Grizzly bears, fragmentation, connectivity, and management in the Canada - US trans-border region

Michael Proctor, Wayne Kasworm, Chris Servheen and others
Walls of Mortality
Grizzly bear linkage enhancement plan for Highways 3 & 3A corridors in the south Purcell and Selkirk Mountains of British Columbia

Researched and prepared by
The Trans-border Grizzly Bear Project
Michael Proctor
Chris Servheen
Wayne Kasworm
Tom Radandt

1 Birchdale Ecological
PO box 606 • Kaslo, BC • V0G 1M0 • Canada • mproctor@netidea.com

2 US Fish and Wildlife Service • College of Forestry and Conservation, 309 University Hall, University of Montana, Missoula, MT 59812, USA

3 US Fish and Wildlife Service
475 Fish Hatchery Road, Libby, MT 59923, USA

March 2008
NCC connectivity properties across Creston Valley

<table>
<thead>
<tr>
<th></th>
<th>Acres purchases</th>
<th>CEs</th>
<th>total acres</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian lands</td>
<td>1051</td>
<td>211</td>
<td>1,262</td>
<td>3,600,000</td>
</tr>
<tr>
<td>Creston Valley</td>
<td>468</td>
<td>211</td>
<td>679</td>
<td>1,850,000</td>
</tr>
<tr>
<td>US lands</td>
<td>71</td>
<td>32,720</td>
<td>32,791</td>
<td>26,565,000</td>
</tr>
</tbody>
</table>
Non lethal management

Table 3. Grizzly bear non-lethal management 2004 – 2015 Creston Valley - Nelson area

<table>
<thead>
<tr>
<th></th>
<th>Managed</th>
<th>alive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Females</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Offspring w mom</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>total adults</td>
<td>13</td>
<td>10</td>
</tr>
</tbody>
</table>

BC Conservation Officer Service has really embraced this program
Non lethal management
Table 4. Electric fences (50% cost share program) Creston Valley – Nelson area

<table>
<thead>
<tr>
<th>Year</th>
<th># fences</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>4</td>
<td>8156</td>
</tr>
<tr>
<td>2013</td>
<td>10</td>
<td>22864</td>
</tr>
<tr>
<td>2014</td>
<td>6</td>
<td>4620</td>
</tr>
<tr>
<td>2015</td>
<td>29</td>
<td>17382</td>
</tr>
<tr>
<td>2016</td>
<td>2</td>
<td>1024</td>
</tr>
<tr>
<td>total</td>
<td>51</td>
<td>54047</td>
</tr>
</tbody>
</table>

This program has expanded regionally, with over 100 fences put up.
The face of connectivity - Females residing in Linkage Areas

Increases need for coexistence programs

May require permanent management effort
Bringing conservation to the people living with it in their face, in their yards

Farmers
Ranchers
Hunters, Birders
Recreationists

Local and Regional government planners workshops

Farmer / rancher workshops and working groups
  Electric fences, composting dead animals, silage containment, personal safety

Bear Fair  we teach use of and sell bear spray,
  demonstrate electric fences

Teach methods for dealing with GBs in their yards, or when hiking, bird watching, or hunting
“Bear Fair” in the Creston Valley
Summer 2016

Coexisting with grizzly bears in the valley

Electric fencing demo
Bear resistant garbage bins
Bear spray training
Bear spray for sale (cheap)
Bear encounter training
Resources for living with bears
Deadstock compost facility in the Creston Valley

Deadstock compost facility in Pincher Cr
Bottom up and Top down conservation

**Bottom up** – out on the land, farms and ranches, and backcountry

**Top down** - in the office, agency, boardroom, government office theory, policy, laws, bylaws, regulations

Both are useful

**Bottom up might be more essential**

Integrate the people, industry, & government in mgt planning and actions

Make linkage areas as common as PARKS
Mortality reduction in Cranbrook-Eureka region
Pedigree analysis to assess and monitor functional connectivity of grizzly bears in the trans-border region of northern Montana, Idaho, Washington, and southern British Columbia

Michael Proctor, Birchdale Ecological
Wayne Kasworm, USFWS
Wayne Wakkinen, Idaho Fish & Game
Chris Servheen, USFWS

Prepared for
Great Northern Landscape Conservation Cooperative
Liz Claiborne Art Ortenberg Foundation
Wilburforce Foundation
Habitat Conservation Trust Foundation
Columbia Basin Fish Wildlife Compensation Program
National Fish and Wildlife Foundation
Yellowstone to Yukon Conservation Initiative

December 2012
Male dispersal
Male breeding across BC Hwy 3
Predicting and mapping huckleberry patches important to grizzly bears

Michael Proctor
Clayton Lamb
Grant MacHutchon
Scott Nielsen
Wayne Kasworm
Chris Servheen
Unified theory of **bottom up habitat selection** and **top down habitat survival**

**The Grizzly Dance of Berries & Bullets**
Grizzly bears need to store fat to reproduce each year

> ~20% body fat to keep young over winter in den
Huckleberries drive much of the regional grizzly bear reproduction and productivity

McLellan & Hovey 1995

McLellan 2011, 2015
The state of our knowledge of the location of our regional GBs most important foods a few years ago.
~40 GBs

Summer GPS locations

Used to find huckleberry patches

Huckleberry patches important to bears
2 summers

Over 400 site visits

277 huck patches
2 summers

Over 400 site visits

277 huck patches
2 summers

Over 400 site visits

277 huck patches
Environmental variables used to predict huckleberry patches used by grizzly bears

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>cofrag_utm</td>
<td>Coarse Fragments in soils</td>
</tr>
<tr>
<td>Canopy_cov</td>
<td>Canopy cover</td>
</tr>
<tr>
<td>PAS_wt</td>
<td>Precipitation as snow (Winter)</td>
</tr>
<tr>
<td>MAR</td>
<td>mean annual solar radiation (MJ m⁻² d⁻¹)</td>
</tr>
<tr>
<td>slope</td>
<td>Slope</td>
</tr>
<tr>
<td>globlrad</td>
<td>Global radiation</td>
</tr>
<tr>
<td>FFP</td>
<td>Frost Free Period</td>
</tr>
<tr>
<td>MAP</td>
<td>Mean Annual Precipitation</td>
</tr>
<tr>
<td>CMD</td>
<td>Hargreaves climatic moisture deficit (mm)</td>
</tr>
<tr>
<td>PPT_sm</td>
<td>Precipitation in Summer</td>
</tr>
<tr>
<td>aspect</td>
<td>Aspect</td>
</tr>
<tr>
<td>PAS</td>
<td>Precipitation as snow</td>
</tr>
<tr>
<td>cti</td>
<td>Compound Topographic Index</td>
</tr>
<tr>
<td>phca_utm</td>
<td>pH of soils</td>
</tr>
<tr>
<td>MSP</td>
<td>mean annual summer (May to Sept.) precipitation (mm),</td>
</tr>
<tr>
<td>fire_cnt</td>
<td>Number of fires in a region since 1900</td>
</tr>
<tr>
<td>Tmin_wt</td>
<td>Temperature Minimum</td>
</tr>
<tr>
<td>tcaly_utm</td>
<td>% clay in soils</td>
</tr>
<tr>
<td>SHM</td>
<td>summer heat-moisture index</td>
</tr>
<tr>
<td>tsand</td>
<td>sand % in soil</td>
</tr>
<tr>
<td>MCMT</td>
<td>mean coldest month temperature (°C),</td>
</tr>
<tr>
<td>Tave_wt</td>
<td>Average Temperature- winter</td>
</tr>
<tr>
<td>DD5</td>
<td>degree-days below 5°C</td>
</tr>
<tr>
<td>Tmax_sm</td>
<td>Maximum Temperature - summer</td>
</tr>
<tr>
<td>SHM</td>
<td>summer heat-moisture index</td>
</tr>
<tr>
<td>MAT</td>
<td>Mean Annual Temp</td>
</tr>
<tr>
<td>Last fire binned</td>
<td>Time since last fire binned into 5 categories</td>
</tr>
<tr>
<td>MWMT</td>
<td>mean warmest month temperature (°C),</td>
</tr>
<tr>
<td>NFFD</td>
<td>number of frost-free days</td>
</tr>
<tr>
<td>orgcarp</td>
<td>organic carbon % in soils</td>
</tr>
<tr>
<td>ph2</td>
<td>soil ph, dissolved using water</td>
</tr>
</tbody>
</table>
Ecological variables

Top variables

Low % coarse soil fragments
Low canopy cover
High Precip as winter snow
High mean annual radiation
Lower slope
Shorter Frost Free Period
Mean annual Precip
Low climatic moisture deficit
High Precip in summer
Aspect
Wet topography
Soil pH
Huckleberry patch layer
Huckleberry patch layer

Within a Resource Selection Function model
RSF with huck layer very predictive for female habitat use
RSF with huck layer very predictive for female habitat use

And With and DNA capture data
Potential for access management

To inform land use decisions

DO NOT DISTURB areas
Potential for access management

Protect a nursery for potential migrants

Potential to manage for huckleberry patches post timber harvest
Integrate with Mortality Risk

Integrate with Reproductive data
Unified theory of bottom up habitat selection and top down habitat survival

The Grizzly Dance of Berries & Bullets
Fine scale sex and season specific habitat use

For land use managers
Papers coming up

Huckleberry patches important to bears, their prediction and mapping in southeast BC

Spatial, temporal, & causal implications of grizzly bear mortality patterns

Fine scale sex and season specific habitat use by grizzly bears across 3 mountain ranges

Unified theory of bottom up habitat selection and top down habitat survival, includes hucks, morts, road densities, habitat use, survival, and reproduction

Black bear fragmentation detected with pedigrees

Black bear connectivity mapping
Our goal is to use science to understand conservation challenges for grizzly bears in the Trans-border southern Selkirk and Purcell Mountains of British Columbia, NW Montana, and N Idaho and implement our researched solutions.

Use this website to see how grizzly bears in this area are doing, what we are doing, and what you can do.
Funders

Habitat Conservation Trust Foundation
Fish & Wildlife Compensation Program
National Fish & Wildlife Foundation
Liz Claiborne & Art Ortenberg Foundation
US Fish & Wildlife Service
Wilburforce Foundation
Great Northern Landscape Conservation Cooperative
Yellowstone to Yukon Conservation Initiative
Nature Conservancy of Canada
Parks Canada
Alberta Ingenuity
NSERC
Killam Trust
Tembec Industries
BC Min of Environment
BC Min of Forests
BC Parks
Creston Valley Wildlife Management Area

Fish & Wildlife Compensation Program