Black Bear Density in Glacier National Park, Montana

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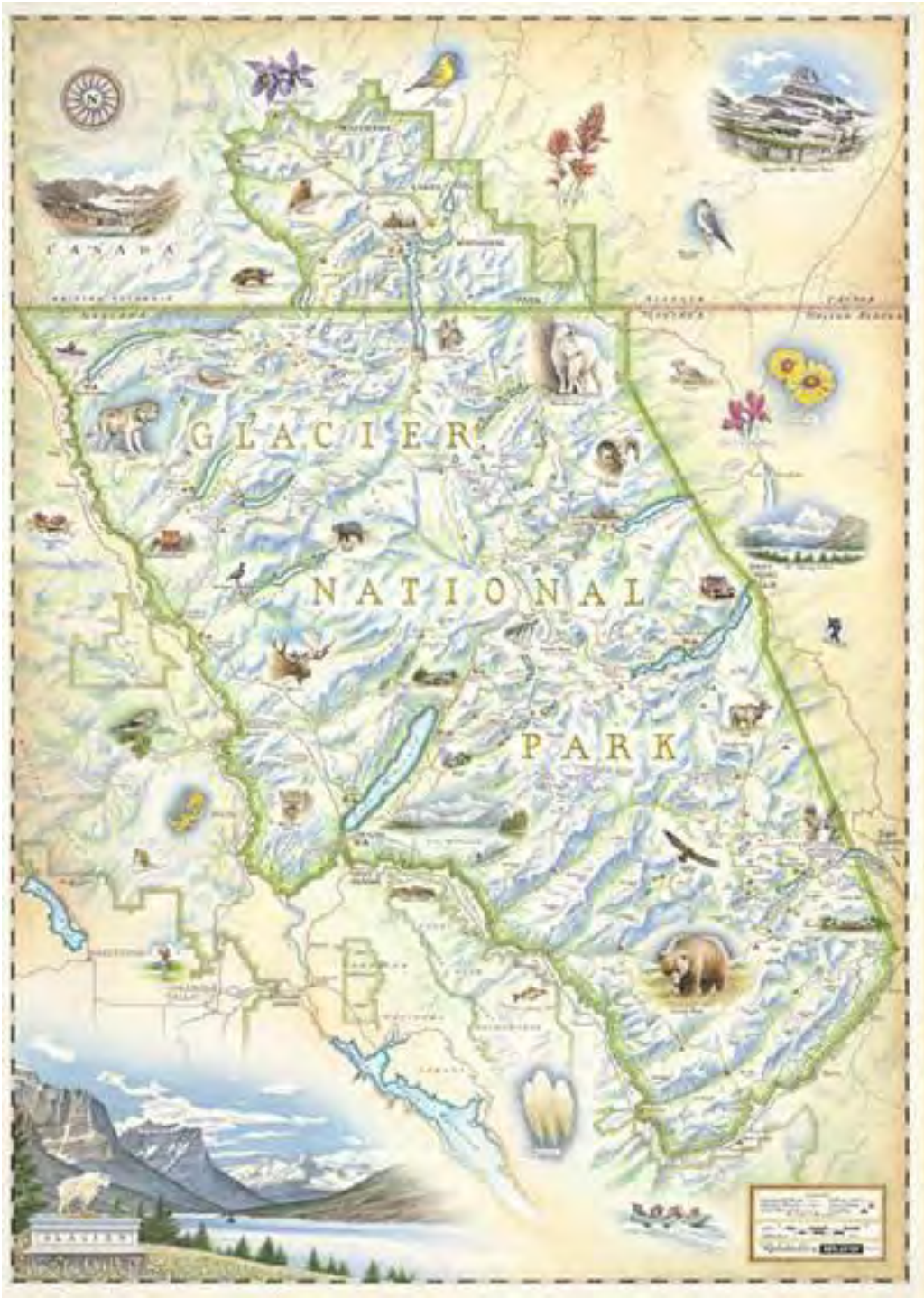
U.S. Organic Act (1916):

"…regulate the use of the Federal areas known as national parks … to conserve the … wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Glacier National Park

- **Est. 1910**
- **4,100 km^2**



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Glacier National Park

Nearly complete assemblage of historic species, including:

- **>1,000 plant species**
- **>260 bird species**
- **6 amphibian species**
- **3 reptilian species**
- **62 mammalian species**

↓

“charismatic mega-fauna”

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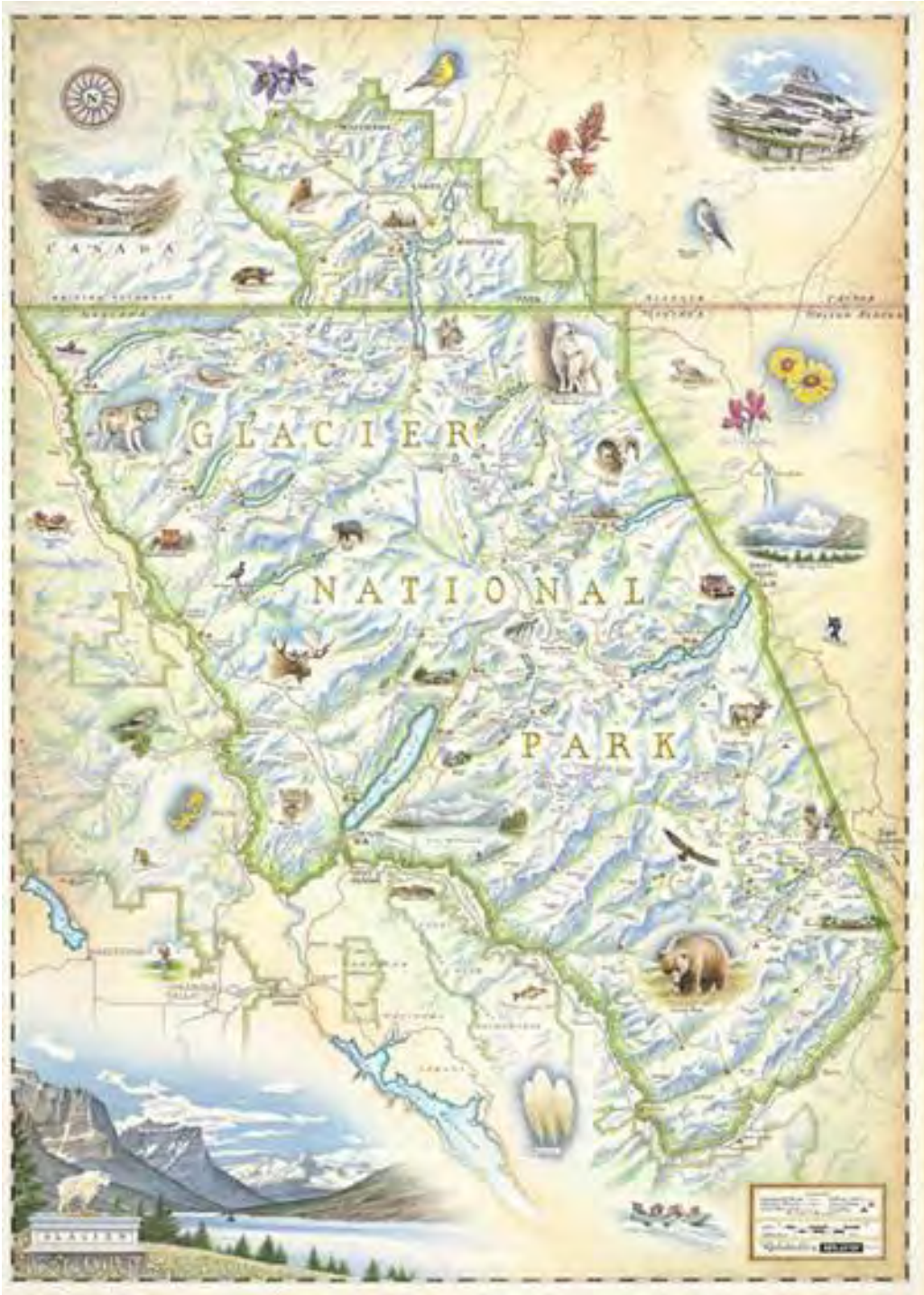
Glacier National Park

Inside: bears protected and receive a large proportion of the Park's wildlife management budget

Outside: subject to harvest:

- **e.g., 1,496 black bears were harvested statewide in 2004, 40% in NW MT**



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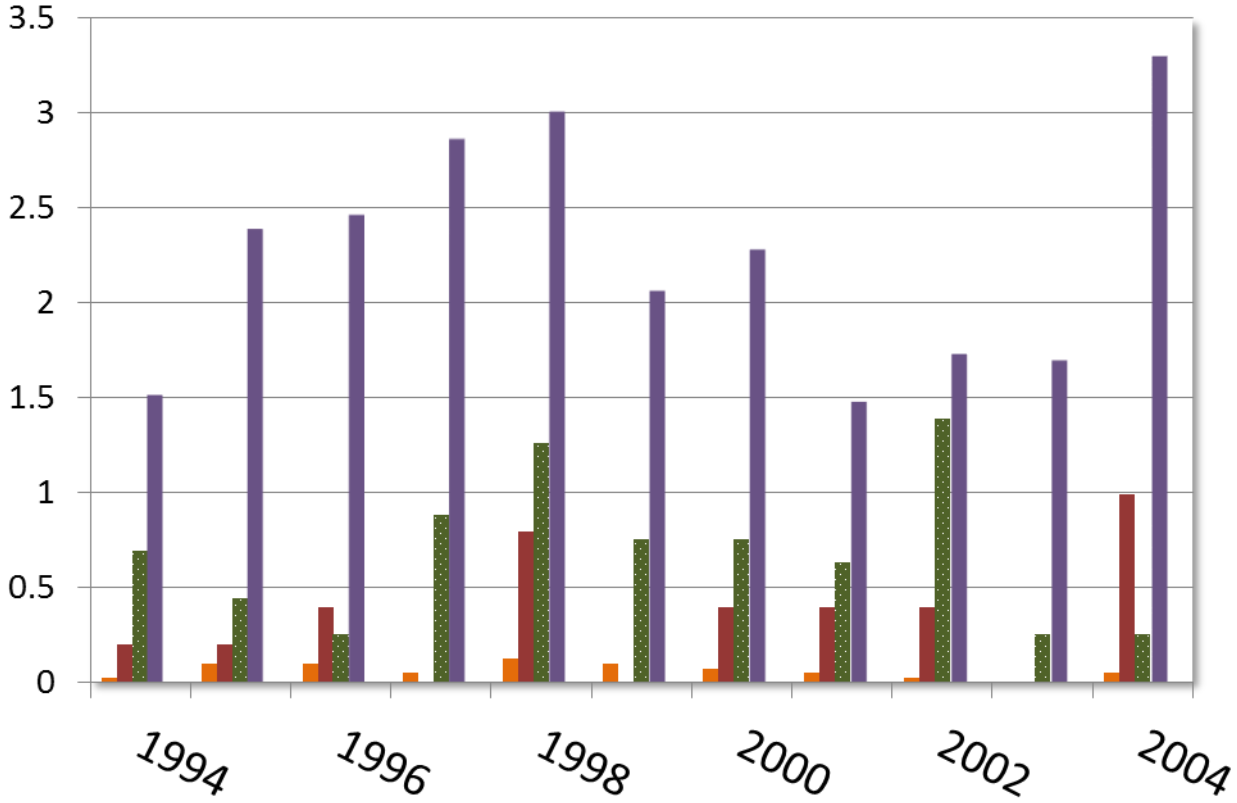
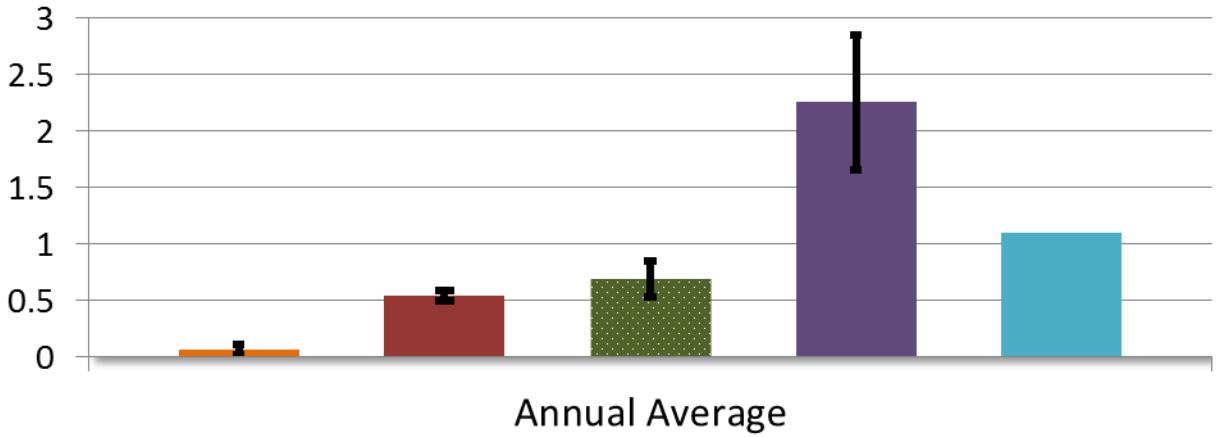
Black bear mortality – per 100 km^2



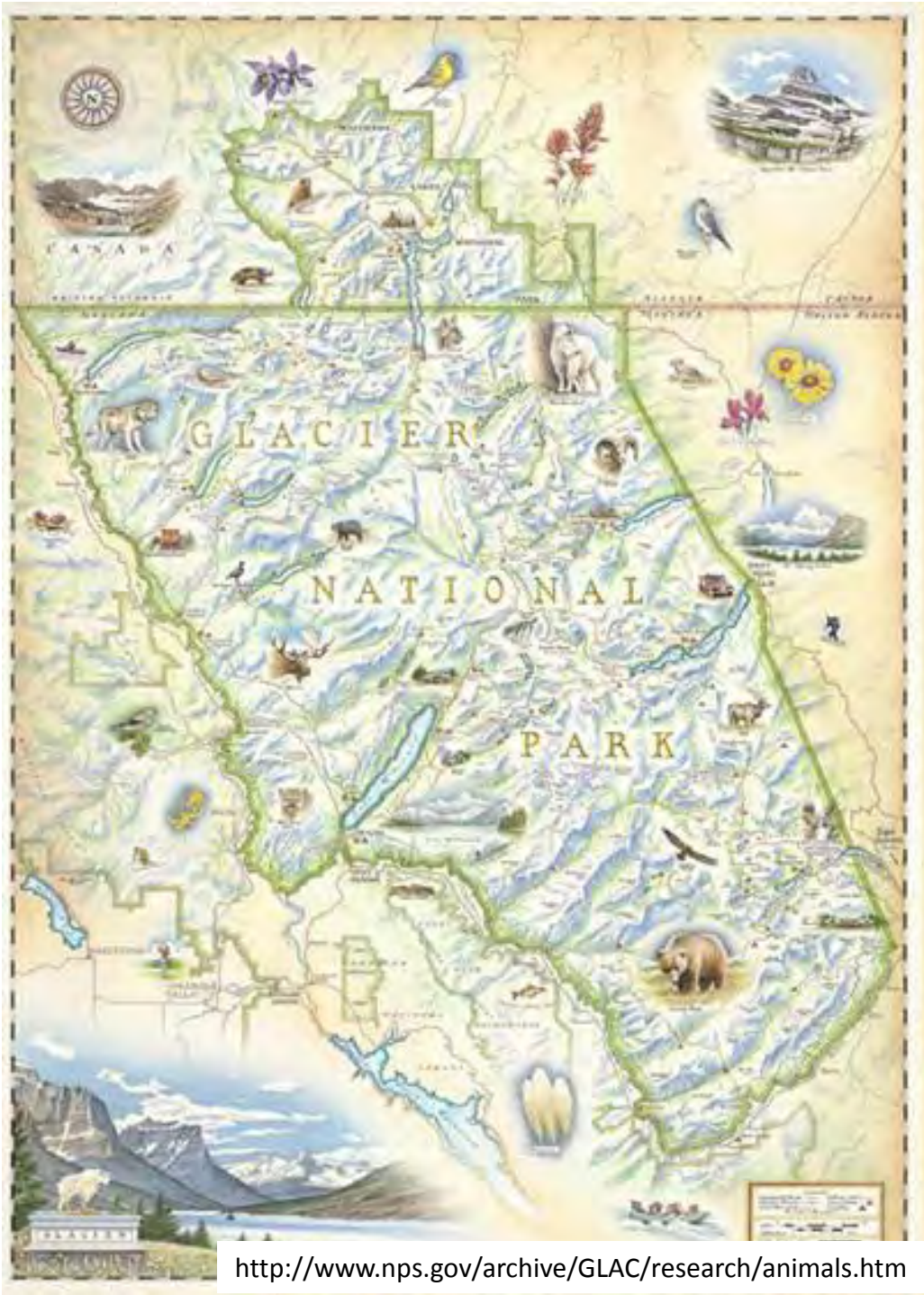
- Glacier National Park
- Waterton Lakes NP
- N Fork Flathead, BC
- N Fork Flathead, MT
- Blackfeet Nation



Glacier National Park

Research Needs:

- **Glacier may act as a reservoir for areas beyond of the park.**
- **Baseline data on abundance and dynamics of wildlife populations**
  - **how human activities within and beyond Park boundaries effect populations**



http://www.nps.gov/archive/GLAC/research/animals.htm

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NORTHERN DIVIDE PROJECT STUDY AREA

Hair Traps

- 30 m barbed wire
- Barbed wire 50 cm high
- 4 14-day sample sessions
- Distributed on 7x7 km grid*

Bear Rub Surveys

- Natural rub trees; no bait
- Along trails
- Used barbed wire
- 1 - 2+ visits / month

Methods

Study Area

Buffer for geographic closure

All sampling points

>2,800 bb samples
~1,000 detection points

Average location per bear

n = 297 ♂
n = 304 ♀

Gender-specific ½ and full MMDM buffers

- Covariates
- Buffer inference

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Model	AICc	ΔAICc	Weight	Model L	No. Par
HT(t*Sex+Sex*.5HTE) BR(Sex*.5BRE)	2060.308	0.000	0.579	1.000	14
HT(t*Sex*.5HTE) BR(Sex*.5BRE)	2062.071	1.764	0.240	0.414	20
HT(t*Sex*.5HTE+DTE) BR(Sex*.5BRE+DTE)	2062.690	2.383	0.176	0.304	21
HT(t*Sex*.5HTE) BR(Sex+.5BRE)	2070.620	10.312	0.003	0.006	19
HT(t*Sex*.5HTE+DTE) BR(Sex+.5BRE+DTE)	2070.936	10.629	0.003	0.005	20
…					
HT(t*Sex+Sex*HTE) BR(Sex*.5BRE)	2516.693	**456.386**	0.000	0.000	14
HT(t*Sex+Sex*HTE) BR(Sex*BRE)	2555.980	495.673	0.000	0.000	14
…					
HT(t*Sex) RT(Sex)	2767.009	**706.701**	0.000	0.000	10

Results: abundance estimate

	Bears Detected	$\hat{N}$	SE($\hat{N}$)	CV($\hat{N}$)	95% CI Lower	95% CI Upper
Males	297	569.9	45.5	7.98%	480.3	659.5
Females	304	614.8	57.6	9.36%	501.9	727.8
Total	601	1184.7	73.71	6.22%	1040.3	1329.2

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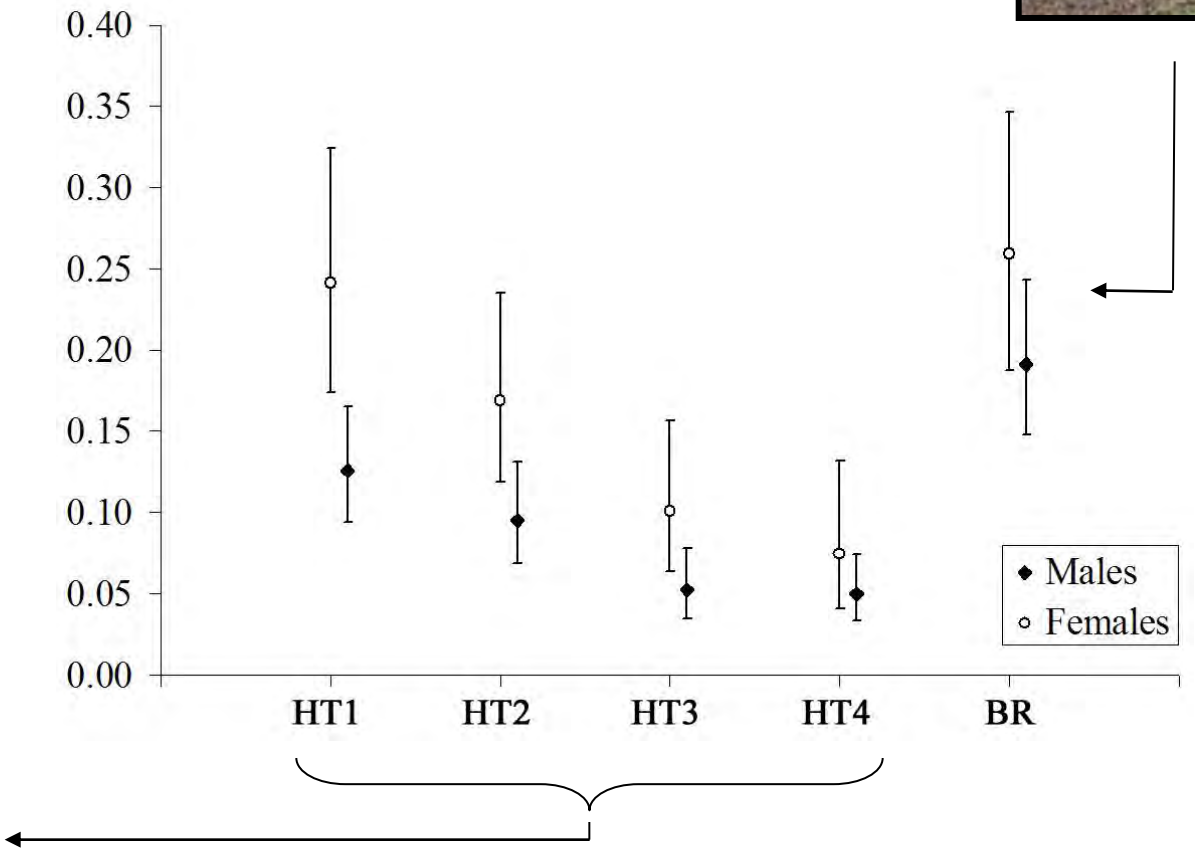
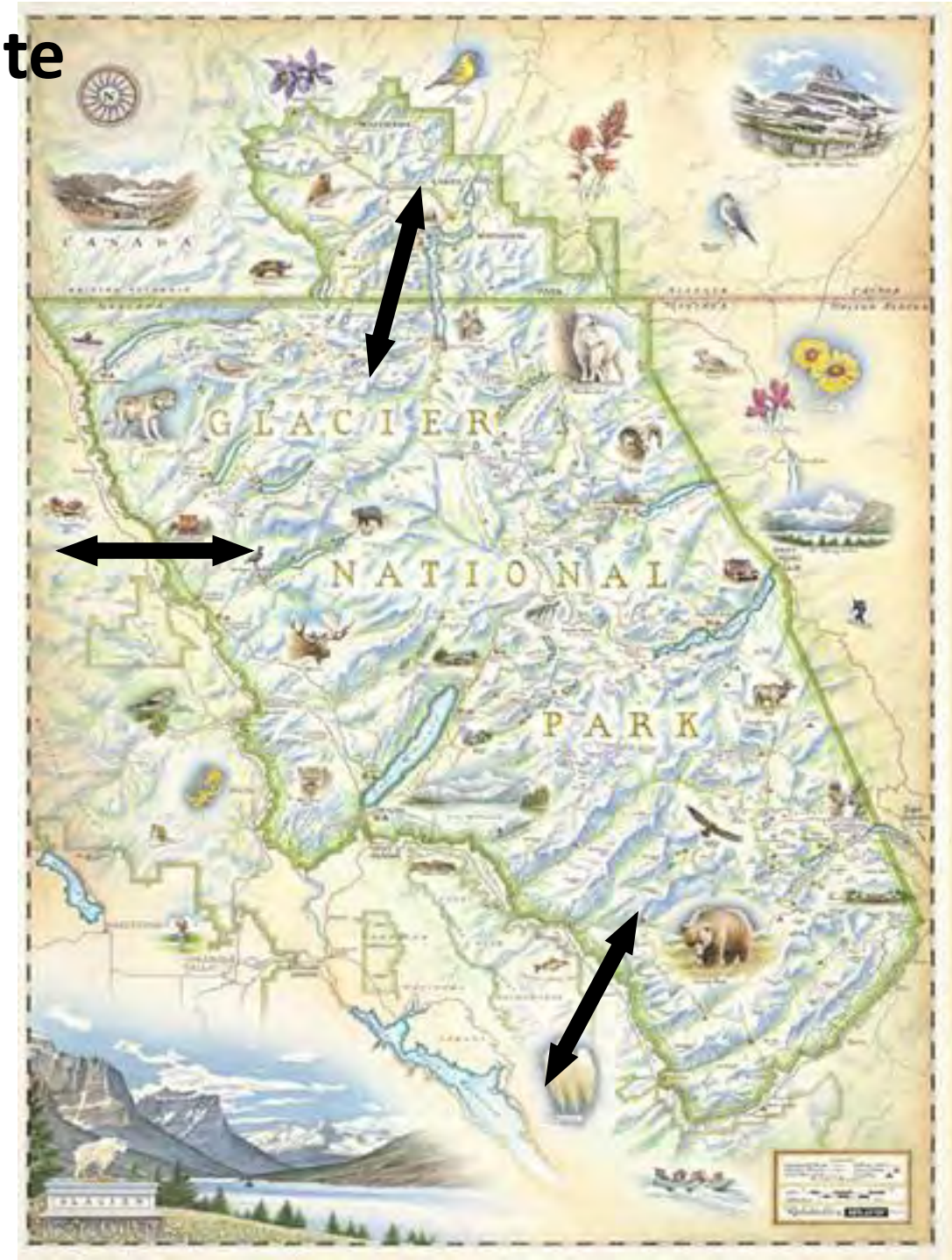
Results: abundance estimate

- Moderate / good capture probabilities
- Similar pattern as grizzlies for HT
- Opposite pattern for BR



Results: *density* estimate

- $\hat{N}$ is the easy part
- no chance for closure
- what is the effectively sampled area?
- buffers are one common method when other data are lacking
- but what size?



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Results: *density* estimate

	Abundance				Density (per 100 km^2)		
	$\hat{N}$	CV($\hat{N}$)	Lower	Upper	$\hat{D}$	Lower	Upper
Males	569.9	7.98%	480.3	659.5	7.18	6.53	7.82
Females	614.8	9.36%	501.9	727.8	8.59	7.32	9.86
Total	1184.7	6.22%	1040.3	1329.2	15.57	14.08	17.46

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Study Area	Source	BB/100km²	GB/100km²
Susitna, AK	Miller et al. (1997), Miller (1984) Garshelis (1994)	8.9	1.1 / 2.7
North Fork Flathead, MT	Jonkel and Cowan (1971) Jonkel (1978, 1980, 1982)	45.0	
	McLellan (1994), Hamilton and Austin (2002)		4.8
Glacier Park, MT	Martinka (1974)		4.7
Waterton NP, AB	Alberta Forestry, Lands and Wildlife (1990)		4.8
South Fork Flathead, MT	Jonkel (1978, 1980, 1982)		1.6
East Front, MT	Aune (1994)		0.7
Mission Mountains, MT	Servheen (1983)		2.0
		n 9	26 **BB: GB**
	(Mattson et al. 2005 *Ursus*)	**μ 16.4**	**2.2** **7.5**
		SD 15.2	1.4 8-11

Results: *density* estimate

GNP plus 10km

→ **17.95/100 km²**

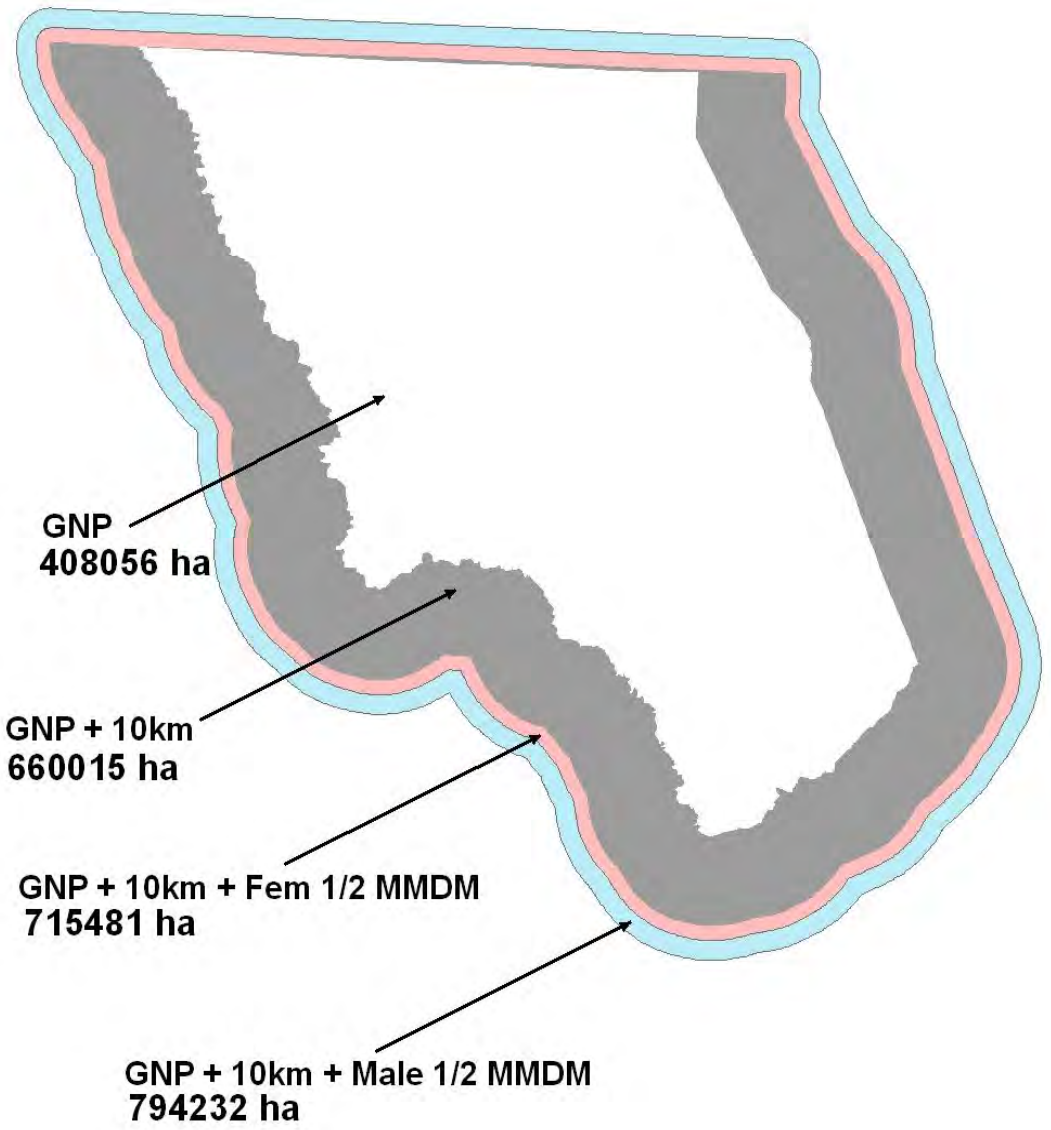
+ Female ½ MMDM

→ **16.56/100 km²**

+ Male ½ MMDM

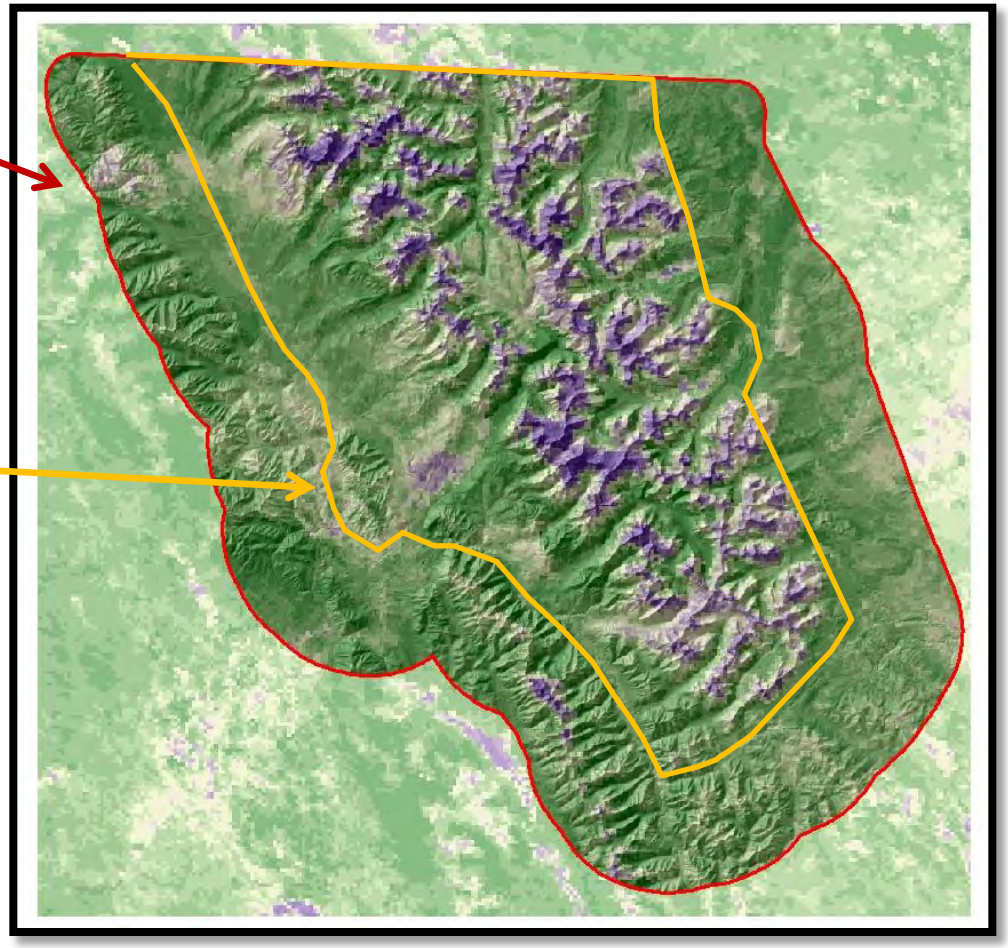
→ **15.57/100 km²**

95% CIs:
13.1 – 20.1 / 100 km²

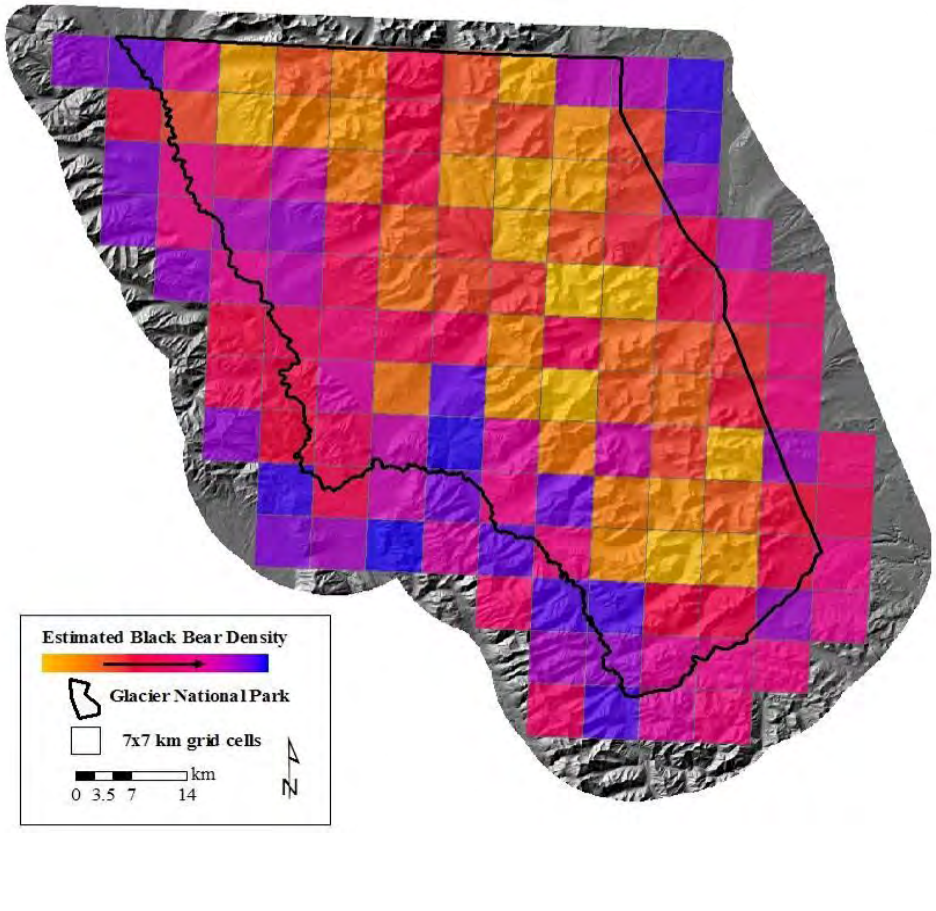


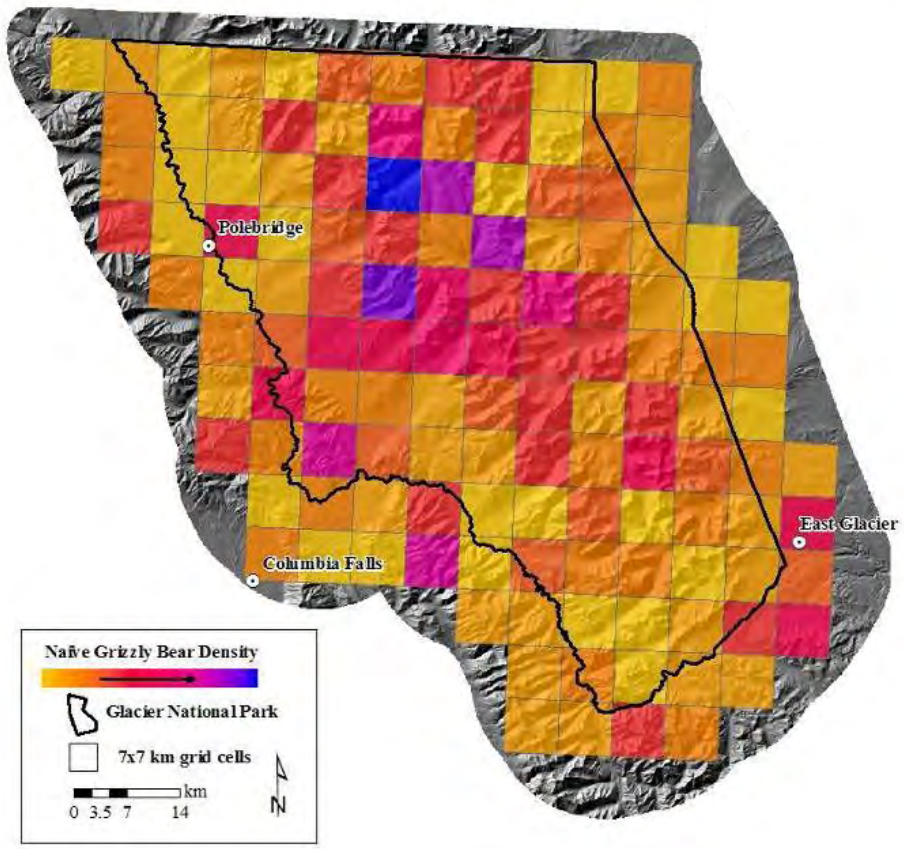
Results: *density* estimate

- Overall, 15.6/100 km^2
- Clearly, variation in habitat
- Outside GNP: 18.4/100 km^2
- GNP *total*: 14.8/100 km^2
  - w/o non-habitat: 18.1



Ongoing research: *black bear vs. grizzly bear*





Black bear density

Grizzly bear density

Ongoing research: *modeling* density patterns

Trails, roads

Sampling effort

Seasonal NDVI

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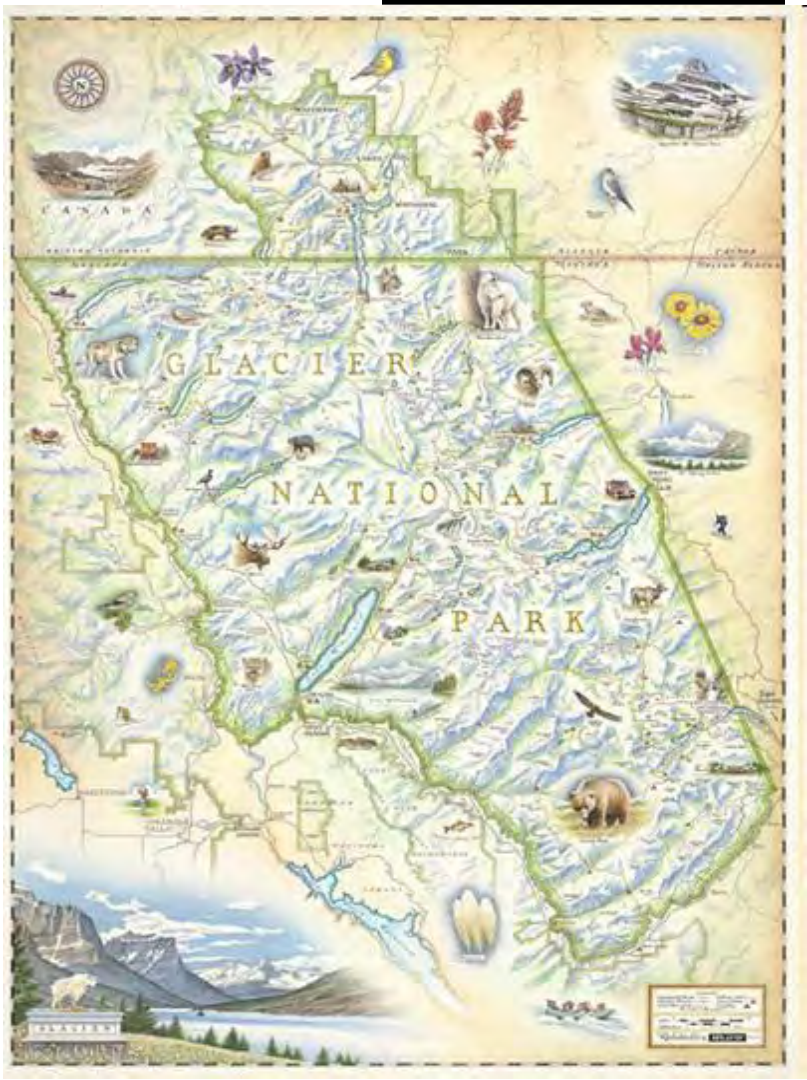
Summary: black bear density estimate

- Despite “low” sampling intensity, produced precise abundance estimate
  - 2 sampling methods
  - covariates
- Informed buffer selection for effective sampling area
- Why not SECR?
  - Two sampling methods
  - Large sample (n=601)
  - Large area (107x ♂ home range)



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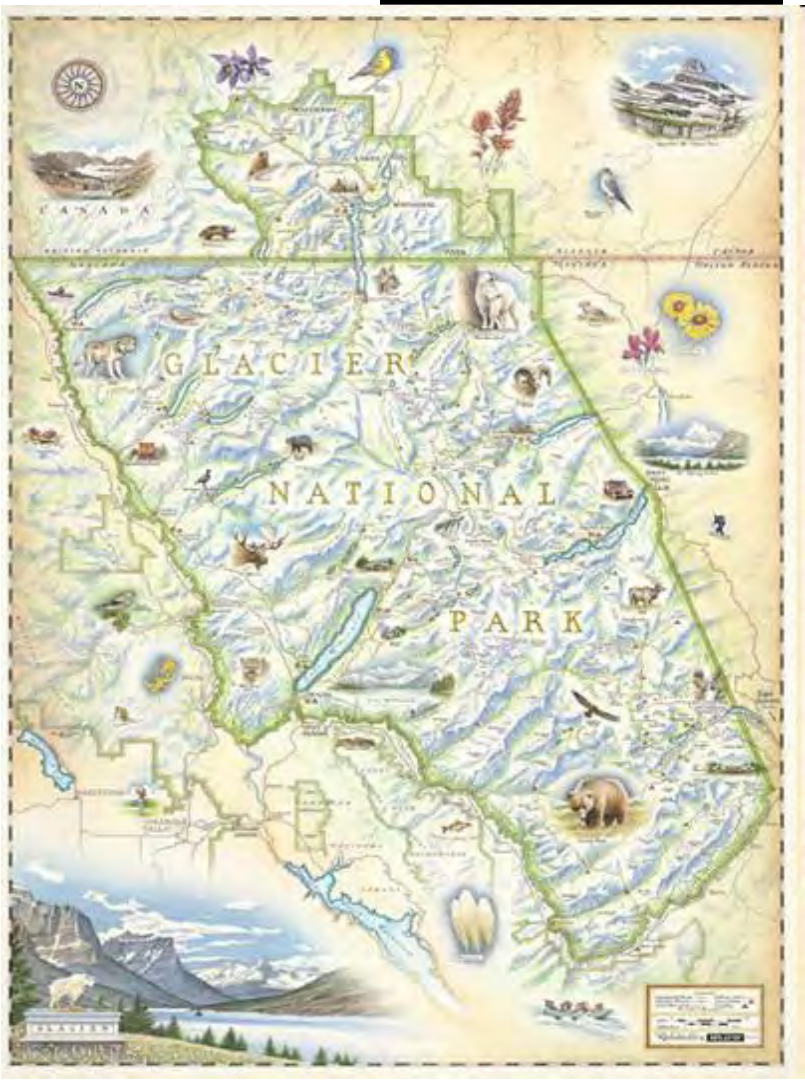
Summary: black bear density estimate

- Demonstrates efficiencies of multi-species study.
- *p*'s on bear rubs high enough to enable monitoring?
- Ratio of BB:GB is far lower due to high GB densities.
- Opportunities to explore competition between GBs and BBs.
- Supports belief that GNP is excellent bear habitat and could be a source population.



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Thank you - Questions?

MONTANA COOPERATIVE Wildlife RESEARCH UNIT

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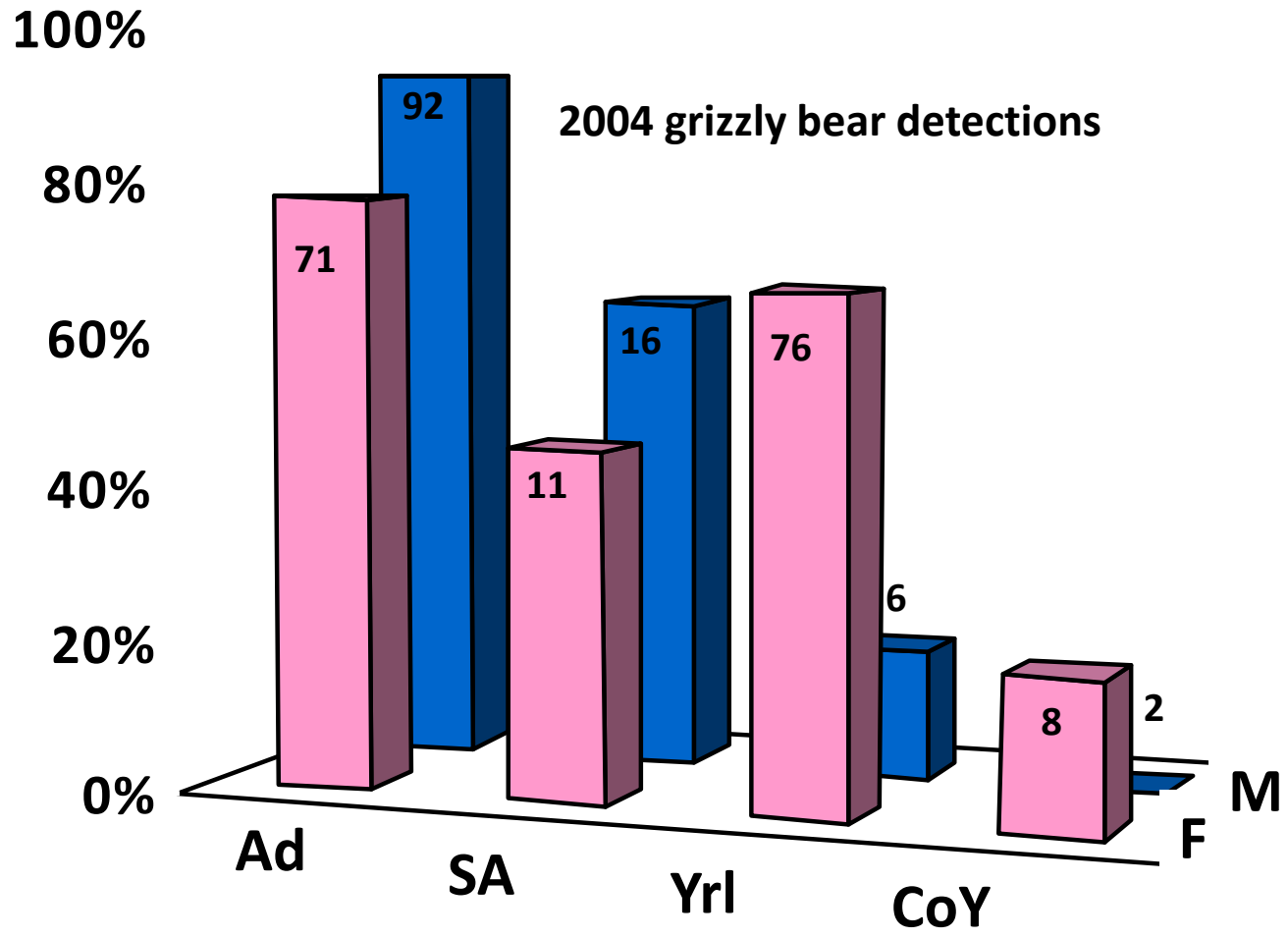
The University of Montana

Know your population

Catch a larger percentage of adult bears, but all bears are represented in the sample*



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