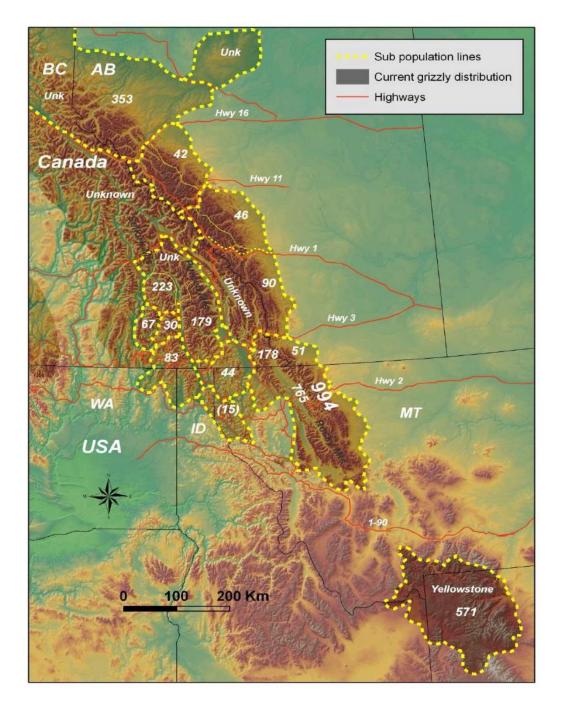
# Grizzly bears, fragmentation, connectivity, and management in the Canada - US trans-border region



Michael Proctor, Wayne Kasworm, Chris Servheen and others

Ron Niebrugge / WildNatureImages



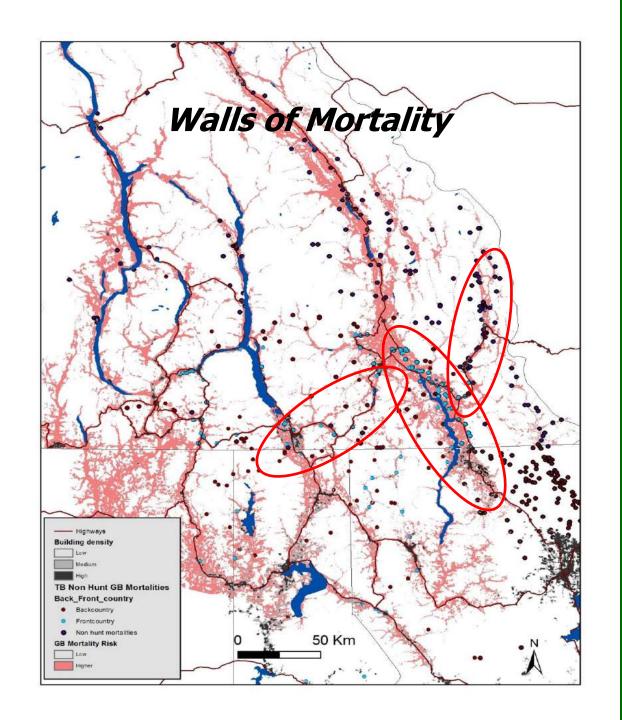


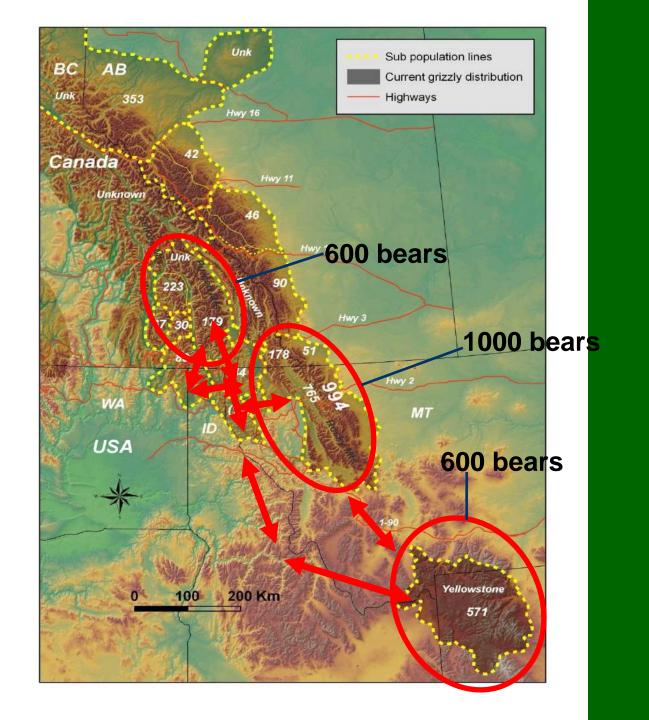
Vol. 180, January 2

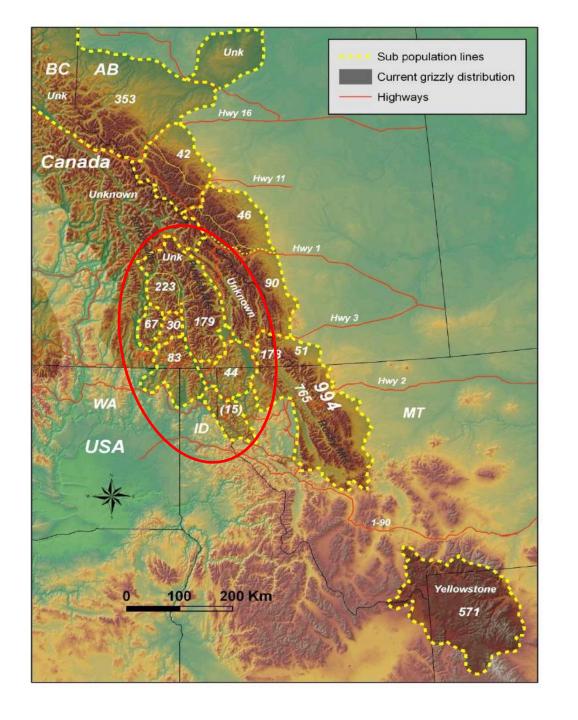


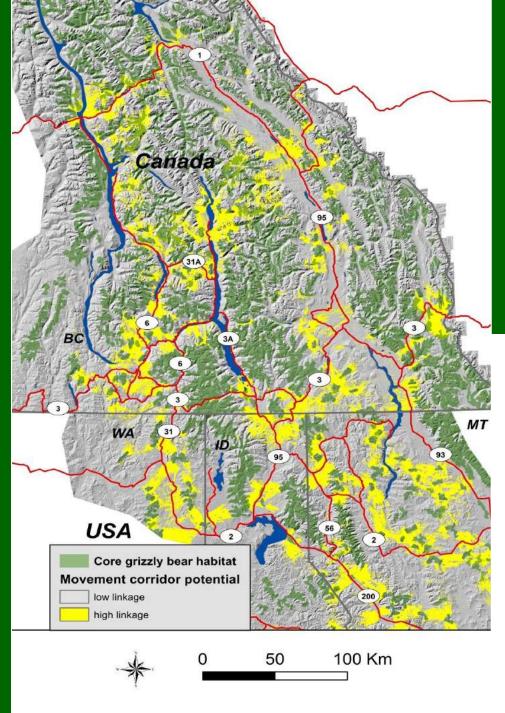
Michael F. Proclor, David Peetsou, Bruce N. McLellen, Gordon B. Stenhouse Kothelene C. Kondal, Richard D. Mace, Wayne F. Kawacorn, Christopher Servicen, Con L. Leusen, Michael L. Glacau, Wayne L. Wakidoni, Mierk A. Harcidson, Gieth Mc Chipfon D. App., Lans M. Clamelso, Robert M. B. Bardos, Mierk B. Bryde,

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

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SCOTT E. N. ELSEN, Department of Renewable Resources, University of Alberta, Edmonton, TSS 265
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HOUMAS G. RADANDT, US Fan and Wildige Service, 285 Fan Hatchery Road, Libby, MT, 59822, USA

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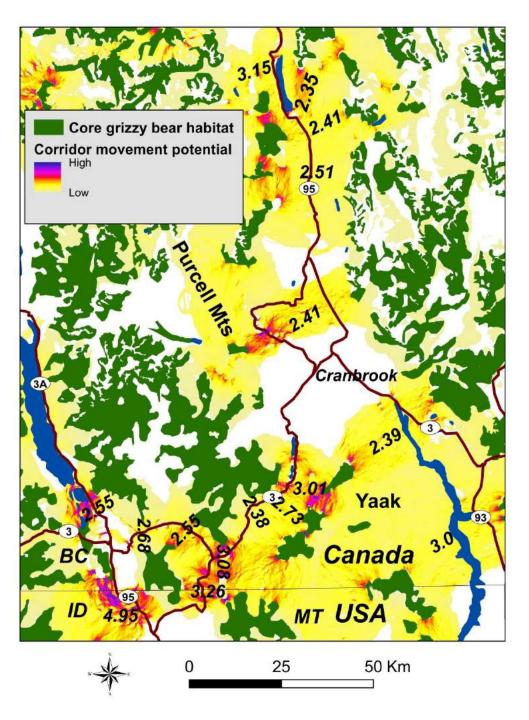
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MICHAEL F. PROCTOR<sup>3</sup>, Brondow Scalegical Ltd., F.O. Box 505 Fasts, Britan Courace, 105 JMC, Conses

SCOTT E, NIELSEN, Department of Renewable Resources, University of Alberta, Samonton, 15G 359 Alberta

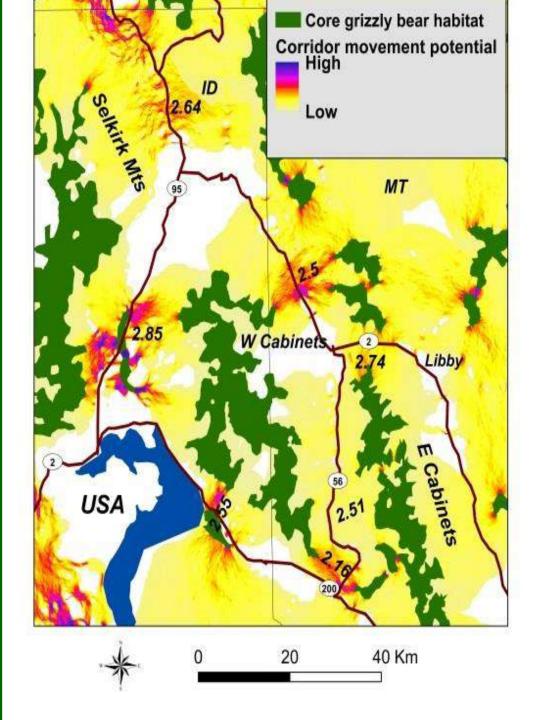
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THOMAS G. BACANOT, US Fan and Wilelfe Service, 285 Fan Hatchery Rood, Libby, MT, 59822, USA A GRAFT MACHUTCHOM, 827 MM 21 Melan, Shann Calumba, VDL 452 Canada MARK S. BOYCE, Openathers of Balagood Sciences, University of Aberta, Samanan, Abenta, 155 252,

MARK S. SDYCS, Department of Bological Sciences, University of Alberta, Samonton, Alberta, 15G 35, Canada



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

M.C.AEL F. PROCTOR<sup>2</sup>, Brohoole Ecological Ltd., A.O. Box 606 Asia, Broan Courtein, 100 JMC, Consists

SCOTT E. NIGLSDN, Department of Renewable Resources, University of Alberta, Edmanton, TSS 252

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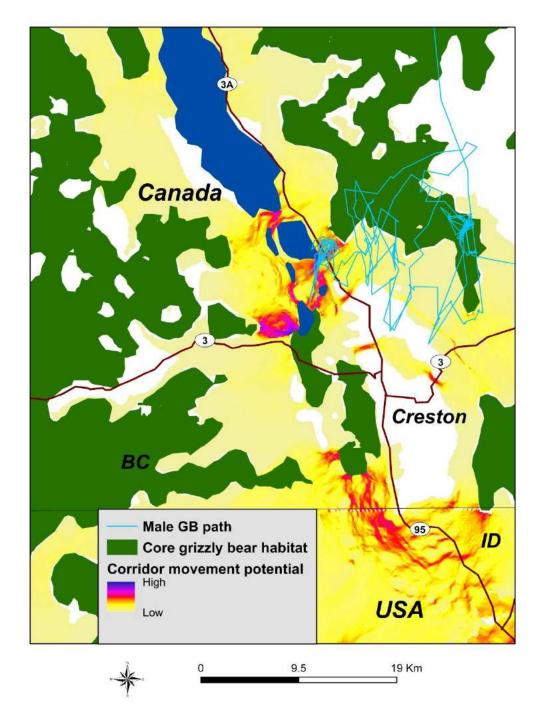
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SCOTT E. N. ELSEN, Department of Renewable Resources, University of Alberta, Edmonton, TSS 259

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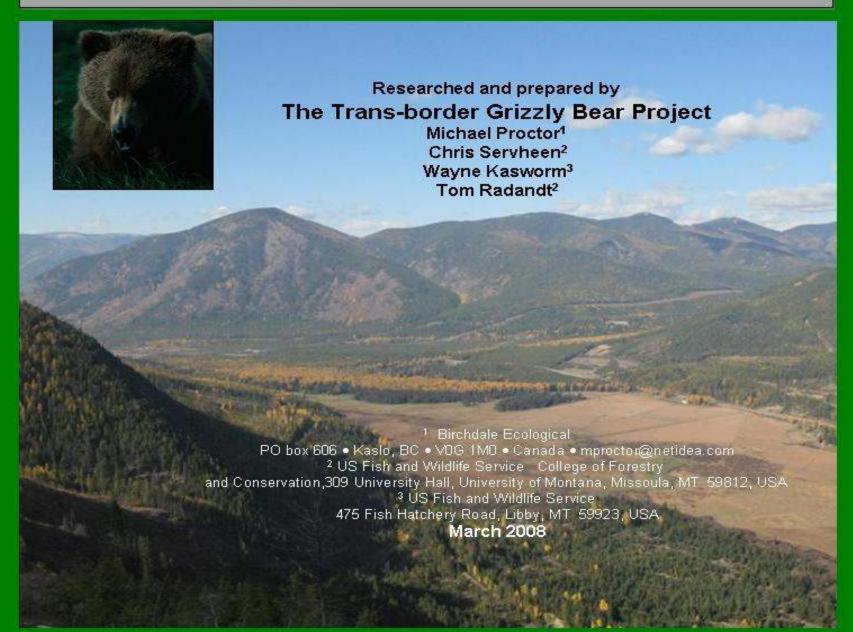
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IMARK S. BOYCE, Department of Biological Sciences, University of Alberta, Samonton, Alberta, TSG 25 Conada



Seed ngreenrigentations

#### Grizzly bear linkage enhancement plan for Highways 3 & 3A corridors in the south Purcell and Selkirk Mountains of British Columbia





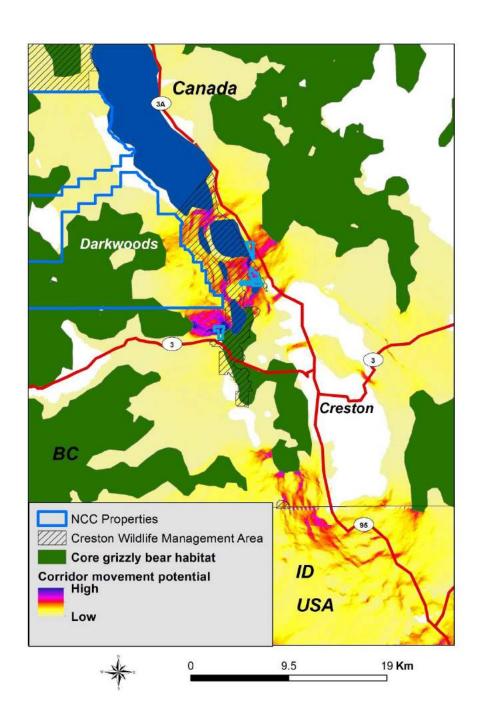
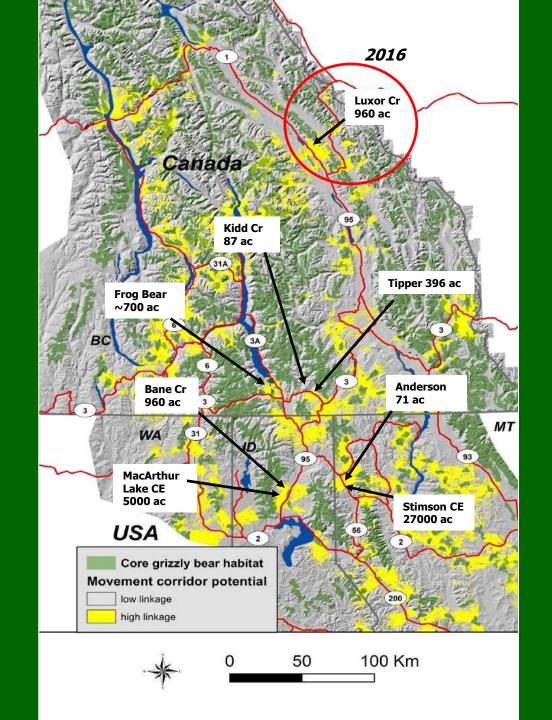




Table 1. Connectivity Land Purchases and Conservation Easements: in conjunction with Nature Conservancy Canada, Yellowstone to Yukon Conservation Initiative, Nature Trust of BC, Vital Ground, US Forest Service Forest Legacy

	Acres purcha	ses CEs	total acres	\$
Canadian lands Creston Valley	1051 468	211 211	1,262 679	3,600,000 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** 



#### **Electric fence program**





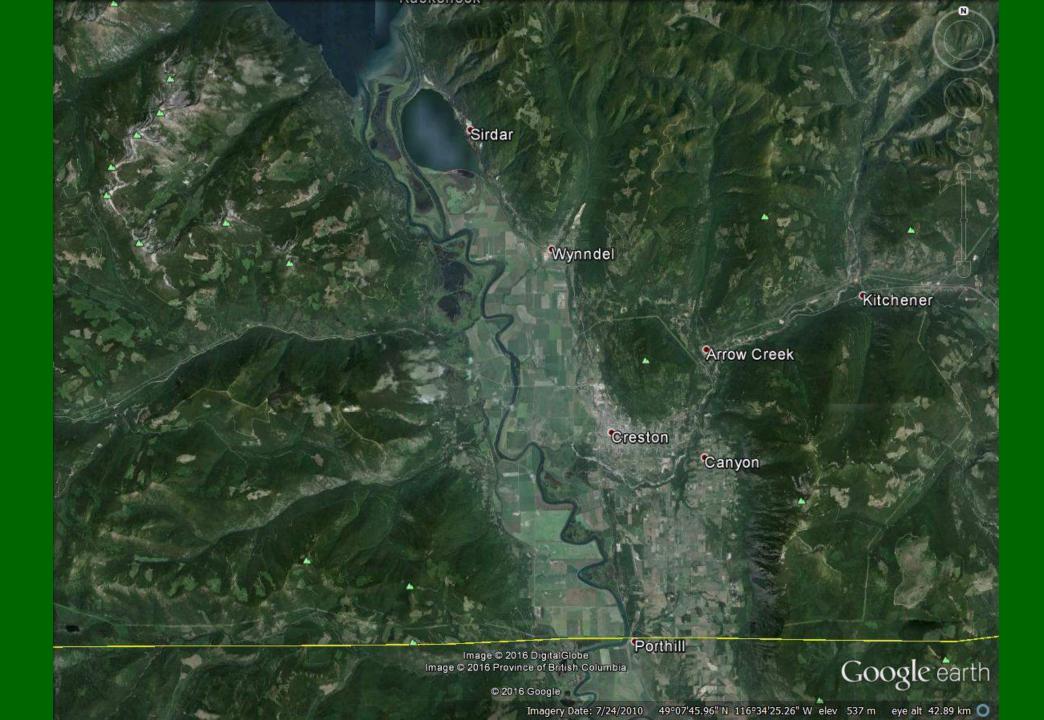


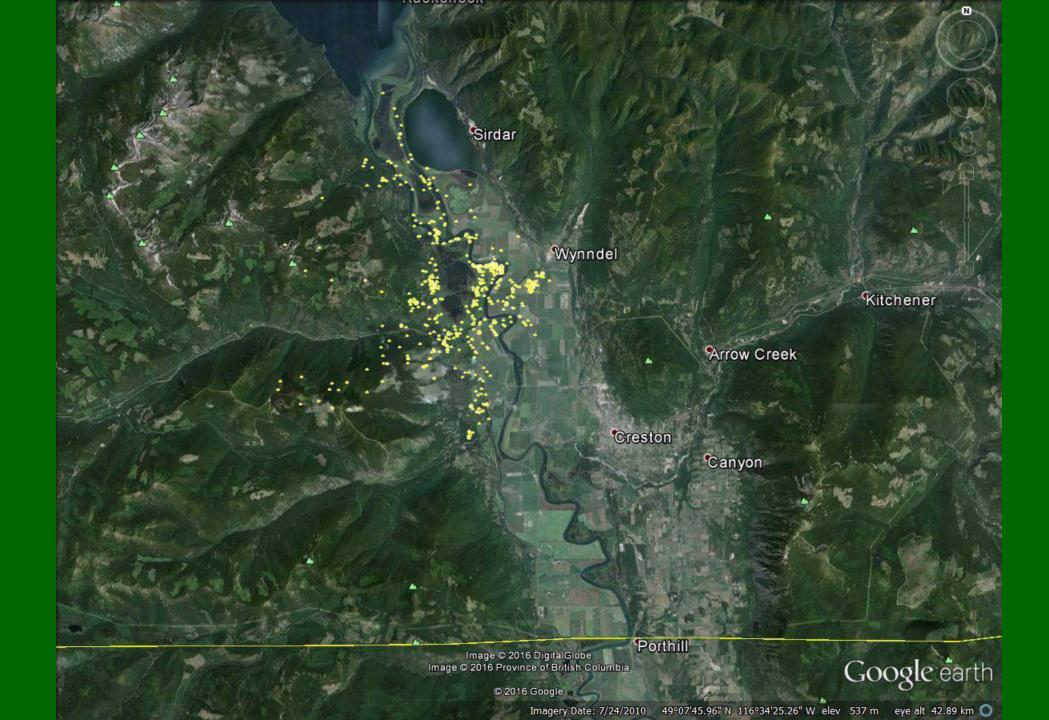


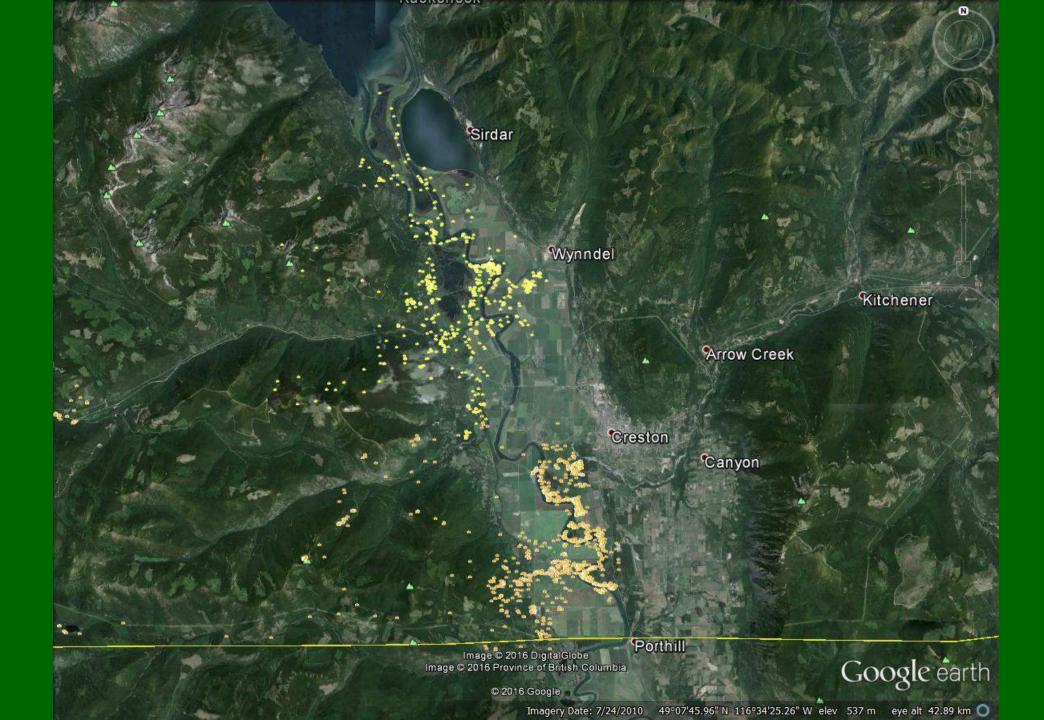
This program has expanded regionally, with over 100 fences put up

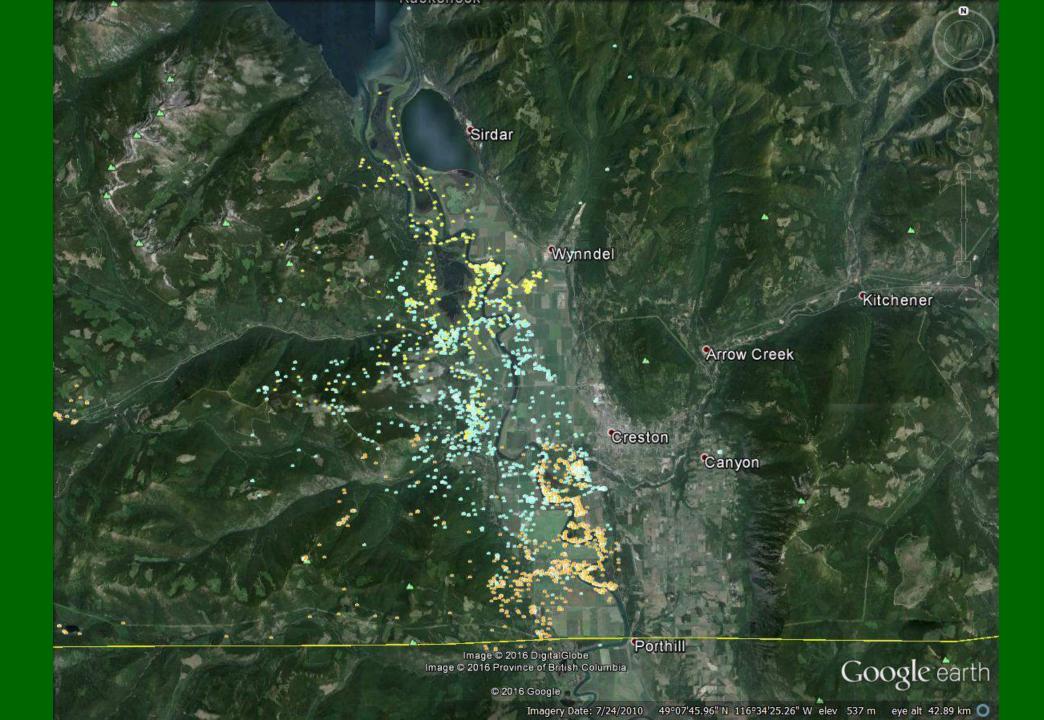
## The face of connectivity - Females residing in Linkage Areas Increases need for coexistence programs May require permanent management effort

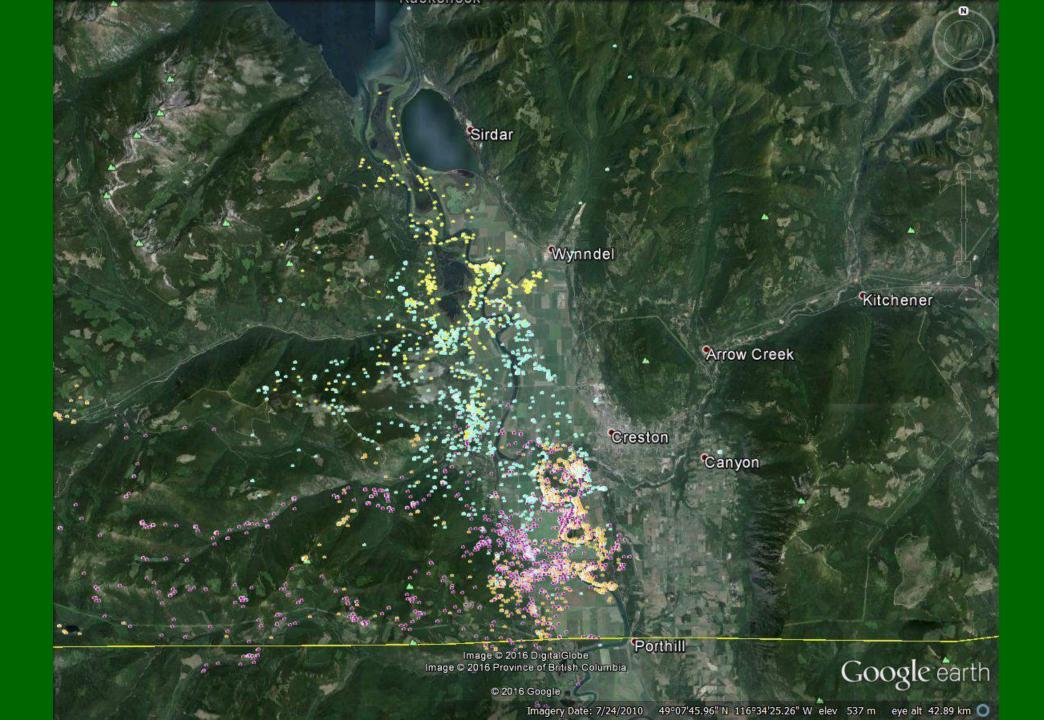


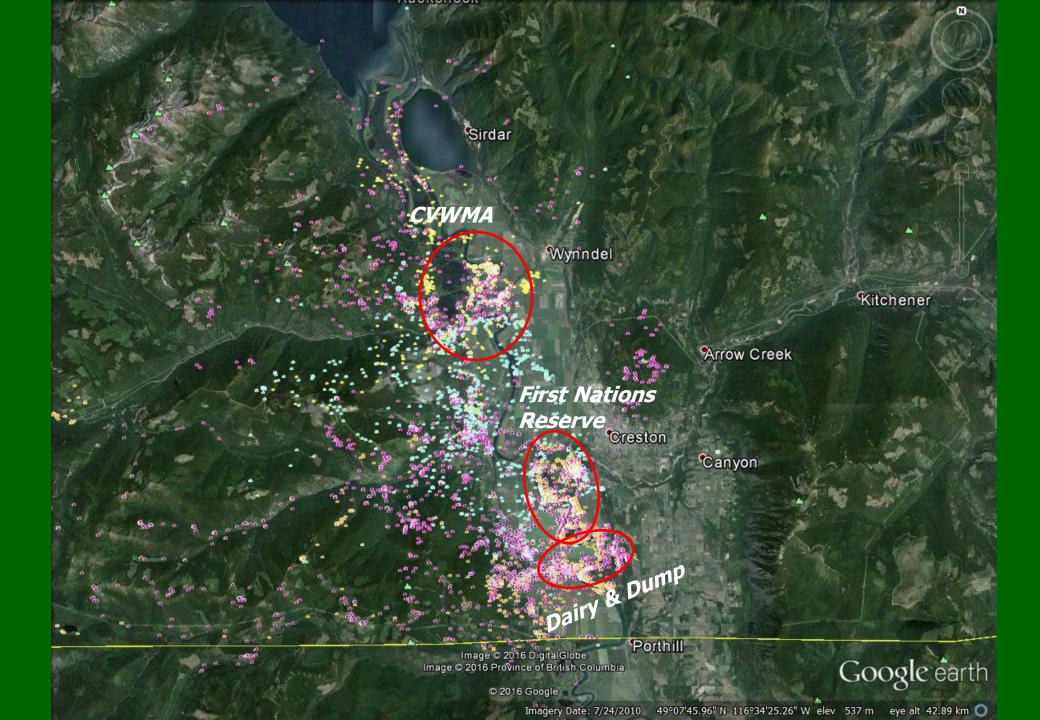


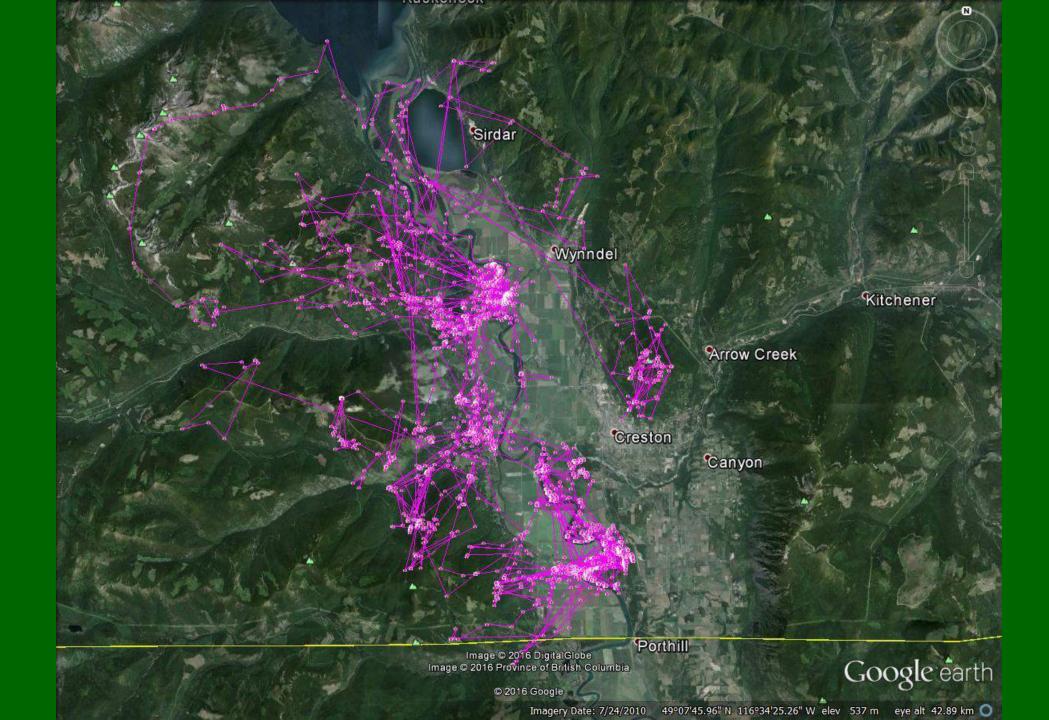












### Bringing conservation to the people living with it in their face, in their yards

Farmers
Ranchers
Hunters, Birders
Recreationists

**Local and Regional government planners workshops** 

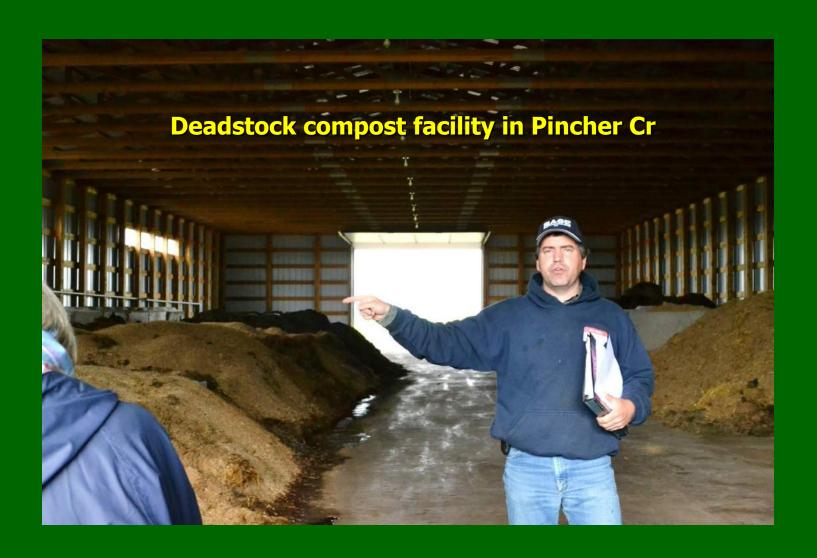
Farmer / rancher workshops and working groups Electric fences, composting dead animals, silage containment, personal safety

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



#### **Deadstock compost facility in the Creston Valley**



#### **Bottom up and Top down conservation**

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

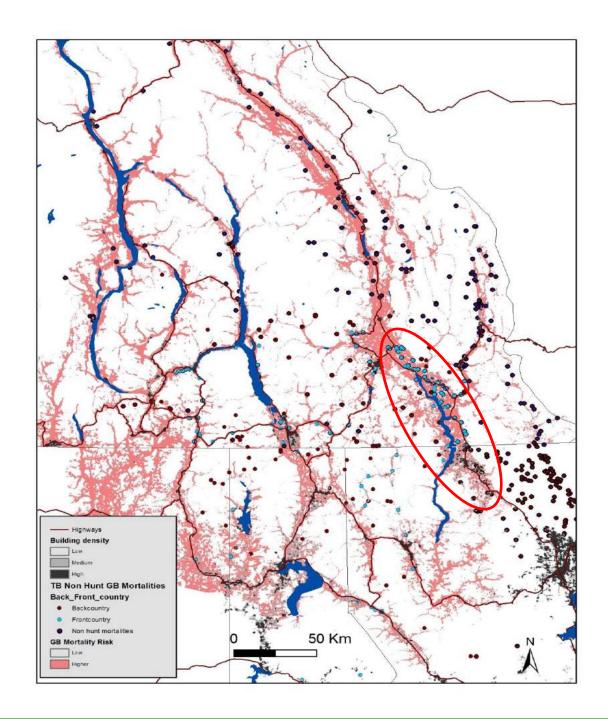
**Top down -** in the office, agency, boardroom, government office theory, policy, laws, bylaws, regulations

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



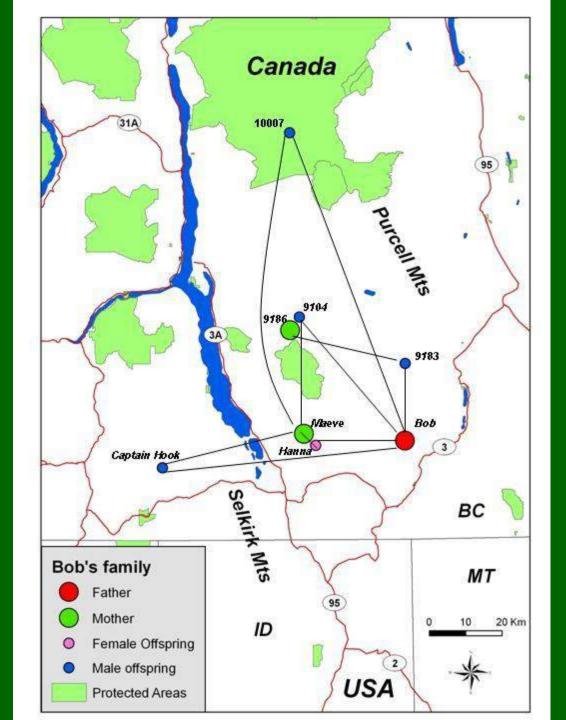


Michael Proctor, Birchdale Ecological Wayne Kasworm, USFWS Wayne Wakkinen, Idaho Fish & Game Chris Servheen, USFWS

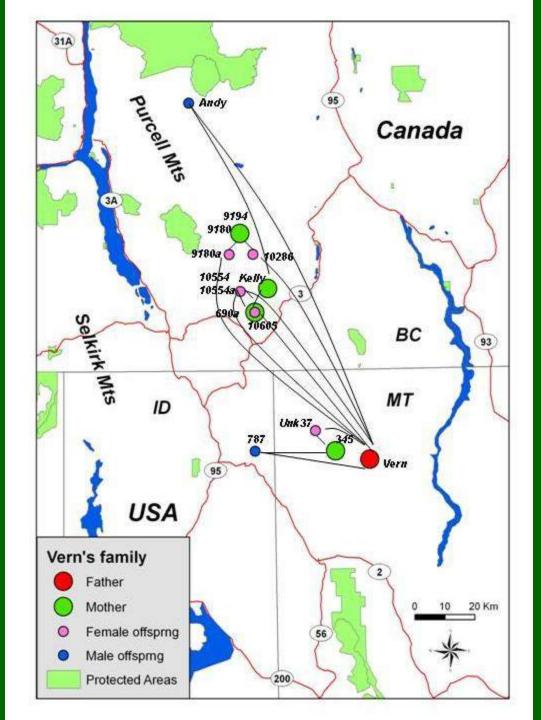
Prepared for
Great Northern Landscape Conservation Cooperative
Liz Claiborne Art Ortenberg Foundation
Wilburforce Foundation
Habitat Conservation Trust Foundation
Columbia Basin Fish Wildlife Compensation Program
National Fish and Wildlife Foundation
Yellowstone to Yukon Conservation Initiative

December 2012

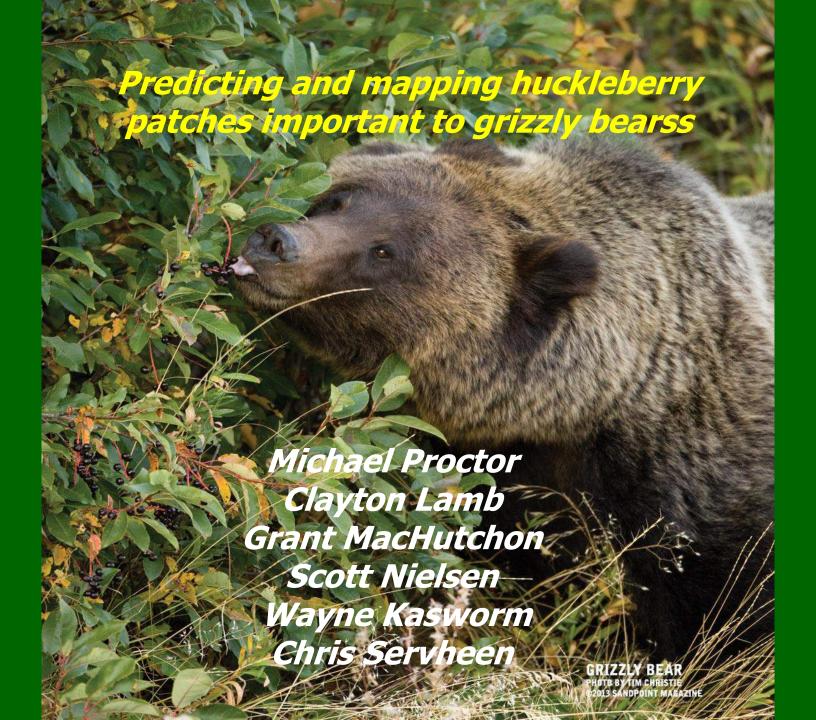
#### Male dispersal



## Male breeding across BC Hwy 3







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





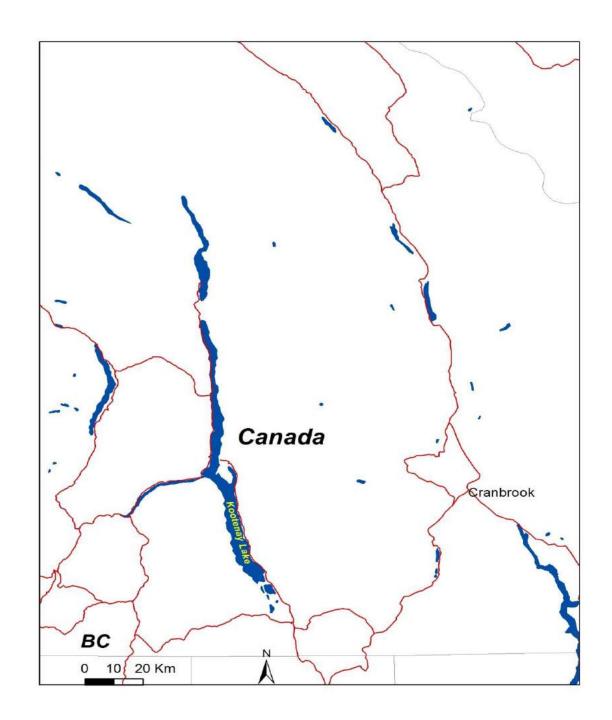
Huckleberries
drive much of the
regional grizzly
bear reproduction
and productivity

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

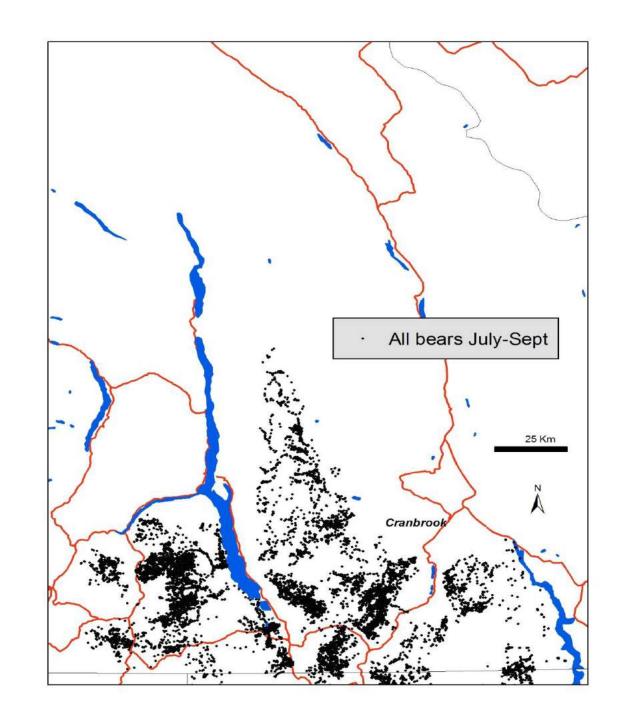


~40 GBs

Summer GPS locations

Used to find huckleberry patches

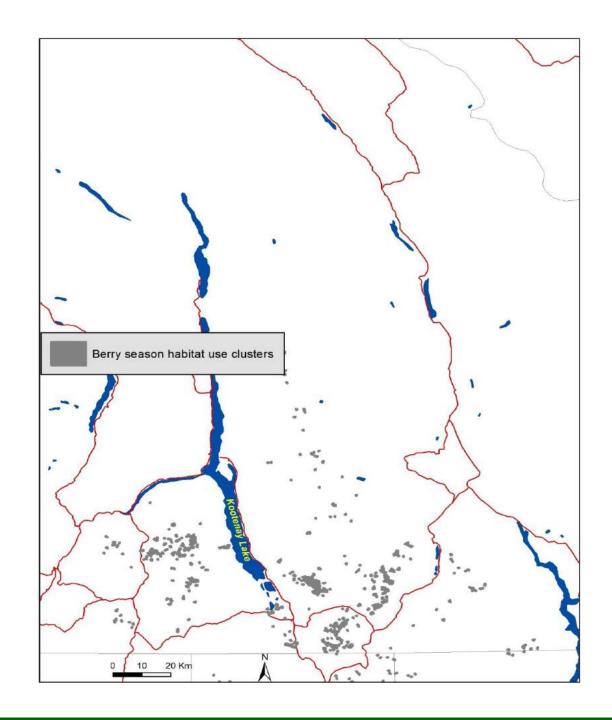
Huckleberry patches important to bears



2 summers

Over 400 site visits

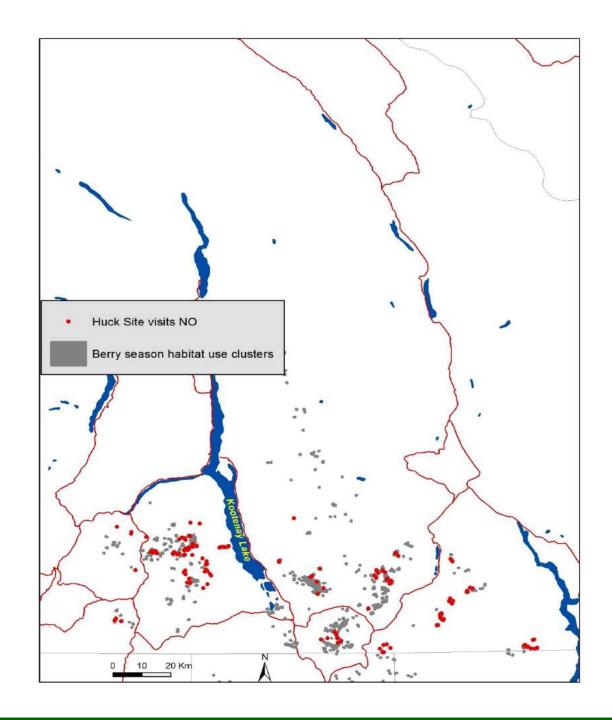
277 huck patches



2 summers

Over 400 site visits

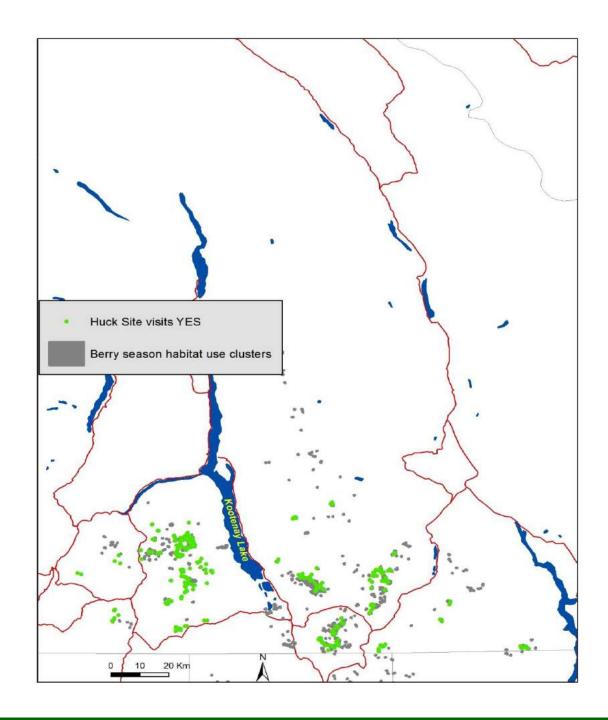
277 huck patches



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

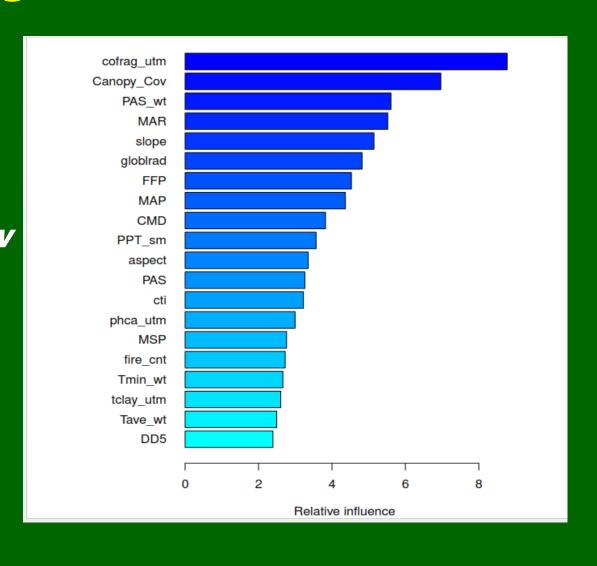
Habitat variables, canopy, fire

,	, , , , , , , , , , , , , , , , , , ,				
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	Precipiation 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				
	p.,				

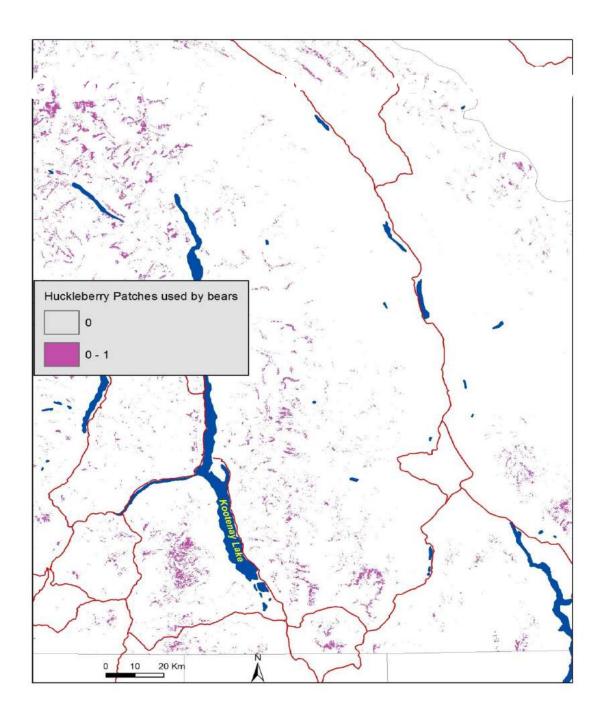
### Ecological variables

#### 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 Sail nH

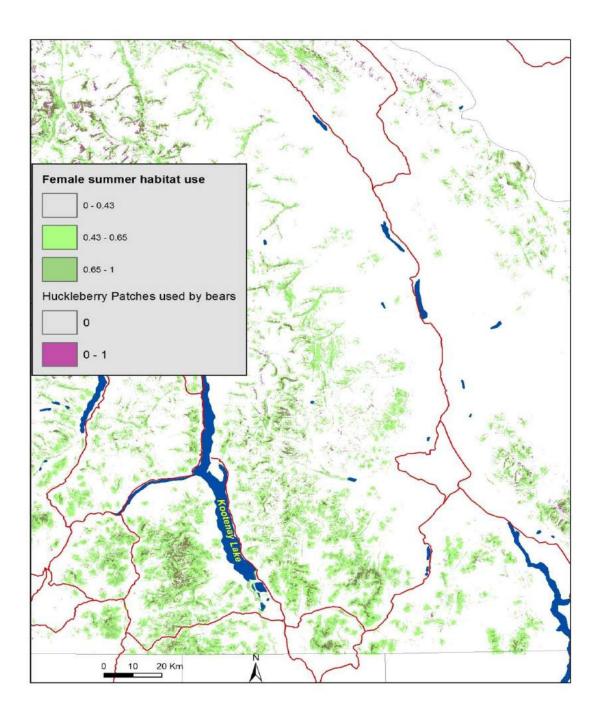


### Huckleberry patch layer

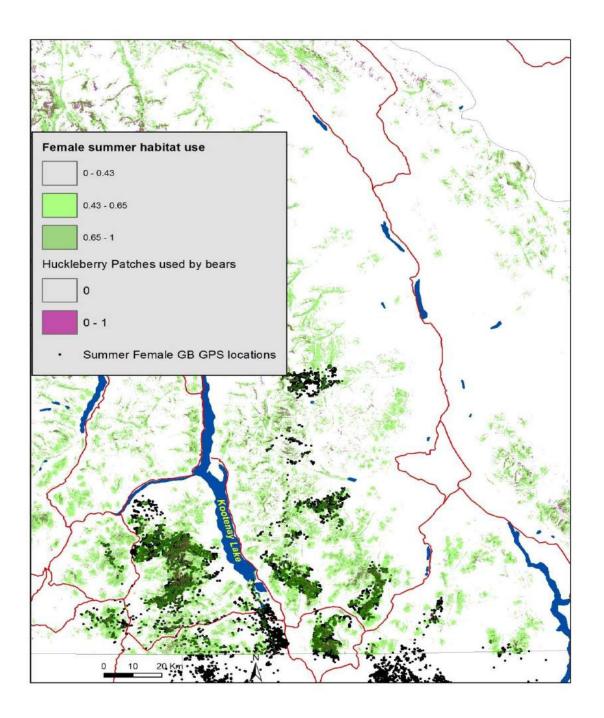


Huckleberry patch layer

Within a Resource Selection Function model

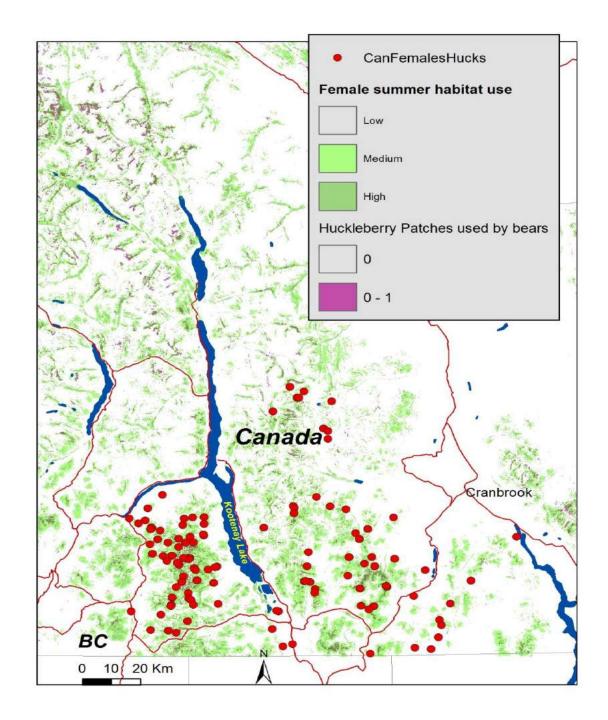


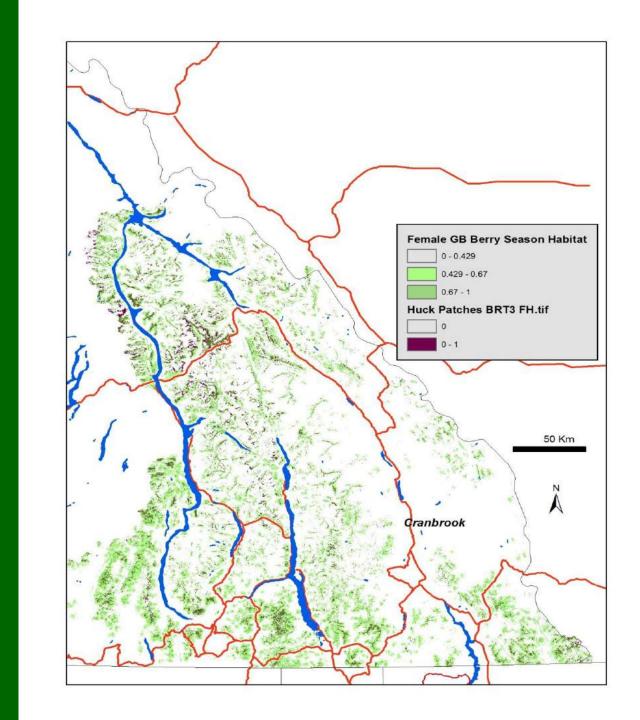
RSF with huck
layer very
predictive for
female habitat use



RSF with huck
layer very
predictive for
female habitat use

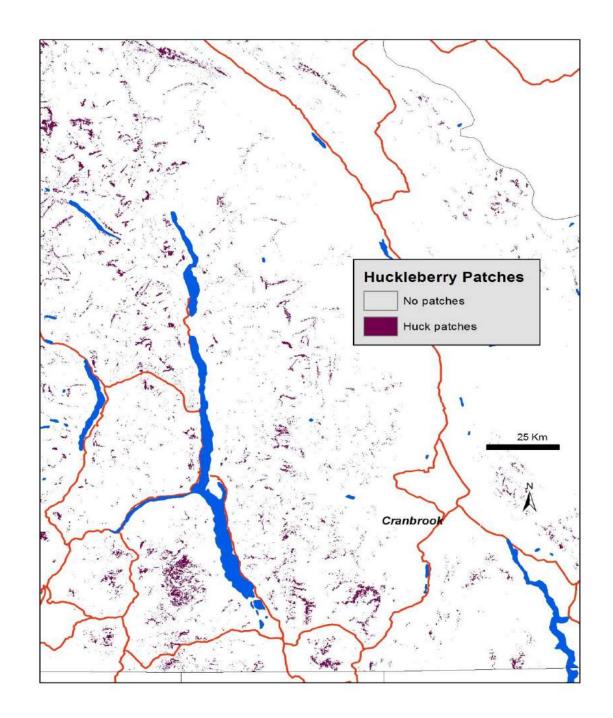
And With and DNA capture data

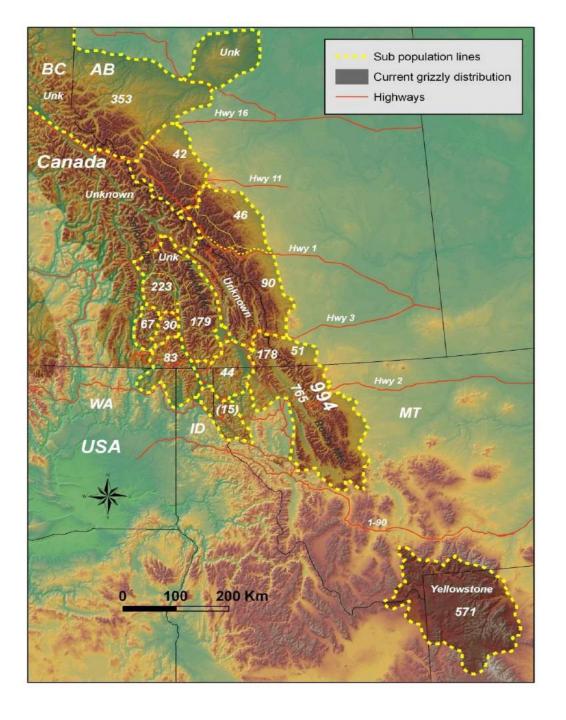




Potential for access management

To inform land use decisions
DO NOT DISTURB
areas





#### **Proctor et al 2012**



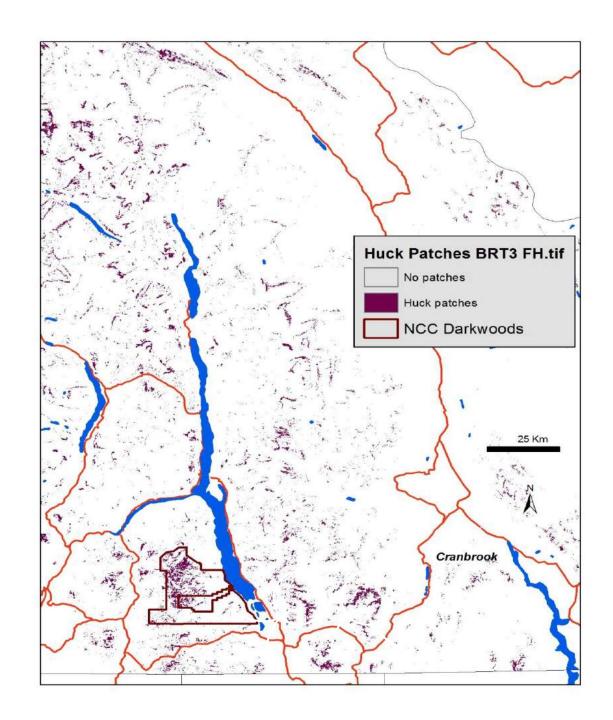


Supplement to The Journal of Wildlife Manageme

Potential for access management

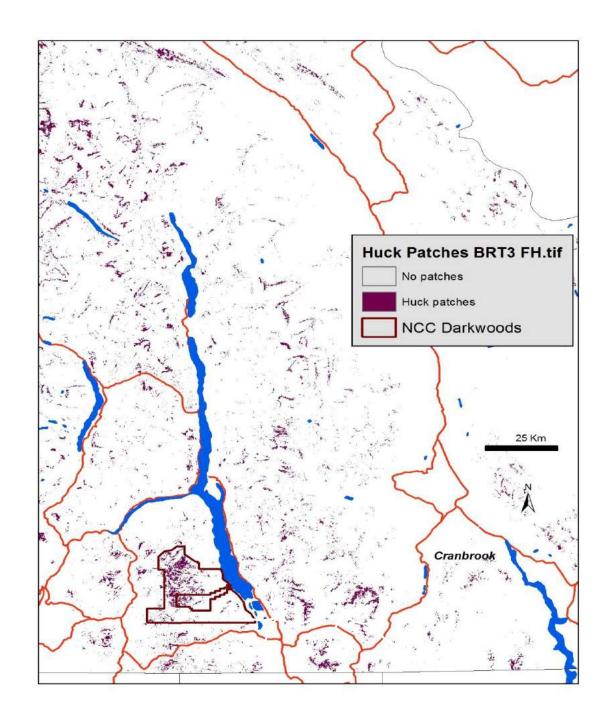
Protect a nursery for potential migrants

Potential to manage for huckleberry patches post timber harvest



#### Integrate with Mortality Risk

Integrate with Reproductive data

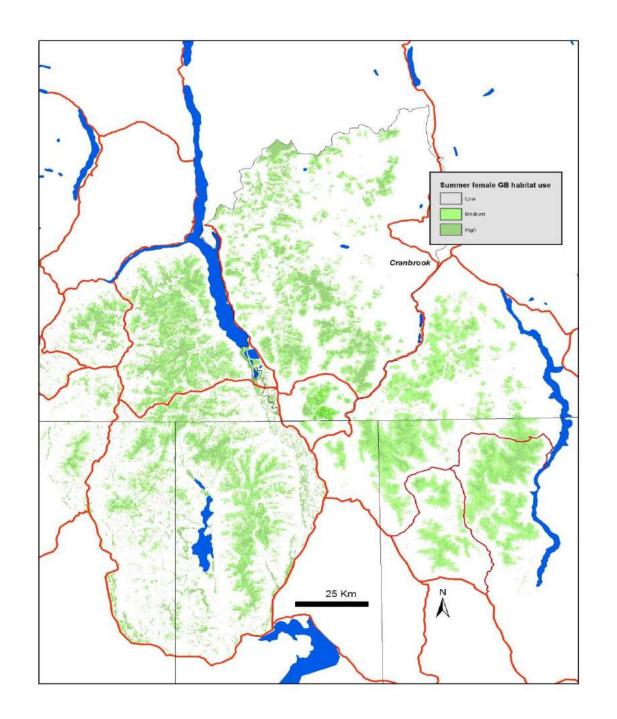


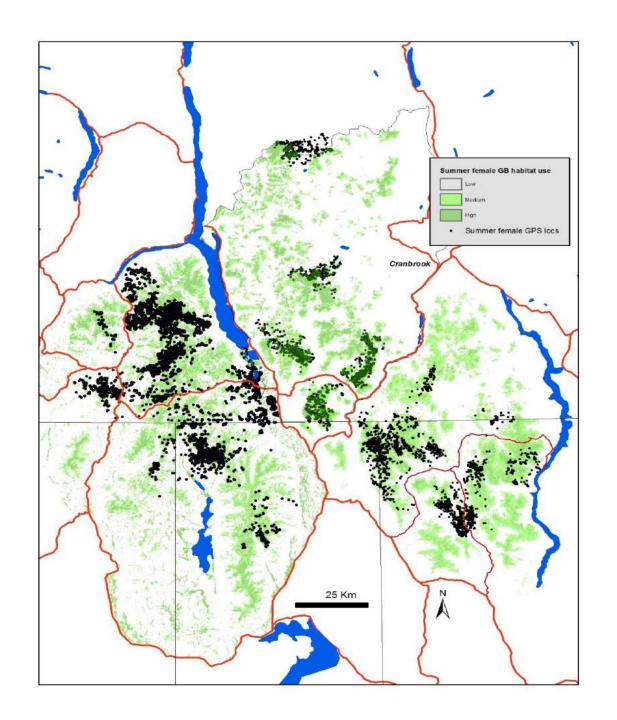
# Unified theory of bottom up habitat selection and top down habitat survival The Grizzly Dance of Berries & Bullets

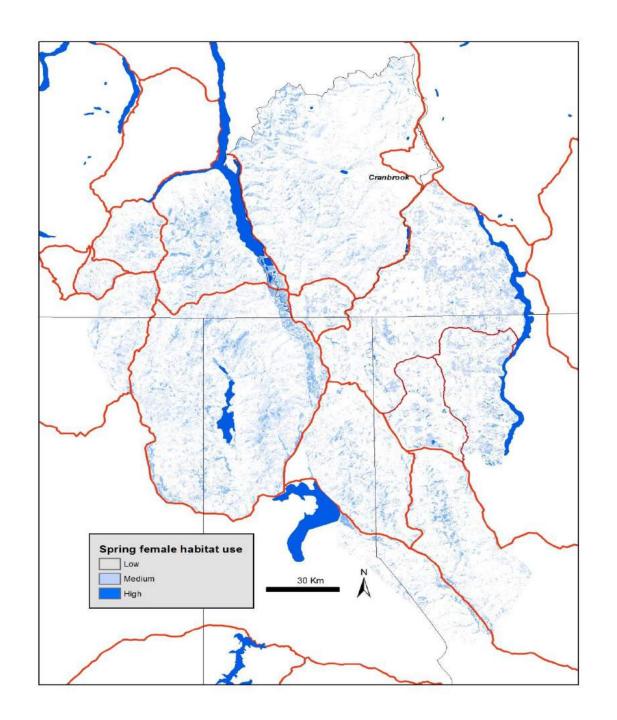


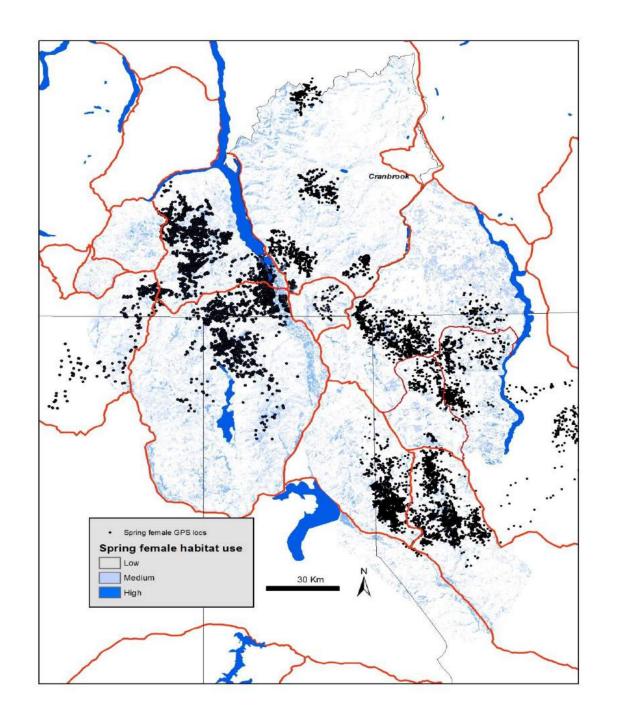
## Fine scale sex and season specific habitat use

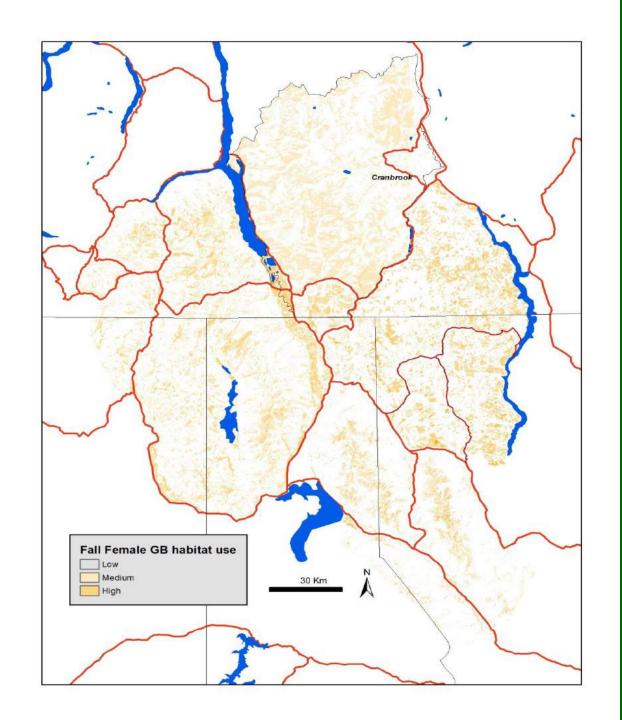
For land use managers

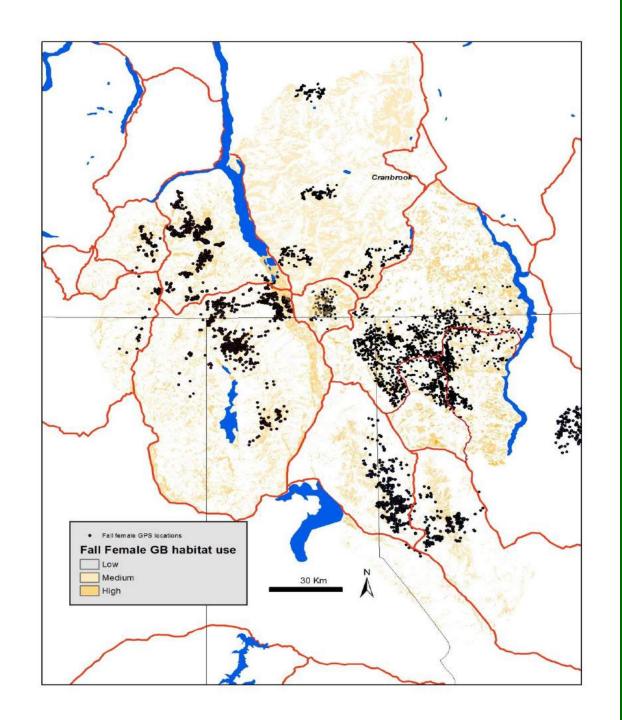












#### Papers coming up

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



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** 

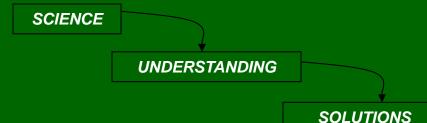
**Know your bear species** 

Help us teach grizzly bears to avoid Learn how trouble.



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













