Long-term responses by an ecological community to highway mitigation measures

Presenter

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3). How do we reduce collisions while maintaining or restoring connectivity?

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4). SLOSS[single large or several small]- are more or wider CS better?

Challenges for *mitigation* ecology

Mitigation tends to be:

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3) Risk averse designs.
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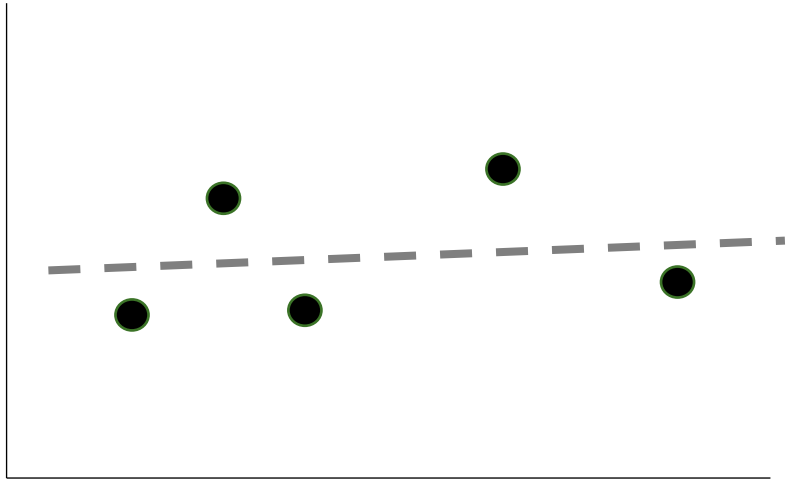
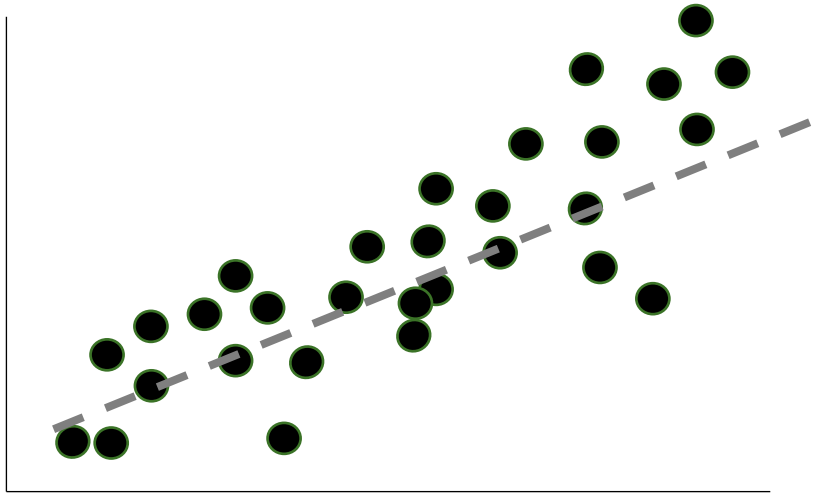


There is low statistical **replication** and lack of **manipulation** in many mitigation systems.



Mitigating problems in *mitigation* ecology

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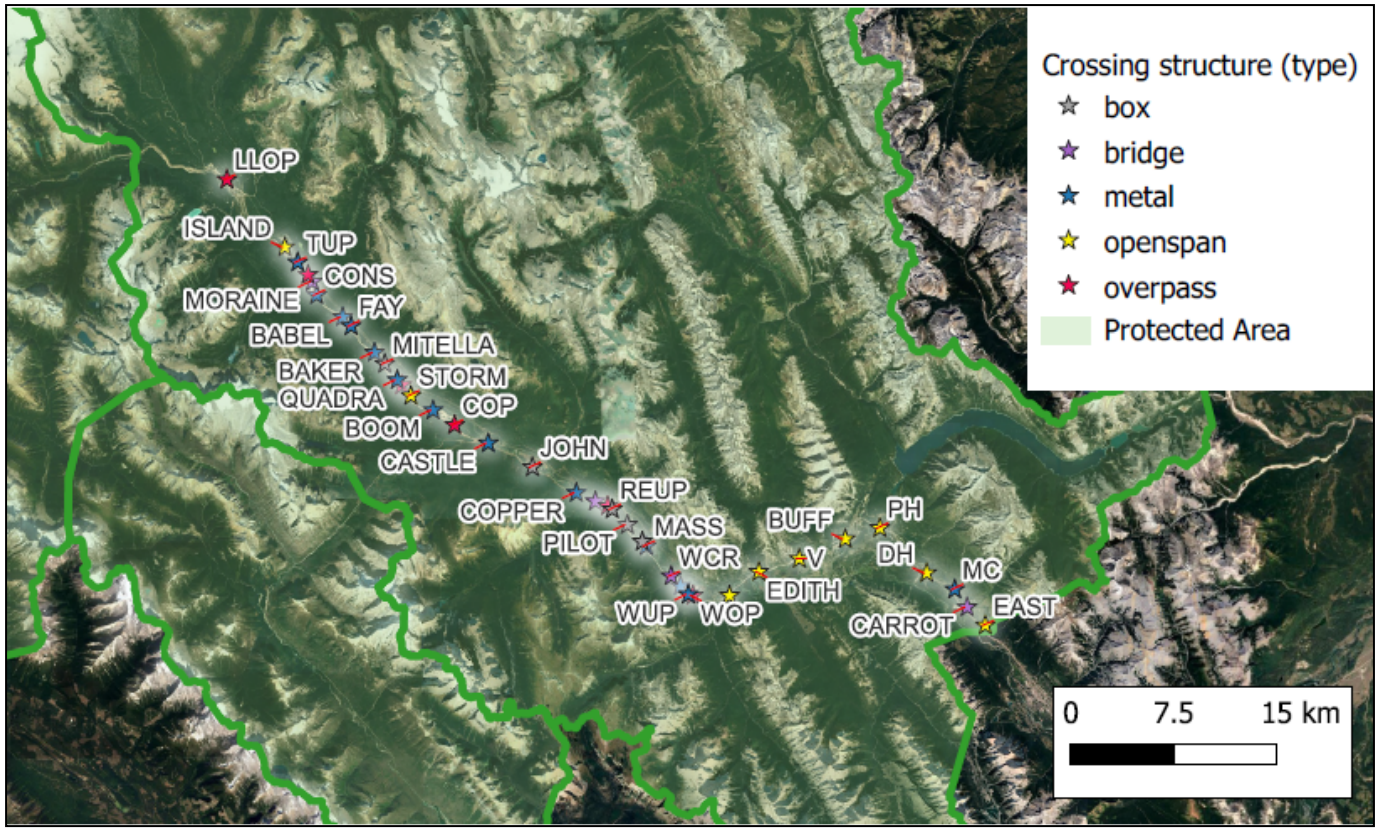
Long-term monitoring and natural variation.

Wildlife Crossing Structures in Banff National Park, AB, Canada



- 40+ purpose built structures along 90 km of 4-lane highway.
- Phased construction ~20km at a time, since 1988.
- 30,000 vehicles per day.
- Monitored **since 1996.**

Wildlife Crossing Structures in Banff National Park, AB, Canada

- Up to 220 monitoring months x 9 taxa = 75240 observations of wildlife use at crossings.

- Grizzly bear, black bear, wolves, coyote, cougar, deer spp, elk, moose.

What factors best explain species-specific variation in use of crossing structures by wildlife?

	black bear		cougar		coyote		deer spp		elk		grizzly bear		human		moose		wolf	
Predictor variable	*B*	p	*B*	p	*B*	p	*B*	p	*B*	p	*B*	p	*B*	p	*B*	p	*B*	p
Type																		
box	—		—		—		—		—		—		—		—		—	
bridge	0.75	0.4	**3.9**	**<0.001**	0.79	0.6	2.5	0.7	0.22	>0.9	1.0	0.3	0.05	>0.9	-0.88	0.6	1.5	0.012
metal	0.45	0.5	**1.6**	**0.019**	-0.16	0.9	-1.2	0.8	-1.0	0.7	0.04	>0.9	-1.7	0.5	-0.84	0.5	0.60	0.2
openspan	**1.8**	**0.004**	**2.8**	**0.002**	1.2	0.4	1.0	0.9	3.4	0.2	**1.7**	**0.033**	0.92	0.8	1.7	0.3	**1.7**	**<0.001**
overpass	**1.8**	**0.002**	**2.0**	**0.013**	-0.10	>0.9	-2.6	0.6	0.24	>0.9	**2.5**	**<0.001**	-2.1	0.4	0.39	0.8	**1.7**	**<0.001**
dist.for.s	-0.09	0.5	-0.16	0.4	-0.08	0.8	-0.27	0.8	0.08	>0.9	0.05	0.8	0.44	0.6	0.49	0.2	-0.01	0.9
tree.1km.s	**0.60**	**0.056**	0.15	0.7	-0.33	0.6	-3.1	0.3	-1.0	0.5	0.05	0.9	-1.9	0.3	-1.3	0.13	0.12	0.6
grass.1km.s	-0.07	0.7	**0.43**	**0.056**	0.79	0.056	3.2	0.060	1.3	0.11	0.31	0.2	1.3	0.2	0.45	0.4	**0.35**	**0.021**
shrub.1km.s	**-0.49**	**0.030**	**-0.38**	**0.087**	-0.16	0.8	-1.4	0.6	-0.32	0.8	-0.21	0.5	-0.68	0.6	-1.2	0.086	-0.19	0.3
elevation.s	**1.2**	**0.060**	1.1	0.3	1.7	0.4	3.8	0.5	2.8	0.5	-0.32	0.7	1.6	0.8	-0.50	0.8	**-1.2**	**0.080**
dist.built.s	-0.18	0.5	0.47	0.2	0.46	0.4	1.6	0.5	0.46	0.7	**0.68**	**0.039**	-0.23	0.9	0.34	0.6	0.02	>0.9
dist.road.s	**0.45**	**0.025**	0.27	0.3	-0.23	0.7	-4.0	0.039	-0.06	>0.9	0.20	0.5	-0.43	0.7	-0.58	0.4	**0.66**	**<0.001**
rad_1000m.s	-0.07	0.8	0.14	0.5	-0.14	0.8	-2.8	0.2	-0.14	0.9	0.07	0.8	-0.21	0.9	-0.72	0.2	-0.05	0.7
dist.water.s	0.24	0.3	**0.72**	**0.009**	-0.24	0.6	-0.62	0.8	-1.0	0.3	0.23	0.4	-1.4	0.2	-0.08	0.9	0.21	0.3

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1. Relative preference for overpasses and open span bridges by: black bear, cougar, grizzly bear, wolf
2. Moose, deer, and elk showed no clear relative preference for structure type.
3. Shrub cover tended to reduce passage rates.
4. Proximity to secondary roads increased use for black bears and wolves.

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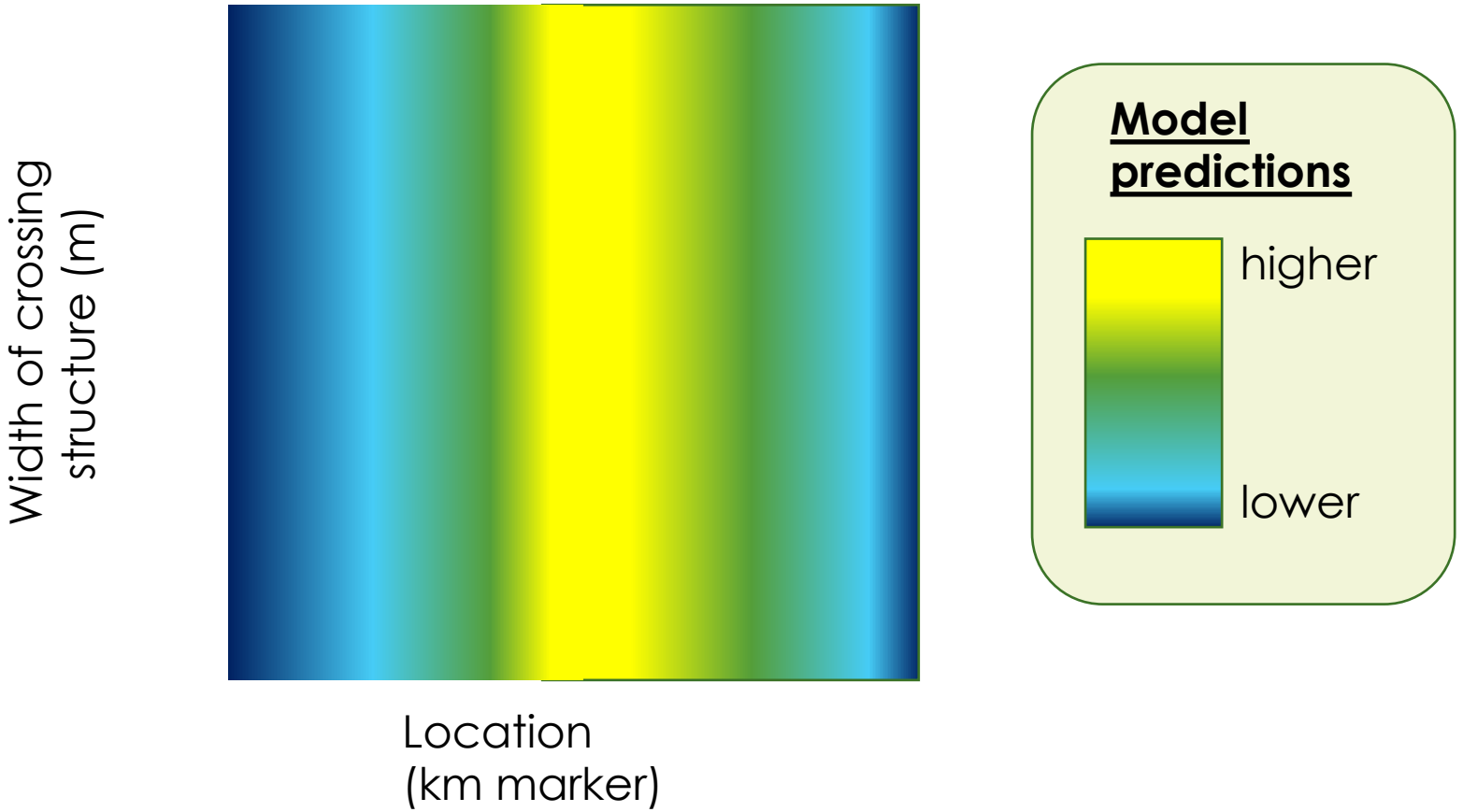
Hypothetical example of location **>** width



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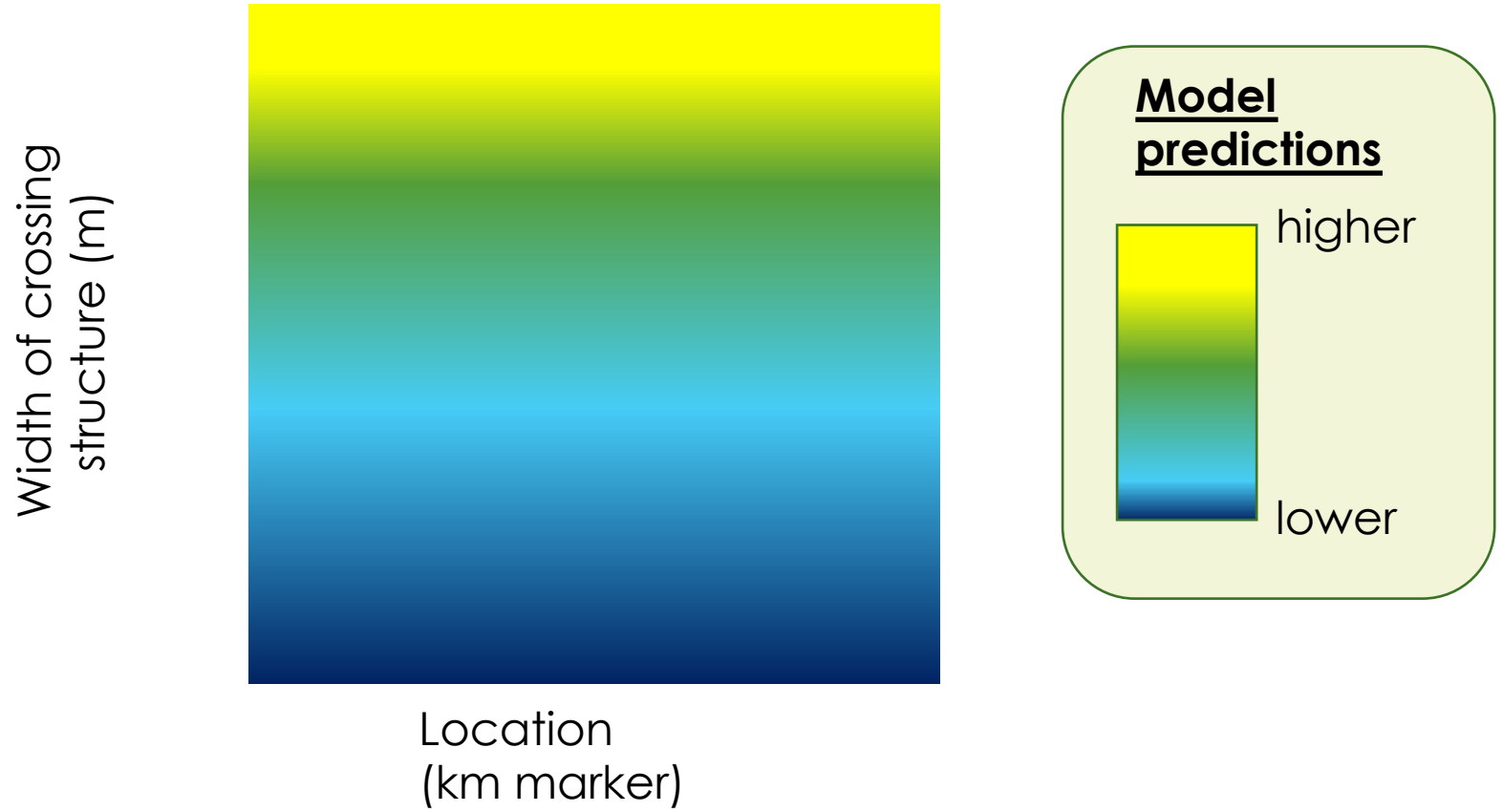
Hypothetical example of location **<** width



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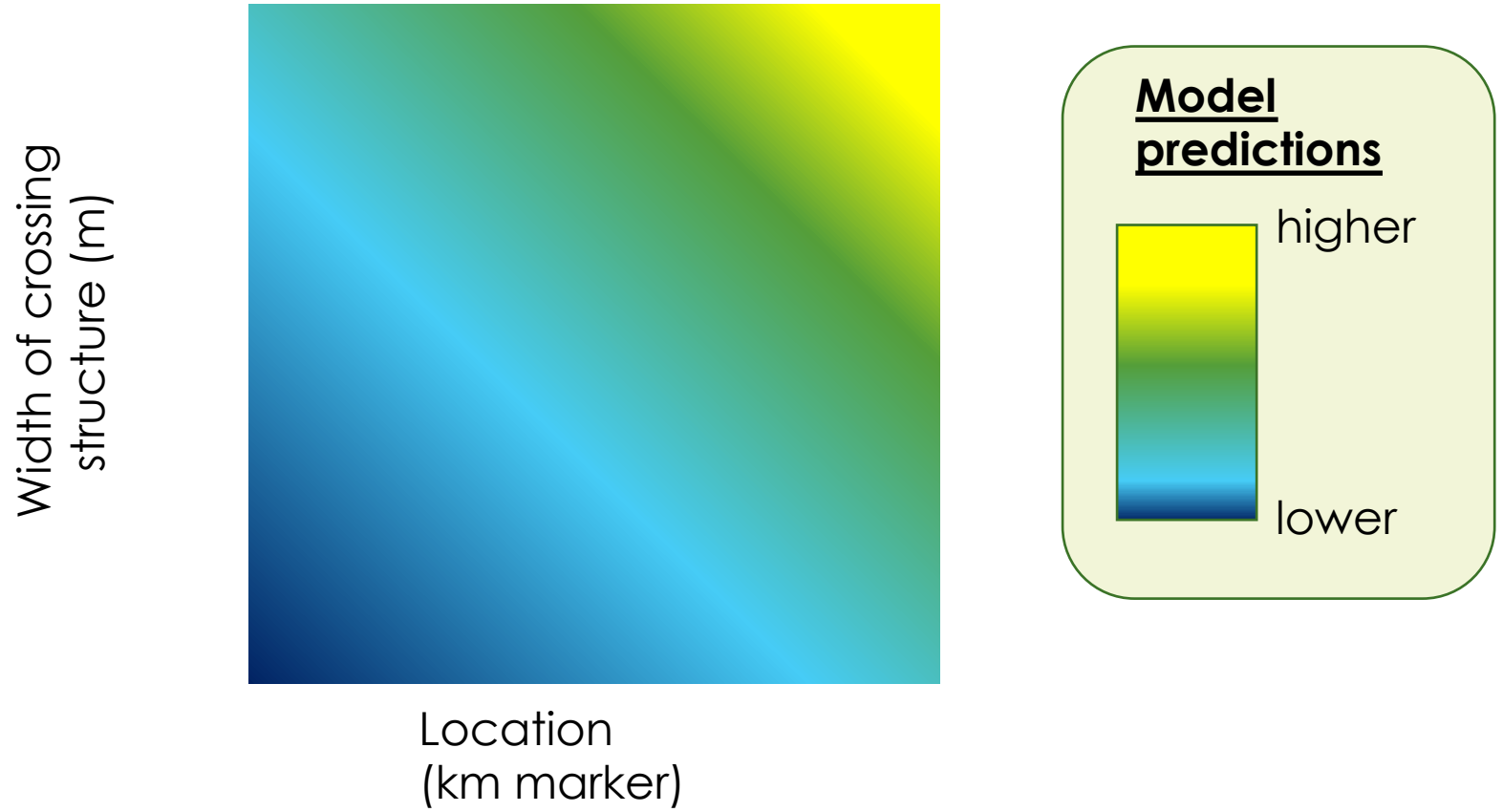
Hypothetical example of location **AND** width



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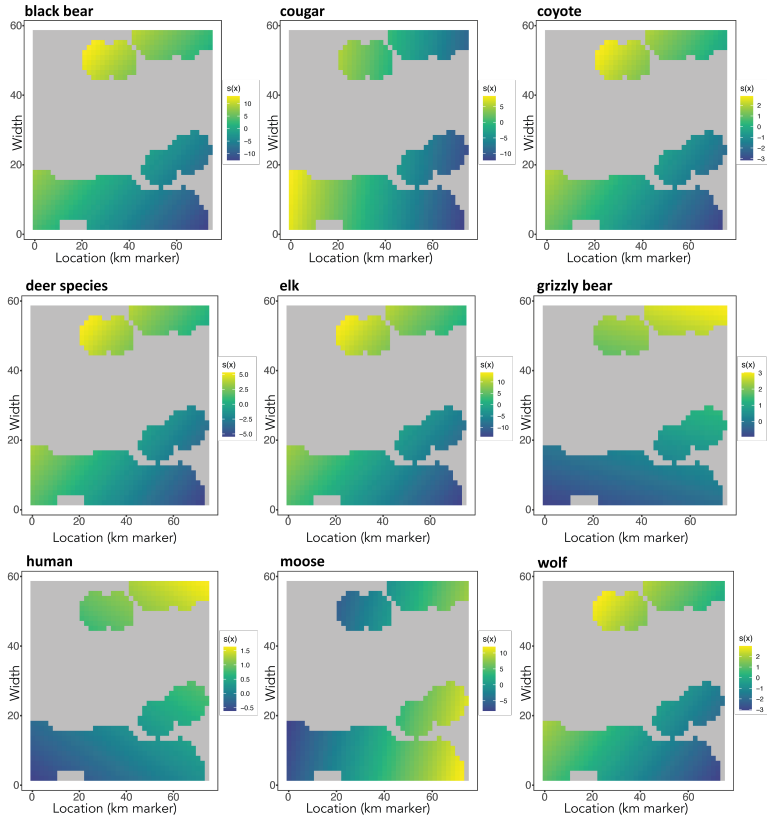

Location (km marker)

Model predictions

higher

lower

No data

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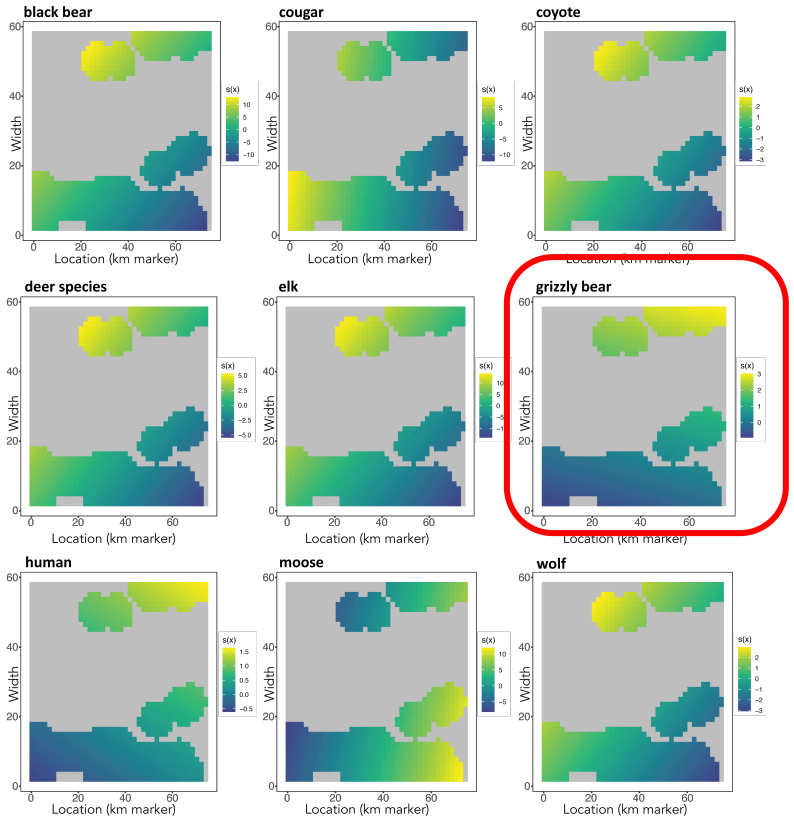

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wider **>** location

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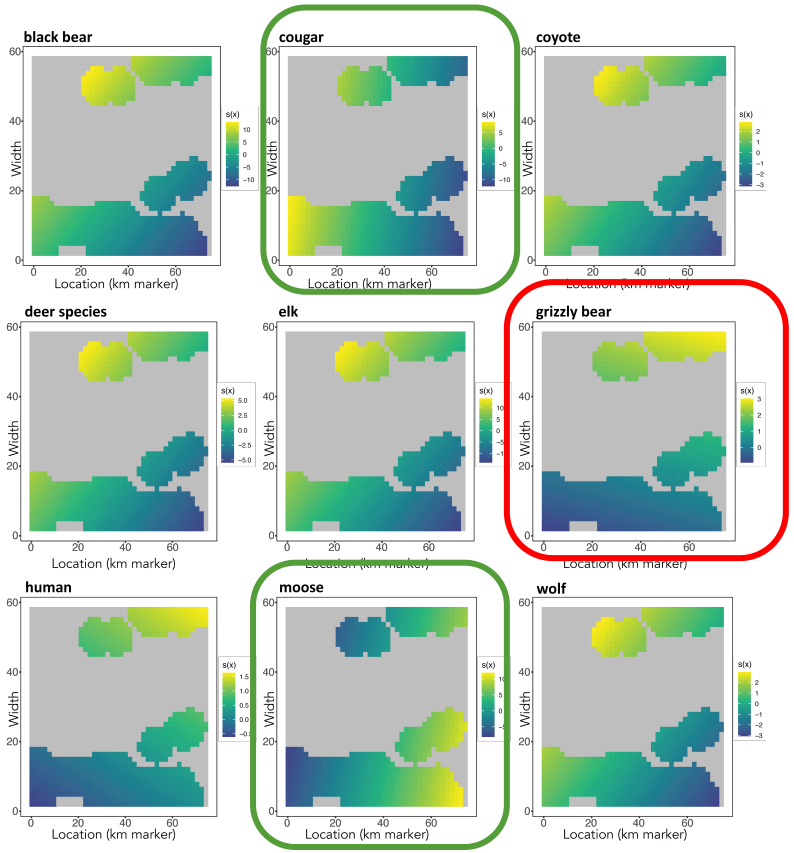

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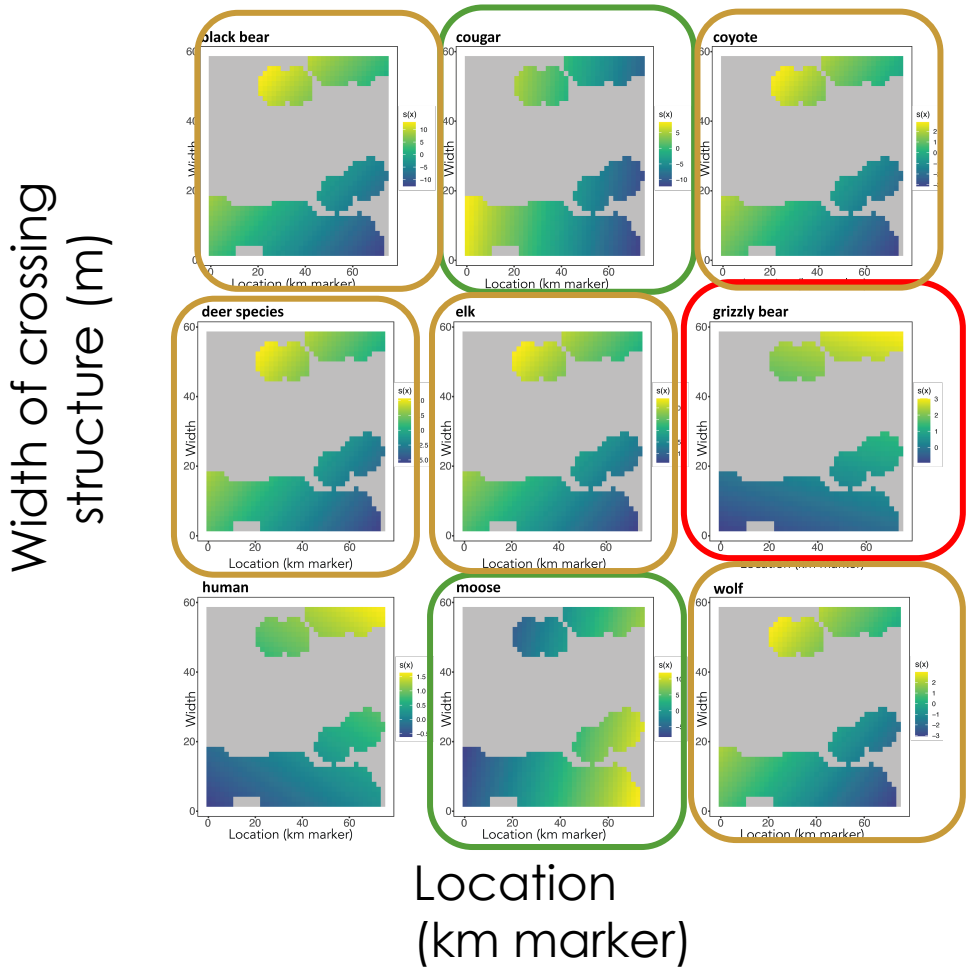

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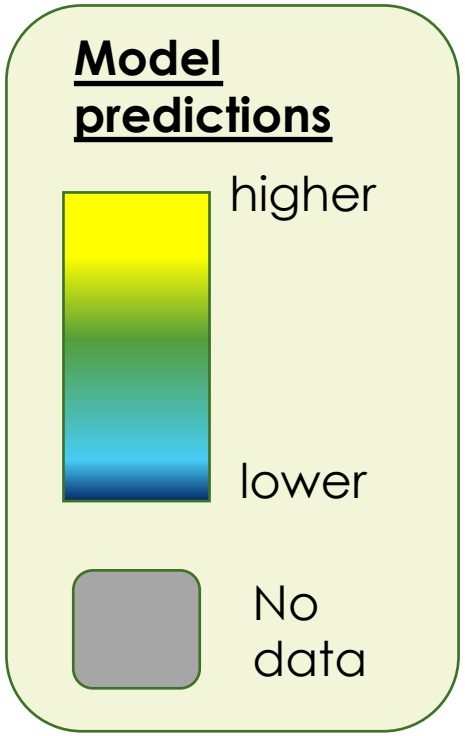

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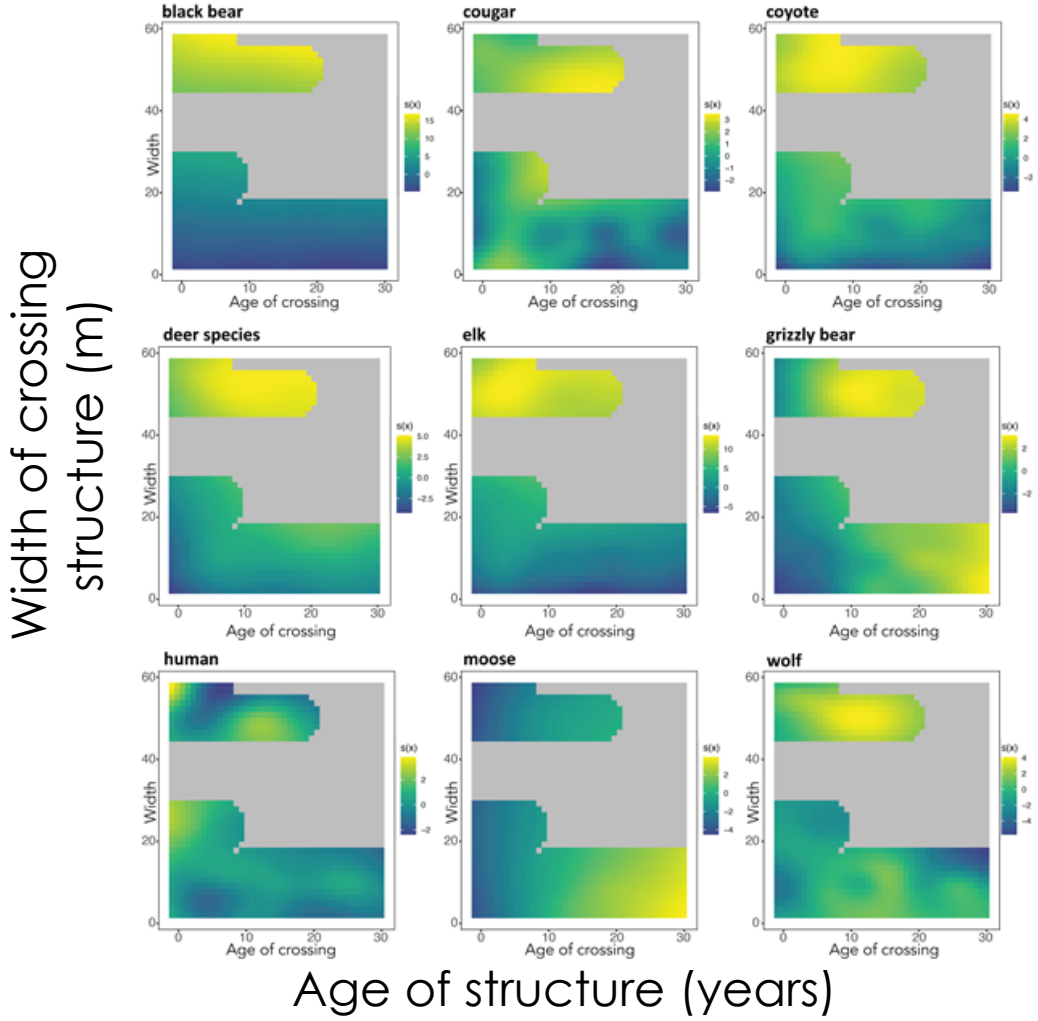

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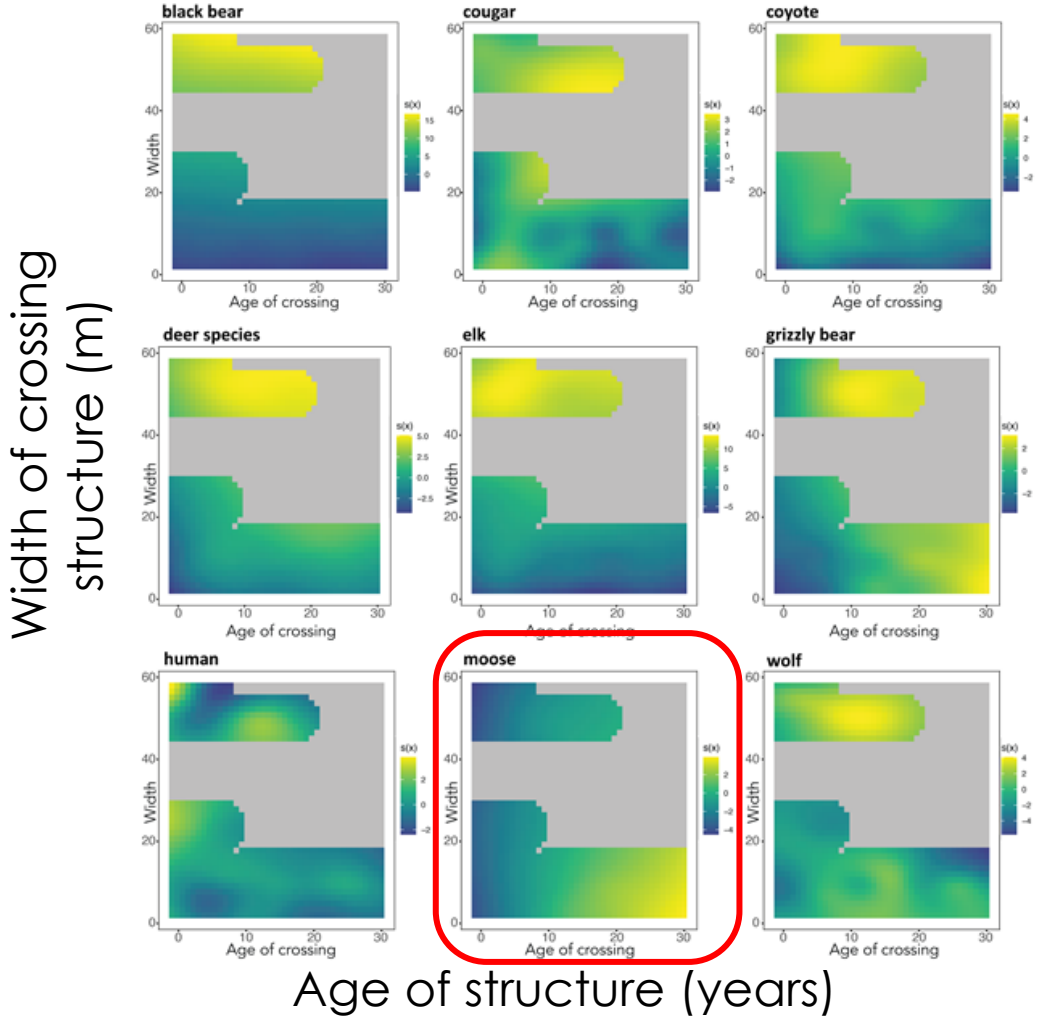

age **>** width

Model predictions

higher

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No data

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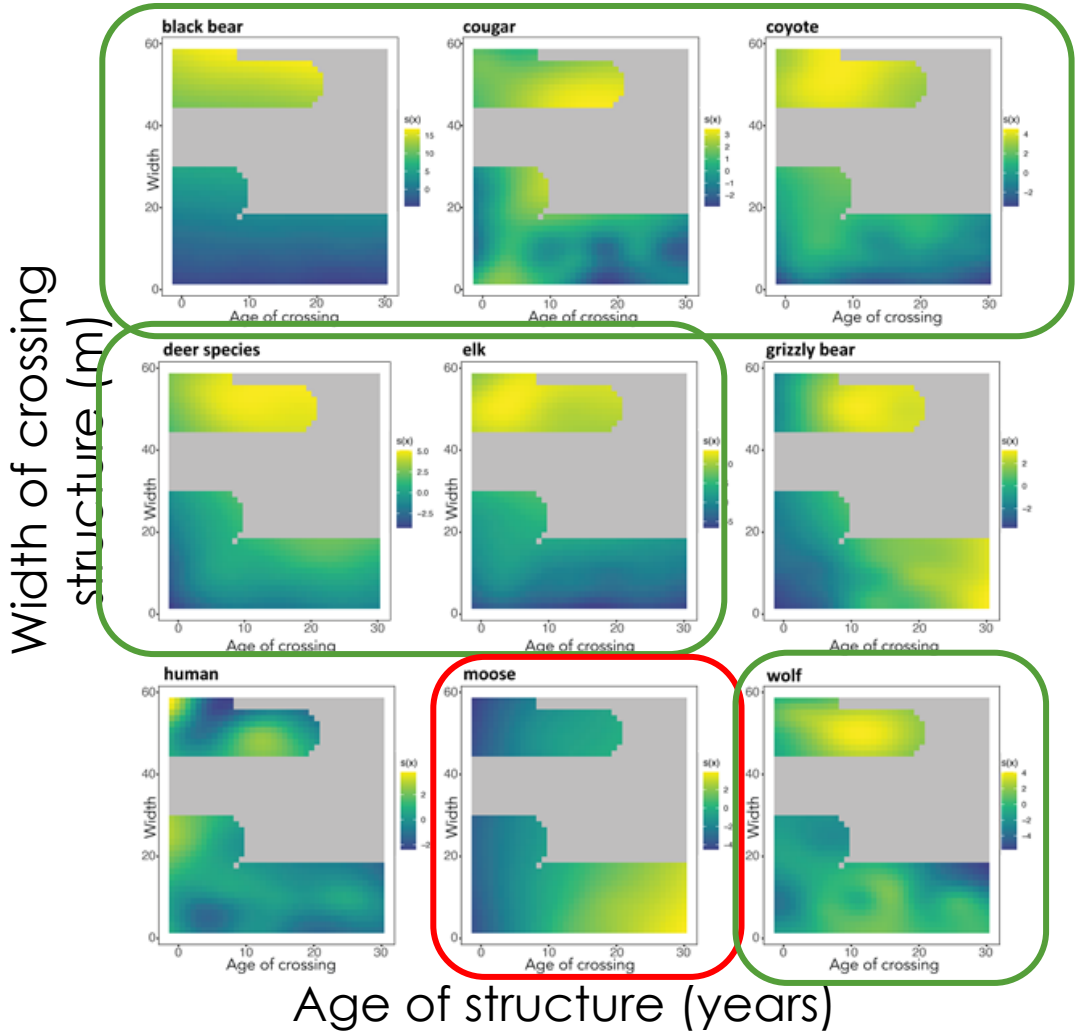

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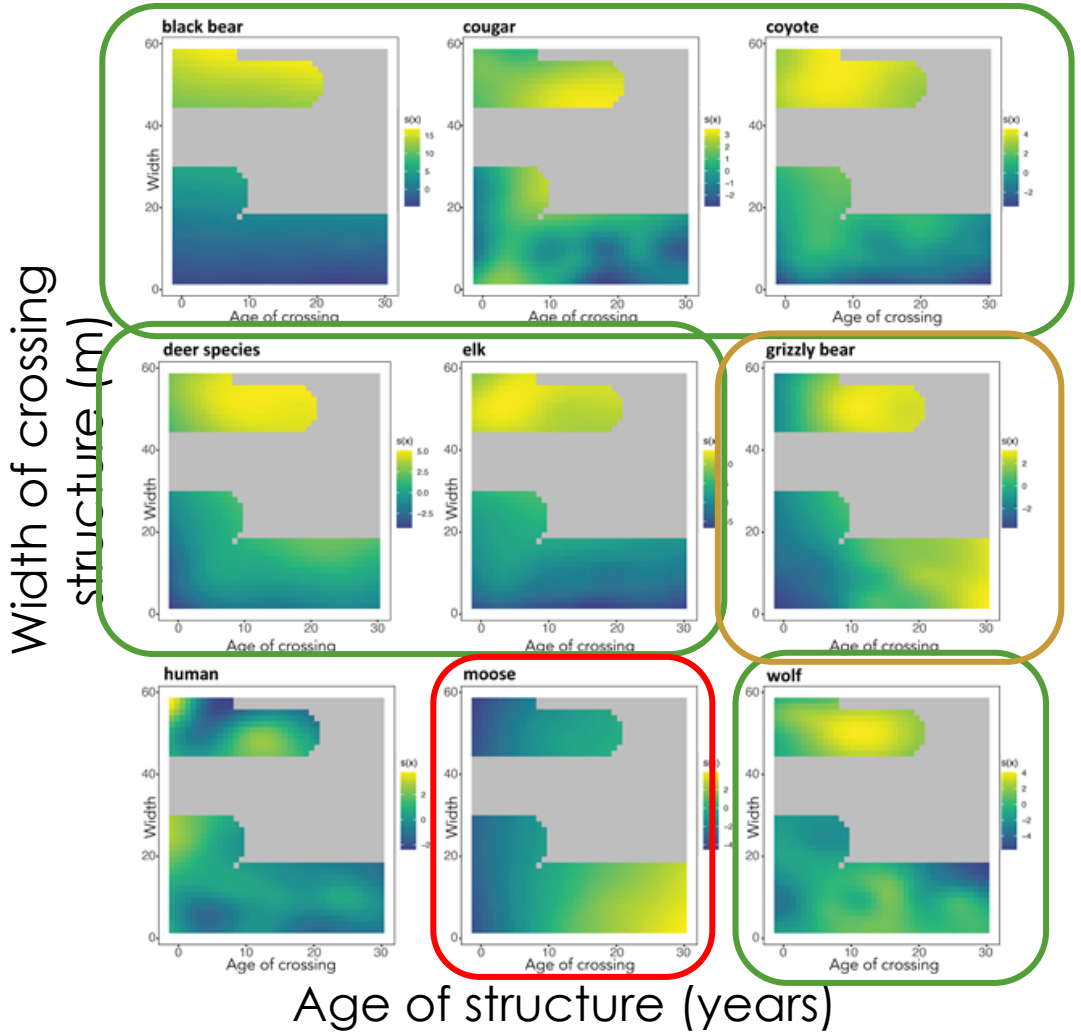

age > width

age < width

age AND width

Model predictions

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lower

No data

SLOSS [single large or several small]- are more or wider crossing structures better?

Number of crossing structures within <5km

Width (m)

Model predictions

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No data

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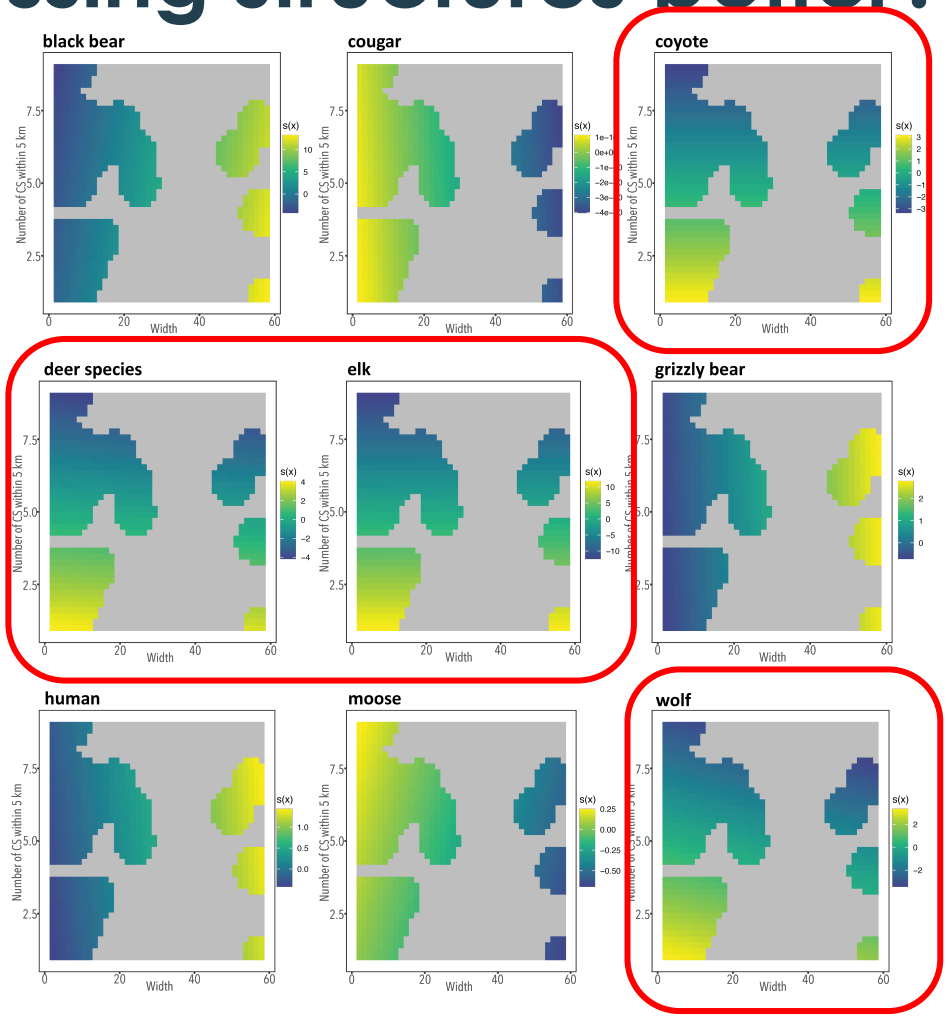

Number of crossing structures within <5km

Width (m)

more **>** width

Model predictions

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lower

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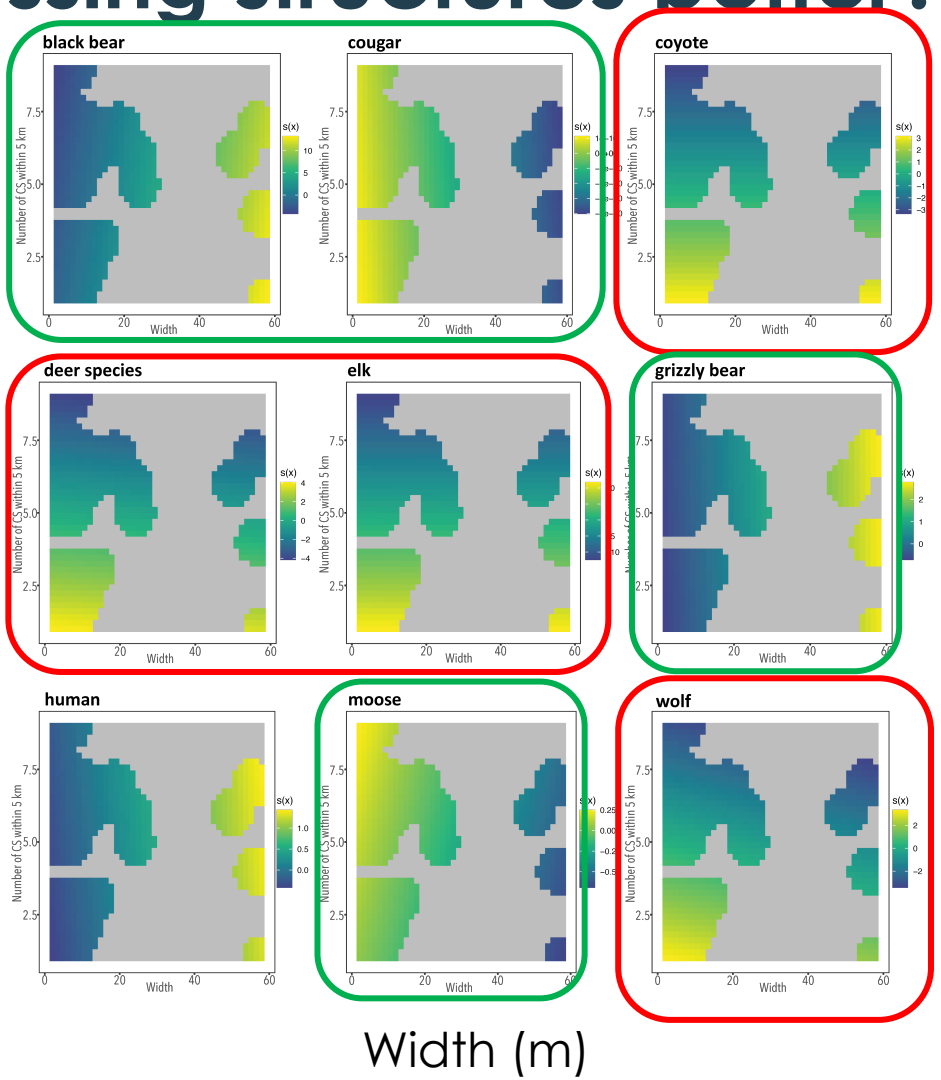

more **>** width

more **<** width

Model predictions

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Community-level responses to design

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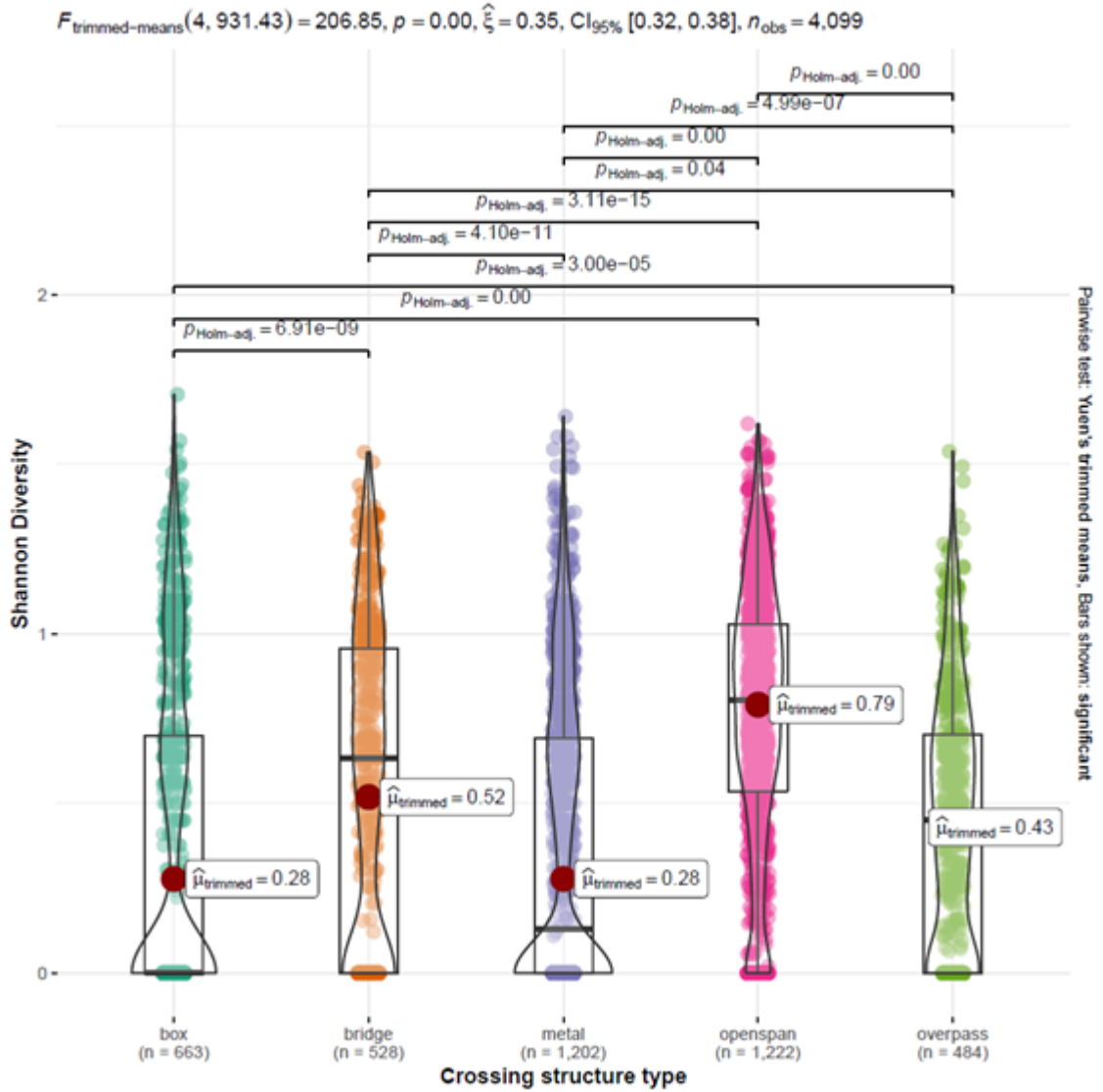

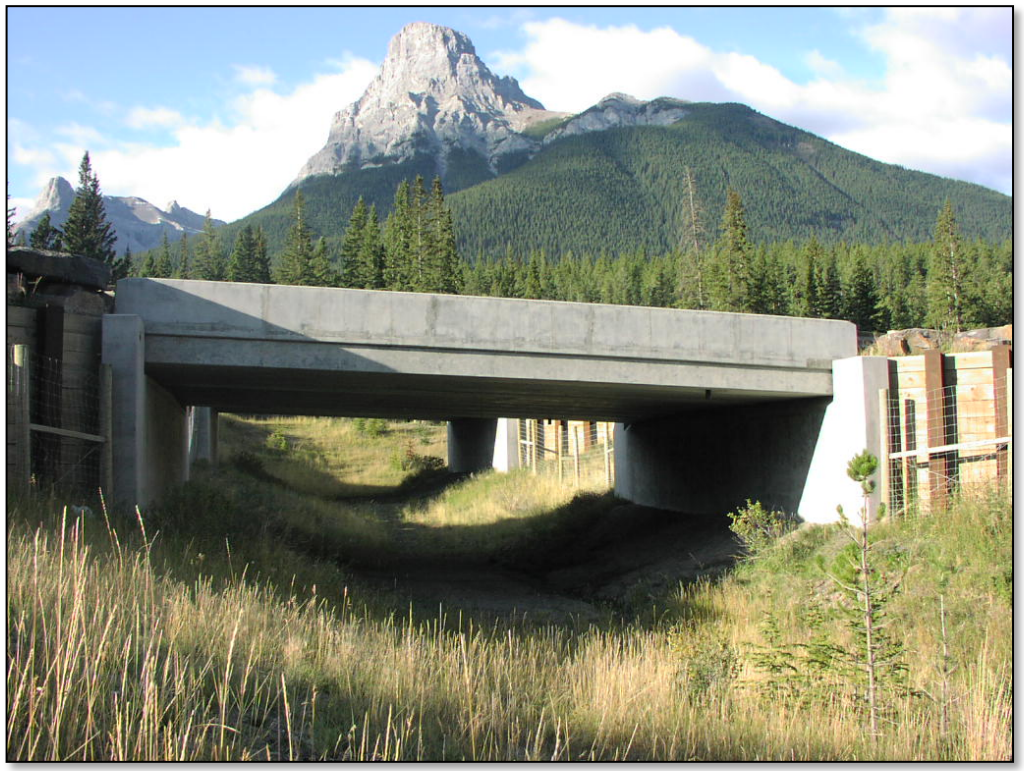

Conclusions

- In multi-species systems, ‘diversity’ is the key to making mitigation effective.

- Some species can be ‘bundled’ in their responses:
  - If less species-rich OR if priority species are identified, bundled responses can help manage trade-offs.