Water Scarcity and Degradation and the Alberta Oil Sands: Treating the Symptoms, Addressing the Cause

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The Alberta oil sands are the largest industrial project in the province of Alberta, representing an area roughly the size of Florida (Alberta Energy 2007a), and are one of the largest industrial projects in the world (Davidson and Hurley 2007). Water serves as a metaphor and link for many of the challenges faced in the development and execution of oil sands projects in Alberta. Just as the mighty Athabasca River flows through the mega-projects of the Athabasca oil sands, water flows through the social, technological, legal, and health issues that challenge the current development of the oil sands in Alberta, tying these tenuous elements together and forcing all actors involved in the execution of the oil sands mega-projects to examine the inter-relatedness of these issues. This intrinsic role of water in the many challenges faced in the Alberta oil sands makes water one of the most important issues for stakeholders in the oil sands, including project proponents, regulators and the public, to address.

Water issues in the Alberta oil sands also serve as an instructive lens through which to examine major debates and theories in Environmental Sociology: the Treadmill of Production and environmental "withdrawals and additions" (Gould et al. 2004: 303), Ecological modernization (Mol and Spaargaren 2000; 2005) and the environmental 'flows' of Mol and Spaargaren (2005:96), World Systems Theory (Bunker and Ciccantell 2005; Wallerstein 1979), dematerialization (Boyd 2003; Ciccantell and Bunker 2004) and resource triumphalism (Bridge 2001) can all be applied to the study of impacts of the usage of water in the Alberta's oil sands operations. The scale of the oil sands provides a stage upon which once may examine the rigor of claims made regarding these important concepts in Environmental Sociology. These debates represent the underlying social, political and economic issues that will have to be acknowledged and evaluated in order to

truly address the pressures placed on water, and the many pressing issues tied to water, in the Alberta oil sands

Environmental Concerns

The environmental concerns linked to the Alberta oil sands are many: water poses challenges in terms of the impact that water withdrawals have on fish habitat (Schindler and Donahue 2006) and declining water quality (Schindler and Donahue 2006). Furthermore, the storage of water in tailings ponds present a far-reaching environmental liability that Albertans must manage, as the toxicity and salinity of these waters renders them hostile to some organisms, including mammals and amphibians (Pollet and Bendall-Young 2000; Rogers et al. 2002).

The most crucial environmental issue related to water and the Alberta oil sands is the cumulative contribution that oil sands processes have on water usage in the province of Alberta (Schindler and Donahue 2006). This is because existing municipal, agricultural and industrial water infrastructure and usage is based on water levels in the province in the twentieth century that were, in fact, anomalously high (Schindler and Donahue 2006; Percy 2005), rendering current water allocations dangerously unable to address the impending decrease in water availability in the province.

Water usage in the oil sands is particularly important in terms of the articulation of these cumulative impacts of oil sands projects on water usage (Schindler and Donahue 2006) with other challenges faced within and outside of the oil sands. Cumulative water inputs to oil sands projects articulate vertically within the ever-growing number and scale of oil sands projects themselves (Alberta Energy 2007), and horizontally with other physical, biological and social effects (Schindler and Donahue 2006). As in other major

large-scale resource exploitation projects, it is these cumulative impacts that pose the largest threat to the viability and sustainability of the Alberta oil sands (Boyd 2003; Schindler and Donahue 2006). It is because of the cumulative impacts of resource extraction on water quality and quantity that the Gordon Water Group of Concerned Scientists and Citizens argues for a "nested watershed approach" (Gordon Water Group 2007: 27), in order to co-ordinate management of water resources on an integrated scale that allows for monitoring of cumulative impacts and also for implementation of measures that address the multifarious factors that threaten water quality and quantity in Canada's watersheds.

Legal concerns

Of particular import are the legal and economic implications of addressing water scarcity in Alberta and the Alberta oil sands: water will serve as a key route through which changes to outdated legal frameworks (Boyd 2003; Percy 2005) and inadequate impact assessment legislation (Boyd 2003) will be updated to adapt to large-scale projects like the Alberta oil sands, and may also precipitate changes in subsidies and tax structures impacting the use of 'abundant' natural resources like water (Adamowicz 2007; Boyd 2003).

Provincial water laws and Canadian water policies are based on the false premise of unlimited water supplies in Canada (Barlow 2007; Boyd 2003; Percy 2005; Schindler and Donahue 2006). As a result "none of these outdated systems evolved with water conservation in mind" (Boyd 2003: 47). In Alberta, water licenses are granted on a "prior allocation" basis (Percy 2005: 2095), which grants senior licensees the right to withdraw the total amount of water allocated in their license before other licensees can withdraw

water (Percy 2005). Furthermore, the amount of water allocated to a licensee is not informed by knowledge of the capacity of the watershed to sustain healthy human and non-human life in the present or the future (Percy 2005; Schindler et al. 2007). This legal structure prioritizes licensee hierarchy over social or environmental concerns, as well as the concerns of First Nations communities downstream of the oil sands that rely on the Athabasca River watershed for country foods (Wein et al. 1991). This structure thus exacerbates existing social concerns stemming from the pressures placed on communities in the oil sands as populations expand faster than infrastructure to ensure water quality through the proper handling of sewage (CBC 2007a).

In Alberta, water law is such that it will "prohibit anyone from using or diverting water without first obtaining a license from the government" (Percy 2005: 2094). Thus, because water is a provincial jurisdiction (Percy 2005), except in the case of navigable waters, fisheries and trans-boundary water concerns (Boyd 2003; Percy 2005), the ability to amend or alter the use of water in the province rests mainly with the provincial government. Even in cases where a water issue does fall under federal jurisdiction, "Ottawa remains reluctant to take actions that provinces regard as interfering in their business" (Boyd 2003: 46). This presents a quandary for any potential attempts to shift water legislation in the Alberta oil sands: any meaningful action will have to involve either major shifts in the provinces' approach to water legislation or the federal government must become willing to forego concerns of 'meddling' and step up to address issues that fall under federal jurisdiction, such as potential threats to fisheries (Schindler et al. 2007). Currently the "Phase I Management Framework" (Schindler et al. 2007: 3) developed to address water management of the Athabasca River, has been developed

without adequate baseline data to truly understand what impacts low and high flows of the river have on fisheries (Schindler et al. 2007). Thus, this potential impact on fish habitat and fisheries represents a potential avenue through which federal jurisdiction could address water withdrawals from the Athabasca River as they relate to environmental impacts of oil sands development. For its part, the Alberta government does have a framework with which to tackle water scarcity issues, given the implementation of tradable water rights legislation implemented in the South Saskatchewan River Basin to address water scarcity in southern Alberta (Adamowicz 2007). There are also numerous economic models upon which the provincial government may draw upon in order to address water scarcity challenges (Adamowicz 2007). However, in both the provincial and federal examples there must be sufficient political will in order to shift current realities towards actions that truly address the cumulative impacts of oil sands development on water quality and quantity in the province, especially the crucial issues surrounding water scarcity and degradation. This rests on a more difficult and sweeping change in how the full impacts of resource extraction are accounted (Boyd 2003) and in how we evaluate the political, economic and social situations of a province like Alberta that is heavily integrated into a larger market and political arena through various trade agreements that prioritize trade over sustainability or conservation of water resources (Barlow 2007).

Environmental assessment

As it stands right now, current frameworks in place to address water issues in the Athabasca River Basin are inadequate to address the pace of development of industrial

activity along the river basin, and do not anticipate the cumulative impacts of climate change and natural drought cycles could have on the health and well-being of the river and those who depend upon it (Adamowicz 2007; Schindler et al. 2007; Schindler and Donahue 2006). This is exacerbated by environmental impact assessment legislation and infrastructure that is ill-equipped to assess the long-term, cumulative impacts of projects such as the Alberta oil sands (Boyd 2003). Boyd (2003) offers a harsh critique of existing environmental assessments, deriding "government actions in weakening EA legislation and decreasing the staff, budgets and resources of environmental departments" (162). We cannot entrust the future of our most vital natural resources, such as water, to a process plagued by inadequate funding and hampered by severe systemic challenges, such as the exclusion of many potentially harmful projects from assessment (Boyd 2003).

In the case of the Alberta oil sands, water issues illustrate the failures of environmental assessment processes, as projects continue to be approved despite concerns over total water withdrawals (Schindler et al. 2007) and the increasing stress they will place on the Athabasca River Basin. Thus, water issues in the Alberta oil sands serve as a precautionary tale of the woeful inadequacies of current environmental assessment procedures in addressing such massive industrial projects. The Alberta example illustrates very clearly that environmental assessment legislation and infrastructure must be strengthened in order to ensure that development of resource extraction projects in Canada proceed in a fashion that accounts for the long-term damage they may pose to the environment. This must occur in combination with other major changes in approaches to the management of water and other natural resources.

Technology, production and the economy: the unanticipated consequences of 'externalities'

The coming water crisis (Schindler et al. 2007; Schindler and Donahue 2006) will pose major threats to the feasibility of current technology employed to extract bitumen from the Alberta oil sands (Schindler and Donahue 2006). At the moment, "oil sands consume three to six barrels of water per barrel of oil produced" (Schindler and Donahue 2006: 7213). Furthermore, as production levels increase, the Alberta oil sands will consume a volume of water "equivalent of nearly half of the Athabasca River's low winter flow during the eight years since 1980 and in every year since 1999" (Schindler and Donahue 2006: 7213).

The failure of regulators to implement and enforce legislation or licensing regimes that would promote conservation of water (Boyd 2003) has allowed the Alberta oil sands to proceed without effective contingency plans for how to manage low water conditions (Schindler et al. 2007). Thus, companies may be forced to make changes to current operations, such as increasing current water-storage practices (Adamowicz 2007), which introduces new production costs, in order to accommodate water scarcity. This presents a major challenge to project proponents that could impact the feasibility and profitability of projects in the oil sands. It also illustrates the pitfalls of "resource triumphalism" (Bridge 2001: 2149): by uncoupling the spatial and temporal aspects of oil sands extraction from rhetoric and mythologies of the resources itself, the issues of water scarcity and degradation resulting from oil sands activities have been largely ignored or written off as mere "externalities" (Boyd 2003: 314). As Bridge (2001) points out, "conventional accounts of postindustrial society tend to underrepresent the continued

significance of primary resources to the experience of everyday life" (2150). This minimization of the realities of water scarcity and degradation is evident in the disconnect between reported health impacts of water-borned contaminants (Timoney 2007) in the First Nations community of Fort Chipewyan, situated downstream of the Athabasca oil sands, and government responses to these concerns that downplay the threats of these health concerns (CBC 2007b).

"Resource triumphalism" (Bridge 2001: 2149) and the rhetoric of "externalities" (Boyd 2003: 314) have masked one very salient issue: "the majority of tar sands oil is exported to the United States under Canada's proportional sharing provisions of the North American Free Trade Agreement. Thus, most of the water used in the production of the oil is traded out of the country as virtual water" (Barlow 2007: 181). Thus, in the case of the large-scale water withdrawals in the Alberta oil sands, and with some of the lowest water prices of nations belonging to the Organization of Economic Cooperation and Development (Boyd 2003), Canada is essentially trading two resources at once, without full compensation for the environmental, social, political or economic impacts that water scarcity and degradation have upon the communities and ecosystems that depend on healthy Canadian watersheds. This also hints at Canada's role as a "semi-periphery" (Wallerstein 1979: 21) region, at least in regards to the extraction and export of bitumen from the Alberta oil sands. This raises significant questions of the control that provincial and federal governments can really exert over the impacts of oil sands development on water scarcity and degradation without addressing the much larger, integrated political, economic and social questions of such a position in the world system.

When examined through a World Systems Theory lens, one notes that "the extraction of natural resources for globalized raw material markets imposes significant disruptions and inequalities on local ecological and social systems. Larger-scale extraction tends to increase the damage to local systems." (Bunker and Ciccantell 2005: 7). In the case of the Alberta oil sands these inequalities are exemplified by the impacts that water scarcity and degradation present to the local communities and ecosystems that depend on local watersheds for survival. But these inequalities are not given full credit in the challenges they pose to the social and environmental sustainability of resource development.

Water scarcity and degradation in the Alberta oil sands: examining and assessing claims in Environmental Sociological Theory

In Environmental Sociology, major debates continue between the neo-Marxist theory of the Treadmill of Production (Gould et al. 2004), which is often placed in stark contrast with Ecological Modernization (Mol and Spaargaren 2000; 2005) and/or examinations of the phenomena of dematerialization (Boyd 2003; Ciccantell and Bunker 2004). Whilst the Treadmill of Production emerged as a social critique of the production processes and capitalist economies that encourage ever-increasing production and consumption (Gould et al. 2004), Ecological Modernization emerged with a focus on "*environmental* reform and not primarily on the effects of these changes in terms of various other criteria" (Mol and Spaargaren 2005: 92).

In response to the arguments of the superiority of the Treadmill of Production in addressing current environmental degradation through a focus on addressing

environmental "withdrawals and additions" (Gould et al. 2004), Mol and Spaargaren (2005) argue that rather than focus on "withdrawals and additions" (Gould et al. 2004: 303), attention should rest on the "sociology of environmental flows" (Mol and Spaargaren 2005: 96).

However, the issue of long-term storage of contaminated water in tailings ponds in the Alberta oil sands challenges the rigor of Mol and Spaargaren's (2005) theory of environmental flows: temporally, contaminated water contained in the extensive tailings ponds in the oil sands (Gordon Water Group 2007; Rogers et al. 2002) cannot flow, but rather more closely resembles the Treadmill of Production notion of "withdrawals and additions" (Gould et al. 2004: 303). Ironically, by removing the "region-focused static, and place-bound" (Mol and Spaargaren 2005: 97) aspects of "withdrawals and additions" (Gould et al. 2004: 303), the loss of local knowledge of how resource extraction, such as bitumen extraction, impacts local communities, ecosystems, economies and political systems, not to mention watersheds, reaffirms the dangers of "resource triumphalism" (Bridge 2001: 2149). Thus, in order to truly assess the impacts of oil sands development on water scarcity and degradation "we must incorporate topography, geology, hydrology, and climate, as well absolute and geographic distances between places-which themselves result from the intersection of these forces-into our analysis of how trade-dominant nations assure cheap and stable access to the volumes and types of materials they need." (Bunker and Ciccantell 2005: 7).

That being said, Mol and Spargaaren (2005) illustrate a number of similarities between both the Ecological Modernization and Treadmill of Production. Realistically, issues related to the Alberta oil sands are broad in scope and complexity, as illustrated by

the complexity of water and the oil sands. Thus, solutions to environmental degradation in the oil sands, such as water scarcity and degradation may be forced to draw from both Ecological Modernization attempts to address "environmental radicalism" (Mol and Spaargaren 2005: 92) in concert with "social radicalism" (Mol and Spaargaren 2005: 92) of the Treadmill of Production approach.

Thus, the issue of water scarcity and degradation in relation to Alberta oil sands development serves as an important tool through which to challenge theoretical notions posited in Environmental Sociology to address the root causes of environmental degradation, while also serving as a stage upon which aspects of these theories may be aligned and theoretical rifts bridged in order to develop new approaches in studying and addressing the causes of environmental degradation.

Solutions

Water scarcity and degradation resulting from extensive and intensive development of the Alberta oil sands presents a major environmental, legal, and social issue that must be addressed in order to curb the impending water crisis that Alberta will face as a prairie province (Schindler and Donahue 2006). As long as the Alberta government's head remains buried in the sand regarding the very real and dramatic impacts that declines in water quantity and quality will have on the sustainability of both the oil sands and current social, economic and political realities, and the public is misled about the environmental degradation as mere "externalities" (Boyd 2003: 314), water issues in the oil sands will not be addressed effectively.

Solutions to water scarcity and degradation include shifting legal frameworks that prioritize licensee hierarchy over social and environmental concerns to systems that better address current water demands (Boyd 2003; Percy 2005), updating and strengthening environmental assessment to better address the cumulative impacts of large-scale projects such as the Alberta oil sands (Boyd 2003), and examining economic solutions that may alleviate water scarcity issues (Adamowicz 2007). These are important points of departure for future research into policies to address the issue of water scarcity and degradation in the oil sands.

These changes, however, must be made in concert with more broad shifts in how environmental issues are considered: this includes no longer allowing issues like water degradation and scarcity to be masked in general talk of "externalities" (Boyd 2003: 314), fostering discourses that do not uncouple the local impacts of resource extraction from discourses of the resource itself.

Thus, water scarcity and degradation is a major challenge faced in the Alberta oil sands that must be addressed, but is also an opportunity to shift how discourse and policy around resource extraction is executed in order to acknowledge and address the cumulative, as well as local, impacts of large-scale resource extraction projects in Canada.

References

Adamowicz, V (2007). Section 2: Water Use and Alberta Oil Sands Development—Science and Solutions: An Analysis of Options. In *Running out of Steam? Oil Sands Development and Water Use in the Athabasca River-Watershed: Science*

and Market based Solutions. Munk Centre for International Studies and Environmental Research and Studies Centre. May 2007. http://www.ualberta.ca/ERSC/, accessed online December 16, 2007

Alberta Energy (2007a). http://www.energy.gov.ab.ca/OilSands/790.asp, accessed December 16, 2007

Alberta Energy (2007b). http://www.energy.gov.ab.ca/OurBusiness/oilsands.asp), accessed December 16, 2007

Barlow, M. (2007). *The Global Water Crisis and the Coming Battle for the Right to Water*. Toronto: McClelland and Stewart Ltd.

Bridge, G. (2001). Resource triumphalism: postindustrial narratives of primary commodity production. *Environment and Planning A* 33: 2149-2173

Boyd, D. (2003). *Unnatural Law: Rethinking Canadian Environmental Law and Policy.* Vancouver: UBC Press

Bunker, S and Ciccantell, P. (2005). Matter, Space, Time and Globalization: An Introduction. In *Globalization and the Race for Resources.* Maryland: Johns Hopkins University Press.

CBC (2007a). "$396M for Fort McMurray hospitals, water, housing". CBC online http://www.cbc.ca/canada/edmonton/story/2007/02/26/fort-mac.html, accessed December 16, 2007

CBC (2007b). "Fort Chipewyan health concerns ignored: residents". CBC online http://www.cbc.ca/canada/calgary/story/2006/05/05/ca-fort-chip-health-20060505.html, accessed December 16, 2007

Ciccantell, P and Bunker, S. (2004). The Economic Ascent of China and the Potential for Restructuring the Capitalist World-Economy. *Journal of World-Systems Research* X(3): 565-589

Davidson, D and Hurley, A. (2007). Preamble. In *Running out of Steam? Oil Sands Development and Water Use in the Athabasca River-Watershed: Science and Market based Solutions.* Munk Centre for International Studies and Environmental Research and Studies Centre. May 2007. http://www.ualberta.ca/ERSC/, accessed online December 16, 2007

Gordon Water Group of Concerned Scientists and Citizens (2007). *Changing the Flow: Blueprint for Federal Action on Freshwater*. http://www.gordonwatergroup.ca/, accessed online December 16, 2007

Gould, K, Pellow, N and Schnaiberg, G. (2004). Interrogatint the Treadmill of Production: Everything You Wanted to Know About the Treadmill but Were Afraid to Ask. *Organization and Environment* 17(3): 296-316

Mol, A and Spaargaren, G (2000). Ecological modernization theory in debate: A review. *Environmental Politics* 9(1): 17-49

Mol, A. and Spaargaren, G.(2005). From Additions and Withdrawals to Environmental Flows: Reframing Debates in the Environmental Social Sciences. *Organization and Environment* 18(1): 91-107

Percy, D. (2005). Responding to Water Scarcity in Western Canada. *Texas Law Review* 83: 2091-2107

Pollet, I and Bendell-Young, I. (2000). Amphibians as indicators of wetland quality in wetlands formed from oil sands effluent. *Environmental Toxicology and Chemistry* 19(10): 2589-2597

Rogers, V, Wickstrom, M, Liber, K and M. MacKinnon (2002). Acute and Subchronic Mammalian Toxicity of Naphthenic Acids from Oil Sands Tailings. *Toxicological Sciences* 66: 347-355

Schindler, D, Donahue, W and Thompson, J. (2007). Section 1: Future Water Flows and Human Withdrawals in the Athabasca River. *Running out of Steam? Oil Sands Development and Water Use in the Athabasca River-Watershed: Science and Market based Solutions.* Munk Centre for International Studies and Environmental Research and Studies Centre. May 2007 http://www.ualberta.ca/ERSC/, accessed online December 16, 2007

Schindler, D and W. Donahue. (2006). An impending water crisis in Canada's western prairie provinces. *Proceedings of the National Academy of Sciences* 103(19): 7210-7216

Timoney, K. (2007) *A Study of Water and Sediment Quality as Related to Public Health Issues, Fort Chipewyan, Alberta.* Prepared on behalf of the Nunee Health Board Society Fort Chipewyan, Alberta. November 11, 2007. Accessed online http://www.connectingthedrops.ca/resources, December 17, 2007

Wallerstein, I. (1979) Part I: The inequalities of core and periphery: 1: The rise and future demise of the world capitalist system: concepts for comparative analysis. In *The Capitalist World-Economy: Essays by Immanuel Wallerstein 1979*. Cambridge: Cambridge University Press: 1-36

Wein, E., Sabry, J and Evers, F. 1991. Food Consumption Patterns and Use of Country Foods by Native Canadians near Wood Buffalo National Park, Canada. *Arctic* 44 (3): 198-205