

July 21st, 2018

Dear Province of BC,

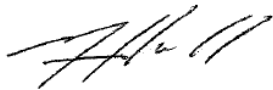
Please accept this submission titled: A Vision for a Modern Habitat Management Framework for British Columbia, as part of your public input submission collected for the current Wildlife and Habitat Engagement initiative open until July 31st, 2018.

I have been a natural resource professional in BC for over 25 years and have worked across many of BC's resource sector including forestry, oil and gas, mining and I have focused much of my career on biodiversity conservation, wildlife habitat management and enhancement and environmental protection.

I give the Province of BC permission to copy, reproduce and distribute this document as needed to facilitate the objectives of the Wildlife and Habitat Engagement initiative.

Thank you for the opportunity to make this submission. Please contact me if there is any aspect of this document you would like to discuss.

Yours in Conservation,



Where Are We At With Habitat Management in British Columbia?

British Columbia is one of North America's most biologically diverse jurisdictions; however, the province has an ever-increasing list of species at risk, declining fish and wildlife populations, and is at an all-time low in terms of funding and capacity related to natural resource management and enforcement. The investment going back into the land is declining while the pressures on the land are increasing.

The August 2015 report - *Getting the Balance Right: Improving Wildlife Habitat Management in British Columbia*¹ is a first step in addressing this imbalance, but misses the mark when it comes to improving biodiversity outcomes.

In the following sections of this report the author proposes twelve elements for a modern habitat management framework for the province.

Elements for a modern habitat management framework:

- 1) Measure Biodiversity
- 2) Create a Legal Framework for Biodiversity Conservation
- 3) Define Limits for Development
- 4) Mandate Cumulative Effects Assessments for Statutory Decisions
- 5) Manage Habitat Systems
- 6) Use Applied Science and True Adaptive Management
- 7) Mandate *No Net Loss* and *Net Positive Impact*
- 8) Invest in Advanced Inventory and Monitoring Technologies
- 9) Create a Real Time Dynamic Planning Model
- 10) Consolidate Habitat Management Programs
- 11) Dedicate Funding to Biodiversity Conservation
- 12) Shift from a Stakeholder Input to a Social Governance Model

¹ Morris, M. 2015. Strategic Advice to the Minister of Forests Lands and Natural Resource Operations. Getting the Balance Right: Improving Wildlife Habitat Management in British Columbia. WWW Document. http://www.env.gov.bc.ca/fw/wildlife/management-issues/docs/getting_the_balance_right_improving_wildlife_habitat_management_in_british_columbia.pdf

Does B.C. Need a New Habitat Management Framework?

British Columbia's approach to managing the environment and its' natural resources is based on *mainstream economics* (Figure 1). In this economic model the objective is to manage the economy for continuous growth and the environment is considered a sub-set of the economy. Some aspects of the environment (i.e., salmon and forests) are treated as commodities in economic analyses. In the case of environmental protection, the environment is one aspect of the economy that needs to be "accommodated" or "considered" depending on supply and demand market pressures for environmental commodities. This model assumes the environment is unlimited and that it can support unlimited economic growth because technology and economic efficiencies will compensate for the pressures placed on the environment.

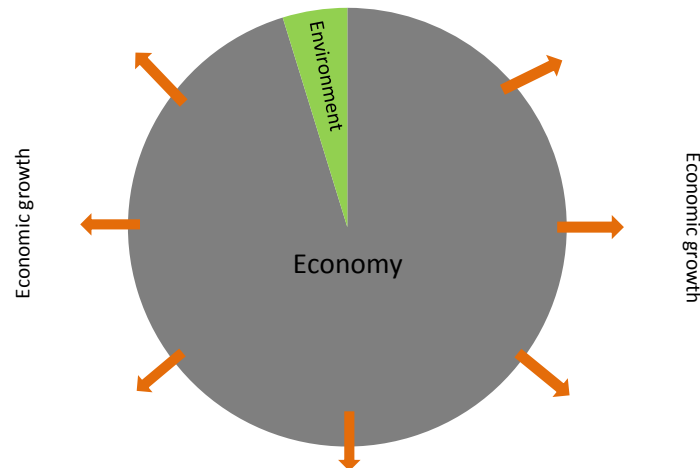


Figure 1. The Mainstream Economic Model.

The *ecological economic* model (Figure 2) is the basis for sustainable development where the economy is treated as a subset of the environment. This model recognizes that the environment sustains the economy and the parts of environment providing goods and services are valued as capital assets (i.e., "natural capital") not commodities. The environment is finite; therefore, it will ultimately control how much an economy can grow before there is an ecological, economic and or social collapse (consider the case of the Atlantic Cod fishery). Non-renewable resources are finite and the environment has limited ability to regenerate and replenish itself, to assimilate pollution, and to sustain the ecological services that supports society. Ecological economics is not intended to prevent economic growth rather it is designed to ensure the environment is capable of sustaining a rate of growth that meets the basic needs of today without compromising intergenerational equity.

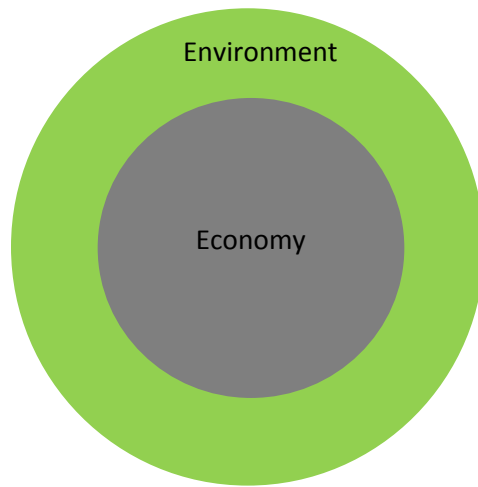


Figure 2. The Ecological Economic Model

In attempts to find the balance between economic and environmental prosperity within the mainstream economic model, British Columbia has gone through various phases of integrated resource management and land use planning, as well as environmental policy and regulatory framework changes. Strategic land and resource planning is used to plan economic growth with environmental protection. This type of planning was once mandated and delivered by provincial Ministries. In more recent times, resources for government-led strategic planning in natural resource management have been reduced or eliminated altogether. Many of the past planning processes took years before plans were available and, in some situations, plans were obsolete before they could be implemented. Land use plans that were entrenched in legislation became more successful frameworks for environmental management including the Muskwa-Kechika Management Area. Other multi-stakeholder planning processes including the Kootenay-Boundary Land Use Plan, completed landscape-scale strategic planning but it was never fully implemented.

The current approach to habitat management and environmental protection has contributed to the province's fish, wildlife and biodiversity declines. The approaches to planning old growth timber harvesting, natural gas exploration and mountain pine beetle timber salvage demonstrates how the current model has not protected the habitat needs of species including Mountain Caribou and moose. The *status quo* is not going to provide the intergenerational equity that future generations of British Columbians are entitled to. Policy modifications and re-organization of the existing hierarchies will not suffice.

A new vision for a habitat management framework for the province is needed.

A Vision for a Modern Habitat Management Framework

1. *Measure Biodiversity*

Managing for biodiversity objectives must be the driver of a modern habitat management program for the province. Biodiversity conservation should be the measure that defines the limits of development at any scale. Managing for biodiversity is often stated as an overarching objective in land and resource management; however, B.C.'s regulatory framework does not recognize the types of biodiversity established by science or the methods used in science for measuring them.

There are four commonly described measures for inventorying biodiversity and each measure corresponds roughly with the four levels of biotic systems:

- 1) **Point diversity** is species richness (a simple measure of all the different kinds of species found in a defined area) at small scales of 10 to 100 m².
- 2) **Alpha diversity** species richness at scales of 0.1 to 1000ha.
- 3) **Gamma diversity** is species diversity at scales of 1000 to 1,000,000 ha (i.e., regional).
- 4) **Epsilon diversity** is species diversity at scales of 1,000,000 to 100,000,000 ha (i.e., geographic).

There are also three common measures of species diversity used for comparing the change in species composition between habitats at different scales.

- 1) **Pattern diversity** is the change in species diversity between points within a biotic community (small scale).
- 2) **Beta diversity** is the variation in species between adjacent communities or habitats. (landscape scale).
- 3) **Delta diversity** is the change in species diversity across major climatic or physiographic gradients (geographic scale).

Species diversity is made up of two basic elements; 1) species richness which is the number of different species in a planning area, and 2) species evenness which is the relative abundance of species. There are mathematical methods to describe species diversity including measures for combining species richness and evenness into a single *diversity index* (i.e., Shannon-Weaver Index). It is clearly established in science that biodiversity can be measured, managed and monitored; therefore, biodiversity objectives can be legislated and managed at any given spatial scale in B.C.

Habitat programs for specific fish and wildlife (i.e., species-by-species management) play an important role in biodiversity conservation. Species specific habitat management; however,

shouldn't drive the overall habitat management process rather it should logically fit within a framework driven by biodiversity conservation.

2. Create a Legal Framework for Biodiversity Conservation

As most often applied in natural resource management, biodiversity simply implies *species diversity*, which is only a list of species occurring in a given area that does not account for relative abundance. Biodiversity needs to be concisely defined and measurable objectives must be established in Canadian federal and provincial law and environmental policy. Other seemingly nebulous concepts such as “fairness” and “efficiency” are defined for the legal or policy contexts to which they are applied. The Constitution of Canada, through division of powers, provides the federal and provincial governments with jurisdictional and proprietary rights over natural resources and the environment. Through these powers, both levels of government can create legislation that can be used as legal tools to manage and protect biodiversity depending on how it is defined and measured within the legal frameworks.

Biodiversity is a value-laden concept and within each policy that it is applied to, the underlying values must be explicit. The scientific literature does not substantiate that “more biodiversity” (i.e., high species richness) is equivalent to healthy, stable, or productive ecosystems; therefore, the underlying values that drive biodiversity conservation (i.e., aesthetic, ethical or economic) must be explicitly stated in the policies that direct the management of common pool resources so that the benefits and costs of any given policy can be effectively analyzed.

3. Define Limits for Development

To ensure that intergenerational equity and biodiversity conservation are forefront in land and resource decisions, a modern habitat management program must serve to define the limit of economic growth that the environment (at varying spatial and temporal scales) is capable of sustaining. All natural resources extracted from the environment flow through society end up as pollution that is discharged back into the environment. A habitat management framework must balance the environment's ability to regenerate from resource extraction with its ability to simultaneously assimilate pollution.

By using an ecological economic approach to define the extent of economic growth at any given spatial or temporal scale will represent a fundamental shift towards a more sustainable economy in BC.

4. Mandate Cumulative Effects Assessments for Statutory Decisions

Cumulative Effects Assessments is an emerging initiative in British Columbia that was implemented in response to an Auditor General report released in May of 2015. The province started with three official pilot projects and one unofficial pilot project later in 2015. Pilot projects were tasked with assessing cumulative effects on a small set of valued ecosystem components and providing recommendations to be considered in future management decisions. As of 2016, cumulative effects assessments are under way in each region of the province. The province is moving in the right direction on this initiative; however, as capacity and expertise in cumulative effects grows, the province will need to transition from a cumulative effects assessment process that looks at isolated parts of an ecosystem to more complex holistic relationships between biodiversity and the human footprint.

Cumulative effects assessment should not become the pinnacle of habitat management in the province rather it should form one component of a provincial habitat management framework. Cumulative effects assessment will need to be incorporated into legislation and become a mandated decision making platform for making statutory decisions. The risk assessment component of the province's cumulative effects assessment framework must be captured by legislation and used to define the point when a geographic area can no longer sustain development, increased use or extraction of natural resources. The Natural Resource and Environment Ministries need clear lines where permits, tenures, authorizations or applications for projects can no longer be issued or considered.

For continuity purposes, cumulative effective assessments conducted for major projects under review by BC Environmental Assessment Office should be required to use the same approach and data sets adopted by the province. As an immediate short-term priority, the province's cumulative effects assessment framework needs to be expanded to freshwater, including groundwater and marine ecosystems as well as, to fish and wildlife populations.

5. Manage Habitat Systems

Historically, landscape planning in British Columbia has been based on defined geographic areas or jurisdictional units such as landscape units, watersheds, biogeoclimatic zones, and forest districts. Land and resource planning is generally driven by the needs of the resource industries, especially the forest industry, and not by the habitat needs of fish and wildlife or for biodiversity conservation. More often than not fish, wildlife and biodiversity are values that need to be “considered” or “accommodated” when planning resource extraction or major projects. Strategic plans created by government cannot commit Ministries to additional fiscal expenditures so strategic plans created by the province are generally *informative* and not *binding*.

Landscape planning in the province is commonly based on *mechanistic* or *reductionist* approaches to habitat management. Ecosystems are broken down into *parts* such as, riparian areas, vegetation types, rock outcrops or biogeoclimatic subzones. The bias for selecting measurement endpoints is typically based on choosing habitat attributes that can be observed, physically measured and spatially mapped. These ecological parts are typically expressed in terms of surface area or as percentages of the overall planning unit. Management objectives are then typically based on creating or maintaining target hectares or percentages of each selected ecological part (i.e., percent retention for old growth forest). The mechanistic/reductionist approach is synonymous with the paradigm: *a whole is equal to the sum of its parts*. Ecosystem restoration represents a shift away from the mechanistic/reductionist approach because it attempts to manage ecosystems based on natural processes (i.e., fire-maintained ecosystems).

Habitat management in the province needs to be based on managing *habitat systems* rather than managing selected parts of an ecosystem. This shift will require a transformation from *mechanistic/reductionist* thinking to a *systems thinking* approach to habitat management. Systems thinking is a concept well established in the literature dating back to the 1920’s. System thinking can be applied to any type of system (i.e., ecological, social, economic) and it has the potential to significantly improve biodiversity conservation in the province.

Key concepts of system thinking that relate to habitat management include:

- A system is a dynamic community that functions as unit.
- Systems are comprised of smaller nested sub systems.
- A system is composed of direct or indirectly related parts.
- A system can overlap with another system.
- A system is bounded in time and space but the parts do not have to be connected.
- A system consists of processes that transform inputs into outputs.

- Systems are often composed of entities trending toward equilibrium but can exhibit patterns, cycling, oscillation, randomness, or exponential behavior.

Habitat systems should be used as the basis for developing detailed habitat management plans rather than using static planning boundaries based on geographic or socio-political boundaries. Managing habitat systems aligns better with the concepts of biodiversity conservation. Managers and legislators will need to adapt to the idea that habitat systems will overlap each other, contain nested subsystems, will transcend socio-political jurisdictions and, will change with time and vary in scale across the province. The shift from managing habitats using the mechanistic/reductionist approach to a systems thinking approach will require resource managers to place greater emphasis on managing ecological processes and interdependent ecological relationships such as, the relationship between ecosystem inputs and outputs.

6. *Use Science and True Adaptive Management*

A habitat management framework for the province needs to be supported by a robust applied science program that is linked to the habitat management information needs in this province. A series of research stations should be established across the province with the purpose of providing baseline inventories, conducting applied research, monitoring change and reducing critical uncertainties underlying important habitat management decisions.

Adaptive management is a concept that is largely misunderstood in natural resource management in BC. Adaptive management is not accomplished by *status quo* practices or by trial-and-error, nor is adaptive management simply the means of adapting policies as we go to see what happens. Resource management, like most business models, generally follows the *plan-implement-monitor-adapt* management cycle; therefore, managers often refer to their programs as embracing adaptive management. This approach; however, leaves adaptive management to chance. If something new is learned from an operational outcome then new ways of doing business may evolve. With this approach there is no purposeful link between applied science and management uncertainty. Consequently, the process of continuous improvement is slow when adaptive management is left to chance and business-as-usual prevails.

True adaptive management is a purposely designed management effort. It is a systematic, rigorous approach for designing and implementing programs to maximize learning about the critical uncertainties that affect decisions on policy or on-the-ground practices. Once critical uncertainties are reduced, the knowledge gained will lead to a different management approach, or to confirmation that current management approaches are appropriate. The true adaptive management cycle builds on most general management feedback loops (i.e., plan-implement-monitor-adapt) by reducing management uncertainty through the testing of hypotheses and by comparing the results of different management strategies tested at an operational scale.

The true adaptive management cycle also differs from the general management cycle because the true adaptive management cycle is driven by questions of what is not known and by what managers need to know in order to meet objectives. The true adaptive management cycle can be thought of as being a more detailed cycle nested within the general management cycle. Once critical uncertainties are answered or sufficiently reduced, the adaptive management cycle for a given management uncertainty can exit from the general management cycle.

A long-term sustainable applied research program coupled with the uncertainties that underlie habitat management decisions is an integral part of a modern habitat management framework for the province of BC. To prevent political agendas and interference, the applied science research function of a provincial habitat management program needs to be independent of government but its mandate and funding needs to be legislated.

7. Mandate for No Net Loss and Net Positive Impact

The human footprint creates risks to biodiversity and these risks can lead to residual impacts to biodiversity that are permanent. Around the world, momentum is growing in biodiversity conservation through the application of *No Net Loss* and *Net Positive Impact* objectives in sectors such as forestry and mining. Negative biodiversity impacts are either *balanced* (i.e., No Net Loss) by avoidance, minimization, or restoration strategies or *outweighed* (i.e., Net Positive Impact) with offsets in the region where the impacts occur (Figure 3).

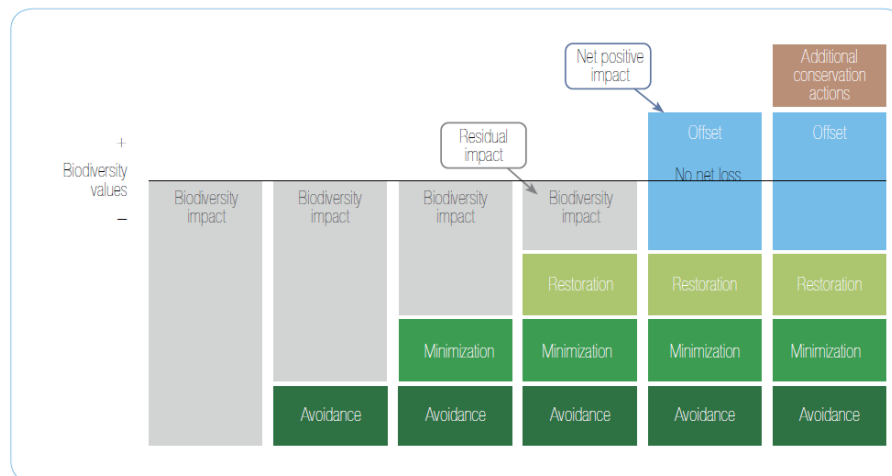


Figure 3. The Mitigation Hierarchy for Managing Biodiversity Risk²

² No Net Loss and Net Positive Impact Approaches for Biodiversity. Exploring the potential application of these approaches in the commercial agriculture and forestry sectors. 2015. International Union for Conservation of Nature and Natural Resources.

The concept of *Net* in the No Net Loss and Net Positive Impact principles recognizes some losses to biodiversity are inevitable and that the gains might not necessarily be evenly balanced in time, space, or with the type of biodiversity that is impacted. Overcompensating for residual impacts to biodiversity by achieving a *Net Positive Impact* is a cautionary way of achieving *No Net Loss*. In other words, compensate for more than what has been lost. The No Net Loss and Net Positive Impact principles need to be a fundamental part of a habitat management framework for the province. Provincial and federal laws need to be structured so that No Net Loss and Net Positive Impacts are defined and measurable for all the natural resource sectors.

8. Create a Real-Time Dynamic Planning Model

The output of land and resource planning initiatives in the province were often just sets of maps and reports that typically ended up filed away in government and industry offices. A habitat management framework driven by biodiversity conservation across multi-dimensional habitat systems will require a new mindset as to what the “product” of a modern habitat planning process should look like.

Rather than the product of habitat planning being maps and reports, a modern habitat management program should create a dynamic and all-encompassing electronic platform that is accessible to everyone through open-source data/information sharing and real-time spatial databases. A modern habitat management program needs to focus on creating a dynamic geospatial model covering the entire province that is capable of site-level and landscape-scale resolution.

The world today runs on data and the rapid assimilation and dissemination of information. The pace of the modern world is fast; therefore, a modern habitat management program needs to be in step with the current pace of demand for information and knowledge. A habitat management program needs to operate on information and a planning platform that is based on up to date data and state-of-the-art habitat simulation models and leading-edge science. Inventory data, monitoring results and changes to the land base need to be uploaded to the habitat model on a continual ongoing basis. Managers need to have as close to “real time” snapshots of the province’s habitat and wildlife population as possible to make timely environmental decisions. Biodiversity information and knowledge can no longer afford to be decades behind the pace of development, resource extraction and pollution discharge.

9. Invest in Advanced Inventory and Monitoring Technologies

To cost effectively operate a modern habitat management program in a world that demands almost instantaneous information, the province of BC needs to invest in and rely heavily on advanced and emerging technologies that can rapidly capture habitat and wildlife-related data and make it available to land managers, decision makers and industry.

Remote sensing is the science of obtaining information about areas of the earth from a distance using aircraft or satellites. Remote sensing collects data by capturing natural energy emitted from the earth surface or by measuring the time it takes for directed energy to reflect back to the sensors. Remote sensing can be used to monitor many environmental indicators including shoreline changes, water temperature, sediment transport, changes in land uses and habitat fragmentation. Remote sensing can be used to measure stress in vegetation which may allow managers to detect changes in habitat quality years in advance of any impacts to fish, wildlife or biodiversity. Imagine biologists having had the ability to detect stress in the lodgepole pine forests of central BC years before the mountain pine epidemic. Had that technology been employed in the province, impacts and mitigation strategies could have been analyzed and put in place to protect moose populations long before the first pine beetle killed trees were logged. In Idaho and Montana, for example, wildlife managers use vegetation indexed data collected by NASA satellites to predict forage quality and model population dynamics of mule-deer on an annual basis.

LIDAR (Light Detection and Ranging) is a form of remote sensing using laser pulses to map features on the earth. Recent advances in LIDAR allow it to precisely map riparian habitats through a process called *WAM – Wet Area Mapping*. WAM is more accurate than the Terrestrial Ecosystem Mapping (TEM) or Predictive Ecosystem Mapping (PEM) tools currently used for riparian habitat in the province. LIDAR can map vegetation layers down to small ground plants (i.e., 10cm) even through heavy forest canopies.

Remote sensing and other cutting edge technologies need to be readily-accessible tools for habitat managers in the province. Large areas of the province need to be mapped faster, more economically and more accurately than the current approaches. Ultimately, data needs to be more comprehensive and more readily available for analysis and decision making much sooner than what is available to biologists today.

10. Consolidate Habitat Management Programs

While attempts have been made to amalgamate natural resource Ministries in the province, BC still has conflicting policies, legislation, budgets and organizational mandates that puts fish, wildlife and biodiversity values at odds with economic goals and resource extraction practices. To fill the gaps, non-government organizations and industry are playing increasing lead roles in funding, planning, monitoring, and habitat management. Some of these habitat programs are

made up of government stakeholder and First Nations partnerships intended to ensure the benefits of habitat investment serve the greater public interest. However, setting priorities and actively managing public resources based on the agendas of non-government funding agencies or private interests has been referred to as the *tail wagging the dog* approach to fish, wildlife and habitat management in BC.

The overall result of decentralized habitat management across the province is that the approach to big picture biodiversity conservation is also fragmented. Regional and local habitat management efforts operate in silos and are still focused on species-by-species type management in isolation of the big picture. Workshops and multi-stakeholder meetings are sometimes held so that all the players (inside and outside government) can learn what each other is up to. There is no overarching system in BC to direct and coordinate all the dozens of NGOs involved in habitat management.

A modern habitat management program for the province needs to fall under one framework guided by legislated objectives for biodiversity conservation. There needs to be a single organizational hierarchy, clear lines of accountability and clear responsibility for decision making whether the habitat management initiatives are led by government, NGOs or industry, so that the management of habitat in the province is not inefficient, counter-productive or fragmented.

11. Dedicate Funding to Biodiversity Conservation

The precipitous decline in investment in fish, wildlife and biodiversity conservation is well documented in the 2014 report - *Trends in Renewable Resource Management in British Columbia*³. While legal responsibilities have increased, the budgets and staffing of government biologists have declined since 1997. In contrast, budgets for other sectors of government have more than doubled. Most fish and wildlife departments across North America operate on budgets in the hundreds of millions of dollars, including jurisdictions with smaller land bases and less diverse ecosystems than BC. In contrast, BC operates on a budget in the range of tens of millions of dollars. While most jurisdictions in North America have dedicated funding models for fish and wildlife management, BC has no such model. Current renewable and non-renewable resource use and extraction policies are not contributing to successful province-wide biodiversity conservation. The author is concerned that BC's lack of investment and approach to resource use and extraction has come at the expense of biodiversity. Many government biologists must apply to outside funding organizations to try and secure the financial resources needed to properly manage public fish and wildlife habitat programs.

³ Archibald, R., D.S. Eastman, R. Ellis, & B. Nyberg. 2014. Trends in renewable resource management in British Columbia. *Journal of Ecosystems and Management* 14(3):1–10. Published by FORREX Forum for Research and Extension in Natural Resources. <http://jem.forrex.org/index.php/jem/article/viewFile/556/498>

Biodiversity conservation needs to be funded by the money collected from all consumptive and non-consumptive resource users as well as, from all land/resource rent, pollution discharge, environmental fines and administrative penalties. For example, fees collected for the discharge of pollution and contaminants into the environment authorized under BC's Environmental Management Act are used to pay for staffing and administration programs within the Ministry Of Environment's Environmental Protection Divisions. The fees collected for pollution discharged into the environment need to go back to the Ministries that are responsible to mitigate or reverse the cumulative impacts of pollution on habitat, fish and wildlife.

Compensation payments should also be established for all projects and resource uses that impact biodiversity so that Net Positive Impact offsets can be created. BC needs to create a type of *Biodiversity Security Bond*, similar to the province's mining reclamation bonds for all industries and sectors posing risks to biodiversity conservation. Security bonds should be used for No Net Loss or Net Positive Impact habitat management initiatives when a responsible party fails to fulfill meet legal habitat objectives.

12. Shift from Stakeholder Input to a Social Governance Model

British Columbia, like many regions of the world, went through an environmental revolution marked by conflict and protest. The benefit of this revolution was that it brought about greater social awareness around the ideas of environmental protection and sustainable development which opened up dialogue on environmental issues important to British Columbians. Over successive decades, the courts of Canada and the province also settled questions of Aboriginal Rights and Title. These turning points in BC's history precipitated change in environmental practices, policy and regulations and these changes lead to greater engagement of public stakeholders and First Nations. Round tables, consultation, multi-stakeholder committees and public review processes are more common in natural resource management in the province; however, questions whether the engagement is meaningful to all those affected by natural resource decisions including First Nations and all British Columbians is becoming more prevalent in natural resource management.

The current stakeholder input model is, however, creating its share of the conflict, inefficiencies and inequities in allocation of natural resources. A stakeholder, by definition, is someone with a vested interest in the outcome. As natural resources become scarce, multi-stakeholder processes have become increasing self-interest driven and position-based in BC. More often than not, an interest represents a *here-and-now* economic interest which is manifested by the efforts of stakeholders to protect their own *status quo*.

A modern habitat management framework needs to have social support and it needs to incorporate the knowledge and objectives of British Columbians and First Nations. However, the

approach needs to shift from the current stakeholder input model where stakeholders advocate their interests to a social governance model where the individuals at the table are engaged in dialogue about intergenerational equity. This means that future provincial, regional and local roundtables designed to support natural resource decisions should not be made up of industry and user group representatives. Future roundtable and stakeholder processes need to be made up of members of First Nations and non-partisan members of the public chosen by citizens to represent the interests of future British Columbians.