



Leave the Sand in the Land, Let the Stone Alone: Pits, Quarries and Climate Change

L. Anders Sandberg¹

Faculty of Environmental Studies, York University
Toronto, Ontario M3J 1P3 Canada
sandberg@yorku.ca

Lisa Wallace¹

Faculty of Environmental Studies, York University
Toronto, Ontario M3J 1P3 Canada
lisa.jean.wallace@gmail.com

Abstract

Conventional climate change discourse promotes green technological innovation, market-based regulation and behavioral adaptation as the answers to the global climate dilemma. Climate justice advocates have criticized this discourse in favor of a focus on the disproportionate impacts of capitalist carbon-producing activities. Both the conventional and climate justice positions, however, tend to overlook the very pillars of the carbon economy that make system change impossible. This paper interrogates one such pillar, the aggregate industry. Using some of the insights of political economy and actor network theory, we convey the interconnections between a carboniferous and calciferous capitalism, and the implications of the unique physical characteristics of aggregate resources for corporate strategies and local and trans-communal resistance. Case studies on



aggregate mining and manufacturing in parts of India, southern Ontario, Canada, and northern Scotland, all connected to the Swiss-based multinational Holcim, illuminate the industry's social, political and environmental impact and reach, its connections to climate change, and its place as a point of current and potential wider contestation in global capitalism.

“delegitimizing capitalism is rebuilding hope.”
François Houtart (quoted in Garcia Muñoz, 2011, 13)

Introduction

Climate justice advocates have provided apt criticisms of the conventional discourse on climate change, the one that revolves around mitigation through green technologies, carbon emissions markets, international agreements, and individuals practicing the three Rs, reduce, reuse and recycle. They have instead urged a focus on those who suffer the most from the carbon economy but are the least responsible for it. These people include not only those who suffer the consequences of climate change per se, in the form of melting polar ice caps, rising sea levels, more and longer droughts, growing desertification, and severe flooding, but also the democratic deficits and social and environmental effects of carbon exploitation, extraction, and refinement in places like the Middle East, Gulf of Guinea, the Alberta Tar Sands, war-torn Iraq, and now, with the BP oil disaster, the communities that surround the Gulf of Mexico. In these and similar places, most local residents would rather have seen the oil stay in the soil (Angus, 2010; Mitchell, 2011; Sandberg and Sandberg, 2010; Shiva, 2009).

This paper builds on the idea that climate change is a symptom of a larger process of global production and profit making under a carboniferous capitalist regime. It also rests on the call for a focus on “system change” rather than “climate change”. At the same time, however, we argue that these premises routinely make illegible some of the wider pillars on which climate change rests. One such pillar is the aggregate industry, which extracts sand, gravel and stone for construction material, from cement and concrete to building stones, for the infrastructure that fuels and supports the carbon economy. Aggregate demand is greatest in the public sector, primarily for construction and maintenance of roads and highways, and infrastructure expansion in the developing world makes it an important emerging market as well as a critical site for social and environmental justice.

An interrogation of a calciferous capitalism, we argue, puts system change in place, grounding it, literally, in the ground, as well as identifying novel sites of contestation and resistance against petro-capitalism. These sites of resistance include the extensive network of an infrastructure of buildings, roads and highways that underpins a consumer-driven and car-dependent society; the increasing number and size of the scars in the earth that constitutes aggregate mines; the disruption of

local communities that live in their neighborhood; the labor employed in the extraction process; the huge amount of energy needed to extract and refine its resources; the obscuring of the role of pits and quarries as part of causes of climate change; and the illusion that exhausted pits and quarries can be rehabilitated into biodiversity reserves. Popular struggles surrounding the terms and conditions of aggregate extraction and a consideration of leaving the sand in the land and letting the stone alone constitute measures to force a reduced use of the resources generally, to lower carbon emissions, to develop more effective, energy-efficient and public means of transportation and to promote more democratic ways of living.

We begin the paper with a theoretical discussion of the literature on global mining. We use the insights of political economy and actor network theory to illuminate this picture. We then proceed with a review of the industry itself, its extent, its ownership pattern, its products, and its connection to climate change, using, in part, Holcim, the Swiss-based aggregate-focused transnational corporation as an example. We then explore three case studies where the aggregate industry and Holcim are prominent actors: parts of India, southern Ontario in Canada and northern Scotland. We illustrate different aspects of industry policies and resistances for the three areas, reflecting different political, social and environmental conditions, different corporate strategies to legitimize and rationalize extractive activities, and different sites of real and potential resistances. In all three areas, corporate strategies and local and trans-communal resistances are intricately connected to climate change.

Theorizing the Global Mining Industry

Political economy is useful for exploring and unraveling the material and discursive power of the aggregate industry, its evolving dynamics in capitalism, and its place in and relations to climate change. We take our first cue from a series of political economy studies on the concentration of corporate power in the mining industry and its negative social and environmental impacts. Carboniferous and calciferous capitalism is dominated by large transnational firms based largely in the western capitalist countries. In the latest phase of capitalist neoliberalization, these corporations have increased their stranglehold on aggregate mine sites, production facilities and post-extraction and consumption patterns globally. International trade and investment agreements have provided mining companies with ease of access to mineral deposits and production facilities. The benefits are typically scarce or non-existent for local communities, workers, and the environment. In fact, there is an abundance of scholarly and non-governmental organizations' accounts that document the violations of human rights, labor rights, and environmental standards by transnational mining corporations, many of them aggregate companies that operate globally (Permanent People's Tribunal, 2008; Friends of the Earth Internacional, 2011; Rock et al., 2009).

In the neoliberal age, many mining corporations also follow an alleged green agenda. Corporations and affiliated environmental government and non-

governmental organizations now use the market and commodity form to promote biodiversity conservation through the purchase of nature reserves or establishing nature reserves at former extraction sites. The corporations also promote the “sustainable production” of secondary products through eco-modernist efforts and carbon markets and “sustainable building” endeavors (MacDonald, 2010; Ranpura, 2008).

We take our second cue from Gavin Bridge (2009) who effectively shatters the discursive separation between carbon extraction, carbon consumption and climate change. He presents a pointed analysis of the connection between below- and above-ground capitalism (see also Pearse, 2009). Coal, gas, and oil deposits, he argues, are the inverted expression of the skyscrapers of a carboniferous capitalism. In a similar vein, we suggest, the same skyscrapers are also the upturned sides of the aggregate resources of a calciferous capitalism. Carbon based minerals and aggregates are intricately linked. Aggregate-based materials both feed the extraction phase of the carbon economy, providing the access roads and offshore drilling platforms for exploration and extraction activities. And at the consumptive end, aggregates are the key ingredients in the provision of highways, parking lots, shopping malls, and house subdivisions. The circuitry of capitalism, therefore, is, as Bridge suggests, inevitably tethered to the nether world. Climate change begins with holes in the ground rather than in the atmosphere.

Our third and last cue we take from the aspect of actor network theory (Latour, 2005) that urges us to look at how different characteristics of mineral materials figure in shaping spatial relations and social and environmental dynamics, impacts and struggles. Bridge (2009) points out that the mining industry is unique because it does not discriminate in terms of place. Mines, as opposed to polluting factories, can't be moved. However, different mineral deposits appear in different proportions and places which have implications for both industry strategies and community and worker buy-ins and resistances. Carbon resources tend to be deposited in limited and distinct regions in large concentrations; though bulky and expensive to move, they sell at an increasing premium and are transported in large volumes over long distances through pipe lines and supertankers. They are also hazardous to extract, are subject to vulnerabilities when transported, and are highly polluting when refined and consumed. All these points of the carbon circuit are open to contestation and resistance. However, there are relatively few communities that have successfully fought the establishment of new, and expansion of old, resource areas. The world is full of well publicized stories of the violence against people resisting the expansion of the carbon economy, both at the scale of the local and national level.

In the aggregate cycle, the unique nature of the resource can yield more successful sites of resistance. Aggregate resources are found in many more places and larger proportions, including urban and peri-urban areas where extraction activities have been favored in the past because of the high costs of transporting a low-cost and bulky substance. In the developed countries, these areas often harbor

or lay adjacent to areas that have undergone a process of rural gentrification where “productivist” values have yielded to “post-productivist” or amenity values. The residents of such areas typically possess the political, economic and often professional expertise to provide stiff opposition to the location of aggregate mines in their neighborhoods. The presence of post-productivist sentiments further means that the aggregate industry has had to develop special means to meet protests, especially when operations occur on local physical landforms that constitute conservation areas. In light of strong post-productivist resistance, the industry has attempted, though often not successfully, to reframe its image as green and committed to restoration and rehabilitation projects.

But resistances have also occurred in more isolated settings where the industry has established mega- or super-quarries. The search for isolated settings with access to convenient shipping facilities constitutes a spatial fix to deal with the resource “scarcities” and resident resistance to pits and quarries in populated areas. Some super quarries have succeeded in operating unencumbered by local protests while others have faced stiff opposition. In some parts of the developed world, First Nations, rural, and recreational groups have successfully rallied against pit and quarry operations as destructive of local livelihoods and the local non-human environment (see below). In the developing world, however, though resistances are wide-spread and common, conditions are bleaker. There is some evidence of elite groups successfully resisting aggregate mines in aesthetically coveted regions that are also dependent on tourism (Gadgil and Guha, 2007). Typically, however, rural citizens' homes and traditional livelihoods are displaced and industry resistance is often met with corruption and/or outright violence (Friends of the Earth Internacional, 2011; Kalshin, 2007).

The insights of actor network theory also invite an exploration of the agency and resilience of post-extractive mine sites to accommodate social and environmental values. Terms like reclamation, rehabilitation and restoration are routinely used to invoke claims that mining can be sustainable. In spite of oil and gas spills and the vast destruction of natural environments associated with open-pit mining and toxic waste ponds, the mining industry make frequent and confident claims about their rehabilitative schemes. The environmental effects of aggregate extraction are often more localized and aggregate landscapes can be more resilient than other mining landscapes. There are also few dangers associated with the transportation of aggregates. To local communities, however, there are serious problems with dust, blasting, vibrations, and truck traffic. Still, aggregate operators typically refer to pits and quarries as an “interim” use that can yield an equally if not “improved” natural or human environment. In promotional material, they refer to “before” and “after” photos of aggregate landscapes where the latter often feature scenic lakes, botanical gardens, parks, and green areas. However, such efforts often deceive and conceal. Aggregate operators in both the developed and developing world often simply abandon old sites or fail to tackle the serious damage that can disrupt hydrological processes and cause damage to water tables.

In addition, restorations typically do not keep up with the scale, speed and quality of current intensive and super-sized operations. They therefore function more as propaganda and public relations tools for continued extraction on a large and exploitative scale.

But pits and quarries can also be accommodative in their own right by attracting rare flora and fauna as well as to serve as refuges for people (O'Connor, 1998, 98-108). Over time, pits and quarries may have the ability to self-heal as vegetation move in and stabilize disturbed ground. Some quarry operators even fear that endangered species may find a way into working quarries and thereby disrupt extraction; they therefore disturb the quarry floor from time to time to prevent the quarry from becoming a rare wildlife habitat. Examples of the unexpected presence of endangered species in quarries include the rare Berry cave salamander found in the abandoned Mead's Quarry in South Knoxville in 2008, rare snakes found in several quarries in southern Ontario, and endangered amphibians at the Limhamn Quarry in the City of Malmö, Sweden (where the quarry has been designated a nature reserve). Abandoned sand pits and quarries may also serve as liminal places for marginalized peoples who seek a temporary place to live, recreate and find solace (O'Connor, 1998; Sandberg, 2011).

Climate Change and the Aggregate Industry through the Lens of Holcim Ltd

As a result of increasing global consolidation, the aggregate industry is currently dominated by a few large multinational firms, including Cemex (Mexico), HeidelbergCement (Germany), Holcim (Switzerland), Italcementi (Italy), Lafarge (France), and Taiheiyo (Japan). These firms are characterized by a high level of horizontal and vertical integration; together, they accounted for 44 percent of global cement capacity in 2001 (Building Value, 2001, 8). Cement, used as a binding agent in concrete, is an essential ingredient in most infrastructure projects and constitutes one of the world's most widely-used construction materials.

Holcim Ltd exemplifies the industry profile. Holcim began as a family-based cement firm in Holderbank, Switzerland in 1912, but quickly expanded its scope and reach to incorporate North America, Latin America, Africa, and Asia, and now holds interests in approximately 70 countries worldwide. The company recently underwent a further round of consolidation, including major acquisitions in India and Australia. With 154 cement and grinding plants, 485 aggregates plants, 1457 ready-mix concrete plants, and over 800 quarries, Holcim is currently the second largest cement manufacturer in the world.

While climate justice advocates have been absent in defining the relationship between the aggregate industry and climate change, the industry itself has been highly proactive in responding to the challenge of climate change, though the responses are minimal, public relations driven, and largely ineffective. The industry acknowledges its own role in changing climate patterns—even by corporate estimates, cement manufacture alone accounts for approximately five percent of global anthropogenic carbon emissions (Holcim Ltd, n.d.a, 1; World Business

Council for Sustainable Development, 2002, 13)—but places aggregates in the same category as water, a necessary natural resource for which there are no practical substitutes (Holcim Ltd, n.d.a, 1). Accordingly, mitigation measures are situated squarely within the framework of the industrial carbon economy itself (see World Business Council for Sustainable Development, 2002). The main focus is on in-plant energy savings and efficient resource use spurred by technological innovation.

If we turn to Holcim, they tell us, not surprisingly, that they believe “that the most effective way to decrease the emissions of society is via mandatory governmental policies and regulated market instruments that set a cost on carbon within international frameworks” (Holcim Ltd, 2010). Holcim advocates industry-, region-, and plant-specific emissions benchmarks and boasts about its achievements, citing success in reducing manufacturing emissions by 20 percent under the company’s 1990 levels. In 2002, Holcim-owned Aggregate Industries US joined the United States Environmental Protection Agency’s Climate Leaders Program and the Cool Climate Concrete carbon offset campaign, solidifying its strategic position as an industrial environmental leader and further advancing its commitment to emissions- and market-based approaches.

Beyond its glowing environmental rhetoric, however, Holcim's focus on production-side emissions reduction masks the aggregate industry's much larger role in global anthropogenic climate change. With its industry counterparts, Holcim is fully implicated in the expanding network of roads, highways, and buildings that underlies the carbon economy. Numerous studies note that improved technology and fuel efficiency measures are insufficient for real action on climate change (Zimmerman, 2002; Bartholomew, 2007; Ewing et al., 2007). Instead, they urge a reduction in vehicle miles travelled achieved through a combination of urban densification, land-use diversification, and improved mass public transit. Such efforts would combat the growing trend of urban sprawl and car-dependence at the root of much of the current climate crisis. Unsurprisingly, the aggregate industry is resistant to the anti-sprawl movement and the potential effect on product demand, as the assumption is that a growing population should correspond with a proportionate increase in the need for aggregate (Markley, 1999; Ontario Stone, Sand & Gravel Association, 2010). In effect, industry's own efforts at climate change mitigation through in-plant efficiency gains and reduced resource use appear quite meaningless given its central role in the promotion of carbon-based infrastructure development.

Particularly in the developing world, adaptation is as important as mitigation. Adaptation refers to a community's ability to cope with the impacts or burdens of climate change and is central to the achievement of environmental and climate justice (Smit and Pilifosova, 2001; Bartlett et al., 2009; Hardoy and Pandiella, 2009). Unfortunately, aggregate industry activity complicates attempts at adaptation just it does mitigation. Karlzenig (2010), for example, links urban sprawl with a loss of community resilience, adaptive capacity, and self-sufficiency.

Additionally, Doucet (2009, 25-36) notes that the massive amounts of money still being spent on road construction and maintenance leave cash-strapped municipalities little means to prepare for a potential climate catastrophe. In spite of industry's assurances otherwise, climate change and the aggregate industry, including Holcim, are fully integrated at all nodes of the product cycle, from extraction to production to consumption, and at both ends of the climate issue, from mitigation to adaptation.

Directly connected to Holcim's role in global climate change is the company's perpetuation of a broad neoliberal agenda. The Holcim Foundation, established in 2003 as an arms-length education, funding, and grant-making organization committed to sustainable building practices, extends the company's climate mitigation efforts to include an equity focus on disadvantaged communities (Holcim Foundation for Sustainable Construction, n.d.). In turn, Holcim boasts that its various restoration activities "[demonstrate] that the exploitation of a gravel pit for commercial purposes can be done in a sustainable way . . . with tangible social and economic benefits" and land left "even better than before exploitation" (Holcim, n.d.b) Notwithstanding the Foundation's equity focus and the company's restoration discourse, however, Holcim remains a multinational aggregate corporation striving to expand its global presence. Involvement in "green" building practices or the more general concept of "sustainable development" is simply one way to do so (Ranpura, 2008, 30; Goldman, 2005, 5). As the primary funding agent for the Holcim Foundation, Holcim is able to disseminate its economic agenda globally while privileging expert knowledge and capital production, all under the guise of sustainability (Ranpura, 2008, 38). With targeted well-publicized restoration projects, moreover, the company is able to justify the ever-expanding network of pits, quarries, and manufacturing plants which feed the modern carbon economy. As is the case with many transnational aggregate operations, Holcim's social and environmental record reveals its true status as an agent of neoliberalism. Even while promoting specific high-profile climate and equity achievements, the company is active or complicit in community upheaval, resource privatization, labor and safety violations, and environmental destruction and pollution, aided by lax or corrupt government policy and motivated by the potential of easy profit (MAC: Mines and Communities, 2005; New Trade Union Initiative, 2010; Olivet, 2010; Pragatisheel Cement Shramik Sangh, 2011; Radiomundoreal.fm, 2011).

Aggregate Mining in India: "Rich Lands, Poor People"

The case of the aggregate industry in India illustrates the disconnection between industry rhetoric and real action on climate change and environmental justice. India is the world's second largest cement producer (after China) and is rich in cement-grade limestone deposits. Other important aggregates mined and processed include sandstone and marble. The country's thousands of aggregate operations are both large and small and formal and informal. Beyond the nation's largest aggregate firms, including multinational corporations such as Holcim, the industry is heavily dependent on small-scale mining operations. Though no official

statistical data exists, Chakraborty (2002) estimates that small mines comprise approximately 90 percent of the total number of mines in the country.

One of the dominant actors in the Indian aggregate industry is Gujarat Ambuja Cements, bought by Holcim in 2005 for US\$800 million. Ambuja is lauded for its energy efficient plants and own electricity generation and appears representative of the Indian cement sector as a whole in terms of energy use and technological innovation (Bhushan and Hazra, 2005). The New Delhi-based Centre for Science and Environment's 2005 Green Rating Project on the cement life-cycle (Bhushan and Hazra, 2005) praises the industry's world class state-of-the-art manufacturing facilities, rating it above many of its counterparts in the developed world for its low carbon emissions (see also Bhushan, 2010, 67-78).

The industry's energy efficiency and emissions reduction measures, however, mask important realities in the Indian aggregate sector. Firstly, in-plant efficiency measures do little to change an industry that helps create and perpetuate the car-based society at the root of climate change. Moreover, as Bhushan (2009, 16) suggests, emissions reduction in the Indian aggregate industry will become increasingly difficult as the "low-hanging fruits" are dealt with first. Further success might require major and less-profitable changes. This leads to the second reality that the industry's biggest players are only environmental leaders when there is economic benefit involved. The same industry praised for its efficient use of energy and waste is indicted by the Green Rating Project for its mining practices on both social and environmental levels.

The Green Rating Project found that mining regulations are poorly implemented and that aggregate firms are flippant about the environmental effects of their mines. As a result environmental management is poor, quarry rehabilitation is non-existent, and 44 percent of the mines studied are operating in ecologically sensitive areas. Many mines operate in previously forested areas, for example; beyond their negative impact on biodiversity, they may lead to displacement of rural peoples' homes and livelihoods, typically without compensation. Air pollution and land contamination is also common, but generally ignored (Konar, 2005, 10; Mine Labor Protection Campaign [MLPC], 2009, 17).

The situation in Rajasthan provides a stark illustration of the industry's questionable environmental record. In 2002, India's Supreme Court ordered a ban on all mining activity in the Aravali hills, one of the world's largest hill regions and a natural barrier to the encroaching western desert. The order was issued in response to the mining industry's role in deforestation and groundwater table disturbances, and was thought to affect a number of cement companies in the region, including one of Ambuja's subsidiaries. Illegal mining, sanctioned by corrupt state officials, has continued into 2010 in direct violation of the Court's order. Though large multinationals have only recently entered certain sectors of the Indian mining industry, the national government's promotion of an "investor-friendly" regulatory environment combined with increased privatization facilitates

this and similar accounts of environmental corruption (Sarangi, 2004, 1650;; Das and Felix, 2010).

India's aggregate industry also scores poor ratings on the working conditions and social impacts of its mining operations (Moody, 2009; Bhushan and Hazra, 2005). The situation is the worst in the unorganized sector (Figure 1). In a report by a Dutch environmental organization on the aggregate industry in Budhpura village, Bundi District, Rajasthan, the writers describe a landscape pocked by hundreds of sandstone quarries as a Ground Zero (Madhaven and Raj, 2005; see also Bhushan et al., 2008). The operation of these makeshift mines has affected water quality and agricultural land availability while contributing to high levels of pollution- and dust-borne illnesses in both workers and community members.



Figure 1: Working conditions in the unorganized sector are especially appalling. Marble taken from Makrana, Rajasthan, above, built the Taj Mahal but represents certain danger and even death to workers. Several mines in the area have collapsed and others are at high risk. It is estimated that an average of three workers die each month while thirty others are injured in these mines (Bhalla, 2007; photo used with permission of Rana Sengupta/MLPC).

The report also details the deplorable working conditions of the sandstone mines. Workers are often drawn from lower castes and become invisible and unrecorded laborers, their employers unaccountable for injuries, deaths, or missed wages. Women and children make up a large portion of the labor force, and the rate of bonded labor is high, sometimes drawing whole families into an exploitative

cycle of dependency. As their traditional subsistence livelihoods and medicinal support systems are displaced, women in particular feel the uneven effects of mining in both the work and household spheres. Absorbed into the informal mining sector as contract workers, they are often exposed to physical and sexual harassment, exploitative working conditions, and disproportionately low wages (Ghose, 2005, 34-36; MLPC, 2009, 8). Climate change is therefore just the latest negative offshoot of an industry already characterized by high levels of social and environmental injustice. All are high prices to pay for our current infrastructure-heavy, car-dependent society.

Efforts at worker education and organizing in the state have been marginally successful, but the lack of regulation, informal work conditions, and vulnerability of the labor force means there is still much work to be done. Nevertheless, several examples illustrate the potential for an effective trans-communal resistance at the various nodes of the aggregate cycle. The Rajasthan-based Mine Labor Protection Campaign's (MLPC) attempt to establish model cooperatives has seen the most success. Fourteen are now operative in the state, spanning seven districts and including four hundred and forty-eight workers. With the help of MLPC, the worker cooperatives have turned sustainable profits from small mining leases in their communities with a focus on worker entitlement and community and environmental health (see MLPC, 2005). MLPC notes that the existence of the cooperatives has not only benefited members, many of them lower-caste and many of them women, but has also had both direct and indirect positive effects on working conditions in other mines and at the community level (*ibid*, 2005, 9-10). MLPC-sponsored cooperatives have reached out to bonded laborers, for example, using cooperative income to pay off debts, while MLPC's self-help groups for women have included cooperative members' wives. Writing on regularization in the Indian coal industry, Lahiri-Dutt (2007, 64) argues that mining cooperatives may not effect the underlying production and regulatory conditions necessary for structural change. However, MLPC hopes to work with state and local governments to expand the cooperative model, incorporating more workers and ensuring that sustainable, local-level mining can co-exist with traditional subsistence and income-generating activities. Importantly, though the social and environmental impacts of small-scale mines are often deplorable, informal aggregate operations such as those studied by MLPC may in fact constitute their own resistance to the "official" mining economy (Lahiri-Dutt, 2003). As a response to the widespread impoverishment and displacement garnered by traditional mining regulation and governance, these operations reassert communities' right to the aggregate resource. With the proper conditions in place, small-scale mining may contribute to both the ecological and social sustainability of rural and/or tribal communities in India.

The India Committee of the Netherlands' (ICN) work on Budphura Village further illustrates the potential for a multi-scalar transcommunal opposition to conventional mining discourse (Madhaven and Raj, 2005). Budphura was chosen

as a study site by the Dutch organization not only because of the village's representative role in the national sandstone industry but also because aggregate from Budhpura was recently used by the Dutch town of Kampen for work on its city centre (ibid, 4). The Budhpura report therefore attempts to uncover the connections between paved roads and building facades in Europe and miserable working conditions and environmental degradation in India, directly linking workers to consumers and raw aggregate to finished product. The authors note that the ICN is currently working in concert with a Dutch environmental group to engage the Dutch natural stone industry in discussions about the impacts of natural stone quarrying and processing (ibid).

Elsewhere in India, the Turtle People of North Karela are fighting to preserve their village and their livelihoods, threatened by sand mining on their estuary. They see the conservation of the Olive Ridley Turtles, a species on the verge of extinction, as an extension of their fight against the destruction of their estuary, their village, and their lives. Likewise, cement industry contract workers in the province of Chhattisgarh are fighting a 30-year battle against Holcim and a corrupt government concerning workers' rights under a neoliberal regime; in an important show of solidarity, their struggle goes beyond cement manufacture to encompass farmers' groups and the local civil liberties movement (Chhattisgarh Mukti Morcha, 2011). There is therefore room for building connections between workers across space as well as exposing consumers in the wealthy North to the working conditions of aggregate workers in India. Such connections may in turn reveal the extent of the industry's role in the global consumer- and car-dependent carbon economy as well as the injustices on which it rests.

Aggregates in Southern Ontario: Mining the Niagara Escarpment Biosphere Reserve

There are a couple of features that the aggregate industry in southern Ontario shares with the aggregate-resource rich states in India. In both places, the state or provincial governments have taken measures to ensure a steady supply of raw material for the industry. The provisions in Ontario's provincial legislations classify aggregates as an essential public almost sacred good. At the extractive end, these provisions include conservation legislation which typically contains loopholes and concessions that allow the establishment of new mines or continued extraction at existing mines if it is deemed "necessary" (Patano and Sandberg, 2005). At the consumptive end, conservation legislation that cover environmentally sensitive areas also contain loopholes that allow for the construction of infrastructure when deemed "necessary" for the public good, such as sewer pipes and highways. In addition, the industry's siting and expansionary efforts are not constrained by any analyses of supply and demand (Chambers and Sandberg, 2007, 332).

The strong state support for the aggregate sector is closely tied to the carbon economy. The southern Ontario economy is highly dependent of the automobile

sector for jobs and revenue and over half of aggregate resources go to road construction. In a commonly referred to narrative, the generous provisions for extraction in areas close to Toronto is stated to be a good environmental measure that contributes to the reduction in carbon emissions. This is because the establishment of more distant quarries would result in increased carbon emissions from the trucks carrying the aggregates longer distances. There is no mention that most aggregates are used to build and maintain the road system that carries the cars and trucks that are responsible for carbon emissions in the first place (Patano and Sandberg, 2005).

In one of the several unique local landform features that hold special protection status in the Greater Toronto Area, there are valuable and close-to-market aggregate resources. The Niagara Escarpment is a geological feature rich in aggregates that enjoys provincial protective status since 1970, and that was designated a UNESCO biosphere reserve in 1992. The Escarpment is the most famous for the Niagara Falls, which lies at one of its most easterly points, between Lake Ontario and Lake Erie, but the Escarpment is much larger. It extends for over 1600 kilometers from Watertown, in upstate New York, in the east to Manitoulin Island in Lake Huron, one of the Great Lakes, in the west.

The conservation areas surrounding the Greater Toronto Area represent a point in the aggregate cycle where the aggregate industry faces stiff opposition in the exurbs, the prosperous low-density residential neighborhoods lying outside the suburbs. These areas, which contain rich mineral deposits, either harbor or lay adjacent to areas that have undergone a process of rural gentrification. Dufferin Aggregates' Milton quarry, owned by the Holcim Group, is one of many limestone quarries located on the Niagara Escarpment. It is a mere one-hour's drive from downtown Toronto, and serves a 7-million population that constitutes the Greater Toronto Area. It is one of Canada's largest limestone quarries, a super-quarry, that produces close to 4 million tons of aggregates per year and that is 552 hectares in size, the equivalent of close to 800 soccer fields. The mine has operated for approximately 50 years and was therefore protected under grandparent clauses that allowed continued though not expanded production when the conservation designation was put in place. By the late 1990s, however, it was expected to be mined out.

When the closure of the mine approached, however, the company used a couple of strategies to extend and expand its operations. It first invoked the necessity to meet the demand for aggregates, and petitioned the government and associated hearing boards to extend the life of the mine. And though the environmental impacts of the extension took up the majority of the discussion at various hearings, the provision of "necessity" prevailed in the end. Second, the company also embarked on an intense campaign to re-vision its operations as sustainable and compatible with natural processes. Its substantial restoration efforts were widely circulated in the media, describing the invading flora and fauna as forming a "living quarry" that constituted a new nature. The efforts represented the

blurring of boundaries between the massive extraction of aggregate resources and the “natural” geological and ecological processes on the Niagara Escarpment (Figure 2).



Figure 2: At Dufferin’s Milton quarry, the company has maintained the physical edge of the quarry and re-imagined it as a brand new “natural” escarpment. This is referred to as “landscape replication or emulation” where a destroyed or altered landscape form is created or re-created by artificial means. The artificial escarpment appears rather unstable and is inaccessible to the public (photo by L. Anders Sandberg).

In their efforts to extend the life of the quarry, however, Holcim faced a serious opposition that lasted close to a decade, referencing the serious ecological and environmental consequences of the expansion in a protected area. In the end, though, the company’s efforts were successful.

Until only half a decade ago, applications for pit and quarry expansions in Ontario were routinely approved, albeit sometimes after a long hearing process. However, in other areas of the Greater Toronto Area, some opposition to quarry establishments or expansion has been successful (CCC, 2011; Chambers and Sandberg, 2007; FORCE, 2011). These cases have exposed the political flexibility in provincial legislation when financial and expert resources are part of impact hearings and where public opposition and media attention are rallied in favor of local opponents. In these situations, opponents struggle hard to shed the NIMBY label by presenting a concern about broader ecosystem and landform values, urban sprawl, and planning issues that do have the potential for broader trans-regional efforts (Wekerle et al., 2009).

Super-quarries in Northern Scotland: Taking down mountains at Glensanda

In the 1970s, the U.K. government conducted studies that recommended the establishment of super-quarries, huge extraction sites in northern Scotland, to substitute for alleged resource scarcities in the south and to meet what was believed to be a growing market for aggregates in the future. Another reason for the super-quarries was the desire to avoid the growing protests from local exurban communities. Subsequent consultants' reports covering the European Union reinforced the U.K. studies adding Norway and various other sites as potential sites for super-quarries.

Glensanda, on Loch Linnhe, however, represents the only Scottish super-quarry that has materialized from these efforts. It was owned and operated by its founding family for 83 years until it was sold to Holcim Group for an estimated £300 million in 1988. Glensanda produces from 7-8 million tons of stone a year but has the potential to increase output to 15 million tons. At Glensanda, an entire granite mountain, Meall na Easaiche, is quarried, pulverized and transported along a mile of conveyor belts in tunnels to a jetty, where it is loaded directly into bulk carriers which transport the aggregates to distant markets in London and several ports in mainland Europe and the United States. In the 1990s, in a rare open marriage of concrete and carbon, bulk carriers transported Glensanda aggregates to Texas and returned with Utah coal for the European market (Muir Wood, 1990, 92).

The quarry is Europe's biggest coastal quarry. In 2006, it expanded from 125 ha to 206 ha, from 180 to 300 soccer fields, approximately half the size of the Milton Quarry. But the expansion plan included removing the peaks of two more mountains, "The Mam" and "Lag a 'mhaim", from the skyline. The local ecosystems, including the ecologies of otters, seals, and golden eagles, are sacrificed for stepped up aggregate production to satisfy distant demands in the rest of Europe, feeding an expanding economy of gas-guzzling cars and offshore exploring and exploiting oil rigs and platforms.

Calciferous capitalism's spatial fix at Glensanda has succeeded in avoiding protests so common at other sites where quarries and pits are proposed. The site is highly remote, poorly visible and the sparse population has either been employed at the quarry or ensured that traditional economic activities can continue on the surrounding property (Ali and Paradis, 2006, 7-10). There have been few and minor protests and interference from environmental groups. One reason, no doubt is the isolated site of the quarry (Figure 3). Its isolation is well illustrated by one curious visitor: "If you fancy going remember it's a long way to get to the starting point by car, then you're on your own to negotiate 7 or eight miles of very rough ground on a spectacularly remote coastal walk. Go prepared!" (Kat's Logos, 2010).

But the establishment of a super-quarry at Glensanda has constituted more of an exception than a rule, the quarry being the only one of many planned in Scotland. In contrast to Glensanda, other planned super-quarries in Scotland have

faced massive protests. The iconic and precedent-setting case was the proposed super-quarry at Lingarabay on South Harris proposed by French aggregate giant Lafarge. A combination of nationalist, local, and environmentalist factions, sometimes independently, sometimes in alliance, rallied for more than a decade to oppose and eventually defeat the proposal. The fight gathered enormous attention in both the popular and scholarly literature (Warren, 2002). It also exerted a chill on any proposal for other super-quarries in the region. But the situation in Scotland is not unique. On Cape Breton Island and Digby Neck in Nova Scotia, Canada, other super-quarries have been resisted successfully (Warren, 2002; Hornborg, 2008; Richler, 2007). A combination of environmental groups backed by science, local residents protecting local livelihoods, and rituals performed by local/Indigenous groups with a different world view have combined to defeat these proposals. Indigenous peoples' refusals to conceptualize sacred mountains as aggregate resources have been a particularly powerful ingredient in the mix (Hornborg, 2008).

Susan Owens (2004) points to another site of struggle surrounding the aggregate industry sector. She has written that the term "national need versus local interests" when thought of in terms of aggregate sitings often leaves the first part of the term unquestioned. The claim that the nation needs aggregates to grow and prosper is seldom problematized while those who protest quarry establishments are labeled parochial NIBMYists. Owens suggests that these positions should be reversed. Demand projections are not absolute. In the United Kingdom, for example, the demand for aggregates leveled off and then declined at the time of the Lingarabay proposal, a condition that was reinforced by the establishment of several super-quarries in Norway. The devolution of power from Westminster to the Scottish Parliament in 1999 also precluded the use of the "national good" as a compelling reason for planting super-quarries in Scotland (Owens 2004, 108). An added dimension was a change in thinking, quite different from the situation in India and southern Ontario, that rather than projected demand determining the supply, the demand can actually be questioned and managed to modify "needs" (ibid., 109).

Projections of the demand for aggregates typically emanate from industry-friendly consultants who do not question the use to which the material is put. From this perspective, climate change may drive an increased demand for aggregates as, for example, concrete barriers and other infrastructure may be needed to protect settlements from rising sea levels (Bloodworth et al., 2000, S322-3). As Owens points out, however, there are precedents for probing the demand projections model, which then allows a questioning of the large infrastructural projects that support a carbon-, road- and car-dependent society. It also allows for a search for alternative life styles that tread more lightly on the earth.

Conclusion

If you buy Gujarat Ambuja cement in India, in reality you're helping line the pockets of the Schmidheiny family of Switzerland. Their Holcim conglomerate snapped up the company for US\$800 million in 2005, marking the costliest foreign takeover of any Indian domestic company until that date (Moody, 2009, 3).

A similar situation applies if you buy products at Dufferin Aggregates in Toronto, Ontario, or at Glensanda in Scotland. Three ground zeros, three areas where the carbon economy is grounded, all entangled with global producers, all being involved in a global market place, and the Holcim Group of Switzerland being one part of it. As noted, the aggregate companies are world-wide operators with extensive public relations machineries to support their vision throughout the aggregate cycle, from extraction to rehabilitation of mining sites, and from the manufacture of cement and concrete to the construction of roads and buildings.

Oppositions to the industry are fragmentary but may still constitute the foundation and inspiration for a more integrated and concerted trans-communal resistance. The Holcim Group provides an illustration of different accumulation strategies and contestations in different jurisdictions. In India, Holcim is part of the various eco-modernist and sustainability efforts in the cement and building sectors to justify a transnational expansion and to boost its green image. Critics label these efforts as green washing as well as a front for brutal working conditions at pits and quarries and cement factories. These phenomena provide sites for already existing and potential local struggles with trans-communal support from solidarity and consumer organizations in the West and elsewhere. In southern Ontario, the Holcim case illustrates the common presence of state policies that treat aggregates as a public essential good whose extraction face few restrictions. Industry and state politics also view and support aggregate mining as an interim use that can be restored and rehabilitated into its former "natural" condition. Exurban residents and environmentalists on occasion contest quarry expansions on environmental grounds. In the past, they have typically lost on the grounds that aggregate is a "public good" necessary to meet public infrastructure demands, but there are now signs that their influence and arguments are gaining grounds with politicians and the courts. In northern Scotland, Holcim pioneered the industry policy of establishing super quarries in peripheral regions to offset the resource scarcities faced from exurban and environmentalist protests in the southern United Kingdom. The lack of success of other aggregate companies to establish super quarries in the Scottish periphery illustrate the potential power of local and trans-communal protests in defending local livelihoods and natures.

Though different social relationships between the aggregate industry, the state, workers and communities exist in different jurisdictions, they are all connected to the carbon economy. The calciferous economy is tethered to the carboniferous one and they are both built on an economy based on capital

accumulation and conspicuous consumption that militate against local economies, social justice, and public transportation. More roads yield more cars, perpetuating the current cycle of rising carbon emissions and larger and deeper aggregate pits; change can only come by fostering a blend of flexible and integrative public mobility alternatives, encompassing transport and dwelling, that includes all groups of people (Monbiot, 2007, 142-169; Sperling and Gordon, 2009, 37-43). Current forms of carbon colonialism, where projects in poor countries offset growing carbon emissions in the richer countries, need also change (Pearse, 2009). Such change, in turn, can only come if the demand for carbon and calcium carbonate is interrogated, questioned, connected to the broader dynamics of capitalism, and then wider actions across borders and social groups are taken.

Acknowledgements

We are grateful for the excellent comments and constructive feedback for revisions provided by Mark Whitehead, Kelvin Mason, and Kuntala Lahiri-Dutt.

References

- Ali, S. & R. Paradis. 2006. *The politics of land tenure in Scotland*. Working Paper. University of Vermont. <http://www.uvm.edu/~shali/Scotland.pdf>
- Angus, I. (Ed). 2010. *The Global Fight for Climate Justice: Anticapitalist Responses to Global Warming and Environmental Destruction*. London: Resistance Books.
- Bartholomew, K. 2007. Land use transportation scenario planning in an era of global climate change. *Transportation* 34, 4, 397-412.
- Bartlett, S., D. Dodman, J. Hardoy, D. Satterthwaite & C. Tacoli. 2009. Social aspects of climate change in urban areas in low- and middle-income nations. Paper presented at the World Bank Fifth Urban Research Symposium on "Cities and Climate Change: Responding to an Urgent Agenda," Marseille, June.
- Bhalla, N. 2007. Miners pay heavy price for India's famed marble. *Reuters* 28 May, <http://www.reuters.com/article/idUSDEL23519420070528>, accessed 15 July 2010.
- Bhushan, C. 2010. *Challenge of the New Balance*. New Delhi: Centre for Science and Environment.
- Bhushan, C. 2009. Indian industry and climate change: Perceptions, policies, and possibilities. In, David Michel and Amit Pandya (eds.), *Indian Climate Policy: Choices and Challenges*. Washington: Henry L. Stimson Center, pp. 13-17. http://www.stimson.org/rv/pdf/Indian_Climate_Change/RV_FINAL.pdf

- Bhushan, C., M. Z. Hazra & S. Banerjee. 2008. *Rich Lands Poor People: Is 'Sustainable' Mining Possible?* New Delhi: Centre for Science and Environment.
- Bhushan, C. & M. Z. Hazra. 2005. *Concrete Facts: The Life Cycle of the Indian Cement Industry*. New Delhi: Centre for Science and Environment.
- Bloodworth, A. J., P. W. Scott & F.M. McEvoy. 2009. Digging the backyard: Mining and quarrying in the UK and their impact on future land use. *Land Use Policy* 265, S317-S325.
- Bridge, G. 2009. The hole world: Scales and spaces of extraction. *New Geographies* 2, 43-48.
- Building Value. 2001. *Global Consolidation in Heavy Building Materials*. London: Building Value Ltd. <http://buildingvalue.s15310919.onlinehome-server.info/admin/uploads/consolidation.pdf>, accessed 15 July 2010.
- CCC [Coalition of Concerned Citizens], 2011. <http://www.coalitioncaledon.com/>, accessed 14 October 2011.
- Chambers, C, & L. A. Sandberg. 2007. Pits, peripheralization and the politics of scale: Struggles over locating extractive industries in the Town of Caledon, Ontario, Canada. *Regional Studies* 41, 327-38.
- Chakraborty, M. K. 2002. *Issues and Problems of Indian Small-Scale Mines*. National Seminar on Policies, Statutes and Legislation, CMRI, Dhanbad, India.
- Chhattisgarh, M. M. 2011. [Persecution of CMM and Pragatisheel Cement Shramik Sangh union by Chhatisgarh govt and MNC](#). Sanhati. <http://sanhati.com/articles/3322/>, accessed 11 October 2011.
- Das, S. & F. Padel 2010. *Out of this Earth: East India Adivasis and the Aluminum Cartel*. Andhra Pradesh: Orient Blackswan.
- Doucet, C. 2009. *Urban Meltdown: Cities, Climate Change and Politics as Usual*. Gabriola Island, BC: New Society.
- Ewing, R., K. Bartholomew, S. Winkelman, J. Walters & D. Chen. 2007. *Growing Cooler: The Evidence on Urban Development and Climate Change*. Washington, DC: Urban Land Institute.
- FORCE [Friends of Rural Communities and the Environment], 2011. <http://stopthequarry.ca/>, accessed 12 October 2011.
- Friends of the Earth Internacional. 2011. *Holcim in Latin America: Case Studies*. Amsterdam: Friends of the Earth International.
- Gadgil, M. & R. Guha. 2007. Ecological Conflicts and the Environmental Movement in India. In Mahesh Rangarajan (ed.), *Environmental Issues in India: A Reader*. Delhi: Dorling Kindersley, pp. 385-428.

- Garcia Muñoz, G. 2011. The Many Faces of Latin America in Times of Globalization. In Friends of the Earth Internacional, *Holcim in Latin America: Case Studies*. Amsterdam: Friends of the Earth International, pp. 11-14.
- Goldman, M. 2005. *Imperial Nature: The World Bank and the Struggle for Social Justice in the Age of Globalization*. New Haven, CT: Yale University Press.
- Hardoy, J. & G. Pandiella. 2009. Urban poverty and vulnerability to climate change in Latin America. *Environment & Urbanization* 21,1, 203-224.
- Holcim Foundation for Sustainable Construction. n.d. Holcim Foundation origins. http://www.holcimfoundation.org/T700/Holcim_Foundation_origins.htm, accessed 11 October 2011.
- Holcim Ltd. n.d.a. Fact sheet – Climate change. http://www.holcim.com/holcimweb/gc/CORP/uploads/Holcim_FactSheet_ClimateChange_2008.pdf, accessed 25 July 2010.
- Holcim Ltd. n.d.b. Sustainability award for Holcim Spain. <http://www.holcim.com/en/press-and-media/stories/sustainability-award-for-holcim-spain.html>, accessed 11 October 2011.
- Holcim Ltd. 2010. Holcim's position on climate change. http://www.holcim.com/CORP/EN/id/70901/mod/7_4_5_0/page/holcimweb/page/editorial.html, accessed 25 July 2010.
- Hornborg, A-C. 2008. Protecting earth? Rappaport's vision in environmental practices. *Journal of Human Ecology*, 23, 275-83.
- Kalshian, R. (Ed.), 2007. *Caterpillar and the Mahua Flower: Tremors in India's Mining Fields*. New Delhi: Panos South Asia.
- Karlenzig, W. 2010. The death of sprawl: Designing urban resilience for the twenty-first-century resource and climate crises. In Heinberg R & D Lerch (Eds.), *The Post Carbon Reader: Managing the 21st Century's Sustainability Crises*. Healdsburg, CA: Watershed Media, pp. 285-313.
- Kat's Logos. 2010. http://urbanglasgow.co.uk/archive/glensanda-super-quarry_o_t_t_716.html, accessed 27 July 2010.
- Limestone Quarries of Jharkhand and West Bengal, India.*
http://www.asmasiapacific.org/asm_india.php, accessed 2 December 2011.
- Lahiri-Dutt, K. 2003. Informal mining in Eastern India: Evidence from the Raniganj coalbelt. *Natural Resources Forum* 28, 2, 128-132.
- Lahiri-Dutt, K. 2007. Illegal coal mining in Eastern India: Rethinking legitimacy and limits of justice. *Economic and Political Weekly*, 42, 49, 57-66.
- Latour, B. 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.

- MAC: Mines and Communities. 2005. The scheme of plunder. <http://www.minesandcommunities.org/article.php?a=5263>, accessed 11 October 2011.
- MacDonald, K. 2010. The devil is in the (bio)diversity: Private sector “engagement” and the restructuring of biodiversity conservation. *Antipode* 42, 3, 513-50.
- Madhavan, P. & S. Raj. 2005. *Budhpura ‘Ground Zero’ — Sandstone Quarrying in India*. Utrecht: India Committee of the Netherlands. <http://www.indianet.nl/budhpura.pdf>, accessed 25 July 2010.
- Markley, R. 1999. A call to arms. *Rock Products*, 1 September. <http://rockproducts.com/index.php/news-late/715.html>, accessed 5 October 2011.
- Mine Labor Protection Campaign. 2005. *Organising the Unorganized*. Jodhpur: Mine Labor Protection Campaign.
- Mine Labor Protection Campaign. 2009. *Fair Trade Principles and Policies Document (FTPPD)*. Jodhpur: Mine Labor Protection Campaign.
- Mitchell, T. 2011. *Carbon Democracy: Political Power in the Age of Oil*. London: Verso.
- Moody, R. 2009. The destruction of construction. *Infochange India*. http://infochangeindia.org/index2.php?option=com_content&do_pdf=1&id=7718, accessed 26 July 2010.
- Monbiot, G. 2007. *Heat: How to Stop the Planet from Burning*. Toronto: Anchor Canada.
- Muir Wood, R. 1990. Super-quarries. *Terra Nova* 2, 91-2.
- New Trade Union Initiative. 2010. Swiss multinational corporation Holcim kills workers! <http://ntui.org.in/media/item/swiss-multinational-corporation-holcim-kills-workers/>, accessed 11 October 2011.
- O’Connor, J. 1998. *Natural Causes: Essays in Ecological Marxism*. New York: Guildford.
- Olivet, M. C. 2010. Euro transnationals: Crimes of neoliberalism. Brecht Forum. <http://brechtforum.org/euro-transnationals-crimes-neoliberalism>, accessed 11 October 2011.
- Ontario Stone, Sand & Gravel Association. 2010. About aggregates #5: Importance of aggregate. <http://www.ossga.com/Downloads/publicationsPFDs/Importance%20of%20Aggregates2010.pdf>, accessed 5 October 2011.
- Owens, S. 2004. Siting, sustainable development and social priorities. *Journal of Risk Research* 7, 101-114.

- Patano, S. & L. A. Sandberg. 2005. Winning back more than words? Power, discourse and quarrying on the Niagara Escarpment. *Canadian Geographer* 40, 25-41.
- Pearse, G. 2009. Quarry vision: Coal, climate change, and the resources boom. *Quarterly Essay*, 33, 1-30.
- Permanent People's Tribunal. 2008. Session on neoliberal policies and European transnationals in Latin America and the Caribbean. <http://www.tni.org/article/permanent-peoples-tribunal-session-neoliberal-policies-and-european-transnationals-latin-ame>, accessed 6 October 2011.
- Pragatisheel Cement Shramik Sangh. 2011. Chhattisgarh – Contract Workers of Holcim begin indefinite dharna. Sanhati. <http://sanhati.com/articles/3427/>, accessed 5 October 2011.
- Radiomundoreal.fm. 2011. Criminal records. <http://www.radiomundoreal.fm/Criminal-Records?lang=es>, accessed 11 October 2011.
- Ranpura, S. 2008. An architecture of sustainability: Contested ideologies and identity politics. *IMRE* 2, 2, 28-44.
- Richler, N. 2007. Rock bottom: With the seas nearly barren, should Digby Neck, Nova Scotia, settle for selling the earth? *The Walrus* 23 April. <http://www.walrusmagazine.com/print/2007.12-business-nova-scotia-mining>, accessed 24 July 2010.
- Rock, M., J. Murphy, R. Rasiah, P. van Seters & S. Managi. 2009. A hard slog, not a leapfrog: Globalization and sustainability transitions in developing Asia. *Technological Forecasting & Social Change* 76, 241-54.
- Sandberg, L. A. 2011. Ecological restoration and environmental justice at the Limhamn Quarry, Malmö, Sweden. Paper presented at the Annual Meeting of the Society for Ecological Restoration, Merida, Mexico, August.
- Sandberg, L. A. & T. Sandberg (Eds). 2010. *Climate Change – Who's Carrying the Burden: The Chilly Climates of the Global Environmental Dilemma*. Ottawa: Canadian Centre for Policy Alternatives.
- Sarangi, D. 2004. Mining 'development' and MNCs. *Economic and Political Weekly* 39, 17, 1648-1652.
- Shiva, V. 2009. *Soil Not Oil: Climate Change, Peak Oil and Food Insecurity*. London: Zed Books.
- Smit, B. & O. Pilifosova. 2001. Adaptation to climate change in the context of sustainable development and equity. In McCarthy, J. J., O. Canziani, N.A. Leary, D.J. Dokken & K.S. White (Eds.), *Climate Change 2001: Impacts, Adaptation and Vulnerability*. Cambridge: Cambridge University Press, pp. 877-912.

- Sperling, D. & D. Gordon. 2009. *Two Billion Cars: Driving Toward Sustainability*. Oxford: Oxford University Press.
- Warren, C. 2002. Of superquarries and mountain railways: Recurring themes in Scottish environmental conflict. *Scottish Geographical Journal* 118, 101-27.
- Wekerle, G., L. A. Sandberg and L. Gilbert. 2009. Taking a stand in exurbia: Environmental movements to preserve nature and resist sprawl. In Laurie Adkin, (ed.), *Environmental Conflict and Democracy in Canada*. Vancouver: UBC Press, pp. 279-97.
- World Business Council for Sustainable Development. 2002. *The Cement Sustainability Initiative: Our Agenda for Action*. Geneva: World Business Council for Sustainable Development.
- Zimmerman, R. 2002. Global climate change and transportation infrastructure: Lessons from the New York area. In, *The Potential Impacts of Climate Change on Transportation: Workshop Summary and Proceedings*. Washington, DC: United States Department of Transportation, pp. 91-101.