PROTECTED AREAS, LAND USE AND WATERSHED PLANNING, AND DECISION MAKING: AN ECOLOGICAL AND CIVICS PERSPECTIVE

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Abstract

In recent decades, water planning and decision-making have been largely distinct from biodiversity planning and decision-making. This artificial separation is inappropriate. Although there are currently some examples where protected areas specifically involve stewardship of plants, animals, and water, these are atypical. Historically many protected areas were established to conserve water quantity and flow. Today the emphasis is on an ecosystems approach that excludes or minimizes the importance of, water. Biodiversity and biological processes have been emphasized in recent years at the expense of hydrological processes. Experience from British Columbia is used to evaluate this statement and to support changes in contemporary systems of water planning and decision-making where these involve protected areas. Some protected area systems are discussed to exemplify the foregoing ideas and to suggest alternative institutional arrangements for integrating planning for water and biodiversity in protected areas in future. The 2003 World Parks Congress recommended that a much broader approach be adopted that would recognize the importance of water as one of the major ecosystem services provided by parks and protected areas.

Purpose and Context

The purpose of this paper is to highlight an opportunity and a need to address planning for water quantity and quality and biodiversity in a broad, comprehensive, and more effective manner. The essence of the paper is that scientists, professionals, and citizens concerned with water planning can work toward such an approach with those concerned with biodiversity conservation in the context of sustainable development. Historically, these two schools of thought were more closely linked but they have moved apart in recent decades. Water planning and decision-making have been seen as largely distinct from biodiversity planning and decision-making. This separation, in our view, is inappropriate in Canada, North America, and indeed, throughout the world.

Linking Water and Biodiversity Planning and Decision Making

Water. The idea of protecting source areas for water supply was adopted in North America in the 19th century. For example, decision-makers in older cities on the northeast and west coasts of United States believed that water could not be treated to make it potable. Therefore, they either closed their supply watersheds to human trespass, or prohibited swimming in the drinking water supply reservoirs, or both, beginning in the middle nineteenth century (Baumann, 1969). A leading example historically is New York City, which has continued to link protected areas, land-use planning, and planning for water quality and quantity to the present time. Of considerable interest in the New York case is the recent need to decide whether the water supply would be treated for the first time, or whether the historical protected area approach to clean water would be maintained and strengthened in future. Two central issues in this matter are the growth of agriculture in the source areas and the high cost of introducing water treatment processes and infrastructure for the more than 10 million inhabitants of New York.

Currently, as volumes by De Villiers (1999) and Cech (2003) show, the general orientation is toward technical treatment to sustain and improve water quantity and quality for human use to the neglect of land-use planning, protected areas, and the associated potential for biodiversity stewardship. This orientation is apparent in the proceedings of two watershed management conferences in Tucson, Arizona and Albuquerque, New Mexico (Folliott *et al.*, 2000; Tellman *et al.*, 1993).

However, some significant references do point to the need to consider nature and wildlife habitat along with human needs for water. A recent paper in the *World Watch Magazine* (Hinrichsen, 2003) warns of the over-emphasis on a technical or engineering approach to water with its associated emphasis on protecting water for human use. The paper claims that insufficient attention is being paid to the needs of plant and animal life in the thrust to meet growing human demand for water. Recently, the United Nations Food and Agriculture Organization (FAO) observed that the loss of forest cover and conversion of forested land to other uses can degrade supplies of fresh water, threatening the survival of millions of people and damaging the forest environment. The FAO paper stressed the need to *"improve national awareness and [the] policy environment in support of the sustainable management of mountain forests and upland areas."* Indeed, several countries are placing priority on reversing watershed degradation (FAO, 2003). In Canada, a report published by the Ontario Grand River Conservation Authority noted that *" . . . the natural environment, highly dependent on water conditions, is rarely taken into consideration in water management and use decisions"* (GRCA, 1997). Also, in the context of water flow, a shift has begun in recent years away from a focus on engineering technical approaches to water planning toward linking floodplain and hazard planning to protected areas, nature conservation, and ecosystem-based decision-making (Hunt, 1999).

Protected Areas

Historically, however, the role of parks and protected areas has focused primarily on nature conservation and recreation. Two recent reviews of protected areas research illustrate the continuance of this focus to the virtual exclusion of research on water. The first review involves *A Century of Research in Banff and Surrounding National Parks* (Gardner and Campbell, 2002). The second is entitled *Towards a Research Strategy for Ontario Provincial Parks* (Van Osch *et al.*, 2002). Each of these reviews includes a graphical record of the research, which indicates the general paucity of research on water. In fact, in neither case is water, or the associated field of hydrology, included in the review results.

The current tendency to separate water planning and management and protected area planning and management seems to have begun in the years following WW II. At that time, a general orientation to engineering or technical approaches gained strength in a number of disciplines, sectors, and fields of public policy. One example is flood and hazard management where studies have shown an emphasis on the engineering approach while also revealing that this approach has not been effective in reducing flood losses and has numerous deleterious effects on environment. An outstanding example of such studies is found in research in the United States, and specifically the Mississippi basin (Hunt, 1999). It has become widely recognized since the 1942 publication of a seminal work by Gilbert F. White, that single-purpose structures such as dams and dikes seldom solve flooding crises (White, 1945). Indeed, they usually exacerbate the problem. Today, an ecosystem approach is recommended which links water, plants, and wildlife, and also provides for associated protected areas and land-use planning.

Lyle (2001) observed that a broad natural, as opposed to an engineering approach, to flood damage reduction has the potential to create a number of benefits. An alternative strategy to reduce flood losses exists based on restoring hydrologic functions in a river system and reducing the number of people vulnerable to floods. Reinstatement of biological and hydrologic processes reduces the severity of flooding and decreases the number of vulnerable properties, thus reducing the cost of future flood events. The positive externalities of this approach are numerous: overall environmental quality is improved; agricultural irrigation can be augmented; commercial and sport fisheries are enhanced; recreation and environmental education possibilities are increased; and local economies may be strengthened through community revitalisation (Lyle, 2001).

A recent book, *Protected Areas and the Regional Planning Imperative in North America* (Nelson *et al.,* 2003), illustrates the emergence of such a wider approach in the protected areas field. It promotes envisioning protected areas in terms of a comprehensive land use and regional planning approach, which would include not only biodiversity but also water and air quality. In this context, ecosystem theory and planning are seen as moving beyond their focus on biology to include hydrology, weather, climate, and other aspects of a comprehensive view of ecosystems (Nelson *et al.,* 2003).

Case Studies in British Columbia

Some recent large-and small-scale case studies in planning and managing protected areas in British Columbia will now be considered in terms of our interest in a broader approach to protected areas in water, wildlife, land-use, and environmental planning and decision-making.

Case 1: Land and Resource Management Planning in the 1990s

The provincial approach to sustainable development in the 1990s grew out of the prevailing scientific thinking and institutional analysis of the time. The Canadian Environmental Advisory Council established an agenda for the country in 1988:

> *"The Brundtland Commission challenged all nations to protect their diversity of species and ecosystems, calling this a pre-requisite to sustainable development. Thus, to truly achieve sustainable development, Canada must identify and protect a complete range of representative and unique natural areas, wilderness landscapes and wildlife habitats. Defining, establishing and managing a comprehensive network of protected areas will require the active participation of many groups and individuals, in addition to the work of all of Canada's federal, provincial and territorial governments."* (CEAC, 1988)

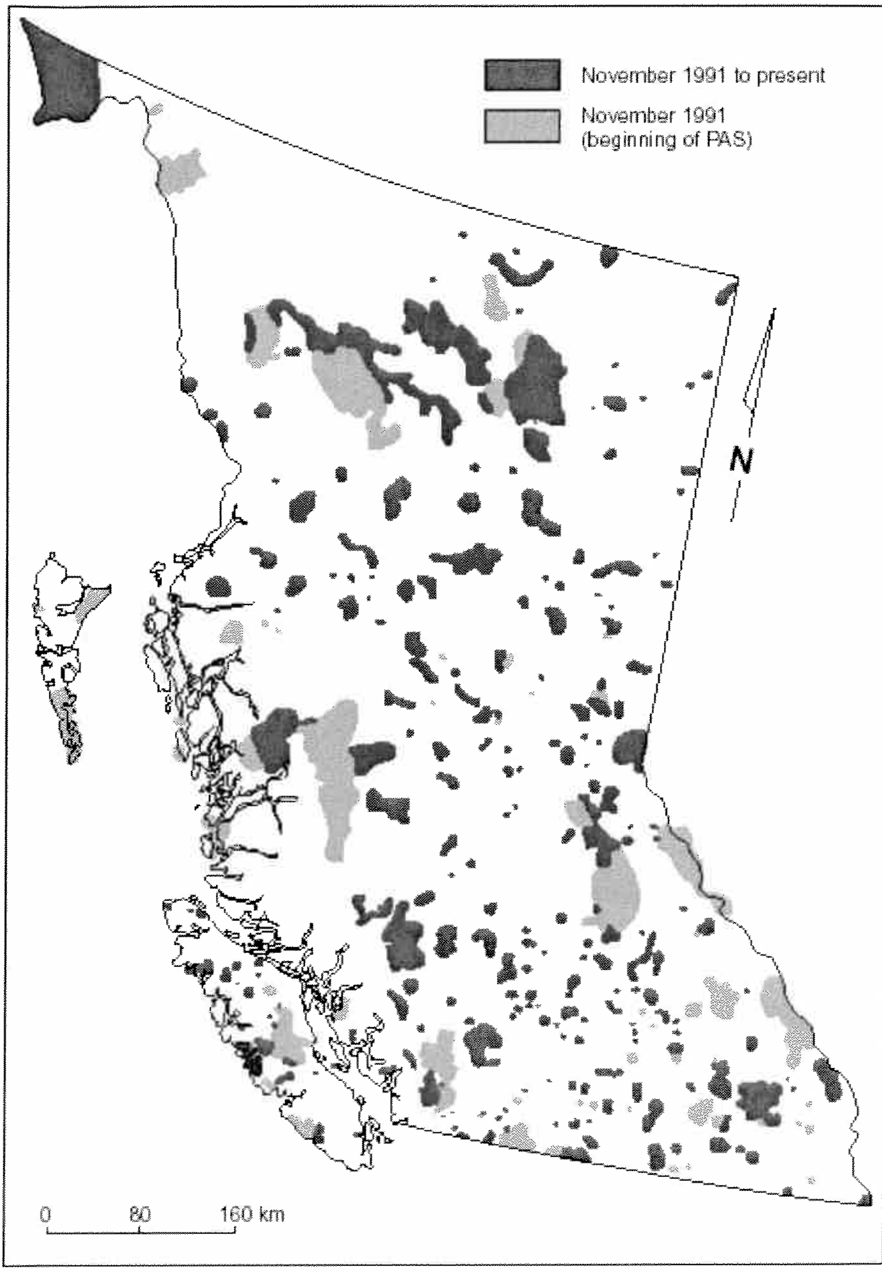
At the time of this observation, approximately 6% of the B.C. land base was protected by various jurisdictions. As one of the world's most ecologically rich and diverse jurisdictions, the province was able to respond positively by creating its *Protected Area Strategy* (PAS)(B.C., 1993). This charted a vision for moving toward Brundtland's target of protection for 12% of the land base. The aim in B.C. was to do so by the turn of the millennium. Ultimately, this goal was exceeded by reaching 13% (12-million hectares) (B.C., 1993)(Figure 1). This figure included land, fresh water, and marine areas that are set aside to protect natural and cultural heritage, and recreational values. These protected areas generally prohibit industrial extraction or development including logging, mining, hydroelectric dams, as well as oil and gas development.

The 13% target was achieved largely through the creation of new institutions that reached land-use decisions based on shared decision-making (SDM). Of these new institutional arrangements, resource management planning tables (LRMPs) were the most influential and innovative. These negotiation tables varied from 12 to over 70 members, typically representing interested stakeholders and relevant government agencies. The Cabinet approved the consensus or near consensus recommendations of the first 15 tables (72% of the province). Six more are in progress (cumulatively 85% of the province). Approximately 13% of the province was protected from development through this process.

A number of criteria were used to identify and evaluate areas for possible protection within each local area, or ecosection, of the province. To achieve the goal of protecting representative examples of natural diversity, the criteria included representativeness, degree of naturalness, viability, diversity, vulnerability, opportunity for public use and appreciation, and opportunity for scientific research. Criteria for the second goal of protecting the special natural, cultural, and recreational features of the province included protecting special features, rarity, scarcity, and uniqueness; diversity; vulnerability; opportunity for public use, appreciation, and scientific research; and cultural heritage significance. Even though impressive gains were made in the system of protected areas in the province during the first decade of the Land and Resource Management Plans (LRMPs), it appears that hydrologic features played a minor or insignificant role in the selection of the new protected areas that were created throughout the province under the *Protected Area Strategy* from

1992 to 2003.

Figure 1. *Protected areas in British Columbia: 1991 and 2001.*



Case 2. Urban Water Planning

Protection of the drinking watersheds for the current Greater Vancouver Regional District (GVRD) developed in a series of complex institutional moves over the past century. Initially, metropolitan Vancouver was provided legislative protection on the remainder of unalienated lands in its two water supply watersheds, the Capilano and Seymour, in 1905 and 1906, respectively, through provincial orders-in-council land act reserves. In March 1910 (Canada), a federal order-in-council reserve fully protected New Westminster city's water supply, the Coquitlam River watershed, from logging and human encroachment; in 1931 it was incorporated into Greater Vancouver's water supply. The provincial government enabled legislation for the creation of the Greater Vancouver Water District, in December 1924 — *An Act to Incorporate the Greater Vancouver Water District* — which came into effect in February 1926. In August 1927, the water district negotiated a 999 year lease of public lands with the provincial government to protect the forestlands from commercial logging under the land act legislation. The water district also purchased all alienated lands in the two watersheds to gain complete control of forestlands. In addition, the water district was provided with legislation in 1930 to prevent mineral exploration and development. In 1942, the water district amalgamated the Coquitlam watershed into the lease agreement.

The earliest arrangements reserved watersheds for drinking water purposes and occasionally for hydroelectricity. All settlement and occupation was prohibited and the timber was protected for water supply purposes. Unauthorized visitors were excluded, a practice that continues to the present time. Logging which began in Greater Vancouver Regional District watersheds as early as 1964, contributed to high turbidity reaching consumers taps. This eventually led to widespread public protests to ban logging in the affected watersheds in the late 1980s. In response, the Greater Vancouver Water District Board initiated a process to prepare a new management plan. The protection and enhancement of a quality water supply was confirmed to be the guiding principle for a new watershed plan. To inform this process, a $6.3 million ecological inventory was undertaken to guide the decision-making process. A Regional Water Advisory Committee was also established as a sounding board to comment on regional water supply policy options and provide directions for the new GRVD Watershed Management Plan. This committee consisted of 15 citizens chosen from a variety of occupations and interests and was chaired by the senior author.

While the purpose of these studies was to provide safe, cost-effective, high-quality drinking water, the outcome fell short of the target for a variety of reasons. The terms of reference given to the planning consultants in the early 1990s focused almost exclusively on management of trees within the watersheds, and their terms of reference changed repeatedly. This resulted in water quality being relegated to the end of the modeling process. Data were not provided on the hydrological cycle generally, including temperature, precipitation, ground water, water chemistry, stream flow, and water-borne pathogens. Wildlife received comparatively little attention. The reports did not sample the range of scientific information available on much of the subject matter, compromising the predicted outcomes in three study scenarios as well as the associated costs and benefits (Day, 1999). In short, little time and attention were devoted to water and the hydrological cycle in planning for the ecosystem. Instead the report emphasized forest type, age, and ecology, forest fire, and a road network analysis. These deficiencies were identified by RWAC, which believed that the primary purpose of these basins should be to supply water for two million residents of the Vancouver area. For these reasons, the public generally rejected the ecological inventory that had so little emphasis on a sustainable supply of drinking water.

In response, the GVRD Board adopted the following five principles to guide preparation of a new watershed planning process: 1) the purpose of the watersheds is to provide clean, safe water; 2) the watersheds are to be managed to reflect the region's commitment to environmental stewardship and protection of the watersheds and their biological diversity; 3) the minimum necessary intervention should be used to meet the objectives; 4) areas disturbed by human activities should be returned to their predisturbance state; and 5) all decisions made under the plan should be transparent and open to the public for review and input (Carline, 2000).

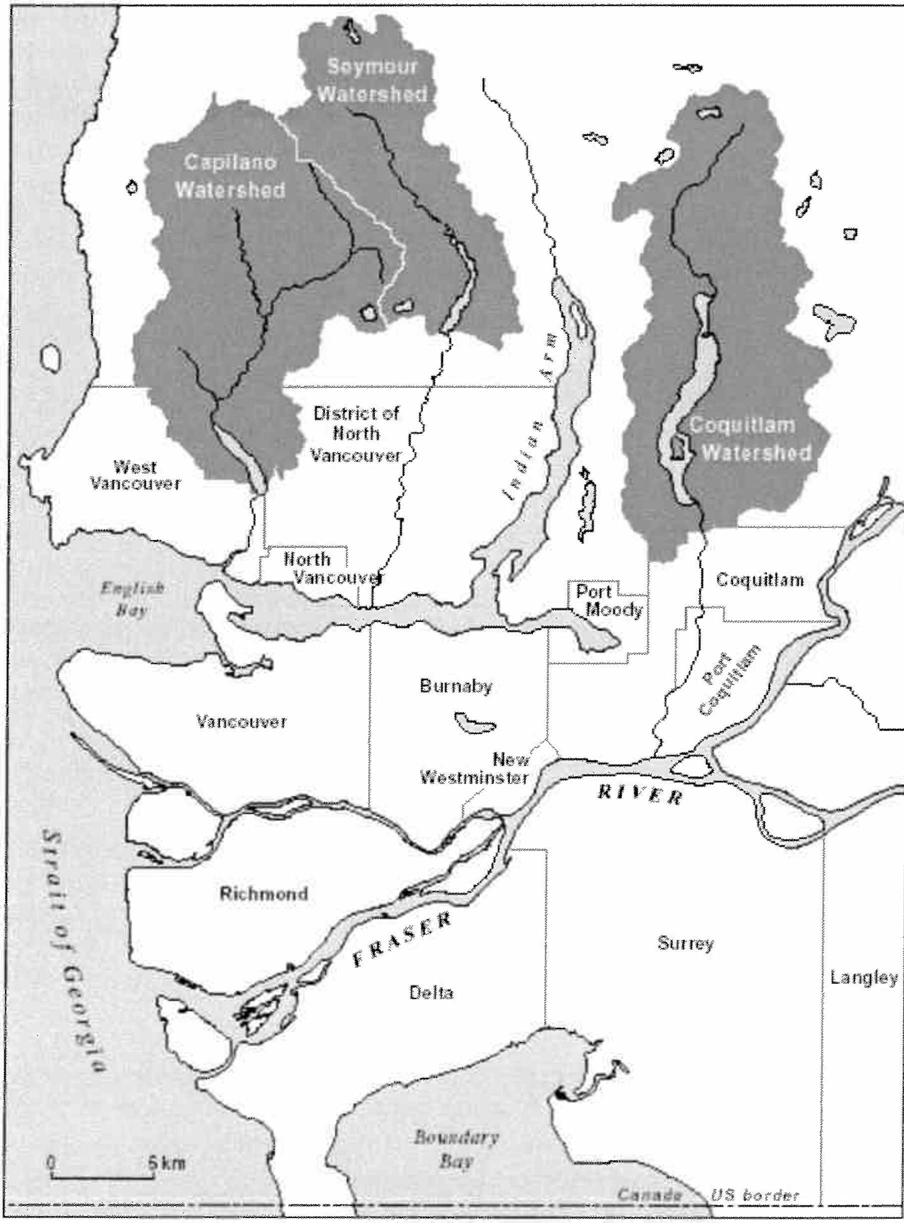
The outcome of this civics-based process has been a new watershed management plan that concentrates on providing clean, potable water from three protected areas (Figure 2). All commercial logging is prohibited. The road network of 300 km is being reduced by 60% over the next decade. Mainly high-elevation roads are being removed and restored to their original condition. Fire fighting will mainly be conducted from aircraft in future. Visitors are excluded from the watersheds except on guided watershed trips during the summer months. In effect, clean water and ecosystem diversity have become the predominant values in these fully protected urban watersheds. There are important lessons in the Vancouver experience for other urban areas which are experiencing harmful consequences from multiple uses of watersheds for agriculture, forestry, urbanization, and other uses. The Vancouver plan exemplifies the importance of undisturbed, natural ecosystems-particularly forests-which are protected from outside influences and dedicated to the provision of high-quality drinking water.

Case 3: The Nechako-Kemano Diversion

For many years, B.C. engineering projects were developed to redistribute river flows to regions experiencing greater demand for water and electricity. Generally, these projects involved diversions of river flow. The benefits of such projects are real and substantial. Just as real, if not as easily quantified, are the wide-ranging and long-term biophysical and socioeconomic costs. Parks and protected areas can be detrimentally affected by such projects.

The Nechako-Kemano Diversion is an example (Figure 3). The Aluminum Company of Canada (Alcan) entered into an agreement with the British Columbia government in 1950 to develop a hydroelectric project, which would support an aluminum smelting industry and a new population center in the west-central portion of the province. Kemano Phase I began operation in 1954 (NEEF, 1999: 2). It redirects flows of 115 cubic meters per second on average from the Nechako River (Fraser basin) to spill westward by tunnel through the Coast Mountains — a vertical drop 16 ntimes higher than Niagara — into the Kemano basin of the Pacific drainage. In return for the company's investment, the province provided-in perpetuity and at a nominal charge-a huge area and much of its resource wealth in the form of agricultural and park lands, water, forests and fish. All waters covered by the license were to be diverted before the year 2000.

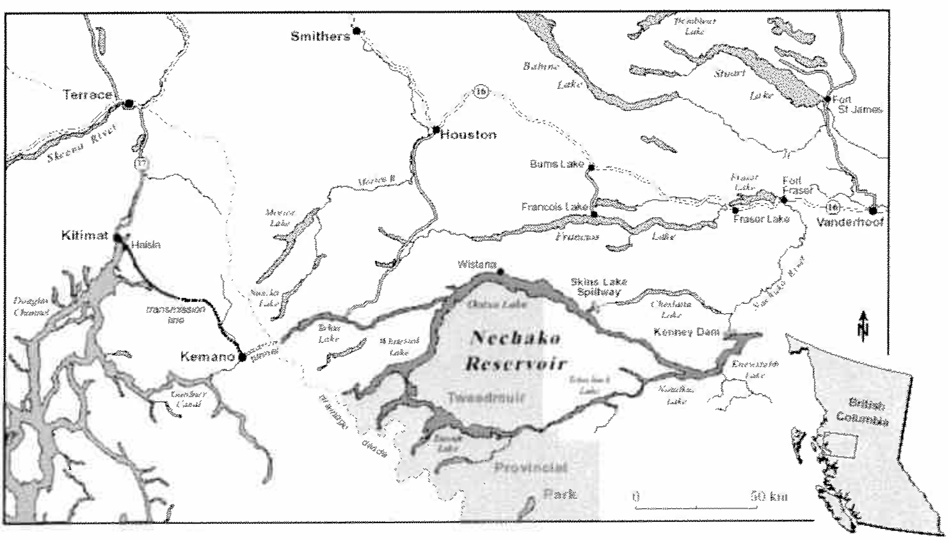
Figure 2. *The drinking watersheds of the Greater Vancouver Regional District.*



The project involved many effects and trade-offs, not all of which can be considered here. For example, in providing for major power generation for Kitimat, the diversion may have reduced the flood threat slightly in the lower Fraser basin. However, a major concern for this paper is the substantial loss to Tweedsmuir Provincial Park. Its boundary was modified to accommodate lands required for reservoir flooding. The original area of 1.4 million ha made it the "largest scenic park in North American" when it was created in 1938. A distinguishing feature was its 400 km circle of large-to-small lakes connected by short-to-medium river reaches that were popular with canoeists. In order to exclude the Nechako Reservoir from the park, its area was reduced to 1 million ha. The Parks Branch was not compensated for the loss of land, and no tree clearing was undertaken prior to flooding. Park officials believe that the loss of wilderness boating was the major impact as the circle of lakes was replaced by a large, dangerous reservoir choked with logs and floating debris (Gomez Amaral, 1986: 31-33).

The upper Nechako River suffered 100% loss of flow during the construction of Kenney Dam and filling of its reservoir. After 3 years, 60 to 70% of flow was restored via a spillway that discharged, not from Kenney Dam but down the Cheslatta, a Nechako tributary. The comparatively large discharge down this small stream scoured a deep channel in the unconsolidated deposits and deposited huge volumes of sediment in the upper Nechako (Kellerhals *et al.,* 1979). Due to a dam constructed near the mouth of the Cheslatta, homes and a graveyard of the local Indian community were flooded. The community was forced to relocate on short notice to a new area and unfamiliar way of life (Gomez-Amaral and Day, 1988), which led eventually to legal action for redress of their losses as part of a land settlement process.

Figure 3. *The Nechako-Kemano interbasin diversion.*



Beginning in the mid-1970s, Nechako flows were gradually reduced as Alcan increased power generation at its Kemano plant. In 1980, the federal Minister of Fisheries took legal action to force Alcan to release more flows to protect salmon from bed dewatering, siltation, and higher temperatures, as the Nechako channel was far too wide for the remaining flow. Since then, 30% of prediversion flows have been returned to the Nechako River. Meanwhile, Alcan proposed to take full advantage of its 1950 license, which gave it rights to divert all the flow from the upper Nechako plus flows from the Nanika tributary of the Skeena River system, thereby increasing the diversion to the Kemano powerhouse from 115 to 202 m3/s (Rosenberg *et al.*, 1987). This Kemano Completion (Phase II) was rejected in 1995 after considerable controversy. Alcan, however, remains interested in cost sharing with the provincial and federal governments and local interests to add a cold-water release from the Kenney Dam that would improve flows and temperature conditions for Nechako River fish populations. At the same time, however, this project allowed for increased diversion from the Nechako Reservoir to the Kemano River.

The absence of reliable long-term data on stream flows and ecosystems in both the Fraser and Kemano River basins has made the determination of diversion impacts difficult to quantify. Beginning in the late 1980s, a number of committees composed of people from governments, Alcan and civilians studied these questions and a variety of lawsuits have been filed. As a result of the 1987 Agreement between Alcan and the federal and provincial governments, the Nechako Fish Conservation Program was established. In spite of 15 years of study, a report has not been released on the effect of the diversion of salmon populations. Similarly, there is also a group involved in the Nechako Sturgeon Recovery Program in an effort to understand the causes for the local decline in this species.

Various efforts have been made to deal with the adverse effects of this project. For example, the Nechako Watershed Council was formed as part of the Nechako Environmental Enhancement Fund (NEEF), which grew out of the 1997 B.C.-Alcan Agreement to settle legal disputes between the parties. Also, the Fraser Basin Council facilitated a searched for common ground among local stakeholder groups in the area. Although half a century has passed since the Kemano Diversion began operation, much uncertainty remains concerning the full range of its ecological and hydrological effects. Parts of Tweedsmuir Park were allocated to this project, notably valley lands and parts of the watershed important to water quantity and quality and the well-being of human and other life. The absence of benchmark data on all of the affected river systems has frustrated efforts to understand and remediate induced changes. Clearly, little was known about any aspect of the environment to be affected. This provides a powerful example of the need for careful surveys of hydrology as well as forests and other elements of ecosystems before any human disturbance is permitted. Continued monitoring is also needed when a project becomes operational. In this case, important lacustrine and riverine components of complex ecosystems in Tweedsmuir Park were significantly affected by a world-scale interbasin diversion. Many of the principles and procedures that should be applied are reviewed in Day and Quinn (1992).

Conclusions

Clearly, the simultaneous protection of fresh water and biodiversity is a neglected, complex, multidisciplinary, and multisectoral task. Our social institutions have not made the transition to integrate these complex processes into current planning and implementation systems. Protected areas experts have recognized this need since at least the early 1990s, for example, Poore (1992) and Hamilton (1996) of the International Union for the Conservation of Nature both spoke to the potential of protecting fresh water quality and quantity by creating systems of parks. The recent World Parks Congress in South Africa (IUCN WPC, 2003) also recognized this need and made the following recommendation:

> *"The integration of inland water protected areas into lake and river basin management frameworks offers the potential of a range of win-win opportunities. These protected areas can link biodiversity conservation with water and food security, poverty reduction[,] flood and flow management and human health objectives."* (IUCN WPC, 2003)

The World Park Congress stressed that protected areas play a vital role in the comprehensive conservation and management of fresh water resources, biodiversity, and ecosystems. The planning of protected areas should, therefore, be part of integrated river basin or watershed management. Protected areas have the potential to play a much larger role in sustaining fresh water and biodiversity in future than has been considered in the recent past. This potential represents a major challenge and opportunity for water, protected area, land-use, and environmental planners in future. The likelihood of achieving such a broad, integrated approach will, in our experience, be considerably increased if planning, management and decision-making are undertaken from a civics perspective and involve a diversity of hydrologic, biologic, land-use, and other experts along with nongovernmental organizations and concerned and affected citizens.

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