Creating a Knowledge Platform for the Reclamation and Restoration Ecology Community: Expanding the OSRIN Model Beyond the Oil Sands

Alberta Centre for Reclamation and Restoration Ecology
and
Oil Sands Research and Information Network

University of Alberta

December 2014

Oil Sands Research and Information Network

The Oil Sands Research and Information Network (OSRIN) is a university-based, independent organization that compiles, interprets and analyses available knowledge about managing the environmental impacts to landscapes and water affected by oil sands mining and gets that knowledge into the hands of those who can use it to drive breakthrough improvements in regulations and practices. OSRIN is a project of the University of Alberta's School of Energy and the Environment (SEE). OSRIN was launched with a start-up grant of $4.5 million from Alberta Environment and a $250,000 grant from the Canada School of Energy and Environment Ltd.

OSRIN provides:

- **Governments** with the independent, objective, and credible information and analysis required to put appropriate regulatory and policy frameworks in place
- **Media, opinion leaders and the general public** with the facts about oil sands development, its environmental and social impacts, and landscape/water reclamation activities – so that public dialogue and policy is informed by solid evidence
- **Industry** with ready access to an integrated view of research that will help them make and execute environmental management plans – a view that crosses disciplines and organizational boundaries

OSRIN recognizes that much research has been done in these areas by a variety of players over 40 years of oil sands development. OSRIN synthesizes this collective knowledge and presents it in a form that allows others to use it to solve pressing problems.

Citation

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Copies of this report may be obtained from OSRIN at osrin@ualberta.ca or through the OSRIN website at http://www.osrin.ualberta.ca/en/OSRINPublications.aspx or directly from the University of Alberta's Education & Research Archive at http://hdl.handle.net/10402/era.17507.

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REPORT SUMMARY

One of the core mandates for the Oil Sands Research and Information Network (OSRIN) was to enhance access to oil sands environmental management information. With OSRIN's mandate ending December 31, 2014 OSRIN sought a partner with a similar philosophy to provide an archive for the website content and to continue the role of knowledge generation, perhaps with a broader scope than the oil sands. OSRIN provided funding for the Alberta Centre for Reclamation and Restoration Ecology (ACRRE) initiative at the University of Alberta to develop an ACRRE website, which will house the OSRIN content, and to produce a series of knowledge exchange communications that will be used to demonstrate the business case for ACRRE, a knowledge generating and sharing program for the reclamation and restoration community.

Previous work conducted by OSRIN has demonstrated the strong desire, across a broad base of stakeholder groups, for increased access to timely research information. Stakeholders participating in OSRIN's workshops have also demonstrated this thirst for knowledge sharing opportunities.

Outreach and application of knowledge is a key component of ACRRE's mandate. ACRRE will connect scientists, practitioners, managers, regulators, and policymakers. Collaborative efforts within this network will focus on integrating, synthesizing, sharing and applying scientific knowledge to address challenges in land reclamation and restoration. The Faculty of Agricultural, Life and Environmental Sciences (ALES) at the University of Alberta and OSRIN have already provided proof-of-concept of the delivery of the Centre's outreach mandate. The delivery of the outreach program will be through: preparation of major synthesis and review papers on topics of particular importance to partners; creation of short, focused Research Notes synthesizing recent research results; delivery of technology transfer workshops, symposia, and conferences; and organization of field tours.

ACKNOWLEDGEMENTS

The Oil Sands Research and Information Network (OSRIN), School of Energy and the Environment (SEE), University of Alberta provided funding for this project.

1 INTRODUCTION

One of the core mandates for the Oil Sands Research and Information Network (OSRIN) was to enhance access to oil sands environmental management information. This mandate was accomplished through a variety of formats, including:

- The website – which had a broad range of valuable information for researchers and the general public, including daily news feeds, website links and videos
- The Did You Know series of short articles to create interest in, and awareness of, issues relevant to oil sands and the Fort McMurray region
- The digitized collection of historical research and policy documents housed on the University of Alberta's Education & Research Archive (ERA) site (http://hdl.handle.net/10402/era.17209)
- A series of reports arising from the research projects that OSRIN funded, also available on the ERA site

With OSRIN's mandate ending December 31, 2014 they sought a partner with a similar philosophy to provide an archive for the website content and to continue the role of knowledge generation, perhaps with a broader scope than the oil sands. OSRIN has provided funding for the Alberta Centre for Reclamation and Restoration Ecology (ACRRE) initiative at the University of Alberta. Funds were used to develop an ACRRE website, which will house the OSRIN content, and to produce a series of knowledge exchange communications that will be used to demonstrate the business case for ACRRE, a knowledge generating and sharing program for the reclamation and restoration community.

Previous work conducted by OSRIN has demonstrated the strong desire, across a broad base of stakeholder groups, for increased access to timely research information (Alberta Innovates – Technology Futures 2012, Jones and Forrest 2010, Oil Sands Research and Information Network 2014a,b). Stakeholders participating in OSRIN's workshops have also demonstrated this thirst for knowledge sharing opportunities.

2 ALBERTA CENTRE FOR RECLAMATION AND RESTORATION ECOLOGY

The Alberta Centre for Reclamation and Restoration Ecology at the University of Alberta (ACRRE) will serve as a nucleus for the development of world-class research programs, education of natural resource professionals, application of scientific knowledge to best management practices and policies, and enhancement of public education.

The Faculty of Agricultural, Life & Environmental Sciences (ALES) is working with industry and government to secure funding to establish a world-class Centre with the expertise, skills, infrastructure and financial support to tackle today's pressing challenges in reclaiming and restoring damaged ecosystems. The Centre will bring together and encourage the activities of a strong group of natural and social scientists at the University of Alberta who are passionate about providing science-based solutions to these challenges. This group has expertise in the diversity

of natural and social science disciplines required for the holistic approach needed to effectively address these challenges. The Centre will be the 'go-to' place for students, managers and policy makers who share this common goal. The Centre will facilitate high quality discovery research, that is credible with peers in the global scientific community – and that is always focused on applications towards solving real-world problems. It will provide the scientific basis for best management practices, whether those involve altering industrial processes or developing mitigation procedures to speed recovery of ecosystems. Training the next generation of managers and problem solvers both at the undergraduate and graduate levels will be a key mandate for the Centre.

ACRRE will support and expand upon the current natural and social sciences expertise in the Faculty of Agricultural, Life and Environmental Sciences (ALES) and other faculties at the University of Alberta (e.g., Engineering, Science, Business). This includes research encompassing conservation and sustainable management of water, soils, vegetation, and wildlife complemented by work at the interface of social, economic and environmental policy. The University of Alberta is ideally positioned to provide the knowledge base required to support development of new approaches and strategies for ecosystem and landscape reclamation and restoration. ACRRE will allow realization of this potential.

Outreach and application of knowledge is a key component of ACRRE's mandate. ACRRE will connect scientists, practitioners, managers, regulators, and policymakers. Collaborative efforts within this network will focus on integrating, synthesizing, sharing and applying scientific knowledge to address challenges in land reclamation and restoration. ALES and OSRIN have already provided proof-of-concept of the delivery of the Centre's outreach mandate. The delivery of the Outreach program will be through: preparation of major synthesis and review papers on topics of particular importance to our partners; creation of short, focused Research Notes synthesizing recent research results; delivery of technology transfer workshops, symposia, and conferences; and organization of field tours.

2.1 ACRRE Website

With funding from OSRIN, ACRRE has established a website (http://acrre.ualberta.ca/) as a starting point for its outreach efforts. The website provides prospective partners with examples of knowledge generation and sharing materials and services offered by ACCRE. In addition, the ACRRE website has a dedicated archival section for the original OSRIN website content.

2.2 ACRRE Research Notes

ACRRE has developed Research Notes to provide short summaries of key research initiatives and their management implications. These Research Notes build on similar communications offered by University of Alberta's Enhanced Forest Management Group (http://hdl.handle.net/10402/era.32846). A sample Research Note is provided in Appendix 1 and is available online at http://acrre.ualberta.ca/Outreach/ACRRE-Research-Notes.

2.3 ACRRE Newsletter

Stakeholders have indicated a desire for more knowledge (Alberta Innovates – Technology Futures 2012, Oil Sands Research and Information Network 2014b) but they do not always have the opportunity to search the website regularly. Therefore, OSRIN found it helpful to *promote new* information through a Newsletter. OSRIN's Newsletter was issued bi-weekly and focused on alerting readers to new information that had been added to the website and new research reports that would be of interest to the community (sample provided in Appendix 2). By providing these alerts, the Newsletter lowered the demands on people's time and increased exposure. As of December 2014 OSRIN's Newsletter reached 274 people, with approximately 42% of subscribers opening the Newsletter each issue and about 23% clicking on at least one of the items to get more information.

The Faculty of ALES currently produces a bulletin called "Renew" as an information dissemination tool (http://www.rr.ualberta.ca/en/AboutUs/RenewNewsletter.aspx). RENEW highlights current research being conducted in the Department of Renewable Resources in conservation biology, forest ecology and management, agriculture and the environment, as well as reclamation and restoration of land and water. It is issued twice a year to approximately 250 subscribers.

In future an ACRRE Newsletter will continue the success of the OSRIN Newsletter, and complement RENEW by focusing directly on research related to reclamation and restoration ecology.

2.4 ACRRE Extension Opportunities

There are a number of other opportunities for knowledge exchange and extension that ACRRE aims to pursue in the future. For example, a Lunch and Learn session that will bring the latest research findings directly to practitioners and provide opportunities for discussion and exchange of ideas. The first Lunch and Learn events are planned for March 2015 in Calgary and Edmonton. Another opportunity would be to organize symposia or workshops on topics of key importance to partners. These would be modelled after similar, very successful, OSRIN initiatives such as the symposium on the concept of resilience in reclaimed ecosystems (Pyper et al. 2013). In a similar vein, field tours would provide an excellent opportunity for active discussion and exchange of ideas between researchers and practitioners.

Another future opportunity is in the area of professional continuing education, whether that be through formal programs, certificate programs or short courses. The Faculty of ALES at the University of Alberta offers a major in Land Reclamation within its Bachelor of Science in Environmental and Conservation Sciences; ALES is also home to the Land Reclamation International Graduate School which supports graduate education in land reclamation. As such, ALES and the University of Alberta have the capability to provide world-class continuing education to natural resource professionals.

Finally, ACRRE aims to become a trusted source of information for the general public. Dissemination of information could be through the website and through special public

presentations. There are also exciting opportunities for development of educational materials aimed at school children.

2.5 Opportunities for Strategic Partnerships

There are a number of Alberta organizations that share some of the core goals of ACRRE that we could partner with to deliver the products that stakeholders have expressed interest in (Alberta Innovates – Technology Futures 2012, Oil Sands Research and Information Network 2014b). For example, the University (Department of Renewable Resources) has already worked with the Alberta Land-use Knowledge Network (LuKN) in producing videotaped seminar presentations. Staff also have relationships with the Canadian Land Reclamation Association and Alberta Institute of Agrologists; both organizations provide excellent opportunities for partnerships in knowledge exchange and professional education.

3 REFERENCES

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4 ACRONYMS

ACRRE	Alberta Centre for Reclamation and Restoration Ecology
ALES	Agriculture, Life & Environmental Sciences
ERA	Education & Research Archive

LuKN	Alberta Land-use Knowledge Network
OSRIN	Oil Sands Research and Information Network
SEE	School of Energy and the Environment

APPENDIX 1: Sample ACRRE Research Note

ACRRE ALBERTA CENTRE FOR RECLAMATION AND RESTORATION ECOLOGY

RESEARCH NOTES

Research Note #1 Oct. 2014

Rat root plants may not be suitable for reclaiming oil sands tailing ponds

Research led by: Janusz Zwiazek

The Challenge

Reclamation projects underway in northern Alberta aim to convert tailings ponds—a byproduct of oil sands production that typically have high pH and salinity—into constructed wetlands. Though research suggests that such wetlands can support healthy aquatic plant communities, we know little about the combined effects of high pH and salinity on plant growth.

Rat root (*Acorus americanus* Raf.) is a native species that has been effectively used in reclamation projects outside of the oil sands region, as it has high ecological value and significant cultural value to First Nations groups. This study tested the ability of rat root to grow in a high pH/high salinity environment, similar to that of a constructed wetland.

The Approach

Growth of rat root was tested in two different experiments. The first tested plant response to seven different pH levels (range 6.0-9.5). The second experiment tested four different salinity levels (range 0-100mmol/L) while holding pH constant at either neutral (7.0) or high (8.5) levels. Throughout the study researchers measured a series of variables (growth rate, plant mortality, leaf transpiration rates, chlorophyll concentration, nutrient uptake) to quantify rat root growth and development.

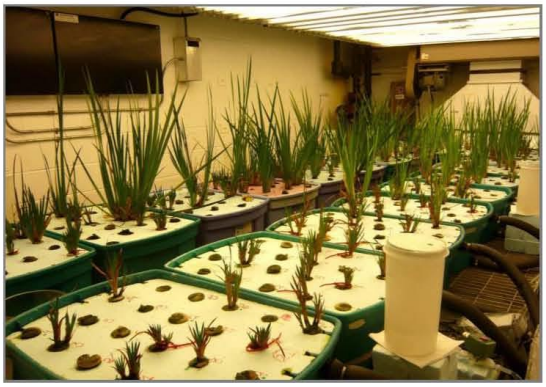

Fig. 1 Rat root trials after 3 months exposure to high pH

The Results

The researchers found that increasing pH alone had less of an impact on plant development than the combination of high pH and high salinity.

As pH increased, rat root growth rates were initially reduced, though the effect was minimal over time. Chlorophyll concentrations decreased with increasing pH, which could affect long term plant growth, and root growth was stunted at higher pH.

With increasing salinity, however, there was a decline in rat root growth rate, transpiration rate, and chlorophyll concentrations – these effects were even greater with high pH. The rat root had reduced shoot growth, and eventually died as both salinity and pH increased.

The researchers then compared their study results with other research on plants used in constructed wetlands, to assess the relative performance of rat root in a reclamation program.

Management Implications

- Rat root appears to have a lower salinity tolerance than other plants commonly used in constructed wetlands.
- A pH greater than 7.5 and salinity values greater than 25 mmol/L will have a negative impact on rat root growth.
- Despite its ecological and cultural significance, rat root may not be an appropriate species to use in tailings pond reclamation in the oil sands region.

Further Reading

Calvo-Polanco, M. *et al.* 2014. Responses of rat root (*Acorus americanus* Raf.) plants to salinity and pH conditions. *Journal of Environmental Quality* **43**: 578-586.

Equiza, M.A. and J.J. Zwiazek. 2014. Nitrogen form affects physiological responses and root expansigenous honeycomb aerenchyma in the emergent macrophyte *Acorus americanus*. *Botany* **92**: 541-550.

Acknowledgements

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This summary was written by Sarah Boon and Matthew Pyper – Fuse Consulting Ltd.

For more info or to obtain a copy of the publication contact Janusz Zwiasek (janusz.zwiasek@ualberta.ca).

UNIVERSITY OF ALBERTA

APPENDIX 2: Sample OSRIN Newsletter

Friday, November 28, 2014

OSRIN News

We are covering registration costs for 5 students to participate in the Hot Topics in Oil Sands Tailings Management short course at IOSTC 2014 in December.

We are sponsoring RemTec 2015 and WaterTech 2015 (we encourage people to submit oil sands abstracts!).

We are sponsoring the 2015 COSIA Oil Sands Clay Conference.

Two new presentations:

- Powter, C.B., 2014. Issues in Reclamation and Remediation (Workshop presentation at CI Energy Group's Cumulative Effects Assessment & Management Conference)
- Powter, C.B., 2014. OSRIN: 5-Years of Creating and Sharing Oil Sands Environmental Management Knowledge (UofA Renewable Resources Visiting Speaker presentation)

Research News

We have released the following reports:

- Schoonmaker, A., J-M. Sobze, E. Fraser, E. Marenholtz, A. Smreciu, C.B. Powter and M. Mckenzie, 2014. Alternative Native Boreal Seed and Plant Delivery Systems for Oil Sands Reclamation. OSRIN Report No. TR-55. 61 pp. http://hdl.handle.net/10402/era.40099
- Aguilar, M., E. Glucksman, D. Bass and J.B. Dacks, 2014. Next Generation Sequencing of Protists as a Measure of Microbial Community in Oil Sands Tailings Ponds: Amplicon Versus Metagenomic Approaches. OSRIN Report No. TR-56. 24 pp. http://hdl.handle.net/10402/era.40100

New Videos

See OSRIN's Video page for the rest of the videos.

- **Bloomberg TV** – Does Keystone XL Pipeline Matter to Oil Industry? (November 18, 2014)
- **National Public Radio** – What You Need to Know About the Keystone XL Oil Pipeline (November 2014)

Interesting Reports

Angel, A.C., 2014. Voices from the shadows: Investigating the identity and wellbeing of male mobile workers in the contemporary 'boom-sphere' context of the Alberta oil sands. University of Alberta, Department of Resource Economics and Environmental Sociology, Edmonton, Alberta. M.Sc. Thesis. 202 pp.

News Items

News items highlights. To see all the news items click here

Transportation

Pipelines south - US Senate rejects Keystone bill

Pipelines east

Pipelines west

TransCanada plots new pipelines for surging North American oil output

Enbridge mulls 120,000-barrel-per-day rail terminal in Oklahoma to handle Canadian crude shipments

More oil to travel on N.J. railroads

Canada deserves meaningful dialogue on pipelines

Issues

Bear-safety training to be mandatory for oil sands workers

Canadians divided over merits of oil sands, Nanos says

Business

Just how much is the oil price drop hurting oil sands projects?

Suncor goes against the grain with plan to boost overall spending

Anglow Kouakou, W., 2014. Geotechnical characterisation of oil sand tailings beach deposits in flume tests. University of Alberta, Department of Civil and Environmental Engineering, Edmonton, Alberta. M.Sc. Thesis. 226 pp.

Forsch, K.B.C., 2014. Oil sands reclamation with woody debris using LFH mineral soil mix and peat mineral soil mix cover soils: Impacts on select soil and vegetation properties. University of Alberta, Department of Renewable Resources, Edmonton, Alberta. M.Sc. Thesis. 110 pp.

Hande, A.B., 2011.Accelerated dewatering and drying treatment of oil sands tailings by electrical resonant auto-transformer. University of Alberta, Department of Chemical and Materials Engineering Edmonton, Alberta. M.Sc. Thesis. 86 pp.

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Khan. M.F., 2014. Application of wet oxidation for the treatment of oil sands mature fine tailings. University of Alberta, Department of Civil and Environmental Engineering, Edmonton, Alberta. M.Sc. Thesis. 100 pp.

Roy, M-C., 2013. Marsh reclamation in the oil sands of Alberta: Providing benchmarks and models of vegetation development. University of Alberta, Department of Renewable Resources, Edmonton, Alberta. Ph.D. Thesis. 165 pp.

Stats

OSRIN report downloads: 38,046

Digitized historical reports: 378

Newsletter subscribers: 274

Entries in Oil Sands Environmental Management Bibliography: 3,162

New clinic in Fort McKay caters to oil sands contractors

Falling oil prices won't cause shut-downs in Alberta: Prentice

Regulatory / Legal

Cenovus gets regulatory green light for Telephone Lake oil sands

Oil sands operators following rules when 196 birds died

Environment / Technology

A cleaner way to get petroleum out of oil sands

Oil sands study confirms link between tailings ponds and air pollution

New emissions from Canada's oil sands 'extremely low,' says IEA's chief economist

Oil sands alliance sets water use goals; GHG targets proving harder

Oil sands firms put high-tech methods to extract bitumen on display for reporters

People

New book on oil sands pioneer John Allan offers fascinating glimpse of early Alberta

New energy lobby chief seeks 'advocates' to counter anti-pipeline sentiment

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LIST OF OSRIN REPORTS

OSRIN reports are available on the University of Alberta's Education & Research Archive at http://hdl.handle.net/10402/era.17209. The Technical Report (TR) series documents the result of OSRIN funded projects. The Staff Reports (SR) series represent work done by OSRIN staff.

OSRIN Technical Reports – http://hdl.handle.net/10402/era.17507

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Jones, R.K. and D. Forrest, 2010. Oil Sands Mining Reclamation Challenge Dialogue – Report and Appendices. OSRIN Report No. TR-4. 258 pp. http://hdl.handle.net/10402/era.19092

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Welham, C., 2010. Oil Sands Terrestrial Habitat and Risk Modeling for Disturbance and Reclamation – Phase I Report. OSRIN Report No. TR-8. 109 pp. http://hdl.handle.net/10402/era.22567

Schneider, T., 2011. Accounting for Environmental Liabilities under International Financial Reporting Standards. OSRIN Report TR-9. 16 pp. http://hdl.handle.net/10402/era.22741

Davies, J. and B. Eaton, 2011. Community Level Physiological Profiling for Monitoring Oil Sands Impacts. OSRIN Report No. TR-10. 44 pp. http://hdl.handle.net/10402/era.22781

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