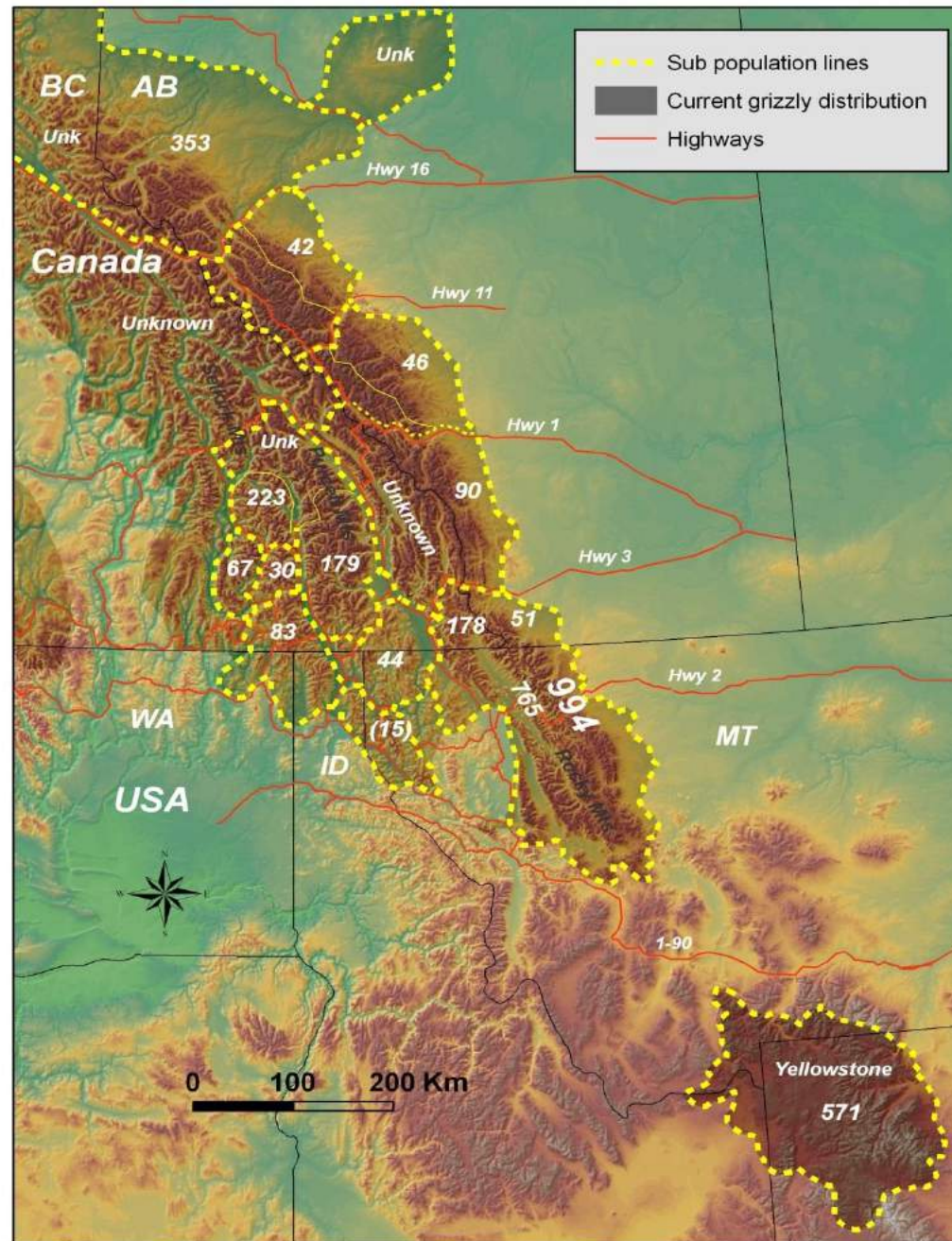


Grizzly bears, fragmentation, connectivity, and management in the Canada - US trans-border region



**Michael Proctor, Wayne Kasworm,
Chris Servheen and others**



Proctor et al 2012

WILDLIFE MONOGRAPHS

Vol. 180, January 2012

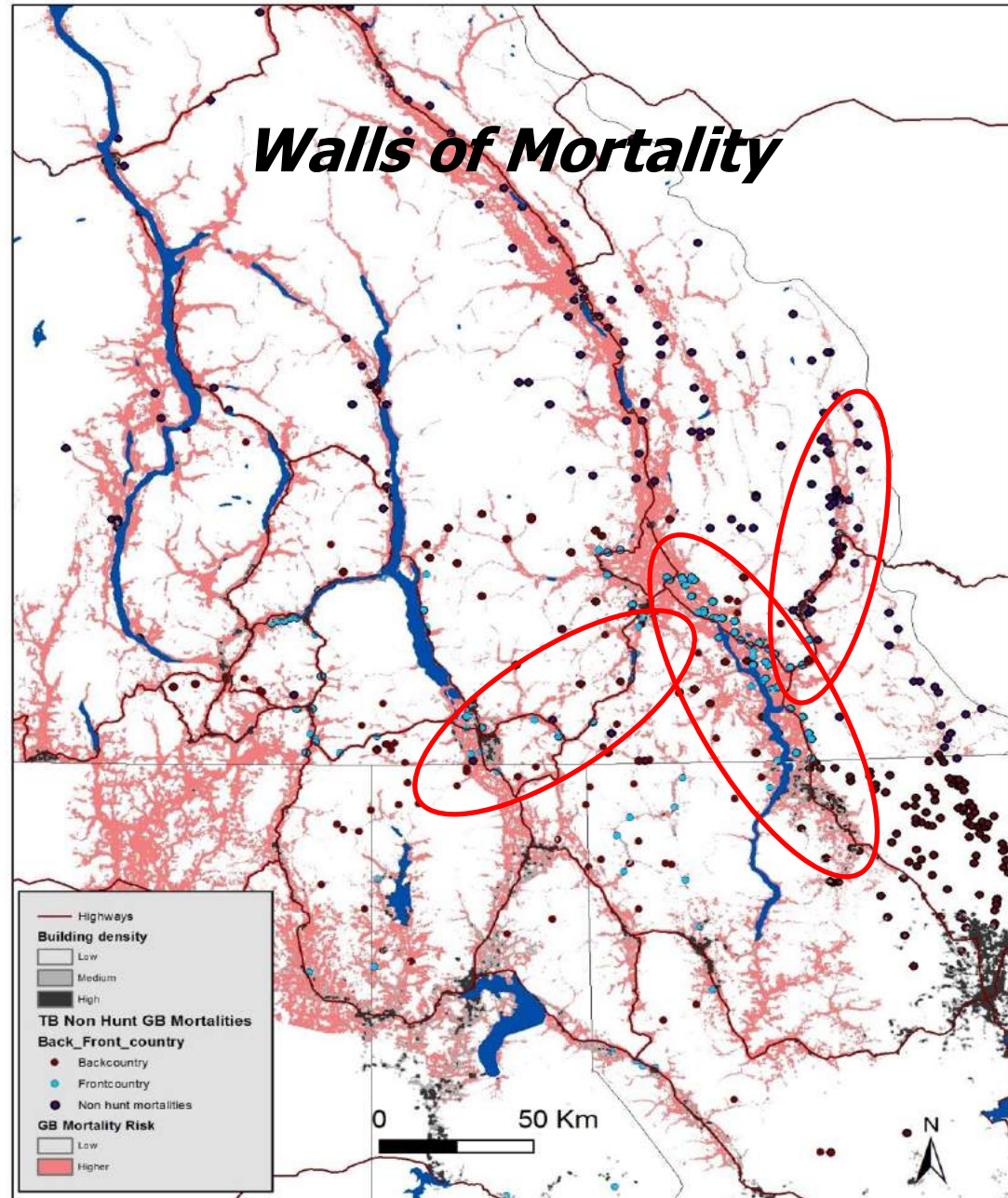


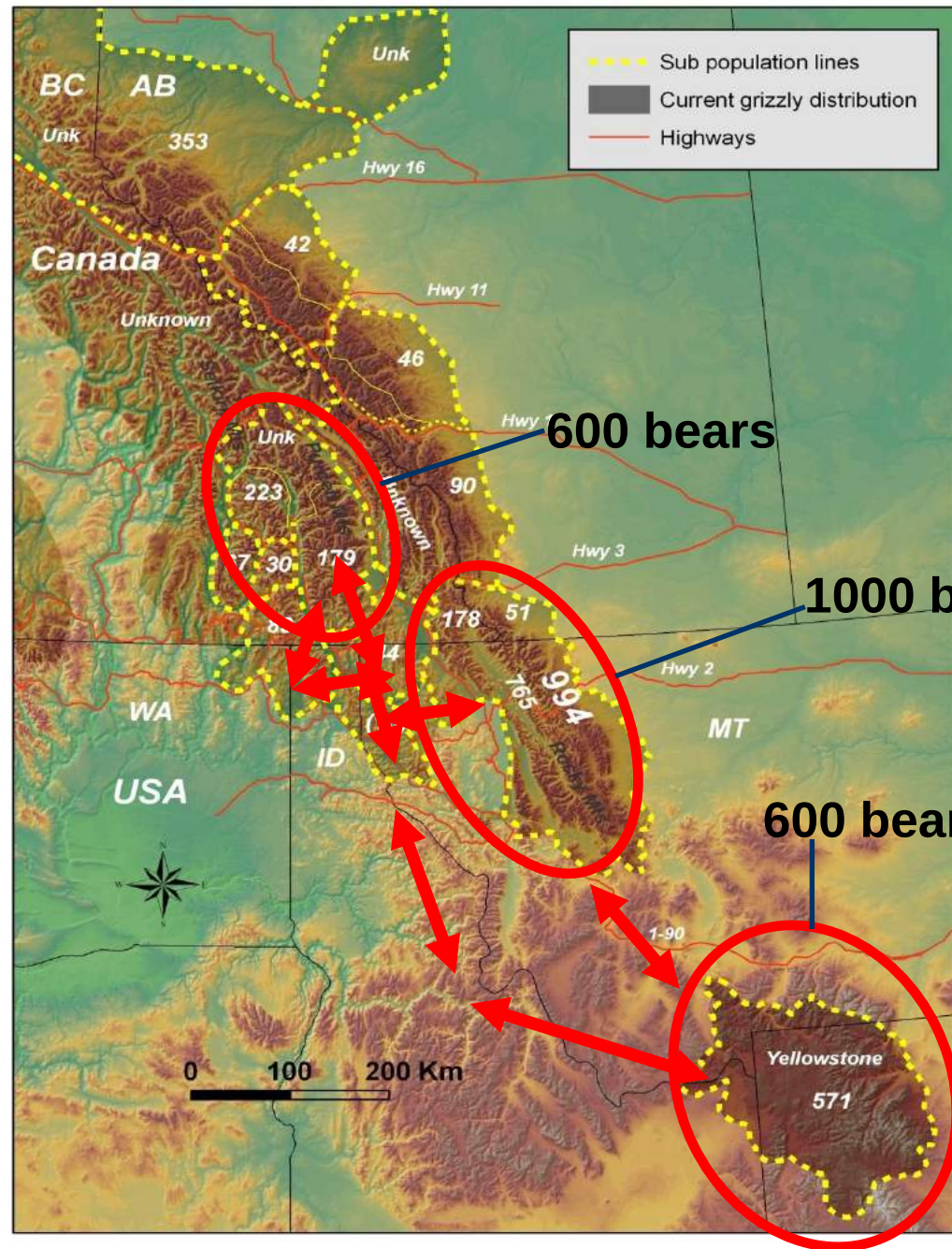
Population Fragmentation and Inter-Ecosystem Movements of Grizzly Bears in Western Canada and the Northern United States

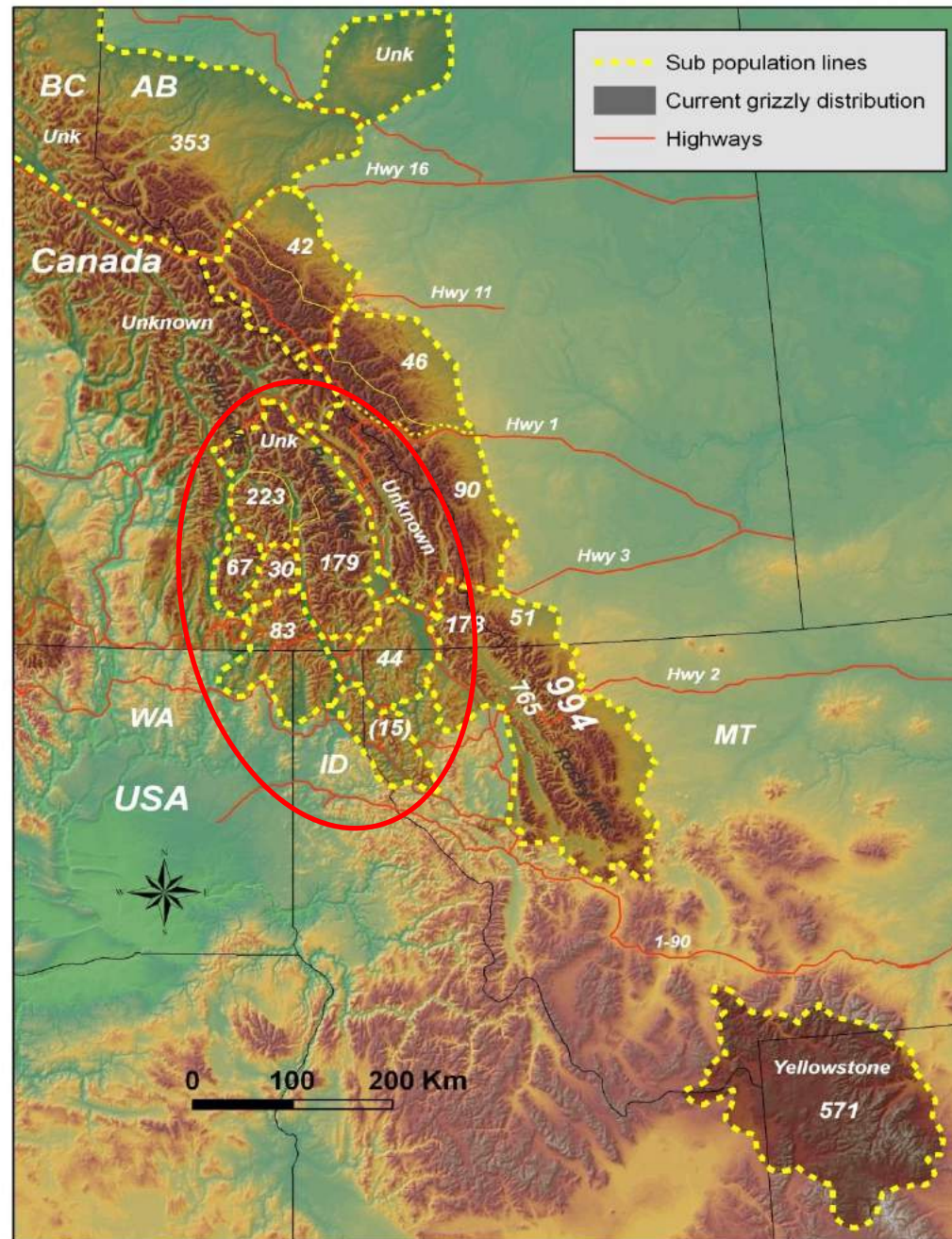
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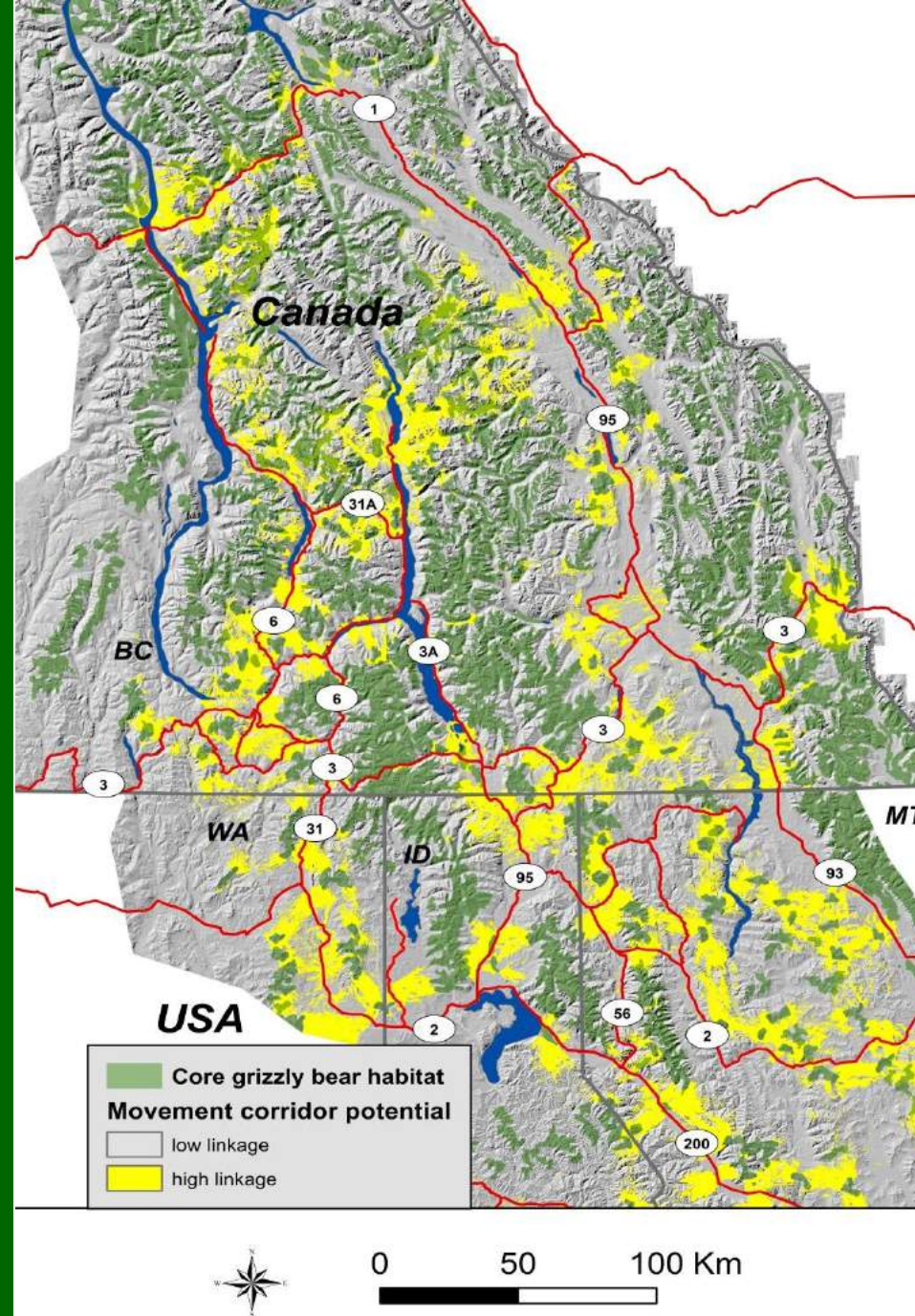


Walls of Mortality







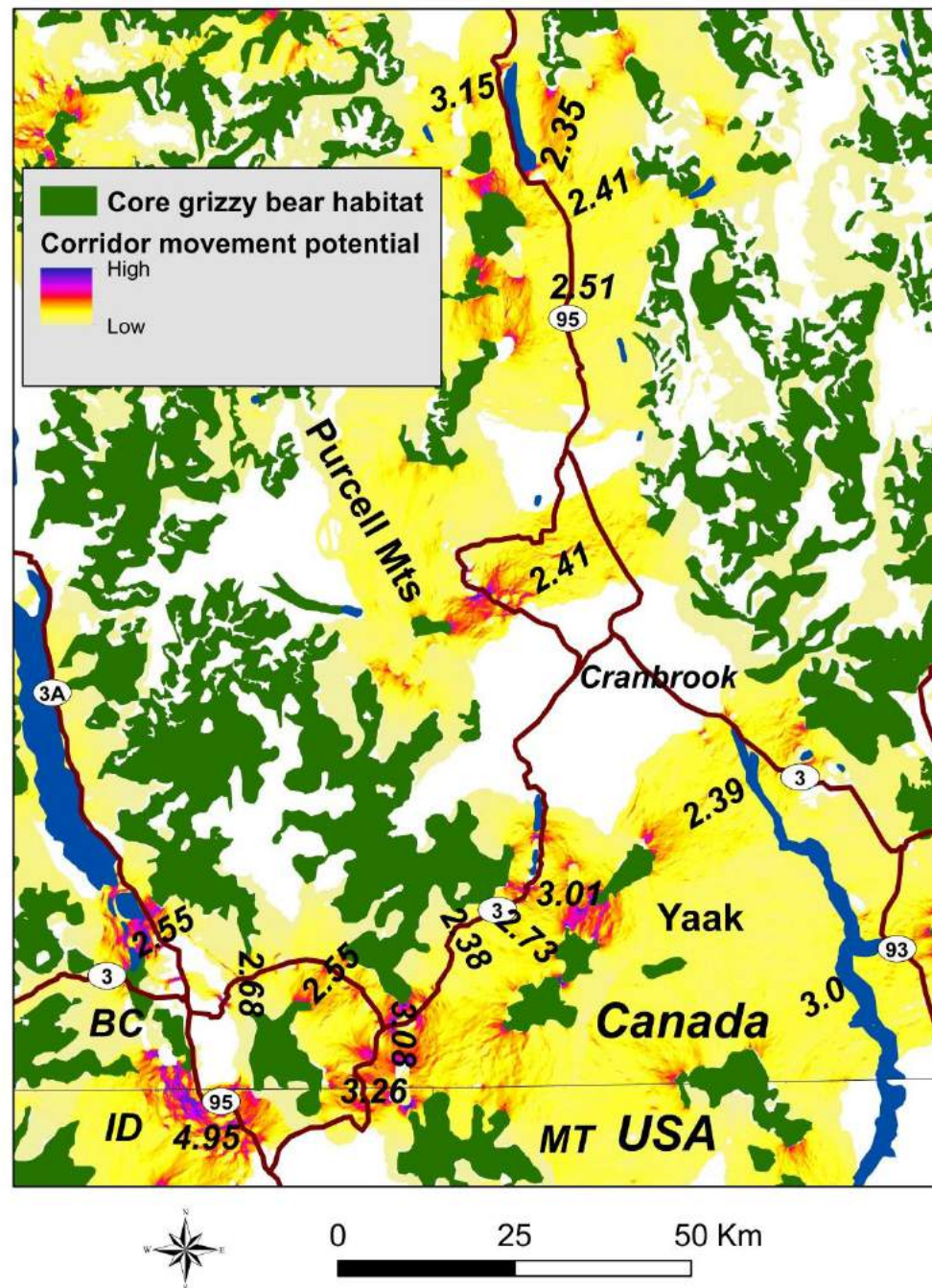


Proctor et al 2015

Grizzly bear connectivity mapping in the Canada-US trans-border region

MICHAEL R. PROCTOR, *Archaeological Ltd., P.O. Box 605 Ross, British Columbia, V0G 2M0, Canada*
 SCOTT E. NIELSEN, *Department of Renewable Resources, University of Alberta, Edmonton, T6G 2G9, Alberta*
 WAYNE F. KADWORN, *US Fish and Wildlife Service, 285 Fish Hatchery Road, Libby, MT, 59923, USA*
 CHRIS SPRADEN, *US Fish and Wildlife Service, College of Forestry and Conservation, 202 University Hall, University of Montana, Missoula, MT, 59812, USA*
 THOMAS G. RACHOWITZ, *US Fish and Wildlife Service, 285 Fish Hatchery Road, Libby, MT, 59923, USA*
 A. GRANT MACHUTCHON, *817 Mill St. Nelson, British Columbia, V1L 4S8, Canada*
 MARK S. BOYCE, *Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2G9, Canada*



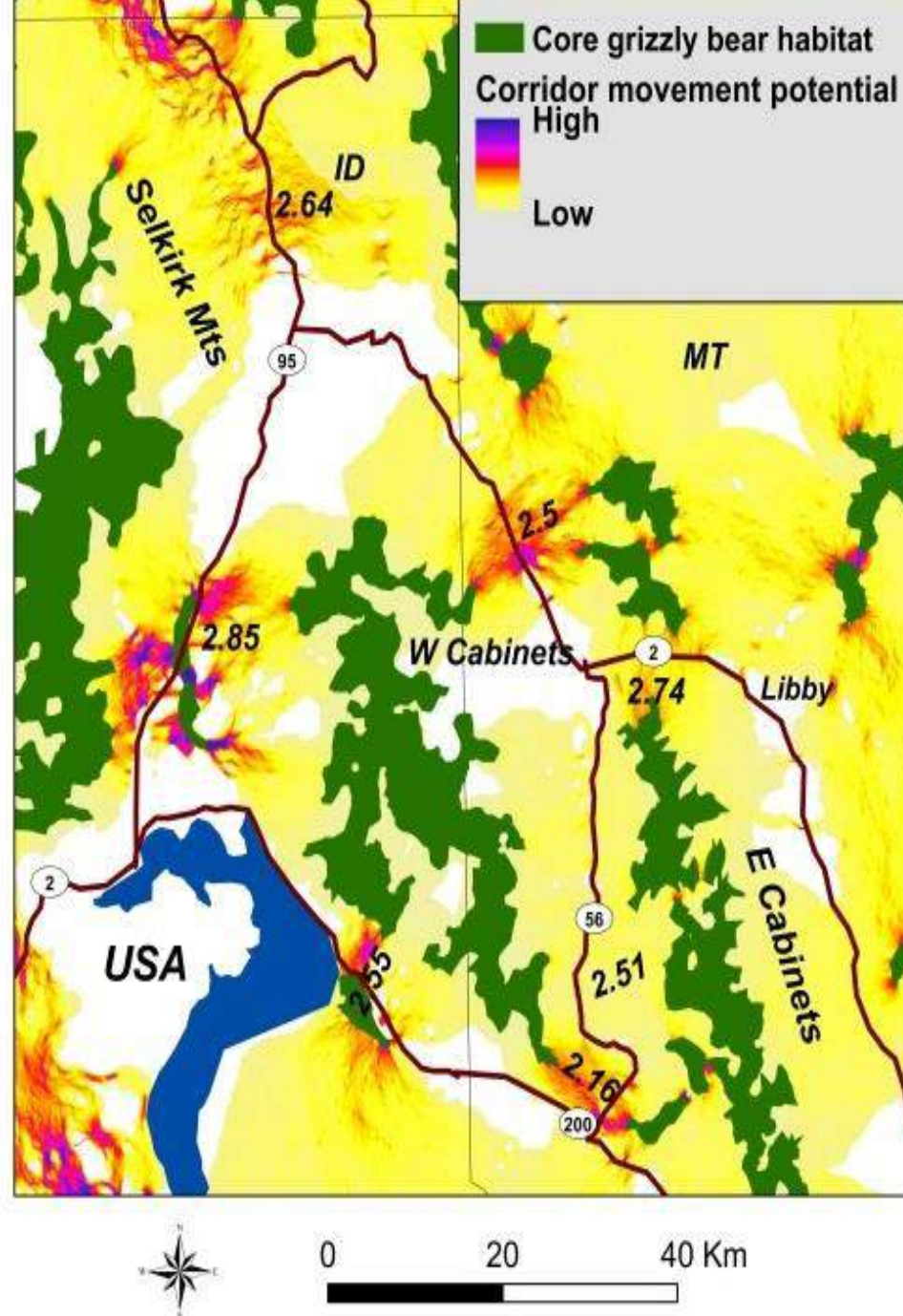


Proctor et al 2015

Grizzly bear connectivity mapping in the Canada-US trans-border region

MICHAEL E. PROCTOR, Brexidec Ecological Ltd., P.O. Box 808 Kootenay, British Columbia, V0G 1V0, Canada
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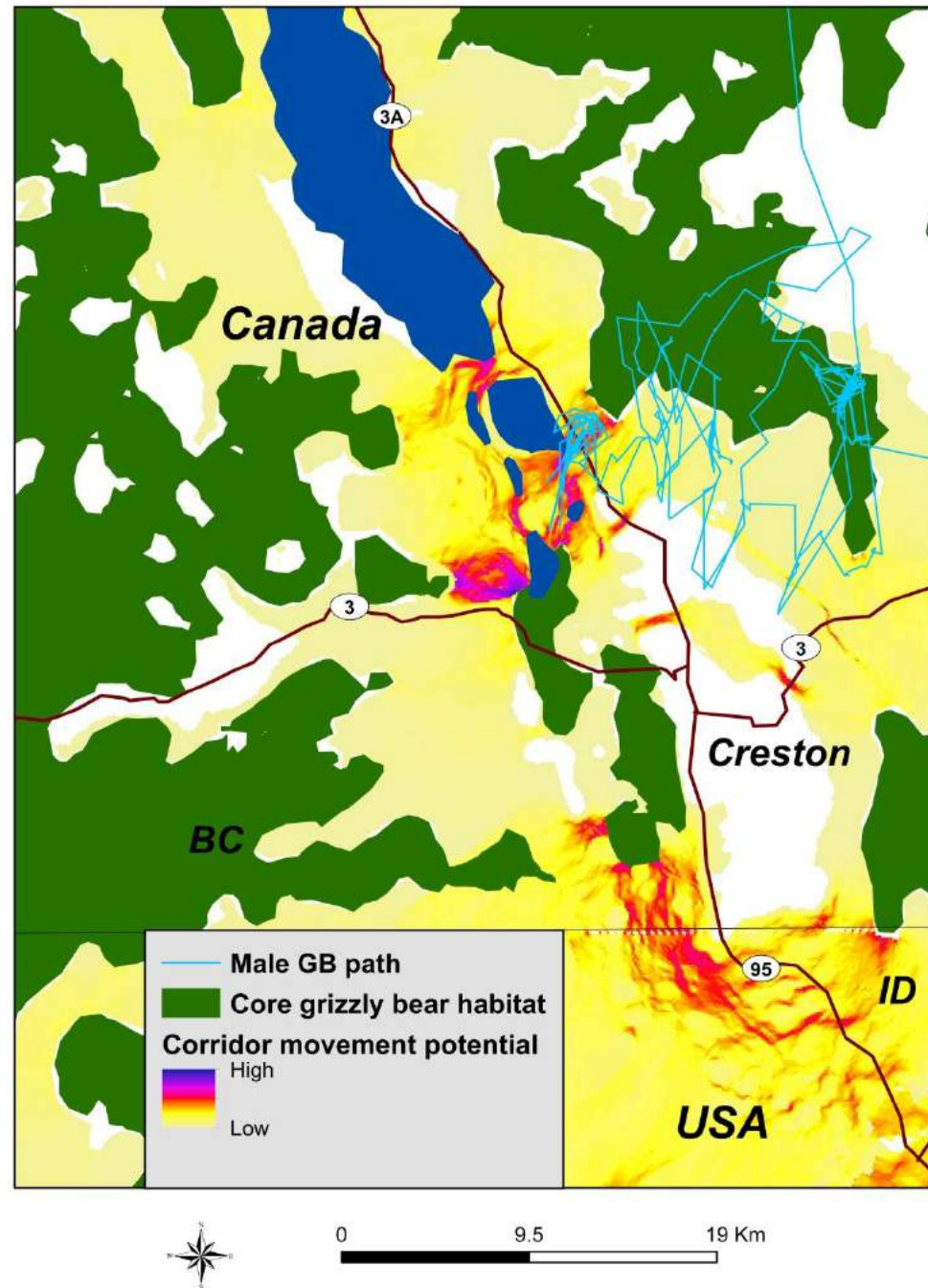


Proctor et al 2015

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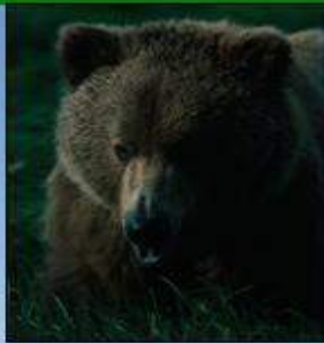
Proctor et al 2015

Grizzly bear connectivity mapping in the Canada-US trans-border region

MICHAEL R. PROCTOR¹, *Brinkman Ecological Ltd., P.O. Box 605 Ross, British Columbia, V0G 2M0, Canada*
 SCOTT E. NIELSEN², *Department of Renewable Resources, University of Alberta, Edmonton, T6G 2G9, Alberta*
 WAYNE F. KADWORN³, *US Fish and Wildlife Service, 285 Fish Hatchery Road, Libby, MT, 59923, USA*
 CHRIS SPRADEN⁴, *US Fish and Wildlife Service, College of Forestry and Conservation, 202 University Hall, University of Montana, Missoula, MT, 59812, USA*
 THOMAS G. RACHOWITZ⁵, *US Fish and Wildlife Service, 285 Fish Hatchery Road, Libby, MT, 59923, USA*
 A. GRANT MACHUTCHON⁶, *817 Mill St. Nelson, British Columbia, V1L 4S8, Canada*
 MARK S. BOYCE², *Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2G9, Canada*



**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 Proctor¹

Chris Servheen²

Wayne Kasworm³

Tom Radandt²

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

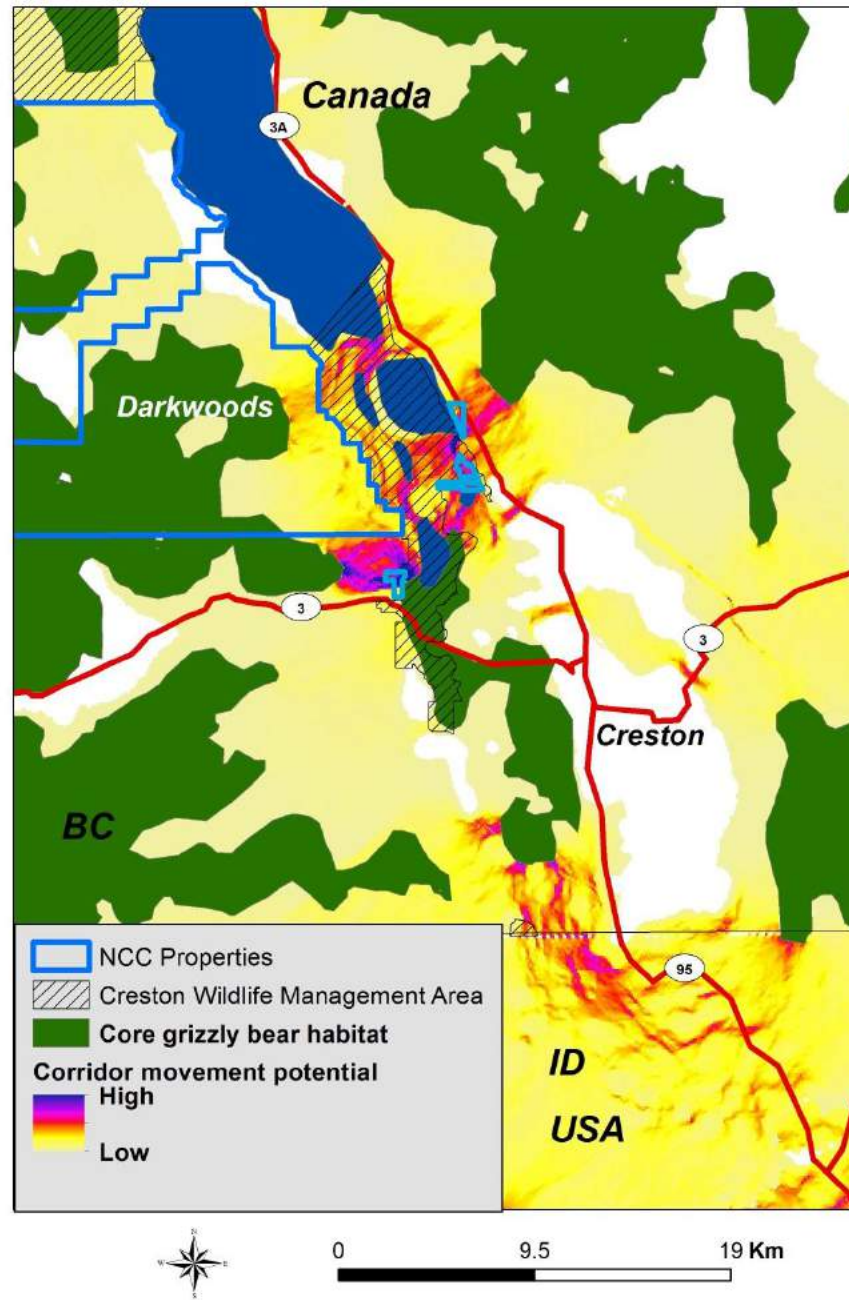
March 2008

Harvey, Y2Y



Nancy Newhouse, NCC



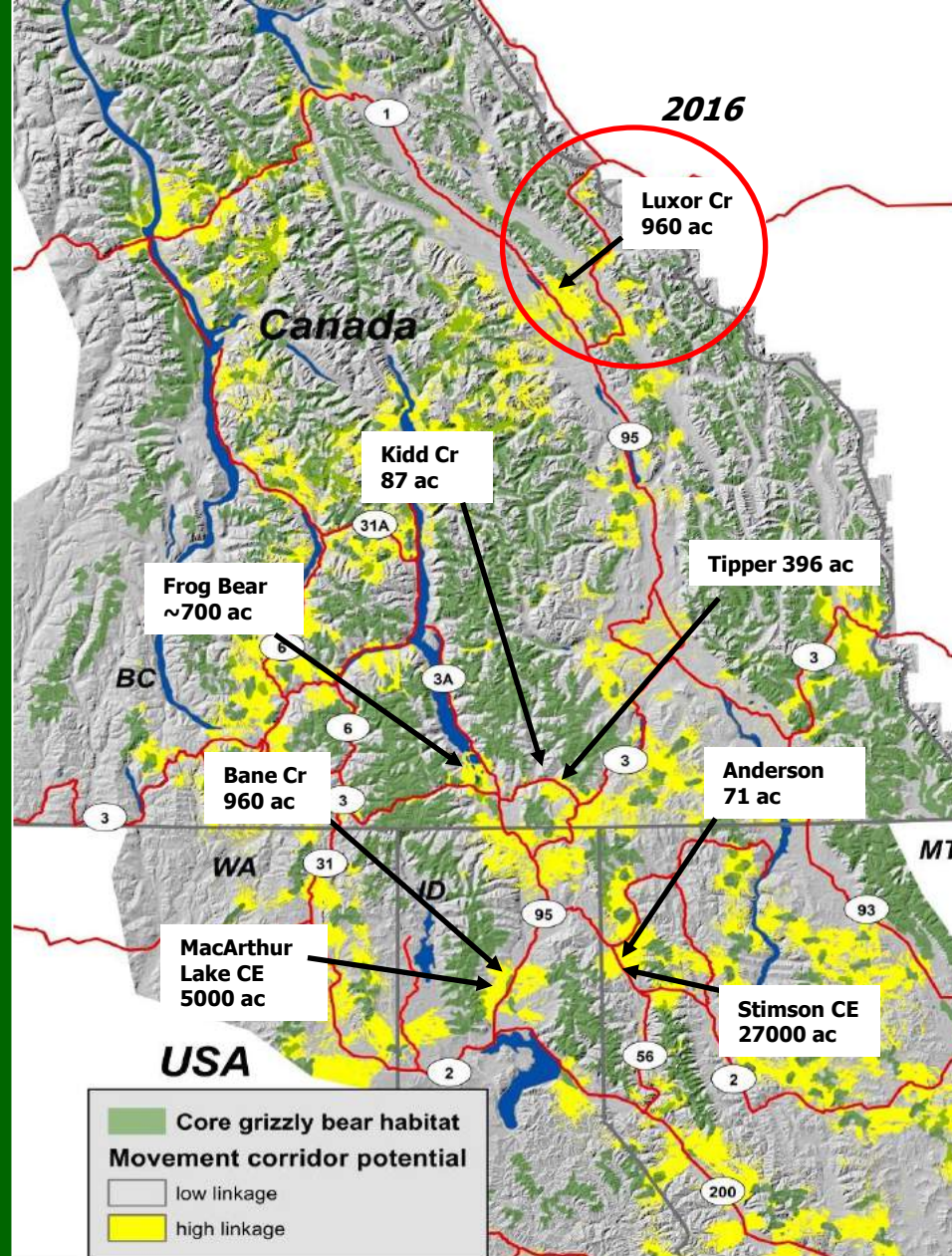


NCC connectivity properties across Creston Valley



Table 1. Connectivity Land Purchases and Conservation Easements: in conjunction with Nature Conservancy Canada, Yellowstone to Yukon Conservation Initiative, Nature Trust of BC, Vital Ground, US Forest Service Forest Legacy

	Acres purchases	CEs	total acres	\$
Canadian lands	1051	211	1,262	3,600,000
Creston Valley	468	211	679	1,850,000
US lands	71	32,720	32,791	26,565,000



Non lethal management



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

	Managed	alive
Males	4	2
Females	9	8
Offspring w mom	6	
total adults	13	10



BC Conservation Officer Service has really embraced this program

Non lethal management



Electric fence program



Table 4. Electric fences (50% cost share program) Creston Valley – Nelson area

Year	# fences	\$
2012	4	8156
2013	10	22864
2014	6	4620
2015	29	17382
2016	2	1024
total	51	54047



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



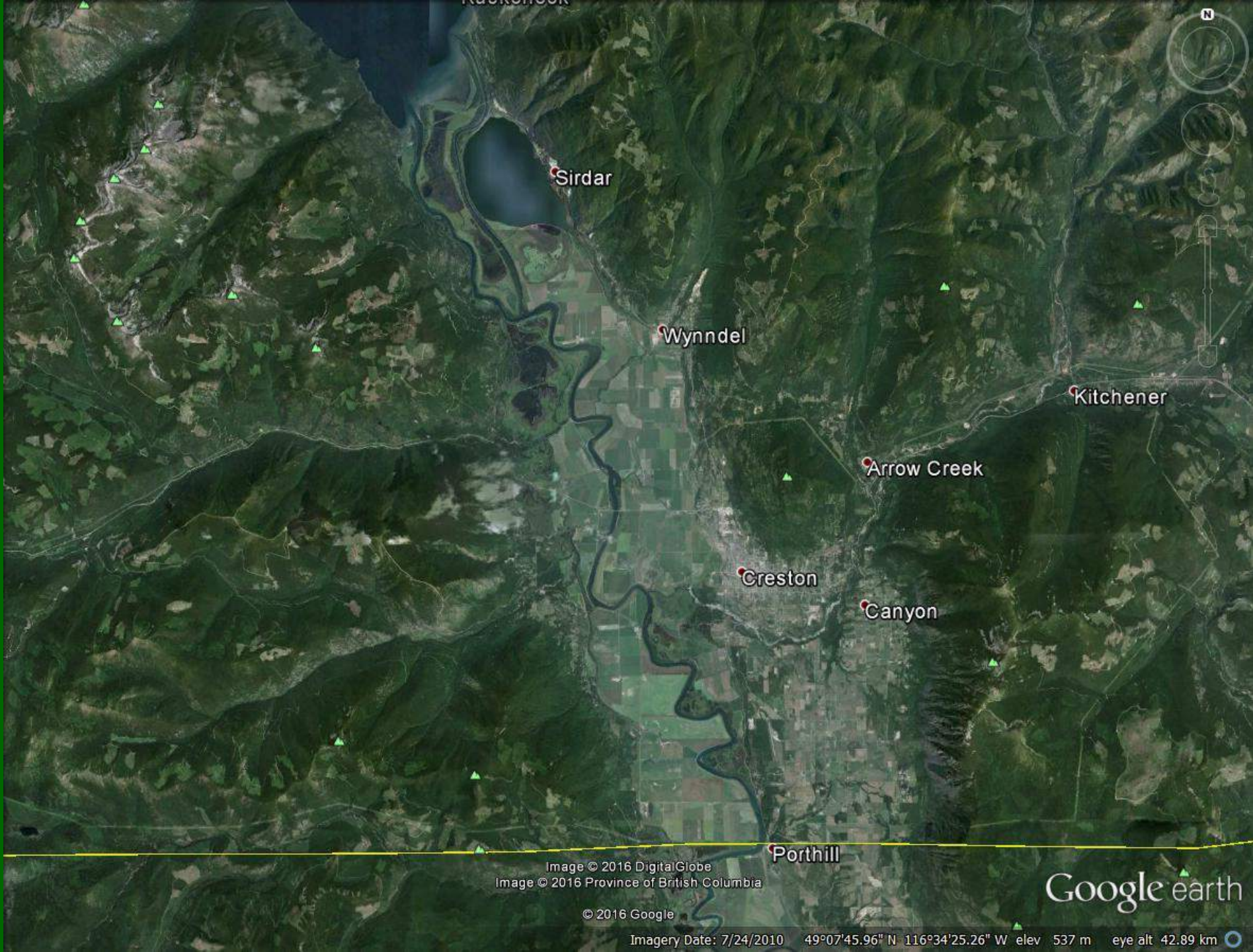


Image © 2016 DigitalGlobe
Image © 2016 Province of British Columbia

© 2016 Google

Imagery Date: 7/24/2010 49°07'45.96" N 116°34'25.26" W elev 537 m eye alt 42.89 km

Google earth

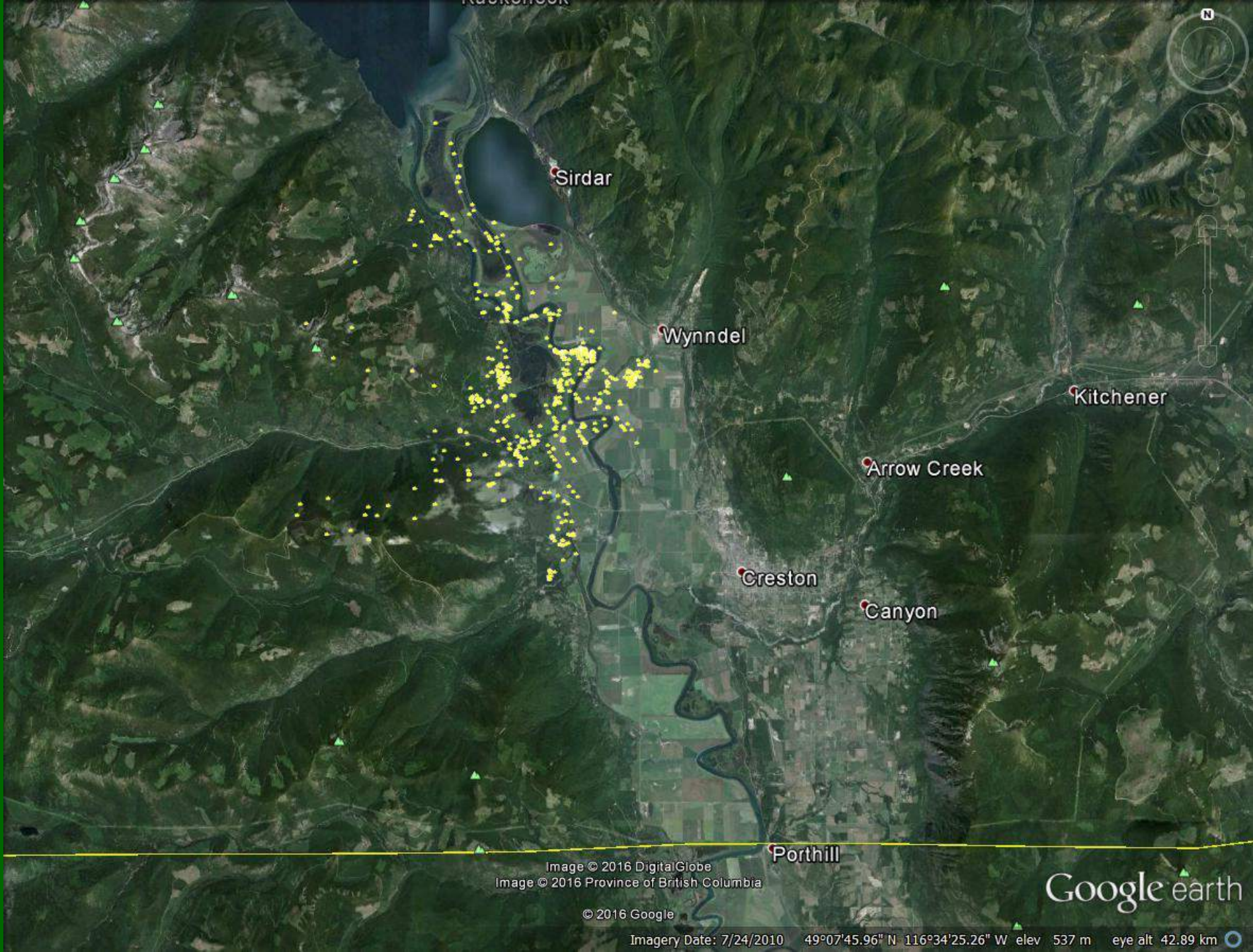
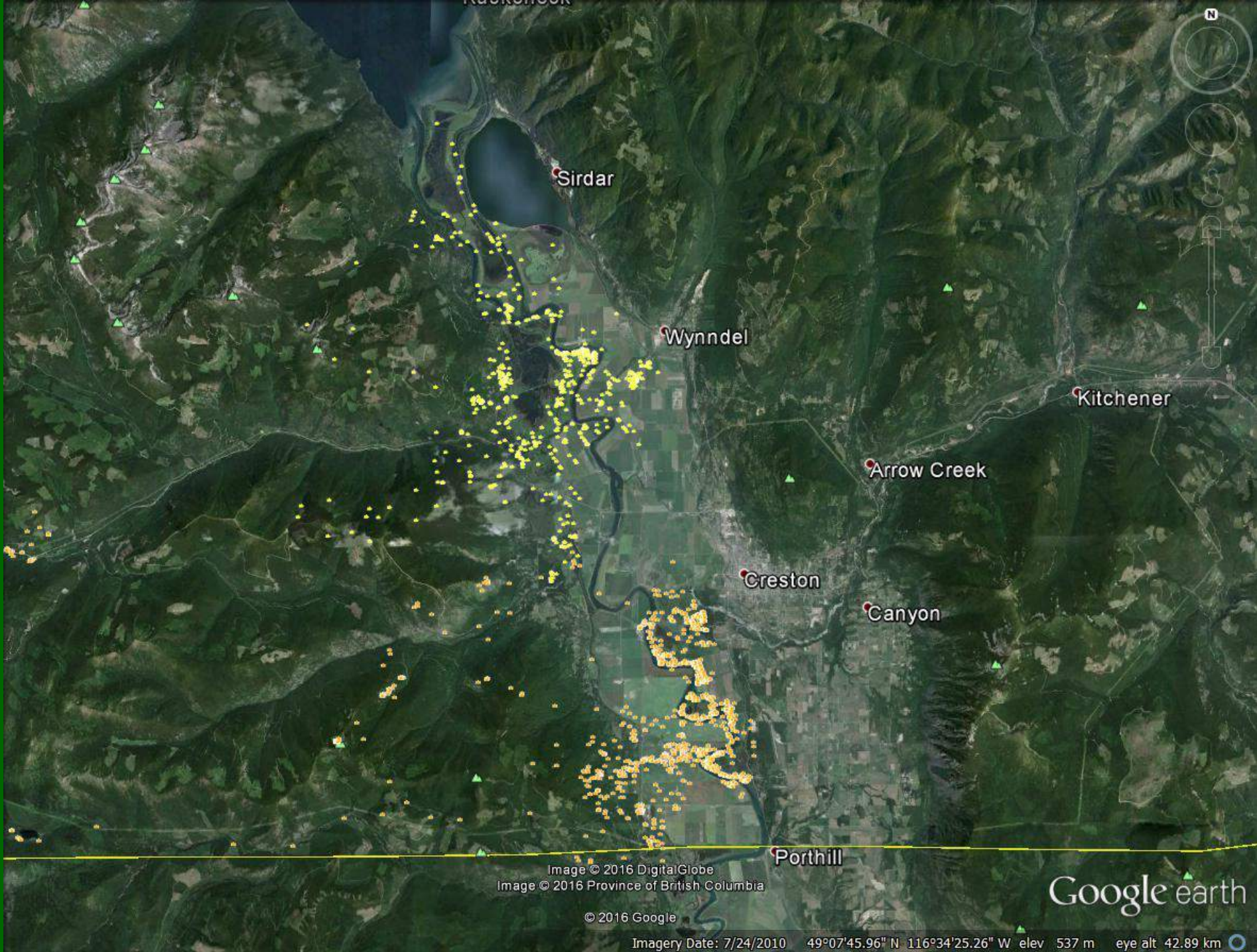


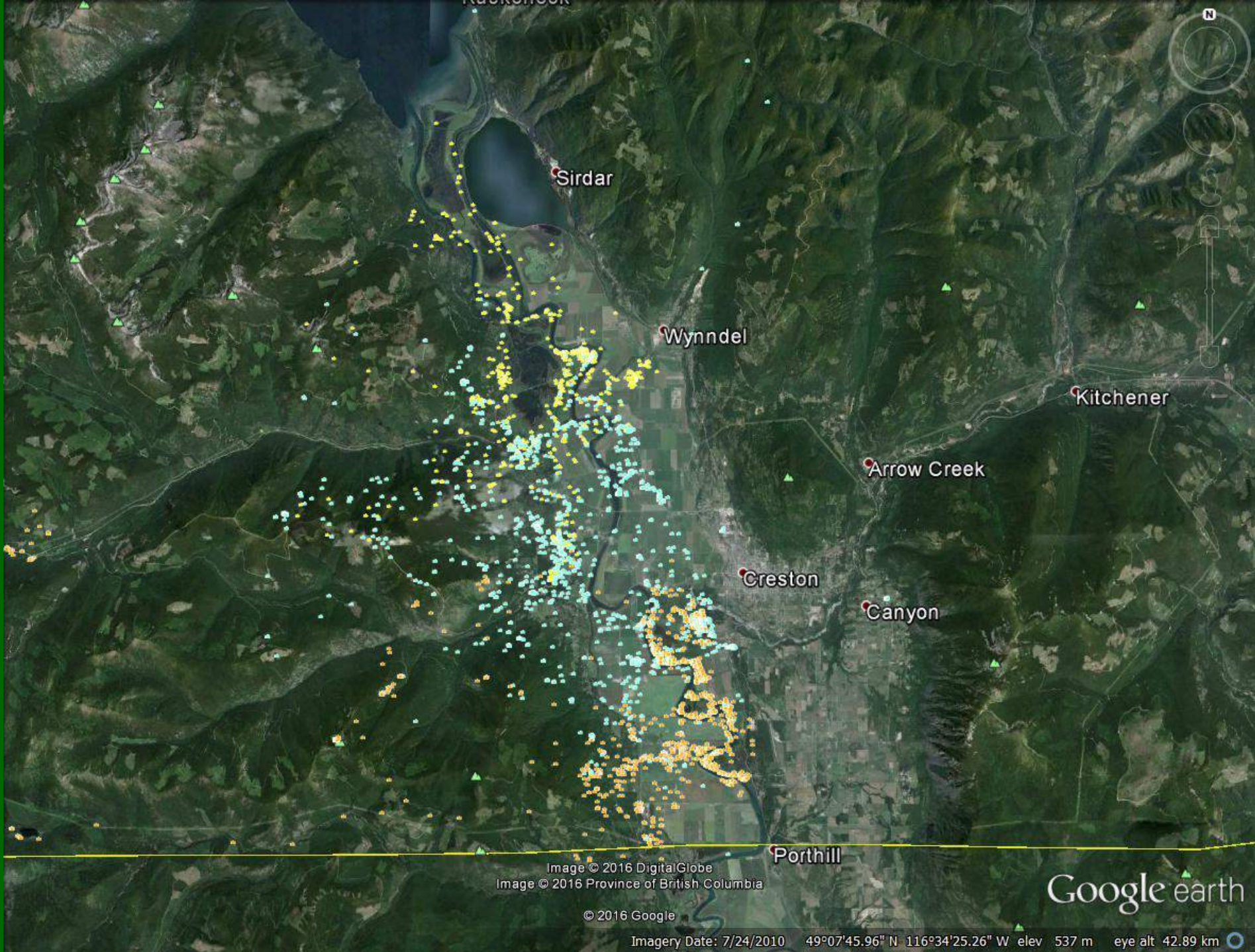
Image © 2016 DigitalGlobe
Image © 2016 Province of British Columbia

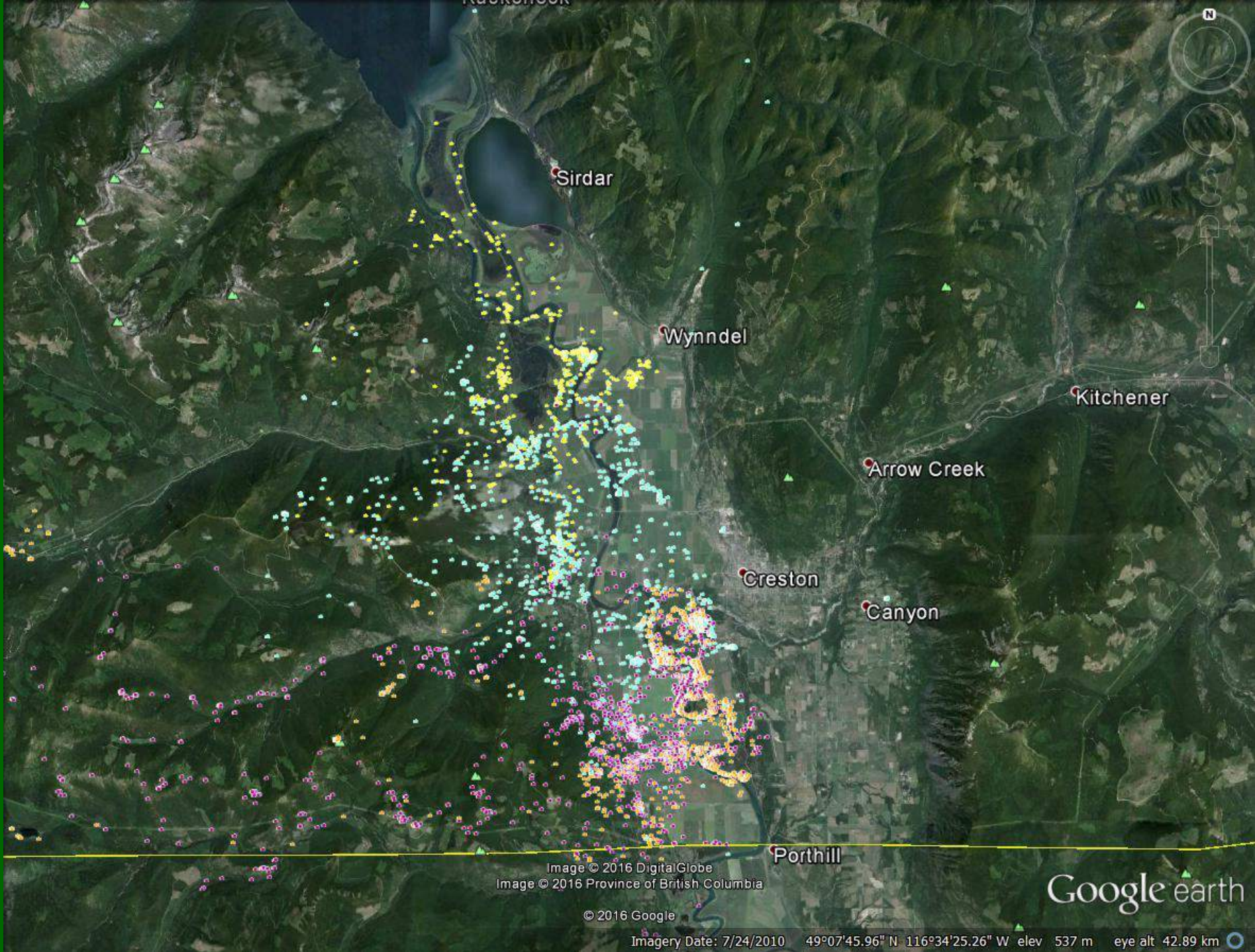
© 2016 Google

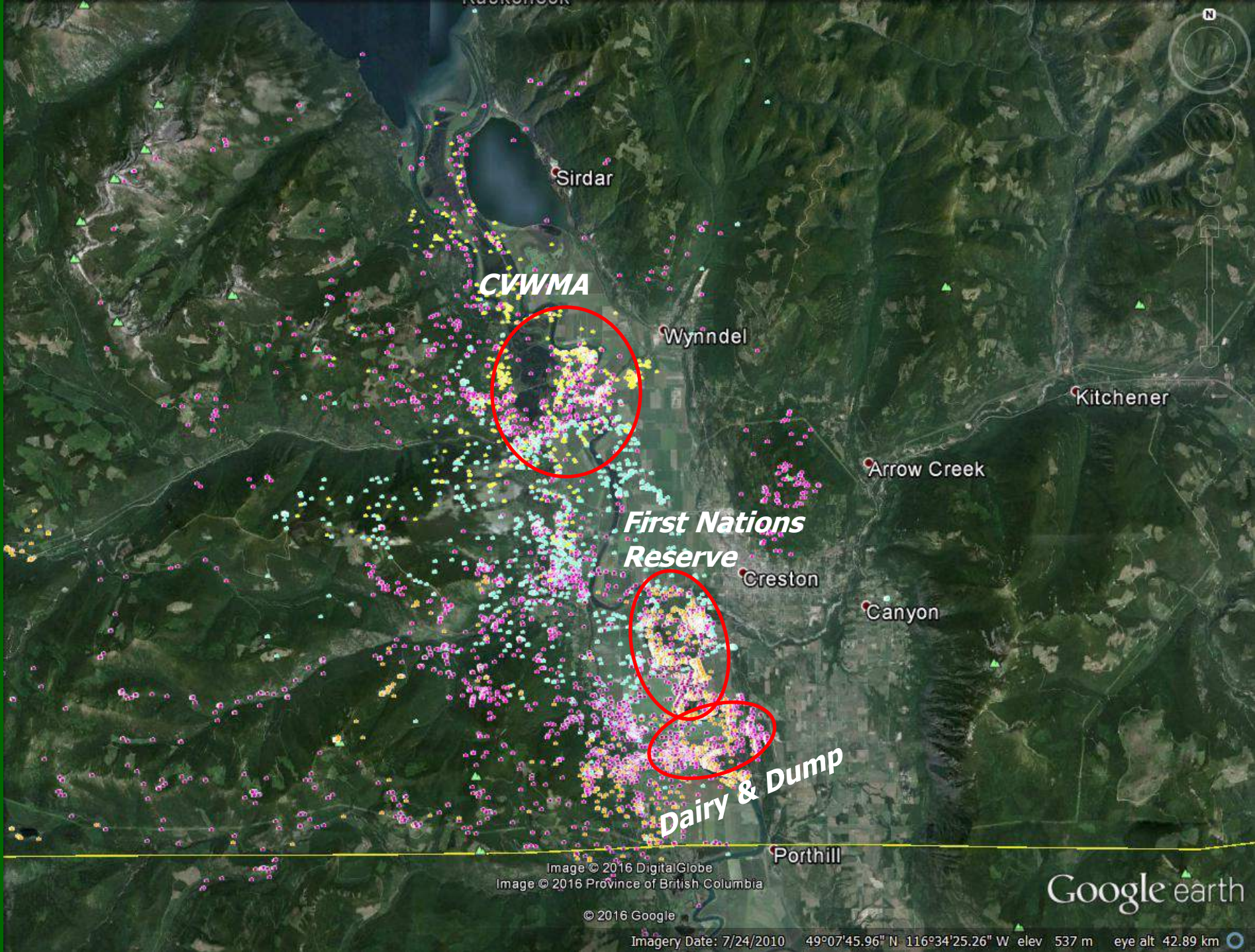
Imagery Date: 7/24/2010 49°07'45.96" N 116°34'25.26" W elev 537 m eye alt 42.89 km

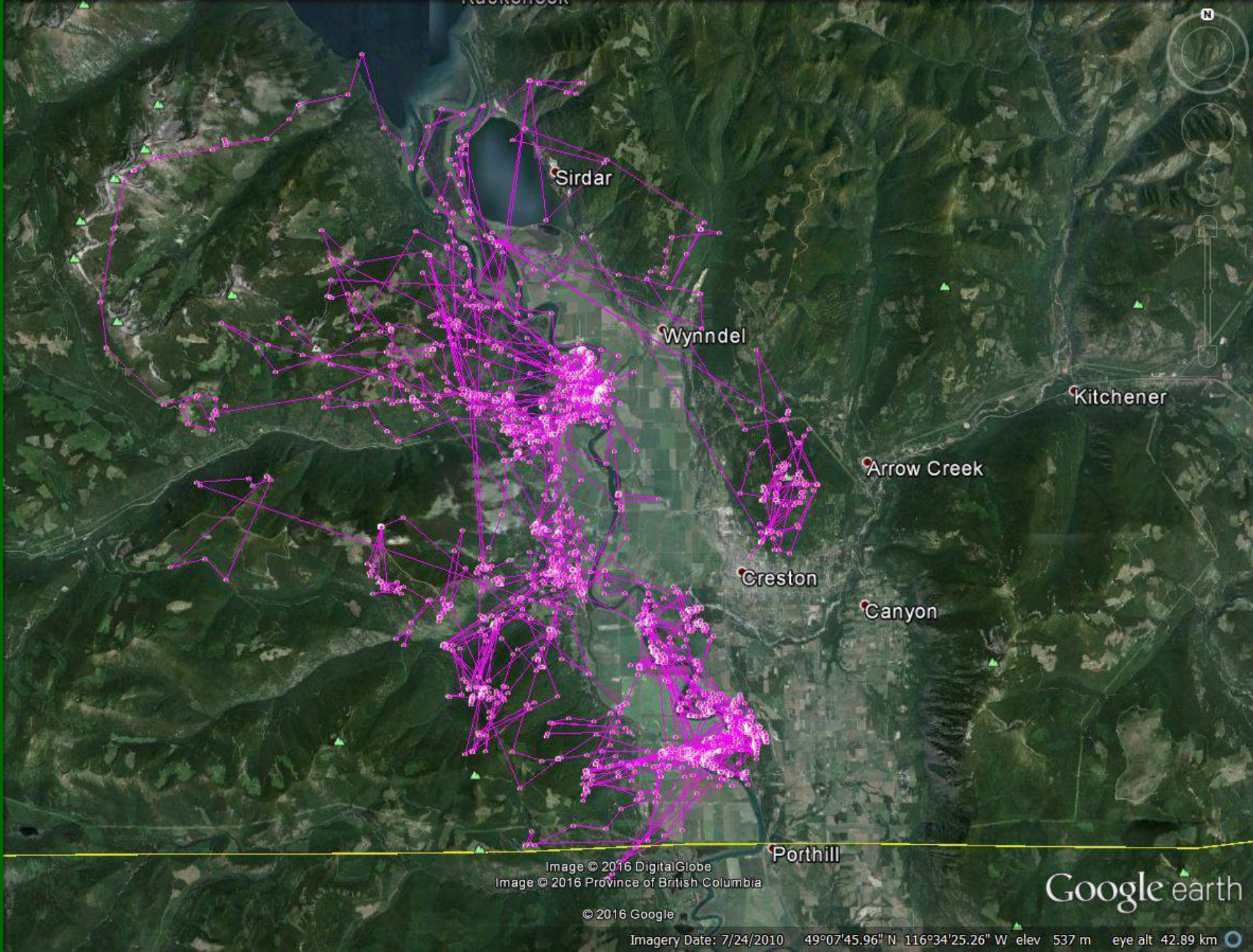
Google earth











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



Bottom up and Top down conservation

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

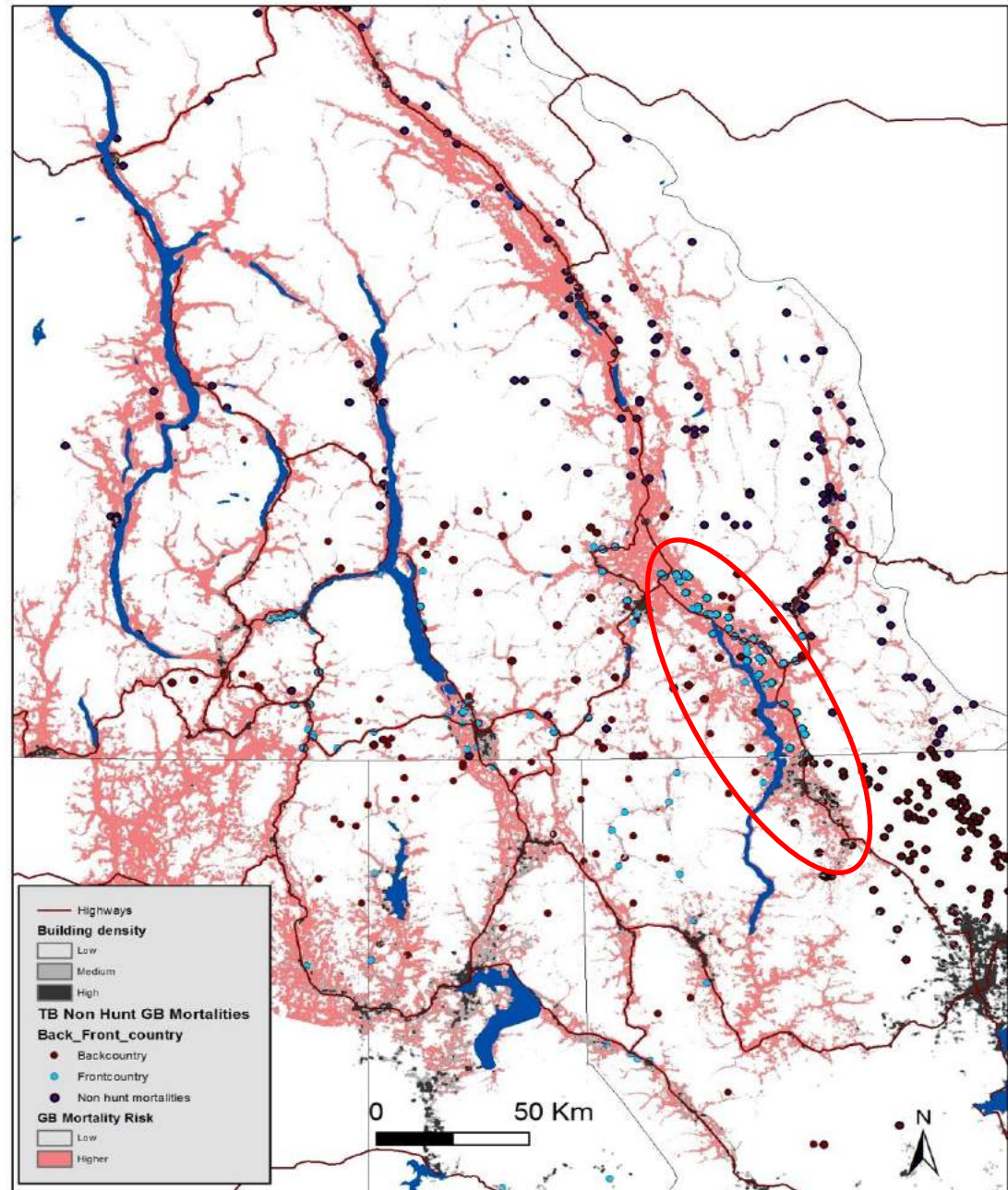
Top down - in the office, agency, boardroom, government office theory, policy, laws, bylaws, regulations

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**

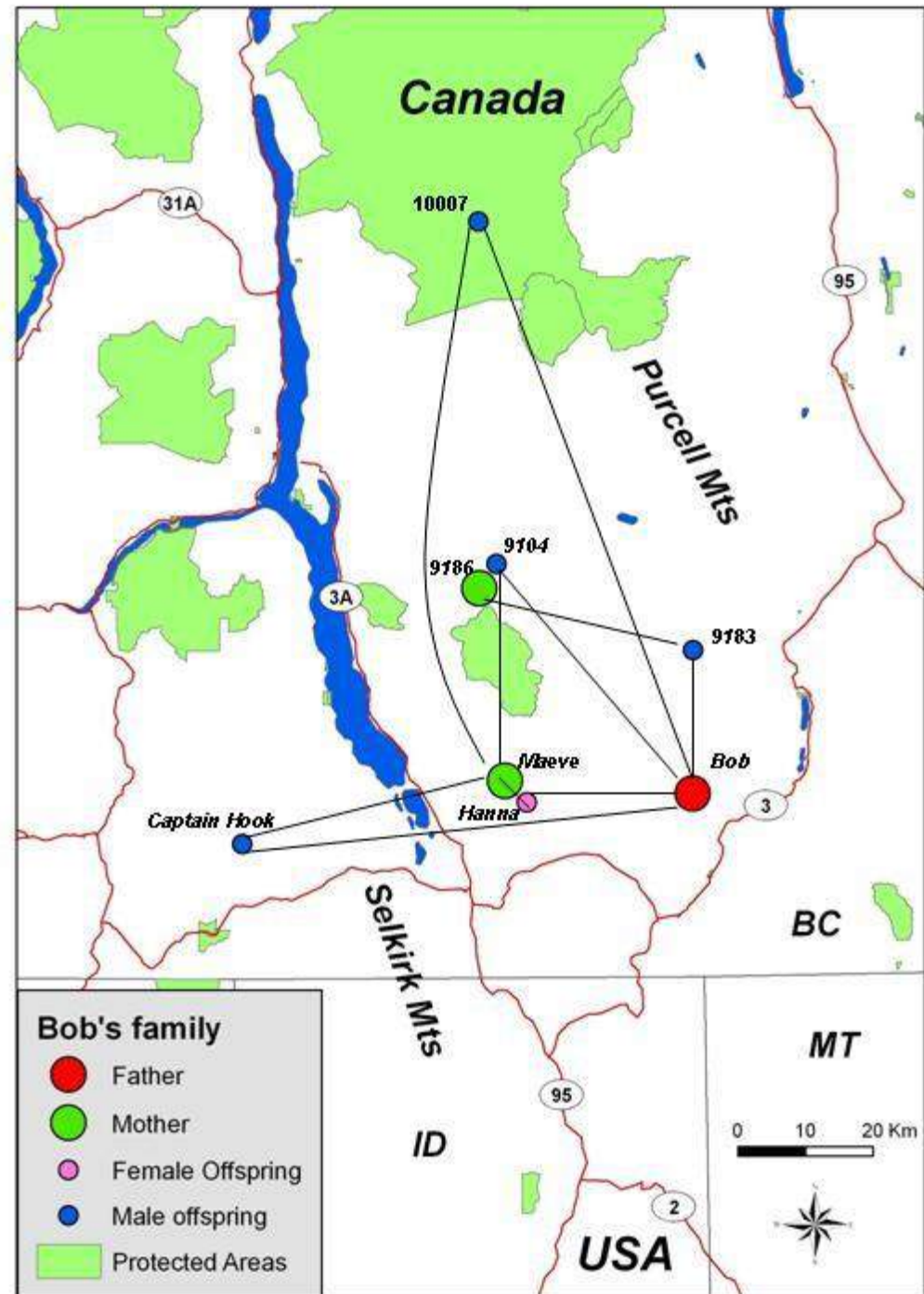


**Michael Proctor, Birchdale Ecological
Wayne Kasworm, USFWS
Wayne Wakkinen, Idaho Fish & Game
Chris Servheen, USFWS**

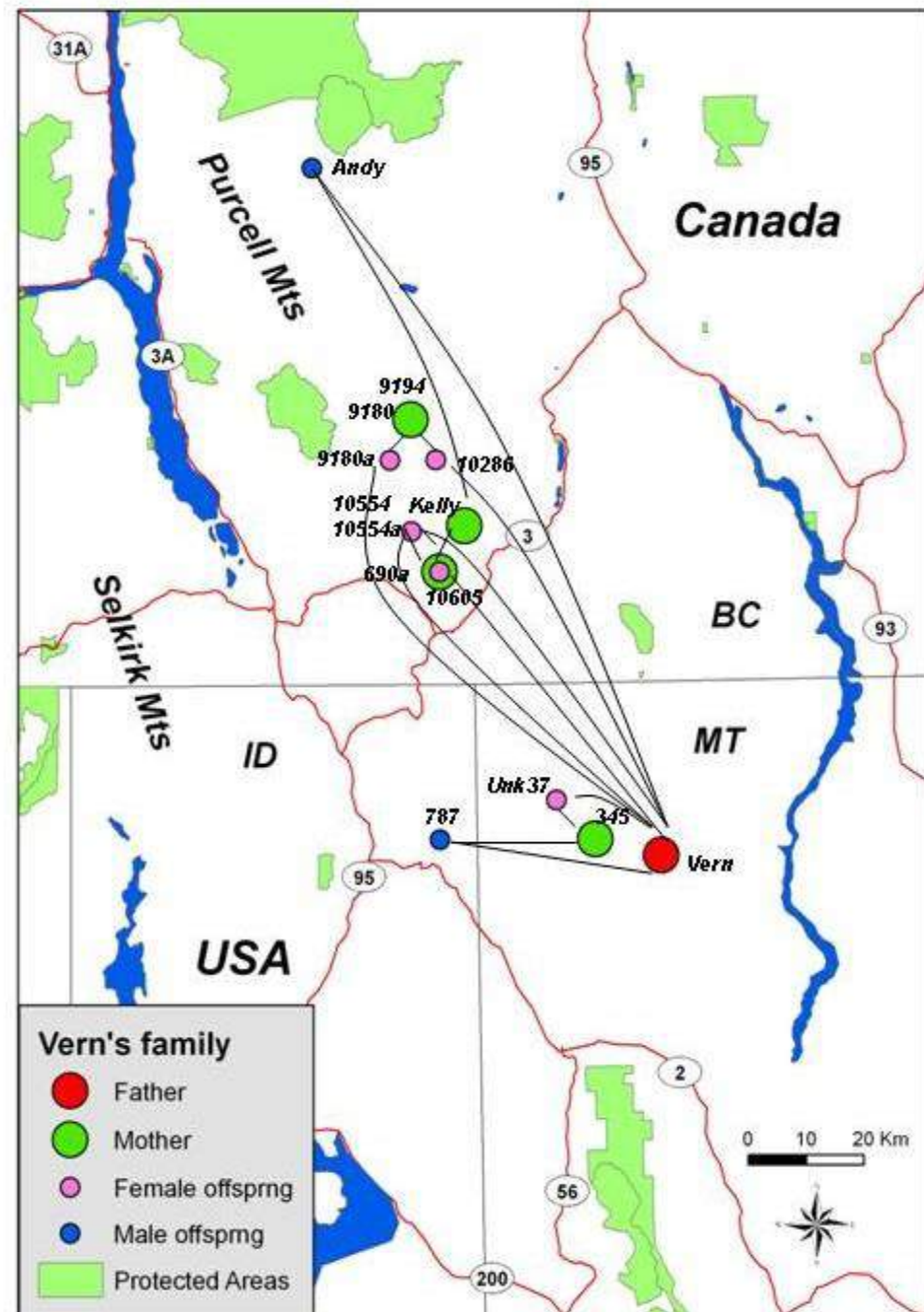
**Prepared for
Great Northern Landscape Conservation Cooperative
Liz Claiborne Art Ortenberg Foundation
Wilburforce Foundation
Habitat Conservation Trust Foundation
Columbia Basin Fish Wildlife Compensation Program
National Fish and Wildlife Foundation
Yellowstone to Yukon Conservation Initiative**

December 2012

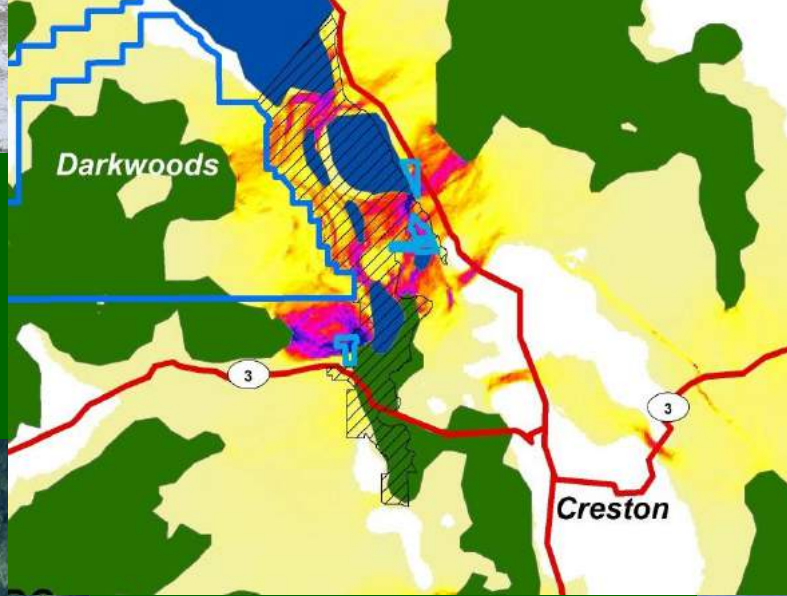
Male dispersal



Male breeding across BC Hwy 3



Bear Aware



***Predicting and mapping huckleberry
patches important to grizzly bears***

***Michael Proctor
Clayton Lamb
Grant MacHutchon
Scott Nielsen
Wayne Kasworm
Chris Servheen***

GRIZZLY BEAR
PHOTO BY TIM CHRISTIE
©2013 SANDPOINT MAGAZINE

*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***



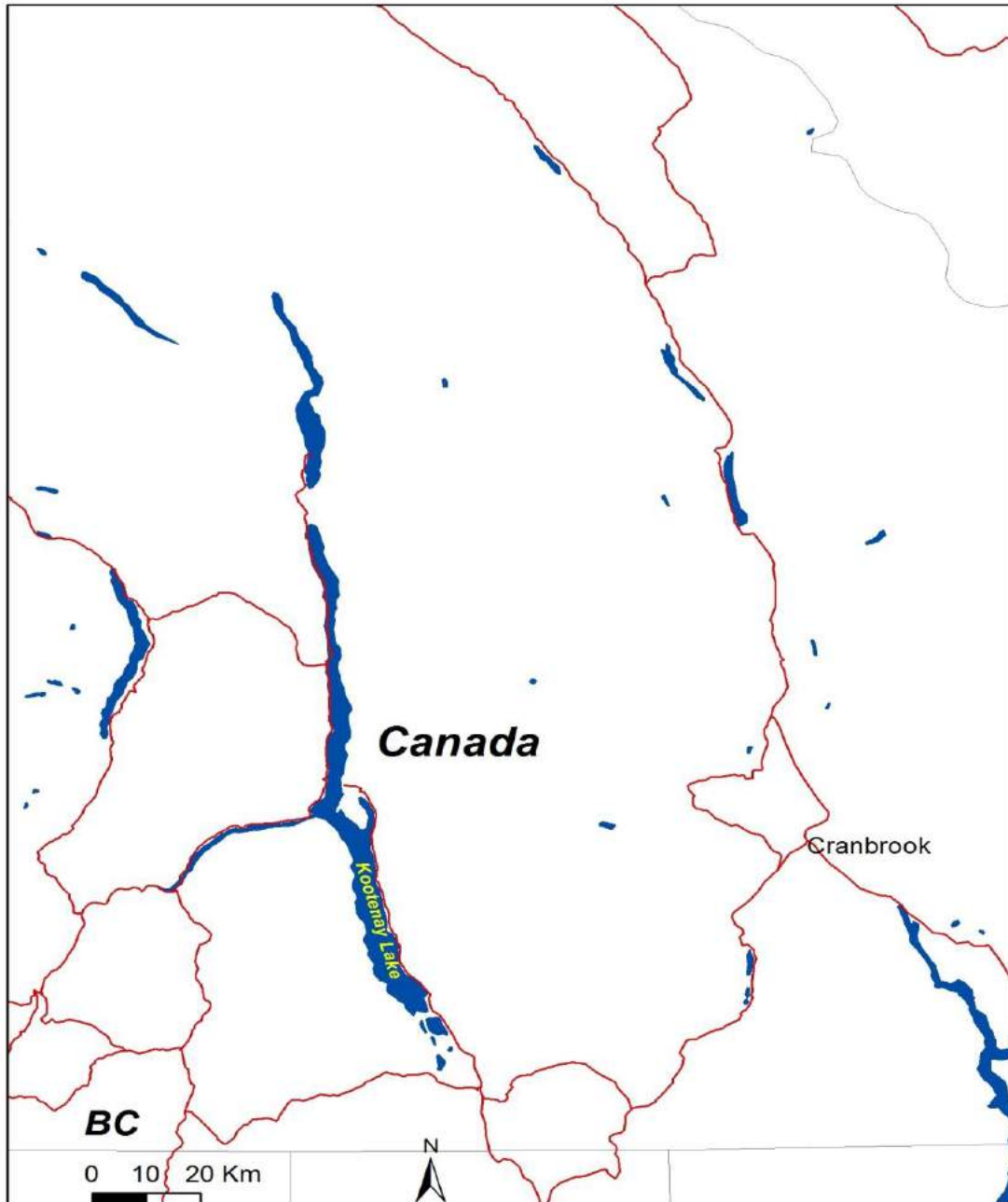
***Huckleberries
drive much of the
regional grizzly
bear reproduction
and productivity***

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***

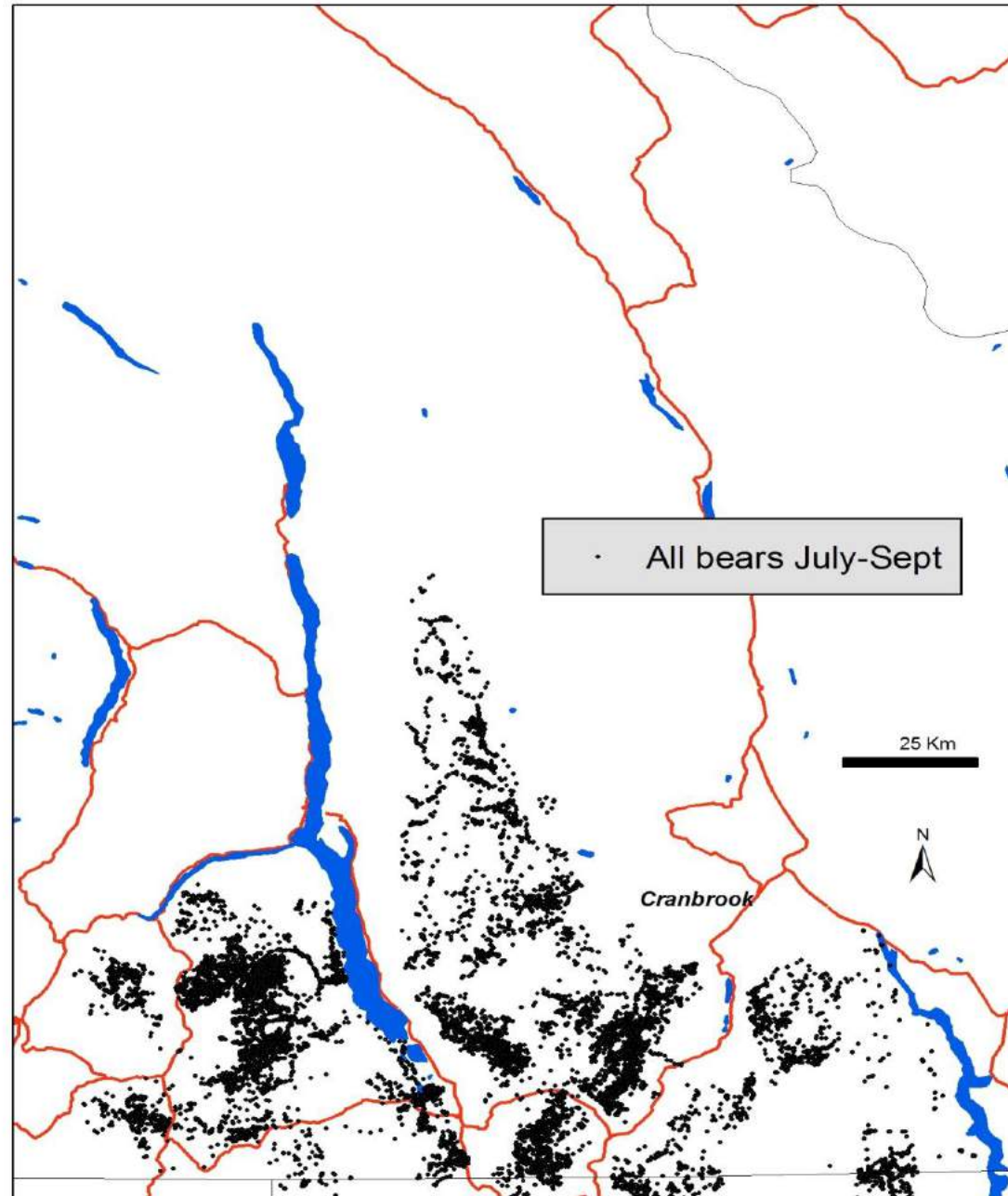


~40 GBs

*Summer GPS
locations*

*Used to find
huckleberry
patches*

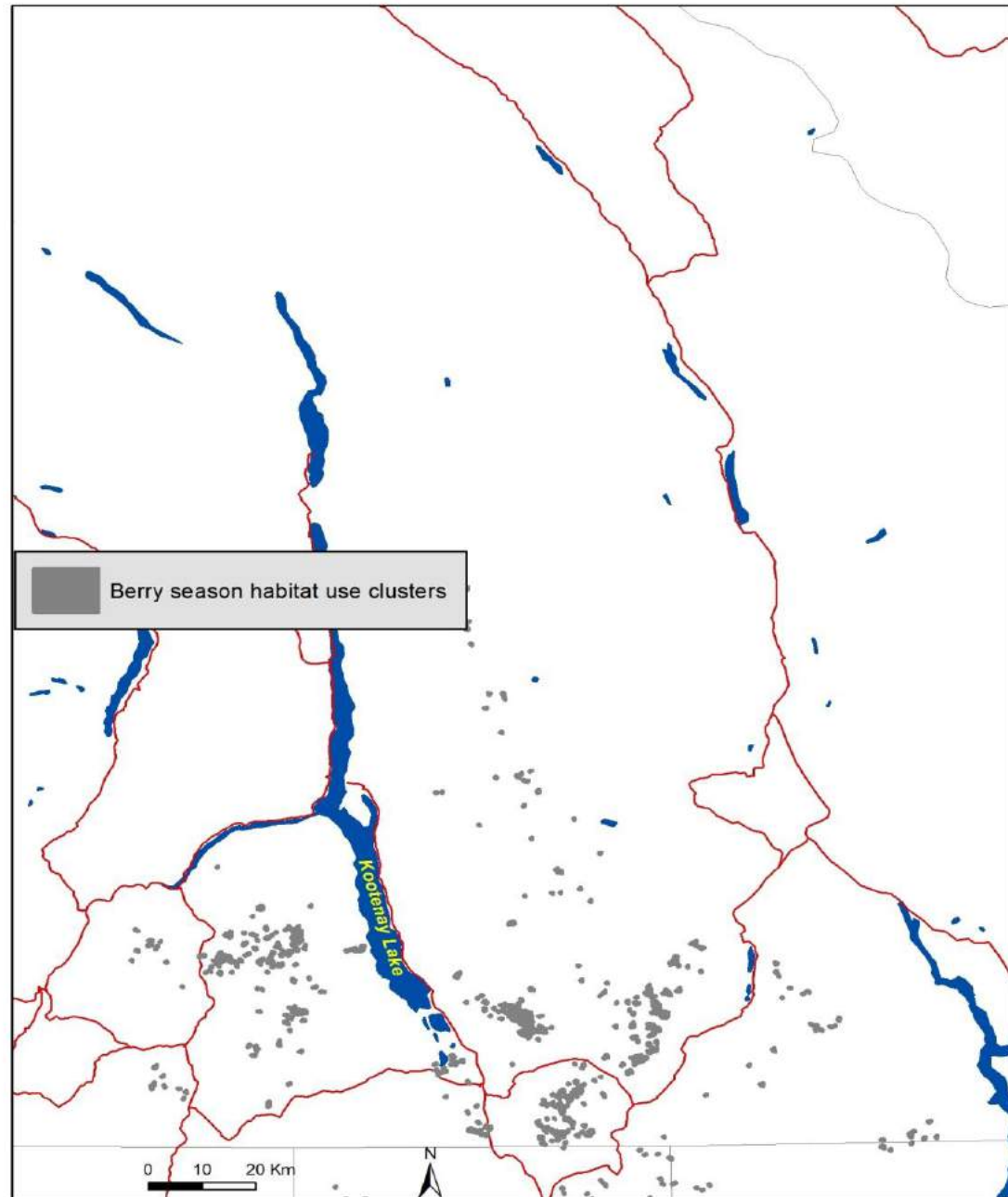
*Huckleberry
patches important
to bears*



2 summers

*Over 400 site
visits*

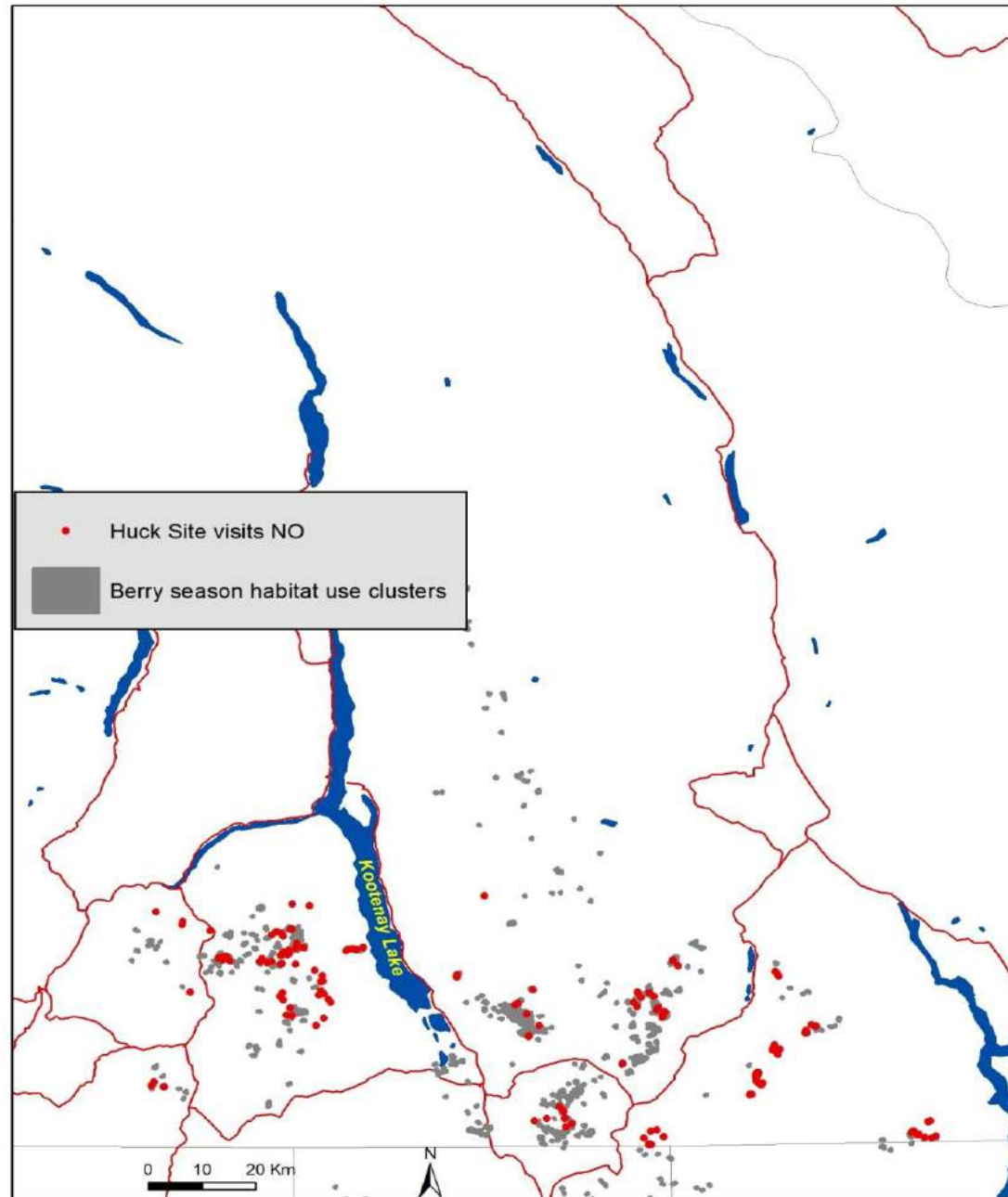
277 huck patches



2 summers

*Over 400 site
visits*

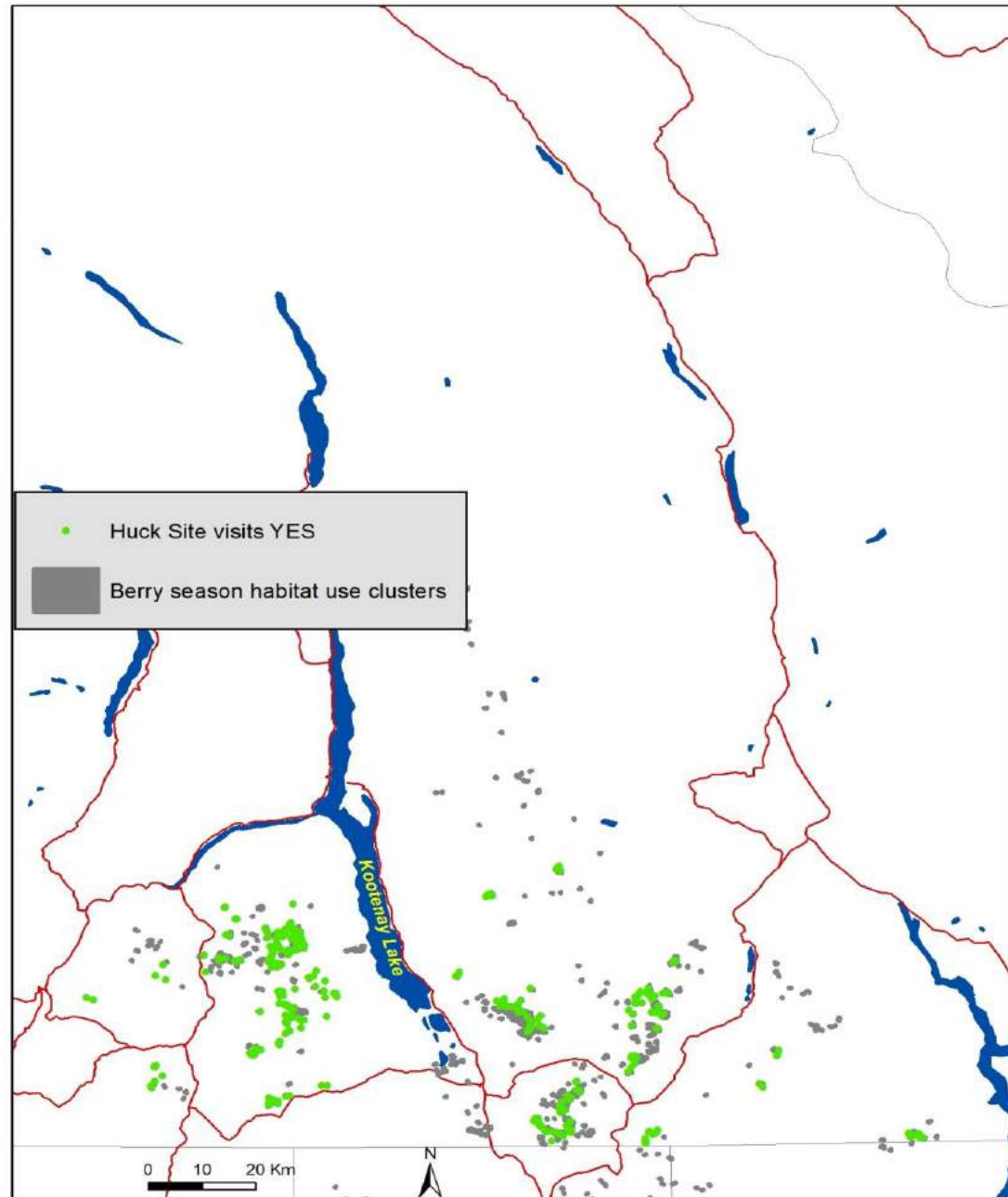
277 huck patches



2 summers

***Over 400 site
visits***

277 huck patches



Environmental variables used to predict huckleberry patches used by grizzly bears

Soil variables

Climate variables

Topographic variables

*Habitat variables,
canopy, fire*

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

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

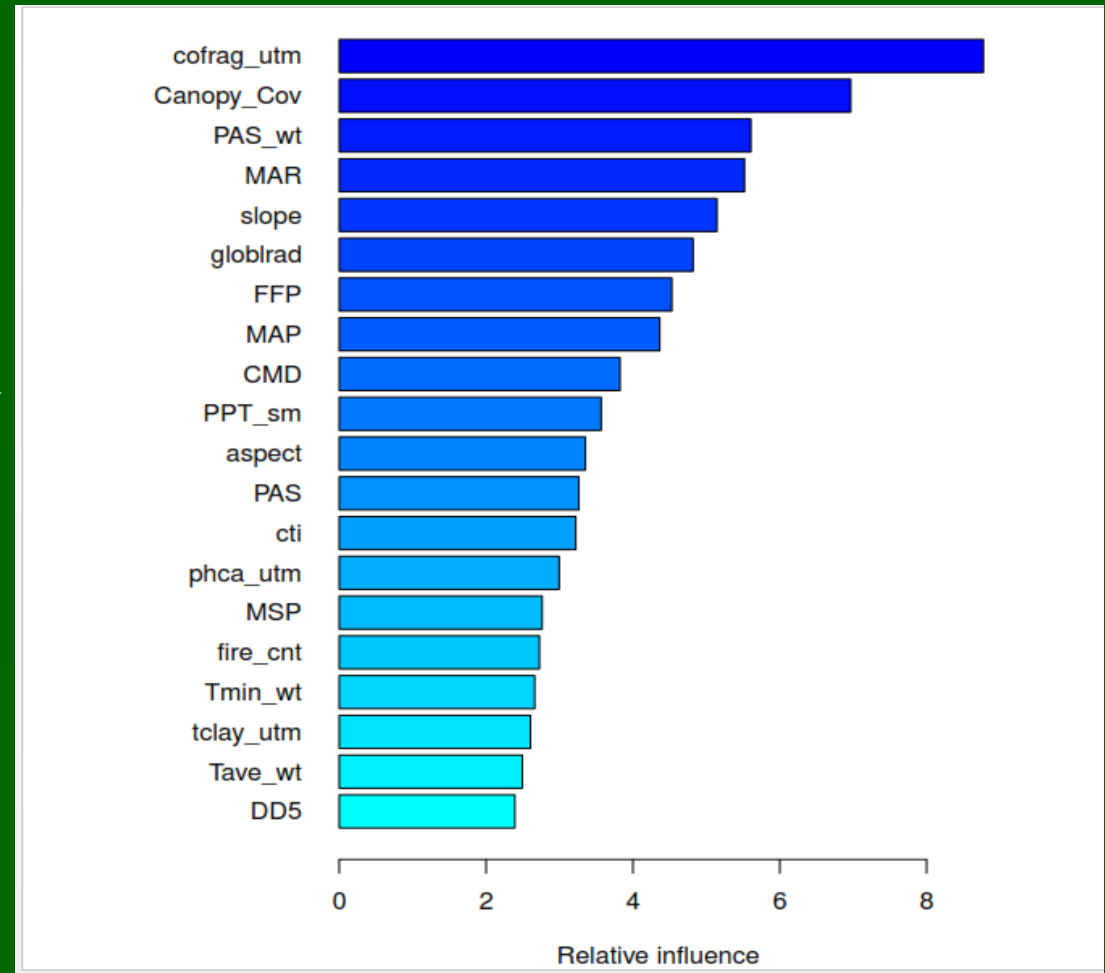
***Low climatic moisture
deficit***

High Precip in summer

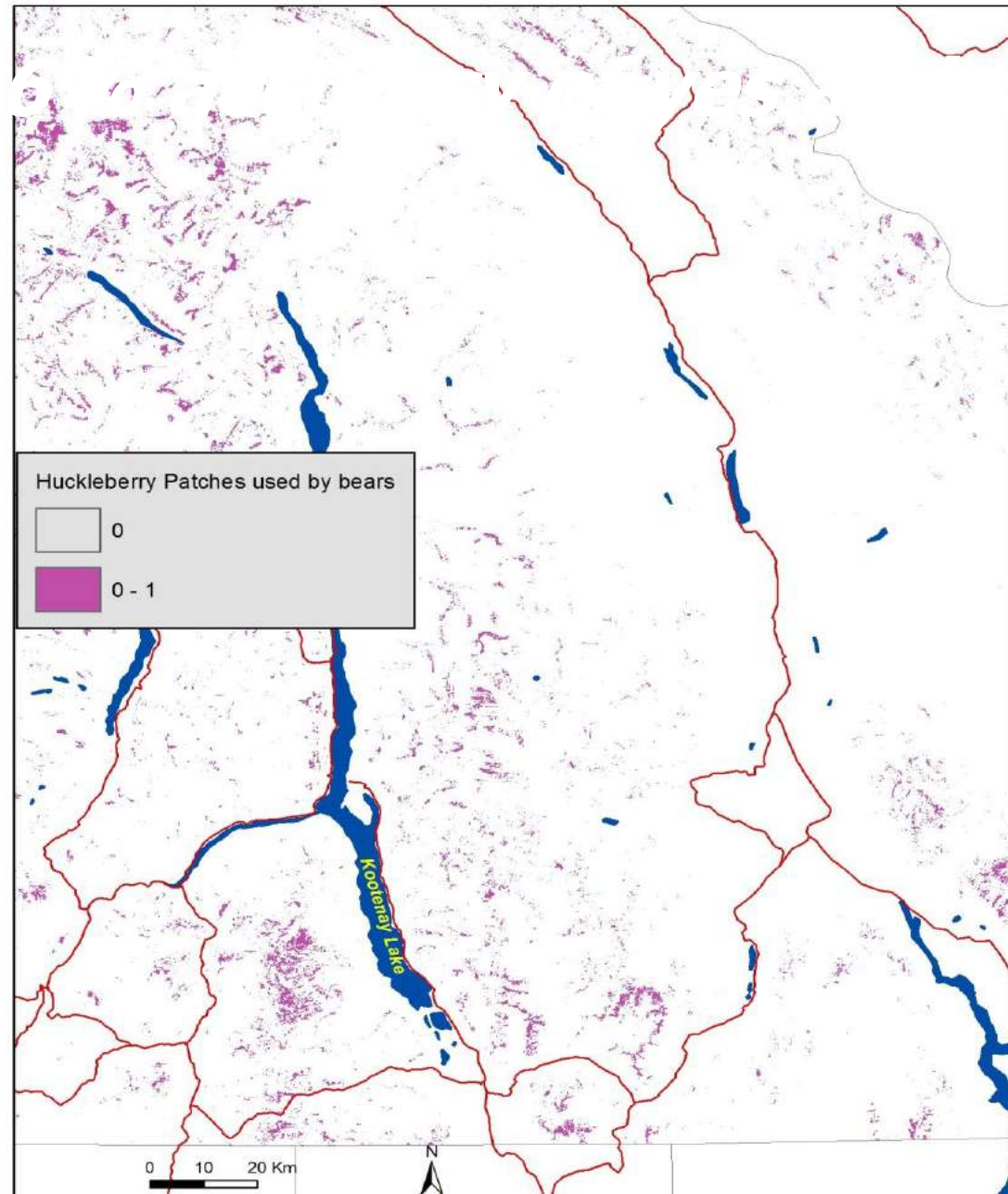
Aspect

Wet topography

Soil pH

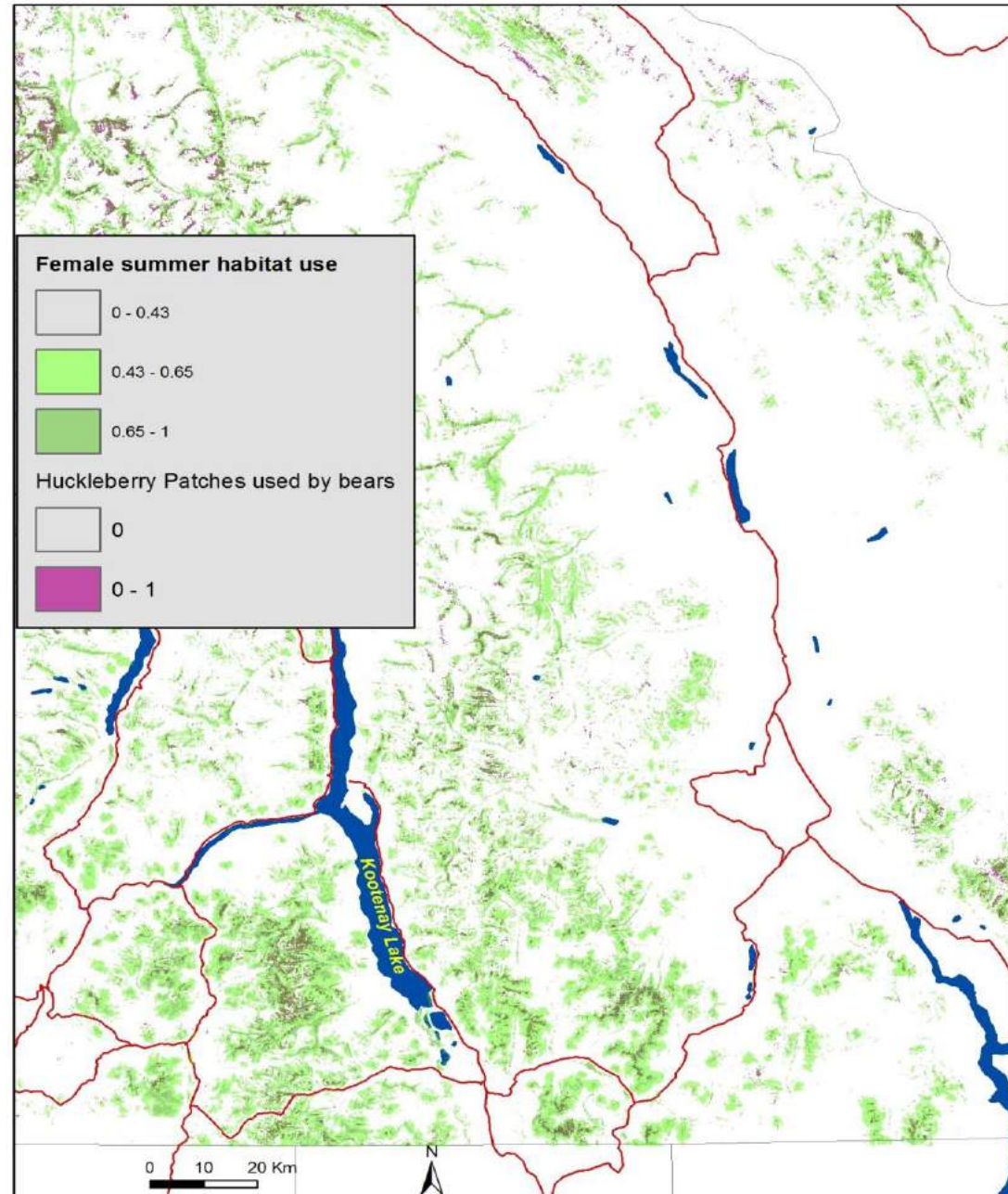


Huckleberry patch layer

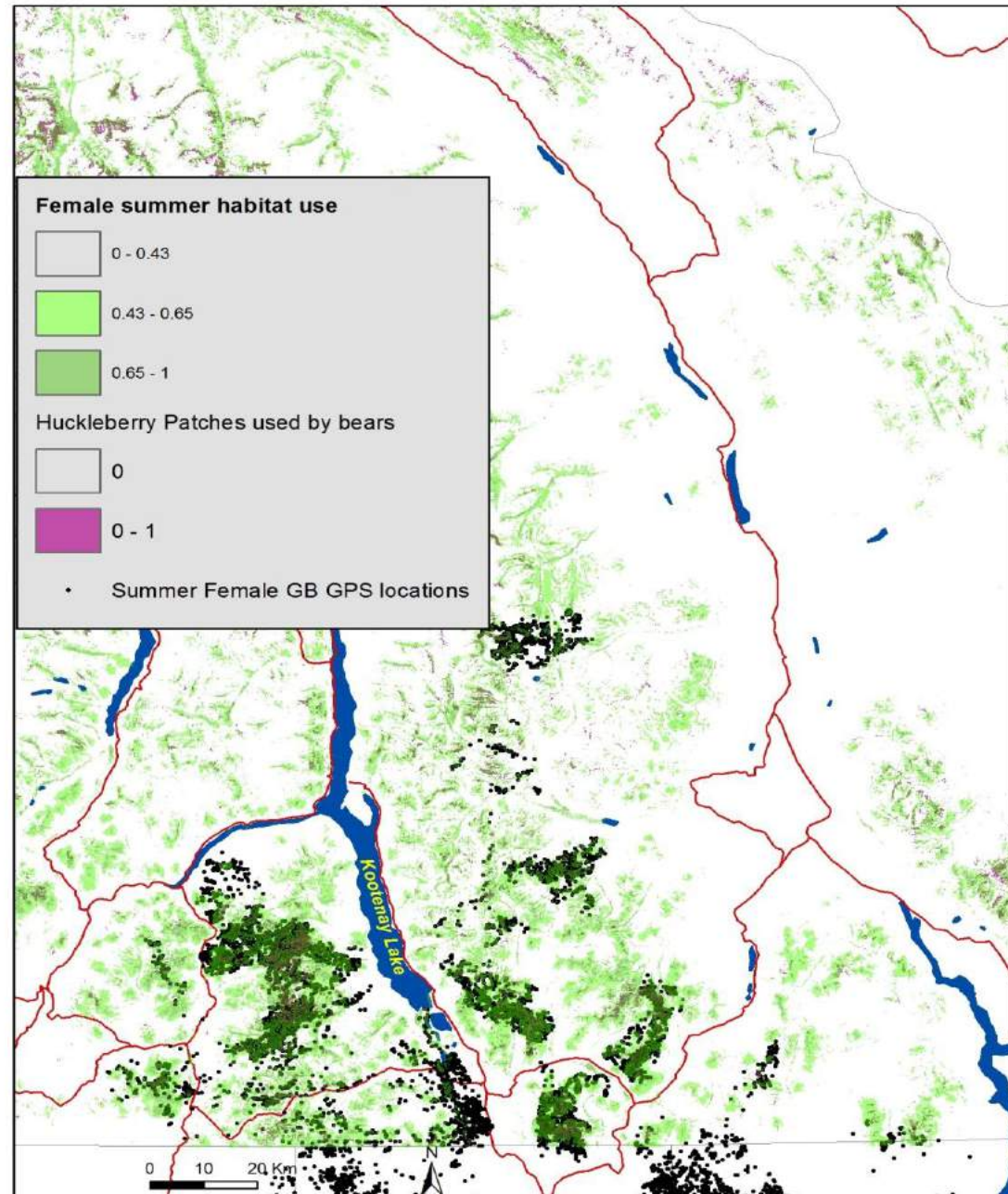


Huckleberry patch layer

Within a Resource Selection Function model

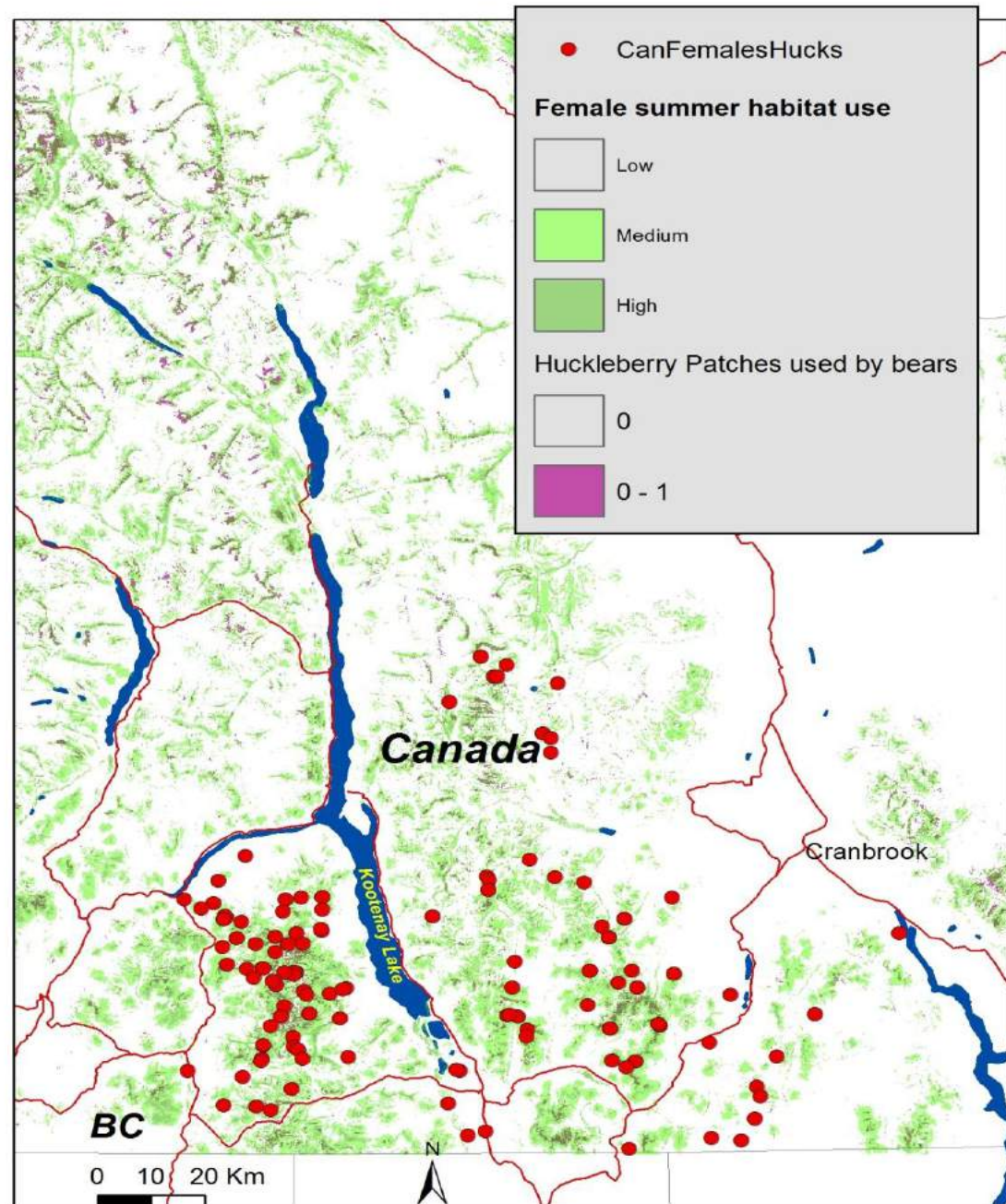


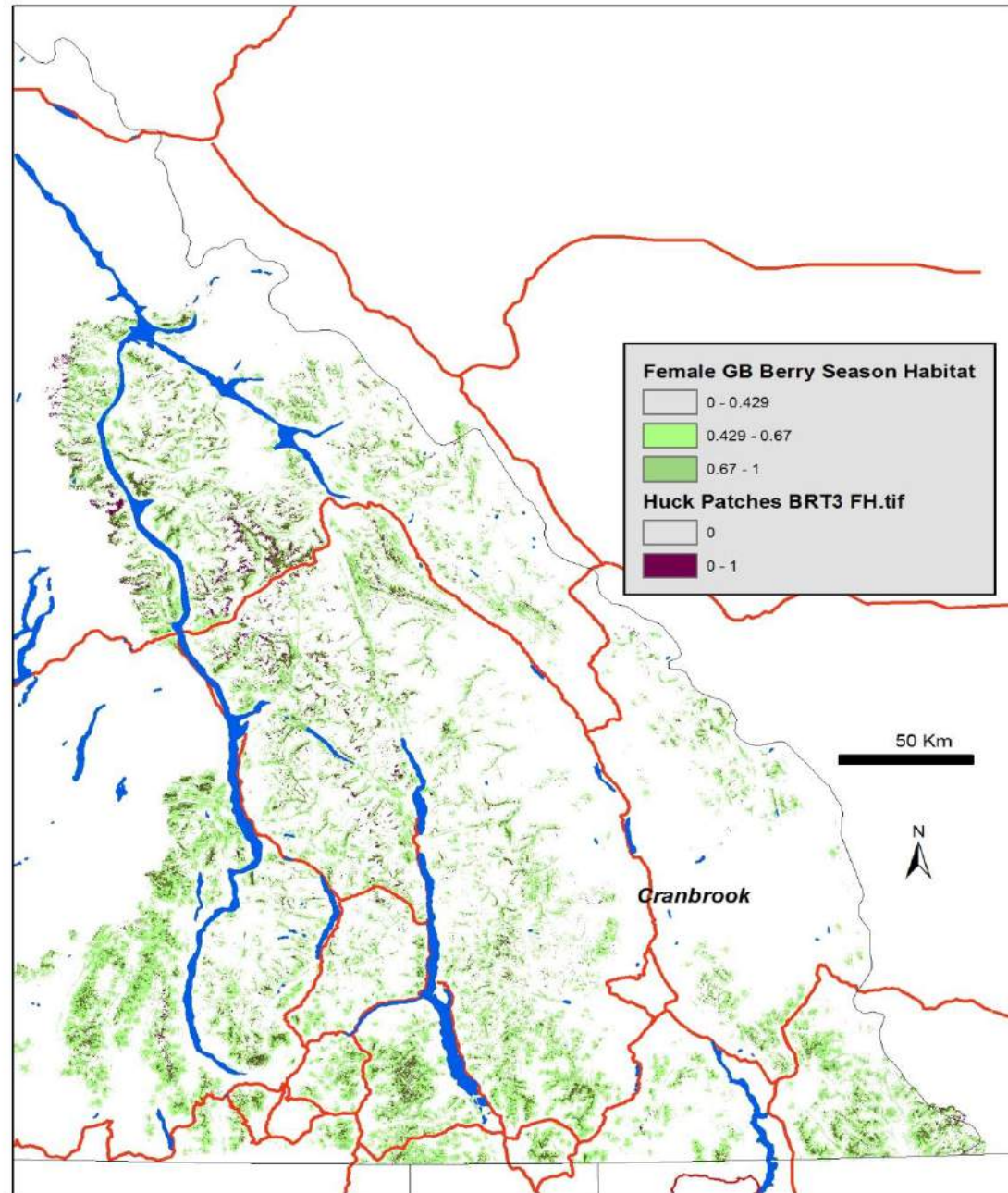
***RSF with huck
layer very
predictive for
female habitat use***



***RSF with huck
layer very
predictive for
female habitat use***

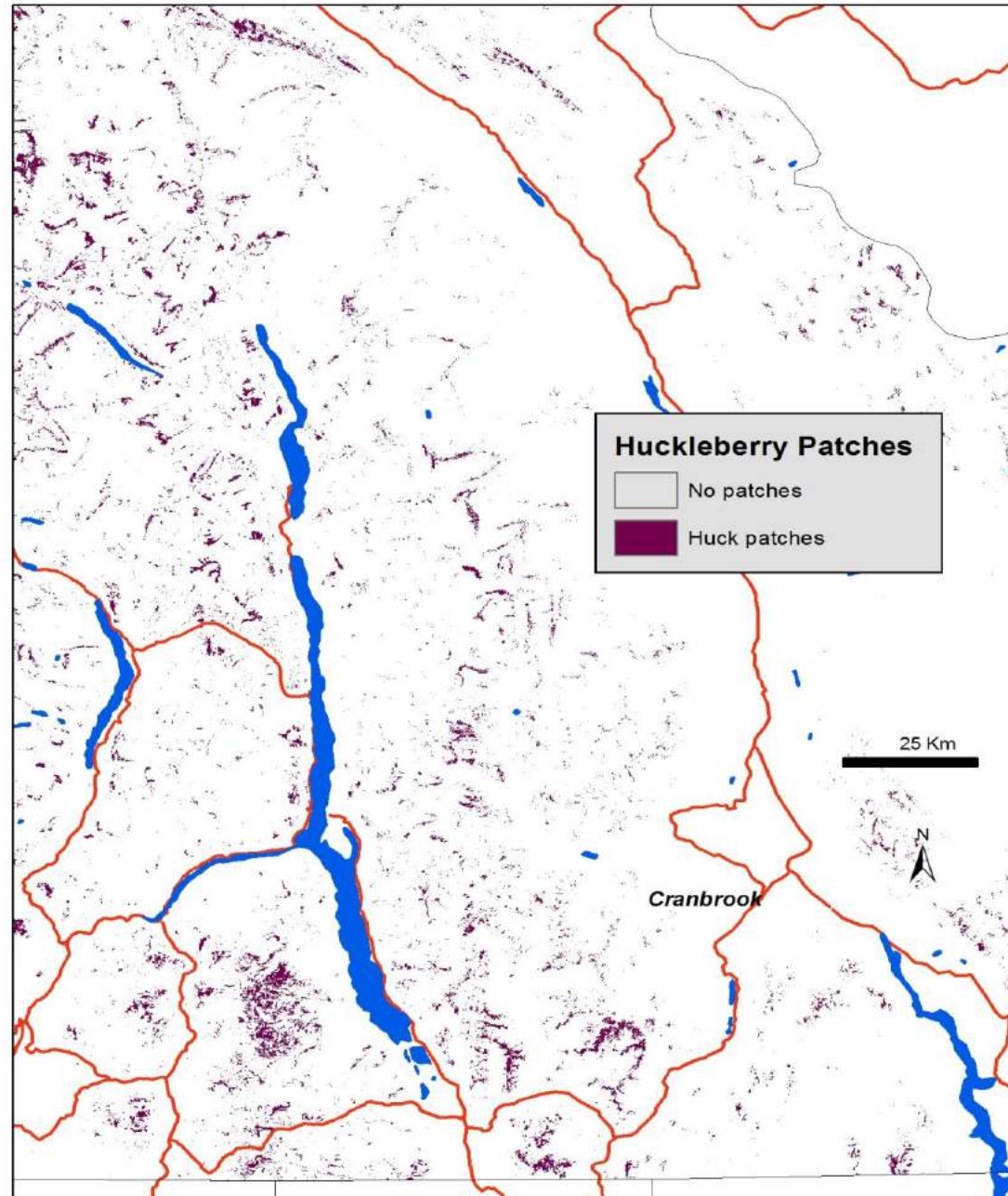
***And With
and DNA capture
data***

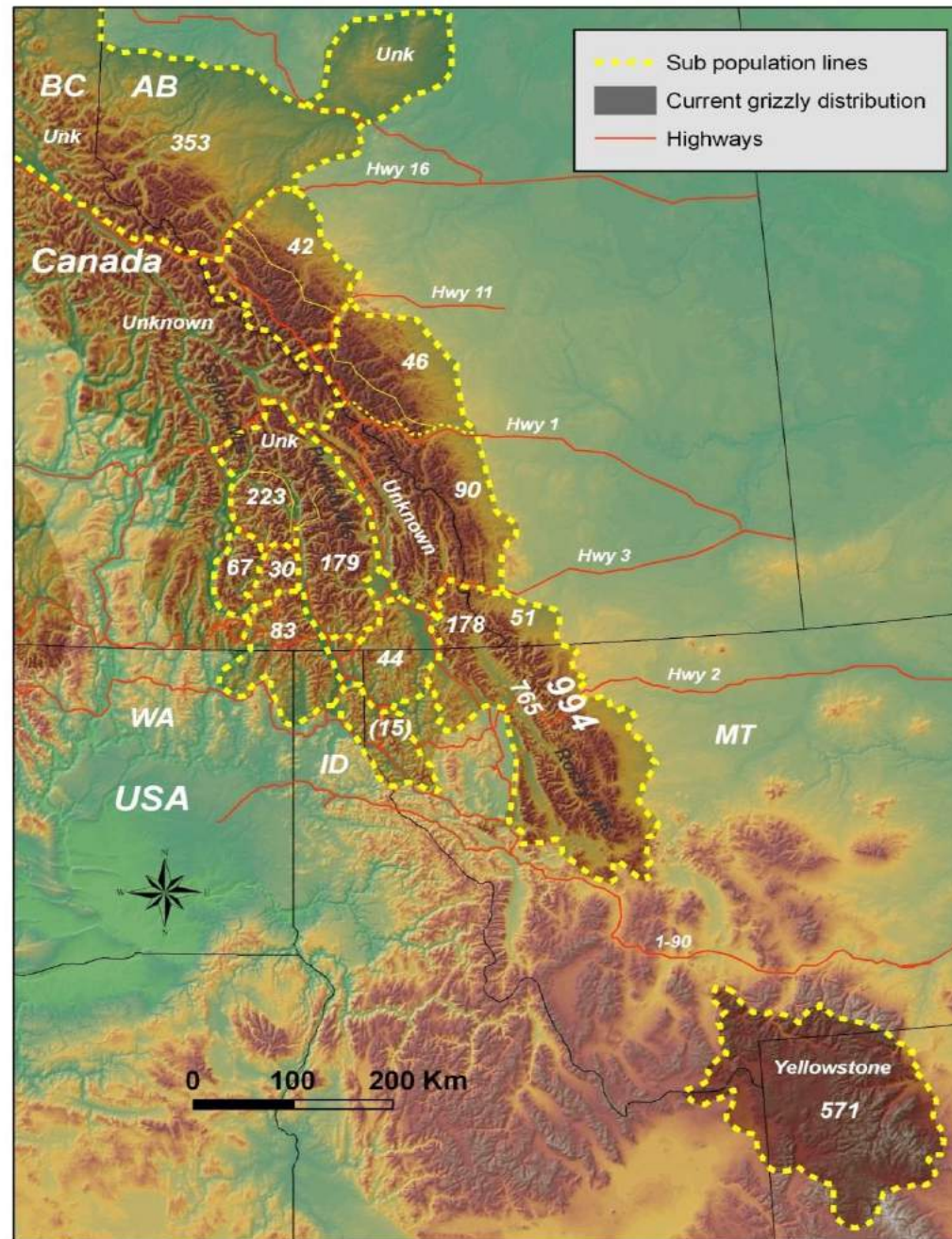




*Potential for
access
management*

*To inform land use
decisions
DO NOT DISTURB
areas*





Proctor et al 2012

WILDLIFE MONOGRAPHS

Vol. 180, January 2012



Population Fragmentation and Inter-Ecosystem Movements of Grizzly Bears in Western Canada and the Northern United States

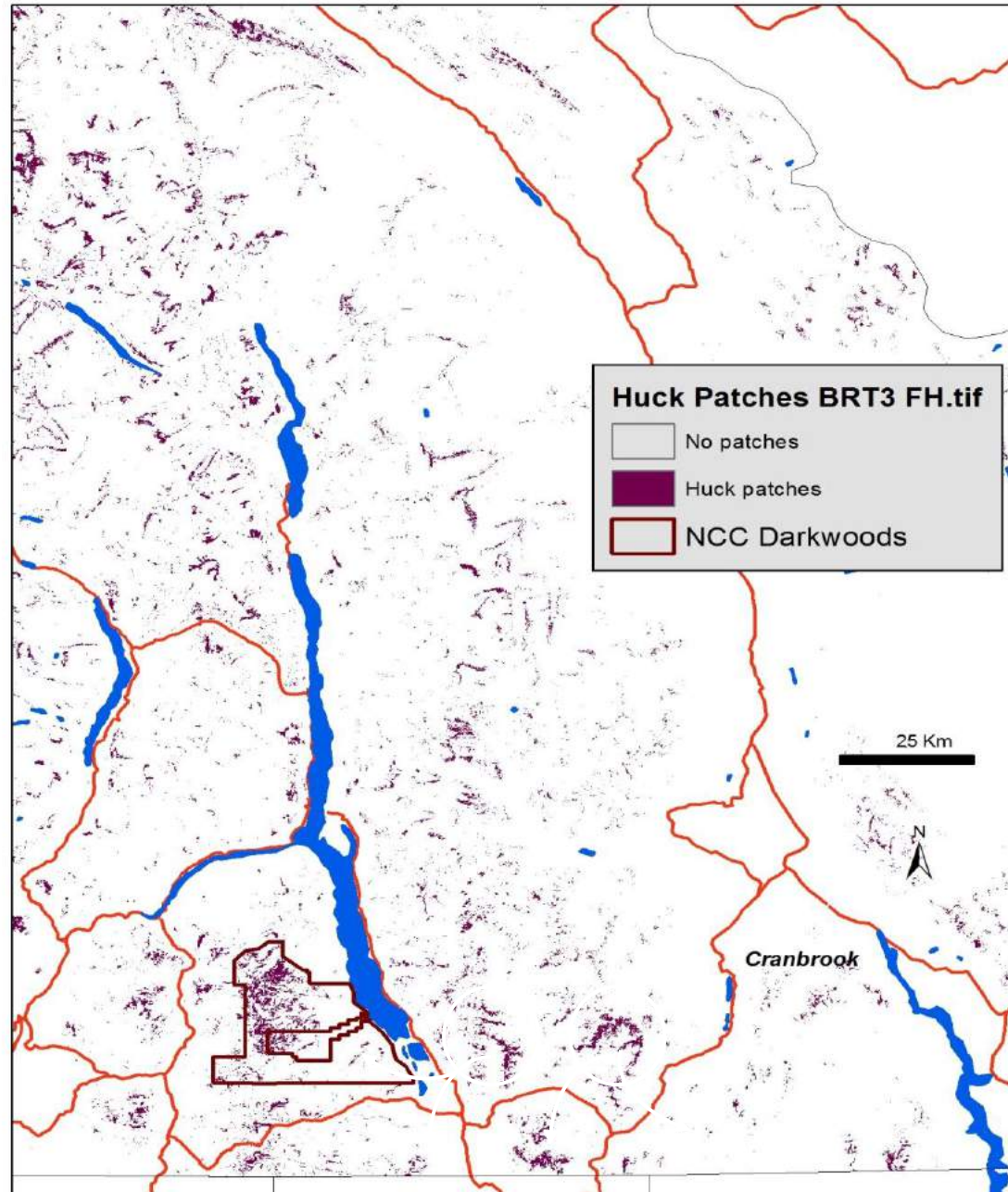
Michael F. Proctor, David Paetkau, Bruce N. McLellan, Gordon B. Stenhouse, Katherine C. Kendall, Richard D. Mads, Wayne F. Kasworm, Christopher Serpheen, Cori L. Lausen, Michael L. Gibeau, Wayne L. Waddell, Mark A. Haroldson, Garth Mowat, Clayton D. Apple, Lena M. Ciampello, Robert M. R. Barclay, Mark S. Boyce, Charles C. Schwartz, Curtis Strobeck



***Potential for
access
management***

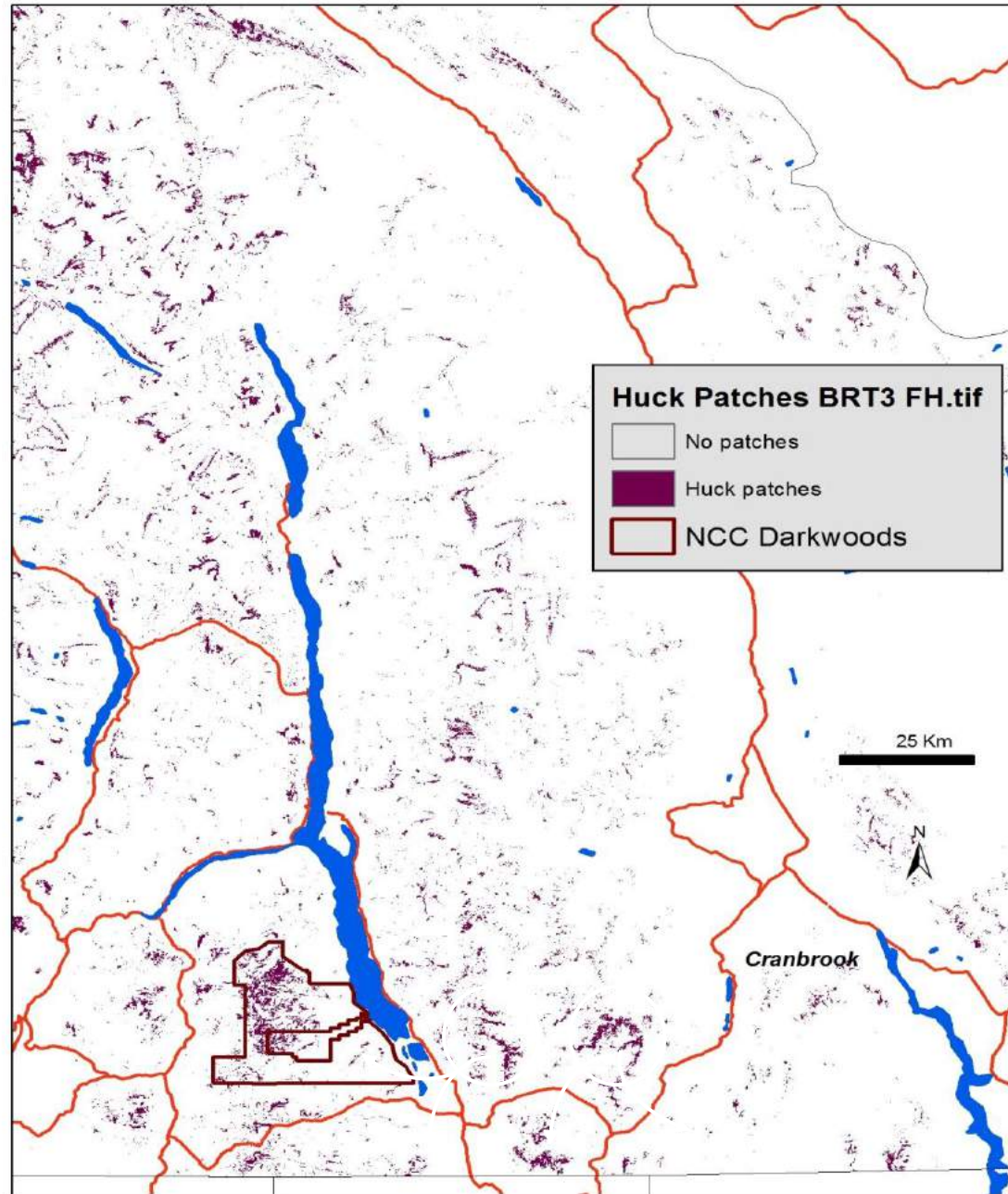
***Protect a nursery
for potential
migrants***

***Potential to
manage for
huckleberry
patches post
timber harvest***



***Integrate with
Mortality Risk***

***Integrate with
Reproductive data***

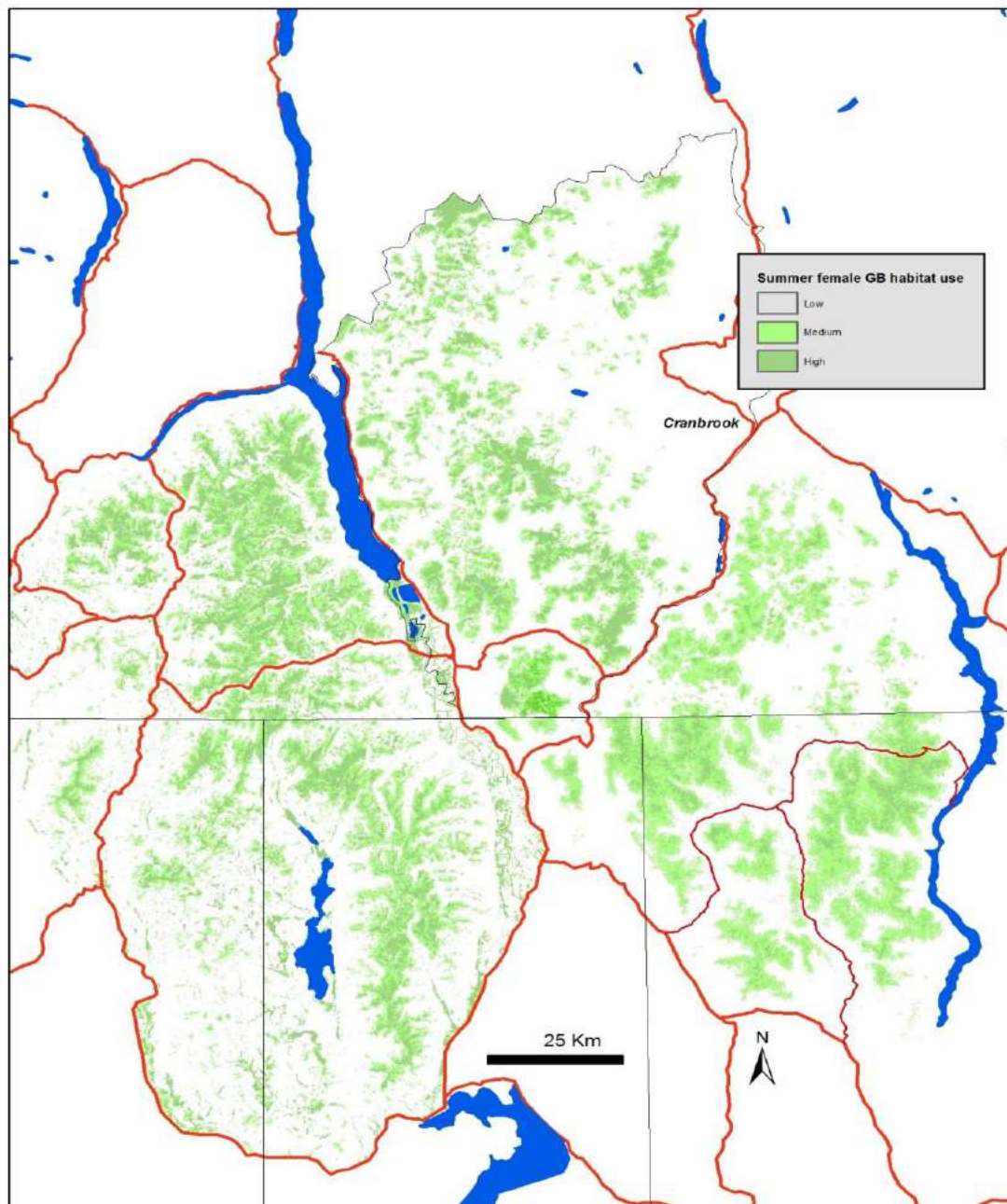


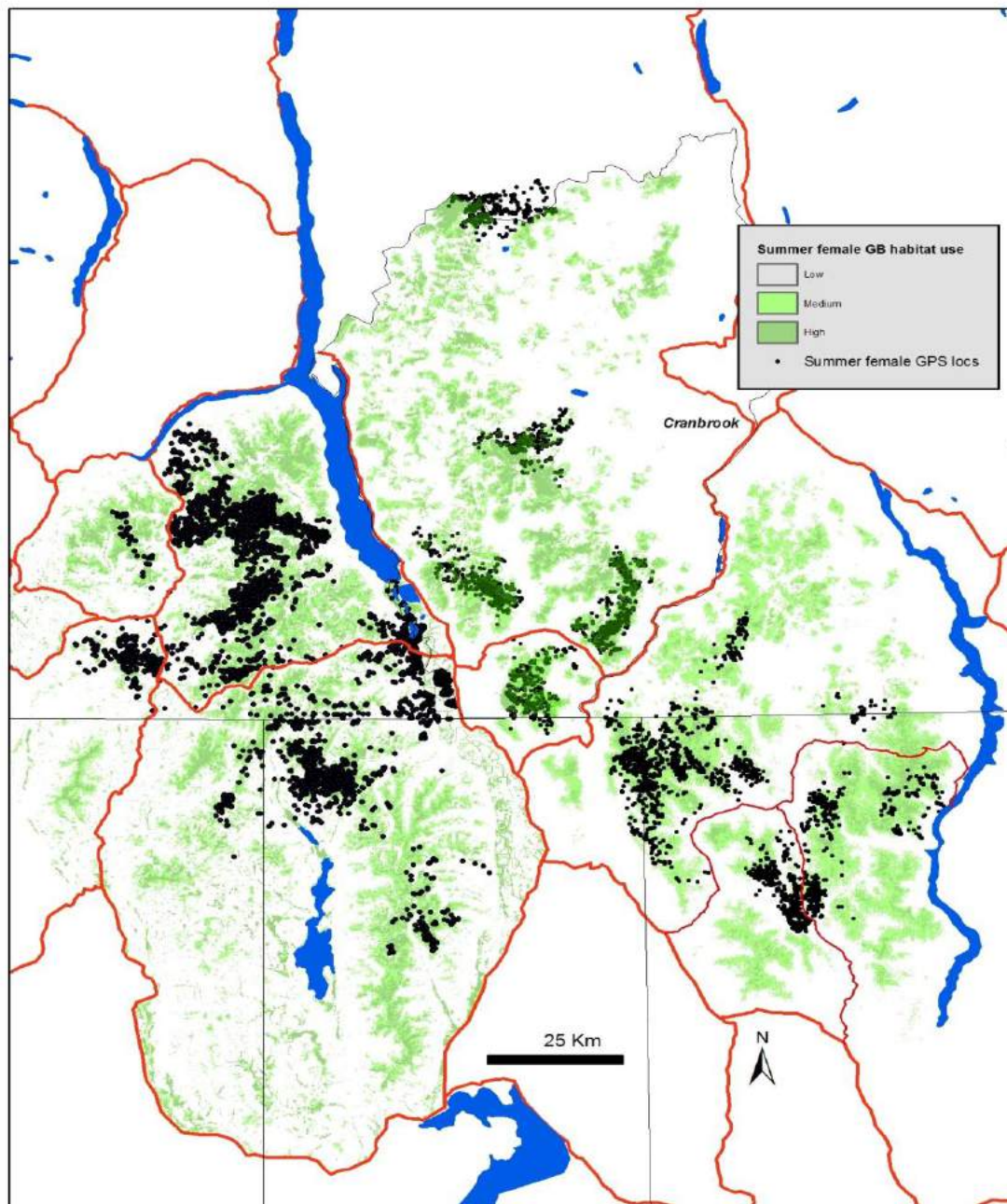
***Unified theory of bottom up habitat
selection and top down habitat
survival***
The Grizzly Dance of Berries & Bullets

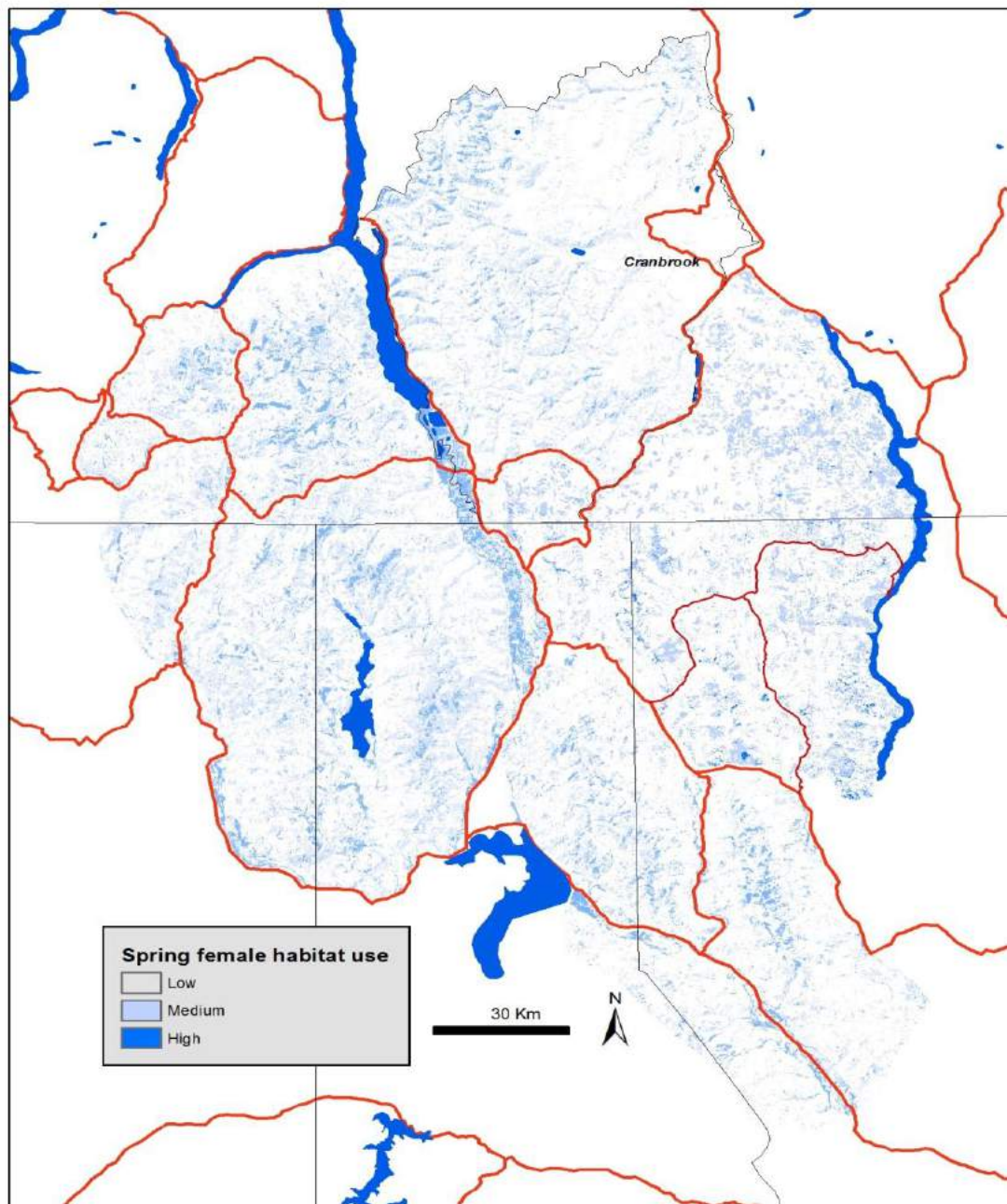


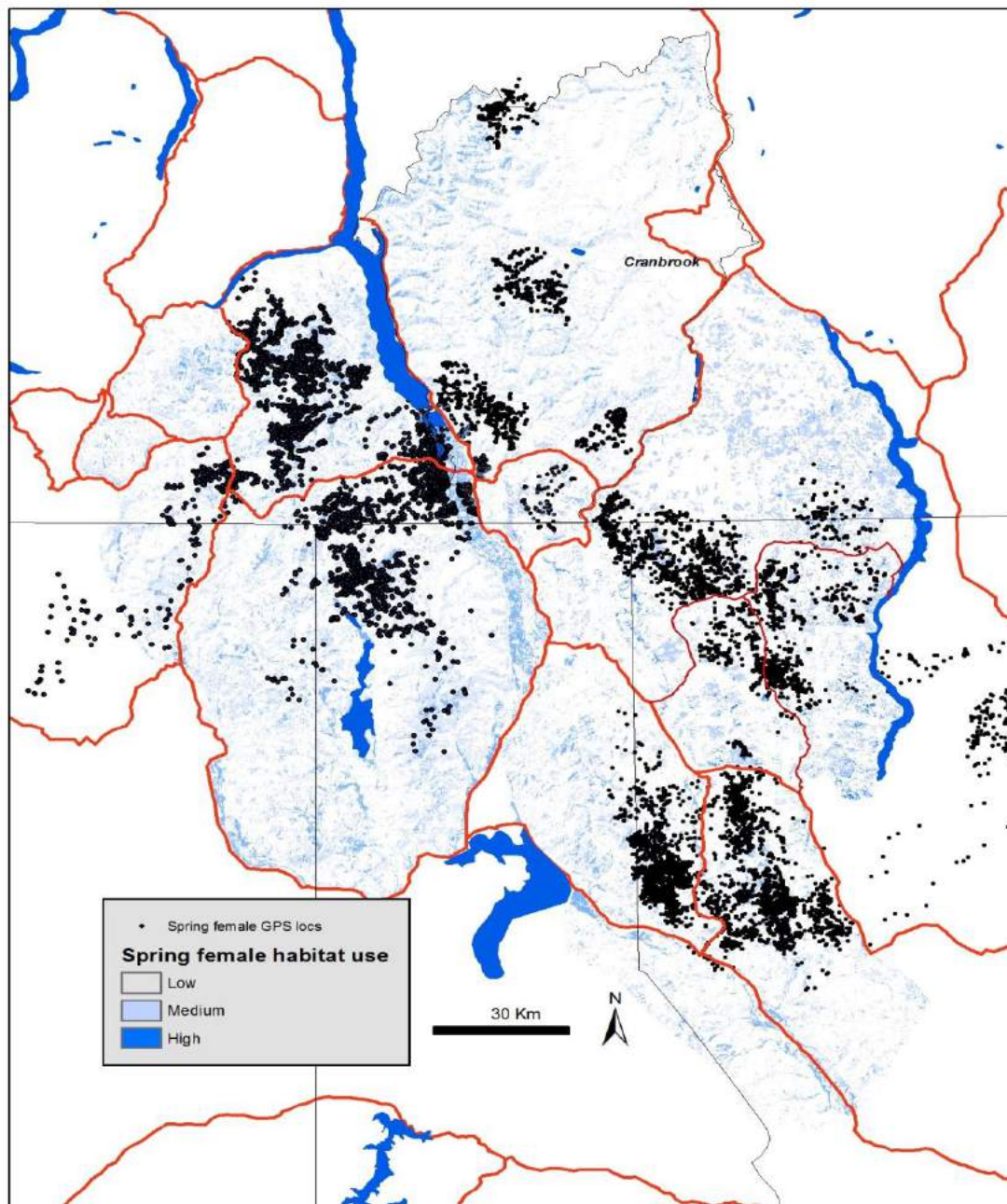
***Fine scale sex and season
specific habitat use***

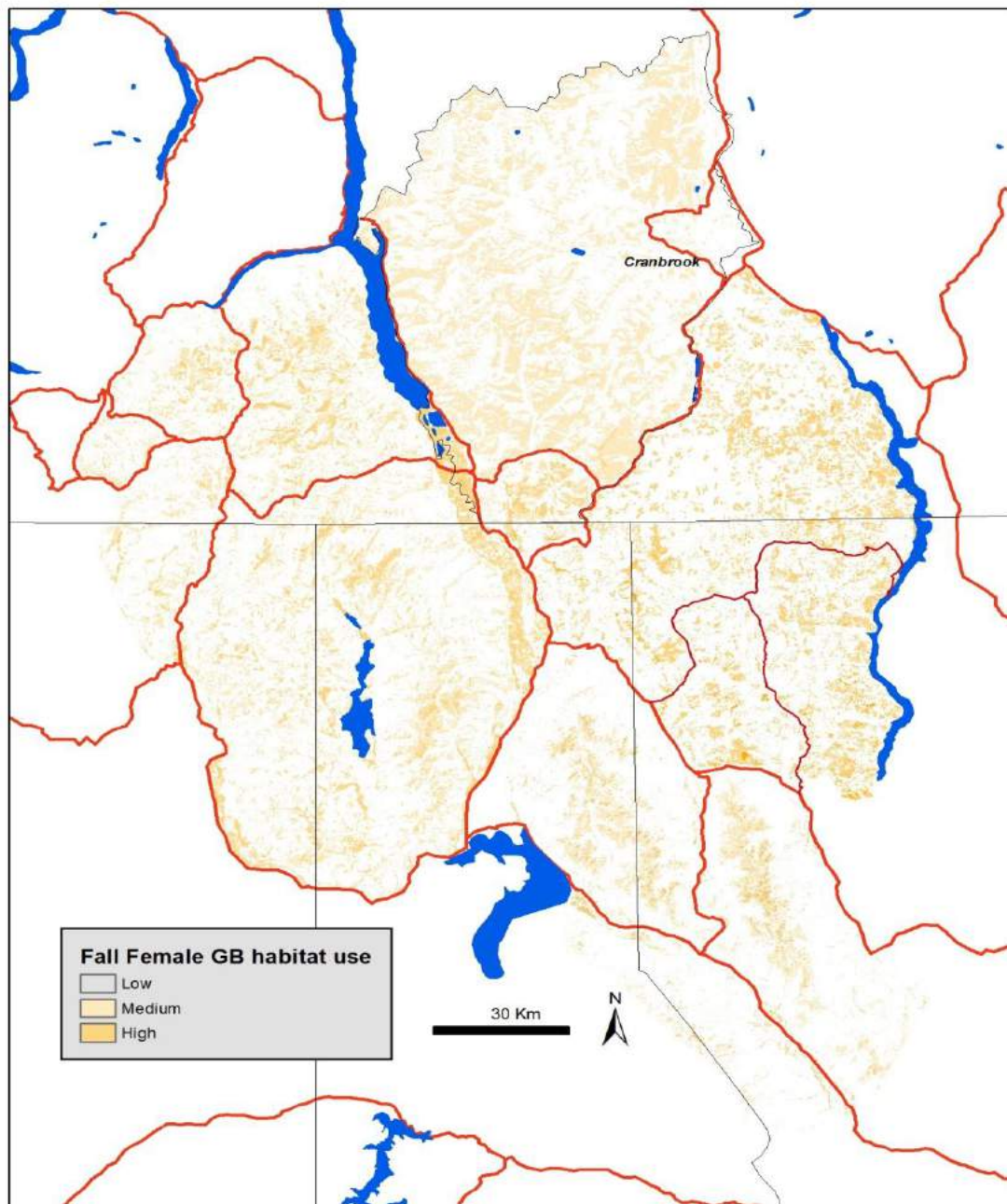
For land use managers

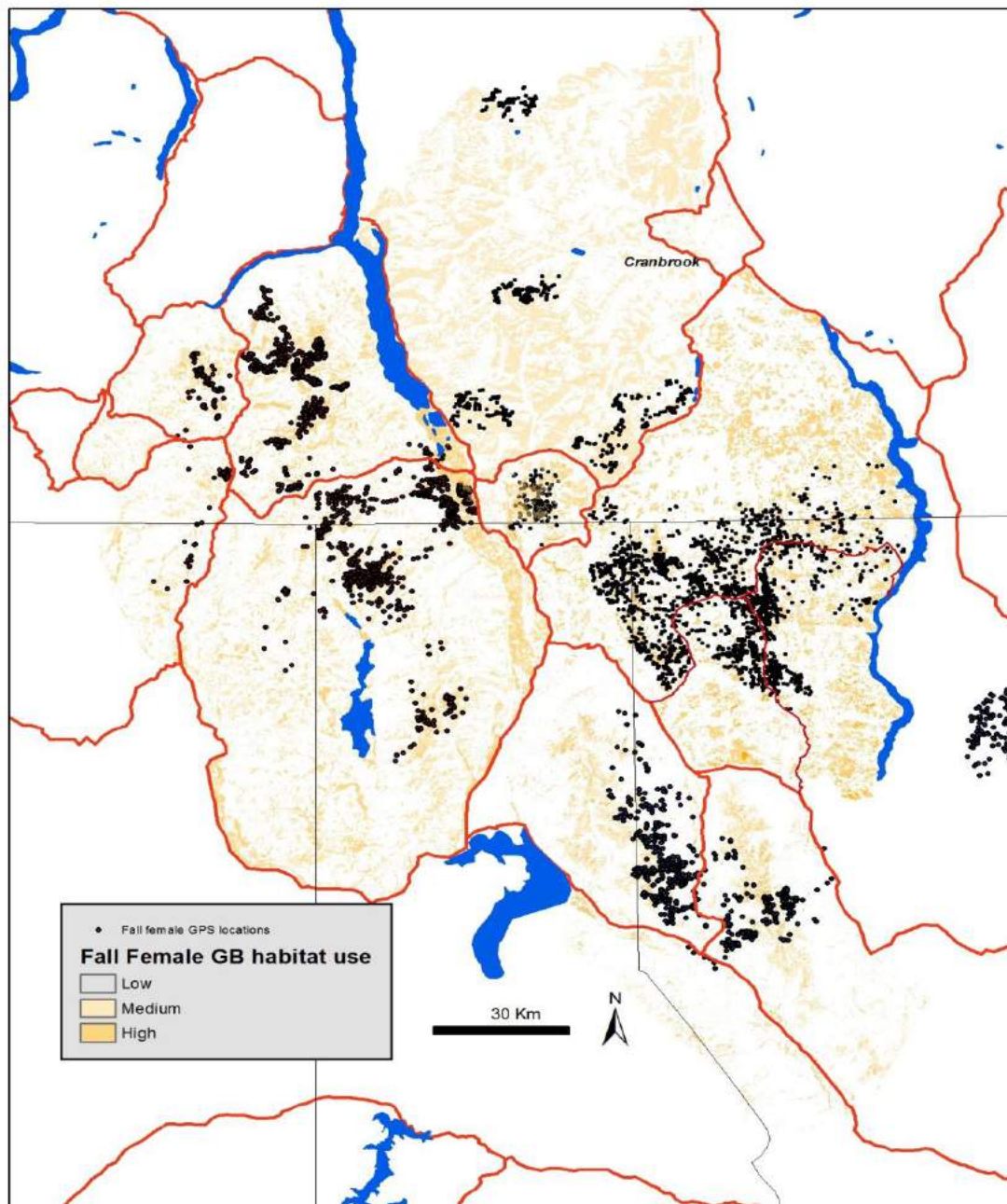












Papers coming up

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

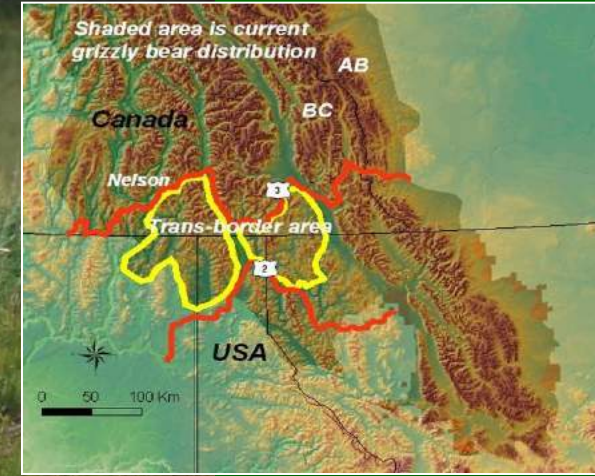
Unified theory of bottom up habitat selection and top down habitat survival, includes hucks, morts, road densities, habitat use, survival, and reproduction

Black bear fragmentation detected with pedigrees

Black bear connectivity mapping



Trans-border Grizzly Bear Project



- HOME
- ABOUT US
- TRANS-BORDER GB STATUS
- RESEARCH RESULTS
- PARTNERS
- CONTACT US

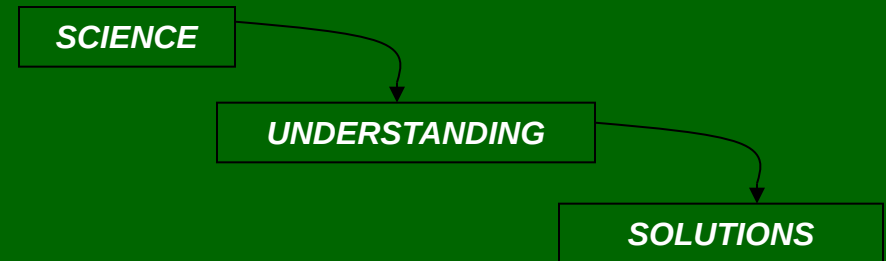
- ### QUICK LINKS
- Linkage Zones
 - Bear Aware
 - Report a problem grizzly
 - Bear-proof your home site
 - Electric fencing
 - Education slide shows
 - Know your bear species

Help us teach grizzly bears to avoid trouble. [Learn how](#)



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.



CONSERVATION SOLUTIONS



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

