



**CANADIAN GEOSPATIAL DATA INFRASTRUCTURE
INFORMATION PRODUCT 18**

**GeoConnections
Geospatial Return on Investment Case Study:
Hectares BC**

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Financial analysis performed by
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Executive Summary

This study is one in a series of geospatial Return on Investment (ROI) case studies based on the GITA ROI methodology. It focuses on Hectares BC, a web-accessible geospatial analytical tool developed as a collaborative project by federal and provincial government agencies and non-government organizations. GeoConnections provided \$150,000 in funding for the project, matched by \$100,000 in cash contributions from the Province of BC, Fisheries and Oceans Canada, and Parks Canada. An additional \$70,000 of in-kind contributions were made by these agencies and the Nature Conservancy of Canada. Development took place in 2007 and 2008.

Hectares BC was a pilot project to develop a system for geospatial data analysis in the natural resource sector. The system grants anyone with web access the ability to view, download or analyze large volumes of data with a query tool. The system enables both technically sophisticated geospatial analysts and those with limited understanding or access to geospatial data and tools to complete timely, transparent, repeatable modeling and analysis using centrally held data. The tool can save time acquiring and disseminating datasets, completing analysis and developing geospatial models and thematic maps, while enabling collaboration.

This study includes benefits to provincial government agencies at the Integrated Land Management Bureau (GeoBC), Ministry of Environment, and Ministry of Forests and Range, and to a Federal agency, Agriculture and Agri-Food Canada. This report references staff assignments at the start of the case study prior to a restructuring of the provincial government.

Cumulative costs for this ten-year project are \$903,767. Cumulative benefits are \$10,680,851. Net Present Value is \$9,777,084 with an annualized ROI of 108%. Payback period is three years with breakeven point in 2010. The greatest benefit is increased productivity to Ministry of Forests staff, followed by reduction in costs to acquire data for environmental assessments.

Analysis for Non-governmental organizations (NGOs) was performed separately. Net Present Value to NGOs is \$14.5M, with a two-year payback period. The greatest benefit is increased value to conservation from land purchased, followed by increased scientific credibility leading to greater funding levels. Annualized ROI values are disproportionately high, a result of leveraging a project primarily supported by the province, and are not used for this analysis.

Analysis for First Nations was also performed separately. Net Present Value is \$100,589 with a 54% ROI for use of current applications. The greatest benefit is the potential for Hectares BC to assist in the development of resource management planning information, leading to avoidance of the environmental referral process. The study determined that adding enhancements and expanding use to include 30 First Nations would result in a Net Present Value of \$4.1M.

Conclusions: The Hectares BC study shows strong benefits due to a broad user base. There is significant potential for further benefits if use was expanded to transform the current business processes associated with resource development allocation, environmental assessment and First Nation referral. Expanding use to other sectors such as health and social sciences also warrants investigation. A modest level of applications enhancement and growth of the user base could yield dramatic increases in ROI, as demonstrated in alternate scenarios of this analysis.

Résumé

La présente est l'une des études de cas sur le rendement du capital investi (RCI) dans la technologie de l'information géospatiale effectuée selon la méthode de la GITA. Elle met l'accent sur Hectares BC, outil d'analyse géospatiale accessible sur le Web et élaboré dans le cadre d'un projet conjoint du gouvernement fédéral, de la province et d'organisations non gouvernementales. GéoConnexions a financé le projet à hauteur de 150 000 \$, et 100 000 \$ au comptant ont été contribués par la province, Pêches et Océans Canada et Parcs Canada. Une contribution additionnelle de 70 000 \$ en nature est venue de ces organismes et de Conservation de la nature Canada. Les mesures ont été réalisées en 2007 et 2008.

Hectares BC, projet pilote en vue d'élaborer un système pour analyser les données géospatiales concernant le secteur des ressources naturelles, permet à tous ceux qui y ont accès par le Web de visualiser, de télécharger et d'analyser de grandes quantités de données à l'aide d'un outil d'interrogation. Le système permet aux spécialistes de l'analyse des données géospatiales comme à ceux qui ont une connaissance limitée des données et outils géospatiaux ou un accès restreint à ceux-ci d'effectuer des travaux de modélisation et d'analyse opportuns, transparents et reproductibles à l'aide de données centrales. L'outil permet d'économiser du temps lors de l'acquisition et de la diffusion des ensembles de données, de la réalisation des analyses et de l'élaboration de modèles géospatiaux et de cartes thématiques, tout en favorisant la collaboration.

L'étude se penche également sur les avantages pour des organismes provinciaux, soit le bureau de gestion intégrée des terres (GeoBC), le ministère de l'Environnement et le ministère des Forêts et des Pâturages, et pour un organisme fédéral, Agriculture et Agroalimentaire Canada. Dans le rapport, toute mention relative au personnel renvoie à la situation au début de l'étude, avant la restructuration du gouvernement de la province.

Les coûts cumulatifs du projet décennal s'élèvent à 903 767 \$. Ses avantages globaux s'élèvent à 10 680 851 \$, et sa valeur actualisée nette de 9 777 084 \$ affiche un RCI calculé sur une année de 108 %. La période de récupération est de trois ans et le seuil de rentabilité devait être atteint en 2010. Le principal avantage du projet est l'accroissement de la productivité du personnel au ministère des Forêts, suivi d'une réduction du coût de l'acquisition des données destinées aux évaluations environnementales.

L'analyse concernant les organisations non gouvernementales (ONG) a été effectuée séparément. La valeur actualisée nette pour les ONG s'élève à 14,5 M\$, et la période de récupération est de deux ans. Le principal avantage du projet est la valeur de conservation accrue des terres achetées, suivi d'une plus grande crédibilité scientifique entraînant un plus grand apport de fonds. Les RCI calculés sur une année sont disproportionnés, étant donné le financement de contrepartie obtenu pour un projet principalement provincial, et n'entrent donc pas en ligne de compte dans l'analyse.

L'analyse concernant les Premières nations est également distincte. La valeur actualisée nette de 100 589 \$ affiche un RCI de 54 % pour les applications actuelles. Le principal avantage conféré est la possibilité pour Hectares BC de contribuer à la prestation de l'information nécessaire pour planifier la gestion des ressources, ce qui permet d'éviter les renvois pour évaluation environnementale. L'étude a permis de déterminer que la valeur actualisée nette pourrait atteindre 4,1 M\$ si des améliorations étaient apportées et si l'utilisation était étendue à 30 Premières nations.

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Conclusions : Selon l'étude, le grand nombre d'utilisateurs procure d'importants bénéfices. Des avantages supplémentaires potentiellement nombreux pourraient découler d'une utilisation accrue en vue de transformer les processus opérationnels actuels associés aux allocations de mise en valeur des ressources, aux évaluations environnementales et aux renvois par des Premières nations. Il est également justifié d'enquêter sur l'expansion de l'utilisation à d'autres secteurs comme ceux de la santé et des sciences sociales. Même modestes, l'amélioration des applications et la croissance du nombre d'utilisateurs pourraient entraîner une hausse majeure des RCI, comme le démontrent les divers scénarios d'analyse utilisés.

Introduction to the Case Study

GeoConnections has been a partner in the development of the GITA Return on Investment methodology, sponsoring a portion of the original case studies. As the methodology continued to develop and more U.S. case studies were conducted, GeoConnections became interested in sponsoring additional case studies suited to its mission in Canada. It issued an RFP in August, 2009, for consulting services to create a Geospatial Return on Investment Project and awarded a contract to Mary Ann Stewart at Nova Blue Inc. of Kansas City, MO, to perform this work. The first case study was delivered on March 31, 2010. The contract was extended on April 2, 2010, to include four additional case studies to be completed by March 31, 2011.

Hectares BC, developed by a partnership led by Biodiversity BC, is the third of the contract extension studies. The case study was authorized by GeoBC as the participating lead agency on July 6, 2010. A kickoff phone conference was held July 26, with participation from Tim West, GeoConnections, and Greg Lawrance, GeoBC at the Integrated Land Management Bureau.

Preliminary phone interviews were conducted with Hectares BC stakeholders in September and October, 2010. Ms. Stewart made a three-day site visit to Victoria, British Columbia, October 5 through October 7, 2010, to conduct an ROI training session and participate in on-site interviews to collect metrics for the financial analysis.

On-site interviews were held with: Greg Lawrance, GeoBC; Andrew Harcombe and Sara Howard, Nature Conservancy Canada; Scott Trusler, Stantec; Steve Young, Westland Resources Group; Tim Salkeld, Ministry of Forests; Marvin Eng, Forest Practices Board; and Nancy Densmore, Ministry of Forests. A one-day training session was held October 6, with attendees: Dave Nicholson, Black Coffee Consulting; Nancy Densmore, Ministry of Forests; Per Wallenius, GeoBC; Steve Kachanoski, GeoBC; Susan Westmacott, GeoBC; Greg Lawrance, GeoBC; Matt Austin, Ministry of Environment; and Malcolm Gray, GeoBC.

Follow-up phone interviews were conducted from October, 2010, through February, 2011. Participants include: Kristina Robbins, Ministry of Environment; Orville Dyer, Ministry of Environment; Matt Austin, Ministry of Environment; Sara Howard, Nature Conservancy Canada; Larry Joseph, FORREX; Lew Greentree, Ministry of Forests; Jim Munroe, Community of Maiyoo Keyoh; Charlie Short, Ministry of Natural Resource Operations; Glen Davidson, Ministry of Environment; David Carruthers, PlanLab; Cody Crocker, Ministry of Forests And Range; Deepa Spaeth Filatow, Ministry of Environment; Michael Ryan, Ministry of Forests; Will Burt, Ministry of Forests; Andrew Harcombe, Nature Conservancy Canada; Tory Stevens, Ministry of Environment; Grace Frank, Agriculture and Agri-Food Canada; Marian Adair, The Nature Trust; Dan Buffett, Ducks Unlimited; Valerie Cameron, Regional Water Manager; David "Archie" Riddell, Environmental Assessment Office; Nancy Elliot, Ministry of Forests; Laura Kristiansen, Ministry of Natural Resource Operations; Laurie Whitehead, Heiltsuk Integrated Resource Management Department; Frank Brown, Heiltsuk Integrated Resource Management Department; Jennifer Carpenter, Heiltsuk Integrated Resource Management Department; Larry Reed, Heiltsuk Integrated Resource Management Department.

The Hectares BC Project

Hectares BC was a pilot project to test the concept of a new tool for geospatial data analysis in the natural resource area. It is a web-accessible application with a query interface that allows users to obtain statistical tables and maps based on easily formed queries. Hectares BC improves access to geospatial data for a wide range of clients and delivers timely, consistent analytical responses. The system builds on and extends the provincial government's BC Geographic Warehouse.

GeoConnections provided \$150,000 in funding for this project, which was matched by \$100,000 cash contributions from the BC provincial government, Biodiversity BC, Fisheries and Oceans Canada, and Parks Canada. Nearly \$70,000 of in-kind contributions were made by these agencies and the Nature Conservancy of Canada. The project was developed in four milestone stages from July 2007 through June 2008, with Biodiversity BC (aka the Conservation Planning Tools Committee of the BC Trust for Public Lands) as project sponsor, The Nature Trust as banker, and Matt Austin of Ministry of Environment as project manager. At the conclusion of the GeoConnections project, the Hectares BC pilot was fully functional and available online, with hosting provided by The Nature Conservancy of Canada. Hectares BC currently houses 1800 data sets and has served over 18,000 queries.

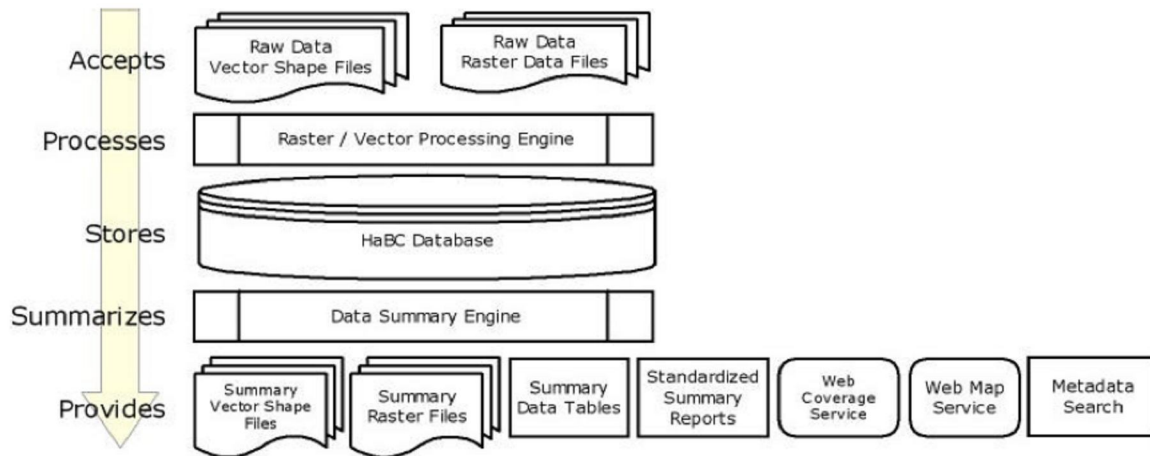
Biodiversity BC provided the organization for building Hectares BC. Initial stakeholders were: Conservation Planning Tools Committee, Fisheries & Oceans Canada, Integrated Land Management Bureau, Ministry of Environment, Ministry of Forests and Range, Nature Conservancy Canada, and Parks Canada.

The system divides the Province into 95 million one-hectare (100m X 100m) cells, and calculates key metrics of environmental conditions (e.g. length of road, age of forest, steepness of terrain, average temperature, land ownership, expected species habitat) for each cell. Conceptually, each cell is considered a unique feature and corresponds to a row in a database, with the columns of the database providing attribute values. Both vector and raster data sets from a variety of sources can be transformed into this canonical raster form. The associated metadata is also retained in a unified fashion in the database.

Users can submit queries and get tabular responses and raster maps as outputs. These outputs may constitute the final results or may be passed into other tools, such as specialized analysis routines, statistical packages, image analysis systems and geographic information systems.

By making analytical services directly available to external clients, Hectares BC benefits the government and the public by reducing wait times and demands on government services. The application has a wide user base that includes staff within provincial agencies, the Forest Practices Board, private consulting companies, and universities. It is being used by professionals with access to full analytical capacity to answer questions faster and by those with little training in geomatics and no access to GIS software or data.

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Hectares BC eliminates delays associated with accessing analytical resource capacity and provides a common analytic framework, enabling users to receive repeatable results from a documented methodology. Traditional processes for producing geospatial information have been project based: raw data are assembled from multiple sources; an overlay with the analysis unit(s) is carried out; metrics are calculated and a report is written. The project datasets, analytical models and resulting datasets are typically stored on an individual desktop or agency fileshare or placed on an agency FTP site. When new geographic areas are of interest, or different attributes or metrics are required, the entire project process is often repeated.

Hectares BC provides transformational technology. In the present business process there is little awareness of the use of data, because data is typically downloaded and used within an analytical tool that is detached from the warehouse. By exposing and leveraging existing datasets in the BC Geographic Warehouse, Hectares BC can help agencies understand the inherent value in data that is collected and distributed. By seeing directly where data is being used, an opportunity is provided for those examining it to help improve government data.

Hectares BC was also used to pilot the use of the Conservation Framework in statutory decision-making regarding development proposals within the Resource Management Conservation Project (RMCP), for providing information regarding the incidence of species and ecosystems to clients. The Conservation Framework was developed to support resource managers and practitioners in setting priorities related to conservation issues and the allocation of limited resources. Hectares BC provides a tool for determining which of approximately 1,800 high priority species and ecosystems may occur in a given area and facilitates access to information on those conservation values.

Hectares BC presents a system that allows multiple environmental analysts to share information about the state of the land and water in British Columbia, prepare summaries of that information, and extract the raw information for use in more complex modeling routines. As queries and data are directly available, it encourages and simplifies the process of collaborating on geospatial analysis and dataset creation.

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The resource sector funded the development of the application and accordingly the system primarily contains environmental and resource datasets. Expansion to other sectors such as human health and social and economic sciences are now being contemplated. Linkages between disease occurrence and environmental conditions could be easily explored as could relationships between social, demographic and economic statistics once these data are made available. Given the simplicity of use and ease of access it is anticipated that if made available wide spread use and adoption for decision support in the non-resource sector could return significant benefits.

Although Hectares BC now provides measurable benefits to the resource sector, the provincial government views the current system as a pilot or prototype as maintaining currency of dynamic datasets is a manual process. Design effort is now underway to ensure closer integration between Hectares BC and the BC Geographic Warehouse datastore.

Benefits to Routine Processes Using Hectares BC

Twenty-one staff in four ministries were interviewed regarding benefits they have experienced from use of Hectares BC. This study presents strong contributions in the area of productivity benefits due to use of the tool by many staff members. An in-house study showed 95% saving of staff time when analysis is done by Hectares BC and this metric was used in calculating GeoBC staff productivity benefits. Other metrics used are based on information from interviews regarding specific uses of the tool. Ministry of Forests had the greatest number of interviews, representing diverse sectors of the organization, and thus this Ministry's benefits are the most complete. Benefits were collected from one Federal agency, which provides a typical Federal use but does not quantify the broad range of benefits from use of Hectares BC by Federal agency staff.

Interviewed Nine Forests staff:

Nine analysts in Forests and Timber Sales save 50% of their annual hours in data preparation and analysis = 49329 hours, providing the largest calculation of productivity benefits. Typical staff members estimate it takes 20 to 50 times longer to do analysis using traditional tools.

Time saved doing long analysis: 17 regional analysts spent 25% of their time doing analytical work for 25% of the projects suited to Hectares BC with 90% time saved = 14008 hours, the third largest calculation of productivity benefits.

Time saved doing analysis for others in organizations: 17 regional analysts each save 40 hours annually = 4760 hours, the fourth largest calculation of productivity benefits.

Interviewed Six Environment staff:

Savings in contracted data acquisition for environmental assessments: \$300,000/year saved by one consulting firm over 6 years = \$1.8M, second largest category of general benefits.

Interviewed Five GeoBC staff:

Fifty staff spend 20% of their time doing analytical work with 20% of their projects suited to Hectares at 95% time saved using results of time study = 27770 hours, second largest category of productivity benefits

Savings on ILMB contracted analysis: 20% of \$265658 in average annual contracts over 8 years = \$425,000.

Interviewed One Ministry of Natural Resource Operations staff: Savings on research & publication effort for large marine studies -- 10 efforts over 6 years X (\$20,000 contracted work + 406 days effort at \$500 day) = \$2.23M, the largest calculation of general benefits.

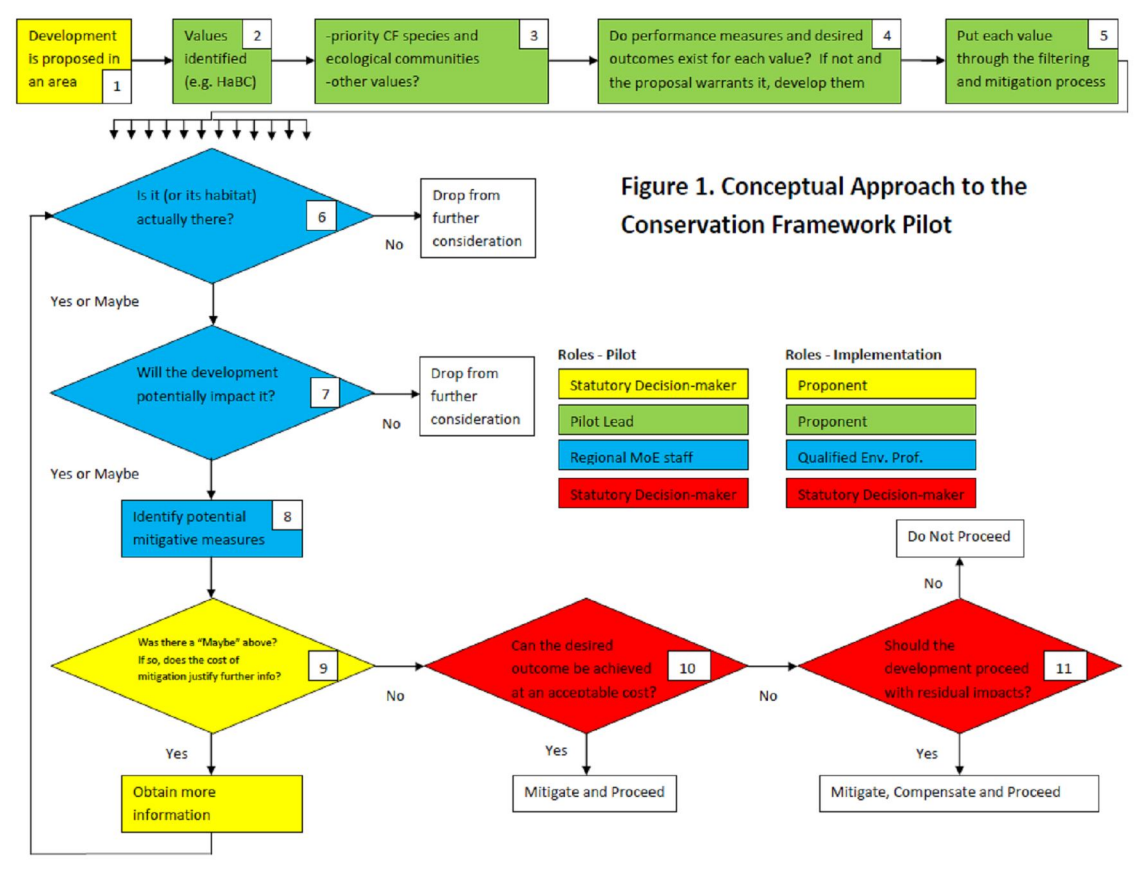
Interviewed One Federal (Agriculture and Agri-Food Canada) staff: 36 hours/year saved doing queries for others and searching for data.

Hectares BC and the Environmental Assessment and Permitting Process

Hectares BC, through the Conservation Framework Pilot, has been studied as a potential tool for improving the efficiency of the environmental review process.

Industrial and commercial proponents of projects must have proposals reviewed and approved by government before permits are granted. The current process requires significant assistance from government to obtain information and review proposals. The Ministry of Environment has been attempting to shift away from responding to referrals, but there continues to be considerable demand on limited staff resources. Turnaround time for referrals can be long and the lack of input may result in decisions leading to unintended conservation impacts and associated damage to the social license of the industry involved.

Under the current process, a referral letter is sent from the statutory decision-maker's agency to the Ministry of Environment's regional Ecosystem Section staff describing the proposed activity. Regional staff review the proposed activities regarding important values such as species and ecosystems and provide a response letter to the referral. This process requires considerable staff time, contributes significant time lag to the decision-making process, leads to inconsistent results, and may not provide balance between conservation impacts and socio-economic benefits.



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The Conservation Framework pilot was designed to address the following questions: 1) Could using the Conservation Framework in the statutory decision-making processes result in better conservation outcomes? 2) Are there efficiencies to be gained in time required for reviewing applications, consultation, decision-making? 3) Would the process be more defensible?

A total of 20 decisions were addressed through the pilot. The statutes involved were the *Water Act*, *Land Act*, *Forest and Range Practices Act*, *Forest Act* and *Mines Act*. The time required to generate the initial lists of high priority species and ecological communities from Hectares BC was less than five minutes when coordinates were readily available.

Results from the Conservation Framework Pilot approach were studied extensively and findings were that it generated consistent and more comprehensive species lists than those created using the traditional approach to referrals.

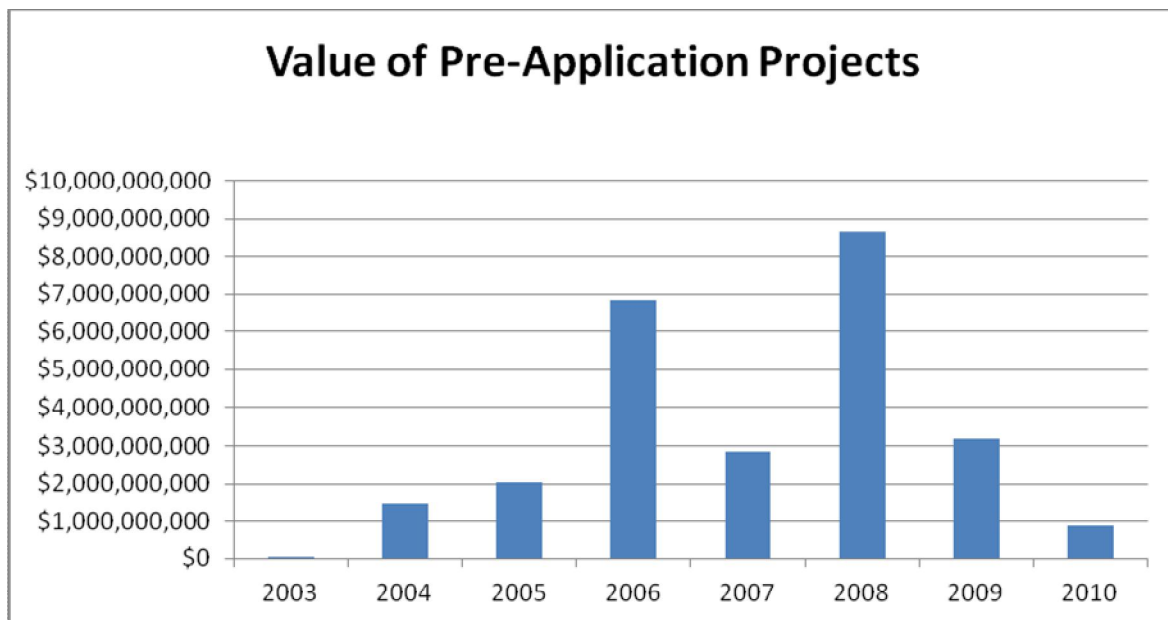
The GeoConnections publication *“Improving Canada’s Geospatial Information Management Capacity for Regional Environmental Assessment”* contributed input to the following benefits list.

Potential Benefits to the Environmental Assessment Process:

- Assists in data dissemination. Hectares BC provides gridded data readily available for review, saving the proponent time to obtain the information and the government time to provide it.
- Provides an efficient means to handle large volumes of data, often covering extensive areas.
- Assists proponents in a decision to place projects in a different location, as they identify conflicts that could require mitigation or locate a more valuable alternate site. This will reduce the effort of the proponent in resubmitting proposals and of the government in reviewing proposals and advising on outcomes. The overall effect is less delay in the permitting process.
- Facilitates integration of information collected by diverse organizations in multiple jurisdictions, at various scales and representing many different times of collection.
- Capture and display of long-term monitoring results aids continuous learning about cumulative effects and results of mitigation and can educate future proposals regarding mitigation.
- Communicates environmental expectations and information requirements to industry.
- Facilitates access by all government reviewers to the best information on a proposed project, including timely integration of new information.
- Fosters collaboration by multiple stakeholders, by providing the capability to share and critique opinions regarding a project.
- Supports key processes such as providing opportunity for public comment.
- Promotes consistent standards for data collection and regulatory decisions. Results include: better decisions for the environment and the public, creation of a more level playing field, less cases taken to the Environmental Review Board or Forest Practices Board or Auditor General, increased ability to have analysis done by consulting firms rather than by government.
- Reduces mitigation costs as a result of better decision making throughout a project’s lifetime.
- Promotes improved decision making, resulting in reduction of conflict between stakeholder groups, and ultimately less need for environmental assessments and less need to consult.

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As the recommendations of the Conservation Framework Pilot have yet to be implemented, it was not possible to collect realized benefits from staff using Hectares BC in place of the current review process. Tangible benefits to the review process are projected for 2011 through 2016 based on average annual value of projects tracked by the provincial Environmental Assessment Office. Average annual value of projects is \$1731M, with considerable variation from year to year, shown in the chart below. Calculation of benefits was made using the assumption that 1.5% of the cost of a project is in environmental assessment, 10% of an environmental assessment involves geospatial work, and 10% of that geospatial work could be done by Hectares BC. The result is a conservative estimate of annual potential savings of \$259,709 from use of Hectares BC in the environmental assessment process.



Use of Hectares BC by Non-Governmental Organizations (NGOs)

Nature Conservancy Canada, Ducks Unlimited, and The Nature Trust participated in interviews for the Hectares BC case study. The three organizations were original partners in Biodiversity BC, the project which provided the funding and organizational structure for the development of Hectares BC. Hectares BC was originally envisioned as a tool to foster collaboration and communication between government, NGOs and other organizations.

Although Biodiversity BC dissolved in 2009, Nature Conservancy Canada has continued to host Hectares BC. There is current discussion of transferring Hectares BC functionality to the Province and this case study makes the assumption that the transfer will occur in 2011.

This case study makes a separate analysis of NGO costs and benefits, as benefits proved to be quite high and do not accrue to the province directly, although conservation projects may involve joint participation by NGOs and government. Net Present Value of the Hectares BC project for NGOs is \$14.5M, with a two-year payback period. The greatest benefit is increased value to conservation from land purchased by NCC, estimated at \$1.3M annual benefits. The next highest benefit is increased scientific credibility leading to greater funding levels for NCC, showing a \$600,000 annual benefit. Annualized Return on Investment values are extremely high, as NGOs can effectively leverage a project primarily supported by the province, without incurring significant internal costs. Thus, Net Present Value serves as the only appropriate measurement of value of the project to NGOs.

Nature Conservancy Canada (NCC) initially anticipated two categories of productivity benefits: 1) simplification of spatial diversity analysis by rasterization, providing an easily used tool for less technical staff; and 2) increased accessibility to thematic data for GIS staff and those they serve. However, discussion of the benefits of better decision making for this case study led NCC to consider much broader benefit categories. Hectares BC provides the ability to query for a number of species in an area, resulting in knowledge of improved approaches to managing an area. The tool holds data sets not available elsewhere on 1500 species and ecotypes.

One of NCC's primary activities is acquisition of land for conservation. Using Hectares BC as a framework for prioritizing purchases will result in increased biodiversity and conservation value. Without Hectares BC analysis, NCC staff would make an educated guess regarding species at risk in a potential area for acquisition, estimating three species at risk in a typical conservation area, when a Hectares BC analysis would provide eight species. A conservative estimate shows Hectares BC analysis could increase the value of a conservation purchase by 25%. Each year NCC makes four to six decisions to acquire land out of three to four times as many opportunities. This financial analysis uses the average annual cost of NCC purchases as the base value of that conservation land. The annual benefit calculated is 25% of the actual value of land acquired for 2009 and 2010, with a projected benefit for future years calculated using the average annual value of land acquired over the past ten years (\$5,396,981).

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Hectares BC analysis capabilities also contribute to an NGO's ability to apply for funding. For example, a recent North American Waterfowl Conservation Association funding opportunity required six species at risk in a proposed focal area and use of Hectares BC made it possible for NCC to reach this threshold for its application. This study calculates a benefit of 10% of the total value of the waterfowl conservation funding (\$2M over three years), a low estimate as use of Hectares BC analysis will open up a variety of funding options in the upcoming years.

In the past, NCC measured its success by dollars raised and acres purchased. These measures are no longer sufficient to prove the worth of the organization's conservation activities. There is an emerging need to show conservation metrics and Hectares BC can be used to help generate such metrics. NCC is currently developing biological metrics of success, stimulated by a reporting requirement associated with Federal funding, but proving to be valuable for a variety of additional purposes.

Having better results from analysis produces better science, raising the credibility of an NGO. Improved organizational credibility may result in more conservation dollars coming in. This study calculates this benefit as 5% of NCC's average annual funding for BC (\$12M).

The Nature Trust is a land conservation organization serving the province of British Columbia for the past 40 years. It was the first land conservation NGO in BC and often partners with government agencies or other NGOs. The Nature Trust was an original partner in the development of Hectares BC as a participant in Biodiversity BC.

This organization uses Hectares BC to make a first cut assessment of what to develop on a property or what is needed to confirm species at risk. This saves time and results in better decisions. The Nature Trust perceives staff time saved from use of Hectares as their greatest benefit. They are able to react faster when a land request comes in or when putting together grant proposals. Although they perceive a number of strategic and tangible benefits from use of Hectares BC, The Nature Trust was not able to quantify their benefits for this study.

Ducks Unlimited focuses on wetlands and thus secures habitat rather than species. This organization works to protect estuaries along the BC coast. Performing Hectares BC analyses keeps staff from missing areas of interest.

Ducks Unlimited finds that more consistent analysis using Hectares BC results in more coordinated conservation efforts. When two parties agree, more resources can be directed toward conservation actions. Having a consistent set of data and analysis methodology allows users to converge on Hectares BC. This provides an incentive to add more data to Hectares BC, which results in improved credibility and reduced criticism.

Having Hectares BC in place means its users can plan to build new models knowing the structure will be there to support the models. Organizations can leverage Hectares BC rather than building new. Better data leads to stronger proposals. Ducks Unlimited also receives less questions from the Ministry of Agriculture regarding agricultural easements when applications are backed up with Hectares BC analysis results.

Ducks Unlimited was able to quantify staff hours saved using Hectares for various activities: reducing the need to quantify data into raster format, having metadata readily available, facilitating data sharing with partners, faster identification of species for agriculture easement approvals, and reduced need for data sharing agreements.

Use of Hectares BC by First Nations

To fulfill its fiduciary duty, the Crown is required to ensure First Nations are consulted prior to making decisions that might involve sale, lease, tenuring, permitting or development activities on lands where First Nations have an interest. Government or companies will refer descriptions of proposed land use changes to First Nations for their consideration and consultation. These consideration and consultation referrals are received by First Nations from numerous government departments and interested parties. The volume and complexity of the work involved in reviewing and considering these referrals can be quite resource intensive for First Nations.

First Nations have leveraged GIS for developing habitat analysis, reviewing proposed activities and placing these changes in context of other resources and their values. For example, a logging proposal can be evaluated for the value of the timber to be extracted, the amount of a watershed to be disturbed or the portion of a habitat range to be impacted. Simply mapping the proposed activities relative to other values that a First Nation may ascribe to an area can be beneficial. Taking the next step to quantify proposed changes can help to put the changes into perspective to allow the assessment of values and risks over time.

Tracking the cumulative impact of many different activities, from many different actors over time, on a common land base, is complex and time consuming. There is a wide range in the capacity and ability of First Nation communities to review and consider referrals proposing changes to land activities and environmental resources. Some First Nations operate relatively large, sophisticated GIS departments or leverage GIS resources from environmental consulting firms or universities, while others may have no access to GIS resources. Those with minimal GIS resources cannot complete independent assessments of proposed harvest or disturbances in a referral.

Addressing land use and resource development decisions through strategic level consultations with First Nations and the appropriate line ministries is a practical alternative to this scenario, provided this process is respected by the Crown and industry, and provided First Nations are equipped with the necessary funding and capacity to meaningfully participate. Some First Nations are also developing their own territorial stewardship plans with the hope that these strategic plans will be harmonized with Crown land use plans. Use of Hectares BC would contribute meaningful input to any of these alternate scenarios as well as providing time savings for First Nations staff in allowing them to monitor changes to the land base and place both individual and cumulative impacts in a larger context.

Larry Joseph, Extension Specialist for Aboriginal Forestry and Indigenous Knowledge at the Kamloops FORREX office, coordinated conversations with a variety of First Nations organizations considering using Hectares BC. Among these were:

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- Community of Maiyoo Keyoh – forest carbon storage project
- Onistot'en – taking over management of their land
- Ecohealth – Dr. Margot Parkes at University of Northern BC
- Treaty 8 Tribal Association – environmental referral process

The Community of Maiyoo Keyoh was available for extended discussion of potential benefits from use of Hectares BC in the referral process. Jim Monroe of Maiyoo Keyoh created an itemized estimate of time for referral response. In consultation with Greg Lawrance, we determined that use of Hectares BC could save 45.6 hours of staff time/referral, out of an average 508 hours spent per referral. Larry Joseph of FORREX estimated that several other communities would save one hour of staff time for 20% of their 5500 referrals that could be reviewed using Hectares BC. The result is a potential annual savings of 1100 hours of staff time.

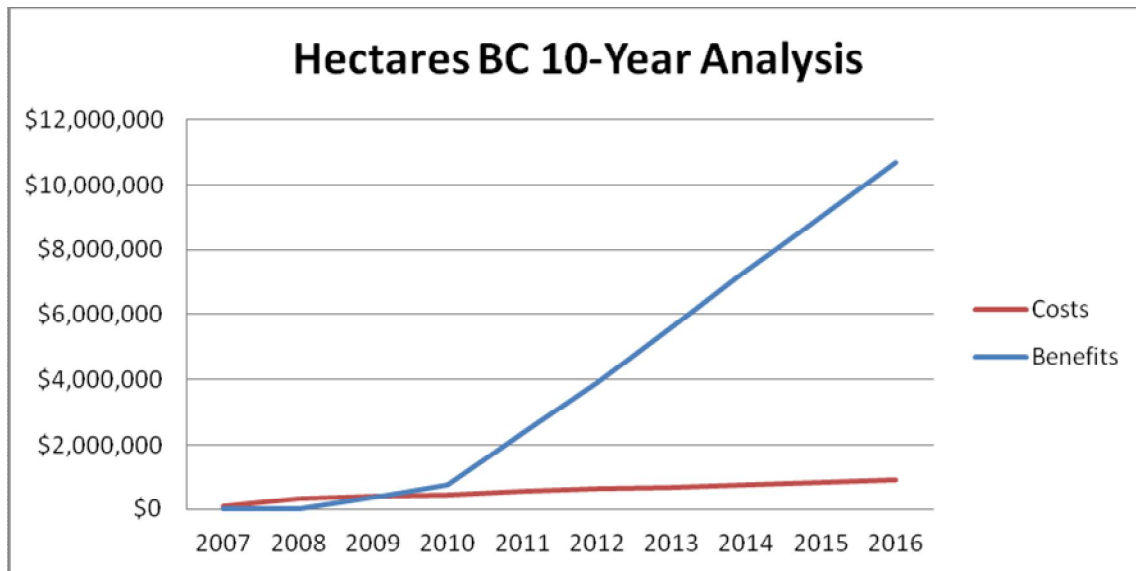
In reviewing the Hectares BC application functionality with First Nations it was determined that there were a number of enhancements that would make the present system a more valuable tool for First Nations for use in referral and resource management activities. Potential enhancements include: creating areas of interest, provision for confidential information, and replication mechanisms to preserve currency and consistency of data from the BC Geographic Warehouse. There is an estimated one time cost of \$100,000 for making these enhancements.

Further analysis of the use of Hectares BC in the referral process could leverage a 2008 GeoConnections project, *“Improving Aboriginal Consultations and Information Sharing Through the Development of a Google-based Web-mapping Application - Needs Assessment.”*

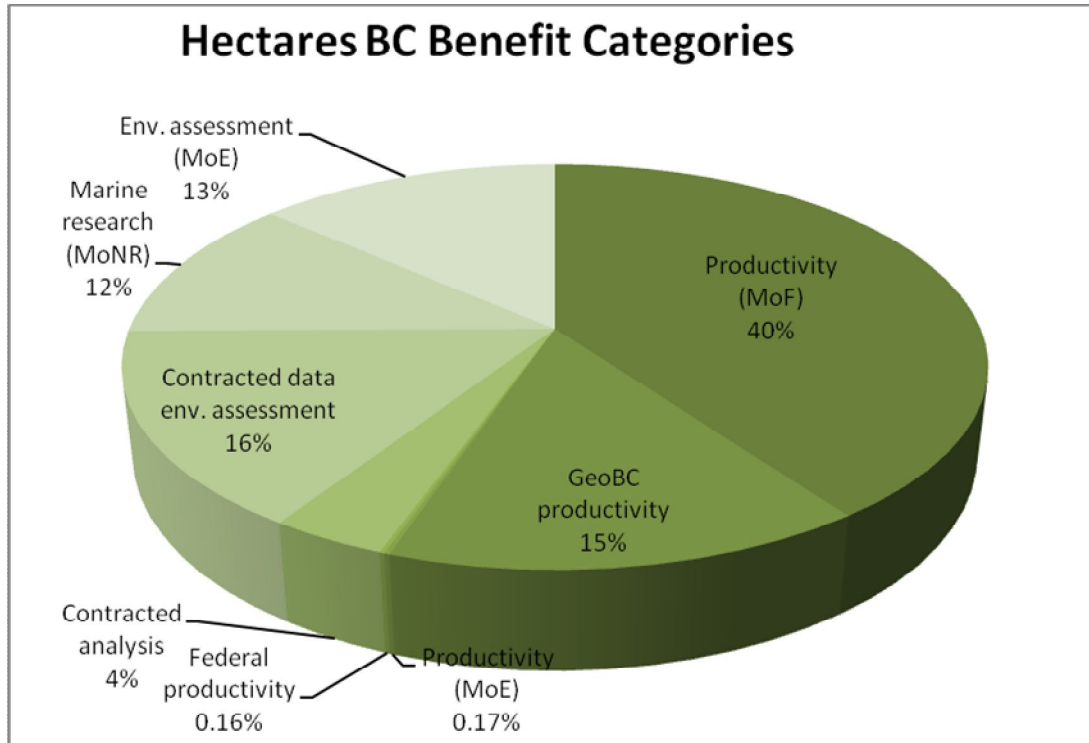
Financial Analysis

Forward-Looking Ten-Year Financial Analysis of Hectares BC

Initial startup costs to develop Hectares BC were \$319,735, which includes \$150,000 in funding provided by GeoConnections. There is an estimated cost of \$20,000 in 2011 to develop the next version of the product, G2E. Annual costs to maintain Hectares BC architecture in its current state going forward include \$22,500 for ongoing maintenance and \$960 for hosting.



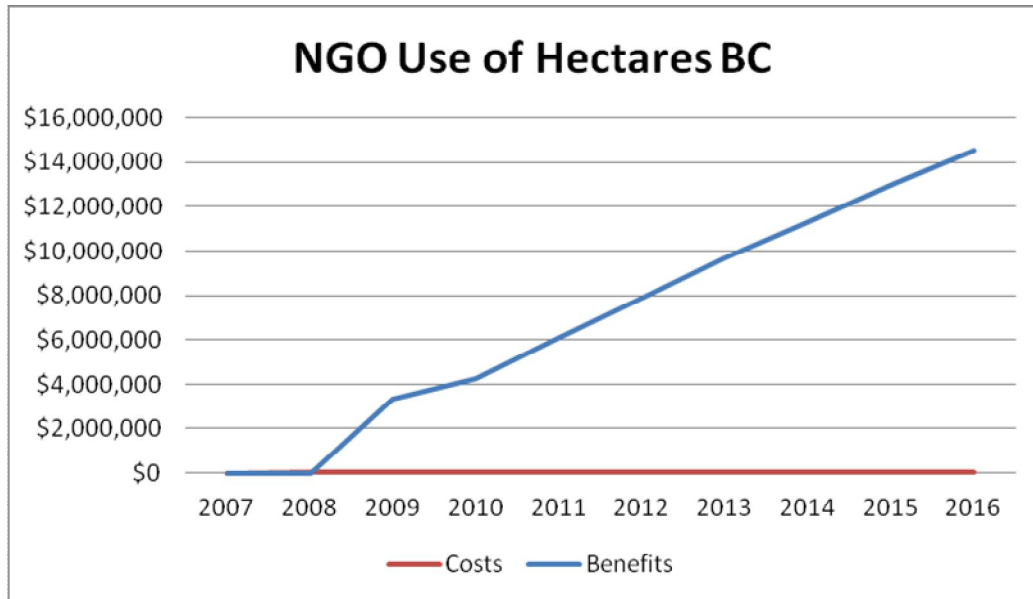
Cumulative costs for this forward-looking ten-year project are \$903,767. Cumulative benefits are \$10,680,851. Net Present Value is \$9,777,084 with an annualized Return on Investment of 108%. Payback period is three years with breakeven point in 2010.



Analysis of Hectares BC shows greatest benefits, \$4.6M, are productivity benefits to Ministry of Forests staff. The second greatest benefits, \$1.8M, come from savings in contracted data acquisition for environmental assessments.

Forward-Looking Ten-Year Financial Analysis of Hectares BC as Used by NGOs

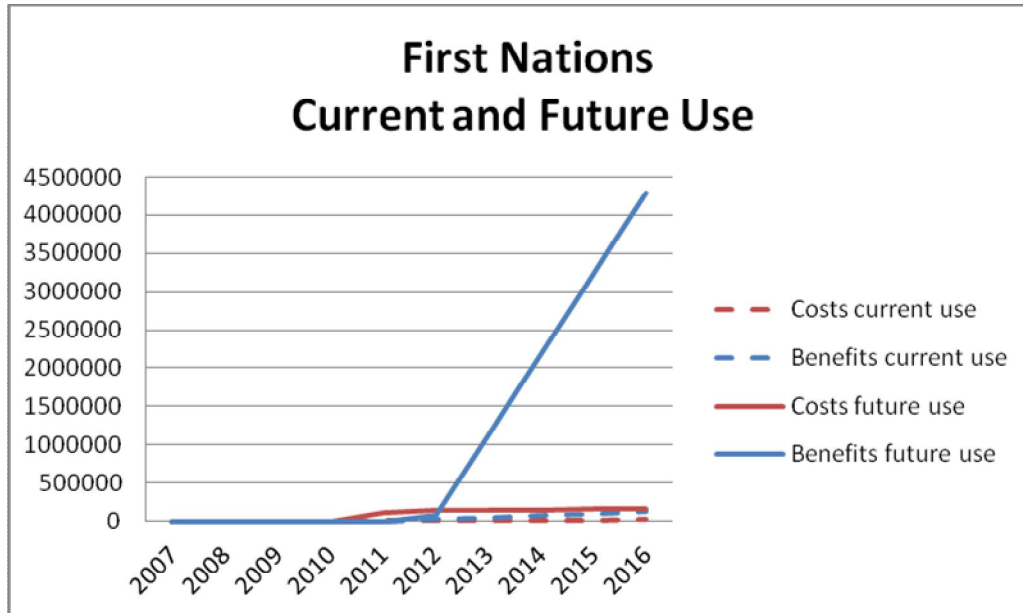
Cumulative costs to NGOs for this forward-looking ten-year project are \$12,478. Cumulative benefits are \$14,534,121. Net Present Value is \$14,521,643. Payback period is two years with breakeven point in 2009. Annualized return on investment for NGOs, which are able to leverage work done primarily by the province for decision making regarding large land purchases, is so high as to present a meaningless value. A typical annual benefit to NCC for improved decision making regarding land acquisition is in excess of \$1.3M.



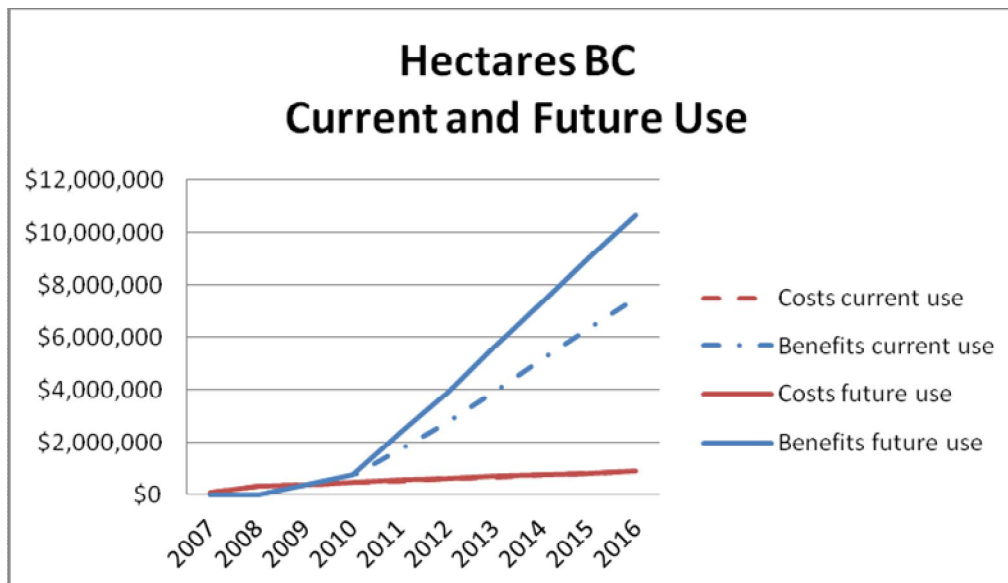
Forward-Looking Ten-Year Financial Analysis of Hectares BC as Used by First Nations

Cumulative costs for First Nations using current Hectares BC capabilities are \$18,793. Cumulative benefits are \$119,381. Net Present Value is \$100,589. Payback period is five years with breakeven point in 2012. First Nations would not begin to use Hectares BC until 2011, resulting in a one year payback period. Annualized return on investment is 54%.

An alternative scenario was done for First Nations benefits with additional enhancements to Hectares BC and use extended from three bands to 30. Cumulative costs are \$154,468. Cumulative benefits are \$4,284,846. Net Present Value is \$4,130,378. Payback period is six years with breakeven point in 2013, again with delayed benefits from delayed adoption of the tool, in this case compounded by development costs for the enhancements. Annualized return on investment is 267%, showing dramatic return due to leveraging the technology for multiple users.



Alternate Scenario – Current and Future Use Analysis of Hectares BC for the Province: A forward-looking ten-year analysis was done to show only benefit categories currently being realized. This analysis provides a way to look at the potential for Hectares through increased use in diverse program areas, particularly in the environmental assessment review process. The current use analysis shows \$6.6M Net Present Value, 75% annualized ROI and a payback period of three years. The future use analysis shows \$9.8M Net Present Value, 108% annualized ROI and a payback period of three years. Costs to provide enhancements needed for the future use scenario are \$20,000, such a small increase in costs that it is barely indicated on the following chart.



Strategic Benefits

Based on the experience of ROI case studies using the GITA methodology, a strategic benefit is any benefit not yet quantified. Strategic benefits may become quantifiable benefits once suitable metrics are discovered or further experience has been gained with the application under analysis. It may never be appropriate to quantify certain types of public benefits, but it is useful to take note of strategic benefits in anticipation of their quantification in the future.

Noteworthy strategic benefits discovered during the Hectares BC financial analysis include:

Enhanced conservation efforts – Increased protection to the environment, through reduced risk to species and ecosystems, due to the ability to query areas being considered for land acquisition and management and use the results to optimize decision making.

Improved reliability of government information and decisions – Having documented and consistent data sets and methodology for analysis results in reliable scientific information coming from the government.

Geospatial analysts' time freed to work on more sophisticated analysis – There is value in having analysts' time engaged in more sophisticated, higher order analysis, which might never be accomplished if they are overwhelmed by staff requests, many of which can now be self-served using Hectares BC. Applying a more powerful skill set to difficult questions will provide better results for analysts' agencies and the public.

Geospatial analysis performed for more projects – Enlarging the community able to do geospatial analysis will result in more analysis being done. If a query can be created easily and results obtained quickly, more people will ask more questions, and the provincial data sets will be put to greater use. Scientific understanding will be increased by more scenarios being run, potentially leading to better decisions

Data improved by use for analysis – Greater viewing of data sets by more sets of eyes will result in more detection of errors and discrepancies, leading to better data quality. Data that is examined only occasionally, by few analysts, is less able to benefit from data users' examination of the metrics supporting their results. Rapid access to graphic display of data means more people will use it and makes error detection more likely. .

Promotes data sets that remain stable over time – Hectares BC addresses a concern that someone will change a data set, using different units or unknown methodologies, thus making an analysis invalid. Having the data sets standardized and models presented prevents this type of change or misunderstanding from happening.

Reduces antagonism between agencies doing environmental review – The current approach sends referrals to the Ministry of Environment for review. There may be time delays or inconsistency in recommendations. Hectares BC processes provide timely, consistent results, making for better relationships between agencies, project proponents and the public.

Providing greater efficiency to project proponents -- A streamlined Ministry of Environment referral business process means project proponents will get a quicker response. Placing the

information in the hands of the proponents also enables them to make strategic decisions concerning siting which will could reduce their mitigation costs.

Decision making becomes more defensible for the government – Enabling consistency, transparency, and comprehensiveness of decisions should result in fewer cases taken to court, the Environmental Appeal Board, the Forest Practices Board, or the Auditor General.

Better planning of field work – Better analysis provides potential for reduction in field work done by stakeholders through better planning of this work.

Develop precautionary rather than reactionary approach to invasive species planning – Agricultural and recreational losses to invasive species in British Columbia are significant, as are the costs of eradication. Using Hectares BC to develop strategies for a preventive approach to invasive plant control should result in substantial savings. Studies of invasive plant control show a cost:benefit ratio of 1:100 for prevention and 1:25 for early intervention and eradication. Scotch broom provides the most visible BC invasive species issue, with 190 additional invasive species.

Simplified technical infrastructure – As the system is completely web based, those completing analysis work do not need to install custom software, download large datasets, or back up datasets. They simply require broadband internet access and a modern web browser.

Reduced training costs – While the use of Hectares BC does require some understanding of the basics of geographic analysis, the time required to train someone to complete quantitative analysis and develop thematic choropleth mapping is greatly reduced compared with other systems.

Conclusions

This case study benefits from the time that Hectares BC has been in use. The application was built in 2007-2008 and benefits began to accrue in 2009. Government, NGO and consulting staff who have been working with Hectares BC have a clear idea of the benefits they receive, yet can recall their level of effort previous to its availability.

Analysis of costs and benefits resulted in a number of findings regarding use of this tool for improved modeling and decision making. These include:

- Availability of rasterized data sets provides time savings to ministry technical staff.
- Ability to run queries without sophisticated technical knowledge or software provides time savings to ministry technical staff and those they provide services to.
- Having data sets in a predefined format readily accessible from a stable environment provides savings in redundant data collection by contractors working on government projects.
- Significant savings have been realized for research and publication activities.
- There is potential for significant savings in facilitating an efficient, standardized environmental assessment process for Ministry of Environment and First Nations.
- NGOs are able to leverage the provincial data sets to save staff analytical time and to reap significant benefits in better decision making regarding purchases of conservation land.

Development of alternate scenarios showed large benefits to be gained from relatively small investments in enhanced applications to serve provincial ministries and First Nations. In general, providing the required applications would result in significantly greater use of Hectares BC by those needing access to additional data sets or analysis tools, as well as by organizations demanding greater security provisions for their data. Analysis of several categories of future benefits shows they could be 50% greater than current benefits.

The case study identified areas of strategic benefit which would be beneficial to attempt to quantify in the future. Quantifying the benefits of improved decision making will continue to provide valuable insight into optimal use of the tool. Areas where Hectares BC could clearly contribute to decision making include: the environmental assessment referral process at Ministry of Environment and First Nations, invasive species planning, conservation land planning, and forest management.

Significant areas worthy of further benefits evaluation include: analysis of costs and benefits of self-serve upload capabilities, use by additional ministries, use by Federal agencies, use by academic researchers, the economic development benefit of faster completion of project permitting, benefits to the environment from better planning for protection, reduction in redundant data collection, and optimized planning for field work, expanding use to the non-resource sector for geospatial analysis of health, economic and social statistics.