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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.

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https://www.asmr.us/Portals/0/Documents/Journal/Volume-8-Issue-3/Likus-Cieslik-Poland.pdf

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Other Papers

PROTOCOLS FOR MONITORING ECOLOGICAL RECOVERY OF RECLAIMED WELL PADS ON GRASSLANDS

Anne C.S. McIntosh[2], Bonnie Drozdowski[2], Dani Degenhardt[4], Chris B. Powter[5], Christina C. Small[6], John Begg[7], Dan Farr[8], Arnold Janz[8], Randi C Lupardus[8,2], Delinda Ryerson[9], Jim Schieck[3]

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https://www.asmr.us/Portals/0/Documents/Journal/Volume-8-Issue-3/Lupardus-AB.pdf

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ABSTRACTS OF PAPERS
Case Studies

CASE STUDY: APPRAISAL OF FOUR SOIL-BASED METRICS IN THE ESTABLISHMENT OF SUSTAINABLE UPLAND GRASSLAND AT A MINE SITE IN SOUTH WALES, UNITED KINGDOM[1]

R. Neil Humphries,[2] Robert J. K. Thompson, and Mark D. Heames

Abstract: In the United Kingdom, rehabilitated mineral workings are subject to a statutory minimum 5-year period of aftercare management to ensure that the rehabilitated land is of a 'standard' that enables the intended after-use to be "beneficial and sustainable." Aftercare begins on the completion of overburden backfilling, placement of soils, and the required sowing/planting. The current devolved Welsh Government guidance acknowledges that specific standards are difficult to define, so there is reliance on certain management activities having been undertaken, rather than specifying the outcome of evaluative methods. We appraise the application of four soil-based metrics (comprising the description of soil profile physical characteristics, grassland soil physical condition, soil fertiliser requirement, and a measurement of soil health) under operational circumstances at a rehabilitated mine site in South Wales. Here, the aim is to establish a sustainable upland acidic grassland ecosystem and to facilitate release of monies from the financial bond. It is concluded that evaluation of the upland grassland is more realistically and reliably based on determining the physical characteristics of the soil profile than the other three metrics deployed; although there is merit in the use of a more rapid visual assessment method for soil physical condition (VESS) for screening purposes and/or for increasing site coverage at a lower cost, as well as the determination of levels of organic matter and nitrogen mineralisation. The use of the soil profile characteristics metric enabled the planning authority to release the rehabilitated land from the financial bond.

Additional key words: soil profile physical characteristics, VESS, soil fertiliser indices, soil respiration indices, mining permit, release of financial bond

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[1] Oral paper presented at the 2019 National Meeting of the American Society of Mining and Reclamation, Big Sky, MT. Welcome Back to Montana: The Land of Reclamation Pioneers, June 3–7, 2019. Published by ASMR, 1305 Weathervane Dr, Champaign, IL 61821.

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https://www.asmr.us/Portals/0/Documents/Journal/Volume-8-Issue-3/Humphries-Thompson-UK.pdf

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CASE STUDY: EARLY OUTCOMES AND LESSONS LEARNT FROM A RECENTLY TRANSLOCATED WOODLAND ECOSYSTEM[1]

R. Neil Humphries,[2] Aude Delmer, and Geraint Hopkins

Abstract: The translocation of wildlife habitats remains controversial in the UK and as a last resort where prime ecosystems are involved. None is more contentious as those for woodland designated as 'ancient semi-natural woodland' (i.e., have been in situ for some 400 years or more). There are very few accessible and informative first-hand reports of woodland translocation schemes from which to learn. In this paper we discuss the outcomes of the monitoring of vascular plants and invertebrates one year after translocation of part of an ancient semi-natural woodland, following the granting of planning consent to extend a nationally important aggregate resource. The monitoring in the first year following translocation has been of particular importance as it identified that the representative species, which are needed to re-establish and develop into similar woodland communities to those of the donor, are present. It demonstrates that the physical translocation of the 'whole woodland' vascular plant assemblage is more feasible than previously canvassed, and something that is equivalent to familiar woodland practices of clear-felling operations or coppice rotations. It also determined the need and focus for the proactive control of invasive species that will be needed to achieve the longer-term objective in the vicinity of both the donor woodland and the receptor site, prior to, during and after translocation. The findings are timely and of relevance, beyond the mineral extraction industry, to infrastructure and other built developments involving important woodland ecosystems.

Additional Key Words: aggregate quarries, *Quercus* woodland, invasive plant species, seed bank, proactive management

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[1] Oral paper presented at the 2019 National Meeting of the American Society of Mining and Reclamation, Big Sky, MT. Welcome Back to Montana: The Land of Reclamation Pioneers, June 3–7, 2019. R. I. Barnhisel (Ed.) Published by ASMR, 1305 Weathervane Dr., Champaign, IL 61821.

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Research Studies

RESPONSE OF PLANT AND ARANEAE COMMUNITIES TO FOREST RESTORATION ON RECLAIMED MINE LAND[1]

Craig Malone[2], Rebecca Swab, and Alexys Nolan.

Abstract: During post surface mining for coal in the 1940s-1960s in the Appalachian region, much of the land was returned to forest either through reclamation or through natural succession. While these forests successfully established in many places, even decades later the understories often lack native understory species, and instead are dominated by invasives. There is also anecdotal evidence of a lack of regeneration of the canopy tree species. This study was conducted to evaluate the success of restoration efforts focused on understory improvement on forested reclaimed mine land in Southeast Ohio specifically focusing on Araneae and plant populations. Three different treatments were studied: managed forest with invasive species removal, managed forest with invasive species removal and subsequent native plantings, and forest that was unmanaged as a control. The first growing season after treatments, Daubenmire vegetation surveys and Rapid Upland Forest Assessments (RUFAs) were used to observe plant percent cover, species richness, Shannon-Wiener diversity, and forest health metrics among treatments. Web misting and pitfall trapping were used to observe the number of Araneae species as well as overall abundance. Plant species richness and diversity was greatest in the managed forest plots where natives were planted, followed by the managed forest plots where only invasives were removed, and lowest in the unmanaged forest where no restoration work occurred. Native plant cover in the understory and RUFA scores, an indicator of forest health, did not significantly differ between the managed and unmanaged forest. Araneae abundance and species richness were greater in the unmanaged forest. Findings indicate that invasive species removal and native plantings can have a positive impact on vegetation communities within 6-12 months after implementation. However, continued monitoring is necessary to assess the long-term impacts of these restoration techniques on vegetation communities. Further research should be conducted on Araneae communities to observe how populations change over time and if understory structure has an effect on these communities.

Additional Key words: Invasive species; Spider; Vegetation

[1.] Paper submitted to JASMR for consideration. Published by ASMR, 1305 Weathervane Dr., Champaign, IL 61821.

[2.] Craig Malone, Restoration Ecology Apprentice, The Wilds, Cumberland, OH 43732; Rebecca M. Swab, Director of Restoration Ecology; Alexys Nolan, Restoration Ecology Program Associate, The Wilds.

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https://www.asmr.us/Portals/0/Documents/Journal/Volume-8-Issue-3/Malone-OH.pdf

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HIGH SULFUR CONTAMINATION EFFECT ON THE ENVIRONMENT AT THE AFFORESTED FORMER JEZIÓRKO SULFUR MINE[1]

Justyna Likus-Cieślik[2], and Marcin Pietrzykowski

Abstract: Sulfur contamination of topsoil (0-20 cm), spatial distribution of contamination, surface water chemistry, growth reaction, vitality, and mineral supply of Common birch (*Betula pendula* Roth.) and Scots pine (*Pinus sylvestris* L.) as well as chemical composition of this and wood small-reed (*Calamagrostis epigejos* L.) were investigated on an area of over 200 ha of an afforested ecosystem after borehole sulfur mining. The chemistry dynamics of soil leaching and the remediation effect of the birch and pine litter were assayed in an experiment under controlled conditions. It was found that hot-spots with high sulfur concentration in soil reaching even 45,000 mg kg^{-1}, pH below 2.0 were still reported, however, it occupied hardly 2% of the researched area. Surface waters were characterized by an excessive concentration of sulfate ions (average 935.13 $mg \cdot L^{-1}$) and calcium ions (up to 434 $mg \cdot L^{-1}$), which was connected with the sulfur mining process and sludge lime used in neutralization. Wood small-reed was found to adapt well to the conditions of elevated sulfur concentration. The experiment confirmed that the addition of organic matter had a significant impact on the chemistry of soil solutions but did not indicate a remediation effect by increased sulfur leaching. The aim of the paper was a comprehensive study of the soil, surface water, and reaction of the plant to high sulfur concentration in soil on former Jeziórko sulfur mine. Soil contamination, plant chemistry, and their reaction were analyzed on 200 ha area (spatially) and at detailed study plots, represented various categories of plant cover. The chemistry of water was an additional element analyzed on independent sampling points (15) localized on streams and ponds on 200 ha reclaimed area.

Additional Key Words: sulfur, reclamation, plant chemistry, soil contamination

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[1] Oral paper presented at the 2019 National Meeting of the American Society of Mining and Reclamation, Big Sky, MT. Welcome Back to Montana: The Land of Reclamation Pioneers, June 3–7, 2019. Published by ASMR, 1305 Weathervane Dr., Champaign, IL 61821.

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Other Studies

PROTOCOLS FOR MONITORING ECOLOGICAL RECOVERY OF RECLAIMED WELL PADS ON GRASSLANDS[1]

Anne C.S. McIntosh[2], Bonnie Drozdowski[3], Dani Degenhardt[4], Chris B. Powter[5], Christina C. Small[6], John Begg[7], Dan Farr[8], Arnold Janz[8], Randi C Lupardus[8],[2], Delinda Ryerson[9], Jim Schieck[3]

Abstract. We developed a scientifically robust monitoring protocol to enable a consistent assessment of ecological recovery of physical, chemical, and biological indicators at certified reclaimed industrial well pads on grasslands. Using the developed protocols, data can be generated from measurement of soil, vegetation, and landscape indicators at reclaimed well pads and adjacent reference sites. We selected the appropriate vegetation, soil, and habitat indicators for a long-term reclamation monitoring program and have provided sampling protocols for the selected indicators here. The protocols may be used to identify and prioritize indicators of reduced ecosystem health and to track ecological recovery of reclaimed sites over time. The development of these integrated monitoring protocols is a first step towards successful and consistent long-term monitoring to assess ecological recovery of certified reclaimed well pads on grasslands.

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[1]. Paper submitted for consideration in JASMR and Published by ASMR; 1305 Weathervane Dr., Champaign, IL 61821.

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ABOUT THE AUTHORS

John Begg (P.Ag.) Retired Manager, Public Land Policy, Government of Alberta.

Dani Degenhardt (Ph.D.), is a reclamation research scientist with Natural Resources Canada. Her research is focused on finding reclamation techniques and technologies to accelerate the creation sustainable forest ecosystems post-industrial disturbances.

Ms. Aude Delmer. is an Agronomist and Environmentalist. After completing an Engineer Master degree in Agronomy and Environmental Sciences and a M.Sc in Land Restoration and Reclamation from Cranfield University, Bedfordshire, UK, she started her career as a Restoration Manager at Tarmac. Her role consists in managing and coordinating the restoration of mineral extraction sites across the UK and finding sustainable solutions to improve soil heath, enhance biodiversity and maintain the created habitats.

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Bonnie Drozdowski (M.Sc, P.Ag), is a researcher in the reclamation team at InnoTech Alberta, with over 10 years of experience in applied reclamation research focusing on the development of innovative and practical land reclamation and remediation procedures and technologies for landscapes disturbed by industrial activities

Dan Farr (Ph.D.), is a biodiversity scientist drawn to the challenge of informing government decisions that affect species, habitats and landscapes. He is currently Director of Biodiversity and Ecosystem Health Sciences at Alberta Environment and Parks.

Mr. Mark Heames trained as a Mineral Surveyor with British Coal in the early 1980s at Newcastle University, having qualified, he then worked as a Mineral Surveyor in the South Wales Coal Field on numerous active and closing surface mines. Following Privatization in 1995 he has been involved in design and contract management of surface coal mine sites, completing three major restoration and rehabilitation projects. In 2010 he became the Mine Manager of Celtic Energy's Selar Surface Coal Mine Site in South Wales, where he is responsible for all operational matters, including the delivery of the current closure of the Site with its innovative approaches to sustainable rehabilitation.

Geraint Hopkins. has a HND in Mineral Product Technology from Derby University and NVQs in Health and Safety. As the Company's Supervisor he has had oversight responsibilities at Tarmac's (a CRH Company) Mountsorrel Quarry, one of the largest granite quarries in Europe, for a major overburden movement of 4 million cubic meters of overburden and soils to form new tips and their rehabilitation. This has included the translocation of woodland vegetation and their soils to facilitate the Quarry's next phase of development. Recently he has been appointed as the Contractor's (Chepstow Plant International) Site Manager for the earth movement works in the development of Mountsorrel Quarry.

Dr. R. Neil Humphries is a chartered biologist and chartered soil scientist who specializes in the re-establishment of plant-soil ecosystems and the development of sustainable reclamation practices. He is a Fellow of the Institute of Quarrying and has over 40 years of practical and research experience; this was recognized in 2013 by the Society by his successful nomination for the prestigious ASMR William T Plass Award. He is currently employed by Celtic Energy Ltd as their Natural Resources Manager in South Wales (UK) and he also practices as an independent consultant (as Blakemere Consultants Ltd) to other mineral resource companies. He is presently undertaking research at Reading University on soil health and conservation and helping the Institute of Quarrying to update the UK's best practice guidance for handling soils with machines.

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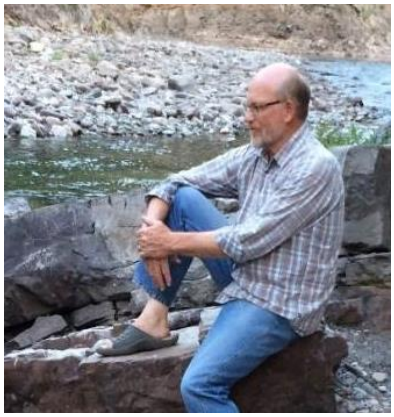
Arnold Janz (M.Sc., P.Ag) is a soil scientist at Alberta Environment and Parks, with 45 years of experience in environmental consulting and government in work areas including soil survey, environmental impact assessment, land conservation and reclamation policy and industrial land impact monitoring.



Justyna Likus-Cieślik is a doctor in the Department of Forest Ecology and Silviculture, Faculty of Forestry, University of Agriculture in Krakow. She took the doctoral degree of forest ecology and reclamation on: "Influence of excessive mineral sulfur content on soil features and plant on former mine Jeziróko areas, reclaimed to forestry."

She is interested in post-industrial areas reclaimed in the forest direction: chemistry of soil and water polluted by industry, plant responses to pollution, particularly sulfur and adaptation of plants in post-industrial areas.

She is a co-author of 15 scientific papers and 3 chapters in a reviewed post-conference monograph.

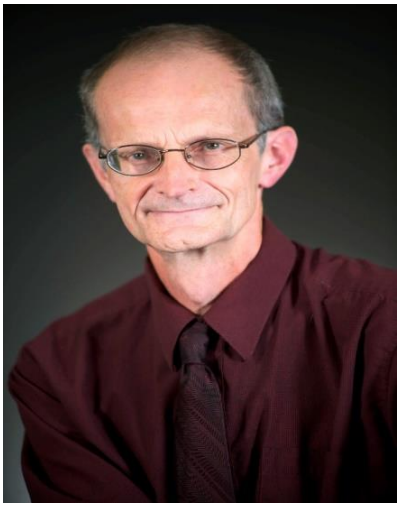
Dr. Randi C Lupardu. She is a data analyst, disturbance ecologist, and joint postdoctoral fellow with the University of Alberta and the Government of Alberta Environment and Parks. Randi focuses on ecosystem functionality in relation to industrial disturbance and land reclamation.

Mr. Craig Malone is a recent graduate from Michigan State University with a B.S. in Environmental Biology whose most recent research has been focused on forest restoration. Prior to his research at The Wilds, he was a research assistant at the Bauer Lab on Michigan State's campus studying biological controls for the Emerald ash borer. His research interests include entomology, conservation/restoration, and forestry.

Anne C.S. McIntosh (Ph.D.), is an Assistant Professor at the Augustana Campus of University of Alberta. Her research focuses on ecological recovery of plant communities in disturbed ecosystems.

Alexys Nolan is the Restoration Ecology Associate at The Wilds, a conservation center in Southeast Ohio. She obtained her BSc in Biology at Western Michigan University in 2015. Current projects include: restoring pre-SMCRA reclaimed forest, studying reclaimed grassland reforestation techniques, and improving prairie habitat quality on site.

Marcin Pietrzykowski completed his doctoral degree in 2005 and habilitation in 2011 in Reclamation of Degraded Land and Forest Ecology at Agricultural University in Krakow, Poland. Currently he is a full professor in Forestry, Forest Ecology and Reclamation at Department of Forest Ecology and Reclamation, Faculty of Forestry, ACU in Krakow. His principal focus rested on the Forest Ecology and Management, Restoration Ecology, Forest Land Reclamation, including soil – vegetation relationships, trees species response to site conditions, forested wetlands restoration, nutrient cycling, carbon sequestration, trace elements plants bioavailability; bio-stabilization and reclamation on mine sites. In 2013 he has taken Fulbright scholarship and developed his research in Department of Crop and Soil Environmental Science at Virginia Tech, Blacksburg VA. He is Laureate of European Award for Sustainable Land Use - CULTURA Prize 2015 by Alfred Toepfer Foundation for his significant input to comprehensive studies of reclamation of brownfield sites and the restoration of their environmental function. He is a Member of The American Society of Mining and Reclamation, Society of Ecological Restoration, The Polish Society of Soil Science. He is an author and co-author of over 150 scientific papers, 5 books and several chapters in monographs. He is an inventor of patents for biotechnologies and reclamation methods of post-industrial sites.

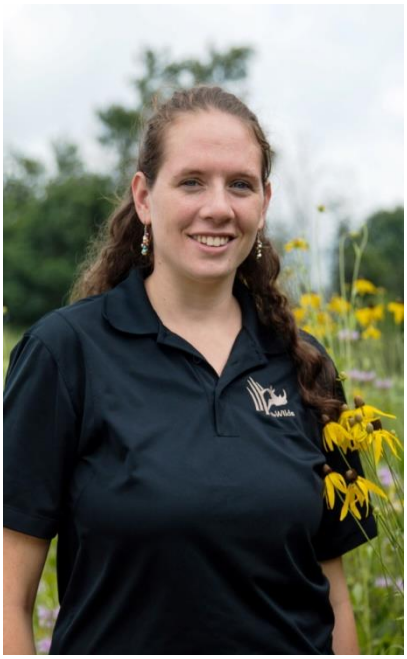


Chris B. Powter (M.Sc.), is a plant ecologist and reclamation specialist with 38 years of experience in government, academia and environmental consulting in Alberta.

Delinda Ryerso Delinda is the principal owner of Eco-Logical Consulting Ltd. She has a B.Sc. from the University of Alberta and more than two decades of experience in fisheries and wildlife-related research and management in Alberta. Driven by her love of nature, she is a conservation biologist and fervent advocate of scientifically-informed land and wildlife management.

Dr. Jim Schieck. Jim is recently retired. He was a Research Scientist at InnoTech Alberta, the Science Director for the Alberta Biodiversity Monitoring Institute, and an adjunct professor at the University of Alberta.

Christina C. Small. The Bio and photo were not available.



Dr. Rebecca Swab Rebecca has been Director of Restoration Ecology at The Wilds since 2015. An Ohio native, Rebecca attended The Ohio State University where she received combined B.S and M.S degrees. She went on to complete her Ph.D. at the University of California Riverside, where she studied how plants respond to stressors such as changing fire intervals and climate change. As director of restoration ecology, Rebecca's goal is to serve as a bridge between conservation managers and researchers. She couples restoration projects on reclaimed mine lands with research to determine which restoration methods work best. Information about which methods and projects are the most successful at reaching goals such as increasing native species diversity and ecosystem function are then shared with the larger conservation community to improve the field of restoration ecology.

Robert J. K. Thompson. Rob graduated from the University of Glamorgan in Pontypridd. South Wales, in 1996 with a First Class Honours Degree in *Surveying for Resource Development* and was awarded the School's 'Surveyors Shield'. He is a Fellow of the Institute of Quarrying. Rob began his career working for Walters Group (the South Wales based Civil Engineering Plant and Mining Contractor) as at various surface mine sites in Wales and England. Over the next 9 years he held various project management positions, working not only in mining, but also in quarrying, earthworks and civil engineering projects, and land remediation. Subsequently, he worked on securing and the discharge of planning consents for large schemes, including surface mines and large contaminated land sites. In 2005 he moved to Celtic Energy as the Manager of their Selar Surface Mine before being appointed in 2011 to Celtic's Management Board as their Operations Director. Rob has had considerable experience in not only the operation of surface mines, but also in the operational and regulatory compliance with planning consents and licenses, as well as the successful delivery of the restoration of such sites using innovative approaches for the long- term sustainable outcomes and biodiversity benefits. He also represents the industry on several national committees and has published a number of papers and articles in journals and conference proceedings.