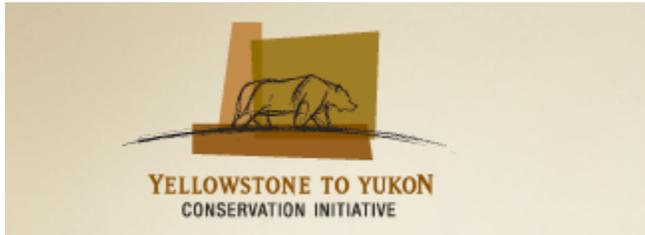


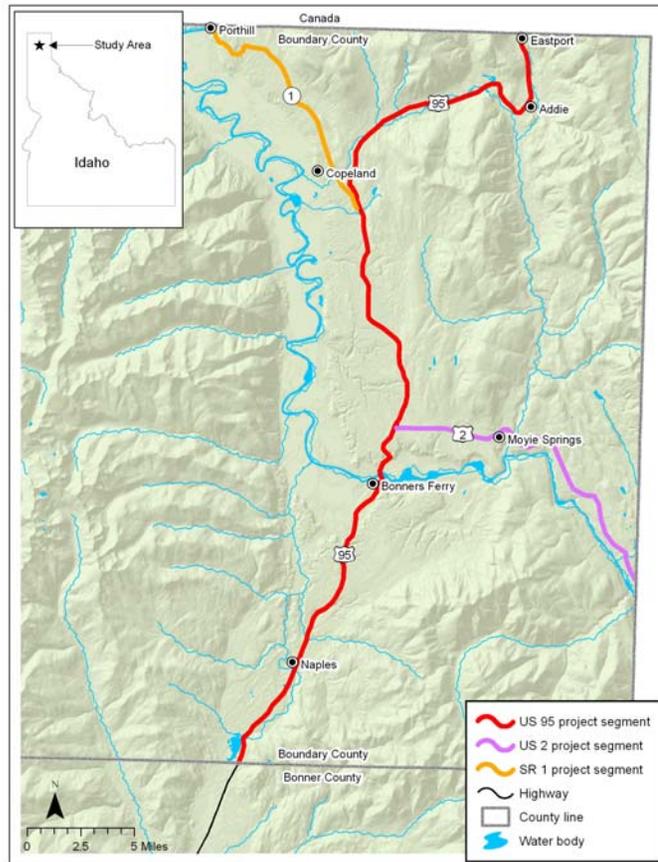
Highway Mitigation Opportunities for Wildlife along Highway 1, 2 and 95 in Boundary County, Idaho

Marcel Huijser & James Begley

Funder:



Study Area



- U.S. Hwy 95: about 46 mi (74 km)
- U.S. Hwy 2: about 15 mi (24 km)
- State Route 1: about 11 mi (18 km)

Tasks

- Identify hotspots wildlife-vehicle collisions
- Prioritize hotspots
- Identify important habitat or corridors for wildlife
- Cost-benefit analyses mitigation measures
- Formulate specific recommendations for selected sites



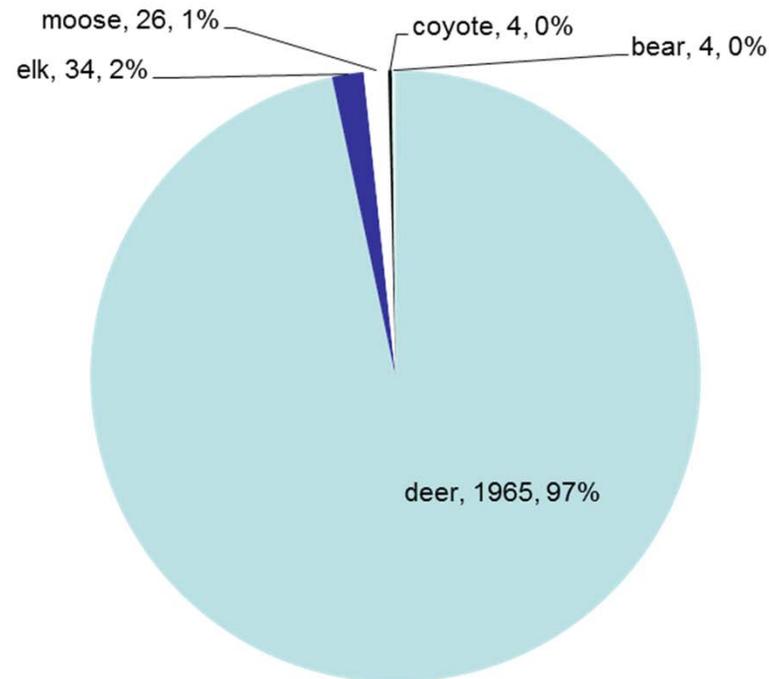
Crash and Carcass data

- Same time period for both datasets
- 1 Jan 2003 through 31 Dec 2010
(excluding 1 Jan 2007-31 Dec 2007)
- Medium and large wild mammals only
(coyote size and up)
- Spatial resolution: 0.1 mi (based on crash and carcass records)



Data summaries

- Crash data: N=290
- Carcass data: N=2033

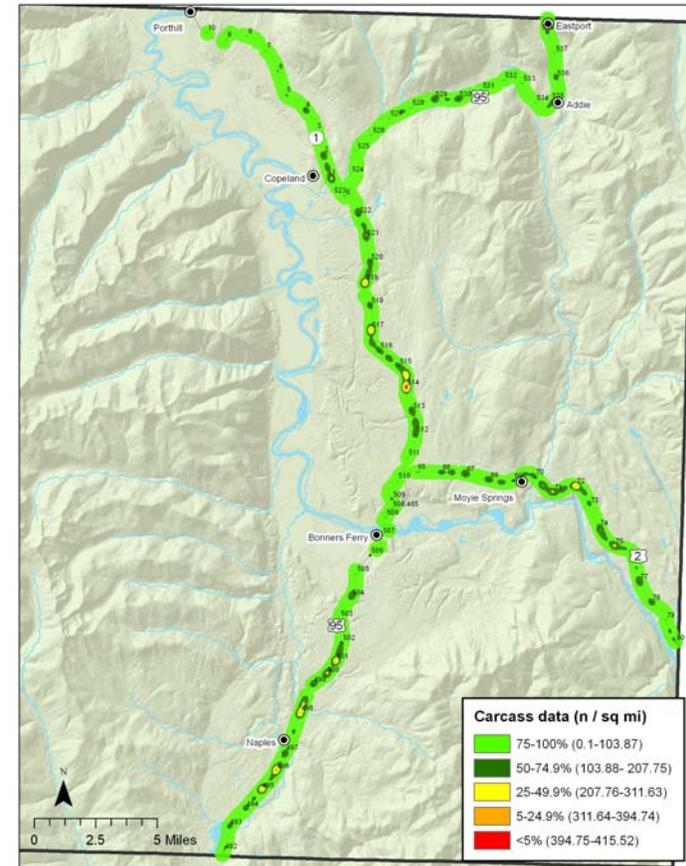
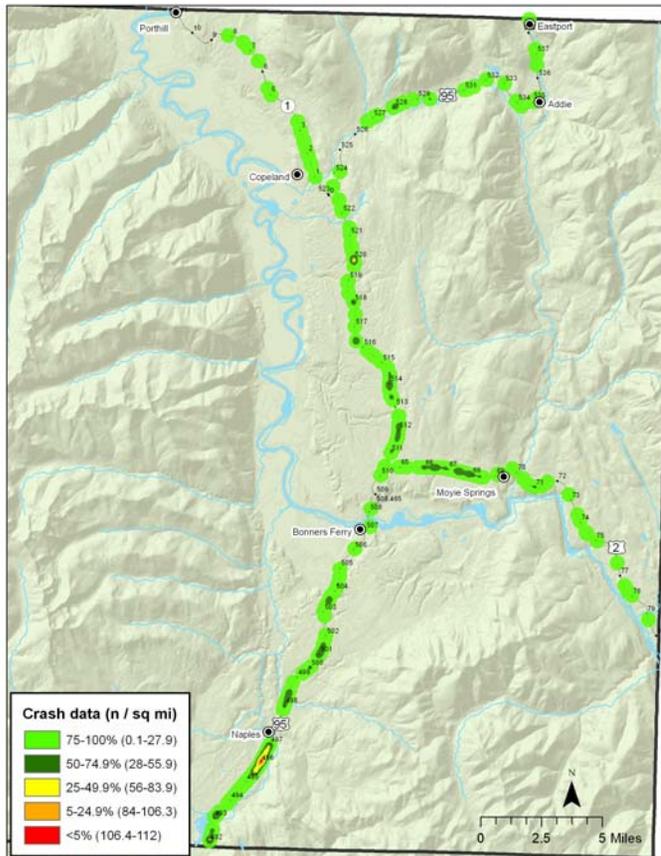


Kernel hotspot analyses

- Separate analyses for crash and carcass data
- All roads and road sections (Hwy 1, 2, 95) combined
- Cell size: 25x25 m
- Search radius: 500 m
- “point density” calculated for each cell
- Categories based on percentiles



Hotspots



Prioritization Hotspots

Crash data

Hwy	Mi marker		Length (mi)	Red category	Orange category	Crashes (n)	Crashes per 0.1 mi (n)	Crashes/ mi/yr
	Low	High						
95	491.8	492.5	0.7	n	n	9	1.29	1.84
95	495.3	497.1	1.8	y	y	36	2.00	2.86
95	519.7	520.2	0.5	n	n	8	1.60	2.29



Prioritization Hotspots (Carcass)

Hwy	Mi marker		Length (mi)	Red category	Orange category	Species	Crashes (n)	Crashes/0.1 mi (n)	Total crashes (n)	Total crashes/0.1 mi (n)	Total crashes/mi/yr (n)
	Low	High									
95	494.8	495.3	0.5	n	n	deer	36	7.20	36	7.20	10.29
95	495.5	496.5	1	n	y	deer	48	4.80	57	5.70	8.14
						moose	9	0.90			
95	497.8	498.6	0.8	n	n	deer	71	8.87	71	8.87	12.68
95	499.8	500.5	0.7	n	n	deer	31	4.43	31	4.43	6.33
95	500.6	502	1.4	n	n	deer	60	4.29	63	4.50	6.43
						elk	3	0.21			
95	513.7	515.2	1.5	y	y	deer	105	7.00	110	7.33	10.48
						elk	4	0.27			
						bear	1	0.07			
95	515.8	517.3	1.5	n	n	deer	76	5.07	77	5.13	7.33
						elk	1	0.07			
95	518.8	520.1	1.3	n	n	deer	73	5.62	74	5.69	8.13
						elk	1	0.08			
95	520.8	521.6	0.8	n	n	deer	38	4.75	39	4.87	6.96
						elk	1	0.12			
2	70.3	71.6	1.3	n	n	deer	70	5.38	70	5.38	7.69
2	71.8	72.6	0.8	n	n	deer	48	6.00	51	6.38	9.11
						elk	3	0.38			
2	73.9	74.7	0.8	n	n	deer	40	5.00	40	5.00	7.14
2	74.8	75.6	0.8	n	n	deer	42	5.25	42	5.25	7.50
1	0.8	1.7	0.9	n	n	deer	47	5.22	47	5.22	7.46

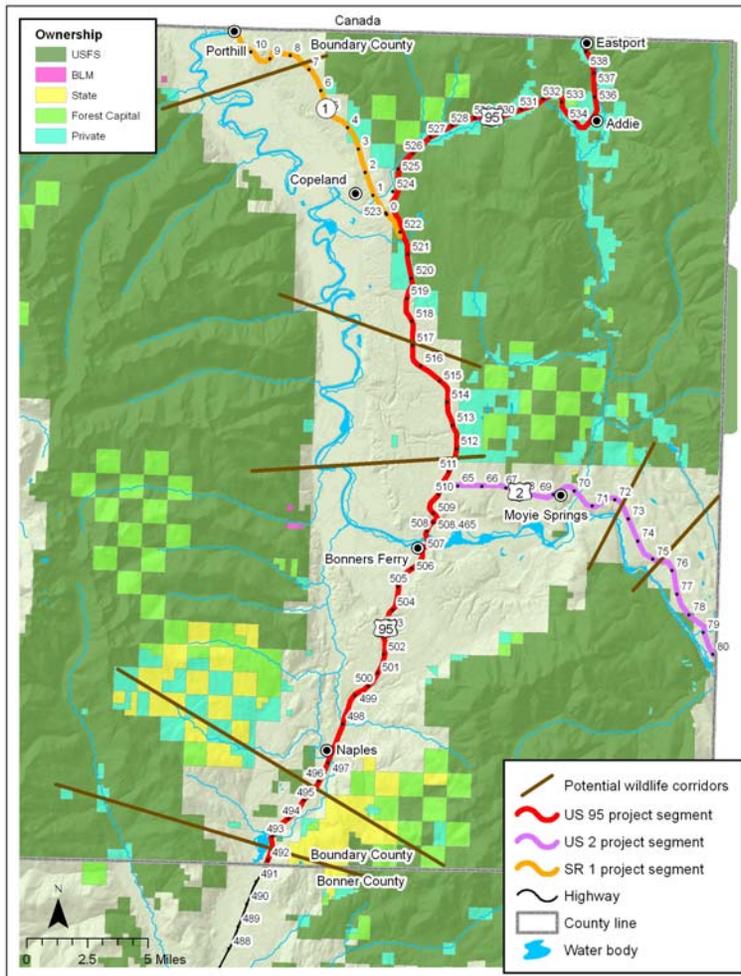
Prioritization

To do:

1. Rank sites based on different variables
no weighting?
2. Integrate ranking crash/carcass data with
habitat /corridors
3. Day/night distribution (hr of day)
4. Seasonal pattern
5. State wide estimate crashes/carcasses



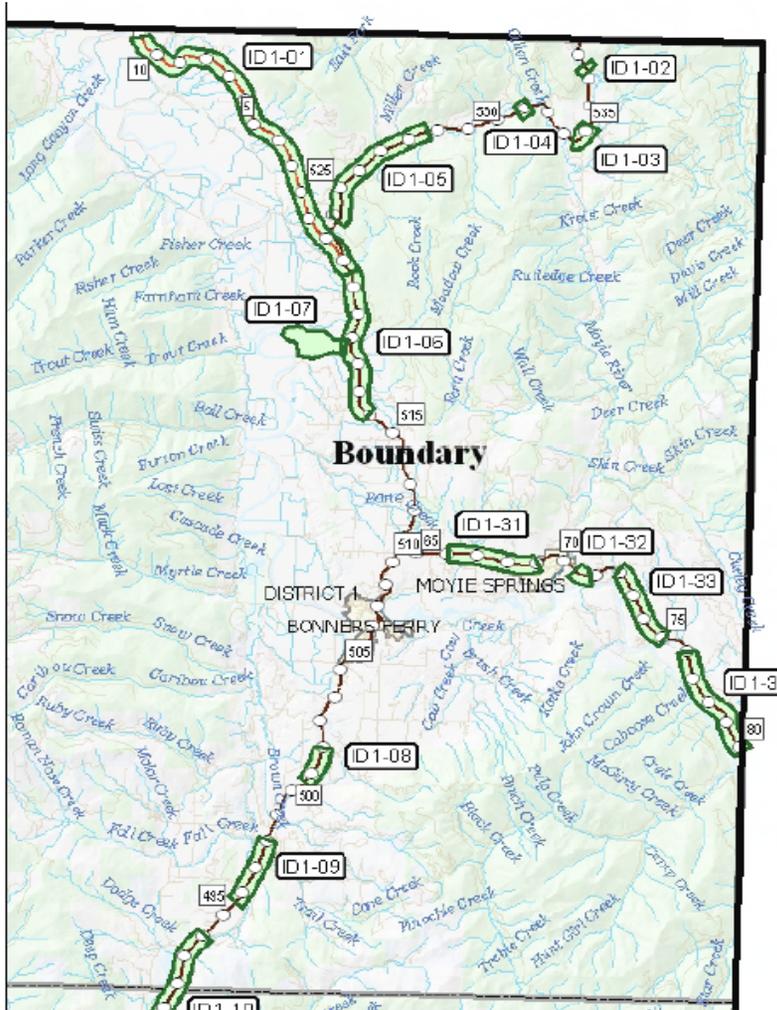
Important Habitat and Corridors



- Land ownership
- Linkage areas (The Nature Conservancy)

Private land data??

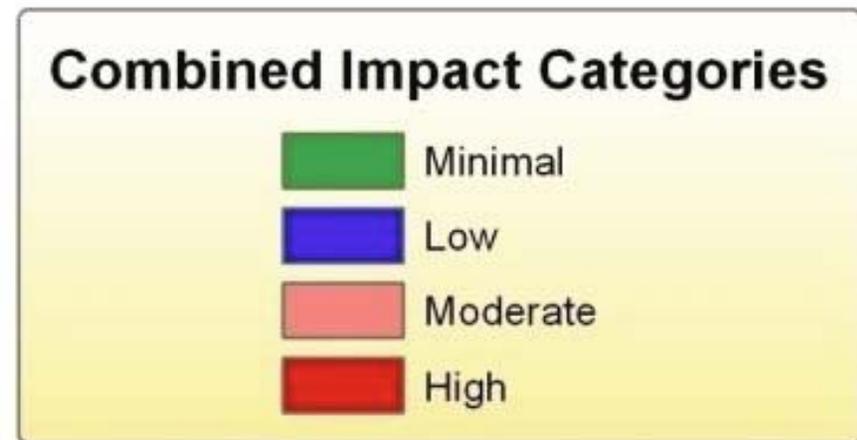
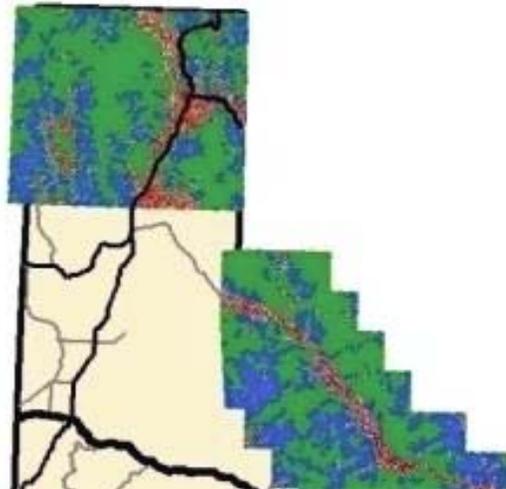
Important Habitat and Corridors



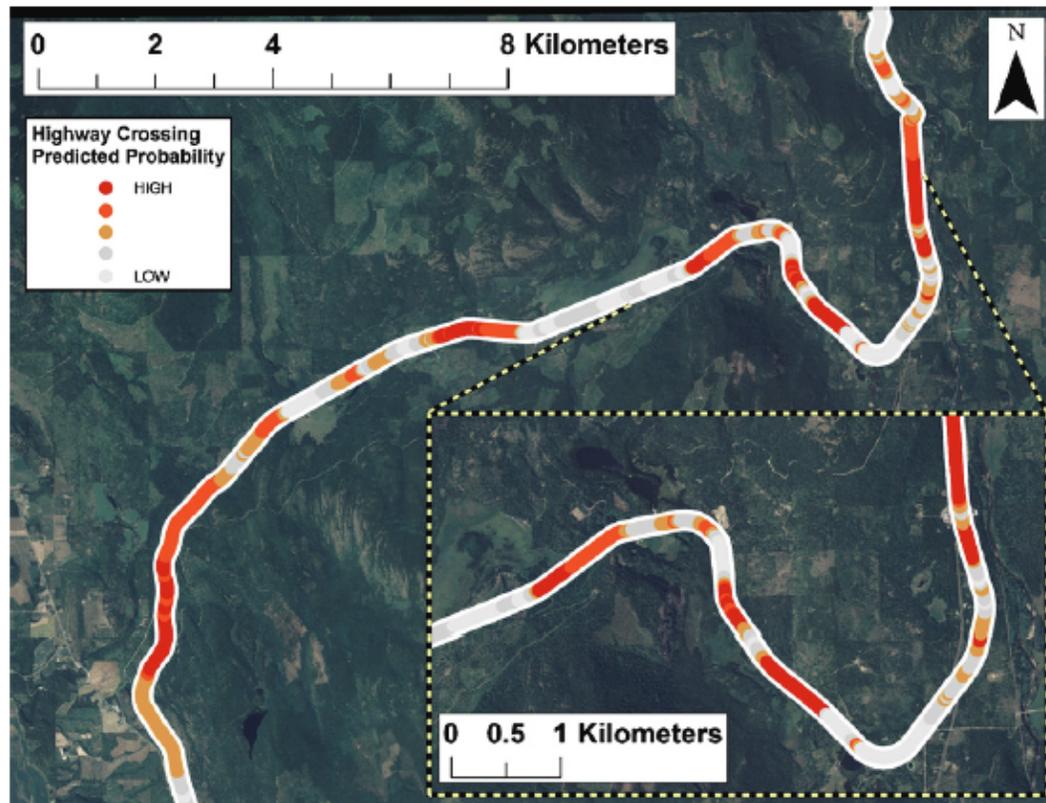
Linkage areas (Geodata 2008)

Important Habitat and Corridors

Idaho statewide wildlife linkage zones (Inghram et al., 2009)



Important Habitat and Corridors



Lewis et al., 2011

Fig 5. Map of predicted highway crossing areas for black bears in the Purcell Mountains of northern Idaho, USA. Habitat characteristics selected for highway crossings were evaluated for black bears fitted with GPS collars during 2005–2006 and this information was used to identify and predict areas that bears will use to cross highway 95.

Important Habitat and Corridors

To do:

1. Integrate data in GIS
2. Acquire additional info:

Grizzly bear habitat and linkage zones

American Wildlands linkage areas

Marty (Fedex)



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Western Transportation Institute

Cost-benefit analyses

- Costs:
Equipment, installation, construction, operation, maintenance, removal
- Benefits:
Reduced costs collisions



Benefits: Costs of collisions

Description	Deer	Elk	Moose
Vehicle repair costs per collision	\$2,622	\$4,550	\$5,600
Human injuries per collision	\$2,702	\$5,403	\$10,807
Human fatalities per collision	\$1,002	\$6,683	\$13,366
Towing, accident attendance and investigation	\$125	\$375	\$500
Hunting value animal per collision	\$116	\$397	\$387
Carcass removal and disposal per collision	\$50	\$75	\$100
Total	\$6,617	\$17,483	\$30,760

Huijser et al., Ecology and Society, 2009



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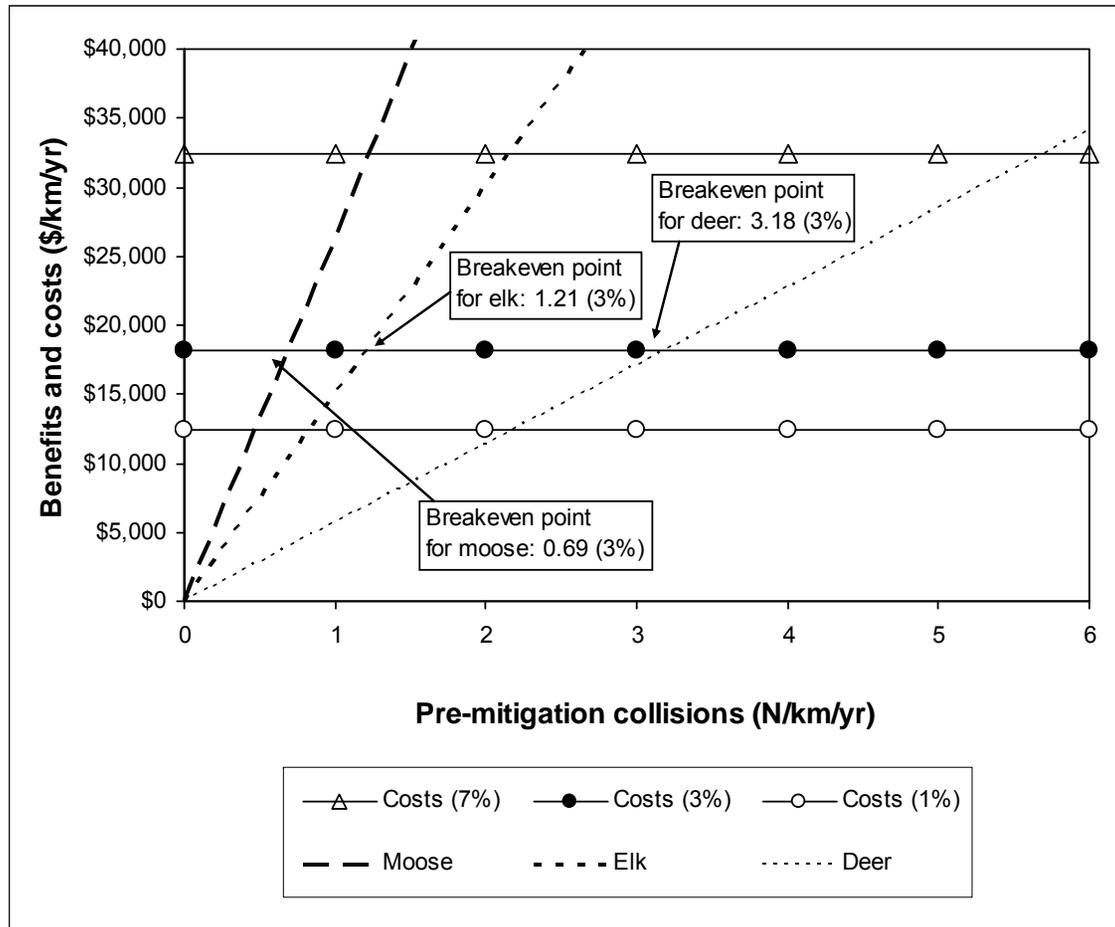
Western Transportation Institute

Cost-benefit analyses

- 75 year long period
- Discount rate: 1%, 3%, 7%



Break-even points (fencing, underpasses, jump-outs)



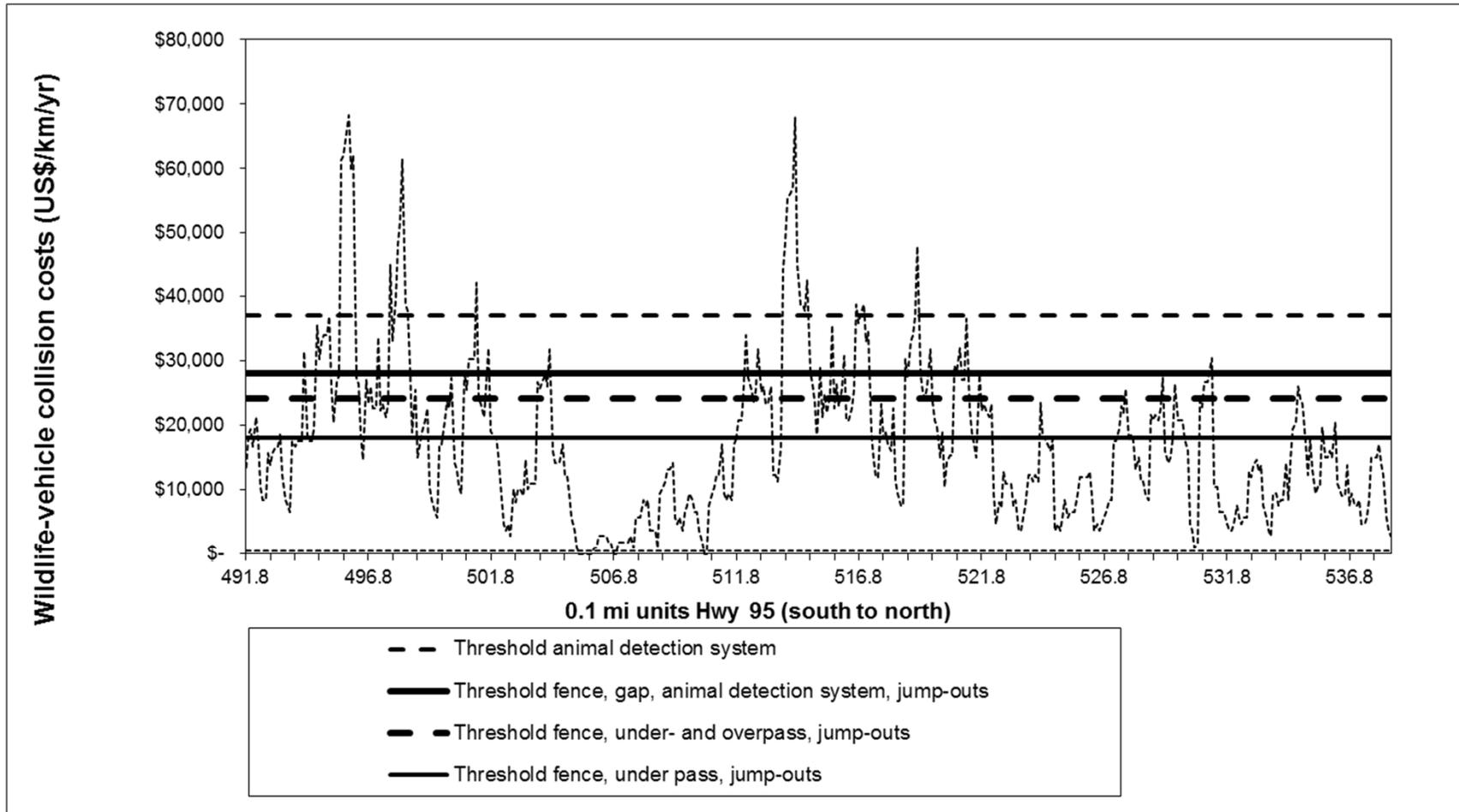
Huijser et al.,
Ecology and Society,
2009

≥80% reduction

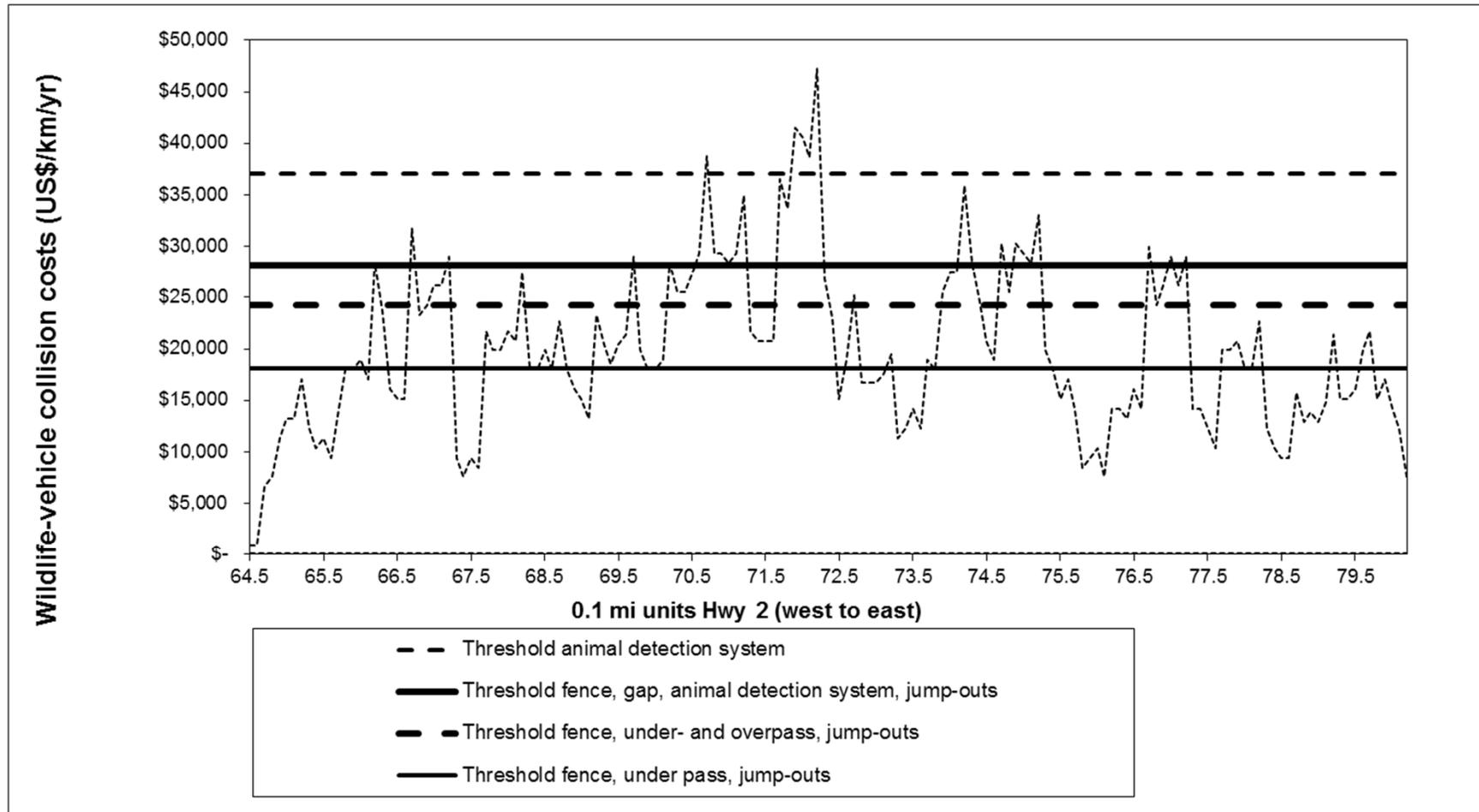
Threshold values	Discount rate	Fence	Fence, under pass, jump-outs	Fence, under- and overpass, jump-outs	ADS	Fence, gap, ADS, jump-outs	Elevated roadway	Road tunnel
\$/yr	1%	\$5,223	\$12,437	\$15,975	\$35,279	\$25,634	\$2,233,094	\$3,328,567
\$/yr	3%	\$6,304	\$18,123	\$24,230	\$37,014	\$28,150	\$3,109,422	\$4,981,333
\$/yr	7%	\$8,931	\$32,457	\$45,142	\$41,526	\$34,437	\$5,369,961	\$9,246,617
deer/km/yr	1%	0.92	2.19	2.81	6.13	4.45	337.48	503.03
deer/km/yr	3%	1.11	3.18	4.26	6.43	4.89	469.91	752.81
deer/km/yr	7%	1.57	5.70	7.93	7.21	5.98	811.54	1397.40
elk/km/yr	1%	0.35	0.83	1.06	2.32	1.69	127.73	190.39
elk/km/yr	3%	0.42	1.21	1.61	2.43	1.85	177.85	284.92
elk/km/yr	7%	0.59	2.16	3.00	2.73	2.26	307.15	528.89
moose/km/yr	1%	0.20	0.47	0.60	1.32	0.96	72.60	108.21
moose/km/yr	3%	0.24	0.69	0.92	1.38	1.05	101.09	161.94
moose/km/yr	7%	0.34	1.23	1.71	1.55	1.29	174.58	300.61

Huijser et al.,
Ecology and Society,
2009

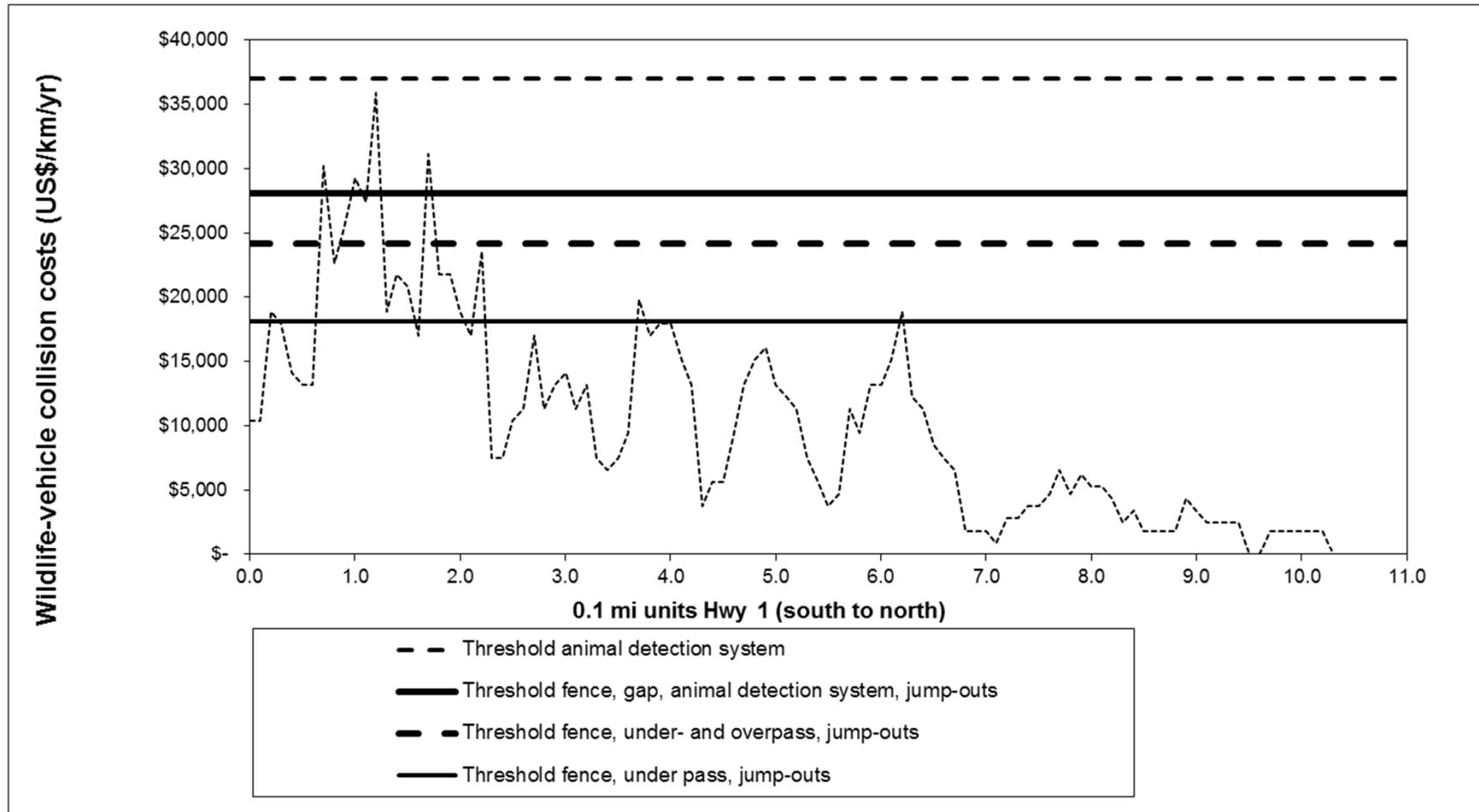
Cost-Benefit Analyses



Cost-Benefit Analyses



Cost-Benefit Analyses



Cost-Benefit Analyses

To do:

- Specific cost estimates
underpasses/fencing from area?
- Underpasses: 4 lane vs. 2 lane?



Site Specific Recommendations

To do: Site specific recommendations
safety, conservation, economics

Example:

495.5-498.6 (2 hotspots)

- Highest number of crashes / mi (but not hottest hotspot)
- Most costly road section -> most potential savings
- Partially in TNC corridor



Site Specific Recommendations

- Topography not especially suited for large underpasses
- Overpass unlikely to be funded
- Suggest animal detection system
 - Combined with fences
 - ADS at gaps in fences
 - Electric mat in road and r-o-w
 - Limit number of driveways (consolidate, small frontage rd)



Questions

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