Group Project Proposal 2016-2017

Proactive Protection: Creating a Conservation Network to Ensure Continued Wildlife Connectivity in the Mackenzie River Basin, the Last of Canada’s Pristine Wilderness.

Proposers:
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Client: Yellowstone to Yukon Conservation Initiative (see above contact information)

A. Objectives

- Develop an array of potential conservation strategies for the Mackenzie River Basin (MRB) by conducting spatial analyses with respect to human land use, natural resources, riparian systems, and caribou habitat in order to maximize ecosystem connectivity and health. Spatial analyses of varying conservation coverage will be used to inform and recommend a practical conservation strategy using caribou as an umbrella species for the protection of ecosystem services provided by the MRB.
- Identify areas at the greatest risk of degradation due to potential future natural resource (oil, gas, precious metals, diamonds, etc.) extraction and associated human development.
- Conduct a cost-benefit analysis of the economic and environmental tradeoffs associated with identified conservation approaches to inform strategic recommendations.

B. Significance

New trends in conservation suggest that current conservation targets are not sufficient to ensure continued ecosystem integrity of protected areas.\(^1\,^2\) The present system of conservation also neglects to account for habitat connectivity, which is required to ensure healthy wildlife populations.\(^3\) Conserving land according to habitat connectivity may be the best way to ensure species can properly react to changes in their environments such as human disturbance and climate change.\(^3,^4\) Riparian habitats—habitats that surround river and stream systems such as wetlands and river associated woodlands—are particularly suited to increased connectivity. By virtue of being at the junction of multiple habitats, riparian ecosystems are also known to have high biodiversity.\(^5\) As these habitats follow river systems, which are naturally connected, riparian habitats are commonly designated as good wildlife corridors through developed regions.\(^3,^6,^7\)

The Mackenzie River Basin (MRB) in the Canadian North has remained relatively undisturbed and is home to an array of sensitive wildlife such as migratory birds, and relict populations of large mammals such as boreal, mountain and barren-lands caribou.\(^8\) Bogs and peatlands serve as the preferred habitat of caribou, a species that is considered an indicator species in northern ecosystems as they are highly sensitive to disturbance.\(^4\) Recent declines in caribou herds in the Canadian North are thought to be a result of population segregation, increased disturbance from development and increased predation.\(^6,^7\) Caribou are thus a priority for conservation. Their wide-ranging movement additionally makes them an ideal umbrella species to help protect preferred habitat for multiple species, and to maintain habitat connectivity and ecosystem services provided by the MRB.

The MRB’s boreal forest and wetlands also serve as enormous carbon sinks. The Boreal forest of the MRB region sequesters enormous amounts of the Earth’s terrestrial carbon within its many peatlands, bogs and permafrost.\(^8\) Non-market values of boreal and wetland ecosystem services such as carbon storage, flood control and water filtration, pest control, and recreation were estimated at $582, $110.7, $5.4, and $4.5 billion respectively.\(^9\) In addition, subsistence hunting on caribou in the Northwest Territories represent a 17 million Canadian dollar/year economic value.\(^10\) The MRB and its associated ecosystem services are facing significant anthropogenic threats as Canada’s reliance on natural resources and associated urban development increases.\(^5\) Urbanization in the southern MRB is threatening many large tributaries including
projects in the basin have produced extensive ecosystems.\(^5\) In addition to potentially devastating losses to wildlife, disturbance of the MRB's ecosystems could severely limit the region's biotic carbon sequestration potential.\(^8\) Despite the impacts of oil sands on ecosystem health, the Canadian economy is reliant on this and other natural resource extraction projects.\(^{11}\) Therefore, the balance between biodiversity, ecosystem service conservation, and economic development is of great importance.

Students on this project will help create a conservation network for the regions of the MRB lying within Alberta, the Northwest Territories and the Yukon Territory, paying particular attention to water and wildlife resources, as well as future threats from the existence of resource deposits in the region. Therefore, the area this project defines as the MRB is in fact 70% of the overall MRB. The last 30% of the MRB lies within British Columbia and Saskatchewan, and will be ignored due to political difficulties inherent in conservation within these provinces. While this project will help the Yellowstone to Yukon Conservation Initiative (Y2Y) further its mission of increasing wildlife connectivity in the Yellowstone to Yukon corridor, it will have resounding benefits for all Canadian peoples and the Canadian economy.

C. Background
The Mackenzie River is one of the world’s largest rivers and its watershed represents a fifth of Canada’s landmass. At least 60% of the area is made up of virgin boreal forest and another 20% of extensive wetland ecosystems. The watershed supplies 11% of the freshwater to the Arctic ocean and is home to two of the largest lakes in the world.\(^5\) While the majority of the area remains untouched, residents and research groups have observed worrying changes in caribou abundances and climate (such as changing river ice thickness).\(^5\) In light of these visible changes to the health of the system, many people of the Northwest Territories (NWT) want to see more environmental protection, and more than 70% want stricter environmental laws.\(^{12}\) Most residents want to designate up to half of the basin that lies within the NWT as off-limit to industrial development.\(^{12}\) The First Nations people of the territory have already begun the process of protecting as much as 26% of the basin within their jurisdictions.\(^{11}\) In addition to Northern peoples, the world community has voiced significant opposition to the pollution potential of large-scale development projects within the MRB such as the Alberta oil sands.\(^{10}\) This opposition has limited world trade of oil sands products and has subsequently had a negative effect on the Canadian economy.\(^{11}\)

Y2Y has been at the forefront of wildlife corridor biology since the 1990’s, and has had a great deal of success in creating wildlife corridors and protected areas throughout the Rocky Mountains.\(^{13}\) Since 1993 Y2Y has helped increase protection in the Yellowstone to Yukon region from 11% to more than 30%.\(^{12}\) Y2Y now proposes to take this same methodology and apply it to the MRB, with the ultimate goal of protecting half of what is one of the last relatively undisturbed systems on earth. This project will have the effect of protecting caribou while helping maintain the ecosystem services of the MRB.

D. Available data
Extensive spatial data about land cover, habitat distributions, human disturbance, geology, mineral deposits, oil and gas deposits, Canadian protected areas as well as First Nations lands designations are available free of charge from the Canadian, provincial and territorial governments including but not limited to:

- CanVec – Vegetation Data for Canada database
- Natural Resources Canada GeoGratis Database
- GeoYukon Database
- GeoDiscover Alberta Database
- Atlas – Government of Northwest Territories Database
- Canada Center for Mapping and Earth Observation
- Forestwatch Canada
- Socioeconomic Data and Application Center Database
Caribou data will be compiled using distribution data provided by the territorial and provincial governments, as well as the 2011 preferred habitat review and the Boreal Caribou Recovery Plan created by Environment Canada.

Data on land use, industrial development potential and the Canadian economy will be retrieved from the Canadian government and will include sources such as The Canadian Land Inventory – Land Capability for Agriculture, Department of Finance Private Sector surveys and Statistics Canada GDP data.

**E. Possible approaches**

A literature based habitat model for woodland, mountain and barren-ground caribou will be created by performing an extensive literature review and using caribou range data. This model will additionally utilize data about land use (e.g. mining, development, oil sands, public and protected areas) and land cover (e.g. vegetation, topography, riverine systems) in the MRB to create spatial models of preferred habitat in ArcGIS. We may also use Maxent, statistical analyses, and other tools to develop species distribution models. These will illustrate potential areas of protection in order to recommend preservation of either 17%, 50%, or 80% of the MRB. 17% is the Aichi conservation target under the Convention of Biological Diversity (current status quo), 50% is the new target based on a growing body of literature, and supported by both the Quebec and Ontario provincial governments, and 80% is the ideal protection percentage in order to ensure prolonged ecosystem health of large systems such as the MRB.1,2,14

We will use existing human footprint, human development, and natural resource deposits to create spatial models in ArcGIS that highlight areas of concern within our recommended conservation areas. We will use cost-benefit analyses to determine the best conservation strategy that maximizes both ecological protection and economic development.

We will conduct a thorough review of current research concerning the potential political and economic inhibitions to the implementation of our proposed conservation actions. A review will be essential to inform the feasibility of our spatial models. The project will result in a compiled informative report that can be used by Y2Y to expedite the process in the conservation of one of the last intact ecosystems on Earth.

**F. Deliverables**

The project will produce a finalized report by April 2017 containing:

1. Spatial analyses and maps depicting connected areas of conservation encompassing 17%, 50%, and 80% of the land area, overlaid with maps displaying human influence, private property, First Nation lands, and areas of current conservation. These maps will identify preferred caribou habitat, locations at risk of human development, and the high-priority locations that will best preserve the integrity of the MRB.

2. An analysis of the economic losses likely to occur as a result of each proposed conservation strategy. Losses will be determined based on reduced potential for natural resource (natural gas, oil, and mineral deposits) extraction and development within the MRB.

**G. Internship**

Y2Y will provide one paid and a minimum of one unpaid summer internship for students working on the project. The stipend for the paid internship will be provided by Y2Y with potential match funding from Canada Jobs. Y2Y staff will provide the interns with a wide set of professional skills through mentoring and opportunities to expand their network in the US and Canada.
Supporting Material

References

Citations


Additional References


Budget and Justification

The $1,300 budget provided by Bren is expected to be sufficient to complete the project.

Client Letter of Support

See attached
January 19, 2016

Group Project Committee
Bren School of Environmental Science & Management
2400 Bren Hall, University of California, Santa Barbara
Santa Barbara, CA 93106-5131


Dear Group Project Committee,

I am writing to express support for the Bren School Group Project Proposal entitled "Proactive Protection: Creating a Conservation Network to Ensure Continued Wildlife Connectivity in the Mackenzie River Basin, the Last of Canada’s Pristine Wilderness". The Yellowstone to Yukon Conservation Initiative (Y2Y) (the "client") intends to offer the group with one paid and a minimum of one unpaid internship but likely two over the summer of 2016. These internships will provide the student interns with significant exposure to applied conservation and help the students gain professional skills as well opportunities to make professional contacts in the Y2Y region. Y2Y has had strong success in obtaining match intern stipend funds through Canada jobs, and will be applying this spring again to help fund the paid intern position.

At this time neither Y2Y nor the student project proposers expect the project to cost more than the allocated $1300 provided by the Bren School. However, if we determine that any additional funds are required throughout the course of the project, Y2Y is committed to try to find additional funding.

Any data in Y2Y’s GIS archive will be made available to students immediately. Y2Y will also make all possible efforts to help the group acquire any additional data it may need. The use of these data are not constrained. Currently available data includes but is not limited to:

- Environment Canada
- CanVec – Vegetation Data for Canada
- Natural Resources Canada GeoGnat Database
- GeoYukon
- GeoDiscover Alberta
- Atlas – Government of Northwest Territories
- Y2Y geographic maps

Y2Y is excited to work with Bren students and is dedicated to the successful completion of this project.

We thank you for your consideration.

Chad A. Seip
Jodi Hilby, Ph.D.
President and Chief Scientist