GREAT NORTHERN LCC PROJECT TEMPLATE 2010

Project Title: Document Fine Scale Linkage Areas and Conservation Delivery in the Northern Rockies of US and Canada

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Partners (name, affiliation, location): Michael Proctor**,** Birchdale Ecological, Kaslo, B.C.**;** Montana Fish Wildlife and Parks; Idaho Fish and Game Department; US Forest Service; British Columbia Ministry of Environment; Montana Department of Transportation, Idaho Transportation Department; The Nature Conservancy, Montana and Idaho; Vital Ground Foundation, Missoula.

Project Summary (3 sentence target): This project is an initiative to secure landscape-scale movement opportunities for multiple wildlife species in the Rocky Mountains of Montana and Idaho and adjacent transboundary areas of British Columbia and Alberta. This movement is necessary as wildlife populations move across the Northern Rockies landscape in response to changes in distribution and abundance of habitats and key foods resulting from climate change. This project has a goal of re-linking all the large blocks of public land in the Northern Rockies for more functional and healthy wildlife communities in response to climate change.

Need: Climate change will cause habitats, seasonal ranges and foods to change in aspect, elevation, and latitude. This project will enhance the movement opportunities for wildlife to follow these habitat and food movements across the Northern Rockies landscape. In addition to movement in response to climate-induced changes, long-term viability for most wildlife species will increase if they have the opportunity to move through low elevation areas and cross highways successfully for purposes of dispersal and for genetic and demographic connectivity. Population connectivity will also increase the resiliency of wildlife populations to climate stressors.

Objective: Identify specific wildlife linkage locations across highways 1, 2, 200, 95 and I-90 in Northwest Montana and North Idaho. Recommend and implement with partners conservation delivery in these areas on public and private lands, and across highways to make these movement areas more permeable to wildlife. Linkage site identification will allow focus of conservation efforts in the most important remaining linkage areas. Use of these areas by wildlife will increase the resiliency of these species and ecosystems to adapt to climate change by providing access to adjacent habitat and maintain genetic connections for adaptation.

Methods:

1. Utilize existing grizzly bear radio collar data from Highway 3 in British Columbia to develop grizzly bear habitat use models that can be extrapolated to Highways 2 and 200 in northwest Montana.

We have been using GPS telemetry methods on grizzly bears in the US-Canada trans-border region since 2004 and have accumulated a good database of grizzly bear habitat use along BC Hwy 3 just north of the US-Canada order. This existing database has been used to develop habitat use models or Resource Selection Function (RSF) models that are in turn used for a variety of ecological and management purposes. In the Hwy 3 area we have used these models to identify backcountry high quality grizzly bear habitat, "core" and front country "linkage" habitat. The linkage habitat identifies the best available options for securing linkage zones through human environments, such as settled valleys containing major highways. Along Hwy 3, this work underpins an ongoing effort to establish formal Linkage Zones (LZ). Using these data, Canada applies special management to secure these areas for wildlife movements. Actions that have resulted from this work include, direct land purchase of strategic lands for wildlife movement, access management within LZs on public timber lands, refinement of timber harvest protocol to reduce bear mortality and provide security, and the strategic education of landowners within LZs to minimize actions that put grizzly bears and other wildlife species at risk as they move through an area. We want to apply this program to the Hwy 1, 2, 200 and 95 and I-90 corridors in Northwestern Montana and North Idaho. The first step is to develop these RSF models from the US border south across Hwys 1, 2, 200, and 95. This will be accomplished using existing GPS telemetry data gathered 2004-2009 north and south of BC Hwy 3 and into adjacent US areas. These data will be modeled and extrapolated into the US across Hwys 1, 2, 200, and 95. These habitat modeling techniques are all published in the primary scientific literature and are the current standard for habitat modeling using telemetry data (Manley et al. 2002, Nielsen et al. 2004, Proctor et al 2008). The process involves spatially explicit (GIS oriented) logistic regression comparing habitat use (telemetry locations) to extensive random sampling (habitat availability). We model 26 ecological, terrain, land cover, and human-use variables in multi-variate, multi-scale analyses to predict habitat use by grizzly bears. In this project, we will build models using over 50,000 telemetry locations and validate models with an independent set of telemetry locations in the areas where spatial extrapolation occurs. This process results in a data-informed objective and predictive assessment of grizzly bear habitat use across a rather large landscape that will identify backcountry core habitat and front country linkage habitat. We also compare overall habitat characteristics in areas where models are developed and extrapolated to insure extrapolations are valid and reliable.

2. Model existing black bear GPS radio collar data from Highways US 2, BC 3, US 95, and ID 1 to identify black bear linkage habitat that would be also useful to inform conservation linkage management for large carnivores and other wildlife species. Additionally, black bears may be good surrogates for determining linkage in areas with few grizzly bears and we will test this hypothesis by comparing results from both species where they overlap along BC Hwy 3.

Because there are few grizzly bears at this time residing in areas closely adjacent to Highways US 2, MT 200, US 95, and ID 1, we may benefit by identifying black bear linkage habitat that would be useful for directing conservation management to improve inter-area connectivity for large carnivores and other wildlife species. We have been deploying GPS radio collars on black bears in the Hwy 2, 3, and 95, areas since 2006 and propose to use that data to model black bear linkage habitat. We have equivalent data for both black and grizzly bears in the Hwy 3 area and will compare model predictions for both species to assess linkage habitat similarity. Our preliminary analysis suggests that places where male grizzly bears cross Hwy 3 are the same locations where male black bears cross. Protecting linkage habitat through human environments

and important connecting valleys may prove beneficial for other wildlife species and the future recovery of grizzly bears in some areas, and for the ability to adapt to climate change at regional and sub-continental scales. The type of analyses that will be used is the RSF modeling described above

3. Begin collaring black bears near Highway 200 and I-90 to provide data for further linkage modeling.

Fifteen GPS radio collar will be placed on black bears on both sides of Highway 200 and I-90. Bears will be trapped during May and June with collars expected to last 2 active bear seasons with collection of collars occurring during October of 2011. Any grizzly bears captured would also be collared, but probability of grizzly bear capture in this area is low. Habitat layers for GIS analysis will be assembled and location data from bears will be modeled with logistic regression to predict where high probability of use habitat extends to or across Highways 1, 200 and I-90. These are the same methods used to model grizzly bears and black bears on Highways 2 and 3 further north. Hair snagging stations for grizzly bears will be operated on both sides of Highways 2, 200, and I-90 as a performance measure of linkage. Sites will be placed on a grid on both sides of the Highway to detect grizzly bear presence and provide a genetic archive for future comparisons and monitoring. Remote cameras would be placed at all sites to provide photographic detection in addition to hair snagging for genetics. Sampling would occur during the summer months of 2010-2012. Collected samples would be sent to Wildlife Genetics International for analysis each year. All activities will be coordinated with the Montana Department of Fish, Wildlife, and Parks, Idaho Fish and Game Department, Montana and Idaho Departments of Transportation, and the Kootenai, Idaho Panhandle, and Lolo National Forests.

4. **Conduct genetic analysis of parent / offspring relationships for the purpose of documenting inter-area migrants and breeding. This process will develop and demonstrate a means of monitoring effective population linkage while providing a baseline regional dataset for future monitoring efforts.**

Genetic analyses from broad-based sampling now allow us to detect bears that migrate from one area to another, in many instances. However, functional connectivity of inter-area migrants requires breeding. Very recently we have developed a method for detecting successful breeding activity of those migrant grizzly bears in the US-Canada trans-border region. We are doing this through definitive parent-offspring analyses. When genotypes of sufficient quality (21 loci for grizzly bears in our region) are used, parentage can be determined with a high level of confidence. Because of our work over the past 6 years, we have an extensive dataset of genotypes for almost all the bears in the region. We have recently expanded our genotypes to 21 loci (up from 15) and have been developing pedigrees for our study animals in the Canadian trans-border area. We have documented the reproductive histories of many animals including those of migrants, and animals that temporarily move into adjacent areas to breed. This type of analysis was used by Kasworm et al. (2007) to document breeding success of bears used to augment the Cabinet Mountains population in NW Montana. This technique offers great promise of monitoring the success (or otherwise) of our management efforts at increasing regional grizzly bear connectivity. We propose to run all our regional genotypes up to 21 loci and complete a thorough regional trans-border analysis of intra- and inter-area breeding. Besides demonstrating the ability of this methodology to effectively monitor movements and breeding activity, this work will provide a baseline database for future linkage monitoring efforts. Genotyping would be carried out at the Wildlife Genetics International laboratory in Nelson BC (used by almost all bear projects

in the region). We will carry out the parentage analysis and produce a report documenting our results and demonstrate its future use as a monitoring tool.

Deliverables:

1. Provide reports with results of the grizzly bear habitat modeling process and the identification of linkage and core areas for Highways US 2, MT 200, US 95 and ID 1 based on data gathered around Highway 3 in British Columbia. In addition to identifying linkage and core areas the report will recommend appropriate conservation actions such as land acquisition, conservation easements, linkage oriented management, sanitation, and public outreach.
2. Provide reports with results of the black bear habitat modeling process and the identification of linkage areas for Highways US 2, BC 3, US 95, and ID 1 based on local black bear data gathered previously. In addition to identifying linkage areas the report will recommend conservation actions such as land acquisition, conservation easements, linkage oriented management, sanitation, and public outreach. Modeling efforts for black bears will be compared with grizzly outputs from deliverable 1 (above) to describe similarities and differences.
3. Collar black bears near Highway MT 200 and I-90 to provide a database for modeling black bear linkage habitat across MT 200 and I-90. Monitor linkage via hair snagging each side of Highways 2 and 200 for genetic analysis. Annual progress reports will be provided by March 31.
4. Conduct genetic-based parent-offspring analysis with expanded genotypes that will result in our ability to detect and therefore monitor movements and breeding of bears across landscape fractures. We will provide a report detailing this procedure and our results for grizzly bears across the fragmenting Highways BC 3 US 95, and ID 1 separating the Purcell and Selkirk Mountains.

Schedule:

1. Analysis, modeling, and grizzly bear linkage zone identification for Highways US 2, MT 200, US 95 and ID 1 would occur during spring and summer of 2010 with a final report provided September 30, 2010.
2. Analysis, modeling, and black bear linkage zone identification for Highways US 2, BC 3, US 95, and ID 1 would occur during spring and summer of 2010 with a final report provided September 30, 2010.
3. Black bears would be collared around Highways MT 200 and I-90 during spring and early summer of 2010 with collar collection in October of 2011. Data analysis, modeling and reporting would occur by spring of 2012. Annually sample both side of linkage zones by hair snagging and genetic analysis with annual reports due by March 31 2011 to detail results. Final results reported in 2012.
4. Grizzly bear genetic analysis would occur during spring and summer of 2010 with a report detailing parent-offspring results and a genetic linkage monitoring plan by December 2010.

Literature Cited

Kasworm, W., M. Proctor, C. Servheen, and D. Paetkau. 2007. Success of brown/grizzly bear augmentation in Northwest Montana. Journal of Wildlife Management 71:1261-1266.

Manly, B. F. J., L. L. McDonald, D. L. Thomas, T. L. McDonald, and W. P. Erickson. 2002. Resource selection by animals: statistical design and analysis for field

studies. Second edition. Kluwer Academic Publishers, Boston, Massachusetts, USA.
Nielsen, S. E., S. Herrero, M. S. Boyce, R. D. Mace, B. Benn, M. Gibeau, and S. Jevons. 2004. Modeling the spatial distribution of human-caused grizzly bear mortalities in the Central Rockies Ecosystem of Canada. Biological Conservation 120:101-113.
Proctor, M, C. Servheen, W. Kasworm, and T. Radandt. 2008. Grizzly bear linkage enhancement plan for the Highway 3 corridor in the south Purcell Mountains of British Columbia. Birchdale Ecological, Ltd., Kaslo, B.C., Canada.

Budget in 2010:

Deliverables #1, #2, and #4. Grizzly bear and black bear Hwy 1, 2, 200, 95, and I-90 linkage modeling and genetic monitoring analysis and technique development	**Annual Cost**
Subcontract for GIS modeling, data analysis, bear monitoring, and genetic data analysis. (This includes salary, travel and per diem, office costs, and GIS mapping costs)	
Project Biologist (Dr. Michael Proctor) 800 hours @ $100 hr	80,000[1]
2 grizzly bear biologists (GIS modeling, data analysis, bear monitoring)	In kind[2]
TOTAL Deliverables #1, #2, and #4.	**$80,000**

Deliverable #3. Black Bear Hwy 200 and I-90 Monitoring for Linkage Identification	**Annual Cost**
Salaries	
Project biologist for aerial radio collar monitoring, data analysis, report preparation	In kind[2]
Two experienced bear capture personnel to support effort and per diem	In kind[2]
2 Field Crew Leaders at $16/hour for 5 months	27,733[1]
2 Field Assistants at $14/hour for 5 months	24,266[1]
1 temporary field assistant at $8/hour for 3 months	4,160[1]
Fringe benefits	
27.5% fringe - 2 Field Crew Leader for 5 months	7,627[1]
27.5% fringe - 2 Field Assistant for 5 months	6,673[1]
13% fringe - Temporary Field Assistant for 3 months	541[1]
Travel	
Per diem for 5 field workers for 5 months	7,875[1]
Operations:	
30 GPS radio collars	60,000[1]
Vehicle gas and maintenance	10,000
6 GPS Units for field crews	2,500
Capture drugs	4,000
Misc capture supplies	20,000
Air tracking flight time	25,000
Genetics lab analysis	15,000
TOTAL Deliverable #3.	**$ 215,375**

Univ. Montana indirect costs @ 10% of items in footnote[1]	**$21,887**
Total budget request FY 2010	$317,262

[1] These items will be funded by adding to an existing cooperative agreement with the University of Montana.

[2] These will be FWS staff personnel from the Grizzly Recovery Program.