

Fraser Basin Ecosystem Study Final Report - Prospect for Sustainability

Integrative Approaches to Sustaining the Ecosystem Function of the Lower Fraser Basin

This report is derived from material collected by many faculty and students at UBC over a 4 year period of research on the ecosystem of the lower Fraser River basin and from discussions with these same individuals at meetings and workshops. Although I compiled and synthesized the material, I cannot claim ownership of either the information or the ideas. This was a collaborative project and anyone interested in the full authorship of this report should refer to the list of participants in the final section.

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M. Healey, UBC, June 1997.

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EXECUTIVE SUMMARY

The Problem of Sustainability in the Lower Fraser Ecosystem

This research project explored the prospects for sustainability in the settled portions of the lower Fraser River basin, an area of roughly 3090 km², extending from the town of Hope in the east to Vancouver in the west. This is a rapidly changing ecosystem. Population growth is nearly 2% per year. Ethnic character is in transition from predominantly European to predominantly Asian. Lifestyles are changing from rural to urban and the economy from resource based to service based. The region is rich in resources. The Fraser Valley contains productive farm lands while the River and its tributaries are important spawning and nursery grounds for salmon. Yet, the expanding metropolitan area threatens to overwhelm the natural resource base. The growing dominance of the urban environment means that the balance between local self-sufficiency and global inter-dependence is shifting rapidly towards greater dependence. At the same time, aboriginal peoples of the basin are demanding protection for their traditional ways. The lower Fraser basin, thus, exemplifies all the social, environmental and economic problems of modern industrial nations. Defining sustainable options for such a dynamic and complex ecosystem presents formidable challenges but such ecosystems are also at the core of the problem of sustainability.

The Eco-Research Project

Twenty-three faculty from 20 different departments, schools, institutions and centres at UBC and more than 40 graduate students participated in our 4 year study of prospects for sustainability in the lower Fraser. The research also involved collaboration with the federal, provincial, regional and municipal government agencies. The project was designed to build our institutional capacity to address complex, interdisciplinary problems relating to sustainable development, to resolve a range of technical problems of sustainable development in a rapidly changing ecosystem and to design policy options for sustainable development. We put together

a multi-disciplinary research team and encouraged graduate students to undertake research that cut across traditional disciplines.

Our research was structured to address four fundamental questions related to sustainability: 1) What kind of an ecosystem do we have and how did it come to its present state; 2) What kind of an ecosystem do we want to have a generation from now; 3) What is feasible for us to accomplish; and 4) How (in terms of new policies and instruments) can we accomplish what we want? The results of our research highlighted the extent to which the lower Fraser basin has already been transformed by human activities and showed that present trends in population, economic development and land use are carrying us ever further from sustainable configurations.

Research Results

A little more than a century ago the lower Fraser basin was a forest of giant trees with extensive swamps and wetlands along the river courses. Now the valley is primarily farm and urban land and the farm land is being progressively absorbed by the growing metropolis of Greater Vancouver. These changes have resulted in considerable loss of ecological capability. The natural community was much more productive biologically than the farm and urban lands that have replaced it. The extent of the ecological transformation is illustrated by the regional plant community which, in the lowland areas of the valley, is now made up primarily of introduced species. Rapid human population growth and its changing ethnic composition are creating social tensions and straining the physical and social infrastructure of the community. As an ecosystem, the lower Fraser basin is sustained at present only through massive inputs of energy and materials. The ecological footprint of the basin is at least 25 times the land area of the valley.

The ecological transformations that we observe in the lower Fraser basin are driven primarily by market forces but are also encouraged by governments that see natural resources as a source of revenue and development as a source of power. Although the region is a desirable place for human habitation the stress of intensive human activity on the land, water and biota are becoming ever more evident. Urban streams are threatened by toxic substances in storm run-off from streets. Technology for controlling toxic storm run-off is generally not being implemented even in new construction. Intensive agriculture and improperly functioning septic systems are overloading valley soils with nutrients and other chemicals leading to contamination of aquifers and rural streams. The consequences are loss of desirable species, poor water quality and public health risks.

Analysis of community and regional plans reveals that residents of the lower Fraser are anxious to preserve rural landscapes and quality of life although there is a dichotomy between rural and urban communities in willingness to accept high rates of population growth. Polling of lower Fraser residents shows a high concern for maintaining environmental quality but also a belief that not much can be done to contain population growth and environmental change. Plans to manage growth aim at preserving an extensive and interconnected network of green spaces, creating compact and complete urban centres with a better balance between employment and population, and minimizing the need for extensive commuting. Unfortunately, powerful interests often work to undermine these plans. The choices that individuals make are important to achieving sustainable development. Paradoxically, individual choices often conflict with strongly stated beliefs and values, as in the stated concern of a majority of residents over air quality and automobile use at a time when individual automobile use is increasing dramatically.

The Need for Policy Reform

Changes in policies related to population, land and resources, consumption and waste management are needed if we are to move toward sustainability. What is feasible for us to achieve is constrained by a variety of factors such as the geography of the basin, the history of development and institutions to manage development, international trade and market forces, and the values and value systems of basin residents. An important unknown is the extent to which the emerging political power of aboriginal societies will affect patterns of development. Local decisions cannot bring our community to sustainability because much depends on decisions made elsewhere. Nevertheless, local decisions are critical to our future sustainability.

Tools for Policy Reform

To ensure that our research would be accessible to decision makers, we collaborated with government agencies in the study of a number of important local and regional problems such as non-point source pollution, urban stream rehabilitation, and the ecological impact of municipal by-laws. This allowed our results to have direct influence on decision making. The approach was particularly successful with municipal authorities for whom we were often able to provide timely information on immediate problems. We also developed and elaborated three broadly based policy analysis tools: the ecological footprint; the social caring capacity; and a computer based scenario analysis tool, QUEST. The ecological footprint is a tool for determining the land area needed to sustain the socio-economics of any defined community. Ecological footprint analysis shows clearly how dependent urbanizing

regions like the lower Fraser are on extensive and unsecured land and resources distributed around the globe. The heuristic of the ecological footprint is being widely applied in a number of international analyses of sustainable development. Social caring capacity is a tool for examining the social impact of policies that reduce material consumption. This tool is still in its formative stages but shows promise as a means to identify policy prescriptions that reduce the ecological footprint of a community while increasing the quality of life. The computer model, QUEST, is a tool for defining and exploring future scenarios for the lower Fraser basin. Designed to allow decision makers to explore the interactions among policy choices and to highlight the trade-offs inherent in any attempt to change local socio-economic conditions, QUEST has generated a lot of interest locally and internationally.

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations presented here all derive from our broadly based research on the lower Fraser basin ecosystem. We did not, however, attempt to come to consensus on all recommendations. It seems doubtful that we could have reached consensus on some recommendations given their controversial nature and the diversity of views within our team. Nor was full consensus necessarily desirable, as there are many workable configurations of sustainable development. The recommendations illustrate, therefore, the kinds of changes in policy and governance that will be needed if the lower Fraser basin, British Columbia, Canada and the world are to make progress toward sustainable development but they are not the only ways to achieve that end. Many of the more general recommendations will look familiar as similar proposals have been made in the past but not acted upon. This does not reduce their relevance. Rather, our research has emphasized the fact that the problem has not gone away and it is high time that we faced up to it. Some of the policies that we recommend already exist but have not been implemented. Again, we emphasize that sustainable development cannot be achieved with policy placebos. Real problems require real actions. Deciding to postpone action on sustainable development is the moral equivalent to deciding that we don't care about the health and prosperity of our grandchildren.

A Definition of Sustainability

We define sustainable development as development that is environmentally sustainable, economically viable and socially acceptable. By environmentally sustainable we mean that changes to the ecosystem do not degrade its biological productivity, biodiversity or regenerative capacity. By economically viable we mean that the human economy is capable of satisfying the reasonable material desires of the

vast majority of its citizens. And by socially acceptable we mean that the vast majority of the population is willing to live in accordance with the rules of governance. Our analysis of the present state of the lower Fraser basin ecosystem shows that its present structure and the way it is changing are not environmentally sustainable. The ecosystem is being transformed into a configuration completely dominated by an urban metropolis, biological productivity is being diminished, biodiversity is lost and regenerative capacity degraded. The economy is doing well in terms of providing high material standards to the majority of residents but an increasing number of citizens are marginalized in the economy. This suggests that the viability of the economy, in terms of our definition of sustainable development, may be short lived. Social acceptability of the rules of governance may also be in jeopardy. Public apathy and cynicism toward the present systems of governance is widely reported and many communities and citizens are calling for more locally based decision making and more accountability of elected representatives. Rapid population growth and changing ethnicity are straining the bounds of social tolerance and contributing to dissatisfaction with present governance. Although these problems can be addressed without reference to sustainability, the growing need for policy changes raises the possibility of incorporating solutions that are more sustainable. Since all aspects of governance impinge on sustainability, all sectors of government must take responsibility for promoting and fostering sustainable development.

Recommendation 1:

All future policy reforms by all levels of government should have as a primary objective facilitating the transition to more sustainable forms of development.

Recommendation 2:

All levels of government should adopt sustainability as a primary mandate. This mandate should apply to all departments and institutions of government. No government department should be permitted to argue the sustainability is not its responsibility.

The Lower Fraser Basin in a Global Context

The ecosystem of the lower Fraser basin is intimately interconnected with and dependent on the larger global ecosystem. The present structure and function of the lower Fraser ecosystem can be maintained only by massive inputs of energy and materials from other regions of the globe. Furthermore, the waste products generated here can only be neutralized by ecological processes outside the basin. The ecological footprint of the basin, that is the total area of land and water needed to provide the raw materials and energy required to maintain the lifestyle of basin residents and to absorb their wastes, is at least 25 times the land area of the basin. Furthermore, the size of this ecological footprint grows daily as a consequence of our growing population, our growing individual material consumption and our continuing degradation of the absorptive and regenerative capability of the local ecosystem. The security of supply of the resources and energy needed to maintain our lifestyle and the ecological services needed to absorb our wastes is by no means assured. In fact, all communities of the globe are increasing their demands for materials, energy and ecological services so that competition for these resources is rising. Yet, the extent of our dependence on the global ecosystem and the impact of our actions on ecosystems elsewhere in the world is virtually invisible to us. The limits to growth in population, material and energy consumption are uncertain but this is no reason to brush aside their profound implications for our quality and security of life. All communities have a responsibility to identify and monitor their exchanges with the global ecosystem and to seek ways to increase the security of those exchanges that are critical to sustainable development. Tools that we developed, such as the ecological footprint analysis, social caring capacity analysis and the scenario analysis model, QUEST, can provide a framework for assessing these exchanges and for communicating their importance to local residents. Such measures of environmental and social impact need to become as familiar as measures of economic impact if we are to achieve sustainable development.

Recommendation 3:

Each community should monitor and routinely publicize measures of its dependence on material, energy and ecological services in the global commons and the means proposed to ensure the security of those services for the community or to reduce dependence on unsecured resources.

Implications for National Policy

Our research was primarily directed toward understanding how a regional ecosystem functions. However, we believe that the lower Fraser basin can serve as a model for other ecosystems that are being rapidly transformed by direct human activity. Furthermore, the division of powers between federal and provincial governments is such that the national government has significant responsibility for economic and social development and environmental management within our ecosystem. Many of the actions that might be taken locally to encourage sustainable development would be more effective if they were part of a national strategy. Although sustainable development is, ultimately, a global issue, the national government is the highest level that is fully accountable to Canadians. If Canada were to adopt a national strategy for sustainable development that properly recognized the interrelationship of environment, economy and society, it would have implications both inward to provincial and local decision making and outward to international decision making. Based on our research there are several areas in which the federal government could provide important leadership.

The federal government can provide leadership in the development and standardization of accounting systems for environmental and social well being in the context of sustainable development. These are needed to balance the use of indicators like GDP as measures of economic well being. Indeed, measures like GDP also need to be modified as they presently misrepresent the costs of resource liquidation as a benefit. Furthermore, the national government is in the best position to publicize these indicies in ways that will allow citizens to make balanced decisions about trade-offs among economic, social and environmental benefits.

Recommendation 4:

The federal government should take the lead in developing and standardizing effective and meaningful indicators of environmental and social well being and in modifying economic indicators so that they do not misrepresent environmental and social costs as benefits.

The federal government can also provide leadership in the application of sustainability principles to decision making in all departments. In policy making, sustainability seems to be regarded as primarily an environmental issue whereas it is, in fact, an

issue that pervades all aspects of governance. National leadership is not essential for other levels of government to adopt sustainability principals. Indeed, British Columbia has made progress in this regard through its round table on environment and economy and the commission on resources and environment. Nevertheless, national leadership would provide a great incentive for all provinces to adopt their own policies. And, it is only at the national level that sustainability principles can be worked into foreign policy.

Recommendation 5:

The federal government should incorporate sustainability principles and the mandate to promote sustainability into the decision making process for all departments. In particular, sustainability should be made a high priority for external affairs and should become a cornerstone of Canada's foreign policy. However, other areas of policy critical to sustainability, such as finance, immigration, transportation and trade, should also be built on the principals of sustainability.

It is traditional to think of Canada as a land of wide open spaces, sparsely populated and under developed. In fact, our ecological footprint analysis illustrates that on a global basis every square metre of land and water is already fully committed to either the direct or indirect sustenance of the present world population and its demands for energy and materials. Canada can provide leadership in recognizing this fact and in building the knowledge into national policy. For example, Canada is one of the few countries in the world without an ecological deficit in productive land. This does not mean that we have land to spare. Rather, it means that our open spaces provide critical ecological and resource services to the rest of the world. Protecting Canada's ecological capability and biodiversity should be made a matter of national priority as part of our contribution to global ecosystem health and sustainability but also as an issue of national environmental security.

Recommendation 6:

The federal government should adopt national policies on development and land use that recognize the critical importance of Canadian open spaces to global ecological health and well being.

Recommendation 7:

The federal government should adopt systems of taxation, tariffs and regulation (e.g. higher raw material and energy taxes, lower payroll and income taxes, tariffs adjusted to the material and energy content of goods and services, tradable pollution permits, full cost accounting) that will work to reduce material throughputs in society, increase economic efficiency and build stocks of natural capital.

The federal government can provide leadership in the application of sustainability principles to comprehensive land claims. Through land claims negotiations the federal government is pursuing fundamental changes in Canadian social policy and governance. In effect, a new order of government is being created that gives recognition to the inherent rights and title of aboriginal peoples. As a result of the resolution of land claims, First Nations are likely to have an authority and responsibility for decisions affecting development that is out of proportion with their relatively small population. Devolution of authority is, therefore, an issue in sustainable development and the negotiations provide an important opportunity to frame the authority devolved to aboriginal governments in the context of sustainability principles. Given their attachment to place and the preservation of traditional lifestyles, aboriginal peoples should be receptive to the principals of sustainability and may be best positioned to design and implement policies based on sustainable development.

Recommendation 8:

In its comprehensive land claims negotiations, the federal government should seek to frame the devolution of authority to First Nations in the context of sustainability principles.

Rapid population growth and changing ethnic composition in the lower Fraser basin are contributing to a degree of social tension and strife that works against sustainability. There are a number of ways in which social policy should be adjusted to address these problems but most fall under provincial jurisdiction. One area in which the federal government has clear responsibility, however, is in immigration policy. Immigration policy is one facet of the broader issue of population policy which includes issues such as foreign aid, family planning, reproductive health services and child care. These tend to be emotionally charged issues and, therefore, difficult to address politically. Nor is Canada completely free to address these issues independent of international pressures. However, in the absence of an expressed population policy, Canada has a default policy that is made up of its fragmentary approach to various aspects of population. Furthermore, population is central to the problem of sustainability. The government cannot pursue sustainability and at the same time ignore population.

Recommendation 9:

The federal government should adopt a population policy for Canada that is consistent with the principles of sustainability. This policy should guide the formulation of related policies such as immigration, child care, health care and family planning.

Environmental pollution remains a problem that undermines progress toward sustainable development. Considerable progress has been made over the past few decades in control of the use and discharge of toxic substances in industry and in society as a whole. Our analysis of toxic substances in water and sediments of small watersheds, in moss and in resident fishes of the lower Fraser river shows that concentrations of most toxic substances have remained stable or gone down in recent years, although nutrients have gone up dramatically in agricultural areas. Toxic substances that have increased are primarily those associated with non-point sources of pollution, especially those associated with transportation. Whereas lead pollution has decreased with the removal of lead additives in gasoline, manganese has increased as manganese compounds have replaced lead as antiknock additives. Manganese is now receiving considerable attention as a possible health hazard but other trace metals associated with transportation (copper, zinc) should not be ignored.

Recommendation 10:

The federal government should take the lead in providing incentives to the transportation industry to design more ecologically friendly products and to adopt source control for toxic substances that will be released into the environment.

Implications for Provincial Policy

Just as it is important for the federal government so is it important for the provincial government to ensure that sustainability principles govern decision making in all departments. British Columbia has made significant progress in recent years in recognizing the importance of a healthy and productive natural environment to the social and economic well being of the province. The integration of environment, economy and society that characterizes sustainable development has not been achieved, however, and this is no where more evident than in the lower Fraser basin. Attempts by Environment Lands and Parks to protect environmental values and preserve biodiversity in the lower Fraser will be futile if other ministries like Finance, Highways, and Agriculture don't consider overall sustainable development as part of their mandates. For example, the decision to widen the trans-Canada highway in short sections so as to avoid having to conduct an environmental impact assessment is a decision directly contrary to the principals of sustainable development.

Recommendation 11:

The provincial government should incorporate sustainability principles and the mandate to promote sustainability into the decision making process for all departments. No government department or agency should be in a position to argue that sustainability is not part of its responsibility.

In addition to making sustainability a mandate for all government departments, the provincial government also has an important role to play in developing and publicizing measures of sustainability. To be most effective, these should be consistent with any measures used by the federal government. The provincial government is also in the best position to encourage the practice of sustainable development principles in communities throughout the province. Communities that

make progress toward sustainability should receive public recognition for their success whereas those that lose ground should also be recognized. Progress could be measured in a variety of ways including reductions in per-capita ecological footprint, reductions in material throughput, increases in recycling or increases in social capital.

Recommendation 12:

The provincial government should collaborate with the federal government in the development of indices or measures of progress toward sustainable development that are easily understood and meaningful to the public at large. The province should use these measures as a means to encourage more sustainable forms of development and to recognize publicly regional successes or failures in progress toward sustainability.

If the province is serious about sustainable development, it cannot avoid the issue of population any more than the federal government can. Population growth has become an issue of public concern in the lower Fraser basin because population is growing rapidly and this growth is straining the capacity of the regional infrastructure and causing rapid changes in the landscape and ethnicity. That population growth poses significant problems for environmental management and quality of life is implicit in regional plans, like the livable regions strategy. However, regional attempts to manage growth are handicapped by lack of complementary provincial policies.

Recommendation 13:

The provincial government should adopt a provincial policy on population consistent with principals of sustainability and as one of the foundations of provincial social policy for sustainable development.

Whereas issues like population are a shared responsibility of federal and provincial governments, resource use policy is almost entirely a provincial responsibility. Our analysis of the history of resource use within the lower Fraser basin has highlighted the fact that successive provincial governments have seen resources as a primary source of revenue. This coupled with a rather narrow focus on economic development

has made the province an agent for the liquidation of natural capital rather than an agent for sustainable resource use. If environmental sustainability is to be achieved (i.e. no loss of biological productivity, biodiversity or regenerative capacity) then provincial policies must become more balanced in their promotion of economy, environment and society. The remaining stock of natural capital must be sustained and increased over time if sustainable development is to be achieved.

Recommendation 14:

The provincial government should adopt policies that will generate revenue and reduce costs while encouraging increases in natural capital and quality of life rather than material consumption (e.g. shifting the tax burden from income and labour to material and energy use and from value added products to raw materials, encouraging local self-sufficiency and social networking as opposed to centralized government services).

Our research on small watersheds and non-point sources of pollution clearly demonstrated the importance of automobile traffic as a source of trace metal and hydrocarbon contaminants in urban streams. Although it was not part of our study, other investigations have implicated the automobile as the major source of air pollution within the lower Fraser basin. Transportation planning aims at reducing dependence on the private automobile but progress in implementing plans has been slow. Meanwhile, automobiles have been increasing faster than the population and kilometers driven even faster. Further delays in providing alternate forms of transportation and in discouraging automobile use means further declines in environmental quality, ecological capacity and public health. The provincial government has a significant role to play in managing emissions to protect ambient air, water and sediment quality and in construction and promotion of public transit and other, more environmentally friendly, forms of transportation.

Recommendation 15:

The provincial government should move speedily to adopt and implement a firm transportation policy that promotes environmentally friendly transportation and discourages further increases in automobile use. Elements of this policy should include routine emissions testing of all vehicles in the province, including commercial vehicles, financial support for an effective and efficient rapid transit system within the lower Fraser basin, financial incentives for commuters to use rapid transit, financial and other disincentives for the use of private automobiles as well as other measures to put transportation on a more environmentally and socially sustainable foundation.

Our research has confirmed that residents of the lower Fraser basin and BC residents in general believe that the limited farm lands in the province should be protected from development that would make the land unsuitable for farming. Our research has also shown that there is a continual alienation of farm lands from the land base in the lower Fraser as population grows and developers lobby for the removal of lands from the Agricultural Land Reserve. Furthermore, the intensification of agriculture in the lower Fraser means that much of the present agricultural production is decoupled from the land base. This is particularly the case with intensive poultry and hog production systems that import virtually all of their necessary feed. Overuse of the limited land base to dispose of agricultural wastes leads to contamination of streams and aquifers and our research also suggests that voluntary compliance with the code of waste management is poor. Several changes in provincial policy and regulations governing farming are suggested by our observations.

Recommendation 16:

The provincial government should adopt a no-net-loss of farm lands policy for BC. Where development proposals would alienate farm lands the developer should be required to show how farm lands elsewhere will be rehabilitated or enhanced so that no overall loss of farm potential occurs. Other measures, such as a provincial farm land bank might be created to protect farm lands. Farm land in the bank that is not presently being farmed could be used as park land, wildlife habitat or serve as an Ecological Service Centre.

Recommendation 17:

The provincial government should ensure speedy passage of legislation governing groundwater that enables government regulation and management of aquifer use and aquifer contamination. Guidelines and regulations governing land use in aquifer recharge areas should constitute part of the legislative package.

Recommendation 18:

The provincial government should make Best Management Practices (BMPs) for agricultural wastes (both commercial and hobby farms) and farm nutrient application a matter of regulation not voluntary guidelines. Each farm should have a nutrient budget appropriate to its operation and land base that will not lead to soil or water contamination.

Recommendation 19:

The province should implement a policy setting maximum animal stocking densities on farm land related to the capacity of soil types to absorb animal wastes. Densities should only be allowed to exceed these maximum densities where alternative forms of animal waste management are in place.

The pursuit of sustainable development is a new objective for our society and there is no established set of policies and programs by which sustainability can be achieved. Every attempt to move toward sustainable development is an experiment and there is no guarantee of success. Since various levels and orders of government have responsibility for aspects of sustainability, partnerships between governments will be required to ensure that real progress can be made. Since the public will be expected to pay the cost of our uncertain progress toward sustainability, the public must have meaningful involvement in the decision making process. Various planning processes within the lower Fraser basin region have provided a valuable framework for guiding decision making but, in many instances, plans have not been formally adopted or have been subverted by political agendas at a different level of government. The province

has an important role to play in encouraging and fostering the necessary communication and consensus building among governments and the public at large.

Recommendation 20:

The province should adopt policies that specifically encourage the formation of partnerships among government agencies and levels of government to address provincial and regional issues in ways that integrate environmental, economic and social objectives. An important purpose of these partnerships should be to ensure consensus among governments and agencies in how issues will be addressed. This is particularly important for the inclusion of First Nations governments in regional decision making processes.

Recommendation 21:

The province should develop and implement an educational strategy specifically designed to acquaint the public with the meaning and principles of sustainable development. The strategy should target provincial bureaucrats, educational institutions, regional and municipal authorities, corporations and public interest groups. The strategy should be implemented coincidentally with the policy making sustainable development the mandate of all provincial agencies (Recommendation 11). The educational strategy should make use of compelling local examples such as the nutrient contamination in the Fraser Valley.

Recommendation 22:

The province should require that regional and community plans be updated on a regular basis (say every 5 years) with effective public consultation. Regional and municipal councils should also be required to adopt plans through formal votes in council.

Recommendation 23:

As sustainability principles begin to provide the framework for policy and administration in all government departments and begin to effect regional and municipal decision making, the provincial government should implement a system of public recognition for communities that show substantial improvements in provincial indices of sustainability and public identification of those that lose ground. This could be analogous to the list of 100 for polluters who exceed their permitted discharges.

Loss of biodiversity, species extinction, alien species invasion are all features of the ecological transformation of the lower Fraser basin. These changes show that ecosystem structure and function are not sustainable. The changes also progressively limit the options open to policy makers for sustainable configurations. Immediate steps need to be taken to protect critical habitats and landscapes so as not to foreclose attractive options for sustainable development.

Recommendation 24:

The provincial government should take immediate steps to preserve remaining areas of critical habitat in the lower Fraser basin, including the remaining wetlands and any remaining patches of native vegetation.

Implications for Regional and Municipal Policy

The Greater Vancouver Regional District (GVRD) has been very active in developing plans to cope with population growth and sustain environmental and quality of life values within its boundaries. Plans developed by the GVRD provide a basis for more sustainable forms of development within the region. Unfortunately, implementation of these plans has been slow and hampered by a variety of factors including bureaucratic resistance, municipal rivalries and opposition by vested interests. Furthermore, the GVRD plans do not apply to regional districts east of the GVRD. As these districts have recently been amalgamated into a single district (the Fraser Valley Regional District, FVRD) it is appropriate that a regional plan consistent with the principles of

sustainable development be developed and adopted for the FVRD. A number of municipalities throughout the lower Fraser basin have also procrastinated about formally adopting official community plans.

Recommendation 25:

The GVRD should continue to promote implementation of the Livable Regions Strategy and its associated planning documents. Revisions to and updating of some of these plans are ongoing. The GVRD should ensure that such revisions are consistent with the principles of sustainable development.

Recommendation 26:

The FVRD should move quickly to develop and implement a regional plan complementary to the Livable Regions Strategy and consistent with the principles of sustainable development.

Recommendation 27:

Municipal governments that have not formally adopted official community plans or that have not reviewed their plan for more than 5 years should take steps to update and formally adopt plans that are consistent with sustainability principles.

Regional and municipal authorities have important roles to play in the development and implementation of local sustainable development policies. Our experience in working with municipalities has highlighted the enthusiasm and dedication that local citizens groups can bring to community based projects. Municipal and regional authorities are in the best position to help foster and mobilize this community enthusiasm and to encourage technical and other forms of support from provincial and federal governments. With modest assistance from municipal agencies, community

groups can take on and administer a wide variety of projects that will help with the integration of environment, economy and society and provide important services to the community.

Recommendation 28:

Regional and municipal governments should provide modest organizational and technical support to community based groups that can take responsibility for projects to enhance community sustainability. Examples of projects that community groups could effectively undertake include delineating environmentally sensitive areas, monitoring aspects of environmental quality and environmental health, building social networks and social capital within the community, or promoting more environmentally sustainable forms of economic activity.

Recommendation 29:

Regional and municipal governments should promote the formation of partnerships among levels of government to address issues of sustainability. These partnerships provide an important mechanism for local communities to influence regulatory and management processes that are the primary responsibility of federal or provincial agencies. By means of such partnerships the community agenda can begin to drive the regulatory process.

The settlement of comprehensive land claims is expected to have a significant effect on resource and environmental management and development decisions within the lower Fraser basin. However, it will be some time before claims are settled and, in the interim, there is considerable uncertainty about the future. Regional and municipal authorities continue to make decisions about local development that impact on the aboriginal community and aboriginal authorities make decisions about reserve lands that raise concerns in the surrounding communities. Such fragmented and contradictory decision making is contrary to the principles of sustainable development and increases social tensions. Furthermore, there are many situations in which partnerships among local administrations would be highly mutually beneficial. A

better process of communication is needed that will not jeopardize land claims but will help build trust and respect between aboriginal and non-aboriginal authorities.

Recommendation 30:

Aboriginal, regional district and municipal authorities should establish a consultative committee for the purpose of sharing information, ideas and community objectives and with a view to building trust, respect and partnerships between their respective administrations.

Small streams in the lower Fraser basin constitute a significant ecological resource that has historically been greatly undervalued. As many as 50 streams in the greater Vancouver area that once supported runs of Pacific salmon have been turned into storm sewers. Water and sediment quality in the remaining streams are both degraded primarily as a result of non-point source pollution. In urban areas the most important sources of contamination are increasing automobile traffic and increasing amounts of impervious surfaces whereas in rural areas the most important sources are intensive agriculture, improper animal waste management and septic systems. Many municipalities have recognized the problems associated with non-point sources of pollution but little has been done to control the problem. In rural areas our research has shown that information and education programs have made farmers aware of the need for good waste management but have not convinced them to adopt the voluntary code of management. Several policy and regulatory changes at the regional district and municipal level are needed if non-point pollution is to be brought under control.

Recommendation 31:

Regional districts and municipalities should develop management frameworks and management plans for small watersheds to deal with non-point sources of pollution. The plans should include education programs to inform people about the connection between such activities as automobile use, farming and hobby farming, and septic systems and stream and groundwater contamination. The plans should also include a monitoring program that takes account of the highly variable conditions caused by

storm water run-off. These management plans should be developed in consultation with all relevant interests and should involve a component of public stewardship and watershed restoration.

Recommendation 32:

Best Management Practices (BMPs) for waste management and control of run-off from land should be implemented. In urban areas, technology and BMPs to minimize impervious surfaces and control sediment and hydrocarbon transportation into streams should be required in all new developments. As municipalities upgrade or modify existing storm sewers, these should be brought up to standard in terms of technology and BMPs to minimized contaminant transfer to streams. In rural areas proper technology and BMPs for farm waste management should be a matter of regulation not voluntary compliance. Hobby farmers should also be required to manage their farm wastes appropriately. Households on septic systems should be required to service their system at regular intervals.

Recommendation 33:

Guidelines for residential and agricultural development over sensitive aquifers that will prevent contamination of the aquifer should be developed. Where development over aquifers is already leading to contamination, programs to reduce the contaminant loading and restore the aquifer should be implemented.

Our experience working with local communities has also shown how valuable the linkages between the university and the community can be in enhancing the exchange of information and ideas and in providing support for community based initiatives. The university benefits greatly from such a partnership by demonstrating that it has value and is relevant to the community. Graduate students gain important practical experience in real world problems and in working in non-academic settings. The community based activity promoted by the eco-research program is not a routine aspect of university life but is one that all public higher educational institutions should take seriously.

Recommendation 34:

Provincial and regional public institutions of higher education should have, as a formal part of their mandate, the requirement to provide technical and information back up to local communities to assist with local and regional problems.

Recommendation 35:

Funds should be provided by the province to support university/community collaborations with a requirement for some matching of resources by communities that receive funds or participate in projects. The funds should be administered by a regionally based committee and distributed on a competitive basis. The objectives of the fund should be to assist communities with real local problems and to encourage university faculty and students who are prepared to work with local communities.

Implications for Individual Decision Making

Policy development and policy reform at various levels of government are important to sustainable development. In the final analysis, however, whether or not we will achieve sustainable development in our society depends on individual decisions such as where to live, what kind of life-style to lead, who to vote for, and what kinds of community activities to support. While it is convenient to point the finger at governments and corporations for failing to deliver on sustainability, if our environment is degraded, if the economy fails to provide for our basic needs, if our society is balkanized and filled with conflict, it is we who must accept responsibility. The results of our polling indicate a high level of concern among the public for environmental and quality of life values and a willingness to make sacrifices to ensure that these values are sustained. Yet, individual behaviour often runs contrary to people's stated beliefs. In part this is because the system of infrastructure we have built up over time was predicated on human activities that are not sustainable. This infrastructure encourages us to continue, in an almost unconscious way, with activities that are unsustainable and that are in conflict with our present values. Individuals need to reassess their values and their individual decisions and begin to make conscious

choices that more closely reflect the values they espouse. We offer a number of recommendations that we hope will stimulate some debate, both public and private, about the role of individuals in sustainable development.

For Your Environment:

Recommendation 36:

Take responsibility for your own excessive consumption of material and resources. Assess your individual ecological footprint and develop a program to reduce your footprint by some measurable but achievable amount. Make footprint reduction a family game. Organize a community group to explore ways to reduce the footprint of your community.

Recommendation 37:

Learn about the environmental implications of the things that are going on in your community. Don't support those that will increase your individual contribution to environmental degradation or that will affect the quality of your environment. Get involved with those things that will increase environmental quality or rehabilitate the environment.

Recommendation 38:

Learn about the environmental policies and beliefs of the political parties and the individuals who run for office in your community (regardless of the level or type of office). Don't support those that are contrary to your personal values about the environment or that do not put high priority on sustaining environmental quality.

For Your Community

Recommendation 39:

Act to overcome evident social divisions in your community. Question the balance of representation in council chambers, business and service organizations.

Recommendation 40:

Take responsibility for your role in the social cohesiveness of your community. Look for ways to increase the quality of your life and the lives of others through social networking. Look for ways to increase community and individual security by building social relationships.

Recommendation 41:

Remind your council members and other community leaders of their responsibility to base their decisions on sustainability principles. Participate in activities that help your community to be a voice for sustainable development in regional, provincial and national affairs.

For Your Economy

Recommendation 42:

Learn to distinguish between economic proposals that enhance sustainability in your community and those that enrich a small number at the expense of the community. Support the former and oppose the latter.

Recommendation 43:

Make charts of how you dispose of personal or family income. Consider how different patterns of income allocation might support locally beneficial economic activities without reducing your quality of life.

Recommendation 44:

Use your purchasing power to support environmentally and socially friendly products and manufacturing processes. Make buying sustainably a family game. Start or join a local consumer group with similar objectives.

It is worth re-emphasizing that there is no single pattern of sustainable development and no single way to move toward sustainable development. The principles of sustainable development provide a framework within which there is considerable opportunity for individual creativity. We hope that the residents of the lower Fraser basin and the people of Canada will rise to the challenge and the opportunity of sustainability. The alternative does not appear very attractive in the long term.

In addition to information transfer through the collaborations noted above, members of the research team have so far published or submitted for publication 78 papers in scholarly journals or other formal academic media, produced 26 working papers for local distribution, given 42 talks and lectures, 23 of which were to local public audiences, and participated in several public workshops to discuss results of the project. Chapters have been completed for one book on the project and a second is in the planning stages.

Our research project can be accessed on the World Wide Web at:
<http://www.ire.ubc.ca/ecoresearch/>. For the entire final report in MS Word 7.0 format, click [here](#) to begin downloading. A MS Word 7.0 viewer is available at www.microsoft.com/word/internet/viewer

[\[Visual Tour\]](#) [\[Project Description\]](#) [\[Publications\]](#)
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