Failing to account for climate change in mining land reclamation may cost billions

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Credit: Alfred Palmer/Wikipedia

Researchers at the University of Waterloo are warning that plans to reclaim mined land risk failure and could cost industry and government billions in future cleanup costs if they do not take into account the affects of climate change.

In a paper published in the journal *Nature Climate Change* today, Professors Rebecca Rooney, Derek Robinson and Rich Petrone outline a six-step process to improve success rates for ecological reclamation projects and control mine closure costs; reconciling government-mandated mine closing procedures with long-term climate projections.

"Well-meaning reclamation plans that ignore climate change may prove to be a major liability," said Rooney, a professor of Biology in the Faculty of Science at Waterloo. "Most reclamation plans assume the environment, water budget and climate remain the same over time. Our research reveals the need for a more pragmatic approach to reclamation planning that will give these important habitats a more sustainable future. If these reclaimed landscapes fail, the public could be left with a staggering environmental problem covering hundreds of square kilometers across Canada alone - and billions in additional costs."

Under Alberta's Environmental Protection and Enhancement Act of 1993, oil sands mining companies are required to return natural areas to a natural state once a mine closes. They must submit a reclamation plan and set aside an environmental deposit as part of the permitting process.

Regulators currently do not require mining companies to incorporate predictive modeling into reclamation plans, nor do they consider proposals to reclaim with types of vegetation better suited to the projected future climate.

"Significant advances have been made in the science of reclamation and the criteria with which we evaluate reclaimed landscapes," said Petrone, a professor of Geography and Environmental Management from the Waterloo Faculty of Environment. "The big question is how we use this knowledge to adapt in the face of climate change."

Mega projects like oils sands extraction, mountain-top removal and open-

pit diamond mines are so large that they can take several decades, sometimes up to a hundred years, from opening to closure. Over these time spans, habitats like the boreal forests are predicted to shrink in Alberta, even under the most optimistic climate scenarios.

The idea that new landscapes may be more sustainable in the long term is how Rooney pulled Petrone and Robinson, also a professor in the Department of Geography and Environmental Management, into the project.

"We measure and compare the composition and configuration of habitats in different natural regions and estimate how these changes in habitat pattern under different climate scenarios affect hydrological processes. It's essential for reclamation success," said Professor Robinson.

The six-step process proposed by the Waterloo academics uses climate modeling, hydrologic modeling, bioclimate classification, and landscape and habitat modeling to provide planners with more adaptable closure designs that meet the provincial regulations.

"We want to target a climate envelope and hedge our bets on the future," said Professor Rooney. "If an area is located in an ecological transition zone between boreal to the north and parkland to the south, it could be better for reclamation to target parkland forest than boreal so it will be more capable of adapting as [climate] change continues."

More research in this area is needed as the predicted landscapes may have an additional effect on water availability for the region. Regional climate models will also have to be continually refined to be useful.

More information: Rebecca C. Rooney et al. Megaproject reclamation and climate change, *Nature Climate Change* (2015). DOI:

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