be addressed, and establish a work plan for the proposed project. The PA DEP evaluates each proposal to determine if the project is capable of reclaiming the land or improving water quality. The PA DEP will also advise participants on any permits that may be required. Once the project is approved, PA DEP will maintain a permanent record of the participants and landowners who are protected under the PA EGSA.

Pennsylvanians have undertaken and completed 86 Good Samaritan projects as of December 2019. These 86 projects have been undertaken by 44 different groups/participants and have included local governments, individuals, watershed groups and associations, corporations, municipal authorities, and conservancies. This paper discusses key aspects of the EGSA Program and highlights several successful EGSA projects that have been completed in Pennsylvania.

Additional Key Words: Mine Drainage, Abandoned Mine Reclamation, Oil and Gas Wells

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ABOUT THE AUTHORS

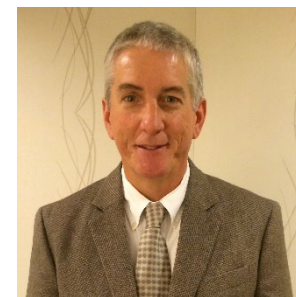
Mr. Richard Beam is a Professional Geologist Manager at the Pennsylvania Department of Environmental Protection's Bureau of Abandoned Mine Reclamation, Rich is responsible for the collection and analysis of surface and subsurface geologic and hydrologic information needed for the development and design of reclamation projects. Rich also provides technical assistance with respect to both passive and active mine drainage treatment projects and for the past 18 years has been an instructor for OSM's National Technical Training Program (NTTP). Rich graduated from the University of Pittsburgh at Johnstown with a B.S. Degree in Geology. He was previously employed, for approximately 3 years, by a Geotechnical Engineering Firm in Pittsburgh Pennsylvania and for the past 34 years has worked for the Pennsylvania Department of Environmental Protection in both the surface coal mining regulatory program and the abandoned mine land program.



Dr. Jon Bryan Burley has been a member of ASRS for almost 40 years and a faculty member at Michigan State University for the last 29 years. He earned his PhD in 1995 from the University of Michigan, in Landscape Architecture where he developed vegetation soil productivity equations for the North Dakota coal fields. He is a Fellow in the American Society of Landscape Architects for his research investigations in surface mine reclamation and visual quality studies. Over a decade ago, he was honored as ASRS researcher of the year. He was also the editor of *Environmental Design for Reclaiming Surface Mines* by the Edwin Mellen Press, an ASRS project in the 1990s. Jon has been teaching in higher education for over 45 years and published his first paper as an undergraduate in 1978. He has lectured at 35 universities around the world, is a Fulbright scholar, and was funded by the French government to conduct landscape research for a year. In addition, he has had 33 visiting scholars and visiting students from China, Japan, Turkey, Portugal, and France to collaborate with him at Michigan State University. He has published approximately 400 articles, book chapters, and abstracts in his career, many of them concerning surface mine reclamation. Jon has served on nearly 70 graduate student committees (10 PhD. and 60 masters) and was the major professor for about half of these graduate students.



Mr. Eric Cavazza is the Director of Pennsylvania's Bureau of Abandoned Mine Reclamation within the PA Department of Environmental Protection. The Bureau administers both the Acid Mine Drainage and Abandoned Mine Land Reclamation Programs. He has over 36 years of service with the Commonwealth and has held many roles within BAMR including the last 9 years as Bureau Director. He has both a Bachelor of Science degree in Mining Engineering and a Master of Engineering degree in Environmental Engineering from the Pennsylvania State University and is a registered Professional Engineer in Pennsylvania.



Dr. Bert Cregg is a Professor of Horticulture and Forestry at Michigan State University. Dr. Cregg's lab conducts research on the physiology and management of trees in landscape, nursery, and Christmas tree systems. He holds a doctorate in Forest Resources from the University of Georgia, an M.S. in Forest Science from Oklahoma State University, and a B.S. in Forest Management from Washington State University. He has published 80 papers in peer-reviewed scientific journals and has written over 200 articles in nursery and landscape-related professional publications and extension outlets and is frequent speaker at nursery, landscape, and arborists conferences. He has served on more than 60 graduate student advisory committees; serving as major advisor for 13 graduate students. Prior to joining the faculty at MSU in 1999, he was a research plant physiologist for the US Forest Service and International Paper. A native of Washington State, Dr. Cregg has had a lifelong love affair with conifers.



Mr. Dustin Corr earned a Bachelor's of Landscape Architecture from Michigan State University in 2010 and a Master's of Arts in Environmental Design, also from Michigan State University in 2012, developing vegetation productivity equations for the Upper Peninsula of Michigan for surface mine reclamation. He is a technically proficient, creative designer with a broad range of experience from park planning to large scale development design. Prior to joining the Nederveld team, Dustin worked for the State of Michigan, Park Planning Department, aiding in the development of the state-wide equestrian trail network plan, safe harbor & boating access plan and visioning for the redevelopment of Belle Isle Park. Subsequently, Dustin transitioned his efforts to bringing innovative design to high-end residential clients in the Chicago area. Joining Nederveld (a surveying, engineering, planning, and design firm from western Michigan) in 2016, Dustin has been involved with designing streetscapes, park, as well as residential and commercial development plans. His public visioning projects, such as the Roosevelt Park Area Specific Plan Charrette, has allowed Dustin to help communities see their potential through his quick illustrative graphics and an eye for detail development. Dustin's work on the Downtown Grand Rapids Streetscape Guidelines have greatly shaped his perspective on urban streets and urban forestry. He continues to apply his passion for the advancement of Grand Rapids through professional and volunteer efforts.



Dr. Leslie C. Hopkinson is an Associate Professor in the Department of Civil and Environmental Engineering at West Virginia University, specializing in water resources. She received her B.S. in Biological and Agricultural Engineering at Louisiana State University and her Ph.D. in Biological Systems Engineering at Virginia Tech. Her research focus is on hydrology, reclamation, and ecological engineering.

Dr. John D. Quaranta John D. Quaranta, Ph.D., P.E. is an Associate Professor with the Wadsworth Department of Civil and Environmental Engineering at West Virginia University. Dr. Quaranta teaches and performs research specialized in geotechnical and geoenvironmental engineering and encompasses slope stability and seepage analysis for landform design, dam safety, and groundwater impacts resulting from mineral, and oil and gas life-cycle phases.



Mr. Iuri Lira Santos is a doctoral Student at WVU with a B.S in Civil Engineering from UPE – Brazil and M.S. in Civil Engineering from WVU and. He works with Dr. John Quaranta in the Geotechnical Engineering group. Iuri's interest are to continue helping the environment through engineering and improve people's quality of life.



Dr. Robert Schutzki is an Associate Professor Emeritus in the Department of Horticulture at Michigan State University. His area of expertise includes: landscape horticulture; characterization of adaptive traits; and plant physiological status during landscape establishment. He earned his PhD in 1988 from Michigan State University and before that degrees at Rutgers University. Dr. Schutzki taught very popular courses in planting design to horticulture and landscape architecture students for many decades and is very active in regional



John J. Stefanko John Stefanko serves as the Deputy Secretary for the Office of Active and Abandoned Mine Operations at the Pennsylvania Department of Environmental Protection (DEP). As Deputy Secretary he oversees the bureaus of Mining Programs, Abandoned Mine Reclamation, Mine Safety, and the District Mining Operations. John has been with the Department since 1987. Prior to his appointment John was the Executive Assistant and served as the senior advisor to the previous Deputy Secretary until his retirement. He has also served as the Chief of DEP's Division of Contracts, Procurement and Bonding within the Bureau of Office Services, where he managed bidding, awarding and management of the activities of all construction contracts and the procurement of goods and services for the Department. Prior to that, he was a Project Designer for the Department's Bureau of Abandoned Mine Reclamation, Division of Acid Mine Drainage Abatement, where he reviewed and created engineering designs for departmental mine reclamation, water supply replacements, mine fire control, subsidence control, abandoned mine lands projects and other associated facilities. John holds an Associate Degree in Mechanical Engineering from Pennsylvania State University, Altoona Campus and Bachelor's Degree in Civil Engineering Technology from the University of Pittsburgh at Johnstown.



Dr. Paul F. Ziemkiewicz received his PhD from the University of British Columbia and an MS and BS from Utah State University in the biological sciences. After graduation he worked for ten years with the Alberta Department of Energy before coming to West Virginia University to serve as director of the Water Research Institute. The Institute develops and carries out environmental research projects in the region and nationally. Research focus areas include management and treatment of waste streams from coal mining and oil and gas development. Major programs include acid mine drainage, coal ash, water use in power generation, rare earth recovery, coal mine reclamation, industrial water treatment and watershed restoration.

