

Effectiveness of wildlife mitigation measures along US Hwy 93 North, Flathead Indian Reservation; preliminary results

Marcel Huijser

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DIVISION OF FISH, WILDLIFE,
RECREATION & CONSERVATION



U.S. Department
of Transportation
**Federal Highway
Administration**

MONTANA
MDT★
DEPARTMENT OF TRANSPORTATION



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Human perspective

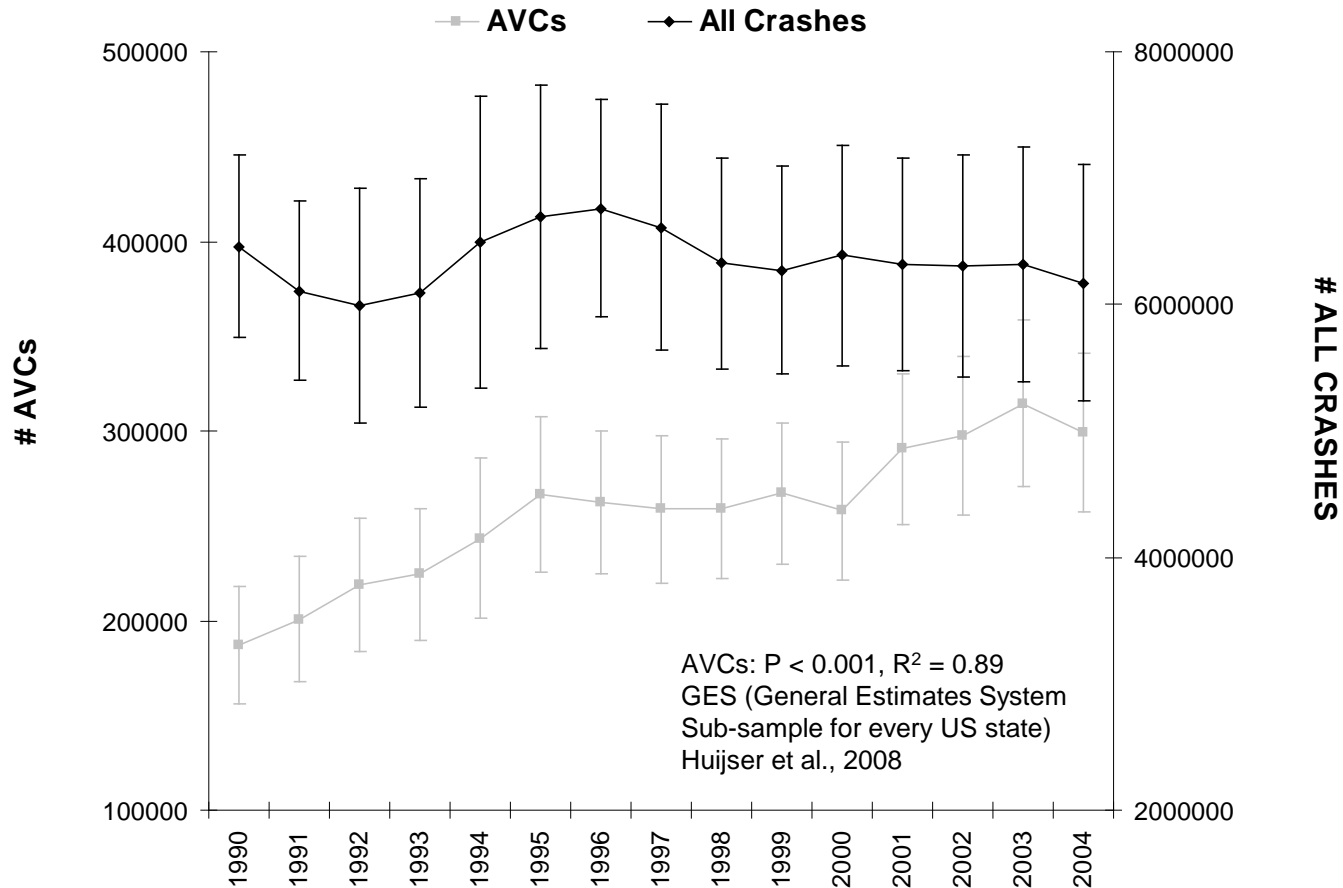
	US	Canada	Europe
Animal-vehicle-Collisions	1-2 million (deer)	\pm 28,000	507.000 (ungulates)
Human injuries	29.000	1,565	30.000
Human fatalities	211	18	300
Property damage	> 1 billion US\$	200 million CAN\$	> 1 billion US\$



Conover et al., 1995; Cook & Daggett, 1995;
Groot Bruinderink & Hazebroek, 1996';
L-P Tardiff & Associates Inc. 2003;
Huijser et al. 2008

per year
.... and increasing

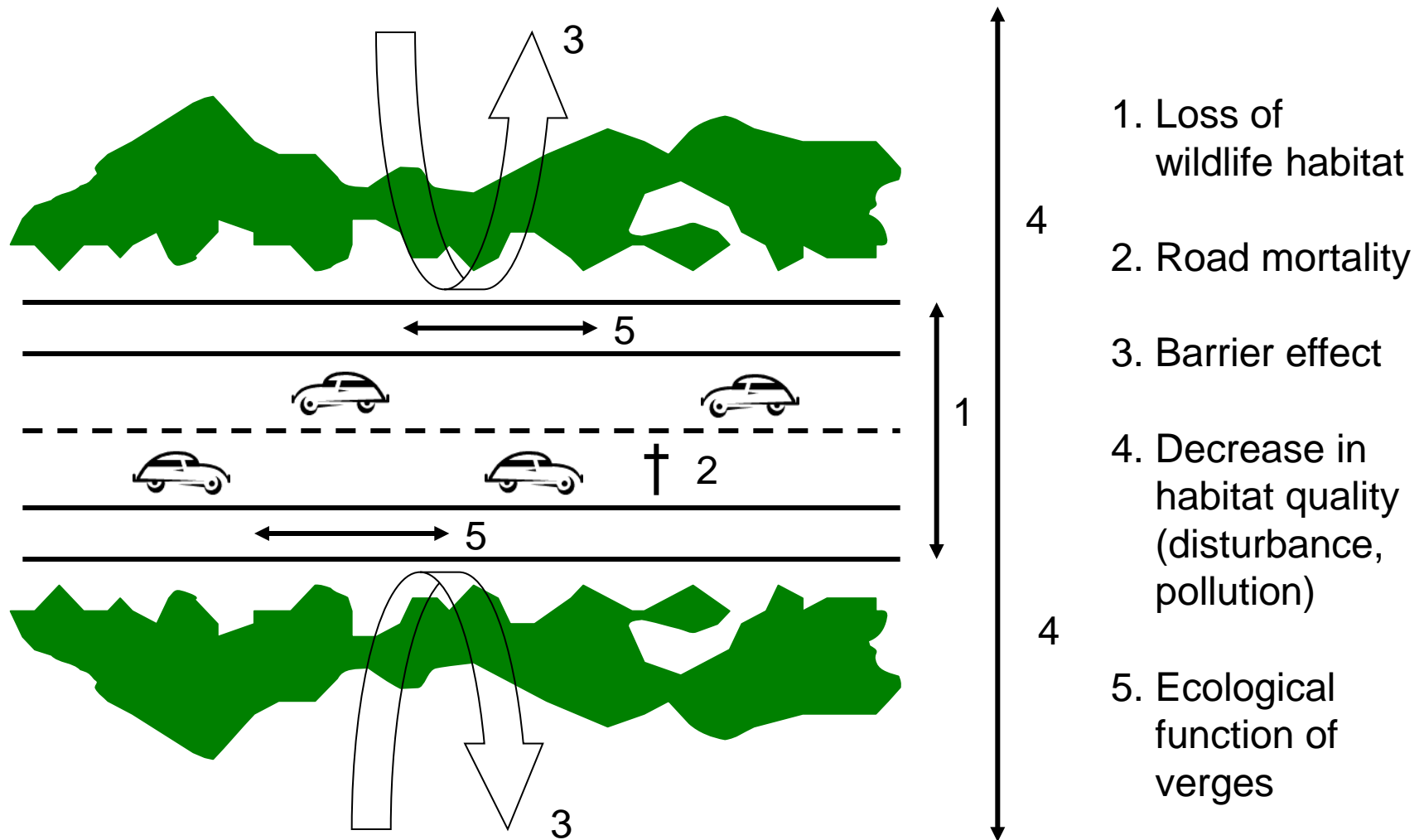
Trend animal-vehicle collisions



1-2 million ungulate-vehicle collisions / year in US (Huijser et al. 2008)



Ecological Impacts



Species and numbers

Table 1. *Estimates of annual nationwide road kills in wildlife, as obtained from field inventories or drivers enquiries.*

Species	Road kills *	Country	Year/Period	Reference
vertebrates	365	USA	1960's	Humane Society 1960, in Lalo 1987
	100	ES	1990's	Caletrio et al. 1996
	6.5	FI	2002	Manneri 2002
	4.0	BE	1994	Rodts et al. 1998
birds	8.5	SE	1998	Svensson 1998
	5.0	BL	1983	Mankinov & Todorov 1983
	4.0	UK	1966	Hodson 1966
	3.7	DK	1981	Hansen 1982
	2.5	UK	1965	Hodson & Snow 1965
	2.0	NL	1993	Tempel 1993
	1.0	SE	1970's	Göransson et al. 1978
	0.6	NL	1977	Jonkers & De Vries 1977
birds & mammals	2.0	CAN	1970's	Oxley & fenton 1976
large & medium sized mammals	1.5	DK	1980	Hansen 1982
	0.5	SE	1970's	Göransson et al. 1979
	0.2	NL	1977	Jonkers & De Vries 1978
amphibians	5.0	AUS	1983	Ehmann & Cogger 1983, in Bennett 1991
	3.0	DK	1982	Hansen 1982
ungulates	0.5	USA **	1991	Romin & Bissonette 1996
	0.5	EU	1995	Groot-Bruinderink & Hazebroek 1996
	0.004	F	1990's	SETRA 1998
	0.002	ES	1992	Fernandez 1993

* in millions per year, nationwide

** only deer (*Odocoileus spp.*)

Seiler (2003)



Federally listed species

Species Group	Species Name
Amphibians	California tiger salamander (<i>Ambystoma californiense</i>), C. CA, S. Barb., Son. county
Amphibians	Flatwoods salamander (<i>Ambystoma cingulatum</i>)
Amphibians	Houston toad (<i>Bufo houstonensis</i>)
Reptiles	American crocodile (<i>Crocodylus acutus</i>)
Reptiles	Desert tortoise (<i>Gopherus agassizii</i>), except in Sonoran Desert
Reptiles	Gopher tortoise (<i>Gopherus polyphemus</i>), W of Mobile/Tombigbee Rs.
Reptiles	Alabama red-bellied turtle (<i>Pseudemys alabamensis</i>)
Reptiles	Bog turtle (Muhlenberg) northern population (<i>Clemmys muhlenbergii</i>)
Reptiles	Copperbelly water snake (<i>Nerodia erythrogaster neglecta</i>)



Species Group	Species Name
Reptiles	Eastern indigo snake, eastern indigo (<i>Drymarchon corais couperi</i>)
Birds	Audubon's crested caracara (<i>Polyborus plancus audubonii</i>), FL pop.
Birds	Hawaiian goose (<i>Branta sandvicensis</i>)
Birds	Florida scrub jay (<i>Aphelocoma coerulescens</i>)
Mammals	Lower Keys marsh rabbit, (<i>Sylvilagus palustris hefneri</i>)
Mammals	Key deer (<i>Odocoileus virginianus clavium</i>)
Mammals	Bighorn Sheep, Peninsular CA pop. (<i>Ovis canadensis</i>)
Mammals	San Joaquin kit fox (<i>Vulpes macrotis mutica</i>)
Mammals	Canada lynx (<i>Lynx canadensis</i>), lower 48 states
Mammals	Ocelot (<i>Leopardus pardalis</i>)
Mammals	Florida panther (<i>Felis concolor coryi</i>)
Mammals	Red wolf (<i>Canis rufus</i>), except where XN

US93 N, Flathead Indian Reservation, Montana (2002-present)

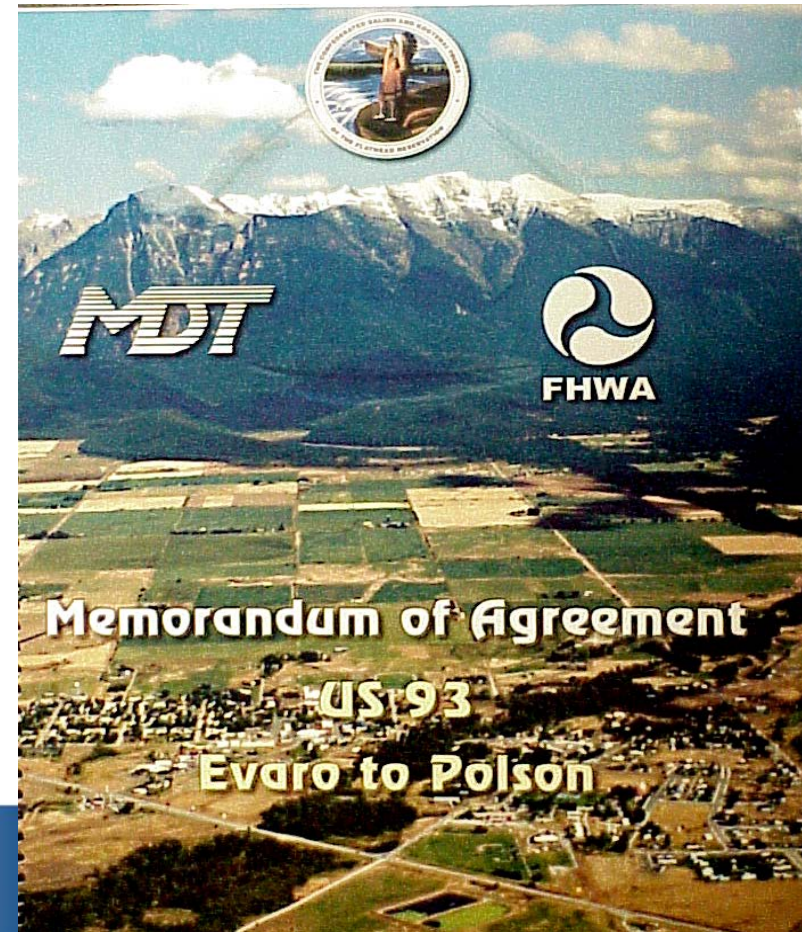


Confederated Salish and Kootenai Tribes:

- “Road is a visitor”
- Respectful to land and “spirit of
- Cultural values
- Natural resources

Transportation agency:

- Human safety



163 Killed • 4,992 Injured on Hwy 93

MDHS STATISTICS SINCE 1987

PLEASE BUCKLE UP!

TURN ON YOUR HEADLIGHTS • PASS WITH CAUTION

Your Health Is Our Concern...



**ST. LUKE COMMUNITY
HEALTHCARE NETWORK**
Ronan, MT
The HEART of Healthcare in the Western Valley



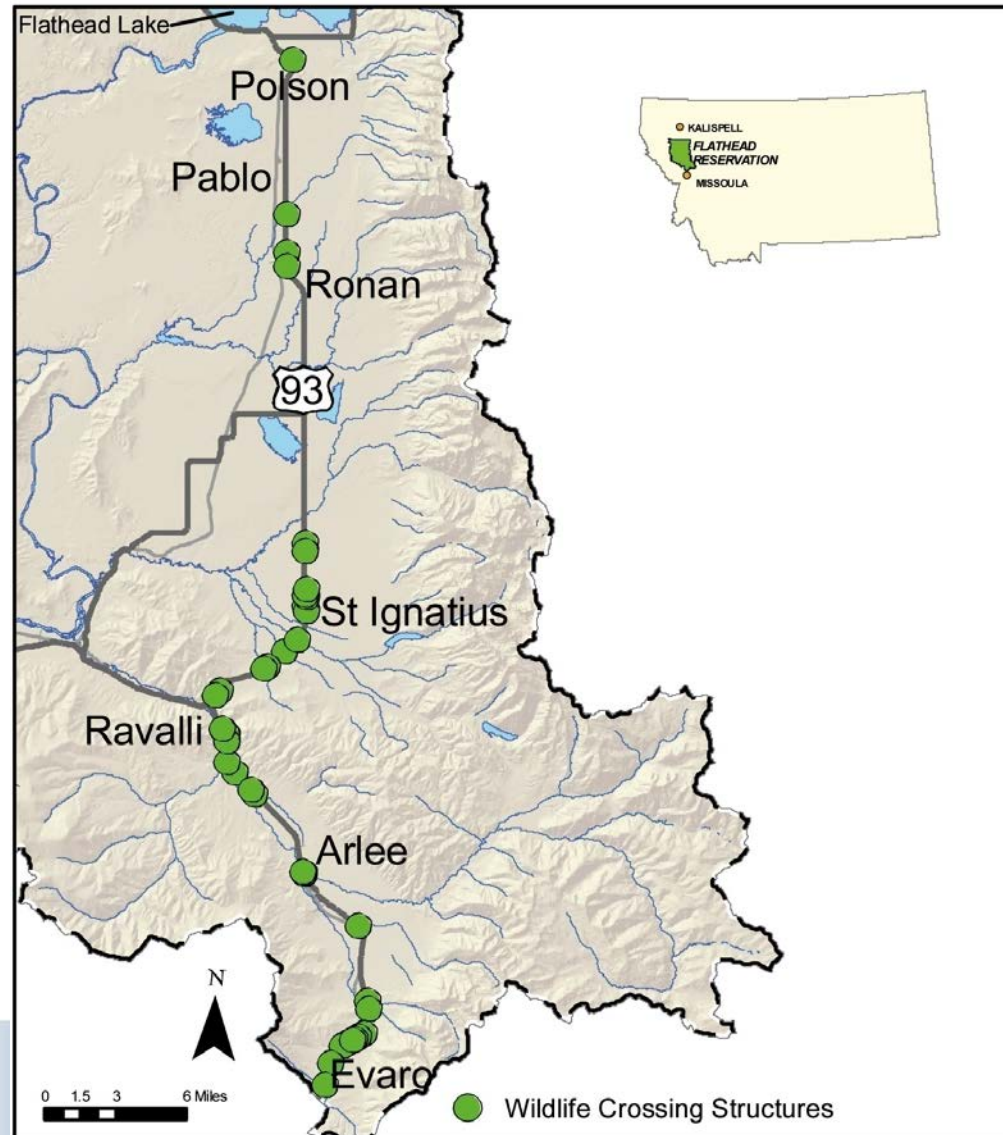
*Missoula, Mt

ABEL OUTDOOR

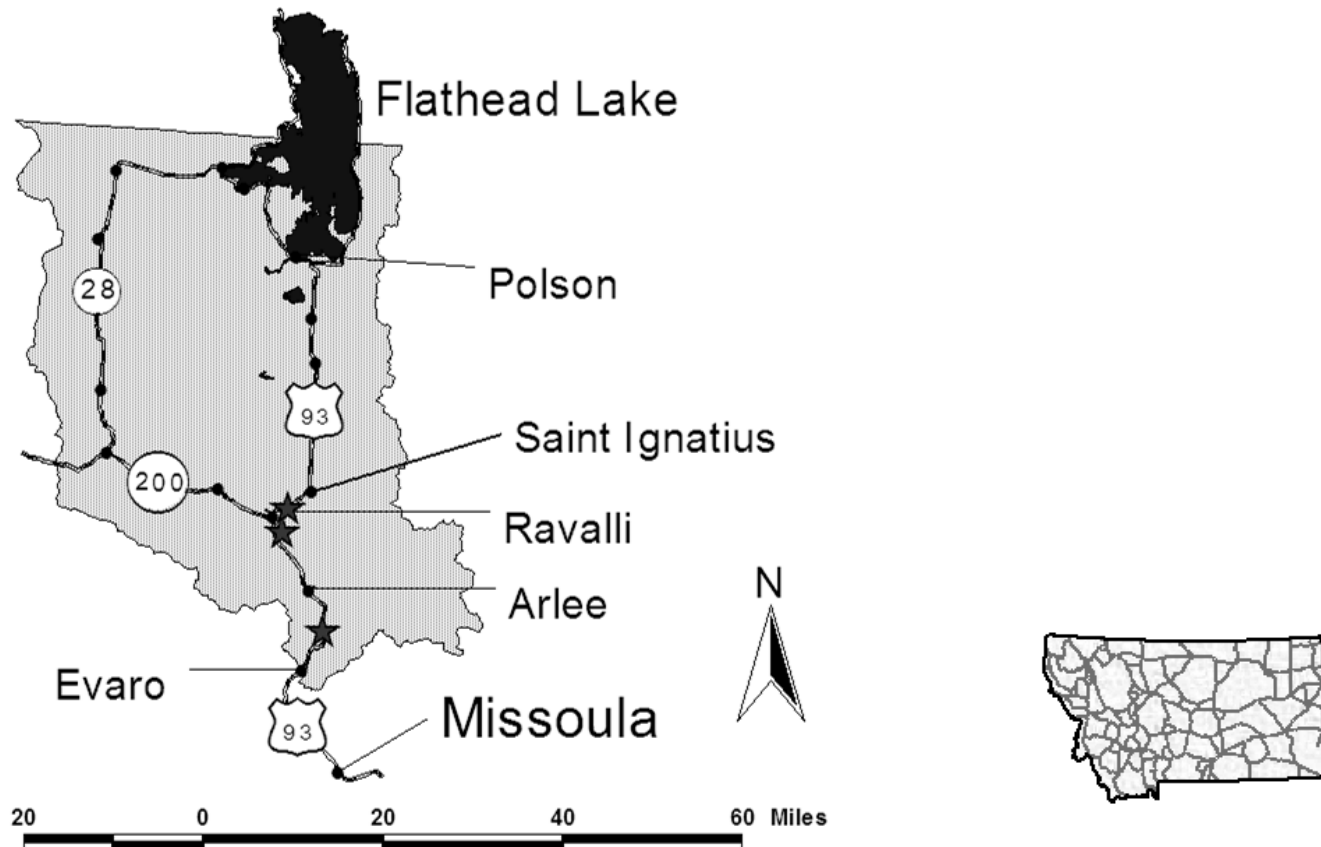
US93

41 crossing Wildlife structures

Agriculture
Residential areas
Access roads
Short fence sections
Cultural values



US93 focus areas

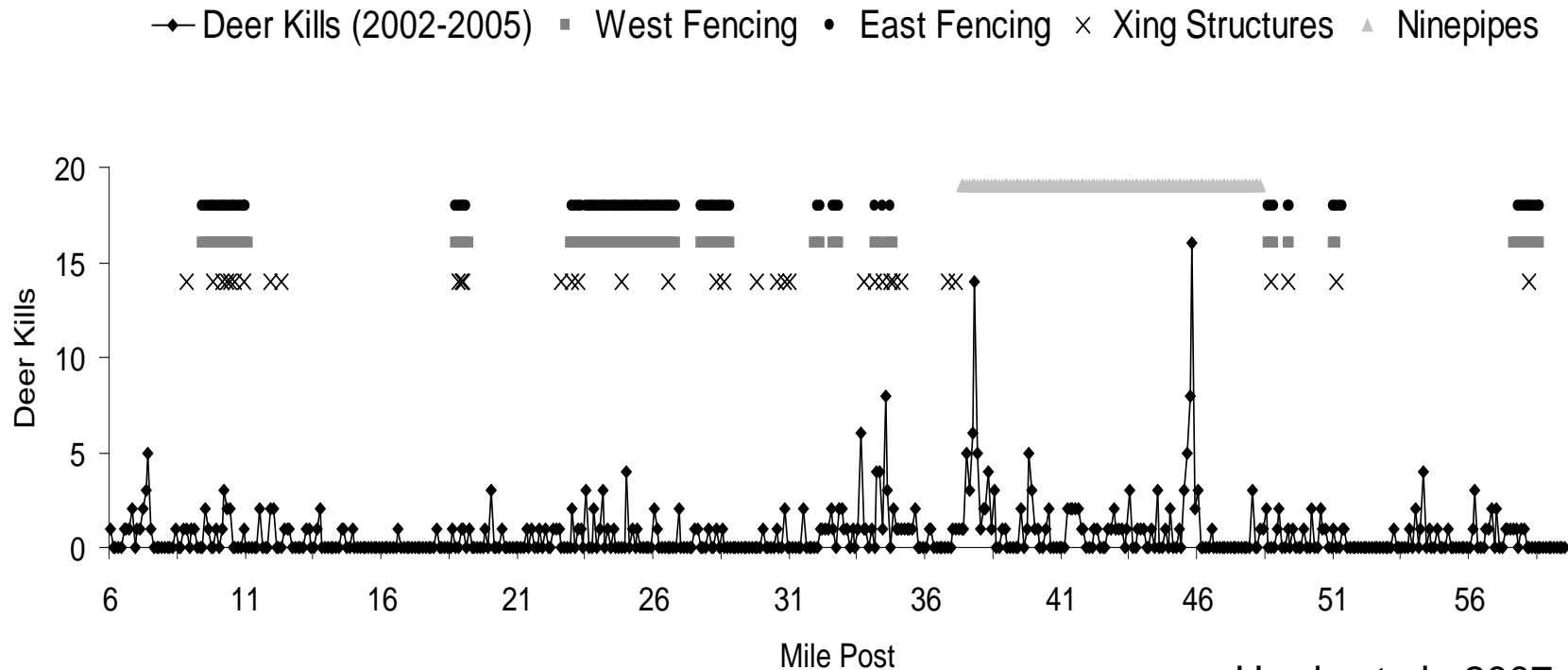


US93, Flathead Indian Reservation, Montana

- 8.3 miles (13.4 km) fencing on both sides
- 40 wildlife underpasses
- 1 wildlife overpass



What is mitigated and what not?



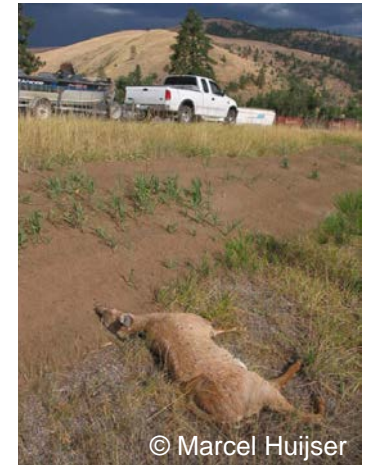
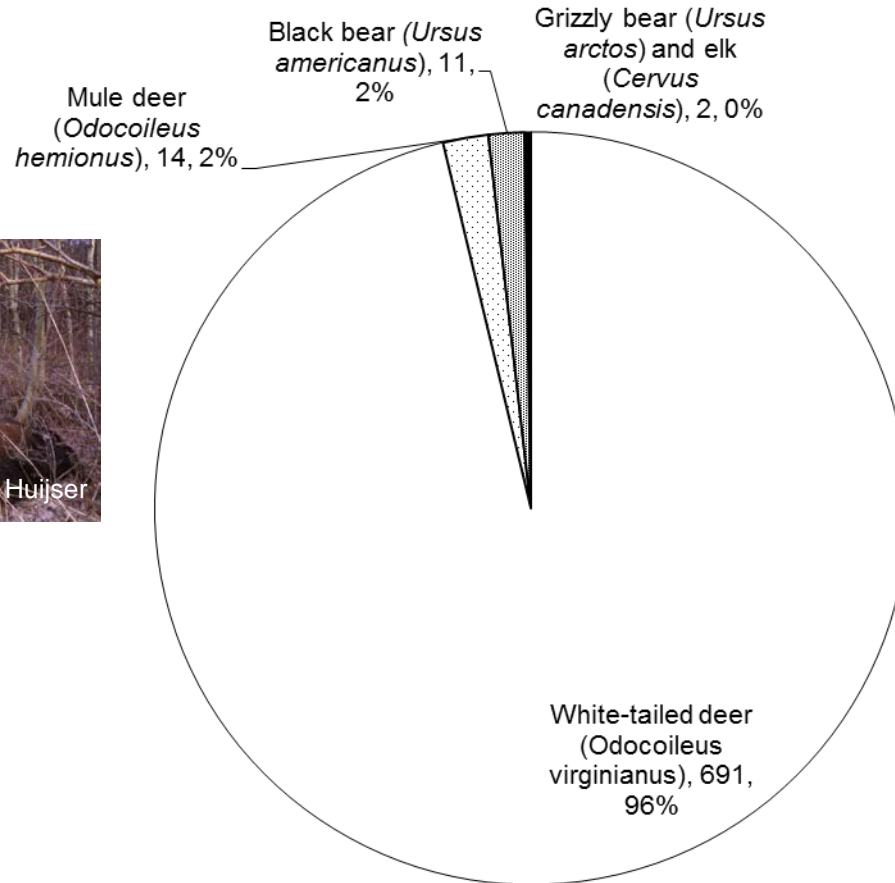
Hardy et al., 2007

Research questions

- Human Safety
- Habitat Connectivity
- Costs and benefits
- Outreach



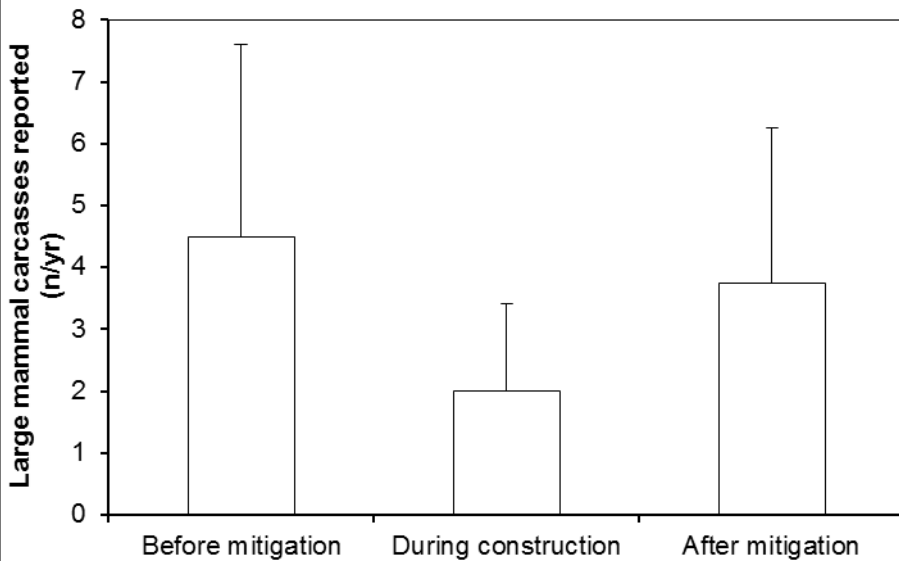
Species hit and recorded



Species involved with animal-vehicle collisions based on carcass removal data (1998 through 2011) along US 93 North between Evaro and Polson (N=718).

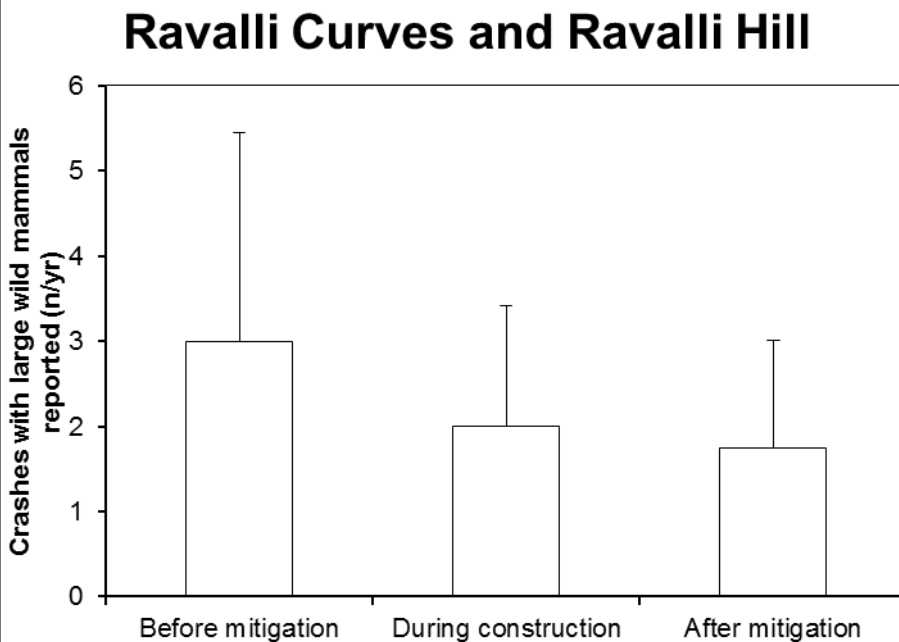
Huijser et al. 2013

Ravalli Curves and Ravalli Hill



Carcass removal data:
16.7% reduction

Crash data:
41.7% reduction



Compare to continuous
fencing and structures, no
gaps: 80-<100%

Edge effects

Gaps

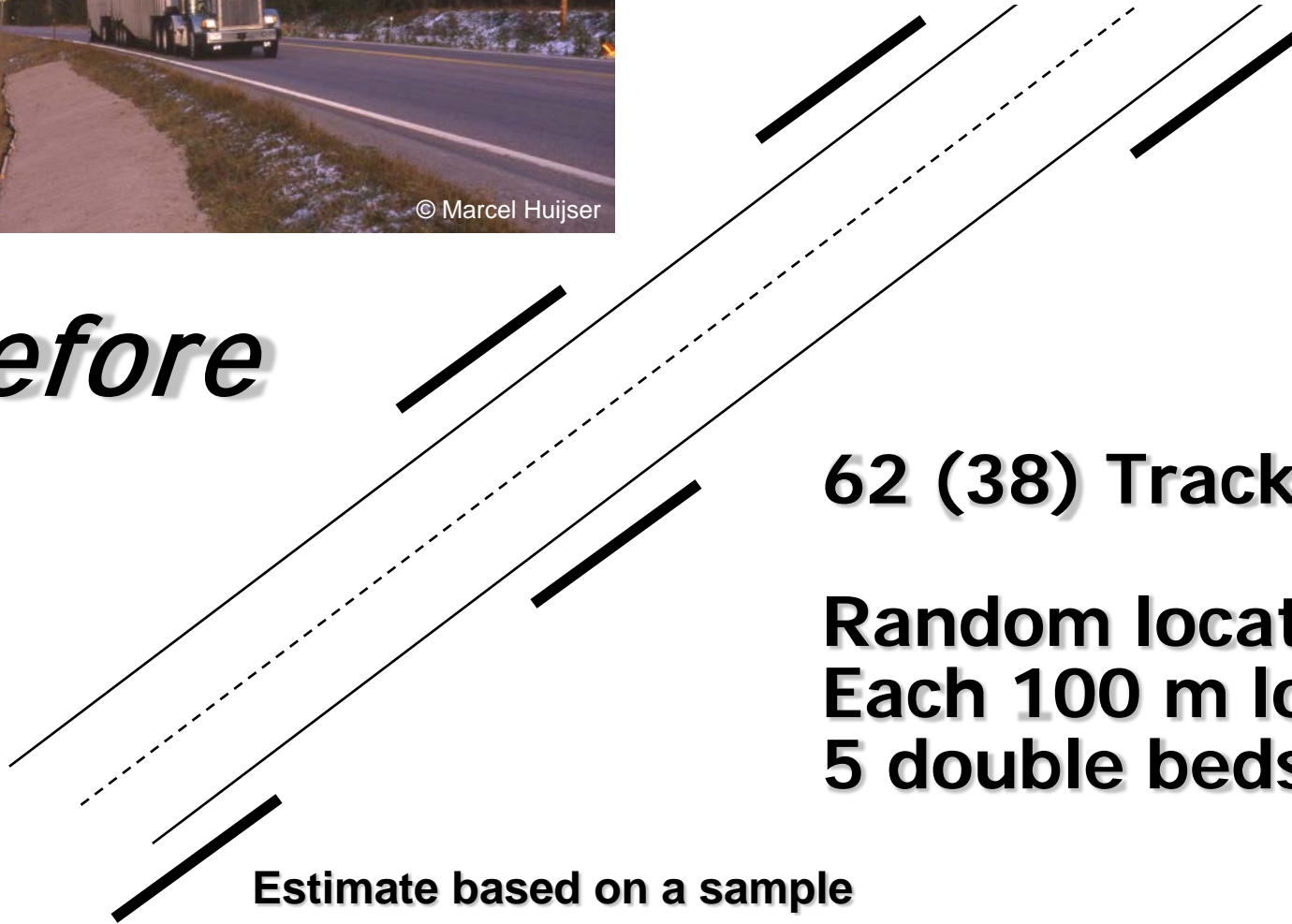
Low absolute numbers

Huijser et al. 2013



Deer and black bear

Before



62 (38) Tracking beds

**Random locations
Each 100 m long
5 double beds**

Estimate based on a sample



Check and erase



Black bear

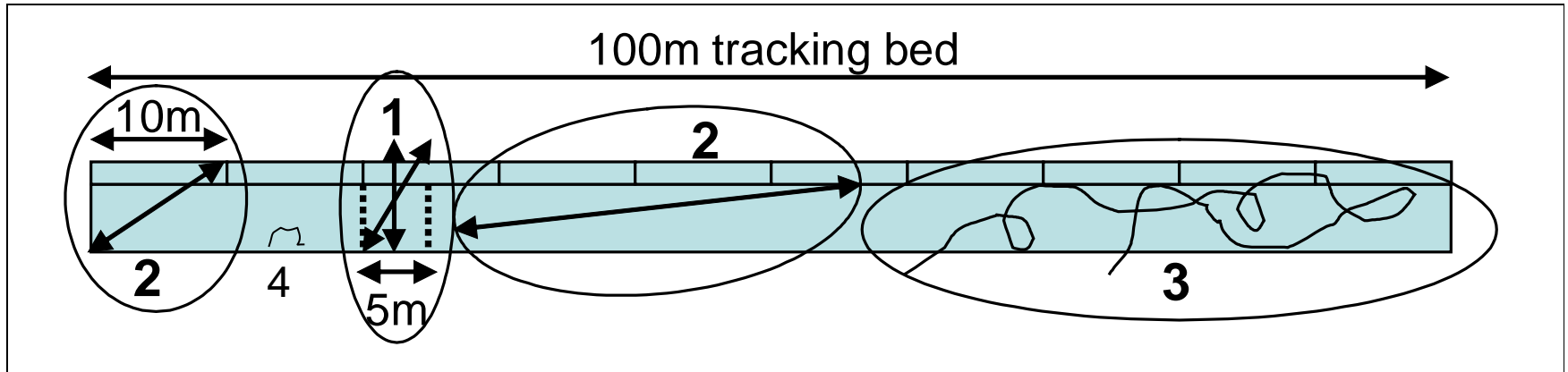
Twice a week

Jun-Oct



Deer

Classification of tracks

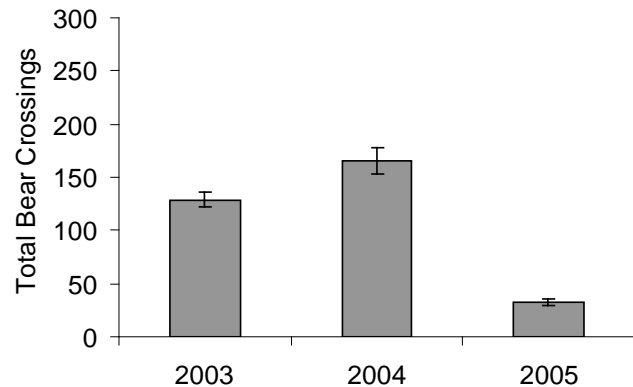
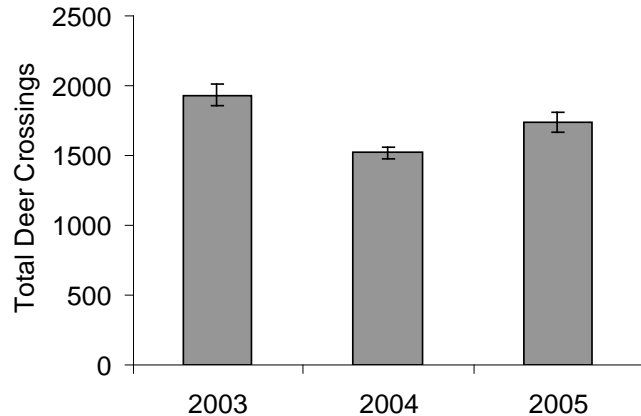


1 = Crossing

2, 3 = "Parallel" movements

4 = Presence

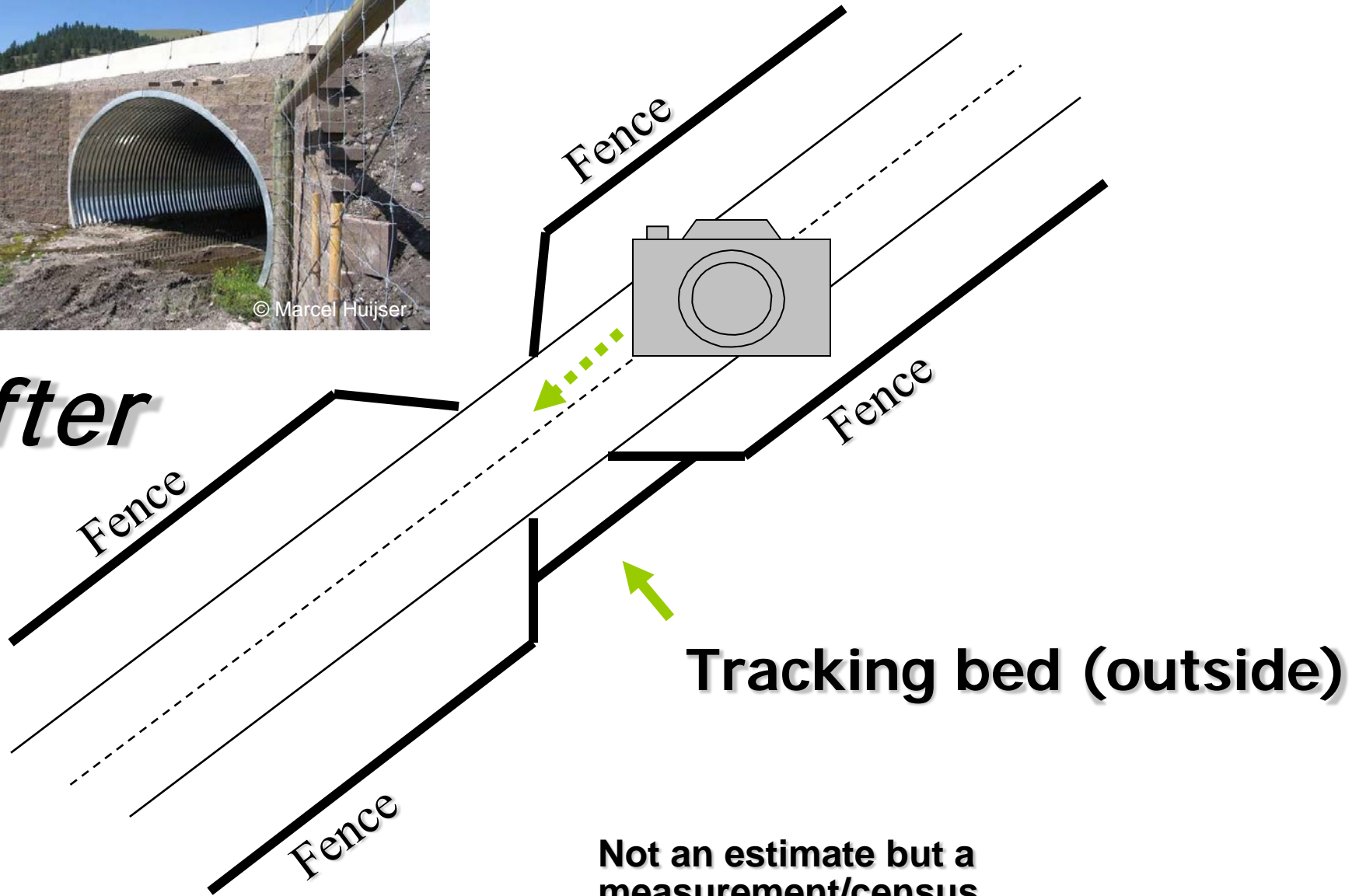
Crossings in the 3 areas (based on 38 tracking beds)



Hardy et al., 2007



After



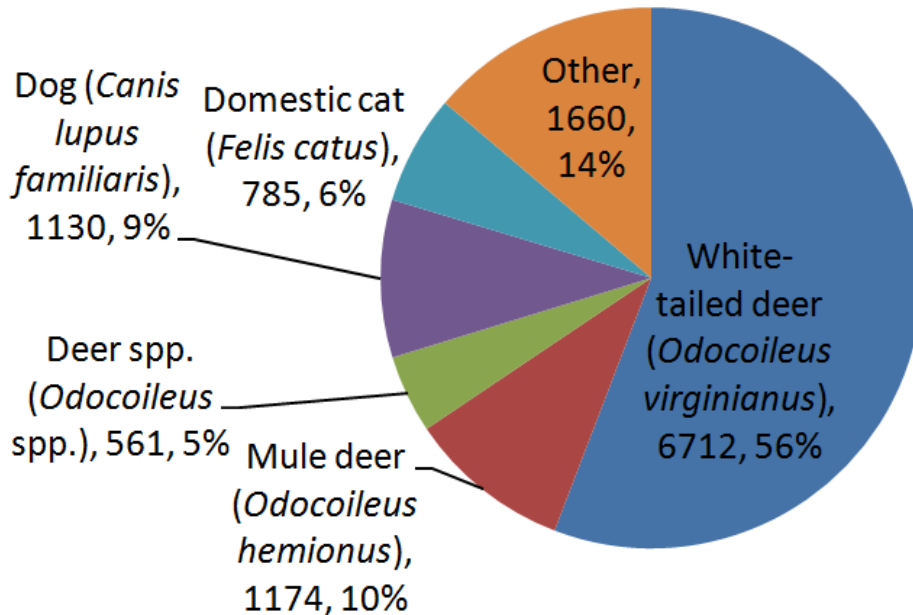
Not an estimate but a
measurement/census

Sample Use Underpasses



Use of structures US Hwy 93 N (2010)

All structures monitored



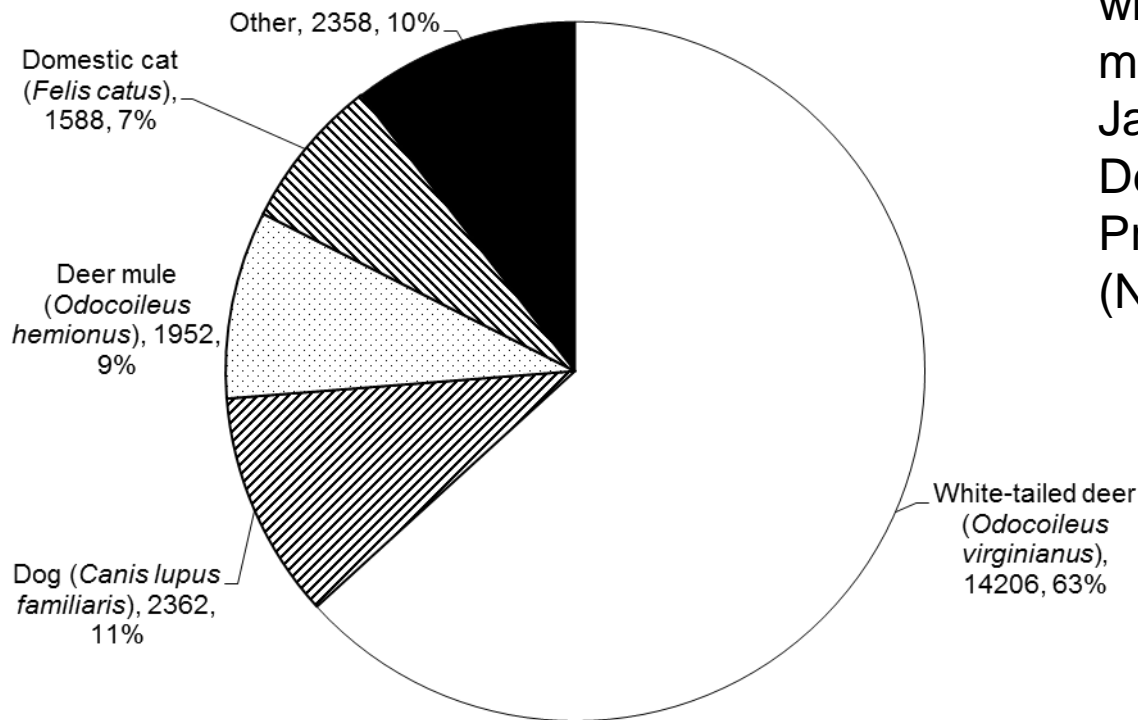
Wildlife use of all wildlife crossing structures monitored in 2010 with different start dates through 31 December 2010. Preliminary data (N=12,022).



Huijser et al. 2010

Use of structures US Hwy 93 N (2011)

All Structures Monitored



Wildlife use of all the 29 wildlife crossing structures monitored in 2011 (1 January 2011 through 31 December 2011). Preliminary data (N=22,466).

Monitored structures (2010)

Conservation interest



Compare to continuous
fencing and structures, no
gaps: **lots of domestic cats
and dogs!**

Compare to reference values:
similar connectivity or better



Species	N	%
Birds (Aves)	553	2.46
Raccoon (<i>Procyon lotor</i>)	439	1.95
Black bear (<i>Ursus americanus</i>)	289	1.29
Coyote (<i>Canis latrans</i>)	263	1.17
Red fox (<i>Vulpes vulpes</i>)	250	1.11
Bobcat (<i>Lynx rufus</i>)	202	0.90
Western striped skunk (<i>Mephitis mephitis</i>)	124	0.55
Deer spp. (<i>Odocoileus</i> spp.)	63	0.28
Rabbits and hares (<i>Lagomorpha</i>)	55	0.24
Mountain lion (<i>Felis concolor</i>)	51	0.23
Other	18	0.08
Grizzly bear (<i>Ursus arctos</i>)	15	0.07
Unknown	12	0.05
American badger (<i>Taxidea taxus</i>)	9	0.04
Elk (<i>Cervus canadensis</i>)	6	0.03
Bear spp. (<i>Ursus</i> spp.)	3	0.01
River otter (<i>Lutra canadensis</i>)	3	0.01
Yellow-bellied marmot (<i>Marmota flaviventris</i>)	2	0.01
Weasel spp. (<i>Mustela</i> spp.)	1	0.00

Huijser et al. 2010

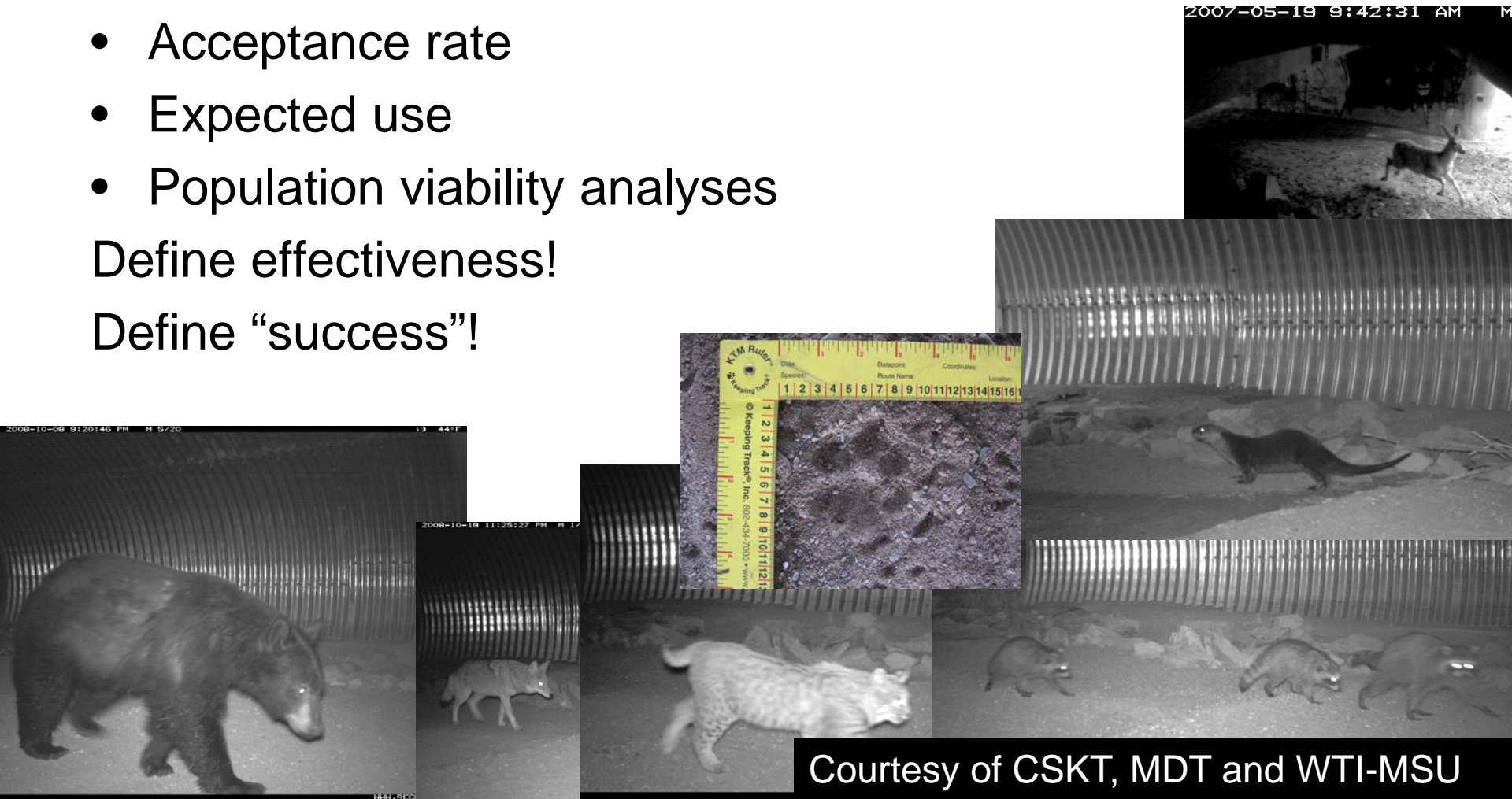
What does “use” really mean?

What are our goals?

- Before-After comparison
- Acceptance rate
- Expected use
- Population viability analyses

Define effectiveness!

Define “success”!



Courtesy of CSKT, MDT and WTI-MSU

Advise Structure Types and Dimensions

- Behavior when approaching structures accept or reject (e.g. norm 80% accept.)
- Relative population size in surrounding area



Acceptance rate



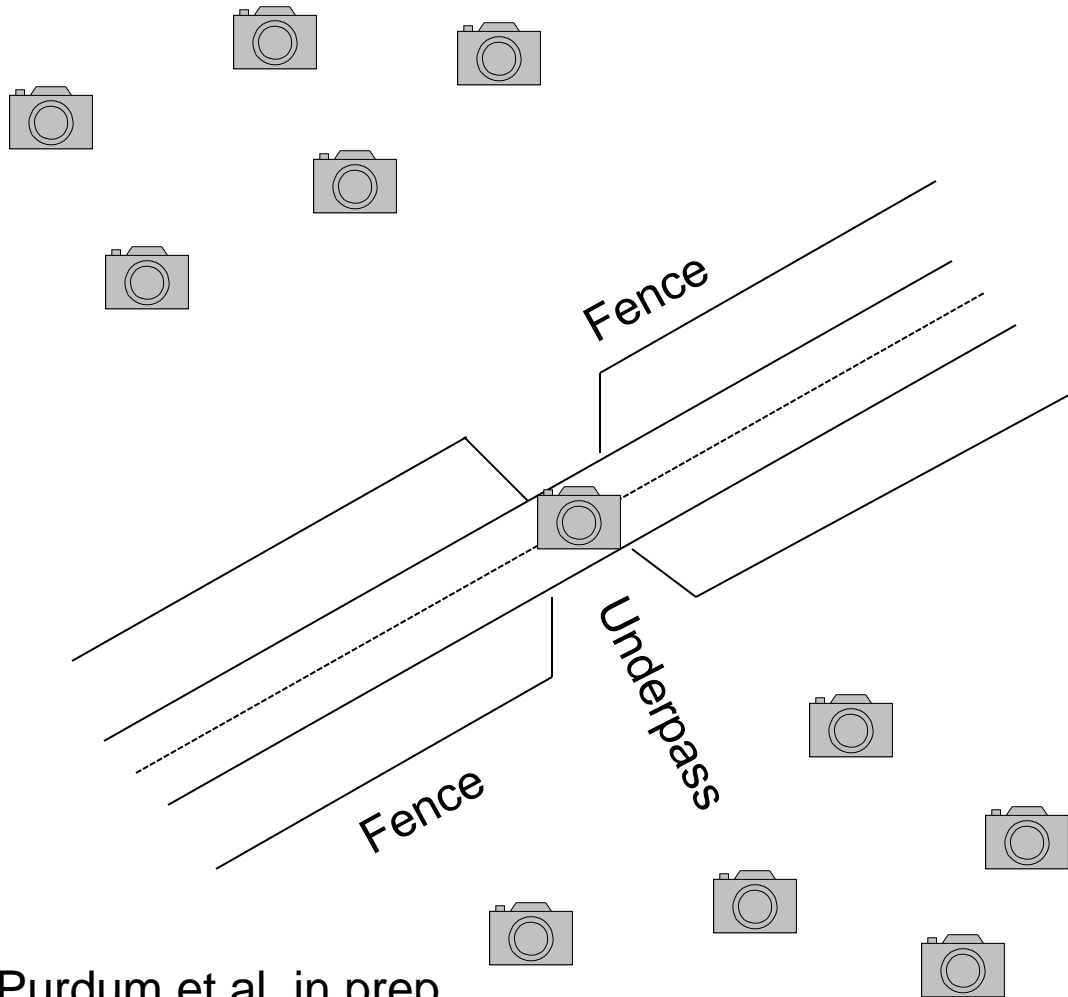
White-tailed deer 84% (n=455)



Mule deer 66% (n=56)

Purdum et al. in prep.

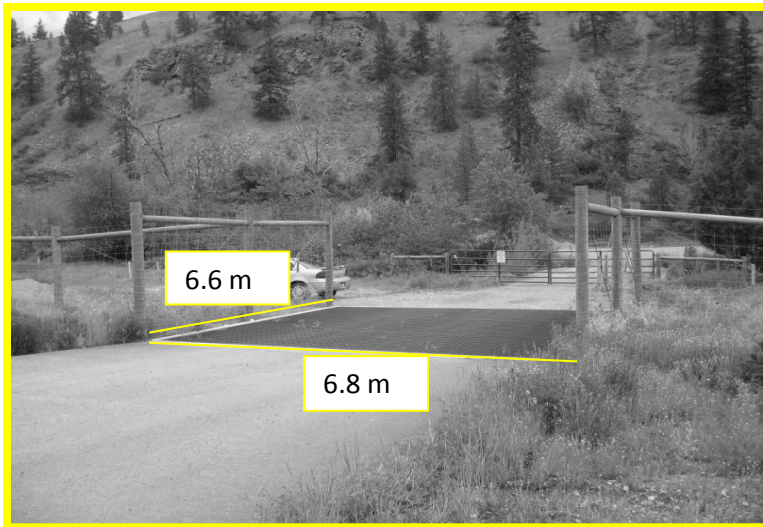
“Expected” use – Actual use



Purdum et al. in prep.



Wildlife Guards at Access Roads



Just published

Original Article

Effectiveness of Wildlife Guards at Access Roads

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ABSTRACT The reconstruction of 90.6 km of U.S. Highway 93 from Evaro to Polson, Montana, USA, includes 41 wildlife crossing structures and 13.4 km of road with wildlife fencing. These measures are aimed at reducing wildlife-vehicle collisions and increasing human safety, while allowing wildlife to traverse the landscape. In the fenced road sections, gaps in the fence for side roads are mitigated by wildlife guards (similar to cattle guards). We monitored wildlife movements with cameras for 2 years from mid-July 2008 to mid-July 2010 at 2 wildlife guards and in 1 large crossing structure adjacent to one of the wildlife guards. We investigated how effective these wildlife guards were as a barrier to deer (*Odocoileus* spp.), black bear (*Ursus americanus*), and coyotes (*Canis latrans*). We also compared movements across a wildlife guard with movements through an adjacent crossing structure. The wildlife guards were $\geq 85\%$ effective in keeping deer from accessing the road and 93.5% of deer used the crossing structure instead of the adjacent wildlife guard when crossing the road. The wildlife guards were less effective in keeping black bear and coyotes from accessing the road (33–55%). However, all black bears and 94.7% of coyotes used the crossing structure instead of the adjacent wildlife guard when crossing the road. Though the wildlife guards were not an absolute barrier to these species, the results indicate wildlife guards are a substantial barrier to deer and can be considered effective in mitigating gaps in a fence at access roads for these species. © 2013 The Wildlife Society

KEY WORDS deer, fence, mitigation, Montana, *Odocoileus* spp., road ecology, wildlife guard.

There are currently >8.4 million lane-miles of highway in the United States, with >6.1 million lane-miles in rural areas (Federal Highway Administration 2007). The ecological effects of roads and vehicles are diverse and include 1) loss of habitat due to pavement or other unnatural substrate; 2) direct mortality by collisions with vehicles; 3) habitat fragmentation due to barriers that affect animal movements; and 4) reduced habitat quality adjacent to roads (e.g., because of chemical or noise pollution; Forman and Alexander 1998, Beckmann et al. 2010).

Roads not only affect wildlife, but people are also at risk when large mammals enter the roadway. Between 1 and 2 million collisions with large animals occur in the United States each year, with about 29,000 human injuries and 200 human deaths (Conover et al. 1995, Huijser et al. 2008). Total estimated costs of animal-vehicle collisions exceed US\$ 8 billion annually, including costs associated with vehicle repair, human injuries and fatalities, accident investigation, carcass removal and disposal, and the monetary value of the animal to hunters (Huijser et al. 2009). Furthermore, ≥ 42 mitigation measures or combinations of mitigation measures have been implemented or suggested to mitigate

impacts, most of which have not been thoroughly studied. These alternatives range from public information to wildlife fencing and from roadside animal-detection systems to culling wildlife (Farrell et al. 2002, Huijser et al. 2008).

Wildlife fencing can substantially reduce ungulate access to the road corridor (Falk et al. 1978) and has been shown to reduce wildlife-vehicle collisions by $\geq 79\%$ (Reed et al. 1982, Clevenger et al. 2001, Dodd et al. 2007). However, in developed areas, gaps in fences are necessary to allow vehicles access to and from main roadways. Without additional measures, gaps can allow wildlife to enter the fenced road corridor. Though gates (locked or unlocked) have been used at low-use side roads, they are sometimes left open and are not suitable for higher traffic volumes. In contrast, wildlife guards, devices that are similar to cattle guards, appear to be an interesting alternative because they are not only designed to handle relatively high traffic volumes but can also discourage wildlife from entering the fenced right-of-way at gaps in the fence for access roads (e.g., Peterson et al. 2003).

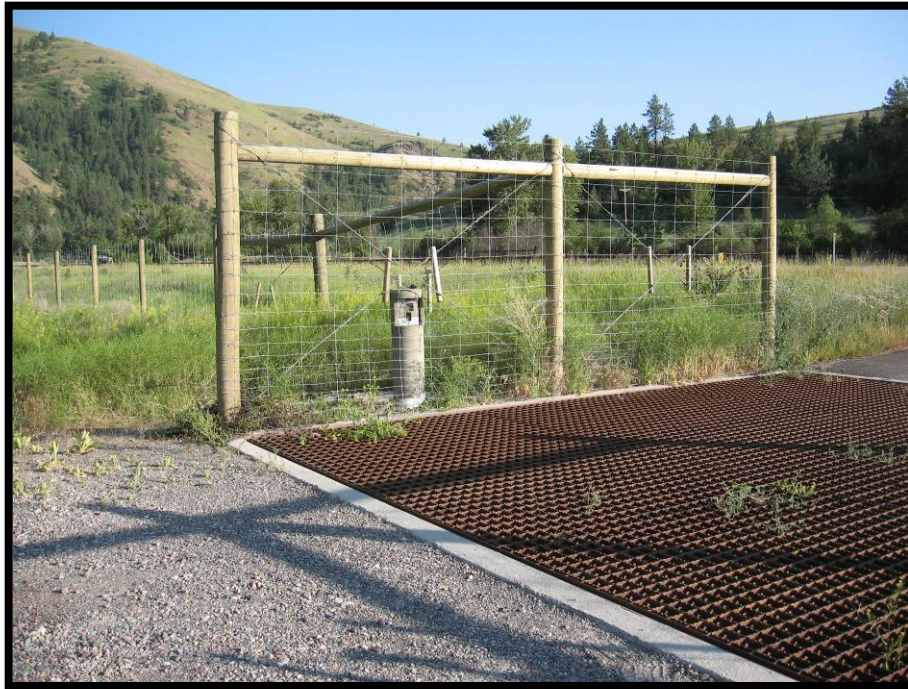
Traditional and modified cattle guards have been found effective for white-tailed deer (*Odocoileus virginianus*) under some circumstances (Bashore and Bellis 1982, Belant et al. 1998, VerCauteren et al. 2009). However, to be suitable for public roads and effectively exclude wildlife from the fenced road corridor, several factors must be considered. Standard cattle guards may not be safe for pedestrians, cyclists, and

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Methods



Effectiveness Wildlife Guards



2008-11-14 4:01:38 AM M 20/20 28°F



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ENGINEERING

Courtesy of CSKT, MDT and WTI-MSU

2009-06-30 12:21:59 AM M 2/20 69°F



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Courtesy of CSKT, MDT and WTI-MSU

Results

Number of wildlife that crossed guards after showing intent to cross

Species	Approached	Crossed	% crossed	Did not cross	% effective
mule deer	21	2	9.5	19	90.5
white-tailed deer	4	2	50.0	2	50.0
deer spp.*	26	4	15.4	22	84.6
black bear	9	6	66.7	3	33.3
coyote	15	10	66.7	5	33.3

*Mule deer and white-tailed deer, combined. One deer was not identifiable to the species level.

Allen et al., in prep.

Wildlife Guard vs. Underpass

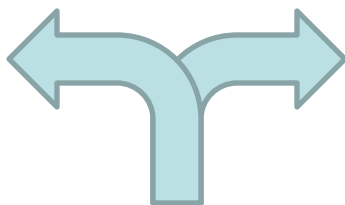


Results

Deer (n=46, Chi2 $p < 0.001$)



6.5% across wildlife guard



93.5% through crossing structure

Allen et al., in prep.

Conclusions

- Guards are a very substantial barrier to deer
- Not a substantial barrier to black bear or coyotes
- Guards much more effective, even for coyote and black bear, when combined with safe crossing opportunity

Remaining questions

Functioning and height of jump-outs



Remaining Questions: Effectiveness Wildlife Jump-Outs



Cover in Underpasses





Study design specifics:

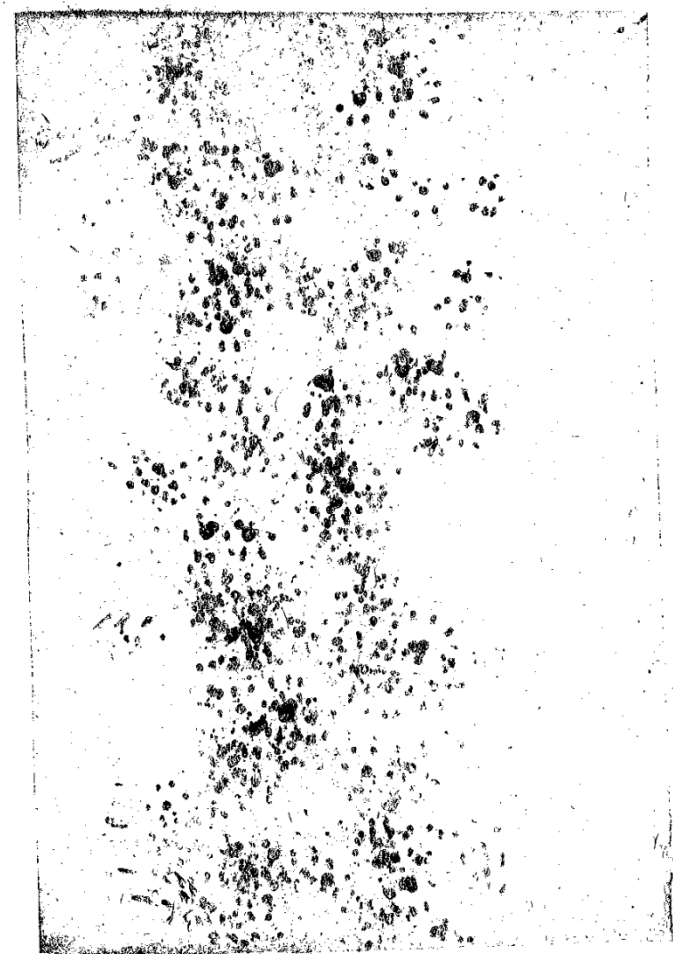
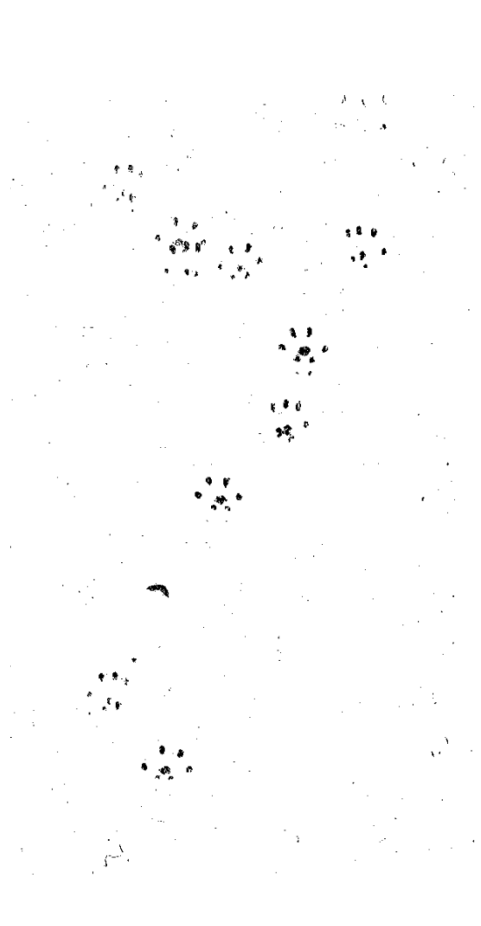
-Fall sampling for highest population numbers

-Checked daily for 5 days (Aug/Sept 2011)

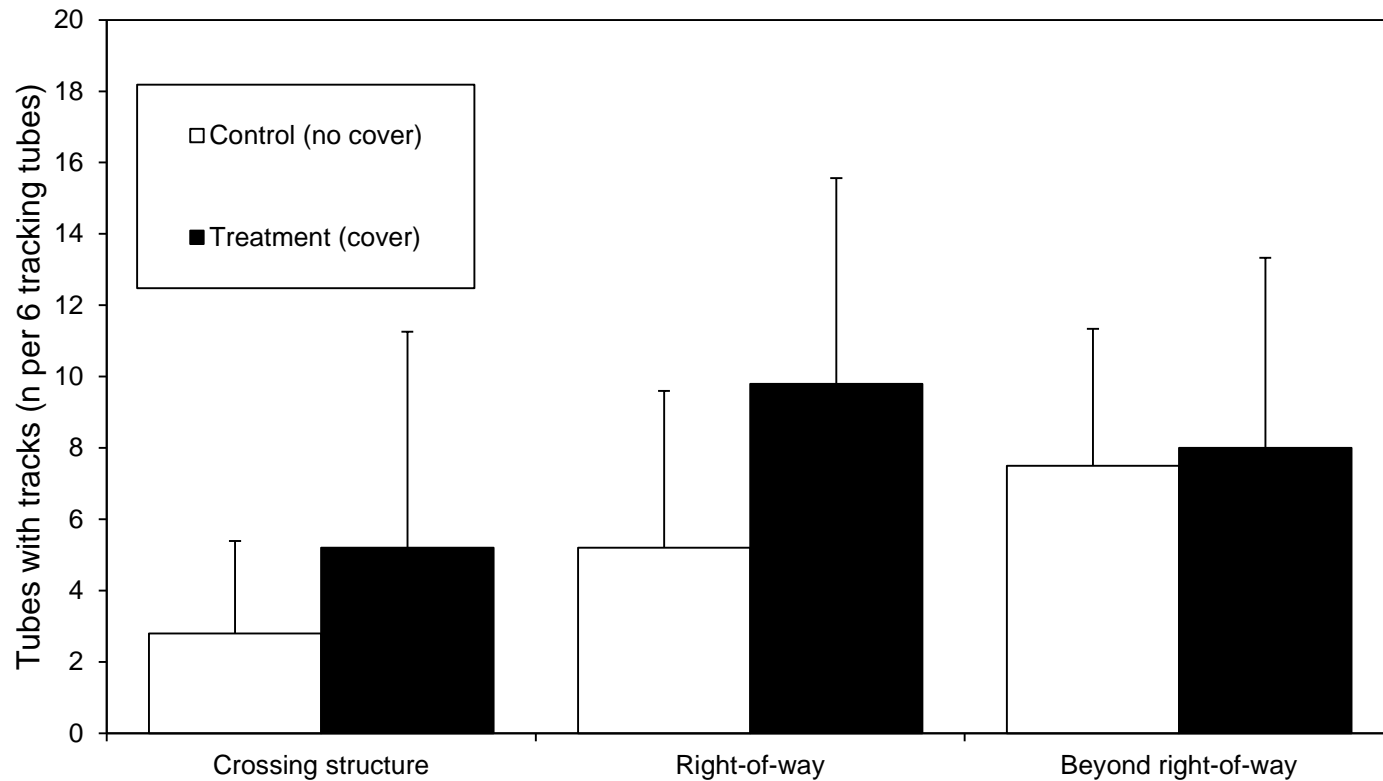
-Track plate (contact paper)
-replaced if used

-1:1 ink toner/mineral oil
applied to felt



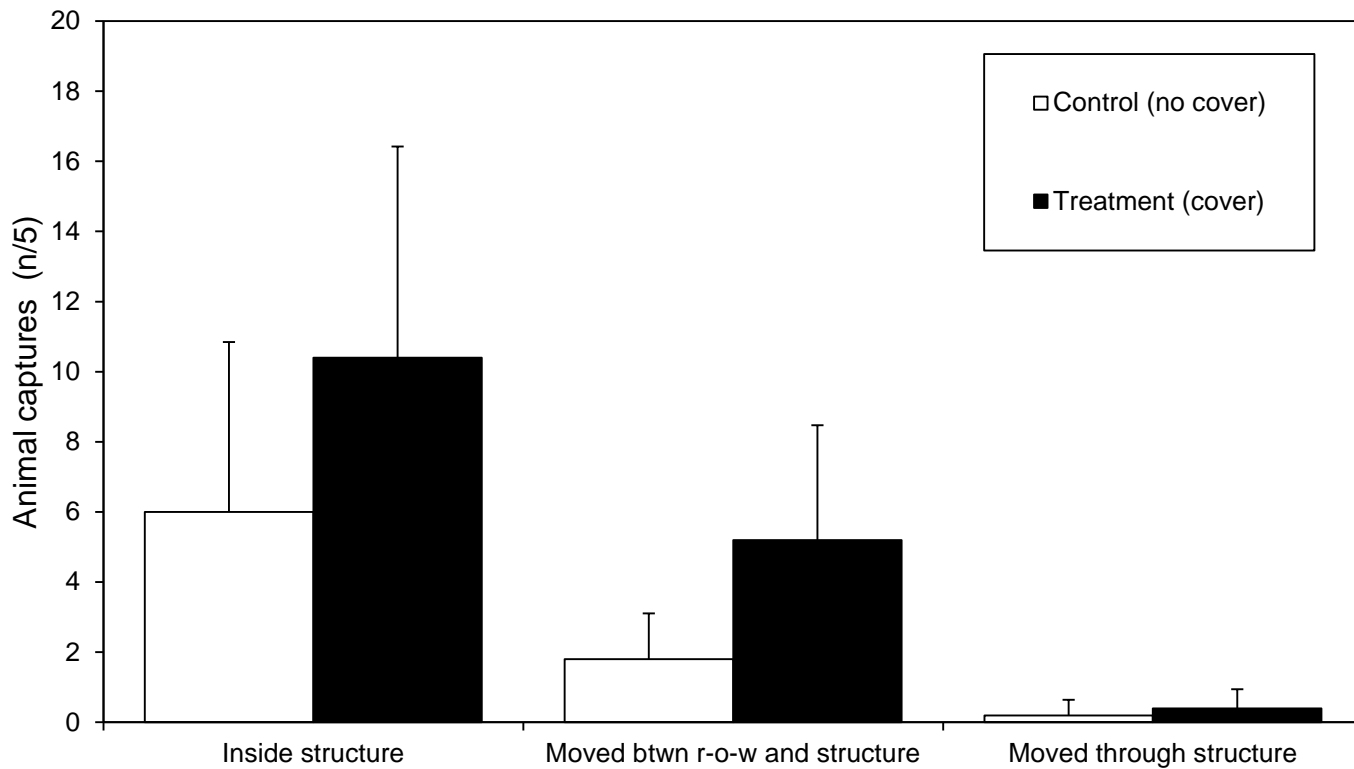


Track Tube: after cover was provided (2012)

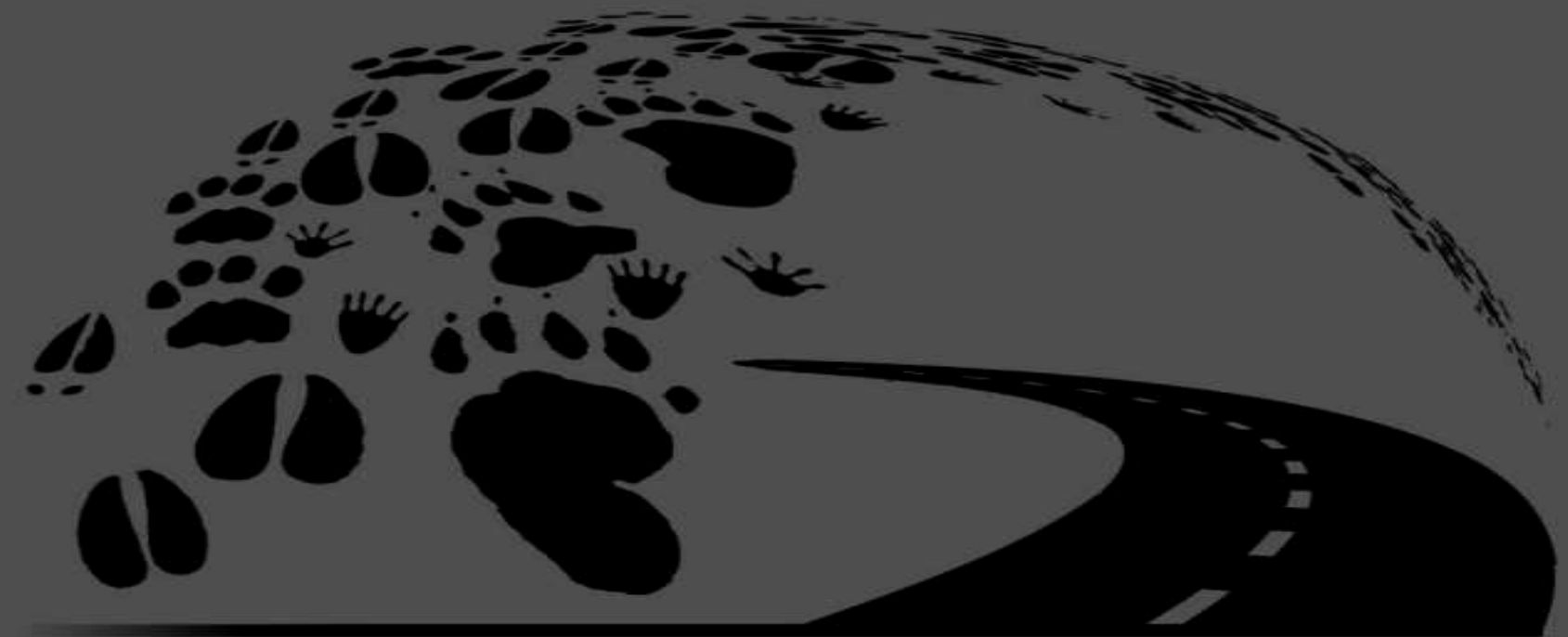


Connolly-Newman et al., in prep.

Live trap data (all species)



Connolly-Newman et al., in prep.



PEOPLE'S WAY PARTNERSHIP



DIVISION OF FISH, WILDLIFE,
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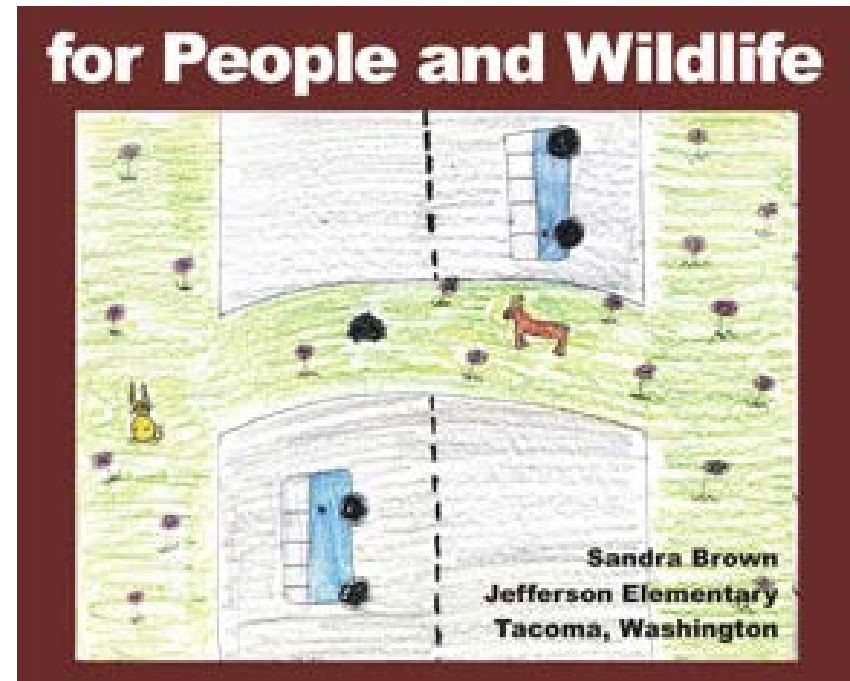


Fence length isolated structures

- Elizabeth Fairbanks
- Ongoing study

Outreach

- Brochure
- Poster
- Interpretive road signs
- Talks at schools
>900 students
- Drawing contest
340 entries
awards next week





Questions

- Marcel Huijser
- E-mail: mhuijser@coe.montana.edu
- Phone: +1-406-543-2377

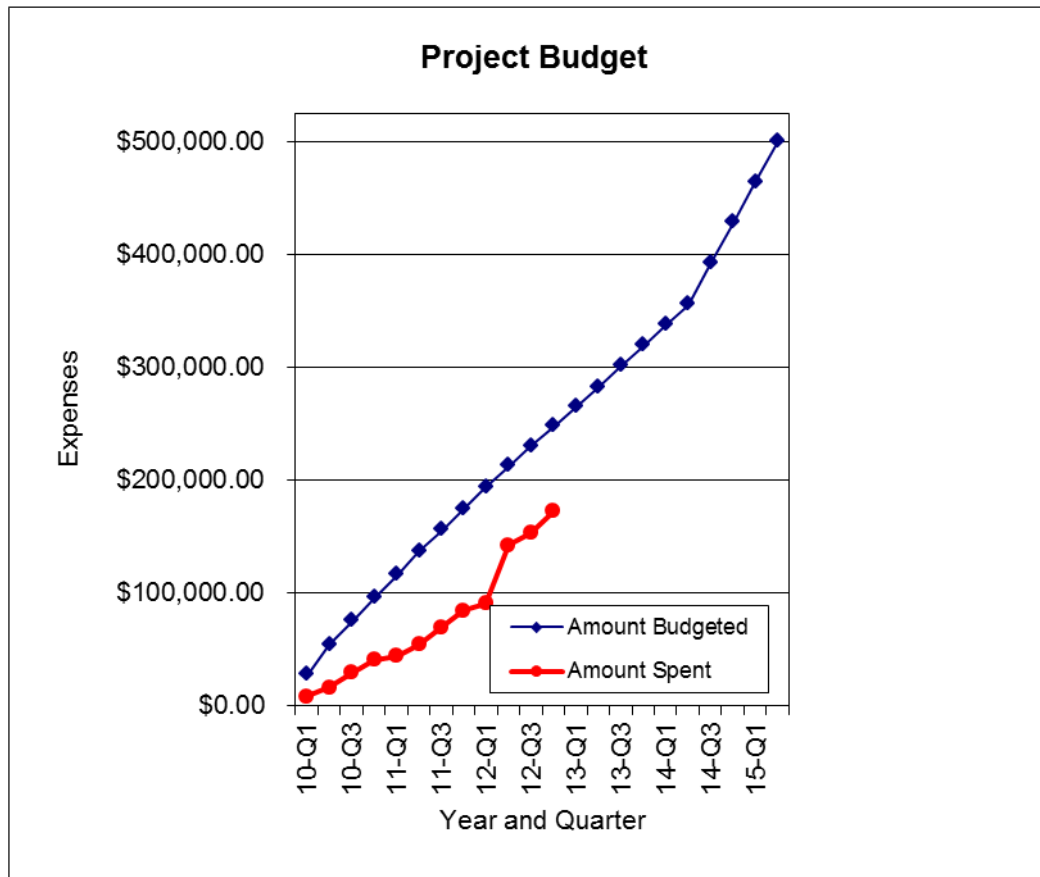
Discussion Points

- Current TAC members?
- Fence length vs. road length fenced
- Missing carcass data 2008-2009
- Fence maintenance
- May 2013: stop monitoring RC and RH
- Finances: change work scope?

Budget

- 4 yrs (2010-mid 2015) \$100,591
UTC shortfall
- 5th year Ravalli hill and curves: \$6,658
MDT/FHWA shortfall
- 5th year EV / isolated structures \$107,249
New money

Budget



Through 31 Dec 2012
Excl 5th yr RC and RH

Budgeted	\$ 247,340
Spent:	\$ 172,712
“saved”	\$ 74,628

But:
End student labor?
New deficit \$6,658 5th yr RC/RH

