INFORMATION NORTH

Published by The Arctic Institute of North America

VOLUME 16, NUMBER 3 SEPTEMBER 1990

Long-Term Threats to Canada's James Bay from Hydroelectric Development

By Jan Beyea, Joyce Rosenthal and Jennifer Hansell

Located about 1100 km north of the U.S.–Canada border between Quebec and Ontario, James Bay possesses extensive coastal marshes and intertidal flats on the southern and western coasts, providing critical habitat for shorebirds and waterfowl migrating between northern breeding grounds and wintering areas farther to the south. They flock there by the millions in spring, summer and fall to feed, moult or nest.

In many ways, James Bay is the northern equivalent of tropical rainforests. Although protected in the past by its remoteness, James Bay now faces severe threats from development projects under consideration by the Quebec government. While environmentalists see James Bay as a home for birds, fish, marine mammals and other wildlife, the Quebec government sees the bay and its surrounding water catchment as an opportunity to reduce high unemployment by developing the area to produce electricity and water for export to the United States. As Premier Robert Bourassa envisions his province: "Quebec is a vast hydroelectric plant in-the-bud, and every day millions of potential kilowatt hours flow downhill and out to sea. What a waste!"

The Quebec government is not insensitive to environmental concerns once a project is approved and is willing to go to great lengths to reduce impacts during construction. It has already done some excellent work in studying the impacts of the proposed projects, but a lot still needs to be done before an informed decision can be made as to the wisdom of additional construction.

A classic battle has developed, one that pits well-meaning people against each other. The Quebec government is striving for economic growth; environmentalists are seeking to preserve habitat and wildlife species; the Cree and Inuit are struggling to preserve a way of life that has lasted for thousands of years. Not surprisingly, environmentalists dispute the need for development and question whether the projects completed so far are of real economic benefit; the government disputes the seriousness of the environmental impact; the natives dispute the legality of their traditional lands being taken against their will. Leaving these questions aside for now, one still must ask what should be done when desires for economic growth seem to conflict with environmental values. In this paper we focus on the environmental aspects, particularly with respect to birds, rather than on the cultural issues facing the Cree and Inuit.

James Bay Hydropower Development Plans

James Bay is a large, shallow marine inlet of Hudson Bay, bounded on the east by northern Quebec and to the west by the province of Ontario. The steep elevation gradient of the Quebec side is highly conducive to hydroelectric generation. The major rivers from Quebec entering the bay are the La Grande, the Eastmain, the Rupert, Nottaway and Broadback, and the Harricana. Except for the southern Harricana, all will eventually be affected by the development plans of Hydro-Québec, a

---

This article is adapted from a National Audubon Society Environmental Policy Analysis Report by Beyea and Rosenthal. Jan Beyea is the Senior Staff Scientist at National Audubon Society, 950 Third Avenue, New York, N.Y. 10022. Joyce Rosenthal is currently Associate Director of the Council on the Environment of New York City; Jennifer Hansell is Associate Director of Friends of Gateway, both at 51 Chambers Street, #228, New York, N.Y. 10007.

government-owned utility. The Great Whale River, which flows into Hudson Bay, will also be dammed.

The total power of all hydroprojects proposed by Hydro-Québec is 20 800 megawatts (MW), equivalent to the power from 35 large coal or nuclear generating stations. (The comparison with coal and nuclear generating stations has been made assuming 1000 megawatts operating at 60% capacity.) The estimated cost of these hydroprojects is at least $25 billion, and by some counts much more, the loans for which would most likely be paid off by long-term sales of electricity to customers in the United States.

During **"Phase I" of the James Bay development**, finished in 1985, three powerhouses with a capacity of over 10 000 MW were built on La Grande Rivière, along with the diversion into this river of water from the upper basins of the Eastmain and Caniapiscau rivers. These two diversions nearly double the average flow of La Grande Rivière.

In July 1987, construction began on LG-2A, a new addition to LG-2, the largest powerhouse on La Grande. Slated to be onstream in fall of 1991, LG-2A involves additional turbines and another tower 1000 m downstream from the existing LG-2 structure.

Phase II of the La Grande proposal will involve construction of at least three more powerhouses on La Grande Rivière for the generation of approximately 2500 MW of electricity, costing $3–9 billion.

The New England states are currently negotiating long-term contracts with Hydro-Québec and the Quebec government to buy electricity from the proposed Phase II, and New York State has recently conducted similar negotiations. Interest is high in the United States, with many New England utilities indicating their intention to rely on Phase II for part of their future electricity supply. A Hydro-Québec spokesperson says the signing of contracts will accelerate the pace of development, but the projects will go on as planned regardless of sales to the U.S.

The **"NBR" hydro-electrical project** would divert the Nottaway and Rupert rivers into the Broadback, along which generating stations would be built to produce an estimated 8000 MW. As a result, the lower 150 km or so of the Nottaway and Rupert rivers will be cut off, leaving virtually dry bedrock. Waterfowl use of Rupert Bay is approximately 1000 times that of the La Grande estuary, and in addition to the NBR impacts on James Bay as a whole, the effect on this rich estuary could be very serious.

Most of the impacts of the **Great Whale project** will affect Hudson Bay, rather than James Bay. Nevertheless, the project is also a huge undertaking with enormous ecological consequences. It would dam the Great Whale River, place three power stations on it, add a storage reservoir at Lake Bienville, and divert the Little Whale River into the Grande Baleine 1 reservoir. Current plans indicate that the Great Whale will be the next project after James Bay II; construction of the access road to Great Whale has already begun.

James Bay Wildlife

This paper deals primarily with the bay itself, not the inland areas. However, terrestrial mammals and fish have also been affected by the creation of new reservoirs. The taiga forests and tundra of northern Quebec support the largest caribou herds on the planet. James Bay Phase I has had a catastrophic impact on the herd. During the dam's first year of operation, more than 10 000 caribou were drowned on their annual migratory routes as a result of severe fluctuations in the Caniapiscau River's stream flows.

James Bay provides habitat for a diverse array of marine mammal species, many of which make their homes on the loose pack ice and denser ice that characterize the marine environment for part of the year. Ringed seals are the most common, with an estimated population of 61 000 in James Bay. The harbour seal is found mainly in river estuaries of James and Hudson bays. Large numbers of beluga whales winter in ice-free waters adjacent to small islands in James Bay. Polar bears tend to spend the warm season on some of James Bay's islands and coasts. Hydrodevelopment could harm these species by changing salinity levels or affecting food sources.

Anadromous fish such as cisco, lake whitefish and brook trout spend most of their lives in the marine environment but use the estuaries on the east coast of James Bay to spawn. As a result, they suffer the most from dams and river diversions through diminished access to spawning grounds.

James Bay is a major North American staging area for migratory shorebirds. Between the spring ice break-up and the fall freeze-over, several million shorebirds congregate and forage or breed at James Bay. The coastal salt marshes and intertidal flats of western James Bay are fertile habitats for migratory bird species. The critically endangered Eskimo Curlew was last sighted in 1976 on the James Bay shore. The cumulative environmental changes brought by Quebec's hydroelectric development plans on this habitat could severely affect the shorebird populations.

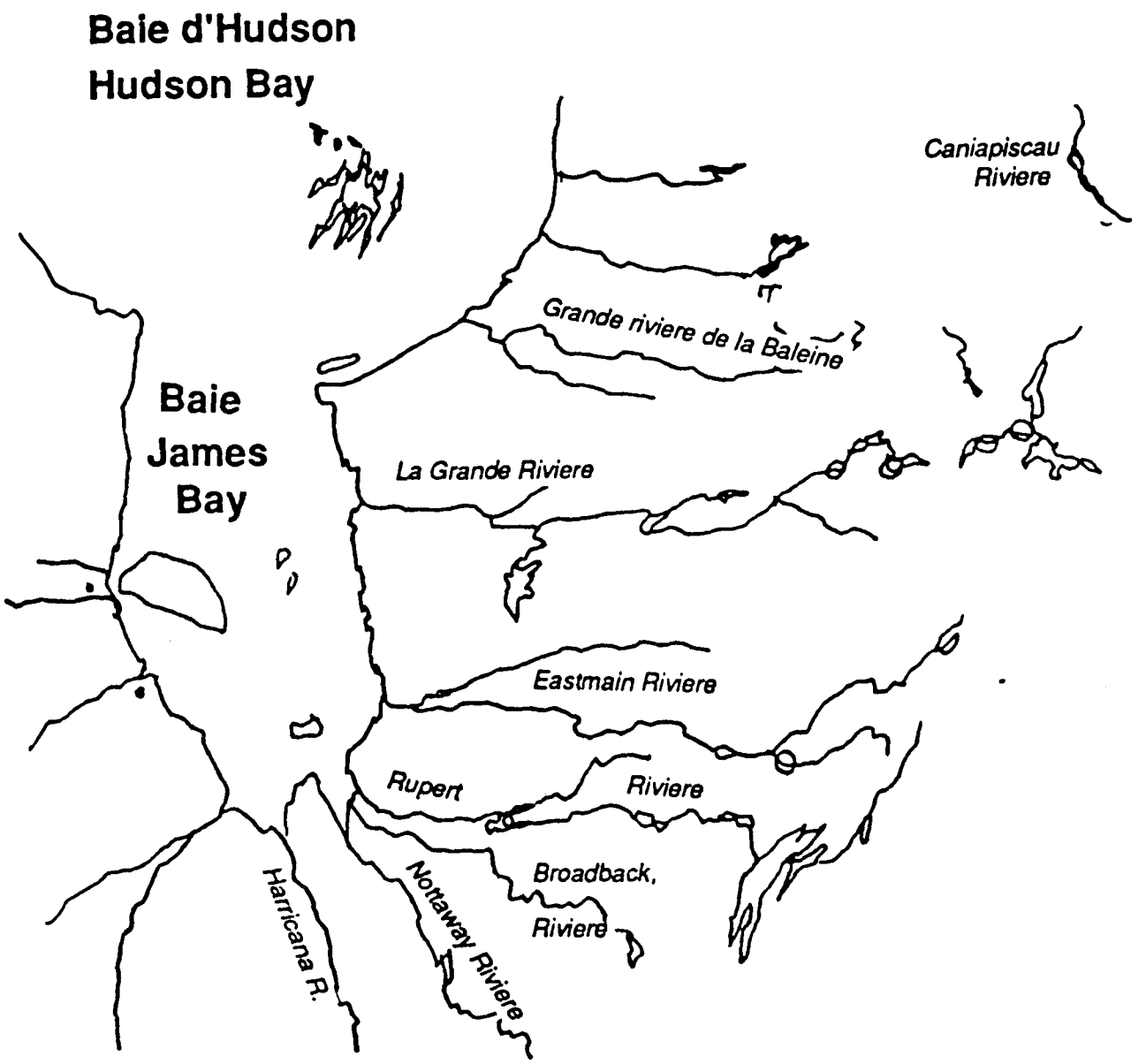
Many species of ducks, such as the Green-winged Teal, American Black Duck, Mallard, Pintail, American Wigeon and Scaup, breed in inland areas and occur in large numbers on the coast in migration.

Information North is published 4 times a year by The Arctic Institute of North America. *IN* welcomes announcements of conferences, workshops and symposia of relevance to the North. Contents of *IN* may be used without permission but with credit to *IN*.

Financial support for the programs and associated projects of the Arctic Institute, Canadian Corporation, is provided by: The Government of Canada, The Government of Alberta, The University of Calgary, Amoco Canada Petroleum Co. Ltd., Canadian Airlines International Ltd., Canadian Petroleum Association, Chevron Canada Resources Limited, Cominco Ltd., Esso Resources Canada Limited, Foothills Pipe Lines, Gulf Canada Limited, Interprovincial Pipe Line Co., Nanisivik Mines Ltd., Nova Corporation of Alberta, Petro-Canada Inc., Polar Gas, Royal Bank of Canada, Shell Canada Limited, TransCanada PipeLines Ltd., and over 2300 individual members and subscribers.

Editor: Karen M. McCullough
Production Editor: Ona M. Stonkus
Printed on recycled paper by Atomic Press, Calgary
 ISSN 0315-2561

Major Rivers from Quebec Entering James Bay



Migratory shorebirds and waterfowl have enormous metabolic needs that must be met at James Bay during their stopover in order to fuel their long flights. Migrants may have no substitute habitat if key sites on James Bay are destroyed. The birds feed mainly on concentrated and unique invertebrate "hotspots" present in the intertidal mudflats and salt marshes that make up the James Bay coast. Many species of migratory shorebirds would be severely threatened, possibly even to extinction, if a crucial stopover area were damaged.

Cumulative Impacts

The impacts of hydrodevelopment on James Bay are uncertain. It is even conceivable that the net impact could be beneficial to some species of wildlife. However, it is more likely that the disruptions to the ecosystem by the totality of the proposed hydroelectric developments would be damaging to local habitats. Although no one can totally predict the impact of hydroelectrical projects, they could be large scale. The law does not require consideration of such cumulative impacts in environmental assessments as a prerequisite to construction of individual projects. Therefore, if the damage from an individual project is marginal, the project can be approved, even though the cumulative impact of many such projects might mean the loss of an ecosystem.

It is the expressed policy of Hydro-Québec that the corporation "plans, designs and carries out its activities

taking into consideration all environmental implications." However, the corporation has only briefly outlined the possible cumulative impacts that full development of northern Quebec could create in James Bay. These brief descriptions have not explored the ways these might affect bird, invertebrate and animal species. Concern has been expressed about changes in salinity, nutrient levels, and the ice-melting patterns of the bay due to hydroprojects. In addition, little consideration has been given to impacts on the Ontario side of the bay.

In response to concerns raised by the National Audubon Society, the New England Power Pool commissioned a series of studies, undertaken with the help of Hydro-Québec and the Société de l'Énergie de la Baie James. These studies maintain that changes to the bay from existing developments have been fewer than expected and that many physical parameters in the bay, including temperature, salinity and nutrient content, are insensitive to river flows. Studies by Hydro-Québec scientists Danielle Messier and others (1989) in the last few years draw much the same conclusions. Whereas these studies are convincing in suggesting that marginal changes in the flows of the rivers entering the bay are likely to have negligible impacts on wildlife that depend on the bay, they do not consider the cumulative impacts of many small changes that would result from a series of projects.

The fact that the impact so far has been less than expected is not a reliable indication that future development will follow the same pattern. The lack of agreement is a sign that the workings of the James Bay system are not well understood and more research is needed. Next time, the unpredicted effects may be more negative. The cause of insufficient research being done by Quebec and its utility on cumulative ecological impacts lies with the Canadian environmental review process.

The Environmental Review Process for Canadian Hydroelectrical Projects

The James Bay projects were the stimulus for most of the current environmental protection policies and requirements of the Quebec provincial government. Two environmental groups, the James Bay Defense Committee and the Société pour Vaincre la Pollution, deserve considerable credit for prodding the government. Alain Soucy, director of the group that conducted the studies, the Société d'énergie de la Baie James (SEBJ), described in a 1983 report how environmental planning originated in Quebec:

> When the James Bay Project began, the area in which it was to be executed was still little understood, and the scale of the project sparked fears on the part of most experts as to the anticipated social and environmental impact.... The James Bay project mobilized these [environmental] groups, which carried on a constant struggle against the project. To a large extent, this action forced the administrators of the para-governmental corporations to take the environmental aspect into account in the planning and execution of the project, since legislation in the area of environmental protection was still nonexistent at that time [Soucy, 1983:3].

The environmental review process has developed over the past 15 years to help balance desires for development projects with protection of the environment whenever they seem at odds. In principle, at the end of the review process, government decision makers and the public should have a good idea of the negative environmental impacts of a proposed project or series of projects before a commitment is made to go forward. In the United States, preparation of an environmental assessment is mandated at the federal level under the National Environmental Policy Act (NEPA) whenever an action to be taken by the federal government might have a significant impact on the environment. Many individual states have their own "little NEPAs" that can also trigger environmental assessments at the state level.

A key feature of the U.S. review process is the requirement that the Environmental Impact Statement (EIS) compare alternatives to the proposed project, including the alternative of not building the project in the first place.

In Canada, environmental impact assessments for hydroprojects can today be prompted by two distinct legal entities: a provincial government or the federal government. For the James Bay hydrodevelopment plans environmental statements have been written by a joint federal–provincial task force and by the province of Quebec and Hydro-Québec itself, but these statements fail to consider either the cumulative impacts of the projects on the entire bay or alternatives to the projects.

What are the prospects that a complete environmental analysis will be carried out under current law? The responsibility for producing environmental documents for the various sectors of the Canadian government is a gray area, with a large amount of shared jurisdictions, joint ventures and waivers among the provincial utilities, the provincial governments and the federal government of Canada. Provincial requirements vary by province, but Hydro-Québec is committed by its charter to assessing environmental impacts in writing. Most important, a unique agreement exists in Quebec among the Cree, Inuit, Hydro-Québec and the federal and provincial governments that spells out the environmental impact assessment requirements for development in the James Bay region.

However, economic pressures create a political climate favorable to developers. Hydro-Québec is an agency of the Quebec government, owned, financed and accountable to the province for planning. It is relatively easy for utilities to get waivers for environmental requirements, and project proponents are largely responsible for preparing their own environmental impact assessments.

The James Bay and Northern Quebec Agreement, signed in 1975, was negotiated due to the interest in developing the hydroelectrical potential of Quebec rivers. The signatories to the agreement are the federal

government of Canada, the Quebec provincial government, the Grand Council of the Crees (of Quebec), the Northern Quebec Inuit Association, the Société d'Énergie de la Baie James (SEBJ) and Hydro-Québec. It establishes a convention under which the environmental impacts of hydroprojects are reviewed and assessed and is the most relevant expression of law in regard to development projects in northern Quebec.

This agreement establishes two groups with the responsibility to conduct environmental reviews for development projects: a James Bay Advisory Committee on the Environment, composed of Cree, Quebec and federal government representatives, and an Environmental and Social Impact Review Committee, a majority of which is selected by the Quebec government (three members) and the remainder by the Cree Regional Authority members (two members). This second committee is the review body for development projects in the territory.

The agreement describes what should be included in an environmental impact statement for development projects in the James Bay region. Examination of the cumulative impacts from the whole series of hydroprojects planned by Hydro-Québec is not mandated under the terms of the agreement. However, it is suggested that, at the proponent's discretion, consideration of cumulative impacts be included if the affected community (the Crees) request it. Even then it is not mandatory. This section reads:

> The proponent may, at his discretion, include in his statement a section on information and questions submitted by the community potentially affected. Where he considers it appropriate the proponent may discuss and comment upon such information or questions.
>
> This section of the statement should consider, whenever appropriate, direct, indirect and cumulative impacts: short term and long term impacts; reversible or irreversible impacts. Attention should also be given to impacts occurring at different phases of the development, and on different scales, i.e. local, regional or national scale.

Unfortunately, the discussion of alternatives to a project is similarly circumscribed in the James Bay environmental impact assessments. Consideration of alternatives is defined as the examination of site alternatives for a project (within the region) or alternatives to the design feature of a given project (to mitigate environmental impact). At no point is there mandated a consideration of what is called the "no-action" alternative in a U.S. EIS, that is, the alternative of building nothing in James Bay and relying instead on other options such as energy conservation. Were it required under Canadian law to consider alternatives to further hydro-development, it is possible that analysts might learn that there are other options that would be both cheaper and less environmentally damaging than continuing with hydro-development. For instance, installation of energy efficiency technologies in Canada might free up existing electricity capacity that could be used for export at a lower cost than building new dams and diversions. Another option is run-of-the-river turbines instead of a large dam and reservoir system. In that case, electricity is produced during the summer melt when the river is high, which coincides with peak demand for Hydro-Québec's American customers. The cost of this approach has not been explored. Without a formal requirement for studying such alternatives, any advantages they hold will likely go undiscovered.

At the federal level, Canada's environmental review process for industrial projects is also weak, although it is steadily being strengthened. The Canadian Environmental Assessment and Review Process was adopted by the Cabinet in 1973, amended in 1977 and codified as an Order-in-Council in 1984. Until 1984, this review process was a policy rather than a declaration of law—it avoided litigation and did not provide the legal recourse available to American environmentalists through NEPA. As a result, the courts in the past have been virtually closed to citizens as a means to redress inadequate consideration of the environmental consequences of projects. Environmental plaintiffs did not have the legal authority to seek court review. Consequently, project developers wrote their own environmental impact statements without court oversight. In spite of the codification of the environmental review process, this has not changed.

The weakness of the environmental review process has serious implications for James Bay. Until recently, there was no federal legal requirement that an environmental impact statement be prepared for a hydroproject. This meant that federal law could not serve as the basis for compelling the preparation of a cumulative impact statement. A recent court decision in Saskatchewan required federal review of a dam project, setting an important precedent for James Bay that is still being tested. There is no doubt, however, that such a document might still be prepared for the federal government, or a provincial government in special cases. If a federal agency is financially sponsoring a hydroproject in part or in whole, or if the development is on federal land, then the Federal Environmental Assessment Review Office is supposed to do an environmental review. Quebec's proposed dams do not entail federal funding and are not on federal land, and thus are exempted from federal Canadian environmental review.

Nevertheless, the National Energy Board (NEB) has jurisdiction over the electrical exports a utility makes; sales require a license from the NEB. The NEB does not have veto authority over dams constructed for export, but if a project will export a component of generation, and if it will increase flooding or require removal of indigenous tribes, then the utility has to explain to the NEB the incremental environmental impacts that will accrue. Whether these requirements will be interpreted to apply to development on James Bay is not clear. If so, hearings would be held before the NEB, and the utility would provide evidence on that part of the project related to the export. Historically, these hearings have focused on the environmental impacts associated with the construction of generating plants and transmission lines to

facilitate exports. Thus, while the board may consider the incremental social, economic and physical impacts resulting from the advancement of construction of both generating plants and international power lines, it would not consider the cumulative impact of related energy projects.

In early 1990, then federal Environment Minister Lucien Bouchard declared his intention of studying the James Bay projects. It was not clear, though, whether Quebec was subject to any determinations made in such a review. Several months later Mr. Bouchard resigned amid the Meech Lake Accord controversies. His successor, Robert de Cotret, has indicated that he will not attempt to prevent the construction of access roads and airports in Great Whale, setting the stage for dam construction.

Electricity was a free trade area before the U.S.–Canada Free Trade Agreement was passed — no duties or tariffs were imposed on exports. Nevertheless, the passage of the agreement in early 1988 has eased restrictions on exporting Canadian power to the U.S. The agreement curtails the Canadian government's ability to impede development if it is for energy export. The changes are primarily related to price structure: in the past, a Canadian utility could not sell electricity at lower rates than the least-cost alternative in the U.S. That limitation has been removed. Canada is now permitted to set its rates regardless of the U.S. competition's prices.

Protecting James Bay

The first step in protecting James Bay is to assess, by preparation of a cumulative impact statement, the likely damage to the bay that will occur from proposed development schemes. Until such a review process is carried out, it will be impossible to rationally decide how best to balance the potential conflicts between environmental protection and economic growth. Upon completion of the review process, decision makers will have the basis for deciding on the appropriate response to concerns about the bay. Should the projected impacts be deemed insignificant, then no protective measures would be needed. Should significant impacts be found, then either mitigation measures would be called for or, if the projected impacts were serious enough, cancellation of some of the individual proposals would be necessary.

With a weak environmental review process currently in place, Canadian citizens concerned about James Bay must look elsewhere to learn about the cumulative impact of future development. James Bay was the stimulus for passage of past environmental laws; perhaps its proposed development can serve to strengthen the existing laws to guarantee review of cumulative impacts. In any case, the request for a cumulative impact statement is so reasonable that public pressure may be sufficient to induce the Quebec government to prepare one, even without a change in law.

Recently, public pressure in Quebec has been mounting to reevaluate energy policy and the James Bay plans. A number of environmental organizations have put pressure on the Quebec government; in response, a Parliamentary commission was formed to examine the issues. In the face of Canada's ongoing constitutional crisis, any rulings by the commission have been delayed.

U.S. citizens also have a responsibility for what happens to James Bay. After all, it will be U.S. imports of electricity that will cause hydro-development to expand or accelerate. James Bay is very much a trans-border issue. Migrating birds do not recognize international boundaries. U.S. citizens can ask state administrators and/or state regulatory agencies to require that a cumulative impact study be carried out before contracts are signed for additional electricity imports. They can also ask their legislators to pass laws, such as a bill recently introduced in the New York State Legislature requiring the New York State Power Authority to conduct its own review of the impacts of development if it purchases power. If New York State and some of the New England states would take such a position, Hydro-Québec would have a strong incentive to comply. In addition, U.S. communities could prepare and organize their own energy plans, taking full advantage of conservation and energy efficiency and using local energy resources wherever possible. This could in turn reduce the pressure to depend on, or exploit, foreign resources.

At the national level, U.S. citizens can urge the Department of Energy to exercise its authority to help assure that the nation's needs for electric power are truly met at the lowest economic, social and environmental costs.

The U.S. federal government's legal role in wildlife protection is well established. Migratory shorebirds in particular have been the subject of a long-standing international treaty between the U.S. and Canada recognizing their international status for preservation. The Migratory Bird Treaty Act was passed by Congress in 1918 to implement the 1916 Migratory Bird Treaty between the U.S. and Canada. Nevertheless, the act's applicability to James Bay is not clear.

If the U.S. government were interested in putting pressure on Quebec to prepare a cumulative impact statement, it might be able to use the leverage it has in approving and/or regulating certain aspects of electricity imports. The Federal Energy Regulatory Commission (FERC) regulates import rates and the Economic Regulatory Agency (ERA) approves reliability aspects of imports. More important, the Department of Energy (DOE) requires permits to be obtained by utilities before constructing electrical facilities at international borders. DOE has on five occasions required preparation of EISs by utilities for the permitting process. DOE has the freedom to consider impacts other than those associated with transmission, such as damage to migratory birds that might result from granting the permit.

It is unclear whether the Bush administration would use any influence it might have to favor the environmental side of a trans-border dispute. In 1987 the Department of Energy specifically rejected any responsibility for dealing with the the concerns expressed in this paper when

it responded to comments filed by the National Audubon Society in connection with a request by New England Power Pool to increase its Canadian imports. Nevertheless, the fact that the U.S. government has a role to play at all in approving electricity imports may be sufficient, under U.S. environmental law, to force the preparation of a cumulative impact study on James Bay by the U.S. government. Due to the enormous scale of the James Bay projects, a "Programmatic Impact Statement" may be necessary, rather than a more narrowly focused EIS.

> In some circumstances a Programmatic Environmental Impact Statement may be more appropriate than an EIS (e.g. where a large geographical area is involved; or when the action contemplated will take place over an extended period of time, and involve a series of phases). A Programmatic Environmental Impact Statement (PEIS) must contain the same kind of analysis as an EIS; the difference between an EIS and a PEIS is that the PEIS is broader in scope [Donaghy, 1985:500,501].

Two preconditions would be needed to trigger the National Environmental Policy Act (NEPA), as well as some state environmental policy acts. There would need to be a significant impact on the environment and there would need to be action by a state or the federal government. Since destruction of bird populations that fly between the United States and Canada would constitute a significant impact on the environment, one that would be felt on both sides of the border, the first condition is satisfied. As for the second condition, because increased development in the North hinges on U.S. commitments to import power, supportive activity by federal or state agencies (such as permit or contract approval) would represent government action in the United States. A programmatic environmental impact statement by U.S. or state agencies, which would provide a sufficient basis for informed decision making by government agencies in the U.S., would therefore seem to be required, unless the Quebec government prepares an adequate one. Although the Department of Energy maintains it does not need to prepare such a statement under NEPA, the basis for court action appears to exist. How the courts would rule on this trans-border NEPA case is difficult to predict.

Other options exist at the state level. For instance, the Audubon Society and the Quebec Cree intervened before Vermont Public Service Board proceedings regarding a proposed power purchase. The Sierra Club and others have filed suit challenging a New York Power Authority purchase from Hydro-Québec under the State Environmental Quality Review Act.

Canada is not a litigious society. Negotiation seems more likely to succeed there than in the United States, where citizens look to the courts to resolve difficult questions.

For environmentalists, the major goal of negotiations at this stage is to ensure that cumulative impact studies are done for James Bay. Without the scientific information that these studies will generate, it is difficult to judge how much additional development, if any, the bay can stand. No doubt, there will be disagreement over the interpretation of cumulative impact assessments, but the range of differences among the parties will be narrowed and the debate will be channelled into the scientific arena. Also, any possibilities to mitigate the stresses on the bay from increased power extraction will likely be identified as a by-product of such a cumulative impact assessment.

Hydro-Québec has established an internal task force to consider cumulative impacts in Quebec but cautions that cumulative impact studies are difficult to do and that there is little guidance in the literature as to how to proceed. Nevertheless, it is important that a good-faith effort be made to estimate how James Bay will look biologically in, say, 50 years if full-scale development goes forward as now planned. The goal of the studies should be to alert policy makers and the public to the level of hydro-development at which major biological effects might begin to appear. Unfortunately, Hydro-Québec's initial interpretation of a cumulative impact assessment is too limited and narrow to provide the needed information.

References and Further Readings

BERKES, F. 1988. The Intrinsic Difficulty of Predicting Impacts: Lessons from the James Bay Hydro Project. Environmental Impact Assessment Review 8:201-220.

BEYEA, J., *et al.* 1984. Audubon Energy Plan. New York: National Audubon Society.

DONAGHY, D.P. 1985. NEPA's Worst Case Analysis Requirement: Cornerstone or Stumbling Block? Natural Resources Journal, April:500-501.

JAMES BAY AND NORTHERN QUEBEC AGREEMENT. 1976. Section 22, Schedule 3: Contents of an Environmental and Social Impact Statement.

MARTINI, P., MORRISON, R.I.G., GLOOSCHENKO, W.A., and PROTZ, R. 1980. Coastal Studies in James Bay, Ontario. Geoscience Canada 7(1).

MESSIER, D., LE PAGE, S., and DEMARGERIE, S. 1989. Influence du couvert de glace sur l'étendue du panache de la Grande Rivière (baie James). Arctic 42(3):278-284.

MORRISON, R.I.G., and HARRINGTON, B. 1979. Critical Shorebird Resources in James Bay and Eastern North America. In: Transactions of the 44th North American Wildlife and Natural Resources Conference. Washington, D.C.: Wildlife Management Institute. 498-507.

MYERS, J.P. 1986. Sex and Gluttony on Delaware Bay. Natural History, May.

POWLEDGE, F. 1984. Saving an Eden Called Canada Is a Task as Big as the Land. New York: Audubon.

SOUCY, A. 1983. Environmental Planning for a Hydroelectric Project: The La Grande Complex in the James Bay Territory. Presentation to the International Workshop on Environmental Planning for Large Scale Development Projects, Whistler, B.C., October 1983.

Conferences

World Renewable Energy Conference
23-28 September 1990, Reading, United Kingdom
Contact: Professor A.A.M. Sayigh, Congress Chairman, Department of Engineering, University of Reading, Whiteknights, PO Box 225, Reading, Berkshire RG6 2AY, United Kingdom.

1990 Arctic Science Conference
8-10 October 1990, Anchorage, Alaska
Contact: Dr. Thomas Newbury, Conference Chair, c/o Minerals Management Service, 949 E. 36th Ave. (Room 110), Anchorage, Alaska 99508-4302, U.S.A.; phone (907) 261-4604.

Canadian Indian/Native Studies Association 1990 Annual Conference — "Coming Full Circle: Responsibility and Reciprocity in Native Studies"
12-14 October 1990, Ottawa, Ontario
Contact: Organizing Committee, Institute of Canadian Studies, Carleton University, Ottawa, Ontario K1S 5B6; phone (613) 788-2366.

Winter Cities Forum '91 — Planning for a Common Future, a Conference on Sustainable Development for Winter Cities and Communities
21-25 January 1991, Sault Ste. Marie, Ontario, Canada
Contact: Winter Cities, P.O. 787, Sault Ste. Marie, Ontario, Canada P6A 5N3; phone: (705) 945-9986; fax: (705) 945-7607.

6th International Symposium on Okhotsk Sea and Sea Ice
3-5 February 1991, Mombetsu, Hokkaido, Japan
Contact: Dr. Masaaki Aota or Dr. Kunio Shirasawa, Sea Ice Research Laboratory, Hokkaido University, Minamigaoka 6-4-10, Mombetsu, Hokkaido 094, Japan; phone: (01582) 3-3722; fax: (01582) 3-5319; telex: 932261 ILTSHU J:.

7th International Hypoxia Symposium
26 February - 2 March 1991, Chateau Lake Louise, Alberta, Canada
Contact: Conference Coordinator 1M10, McMaster University, 1200 Main Street West, Hamilton, Ontario, Canada L8N 3Z5; phone: (416) 525-9140, ext. 2182.

International Arctic Technology Symposium
29-31 May 1991, Anchorage, Alaska, U.S.A.
Contact: Society of Petroleum Engineers.

International Symposium on Cold Region Development: "Growing, Building, Moving — Scientific and Engineering Advances in Cold Climates"
16-21 June 1991, Edmonton, Alberta, Canada
Contact: ISCORD 91, P.O. Box 8330, Postal Station "F", Edmonton, Alberta, Canada T6H 5X2; phone: (403) 450-5218; fax: (403) 450-5198; telex: 0372147.

Mountain Glaciology — Relation to Human Activities
26-30 August 1991, Lanzhou, China
Contact: Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, United Kingdom; phone: +233 355974; fax: +233 336543.

6th International Symposium on Ground Freezing
September 1991, Beijing, China
Contact: Hans Jessberger, Ruhr-University Bochum, P.O. Box 102148, D4630 Bochum 1, Federal Republic of Germany; phone: 02 341700-6135; telex: 0 825 860 UNIBO D.

International Symposium on the Physics and Chemistry of Ice
1-6 September 1991, Sapporo, Japan
Contact: Norikazu Maeno, Institute of Low Temperature Science, Hokkaido University, Sapporo 060, Japan

3rd International Muskox Symposium
3-8 September 1991, Nuuk/Godthaab, Greenland
Contact: Danish Polar Center, 3 Hausergade, DK-1128 Copenhagen K, Denmark; phone: +45-33-158666; fax: +45-33-134976.

POAC '91, 11th Conference on Port and Ocean Engineering under Arctic Condtions
23-27 September 1991, St. John's, Newfoundland, Canada
Contact: Memorial University, St. John's, Newfoundland, Canada.

Antarctic and Global Systems — A Conference on Antarctic Science
23-28 September 1991, Bremen, Federal Republic of Germany
Contact: Prof. Dr. G. Hempel, SCAR Antarctic Science Conference, Alfred-Wegener-Institute for Polar and Marine Research, Columbusstrasse, Postfach 12 01 61, D-2850 Bremerhaven, Federal Republic of Germany.

27th Congress of the International Geographical Union and Assembly
9-14 August 1992, Washington, D.C., U.S.A.
Contact: IGU Congress Secretariat, 17th and M Streets, NW, Washington, D.C. 20036, U.S.A.; phone: (202) 828-6688.