The Industrial Transformation of Subarctic Canada

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The Industrial Transformation of Subarctic Canada

LIZA PIPER

FOREWORD BY GRAEME WYNN

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To Georgia and David

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FOREWORD

The Nature of Industrialization

by Graeme Wynn

"Had we but world enough, and time" to pursue the central concern of this thought-provoking book through all its branches, the task would be fascinating.[1] Books and poems, myths and legends, songs and stories, paintings, photographs, essays, and articles galore have reflected upon the ways in which industrialization changed human relations with nature to produce new socio-ecological circumstances. No list could capture all of this variety, but a hypothetical version might begin with the photographs of Edward Burtynsky or a YouTube video, and move back through the poetry of Allen Ginsberg and the works of environmentalists, nature writers, and eco-critics to consider the American Transcendentalists (Henry David Thoreau, Walt Whitman) and the (sometimes so-called) eco-romantics of eighteenth- and nineteenth-century Britain (including, for example, J.M.W. Turner, William Wordsworth, and William Blake). Alongside them, George Perkins Marsh, Karl Marx, Frederick Engels, and many others would surely warrant attention, until perhaps the search for the beginnings of this complex, braided intellectual thread led back to the Titan Prometheus of Greek mythology, who stole fire from the gods, delivered that powerful technology to mortals, and provided a base both for the conviction that progress depends upon human domination of nature and for vigorous objections to that view.

Recent years have seen a torrent of thoughtful reflection and analysis on this theme. The flood has run in many channels, and Liza Piper's discussion of industrialization in Subarctic Canada inevitably speaks more cogently to some of these than others, but it warrants an important place in the increasingly

1 "World enough, and time" is from Andrew Marvell, "To His Coy Mistress" (1651-52, published 1681).

crucial debate about human–environment interactions. Put simply, this is because Piper knows what novelist Elizabeth Hay demonstrates in her *Late Nights on Air* (set in Yellowknife and the barrens beyond): that the fundamental story of this territory is an ecological one, "about the fragile interdependence of people, animals and their environment."[2] This means that Piper understands the Canadian Northwest as a place where humans and nature have a long and continuing history of co-adaptation, with each changing in response to the actions of the other, rather than as a blank canvas upon which agents of the state, industry, capital, and so on were able to paint their imported designs.

This understanding places Piper's work in conversation with two of the most intellectually productive and widely-engaged ideas in contemporary environmental history. The first, flowing from groundbreaking work by American scholars William Cronon and Richard White, focuses on the ways in which human ingenuity and technological innovation have distanced humans from nature and modified natural processes. The second, allied, theme flows from James C. Scott's cogently-argued and influential book *Seeing Like a State*, in which he draws from a magisterial assortment of sources to explain "how certain schemes to improve the human condition have failed."[3]

The first of these ideas often underpins narratives of environmental decline produced by a combination of human hubris, capitalist greed, and technological might. On this view, sometimes embraced with more enthusiasm than intellectual subtlety, industrialists develop machines and artificial processes that, like Promethean fire, enhance the human capacity to alter, dominate, and conquer nature until ecological disaster results from the application of increasingly powerful brute-force technologies without proper accounting of their environmental costs. This is a broadly familiar argument. Remember that Cronon's engagement with it rests on the distinction, derived from Hegel and Marx, between "first" (original or pre-human) and "second" (human-produced) natures; that however he intended it, William Blake's famous reference, to "dark Satanic mills" has been understood as an indictment of the despoliation of "England's green and pleasant land" during the early industrial revolution; and that George Perkins Marsh, once described as the "fountainhead of the conservation movement" in the United States, announced in 1864 that "man is everywhere a disturbing agent," turning "the harmonies of nature ... [into] discords." There is also much to be said for this view. Everyday experience confirms the dizzying speed of technological advance and the damaging environmental consequences

2 Elizabeth Hay, *Late Nights on Air* (Toronto: McClelland and Stewart, 2007); quotation from a readers' guide to *Late Nights on Air* available at http://www.bookclubs.ca/catalog/display.pperl?isbn=9780771038112&view=rg.

3 William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W.W. Norton, 1991); Richard White, *The Organic Machine: The Remaking of the Columbia River* (New York: Hill and Wang, 1995); James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998).

of human actions, even as one acknowledges the many individual and collective benefits produced by these developments.[4]

Offering a critique of "high modernist, centrally-planned" efforts to transform economies and societies in the twentieth century, Scott focuses on the state's capacity to organize and rationalize territories and behaviours by gathering, quantifying, and codifying increasing amounts of knowledge about people and their circumstances. His story is about the ways in which people in centres of calculation use maps, censuses, and the like to produce simplifications of the world, without regard for local conditions or local knowledge, and about how these abstracted visions then become the basis of state policies and actions. More than this, Scott insists, because "seeing like a state" neglects the social and ecological complexities of the world, grand schemes shaped by this perspective are almost bound to fail.

Focusing on the industrial transformation of the "no man's land" centred on the corridor of large lakes arrayed along the western edge of the Canadian Shield, from Lake Winnipeg to Great Bear Lake, Piper offers significant new angles of vision on these two important themes. First, she finds that the powerful industrial technologies brought into the Canadian Northwest early in the twentieth century were closely bound to natural systems. Far from overwhelming the nonhuman world, they were regulated and shaped by the environment; economy, society, and nature adapted one to the other, blurring the boundaries between mechanical and organic parts of the biosphere and forging new material and cultural relationships through the integration of living and non-living worlds. Here the mighty juggernaut of industrial technology was slowed by ice, muskeg, and the changing seasons, and – as was surely the case in many other times and places – local knowledge and human ingenuity were integral to its successful deployment. People made choices about the ways in which they would occupy and use this environment, and in doing so they changed the scale and effects of their interventions in the natural world, but they did not separate themselves from it entirely.

Second, and much as Scott's work might lead one to anticipate, Piper demonstrates how strategies for the conservation of lake-fish stocks, advanced by government biologists, had deleterious environmental consequences and were refuted by locally specific ecological knowledge. But Piper's measured and nuanced examination of these developments carries her account beyond most readings of Scott's work. For Piper, state knowledge is not so much placeless as displaced. Formulated at a distance from the sites of production where it was applied, and built upon abstractions that emphasized the chemistry of the waters and the shapes of lake basins over the relations between different

4 Cronon, *Nature's Metropolis;* William Blake, "And Did Those Feet in Ancient Time" [also known as "Jerusalem"], preface to *Milton: A Poem* (1804); Lewis Mumford, *The Brown Decades: A Study of the Arts in America, 1865-1895* (New York: Harcourt Brace, 1931), 78; George Perkins Marsh, *Man and Nature; or, Physical Geography as Modified by Human Action,* edited by David Lowenthal (Cambridge, MA: Belknap, 1965), 36.

species, it proved inadequate to the task of environmental management in the Subarctic. In these pages we see that remoteness and private enterprise worked together to weaken the links between humans and nature, as they subordinated "the value and production of natural commodities to distant markets" (p. 4 herein). This is an important claim, and one that connects this work in interesting ways both to Cronon's arguments in *Nature's Metropolis* about the separation of production and consumption and to an often-overlooked part of Scott's argument (evidenced in his opening discussion of forestry, in which he notes that "the forest as a habitat disappears and is replaced by the forest as an economic resource to be managed efficiently and profitably") that state and market logics frequently march together in capitalist societies.[5]

As a study of what historian J.M.S. Careless described, in 1953, as the process of turning "the endless rock barrens of northern Canada ... into a national treasure chest," *The Industrial Transformation of Subarctic Canada* offers the most thoughtful and nuanced account of this topic to date. This is revealing in itself. Between the familiar "near North" – eastern Canada's "cottage country" of Muskoka, Algonquin Park, and the Gatineau Hills, elevated to the status of national symbol by the paintings of the Group of Seven – and the remote frozen fastness of the Arctic that seemed to confer legendary status upon those few voyagers who ventured among the indigenous inhabitants (even, or perhaps especially, when they failed and perished), the "middle North", or Subarctic, has claimed relatively little space in the Canadian imagination. This is surprising, given the economic importance of mining and fishing there. But Piper's contribution is not simply to rescue this territory from what historian E.P. Thompson once characterised as "the enormous condescension of posterity." Her book couples an impressive command of archival sources and empirical detail with an unusually diverse range of scholarship, and demonstrates a creative intelligence that ultimately brings readers to think about the meanings embedded in language, metaphor, and imagination. It prompts reflection upon the ways in which humans interact with the world and upon the links between industrialization and nature. It significantly advances understanding of both the Canadian North and the processes that have remade much of the globe in the last hundred years or so. And finally, like all good historical scholarship, it speaks, in a variety of registers, to the present, as Canadians and others grapple with current manifestations of several of its most important themes: the ethical and ecological costs of natural-resource development, the tensions between centre and margin, the rights of indigenous peoples, and the ways in which human choices shape environmental legacies and thus the prospects of generations to come.[6]

5 Scott, *Seeing Like a State,* 13.

6 J.M.S. Careless, *Canada: A Story of Challenge* (Cambridge: Cambridge University Press, 1953), 352-54; E.P. Thompson, *The Making of the English Working Class* (London: V. Gollanz, 1963), 12.

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Accessing research materials in archives scattered across the country, from Ottawa, to Saskatoon, to Victoria, to Yellowknife, required considerable assistance from archivists and librarians, all of whose efforts I appreciated. Working with some collections was particularly arduous, and some individuals went beyond what was necessary to assist me in this project. With that in mind, I would like to thank Rocky Crupi and Bill Wood at the Library and Archives Canada, who facilitated my access to the Eldorado Nuclear records, as well as Keith Low with Cominco, Peter Hardy with the Northwest Territories Archives, Oliver Glanfield, and Patricia McCormack, who granted me access to her taped interviews from northern Alberta.

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I could get around, if I had thought to ask it in the first place, and in so doing pushed me and this project further and in important new directions. Kate McPherson, Stephen Bocking, Colin Coates, and Cate Mortimer-Sandilands each offered invaluable critiques and suggestions to improve this work at an earlier stage. While engaged in this project, I was very fortunate to meet other graduate students working in environmental history. Shannon Stunden Bower, Darin Kinsey, and John Sandlos in particular shared insights, opportunities, and expertise and thus helped to further my own understanding of the field.

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Abbreviations

A&AT	Alberta and Arctic Transportation Company
AECB	Atomic Energy Control Board
BEAR	Bear Exploration and Radium
BP	Before Present
BPC	Bechtel-Price-Callahan
CCF	Co-operative Commonwealth Federation
CIMM	Canadian Institute of Mining and Metallurgy
CM&S	Consolidated Mining and Smelting (later Cominco)
CNR	Canadian National Railway
DNANR	Department of Northern Affairs and National Resources
EM&R	Eldorado Mining and Refining
FCHS	Fort Chipewyan Historical Society
FRB	Fisheries Research Board
GSC	Geological Survey of Canada
HBC	Hudson's Bay Company
HBCA	Hudson's Bay Company Archives
HBR	Hudson Bay Railway
IDB	Industrial Development Board, Winnipeg
LAC	Library and Archives Canada
MRT	Mackenzie River Transport
NAME	Northern Aerial Mineral Exploration
NT	Northern Transportation
NTCL	Northern Transportation Company Limited
NWTA	Northwest Territories Archives

PAA	Provincial Archives of Alberta
PAM	Provincial Archives of Manitoba
PHR	Port Hope Refinery
RCAF	Royal Canadian Air Force
RCMP	Royal Canadian Mounted Police
SABR	Saskatchewan Archives Board – Regina
SABS	Saskatchewan Archives Board – Saskatoon
SGM	Archives of the Soeurs Grises – Montreal
UAA	University of Alberta Archives
USA	University of Saskatchewan Archives
USAEC	United States Atomic Energy Commission
WCA	Western Canadian Airways
YTCL	Yellowknife Transportation Company Limited

The Industrial Transformation of Subarctic Canada

Introduction: The Industrial Colonization of the Northwest

In recent years, the prospect of building a pipeline to convey fossil fuels through the Mackenzie Valley has again come to the fore in plans to develop and exploit Canada's Northwest. Over 200 years have passed since Alexander Mackenzie observed oil oozing from the ground on his way downriver. It has also been almost a century since Imperial Oil first tapped the Discovery Well near Fort Norman, sixty years since the federal government first seriously considered building a fuel pipeline, and thirty years since the Berger Inquiry helped to scuttle a similar project on social, cultural, and environmental grounds. The current plan for a pipeline is heralded by its supporters as a means of economic development in the Northwest and beyond and opposed by detractors on the ground that it will further the catastrophic alteration of beautiful, culturally rich, and ecologically sensitive lands. Questions about environmental consequences appear at the forefront of discussions about Northwest fossil fuel development. These consequences include the local impacts of constructing a major pipeline through lands characterized by discontinuous permafrost and home to the Cape Bathurst caribou herd. Bigger questions arise about the wisdom of a major natural gas development, intended to further enable the extraction of oil from the Athabasca tar sands, at the same time that citizens across the globe call on their governments to limit carbon dioxide emissions in light of the increasingly obvious impacts of greenhouse gases on global climate. This latter issue is acute in the Subarctic and Arctic, where persistent warming is remaking ecosystems and with them communities and ancient First Nations relationships to lands, waters, and wildlife.

Present discussions of natural resource developments in Canada, such as the Mackenzie Valley pipeline and Athabasca tar sands projects, focus on issues of power, choice, and profit. Who gets to decide the course of development in a particular place? What are the near- and long-term consequences? Whose interests are heard, and whose demands will be met? Who will profit? Media reports and business, government, or academic studies raise these issues through reference to job creation, power sharing, royalties, infrastructure development, and environmental impacts in northern Alberta and the Northwest Territories. The final agreed-upon character of these projects has immediate implications for domestic politics and the economy: in 2005, natural resources contributed to 13 percent of our GDP and 25 percent of new capital investments. These projects also significantly shape Canada's place in the global economy: 46.4 percent of our 2005 export trade was in natural resources.[1] More people are aware of the importance of natural resources to Canada's regional and global economic life than recognize how present discussions represent contemporary variations of debates over the character of resource exploitation that have shaped Canadian history for centuries.

As a result, when discussions about resource projects arise in this year or the next, they are all too often historically blind. Magnificent, expansive wilderness across the Northwest encourages passionate, polarized debates that line up the potential for economic development on one side and the social and environmental costs on the other. Cultural stereotypes about the pristine and fragile North reinforce a prevailing perception that environmental degradation and economic progress share but one mutual relationship and that all debates about development devolve into a simple choice between either preserving nature or making money. Relative to much of the globe, the Canadian Subarctic evidences only modest anthropogenic landscape and ecological change. Nevertheless, the notions of pristine and untouched places suggest human absence, which in the Subarctic is an enduring myth. The memories and lives of First Nations residents, the fur trade history of the region, and more recent works such as this present study on industrialization document the extensive movement and economic activity of peoples, Aboriginal and immigrant, across these lands and waters. Knowing the history of resource development across all parts of Canada (even those that to this day remain lightly populated) offers a perspective that helps us to measure and weigh the significance of current developments. This history provides a foundation for evaluating the cumulative impacts of successive exploitation rather than seeing the Northwest environment as a canvas upon which only current and future development will leave its mark.

In its historical assessment of economic development and environmental change, this book explores the Canadian Northwest: a larger region that includes the Mackenzie River Basin and the Athabasca tar sands but that is focused on neither of these sites. Here the Northwest is the wet west, oriented around some of Canada's largest bodies of freshwater: Lake Winnipeg, Lake Athabasca, Great Slave Lake, and Great Bear Lake (see Figure 1.3). These lakes range in latitude from the southern tip of Lake Winnipeg (50° N 25') to just north of the Arctic Circle on the northern edge of Great Bear Lake (67° N) and thus all fall within the climatic definition of the Subarctic. Hence, I use "Subarctic" and "Northwest" interchangeably in the pages that follow to refer to the lakes and intervening lands. To orient yourself across this land- and waterscape, you can imagine drawing a line through the lakes pinned at one end by the Red River that flows into Lake Winnipeg in southern Manitoba and at the other by the Arctic Red River, another silty watercourse and a tributary of the Mackenzie River that eventually flows into the Beaufort Sea. The line you have now drawn is a simplified representation of a major Canadian physiographical feature: the contact between the Precambrian Shield and the younger rocks that lie to the west. The lakes themselves reproduce this geological line of contact. They are among the largest lakes in the world and are the largest that lie wholly within Canadian territory. They are major repositories of Canadian freshwater wealth, and as a result of combined geographic, economic, and environmental factors, they shaped the twentieth-century industrialization of the larger Northwest.

The Northwest large lakes focused transportation, water, fuel, food, labour, and mineral resources from a vast landscape where the same resources were otherwise widely dispersed and always remote from centres of industrial production. Between 1921 and 1960, the Canadian state and private enterprise looked to these freshwaters as essential openings in the landscape that would facilitate imposing industrial order on the Northwest. People used industrial fuels and technologies to assimilate nature but did not dominate or destroy it. The relationships between these people, wider communities, and the environment acquired a new, industrial character that mimicked and extended natural processes. At the same time, the industrial transformation integrated local economies into international markets. Markets divorced industrial commodities from local places, even if industrialization remained solidly tied to nature. The ephemerality of market conditions and the local exhaustion of rich resources meant that many of the communities, resource operations, and patterns of industrial activity that characterized the large lakes and surrounding lands in the first half of the twentieth century had all but disappeared by the end of the century, reinforcing our current sense of a "pristine" Subarctic nature primed for development and exploitation.

This work seeks to inform present debates about the Northwest, about industry and natural resources, and about human relationships to the natural world. It arises out of a firm belief in the possibility of an alternative future in the Canadian Subarctic, one acknowledging that, in order to know and sustain natural spaces, we must live and work in nature, not just visit preserves and parks as ecotourists. In this respect, it shares Richard White's argument in *The Organic Machine* about the importance of knowing nature through labour. I disagree with White's conclusion, however, that the consequence of industrialization has been to weaken "the link between our work and nature's work."[2] As this history shows, in Canadian resource operations, twentieth-century industrialization – or the application of high-energy fuels and mechanical technologies to production – changed the cognitive and material links between our work and nature's work but did not separate one from the other. Changes in the scale of human intervention in natural systems were the most important. The most consistent and profound weakening that has collaborated in our present ecological crises arose through state regulation principally in the rather paradoxical form of conservation policy and the control of private enterprise that subordinated the value and production of natural commodities to distant markets.

The present work adopts a contiguous geographical region in place of political jurisdictions as political boundaries only occasionally correspond to environmental criteria and therefore can erect irrational boundaries around historical places. Lake Athabasca, for example, extends almost equally into Alberta and Saskatchewan and therefore demands interprovincial analysis. The environmental orientation of region, in this instance, allows for important comparisons to be drawn between different political jurisdictions (provincial and federal) in promoting resource exploitation, conservation, and industrialization. Bureaucrats and politicians within many branches of provincial and federal administrations set the policies and parameters through legislation, funding, and personnel that guided new industrial resource operations on the lakes and surrounding lands. These operations proceeded under the direction of mining, transportation, and fishing companies supported by and at times even more intimately connected to government. Such was the case with Eldorado Mining and Refining and its transportation arm, the Northern Transportation Company, wartime crown corporations created to mine uranium in the Subarctic.[3] Yet, Eldorado was only one of several large companies whose operations typically spanned at least two of the four large lakes. The other major operators included Cominco, Mackenzie River Transport (the transportation division of the Hudson's Bay Company), McInnes Fish Products, and Booth Fisheries.

The state and private enterprise in turn employed geologists, engineers, limnologists, and fisheries biologists to guide new industrial operations as well as hundreds of men and women, most of whom came to the large lakes from the outside for work.[4] It is in the experiences of these individual sojourners that we begin to see the ties binding the large lakes together. Take, for example, Joseph Bjornson (J.B.) Skaptason. Born in Hnausar, Húnavatnssýsla, Iceland, in 1873, Skaptason came to Canada and married a woman from Gimli, Manitoba. They moved to Winnipeg and raised a family. Skaptason served in the Canadian Army in World War I and after the war became a dominion fisheries inspector, stationed at Selkirk and responsible for Lake Winnipeg, among other waters. In 1926, he authored an important provincial government publication on the *Fish Resources of Manitoba*. He became Manitoba's chief inspector of fisheries and later started his own company, Viking Fisheries, with a fellow Manitoban of Icelandic extraction, Paul Reykdal. Viking operated on Lake Winnipeg, on Reindeer Lake in northern Saskatchewan beginning in 1941, and sought commercial licences on Great Slave Lake. Skaptason's brief biography highlights not only the close ties between business and the state in Northwest resource exploitation but also how many of the men involved in the Lake Winnipeg fisheries travelled northwestward in this period, following new fishing opportunities. Irene Biss (later Irene Spry) travelled across the large lake region in the summer of 1935, going first from Pine Falls on a tributary just east of Lake Winnipeg, to Island Falls in northern Saskatchewan, over to Waterways in Alberta, and then north by plane to Cameron Bay on Great Bear Lake. Her itinerary mapped some of the most important industrial operations across the region at the time. With good reason: she travelled north (largely at the suggestion of her colleague and supervisor, Harold Innis) for her doctoral research on water power in Canadian economic development. Unlike Skaptason but like many other sojourners in these years, she limited her time in the Northwest to this summer research trip. Her travels nevertheless illuminate the intellectual as well as the hydroelectric ties binding the region together. Matt Berry, a bush pilot first based out of Manitoba and later Edmonton, traversed the region time and again while flying for Northern Aerial Mineral Explorations, General Airways, Mackenzie Air Service, and Canadian Airways.

Donald Rawson was a University of Saskatchewan limnologist whose research shaped the industrial fisheries on Lake Athabasca and Great Slave Lake. These and countless others, including many workers whose names have not endured in the historical record, created the large lake region through their encounters with Northwest places.

These twentieth-century newcomers to the large lakes encountered local, Native, Métis, and earlier newcomer communities with their own longer relationships to the large lakes. Resource exploitation opportunities lay at the heart of Treaties 5, 8, and 11, which ceded the lands and waters in and around the large lakes.[5] This work opens in 1921 when dominion officials hurried north to settle claims to lands upon which oil had been found the previous summer. From the beginning, the state acted to facilitate development and ensure the freedom of capital to exploit northern resources. From the outset, as well, Native and Métis people participated in this process. In each treaty negotiation, Native participants emphasized that they intended to retain rights to hunt, trap, and fish without restriction and in perpetuity. Natives at the different treaty-signing locations for both Treaties 8 and 11 secured oral assurances from the treaty commissioner that these rights would be defended and preserved. They continued to defend these rights and the health of the ecosystems and cultural landscapes upon which they were predicated, throughout the industrial transformation. This work is conscious of the critique of "the ecological Indian"; nevertheless, and as John Sandlos recently examined in the Northwest Territories, race and resistance were closely linked in the history of large lake resource exploitation.[6] Native peoples were moreover integral to the political economy of northern resource exploitation. Rooted in their experiences in the fur trade, Native and Métis men and women provided labour and expertise necessary to fishing, transportation, and mining operations.[7] Sojourning newcomers, distant authorities, consumers, and established local populations collectively constructed new industrial communities, economies, and environments in the decades leading up to 1960.

Subarctic industrialization occurred at an important stage in international industrial development. What happened on the Northwest large lakes after 1921 presents an essential case study to illuminate how twentieth-century industrialization remade remote and extreme environments and reorganized economic life in many parts of the globe. Marina Fischer-Kowalski and Helmut Haberl describe this episode in world history: "The whole terrestrial sphere of the planet becomes colonized ... Large parts of these colonies are colonies only in a formal sense, though: They are no longer, 'no-man's-land,' but neither are they maintained in a way to preserve their capacity for self-regeneration."[8] The example from the large lakes of Canada further illuminates environmental trends that were at once global in scope and more closely tied to international developments. For international capital helped to finance new industrial operations on the large lakes. Resources produced on the large lakes were directed to distant, especially American, markets and consumers and were not intended for local economic development – this in spite of the Canadian government's stated objectives of northern development. An international migratory workforce supplied much of the labour that extracted large lake resources. The lake operations were guided by scientific insights and used technology and processes that arose out of research and experimentation in Canada, the United States, northern Europe, South Africa, South America, and Siberia.

The relative lateness of the industrial transformation on the large lakes not only illuminates these international trends but also sets the Northwest lakes apart from the Great Lakes. There are important physical similarities and continuities between the Great Lakes and the large lakes. Lake Superior and Georgian Bay on Lake Huron border the Precambrian Shield, and all the Laurentian lakes played a definitive role in regional industrialization. However, in addition to the substantially different overarching political arrangements between Canada and the United States guiding economic change, the Great Lakes industrialized earlier and under different circumstances than their counterparts to the northwest. Second-stage fossil fuels (gasoline, diesel, and oil) and hydroelectricity powered the extractive and processing operations that appeared on large lake shores and waters after 1921. The other crucial characteristic of this later industrial development was its reliance upon new transportation, extraction, and remote-sensing technologies that gave access to previously inaccessible places.[9] New higher-energy fuels and more powerful technologies created significantly different relationships between people and natural resources across the large lakes. Technology, politics, and timing set their history apart from that of the Great Lakes, even as the Northwest lakes became part of larger processes at work in other previously uncolonized places.

The interaction between different governments, provincial and federal, private interests, science and technology, and local landscapes and communities decided the course and character of resource exploitation and its place in economic development. Newcomers were drawn to the large lakes by whitefish populations that had not yet been exhausted and by demands for new materials, such as radium and uranium, that were not so accessible or rich in other locales.[10] Rather than taking up residence on the large lakes, many either remained essentially outsiders in the large lake region (while participating in its environmental and economic remaking) or relied upon local expertise and southern scientists to interpret, translate, and ultimately change environmental conditions. Throughout the twentieth century, local environmental knowledge was subordinated to that of research scientists, if not wholly dismissed by them. These scientists in turn remained bound to the prerogatives of industrial capital and state aspirations for economic development. The arrival of industrial operations led to the meeting of "outside" and indigenous perceptions of Subarctic nature. In this meeting, scientific knowledge and authority, as extensions of industrial capitalist desire, prevailed, and the industrial transformation ultimately carried the imprint of how scientists especially, and to a lesser extent other outside interests (namely, businesspeople, sojourning workers, and the state), imagined the natural world.

World War II is conventionally seen as a turning point in the history of the Canadian North. Shelagh Grant emphasizes that the prerogatives of wartime continental defence coupled with postwar planning and reconstruction brought government intervention into the region on an unprecedented scale.[11] The decline of traditional harvesting industries, the increased sedentarization of indigenous northerners, booming resource communities, and an increased military-industrial presence are used to map the rise of the Cold War North. John G. Diefenbaker's Roads to Resources program epitomized the changed place of the North within federal domestic politics. David Quiring has similarly demonstrated the central place of provincial northern development to the Co-operative Commonwealth Federation government in Saskatchewan after 1944.[12] The emphasis by other historians on changes after 1945 in and of itself reveals something about prewar industrialization. Specifically, and as is detailed in this work, the early-twentieth-century economic and environmental transformations did not divorce people and communities from nature; rather, their interrelationships acquired a new, industrial character that mimicked and extended natural functions. The extent to which industry co-existed with traditional economies and assimilated rather than dominated the physical environment has heretofore masked the long history and profoundly transformative character of industrial resource operations to Subarctic communities and ecosystems.

This work distinguishes between industrialization and commodification to better understand how twentieth-century developments led to unconstrained environmental harm and weaker ties to the natural world. These latter outcomes are the result of the ways in which industrialization integrated local economies into international markets. To successfully travel the distances from the large lakes to urban centres required the commodification of large lake resources, their transformation from integral parts of ecosystems into homogeneous products ready for purchase. Decisions about appropriate scale and intensity of production shifted to distant administrators and consumers. Markets divorced industrial commodities from local places, even if industrialization remained closely tied to nature, and together shaped the long-term consequences of industrial operations to Subarctic environments.

This book is foremost a work of environmental history and as such it will not meet all the expectations of regional or First Nations historians or of political economists or those in environmental studies. This work considers past relationships between humans and nature through an examination of the intersections between ecosystems, production, and culture.[13] It draws on Stephen Boyden's model of "biohistory" (environmental history by a different name), which emphasizes the need "to understand the interrelationships between human societies and the underlying processes of life on which they depend."[14] Boyden pointed to the ecological power of culture and the potential for interpreting social and cultural forms as metabolic processes that change and redirect energy within human societies and history. This book thus explores how industrialization (as the diffusion of mechanical technologies and application of high-energy fuels) manifested in new material relationships that constituted socio-ecological change. A central question for this investigation asks whether industrialization necessarily substitutes natural processes with human artifice. Does it superimpose an alternative set of relationships? Or is its impact a combination of these two? Other historians, following William Cronon's analysis in *Nature's Metropolis,* have answered this question by turning to the notions of first and second nature, further derived from Hegel and Marx, where first nature is the "original, prehuman nature" and second nature is "the artificial nature that people erect atop first nature."[15] These concepts suggest that human productive relationships to nature are best characterized by superimposition and distance between human culture and nature. Cronon admits the inadequacy of the categories of first and second nature for explaining the "complex mingling" of the human, non-human, and natural phenomena that constitute historical experience. Beyond these initial caveats, however, he uses the concept of second nature to account for how industry and capitalists created artificial processes and relationships that mimicked but displaced nature. Similarly, Richard White has further emphasized the place of machines in signifying the conquest of nature.[16] These analyses, widely adopted in environmental historiography, present a declensionist interpretation in which industrial capitalism has principally destroyed and dominated North American nature. The historical change attendant on twentieth-century industrialization evident on the large lakes suggests otherwise. Here nature as something larger than but including humans continued to act independently of human intervention to regulate and shape industrial activities. Nature and industry became integrated on the large lakes; neither dislocated the other. The model of second nature is too artificial; it too readily glosses over the contingency, complexity, and chaos of natural systems and vests in individual people and industrial processes more power than they historically exercised.[17] On the large lakes, we see instead a process of assimilation, whereby nature, economy, and society each adapted to one another in a process that produced new sets of material and cultural relationships binding industrial economies closely to natural systems.

Historical studies of freshwaters focus more often upon rivers than lakes, precisely because, just as their waters flow, so too their historical dynamism is more readily apparent. In the past, people exploited rivers for transportation, food, water, waste disposal, and energy much more extensively than lakes.[18] Conceptually, lakes figure differently from rivers. The word *lacuna,* meaning a "missing portion" or "blank," derives from the Latin for "lake," *lacus,* reinforcing the broader Western cultural sense of lakes as spaces, not places. Large lakes thus occupy an ambiguous place within environmental historiography and Canadian history. Most attention (particularly in North America) is paid to the Great Lakes, where co-operation and conflict between different groups of Natives and newcomers formed a "middle ground" that provided the foundation for international exploitation and governance in later centuries. The history of the Great Lakes is the history of a heavily populated region characterized by ecological abundance, a temperate climate, and early and rapid industrialization.[19] The large lakes, by contrast, acted as sites of abundance across landscapes where scarcity was not uncommon. As a result of combined geographic, economic, and environmental factors, the large lakes served as the staging grounds for the industrial transformation of the twentieth-century Canadian Northwest.

Distinctions between active and dead waters, places and spaces, organic and inorganic hinder our understanding of the historical roles of lakes and other seemingly less dynamic features of the natural world. Ecology, a parent discipline to environmental history, is the study of the interrelationships among organisms and between them and all aspects, living and non-living, of their environment. On the large lakes, non-living rocks, boats, water, fire, and weather played as much a role in shaping human and environmental history after 1921 as did living aspects of this environment. People on the large lakes anthropomorphized the non-living features of their environments, ascribing living attributes and values to boats, engines, rocks, and waters. The process of blurring the boundaries between mechanical and inorganic parts of the environment with living features and processes mirrored and informed the new industrial practices that acted in a similar fashion to integrate living and non-living worlds on the large lakes.

Distinctions between nature and culture, as well as living and non-living parts of nature, are constructed principally for the purposes of analysis. Nevertheless, these constructs have become reified because of the way they simplify and thus help us to grasp the enormous complexity of the natural world. Humans and human culture exist within nature, not outside it, although for various perverse reasons the trajectory of the twentieth century was to use culture (especially science and technology) to substitute ephemeral mechanical contrivances for long-term natural relationships in order to satisfy short-term goals. In the twentieth century, Western societies, including Canada, have used industry and technology to remake the world around us in ways that mimic nature but simplify the physical world, making it easier to achieve specific objectives. In Canada, these objectives were set largely within a capitalist framework that defined value, waste, and how to account for each in profits. Ultimately, this path of development degrades natural environments and leads to a loss of natural diversity as well as circumscribing our potential to understand the larger natural context within which we live.

Characterizing nature in history is difficult, however, as much of the language employed to represent nature and likewise the mental imaginings we extend to nature in the present are largely drawn either from personal experience or from science. In this respect, the scientific language of nature reproduces many of the problems of Western science itself in that it tends to simplify and subdivide as it endeavours to understand.[20] In this book, I draw upon scientific understandings of the long history and present ecology of the large lakes. I recognize that present-day scientific knowledge is as contextual as past scientific knowledge, but in both instances this knowledge can still tell us much about nature. Where I use current scientific accounts, as in the glacial history of the large lakes presented in Chapters 1 and 6, I rely upon the more widely cited, rather than necessarily the most recent, literature. Historical scientific accounts can simultaneously tell us something about nature in the past as well as how people in the past engaged what they understood to be nature, and I explore these sources to both ends. In examining changing practices and concepts in geology, fisheries biology, and limnology through to mid-century, this work builds on historical arguments regarding the limitations of scientific management and the constructions of scientific knowledge in twentieth-century Canada and elsewhere.[21]

Non-scientific accounts of nature on the large lakes also present ecological perspectives. That is, they also present people in the past in relation to their wider environments. Non-scientific understandings of nature are often dismissed as inaccurate, in part because they are non-professional but also because they are subjective and context specific. Yet these perspectives, found in diaries, letters, stories, oral histories, and myths, provide historians with windows that look out on past environments as well as mirrors that show how people understood themselves in relation to other living things, physical spaces, and changing natural environments. Scientific accounts, with their greater objectivity, do a much poorer job of reflecting such self-conceptions, although this weakness can be remedied by looking, as I do in this work, at the personal correspondence and papers of scientists. The greatest challenges arise not in trying to address non-scientific ecological perspectives, however, but in recognizing how in past times and places people conceptualized the environment in very different ways. Some of the people whose records I examined, including the scientists Peter Larkin and Donald Rawson, saw the large lakes as a coherent region, while most people did not.[22] Some people looked at rocks and saw minerals, while others saw obstacles to construction and still others historic sites. What is most important to this analysis is not what people thought of Great Bear Lake when they fished its waters or mined its shores but whether they even saw the lake or just a part of it and, if so, what part of it and why? Historical ecological perspectives can tell us as much about why people made certain decisions, about what to mine, where to take their water from, and where to leave their waste, as the laws, social pressures, and economic variables that structured their activities.

This book is divided into three parts that outline a broad chronological framework from 1921 to 1960 while allowing each chapter the flexibility to explore themes that do not necessarily fit neatly within specific year markers. The first part sets forth the early-twentieth-century conditions that most significantly influenced evolving relationships among Subarctic environments, industrial resource operations, and local communities on the large lakes. In three chapters, I assess the initial assimilation of the Subarctic and the establishment of patterns of development and physical ties that would come to bind the large lakes to international, industrial markets. The second part tells the separate stories of the principal industrial activities, hard-rock mining and industrial fishing, on the large lakes before 1960. The emphasis here is on the ecological perspectives and practices of those who mined, fished, and directed these operations. This part explores how people imagined the natural world with which they engaged, the role of science and technology in shaping these understandings, and conflicts over appropriate development. The final part considers the environmental legacies of industrial exploitation on the large lakes. Industrial energy eclipsed the former solar economy that had lasted largely intact until the early twentieth century. Fossil fuels and hydroelectricity powered extraction, processing, and transportation operations that transformed resources into commodities by harvesting offshore fish populations on the large lakes, extracting ores, and sending these goods to markets. The creation of new industrial networks and relationships involved disordering and dismantling the old ones. Industrial operators on the large lakes in the postwar period thus made choices about habitat integrity, location of waste, the movement of toxic chemicals, and the distribution of profits that irreparably damaged human lives and local ecosystems.

Part I

1

On the Edge: The 1920s

Twenty-first-century eyes will see the large lakes as very young or very old, depending upon whether they take an earth-science or human-historical perspective. This paradox reveals the limitations of human-centred perspectives to grasp the natural world and lends itself to the dichotomy that nature endures while humanity is ephemeral. Human generations are measured in decades, and even the *longue durée* of history does not register on the scale of geological time. This asynchronism contributes to perceptions of nature as separate; its age and ancient rhythms only rarely intersect with our daily lives. When this happens, as in the case of a hundred-year flood or a catastrophic earthquake, these rhythmic events are instead perceived as isolated catastrophes. The present study considers only a forty-year episode in the hundred-thousand-year history of the Northwest large lakes. To understand the significance of the twentieth century in the lakes' longer history, imagine a lake bottom as you read. If, in an attempt to discern the longer history of the lake, we were to drive a core sampler down through the lake sediments, we would pass through a recent history of muck and mud before encountering, farther down, stratified sediment layers that pattern environmental conditions in the much more distant past. Sorting through the muck and mud will tell us something about what the next firm sedimentary layer could look like by considering what has gone into it and why. With reference to the underlying layers, what we find in the mud will suggest how it has departed from and how it will reproduce previous patterns. In sum, this work will map the human fingerprint in the twentieth-century mud and explore how it got there.

Before we can judge the character of the twentieth-century fingerprint on the lake beds, we must consider the longer history of the lakes, which reaches back over a million years, to see their most immediate origin and provide a sense of the scale against which the most recent human drama has played out. Our geological present currently extends 1.8 million years into the past. This period, known as the Quaternary, is characterized by climate change: the buildup and decay of ice sheets of continental scale, the transgression and regression of oceans, and the advance and retreat of deserts. Irregular climatic oscillations caused the growth and decay of continent-scale ice sheets repeatedly over the past million years.[1] The most recent, the advance of the Late Wisconsinan, is also thought to be one of the most extensive, when the Laurentide ice sheet covered most of present-day Canada and extended into the northern United States. At the margin of the Laurentide ice sheet, large glacial lakes formed and fluxed as the ice sheet advanced and retreated. The ice depressed the crust directly beneath it and nearby. Water accumulated in these depressions, creating historically unique drainage relationships.[2] Glacial lakes McConnell and Agassiz are the most direct ancestors of the present-day lakes Great Bear, Great Slave, Athabasca, and Winnipeg. In spite of the pre-eminence of the Laurentian Great Lakes on the modern Canadian landscape, glacial lakes McConnell and Agassiz were the largest known lakes on the North American continent. Lake Agassiz was by far the larger of the two and reached its maximum extent of about 260,000 square kilometres (over three times the area of present-day Lake Superior) during the glacial advance between 9,900 and 9,500 Before Present (BP). Glacial Lake McConnell inundated a total area of 240,000 square kilometres and reached its maximum extent of about 210,000 square kilometres at 10,500 BP.[3]

The climatic oscillations of the Quaternary had global impacts, but the glaciers themselves advanced and retreated from concentrations around the northern and southern poles. Glaciers are therefore a distinctive feature of past Canadian landscapes and the dominant factor in Canada's Quaternary history, in contrast to the United States, where, outside Alaska, glaciers reached only into the Cordillera, the northern plains, and from the Great Lakes to New England. The presence of this massive ice sheet severely disrupted plant and animal populations, reshaped the Canadian landscape, and in some respects defined the territory north of the forty-ninth parallel, loosely corresponding to ice sheet extent, as distinct from territory to the south. From the most recent glaciation, beginning in the Middle through the Late Wisconsinan (c. 27-30 ^{14}C ka BP), most of Canada lay under one of three continental ice sheets: the Cordilleran, the

Laurentide, or the Innuitian.[4] The three major ice sheets grew and retreated at different times and at different rates. The Innuitian ice sheet peaked around 20 ^{14}C ka BP, while the Cordilleran ice sheet started growing 30-25 ^{14}C ka BP and peaked 5,000 years after the Innuitian. The Laurentide ice sheet started from a minimum extent that approximately followed the margin of the Canadian Shield, peaked circa 18 ka BP, and covered most of central, eastern, and western Canada.[5] The Wisconsin glaciation ended approximately 10,000 years ago. This boundary marks the beginning of the postglacial epoch, the Holocene, the focus of most environmental history, when humanity went from just another species to an ecological force of global proportions.[6]

Although now isolated as individual lakes, the large lake predecessors, Agassiz and McConnell, were briefly linked about 9,900 years BP. As the Laurentide ice sheet retreated, large volumes of freshwater stored in Lake Agassiz were episodically released in outbursts, the waters travelling to the ocean via the Mississippi drainage basin south to the Gulf of Mexico, the St. Lawrence drainage east to the North Atlantic, the Mackenzie River drainage north to the Arctic Ocean, or northeast out into Hudson Bay. Failing ice dams caused most outbursts. The largest occurred when ice over Hudson Bay collapsed about 8,400 years BP.[7] From this outburst, waters flowed northwest into glacial Lake McConnell for over two and a half years, eroding the Clearwater-Athabasca spillway and depositing seventy cubic kilometres of sand in the Athabasca Delta. This extra volume of floodwater raised the level of glacial Lake McConnell between ten and twenty metres and widened the channel into the Mackenzie River, where the water drained out of Lake McConnell. Flow from Agassiz into McConnell continued for another 400 years after the initial flood, until eastern outlets draining Lake Agassiz reopened.[8]

Glacial erosion helped to create the large lake basins that in turn influenced the path travelled by the receding Laurentide ice sheet. Faults and resistant sills in the underlying bedrock guided the advancing glaciers, which deepened and sculptured pre-existing valleys.[9] The large lakes also lie on the edge of the Canadian Shield along its boundary with the Interior Plains (or the Precambrian-Paleozoic contact). The different consistency of the bedrock underlying the glacier along this boundary resulted in differential erosion and the formation of large basins into which the remnant waters of glacial lakes McConnell and Agassiz pooled.

Glacial lake waters did not simply pool into large depressions in the earth with the retreat of the ice margin. The weight of ice had depressed the earth's crust by hundreds of metres for a thick ice sheet. As the ice sheet retreated, the underlying substrate or continental crust rose in a process known as isostatic rebound, altering the regional topography and affecting drainage patterns and the direction of flow. The weight of the overlying ice principally influenced the water level in glacial Lake McConnell, whereas the barrier created by the ice sheet was the main determinant of water levels in glacial Lake Agassiz.[10] The Great Bear, Great Slave, and Athabasca basins of Lake McConnell became isolated between 8,500 and 8,100 years BP, largely in response to differential isostatic rebound across the McConnell basin. Geologists working on the shore of Great Slave Lake in the 1920s described "ancient lake beaches of shingle" and gravel ridges at heights above the lakeshores, evidence of the former extent of the large lakes.[11] Outbursts of water through incised outlets played a major role in the emptying of Lake Agassiz and the formation of its remnant lakes Winnipeg, Manitoba, and Winnipegosis. Lake Winnipeg expanded largely due to differential isostatic uplift following the retreat of the ice sheet. The tilting of the lakes continues into the present, as does the infilling of drainage corridors through sedimentation.[12] Lake Athabasca and Great Slave Lake had been linked along the Slave River for much of their postglacial history; the present-day Slave River comprised Great Slave Lake's fourth "arm" prior to its infilling along the active delta.[13]

As the ice sheet retreated and the glacial lakes receded, they left evidence in the form of moraines, eskers, raised beaches, and widened channels. These features mark the Quaternary landscape of the Canadian Northwest, although, to the north, woodlands and overgrowth obscure many of these features compared to the Prairies. As the lakes receded, they also created new possibilities for human populations to move into the formerly inundated areas. Aboriginal peoples moved into southern Manitoba with the retreat of glacial Lake Agassiz about 9,000 years ago, and microlithic technology indicates the arrival of Athapaskans east of the Cordillera between 6,000 and 5,000 years BP.[14] The human history of the region is ancient. However, plant, animal, and human populations thrived only on a landscape shaped by the final retreat of the Laurentide ice sheet. Within the time scale of the glacial ancestry of the large lakes, 10,000 years is youthful indeed.

The Large Lake Region in the 1920s

In the summer of 1921, a dominion treaty party headed by Treaty Commissioner Henry Conroy (who had previously participated in Treaty 8 negotiations) travelled to the Mackenzie River to secure Native and Métis signatures to the last of the numbered treaties. Treaty 11 marked the formal cession of Aboriginal title over the lands from the northern shore of Great Slave Lake to the Mackenzie Delta on the Beaufort Sea and was the final step in the official consolidation of dominion authority over the large lakes. Treaty 8, in 1898, had ceded the land south of Great Slave Lake and encompassing Lake Athabasca, while several settlements between 1870 and 1908 ceded the lands and waters adjacent to Lake Winnipeg. The most important was Treaty 5, which embraced the majority of the lake, while Treaties 1, 2, and 3 abutted small portions of the shoreline to the south. The conclusion of Treaty 11 marked the end of a transitional period across Canada's Northwest that had followed the 1870 sale of Rupert's Land by the Hudson's Bay Company (HBC) to the dominion government. This transaction ended the socioeconomic order that the HBC had created to sustain its trading posts and fur-trade profits since the seventeenth century.[15] Before dominion rule could be consolidated, before new settlers and new agricultural and industrial development could spread throughout their expanded domain, the government had to treat with the indigenous inhabitants, extinguish their Aboriginal title, and thus provide a legal foundation for new environmental, economic, and cultural relationships.

By 1921, the large lakes were only the most spectacular remnants of the ice sheets across a landscape submerged in the waters of countless lakes and ponds of every conceivable size and shape. The basins carved out by the retreating glaciers created the largest lakes in Canada and the world. Great Bear and Great Slave are the ninth and tenth largest lakes in the world in area and volume. Great Bear is the largest lake that lies wholly in Canada, although in area it is smaller than lakes Superior and Huron. Great Slave Lake reaches depths of 625 metres in Christie Bay in the eastern arm – deeper than any other glacial lake in North America or Europe and exceeded only by the ancient tectonic lakes such as Lake Baikal in Siberia or Lake Tanganyika in the African Rift Valley. The lake basins vary considerably over their areal extent, and in Great Slave Lake, while the maximum observed depth in the central region is 163 metres, the average depth in the main part of the lake (excluding the eastern arm) is only 41 metres. Great Bear Lake could be subdivided into two basins, the main lake and the McVicar Arm, connected by a narrow channel. Lake Winnipeg divides into two basins, north and south, connected by a narrow channel. The lakes also contained numerous islands and highly complex shorelines, particularly the eastern arm of Great Slave Lake and Lake Athabasca.

Table 1.1 Dimensions of the large lakes

	Area (km2)	Volume (km3)	Maximum depth (m)
Lake Winnipeg	24,387	371	18
Lake Athabasca	7,935	204	120
Great Slave Lake	28,568	2,088	625
Great Bear Lake	31,326	2,381	452

Source: Max M. Tilzer and Collette Serruya, eds., *Large Lakes: Ecological Structure and Function* (Berlin: Springer-Verlag, 1990), 26-38.

Compared to smaller bodies of water, their immense size influenced the lakes' distinct physical, biological, and ecological properties and brought about unique relationships to people and communities.[16] The massive size of the Northwest large lakes most affected the movement of lake water. Lake water moved constantly as a result of currents and prevailing winds that affected surface waters, horizontally and vertically in response to the seasons, and as a result of the weather. Changes in wind and air pressure patterns directly influenced internal water movements on the lakes.[17] Seasonal stormy weather characterized the open lake waters, particularly in the fall months. Athabasca could blow up quickly into extremely rough water when the wind was from the north or east, and Great Slave and Great Bear lakes were remarkably stormy in the fall months before freeze-up.[18] The repeated pummelling of waves prevented vegetation from taking root and created sandy beaches that were, in turn, ideal camping grounds for travellers and residents along the large lakes. Travellers often found such refuges necessary in the face of the storms that arose with little warning, stranding people and bringing freight to a stop on Great Slave Lake. Helge Ingstad, a Norwegian trapper on the lake in the 1920s (and later the fellow who located the Norse site in northern Newfoundland), claimed that "much depended upon fate, for Slave Lake is treacherous. I have seen it lying there smooth as glass one moment, and five minutes later roaring and tossing with breakers lashed by the wind."[19] Great Slave's mood swings inspired the dominion topographical surveyor John Russell to write that

> the Great Slave is ever like this, one day placid as if asleep, a pleasure to drift upon, as your paddles dip into the quiet water and the ripples spread off to either side, while the shining plain extends to the horizon's brim and the next day, indeed, it is possible in the next half-hour, the winds may be shrieking along the shore, and the waters, churned to foam, instead of giving the voyager a feeling of peace, impress him with the stupendous forces

> of nature, and remind him of how small man is, after all, and how weak his personal power when compared with hers. This is the never-failing marvel of Great Slave lake, renewed every time the tempest blows.[20]

Winds powered vessels equipped with sails across the lakes, but far more often they hindered rather than helped navigation. Many boats avoided the open waters, travelling instead between headlands and islands, increasing the risk of striking rocks but avoiding disasters.

Gravity pulled the water in rivers downstream, and the large lakes were where the momentum of many flowing rivers stopped, creating what George Douglas, a mining engineer and frequent traveller to the northern large lakes, described as "'dead' water (as contrasted to a river with current)."[21] Certainly, each of the large lakes was connected to smaller, less volatile freshwaters as part of drainage basins. The three more northerly lakes, Athabasca, Great Slave, and Great Bear, were all part of the Mackenzie basin that drains northward into the Arctic Ocean. Lake Winnipeg drains northeast via the Nelson River into Hudson Bay. Great Slave and Winnipeg each had large drainage areas in primarily drift-covered Paleozoic sediments. Great Slave Lake's drainage basin was thirty-five times the area of the lake itself. The catchment area of Lake Winnipeg extended from the Rocky Mountains to near Lake Superior, and major rivers – the Saskatchewan, Winnipeg, Red, and Dauphin, along with numerous smaller rivers – all drained into the lake. By contrast, the Athabasca River was the principal tributary to Lake Athabasca, entering the lake at its western end. The Fond du Lac River was the main tributary to the central and eastern portions of the lake. Great Bear Lake had the smallest drainage basin by far. The major tributaries to Great Bear were the Dease River and the Camsell River, which drained into McTavish Arm; most other rivers were small, "the majority being little more than creeks."[22] In winter, a negligible amount of water entered Great Bear Lake.[23]

Their immense size allowed the large lakes to retain heat and nutrients much longer than smaller freshwater bodies. Moreover, because river waters stopped upon encountering large lakes, the movement of matter within the lake itself generally had a greater influence on large lake biology than did influxes from the drainage area.[24] Nutrients provided the foundation for lacustrine food webs and determined the productivity of lake waters. This productivity translates into trophic status – oligo-, meso-, or eutrophic, from least to most nutrient laden – and categories that echo the age of a lake and the size and character of its catchment area. Studies of microfossils in sediment cores from Lake Winnipeg indicate that it has been an oligo-mesotrophic lake since soon after the demise of glacial Lake Agassiz.[25] The three northernmost lakes were oligotrophic, a result of the combination of short postglacial histories, colder temperatures, considerable depth, and, in the case of Lake Athabasca and Great Bear Lake, relatively small and infertile drainage areas. Low in nutrients, with few algae and clear waters, oligotrophic lakes are biologically less productive and support relatively few plant and fish species. The northern location of the large lakes further influenced their trophic status. The northernmost lake, Great Bear, for example, received the lowest annual amount of solar radiation to be converted by photosynthesis into usable energy and nutrients. That said, the high transparency of its waters nevertheless ensured that what solar energy reached the lake penetrated to greater depths. In the 1920s, the most direct effect of a lake's trophic status on its relationship to surrounding human communities was in its influence upon fish populations.

The large lakes shared ten species of fish: lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), ciscoes or lake herring (*Coregonus artedii*), pike (*Esox lucius*), pickerel or walleye (*Stizostedium vitreum*),[26] burbot (*Lota lota*), trout perch (*Percopsis omiscomaycus*), longnose suckers (*Catostomus catostomus*), slimy sculpins (*Cottus cognatus*), and ninespine sticklebacks (*Pungitius pungitius*). While an additional six species were found in Great Bear Lake, at least thirty-four additional fish species lived in Lake Winnipeg (see Appendix B). The fish migrated little within the lakes. Populations remained confined to general areas to the extent that on Great Bear Lake the individual arms of the lake hosted unique species. In the shallow southern basin of Lake Winnipeg, pike, pickerel, and sucker dominated, while abundant whitefish and large individuals of lake trout lived in the deeper, wider northern basin. The richest fishing sites were typically found at the confluences of rivers with lakes. Cisco (Bear Lake herring) concentrated where Bear River flowed from Great Bear Lake. The quick flowing waters kept the surface from freezing throughout the year, and the site sustained an ancient Dene fishery. The fishing opportunities here led John Franklin to select the site as the location of his winter quarters during his second journey into the Northwest, and, in 1908, fur traders erected a post at the eponymous Fort Franklin. Along the shores of each of the large lakes, a similar pattern emerges of indigenous communities and fur trade posts situated at the junctions of rivers and lakes (Fort Resolution, Hay River, Fort Providence, Fort Chipewyan, Fond du Lac, Berens River, Grand Rapids), which provided permanent inhabitants with both important transportation access and rich food resources.[27]

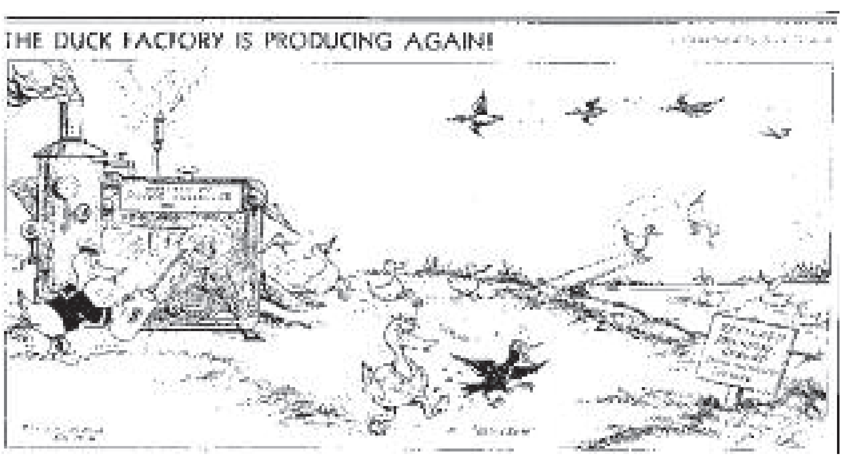
Diverse food resources available at the confluences of rivers and the large lakes were further enriched and sustained by the seasonal inundations of deltas. Freshwater deltas are highly productive and dynamic ecosystems, and the Peace-Athabasca Delta, on the western end of Lake Athabasca, is one of the largest in the world. Extensive wetlands on the Paleozoic shores of the large lakes included not only the Peace-Athabasca Delta marshlands and Lake Claire to the west of Lake Athabasca but also the Netley Marsh at the southern end of Lake Winnipeg and the Mackenzie River outlet from Great Slave Lake. Annual flooding of freshwater deltas brings an influx of sediments that accumulate to reshape the delta over time. Vast marshes joined major rivers to the large lakes at these deltas. These regularly inundated wetlands were ecosystems rich in vegetation that had adapted to the water-saturated soils.[28] This vegetation included swamp grasses used to feed horses, oxen, and cattle introduced to the Northwest beginning in the eighteenth century. When combined with clay, these grasses could also be used as a binding agent in construction. Wild rice, a freshwater grass rich in protein, carbohydrate, iron, and calcium, grew in the marshes along the shores of Lake Winnipeg and was an important food for indigenous people and Euro-Canadian settlers. From their founding in the late 1930s, Ducks Unlimited considered the large lake marshes "mass production factories" for waterfowl. They provided nesting grounds for migratory birds along each of the four North American flyways and a giant staging area for spring and fall migrations.[29] For people who lived on the shores of the large lakes, the wetlands offered a vast hunting ground for waterfowl and diversified diets with ducks, geese, and pheasants in the spring and fall.

The early successional habitats created by freshwater deltas provided rich ecosystems for a wide variety of wildlife, including beaver and muskrat. Muskrat also used emergent vegetation in the marshland to construct houses, or they dug dens out of mud banks. Beavers were less bound to wetland habitats and occupied other waters, such as ponds and streams in forested areas across the large lake region. These creatures were central to the nineteenth-century and early-twentieth-century fur economies as food and objects of trade across the Northwest. Prime muskrat country lay to the south of the large lake region, but large numbers of muskrats traded by the HBC came from the Mackenzie River district. By the late nineteenth century, the large lake region provided the principal remaining habitat for large beaver populations, which trapping pressure had extirpated farther south. Increased demands upon beaver and muskrat populations along the large lakes travelled north with independent trappers in

1.1 Infilling of the Athabasca Delta between 1946 (*left*) and 1968 (*right*), as visible from air photos.
Source: Reproduced with the permission of Natural Resources Canada, 2008, and courtesy of the National Air Photo Library.

the first decades of the twentieth century. Their largely unregulated activities in combination with non-anthropogenic environmental dynamics caused crises in northern furbearer populations in the earliest years of industrialization. In 1928, the minister of the interior declared a closed season on beaver in the Mackenzie district, and then, in the 1930s, low water levels in the Peace-Athabasca Delta led to the collapse of muskrat populations and extensive ecological and economic crises for Native trappers in Wood Buffalo National Park.[30]

Wetlands were just one ecosystem typical of the saturated landscape across the large lake region. In 1920, O.L. Flanagan travelled from Toronto to survey northern Manitoba's hydroelectric potential on behalf of the Mining Corporation of Canada – one of the early interests in the Flin Flon ores. He described how across Manitoba's north, where the water did not pool into lakes and ponds, it soaked into the ground, forming the pervasive Subarctic muskeg.[31] Muskeg shared the glacial ancestry of the large lakes, and Canada has the largest area of peatland, which includes muskeg and fens, in the world. Directly associated with the boreal forest, muskegs provide a nurturing, relatively homogeneous environment for mosses and other acid-loving vegetation.[32] With a high water table, muskeg is principally composed of sphagnum moss, a plant that is at once growing and decaying as its top part is alive while the lower ranges are compressed and decomposing into peat moss. This state of constant creation and decay led



1.2 The Northwest was seen as a mass-production factory for waterfowl in the 1930s.
Source: Cartoon by Walt Munson, *Ducks Unlimited Quarterly*, July 1938.

geographer William C. Wonders to describe muskeg as a condition since it is not water, vegetation, or soil.[33] In northern Manitoba, a surface carpet of mosses about three to five centimetres thick covered a layer of partly decomposed moss, which in turn covered permafrost, encountered at a depth of one and a half metres in summer.[34] Sphagnum moss is highly absorbent and has bactericidal properties. It was used to diaper children, as sponges for cleaning, to chink log house walls and roofs, and in the construction of entire houses – a northern counterpart to the famous sod houses of the Prairies.[35] By the mid-twentieth century, this moss was adapted to insulate pipes and pack specimen samples. Although peat is also a rich fuel, it does not appear to have been widely burned in the Canadian Northwest. The absorbent properties of sphagnum moss allowed it to keep water from draining through to underlying soils and permafrost. On a larger scale, muskeg thus served an essential insulating role, and in the construction of permanent and ice roads across the large lake region truck operators and road engineers soon learned the importance of keeping the muskeg intact to provide a firm foundation for the roadbed.[36]

Discontinuous permafrost underlies much of the lands along the large lakes and is most extensive and nearest to the surface to the northwest. This permafrost impeded drainage and, along with the very low evaporation rates across the large lakes, led to the surface accumulation of moisture in ponds, lakes, and muskeg. Distribution of permafrost depended on climate and the composition of the active soil layer, whether it was sandy soil, clay, or hummocky.[37] When the mines opened on Great Bear Lake, permafrost was traced to depths of 250 feet in the mine workings. It was also found only "several feet below surface in mill tailings and muskeg during the height of summer."[38] Permafrost provided a firm foundation for construction, and it was treated as a fixed part of the landscape, much like bedrock or soil. Unfortunately, with the persistent warming of recent decades, the permafrost foundation has proved to be less than stable, with serious consequences for building and road stability across the Northwest.[39] Prior to this persistent warming trend, permafrost was one of the few fixed features of the landscape and waterscape in the course of a year.

In spite of differences in latitude, climatic isotherms strike roughly parallel to the lakes from northwest to southeast: the fifteen degree Celsius isotherm for June, July, and August touches the western end of Great Bear Lake, cuts through Great Slave Lake, touches the eastern end of Lake Athabasca, and falls not far east of Lake Winnipeg. The large lakes and intervening waters, soils, and muskeg shared in an annual transformation from water to ice and back again. The lakes themselves, on account of their size, exerted a moderating influence on local climates that raised or reduced summer temperatures and delayed fall frosts, allowing for a longer growing season on the lakeshores as compared to inland. In the 1950s, the growing season at Great Slave Lake was 84 to 112 days, whereas inland it was only 56 days at Fort Smith and 68 days at Fort Vermilion.[40] The lakes froze completely for five to eight months of the year, and climatic factors combined with basin shape to influence the length of the ice-covered season. On Lake Winnipeg, in most years, the ice held a person's weight by the middle of November. In the 1930s, the fishing regulations opened Lake Winnipeg to winter fishing on the fourth Monday in November. The ice thickened quickly and persisted into May.[41] On Lake Athabasca, freeze-up commenced in late October and was complete by mid-December. In the spring, the ice broke up on the western end of the lake first, usually in late May or early June, and the main body of ice broke up ten days or so after that. On Great Slave Lake, ice had formed in the larger bays by early December, but the main lake remained open until the end of the month. It was clear again by the second week of June. Great Bear Lake had by far the longest ice-covered season, lasting from early December until late July. In some years, boats travelling across the lake in August still encountered drifting ice.[42]

The long season of ice and snow combined with low annual precipitation across the large lake region to ensure that, while the ground was soggy, the air was dry. Most of the area is semi-desert due to the limited precipitation. In 1945, total annual precipitation on Lake Athabasca was 330.2 millimetres, and Great Slave Lake that year had only 219.8 millimetres of total precipitation; Toronto, by comparison, had 960.7 millimetres of snow and rain that year.[43] Lake Winnipeg was the wettest lake, although even there precipitation was highest in the southeast. Early-twentieth-century visitors to the large lakes wrote of the "dusty roads" at Fort Smith and the "hot dry winds" in Flin Flon, and they photographed dust-coated trees at Uranium City.[44] The arid conditions preserved buildings, facilitating the reopening of Port Radium after a wartime hiatus and the relocation of buildings at Goldfields on Lake Athabasca to the new community of Uranium City. The low evaporation rate and the role of permafrost in limiting drainage kept the region from exhibiting more obvious desert conditions.

The large lakes lie south of the treeline, which abutted the northeastern edge of Great Bear Lake, and boreal woodlands and woodland-tundra transition zones dominate the lakeshores. The boreal forest dominates the

1.3 The large lake region
Map by Eric Leinberger

Canadian interior, ranging in the north from the Brooks Range in Alaska near latitude 68º N southeastward to near latitude 58º N on the western coast of Hudson Bay. The boreal forest's range paralleled and enveloped the large lakes, although to the north the tundra-taiga ecotone abutted the large lake region, as did more mixed deciduous woodlands to the south. Cool summers and cold winters limit the diversity of woodland species. The character of the boreal forest in Canada – its "overriding unity," to borrow an expression from geographer F.B. Watts – lies in the dominant conifers, white and black spruce, and tamarack that occupy wetter sites.[45] In the northern transitional zone, tundra extended across open areas, with spruce in the lowlands and valleys. Where permafrost was found near the surface, shallow-rooted species like black spruce and larch were more common, and in the muskeg only stunted pine could survive in the wet, acid, and infertile ground. Where rock outcrops dominated the landscape, soil was scarce. The rocks themselves were covered with moss. Carl Lausen, a southern geologist who completed a detailed reconnaissance of Great Slave Lake in 1928, noted in his published account that, "where the moss has accumulated and its lower portions decayed, vegetation has gained a foot-hold. In the larger valleys, the boulder-clay and muskeg has given rise to a better stand of timber."[46]

Along the shores of Great Slave and Great Bear lakes, the prevalent Jack pine and spruce were small and scraggly, and it could take many years for cutover to regrow. Patchy woodlands were thickest near the lakeshores. J. Mackintosh Bell (geologist and nephew to Robert Bell) described the shore near Dawson Landing, adjacent to the lead-zinc deposit known as Pine Point, as having "a beautiful park-like effect." Individual Jack pines ranged up to fourteen inches in diameter but were generally smaller. Bell continued, "spruce – both black and white are common and also aspen and tamarack in the swampy stretches. White birch appears about six miles in from the lake and occurs occasionally all the way to the lakeshore but is small about four inches in diameter."[47] Across the Northwest, woodlands had supplied fuel and building materials for hundreds of years. Observers travelling along the Athabasca-Mackenzie river system invariably commented on the striking difference between the northernmost lakes and Lake Athabasca, with its "well-lumbered shores – more southern in appearance."[48] Northern Manitoba and the eastern shore of Lake Winnipeg had dense forests, although north of Beaver Lake "the timber is generally small, in protected valleys some fair spruce is found but these trees are few in number."[49] The thinner, smaller forests to the north also took much longer to regrow, creating a more dramatic visual and ecological impact in places where wood had been harvested, compared to forests farther south in the large lake region that had yet to face the effects of industrial harvesting.

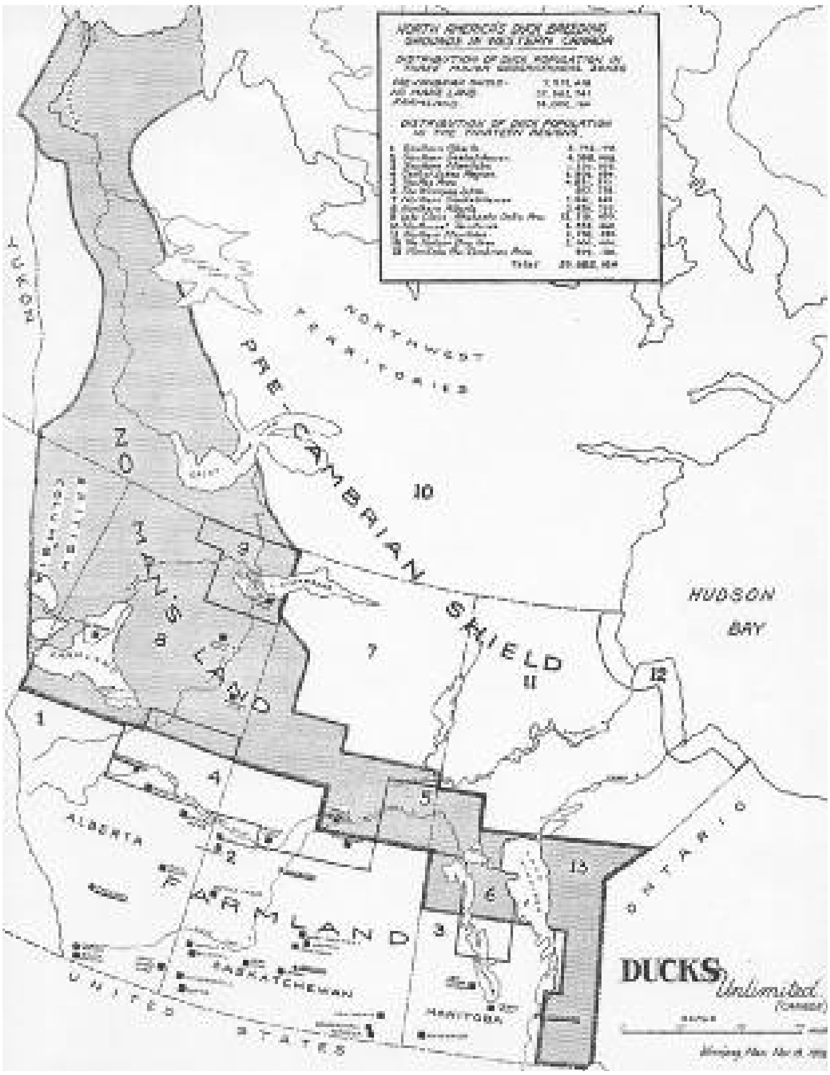
The Precambrian shorelines of the lakes were more "developed," less regular, with more harbours, inlets, and, on Lake Athabasca and Great Slave Lake, islands.[50] Uniformly old, otherwise Precambrian shorelines along the large lakes expressed considerable variety. The first annual report of the Manitoba Department of Mines and Natural Resources, printed in 1928, described Manitoba's Precambrian Shield in some detail, reflecting the interest in the mineral and resource potential of this environment. Along Lake Winnipeg and in northern Manitoba, shield terrain was "hummocky. Rounded hills and ridges of rock alternate with basinlike [sic] depressions and valleys ... Though Precambrian areas have locally a rough, uneven appearance, in a regional way there are no great or sudden changes of elevation. Rarely do the hills and ridges rise more than 100 feet above neighbouring drainage systems."[51] Elsewhere, Precambrian rocks exhibited greater topography, as on Great Slave Lake, where "rough hills, mostly of granite and gneiss, rise 200 feet or more and scattered among them are lakes of all shapes and sizes."[52] Mackintosh Bell, in his 1900 survey of Great Bear Lake, described cliffs that "rise 1000 feet almost perpendicularly from the water's edge." This landscape inspired Bell to detail how the rocks on the lakeshore "weather to beautiful shades of purple, red, and brown, and the reflections of the coloured precipitous cliffs in the clear northern waters, with the brilliant arctic sunlight were singularly beautiful."[53] Other distinctive Precambrian landscapes included the sand dunes on the southern shore of Lake Athabasca, blown into place by postglacial winds.

Narratives of Discovery

Southern entrepreneurs, corporations, and government departments expressed little interest in the large lake, in spite of their great age, before the 1920s. These outsiders saw the lakes as a vast expanse of opportunity, a great empty and wild space ready for exploitation. They wrote their own histories of the lakes, claiming rights to discovery and mastery over nature, justifying their activities in an unfamiliar region where they largely sojourned. The rise of industry on the large lakes mapped the demise of the preceding socioeconomic system of the fur trade; nevertheless, industrialists saw not a region in decline but a place that was altogether new and malleable, in the words of Ducks Unlimited a "No Man's Land."[54] Mine operators, commercial fish companies, and provincial and federal administrators saw the lakes as empty or underused, waiting and ready to be incorporated into Canada's industrial future. To see the large lakes in a way that masked the region's thousand-year human history was not a cynical and opportunistic process of self-deception; rather, it was a product of the new tools – technological and conceptual – that industrial interests used to see the large lakes and a result of the new perspectives from which they surveyed the Subarctic interior.

In the winter of 1929, Gilbert LaBine, an experienced prospector from Ontario, flew over Echo Bay on Great Bear Lake. Brilliant colours, the same "beautiful shades of purple, red, and brown" that Bell had described in 1900, attracted LaBine's attention. He fixated on the spot for much of the winter, reading up on the regional geology, including Bell's published report, and returned the following May, 1930, with E.C. St. Paul, another veteran prospector. Leslie McFarlane described the pair for the readers of *Maclean's* magazine as "experienced, hard-bitten veterans both, inured to hardship." The two men reached Echo Bay on Great Bear Lake, but by this point St. Paul was snow-blind, and LaBine set out prospecting on his own. When LaBine crossed to the point on which pitchblende was exposed, and "examined its craggy wall, his excitement ... was replaced by incredulity." McFarlane imagined that LaBine "danced a jig, flung his hat in the air, turned cartwheels or performed any of the antics that commonly signify a delirium of joy." But instead LaBine, in his own words, "went around the point and found another vein, a better one. Then I went back to camp and told St. Paul the news."[55]

The founding of major mine sites is the source of the most enduring narratives about the Canadian Northwest in the early twentieth century. Such narratives exist for all of the major mines: Pine Point on the southern shore of Great Slave Lake, Goldfields on Lake Athabasca, and Flin Flon in northern Manitoba. But the most famous narrative of all was that of LaBine and St. Paul finding pitchblende on Great Bear Lake, at the site of what would become the Port Radium mine. The fame of this particular account had little to do with the moment when LaBine located the pitchblende. This moment was barely more exciting than the two prospectors pegging out five claims above a minor tributary of the Columbia River, a moment that Jeremy Mouat uses to open his study of mining in British Columbia.[56] Rather, it was the later significance of the mine in supplying radium for medical treatments and uranium for weapons and power that vested the initial moment with such great import. Accounts



1.4 The Ducks Unlimited vision of the Northwest, 1939.
Source: Ducks Unlimited, *Ducks Unlimited Census 1938 and 1939 and Kee-Man Record Book* (Winnipeg: Ducks Unlimited, 1939), 18.

of Eldorado Mining and Refining's origins (the crown corporation that would mine radium and uranium on Great Bear Lake) invariably open with Gilbert LaBine's find. However, as Julie Cruikshank pointed out in her analysis of competing accounts of the origins of the Klondike Gold Rush, *discovery* is an inappropriate term, implying as it does "a discrete bounded incident," where in truth the initial act of locating a mineral deposit always took place within a larger social, cultural, and economic framework.[57]

The rise of bush flying allowed LaBine to locate the pitchblende on the eastern shore of Great Bear Lake and played a major role in its exploitation. The view from the air, moreover, was profound in its influence upon industrial visions of the Northwest large lakes. The 1920s generally were a boom time for aviation.[58] Pilots trained in World War I sought opportunities in peacetime, and many joined or started aviation companies. The end of the war created surplus aircraft that were quickly put to civilian uses. Early applications of this airborne capacity included bush flying as aircraft provided a unique means of accessing previously isolated regions. By the mid-1920s, a second generation of aircraft had been developed, better suited to the demands of distant flying in relatively harsh climates, including Fokkers, Fairchilds, and Junkers equipped with interchangeable pontoons, skis, and wheels, heated cabins, and mass-produced radial engines that could be cooled with air rather than water.[59]

Aerial photographs from the late 1920s and early 1930s record the new perspective that bush flying and aerial exploration provided, particularly for outsiders who did not know or live on the large lakes. The Royal Canadian Air Force (RCAF) flew most of the earliest government surveys at the behest of various government departments but principally for the Department of Mines and Resources. From the outset, in 1925, the RCAF established the National Air Photo Library in Ottawa to organize and store their images of the dominion. Private companies also got involved in aerial photography.[60] Flights into places distant from the core of southern industrial Canadian society provided a view of remote territories and facilitated the dominion's claims over its extensive lands as the act of photographing was itself an expression of control.[61] The earliest photographs from the large lakes date from 1929 and 1930, when a series of oblique lines were flown over the Athabasca Delta and along the Bear River into Great Bear Lake, the choice of rivers leading to the large lakes reflecting the significance of waterways to transportation and navigation.

Aerial photographers adopted vertical photographs to present better elevated views of the ground. Vertical photographs were more readily applied to the practical task of topographical mapping.[62] In this fashion, the aerial surveys provided a new foundation for surveying the distant reaches of the dominion without setting foot on the ground. Vertical photographs reproduced the mapmaker's eye with their two-dimensional overhead view. To ensure systematic, mappable coverage, planes flew parallel flight lines with approximately 60 percent overlap between successive photographs and 30 percent on either side. Pairs of photographs could be viewed together to provide a stereoscopic image of the terrain, where the trees, rocks, and bodies of water would be seen in exaggerated relief. Once corrected for tilt and displacement (only those images in the centre of the photograph were truly vertical), the images could be used to create accurate topographical maps.[63] As Denis Cosgrove argues, composite photographs taken along these flight lines "demanded a different way of looking than the still photograph did. The eye moves over the virtual space of the image as across a map, parodying in some measure the kinetic vision of the flyer and enhancing that experience of vicarious travel."[64] Aerial exploration and photography allowed southern Canadians to reach further into the Subarctic than had been possible with nineteenth-century surveying technologies and, in the process, to assert authority over this region.

The view from the air was different from the view from the ground. Distances shrank from the air, not only seeming smaller but, because of the access afforded by bush planes, actually bringing the Northwest closer to southern centres such as Edmonton or Winnipeg. Aerial photography and exploration played proportionately more important roles the farther a particular location was from a centre of population.[65] The view provided by aerial surveying emphasized wilderness over human settlement. Small northern communities were dwarfed by the wide expanses of rock, water, and trees that surrounded them. The large lakes, veritable inland seas, were transformed into enclosed bodies of water, and the aerial perspective was normalized. For Charles Camsell, born in Fort Liard to an HBC factor, who grew up to become a mining engineer and the geologist who first mapped the Great Bear Lake region with Mackintosh Bell as well as the deputy minister of mines in Ottawa for over twenty years, Great Bear Lake's "proper setting" was only visible from the air.[66]

Aerial surveying and photography introduced a new sense of orientation and scale to northern resource exploitation, one through which mine planners and fisheries scientists plotted development against terrain that they saw – from a distance – as open and undeveloped. In spite of the early bureaucratization of aerial photography, there was no general pattern to the lines flown in the large lake region or elsewhere. The costs involved and the expanse of territory that could potentially be covered meant that most photographs taken in this early period focused on sites of interest: communities and possible mine developments, such as the Dominion Explorers camp photographed on Great Bear Lake in 1930. Although in later decades aerial photography would be used to map sea ice movements, no photographs were taken that captured lake waters and ice, only the waters adjacent to shorelines. The pointed, localized approach taken by these air surveys contrasts with the broad, systematizing views such as the Dominion Lands Survey that organized and subdivided Prairie landscapes for the extension of agriculture. On the ground, these planners, like the dominion surveyors who preceded them, would have seen the large lakes from the routes travelled by trappers and traders, replete with all the signs of human activity and history in the clearings, graves, and debris that people leave behind. From the air, the ground was silent, and Dene moved about Great Bear Lake unseen.[67] A journey that took seven months by canoe and snowshoe in 1900 could be completed in two days in the 1930s, as newcomers now rushed in over space rather than traversing ice and soil.[68] This was what LaBine saw and did not see when he first flew over Echo Bay in 1929.

LaBine's vision was shared by many others who participated in the flurry of aerial exploration that flourished in the 1920s and 1930s and led to the creation of companies such as NAME (Northern Aerial Mineral Exploration) and Dominion Explorers and the identification of new mine sites on each of the large lakes. How these industrial explorers interpreted conditions on the ground revealed a tension between experience and science in knowing nature that resonates, as we will see, throughout the narrative of twentieth-century industrialization. As LaBine looked out the window of the airplane and saw the brilliant colours of the cliffs on Echo Bay, he knew, based upon his previous experience in Cobalt, Ontario, of the relationship between brilliantly coloured cobalt blooms and silver. The Ontario mining district shared considerable similarities, as well as some physical continuities, with the interior Precambrian shores of the large lakes. Although a great distance from Great Bear Lake, LaBine knew a similar nature from Cobalt. Yet, he also turned to scientific expertise when he consulted Camsell and Bell's official 1900 report. Leslie McFarlane's second article on LaBine, "It Wasn't All Luck," published two weeks later in January 1932, emphasized how neither good fortune nor scientific expertise, nor long experience in the field alone, had ensured LaBine's successful discovery. Rather, all three combined to reveal the significance of the brilliant coloured cliffs on Great Bear Lake and led LaBine to stake the site of the future Port Radium mine.

In 1941, Charles Camsell argued that he and Bell dismissed the cobalt bloom at Echo Bay because they were deceived by the inaccessibility of the region at the turn of the century rather than ignorance of its mineral potential.[69] This was not entirely accurate, as in 1900 Camsell and Bell would not have realized the later value of pitchblende. The mineral pitchblende had been recognized and named since the early eighteenth century, but the element radium was only isolated by the Curies in the late nineteenth century and its fluorescent and cancer-treating properties fully recognized. Turn-of-the-century advances in chemistry and medicine made pitchblende the more valuable companion to the silver in the rocks that LaBine staked on Great Bear Lake. To extract radium from pitchblende was significantly more complex than processing saleable silver from the ores. Radium production came to exemplify the industrial transition on the large lakes of Subarctic Canada. Beyond its dependence upon relatively recent scientific advances, radium production required major inputs: the construction of substantial processing facilities and a transportation network to bring radium to market. Where the other great northern mining rush, the Klondike Gold Rush, had an underlying democratic character allowing thousands of individuals the opportunity to find and extract placer gold, radium production required a degree of vertical integration that all but excluded individual exploitation and ensured substantial corporate and government direction over the decisions to industrialize the northern large lakes. Although epitomized in the effort and skill of a single man, the real significance of locating pitchblende on Great Bear Lake was that it heralded the arrival of international capital interested in the application of industrial fuels and technologies to Subarctic resource exploitation directed toward international markets and thus initiated the twentieth-century industrial transformation of the Northwest.

Accounting for Disappearance

Great Bear Lake was only hidden and silent to southerners entering its unfamiliar environment. The Dene had lived on and around the shores of Sahtu (Great Bear Lake) from when the world was new. The Yamoria cycle in Dene oral tradition told of the battles between giant brothers and animals, and, as archaeologist Christopher Hanks observed, "the locations where [Yamoria] slept and the smaller battles he fought with lesser giants mark the topography of *Denendeh*."[70] These traditions mapped and ordered the landscape that the Dene inhabited throughout the Mackenzie basin and not only predate printed maps of the region but also differently interpret the significance of the land. Bear Rock, a striking promontory along the Mackenzie River at the mouth of the Bear River, figured prominently in the Yamoria legends. Dene medicine power was immanent in the landscape, and Bear Rock was an important site of such power; its prominence served as a powerful mnemonic to all who passed by.[71]

Native knowledge of the Northwest's inland waters was crucial to geological, prospecting, and mining development work. In appealing to southern audiences, McFarlane dismissed this knowledge and claimed that "only veterans of the outdoors could have attempted this journey. The country was practically unexplored. There were bays in Great Bear Lake unmarked on any map."[72] The country, however, was very well known to and thoroughly explored by the Dene and unexplored only in a formal sense: official government maps were not available for prospectors. LaBine and St. Paul chose not to hire Native guides on their expedition, likely to minimize costs and to ensure that word of any find did not leak out; prospectors jealously guarded their finds in order to best reap the rewards of their work. Native people, as a result of their intimate knowledge of the land, had a long-standing role as workers in the northern transportation industry. Blondin wrote about his father, Edward Blondin, who was hired "to pilot crossings of Sahtu, because he knew the big lake and all its natural harbours well."[73] Photographs of ships' crews from the boats that worked on Great Bear Lake reveal the prominent place of indigenous people (and indigenous knowledge) in the effective working of the transportation system. In a 1943 submission to the Water Transport Commission, W.S. Hall, superintendent of operations for the Northern Transportation Company Limited (NTCL), confirmed that "the charts available for the three major lakes [of the Mackenzie basin] gave practically no information as to water depths, harbours of refuge, etc. Due to the above, native pilots with local knowledge were then, and are still, essential to the safe navigating of these waters."[74]

Indigenous knowledge of land and waters contributed to the creation of formal scientific knowledge. Alexander Mackenzie, Samuel Hearne, Joseph Tyrrell, and John Franklin, who travelled through Denendeh before the twentieth century, each used Native guides and followed indigenous routes. They then reproduced indigenous landscapes for outside consumption in their maps and journals. Newcomers sought out

1.5 Joe Bird, (here c. 1920-25) was one of the most skilled and best-known Métis pilots in the Mackenzie District. His son, Captain William (Billy) Bird, achieved similar renown as a pilot.
Source: Alma Guest/NWT Archives/N-1979-067:0022.

Native knowledge of mineral deposits. The Yamoria cycle identified coal-bearing outcrops along the Mackenzie River, and George Douglas and prospectors interested in the coal potential of Great Bear Lake relied on Native reports of exposed coal bodies.[75] In 1923, John Hornby, who would famously starve to death alongside his two companions in the Thelon River region four years later, noted that samples of what he called "colbaltite silver" "were brought in by the (Caribou Eaters) Indians. E.W. Dawson (of Bell's Co) went out and hired the Indians who showed him the place and he staked out two claims."[76] Dene place names inscribed local ecological knowledge on the landscape of Great Bear Lake at places like Grizzly Bear Mountain (Saoyúé) and the Scented Grass Hills (Ædacho). The maps drawn up in the early twentieth century failed to preserve Dene names, and the names given by newcomers instead dominated the cartography. The five arms of Great Bear Lake were named for five HBC men who assisted John Franklin's 1827 exploration party on its way north, Dease, McTavish, McVicar, Keith, and Smith. Of these five, only one, Peter Warren Dease, would ever travel to the lake itself, on his own expedition with Thomas Simpson a decade later.[77] Jonathon Bordo has written about the erasure of the Aboriginal presence from the visual landscape of Canadian artists, in particular in the representations of the North by the Group of Seven.[78] The act of renaming this landscape similarly erased indigenous knowledge of the environment and asserted non-indigenous authority over this space.

The myths surrounding southern Canada's rediscovery of the large lakes in the 1920s masked how the systematic advance of industrial activities across the large lakes depended upon pre-existing transportation and knowledge networks. Such masking came out of the assumption that industrialization was inevitably progressive and, by definition, devalued the social and economic arrangements that it replaced. Scientific knowledge of nature would come to dominate decisions about how to remake the large lakes toward industrial ends in subsequent decades. The same science continued to rely on Native and non-Native local knowledge but did not consider that this dependence created any real obligations to the place or its people. Instead, it manipulated local knowledge to industrial ends, furthering the transformation that brought considerable immediate turmoil to communities and individuals who lived around the large lakes. There were also major changes on the ground in the 1920s that helped newcomers to wear their blinders to indigenous inhabitants and communities rather more easily.

The most drastic occurrences directly affecting large lake demographics and societies in the 1920s involved the recurrence of epidemic disease among Native populations and declines in fur-bearing animals. There is a long history of epidemic disease across the Canadian Northwest that dates as early as the 1734 smallpox epidemic that struck Cree and Assiniboine people gathered on the shores of Lake Winnipeg during the summer months.[79] Building upon models of the spread of introduced "virgin soil" diseases first established by Alfred Crosby and William McNeill, historians have reconstructed the spread of epidemic disease across the plains and into the Northwest.[80] This longer history of epidemic disease is inextricably tied up with territorial shifts and expansion of different Native groups, such as the movement circa 1760 of Cree into the lands lying between Reindeer Lake and Lake Athabasca. Documentary evidence of epidemic disease in the Mackenzie district dates to the widespread 1781-82 smallpox outbreak that travelled west from Churchill. Likewise, different epidemics had varying impacts on different populations, as with the 1837-38 smallpox epidemic that moved northwest from Lake Winnipeg and devastated the Assiniboine, while the Cree were less affected. Although certain diseases had become endemic in Native populations in the large lake region, the longer history of ecological disruption and epidemic disease persisted into the early twentieth century.

One of the most devastating epidemics of the twentieth century across the large lake region occurred in 1928. That summer influenza spread along the Mackenzie Valley on board the HBC's main supply ship, the *SS Distributor* (so named because it distributed the annual supplies to each of the fur-trade posts). At least one in ten people living along the Mackenzie River died in this epidemic, with communities such as Providence losing 20 percent of their population and some camps, including the thirty-three people living at Gros Cap, completely destroyed.[81] The epidemic endured in the memories of survivors and their children, in the documentary record, and on the landscape. Jimmy Sabourin, five years old at the time, told how "I started to get sick that night. My ears began to buzz and my head hurt. The next morning I was hungry but I didn't know where any food was. Jean Marie found something for me ... Jean Marie said he wanted to go back down river but he couldn't. He was needed to dig graves. There was no one to help him. He was covered with mud."[82] George Blondin's grandfather, Paul Blondin, died in the 1928 epidemic, but Blondin emphasized how the Dene blamed the epidemic on a great quarrel between two powerful medicine men in Tulit'a (Fort Norman).[83] The epidemic figured in Mackintosh Bell's geological journals from the summer of 1928 and more prominently in Helge Ingstad's narrative of his experiences as a trapper on Great Slave Lake between 1926 and 1930.[84] The Dene landscape changed after 1928. New grave sites appeared on lakeshores and riverbanks, and the people who died left behind empty villages on the lakeshores and along the Idaa trail.[85]

The villages that lay abandoned between Great Slave and Great Bear lakes mirrored declining Native participation in the fur trade, as the architectural style of the buildings in these villages mimicked the log buildings of the fur-trade posts. The dominance of native fur trappers waned as increasing numbers of non-Native trappers came into the Northwest in the 1920s.[86] The disruptions to international trade and the fur market brought about by World War I gave fur traders, large and small, an opportunity to break the HBC's firm control over the Canadian fur trade. By the 1920s, an intense struggle was under way in the Athabasca-Mackenzie district between three large companies, HBC, Northern Traders, and Lamson and Hubbard, and a number of smaller operators. Similarly, to the southeast, the Keewatin fur district was also in transition as fur traders continued to work along the Lake Winnipeg axis but, after 1929, branched out with the extension of the Hudson Bay Railway line.[87] Non-Natives who came into the large lake region in this period generally tried their hand at trapping and tripping, either as the focus of their activities or to supplement other work.[88] As Frank Tough expressed it, "the white trapper seems to have fallen into two categories: the long-term resident and the itinerant trapper. The itinerant trapper consciously over exploited the resource base."[89] The treaty settlements safeguarded non-Native newcomer activities in the large lake region, while the advancing transportation routes brought them in and took their furs out. Meanwhile, high prices for furs encouraged intensified exploitation and contributed to a decline in fur bearers.

The influx of white trappers and the accelerated industrial activity depleted fur-bearing animal populations across the large lake region. Increased forest fires destroyed vegetation that game animals would otherwise have fed on. Shortages were noted in the Great Slave Lake region in the late 1920s and in northern Manitoba, where the caribou failed to appear at their common wintering sites.[90] A sentiment expressed by observers familiar with the large lake region was that the new trappers lacked the respect and restraint practised by their predecessors. In a letter to Prentice G. Downes in 1955, George Douglas wrote that "in your 'Sleepy Island' you mention the dearth of animal life in the North. It wasn't always so. The opening of rail to NW, the booming fur market of the twenties, modern fire arms [and] plentiful ammunition in the hands of men who would shoot anything alive at sight – I was much disgusted with the decrease in all kinds of animal and especially bird life after 1928 even and 1931 in Great Bear Lake."[91] There were also calls, from the Industrial Development Board (IDB) of Manitoba, among others, for improved conservation measures to protect fur bearers.[92] The disappearance of animals was at once temporary, seasonal, and permanent. The coincidence between this disappearance, the effects of epidemic disease, and the new technologies and intellectual frameworks guiding outsider excursions across the large lake region accounts for the empty landscape that they claimed to see.

Conclusion

Treaty 11 consolidated the dominion's claim to the extensive lands and waters that reached from Lake Winnipeg to Great Bear Lake. The transfer of Aboriginal title was largely symbolic, relative to the economic and environmental transformations already under way. Treaties facilitated prospecting and trapping, but the extension of these activities had preceded treaty settlements and then paused, waiting for favourable market conditions, a ready pool of industrial labour, and an expanded transportation network to intensify. The wait was not long. As Chapter 3 describes, the Great Depression soon created the right combination of conditions, and the Northwest boomed. Already, narratives of discovery and the new technology of aerial photography exposed how southern Canadians would remake this landscape toward industrial ends. A new perspective accompanied new political and legal frameworks and together subsumed a massive territory, which the dominion had heretofore largely ignored, and placed the vast reaches of the Northwest within southerners' physical and mental grasp. Southerners hoped to reorder and manipulate the large lakes to meet outside demands, intentions that they quickly put into practice with the creation, described in the next chapter, of a new transportation network. In spite of their claims to this effect, newcomers did not discover a static, empty landscape but encountered a place in the midst of rhythmic and historical change apparent in natural dynamics that ranged from seasonal climatic fluctuations to ongoing isostatic rebound, epidemic disease, and fluctuating animal populations.

The demise of older economies and populations affected the progress and form of industrialization after 1920. Aspects of the nineteenth-century fur-trade economy persisted through the first half of the twentieth century, in particular through credit arrangements between fishers, prospectors, and the companies that hired their labour. More striking, however, was the extent to which new industrial activities displaced previous economic arrangements. As fur-bearing populations strained under the pressure of increased exploitation, newcomers who travelled to the large lakes no longer relied on the fur trade for their livelihood. Native economies that depended on fur-bearer populations were similarly weakened. These changes encouraged both Natives and newcomers to join the new industrial labour force employed by mining and fishing companies in their resource operations. The new human landscapes that emerged after the influenza epidemics in the 1920s influenced the new industrial geography. In the fishery, industrial operators initially moved into areas that either supported much smaller Native populations or that Native peoples had abandoned altogether, as a result of the social disruption that accompanied the epidemics. The Dogrib community located at Gros Cap on Great Slave Lake had occupied a rich fishing site and was a central point for offshore fisheries. This community was decimated in the 1928 epidemic, and the few survivors joined other Dogrib located elsewhere, abandoning the Gros Cap site. When industrial fishing operations commenced on Great Slave Lake in the 1940s, the first site occupied was Gros Cap. In this fashion, the turmoil of the 1920s provided entry points and means for the industrial transformation.