Wildlife Detection System Reliability and Effectiveness US Hwy 95, Idaho

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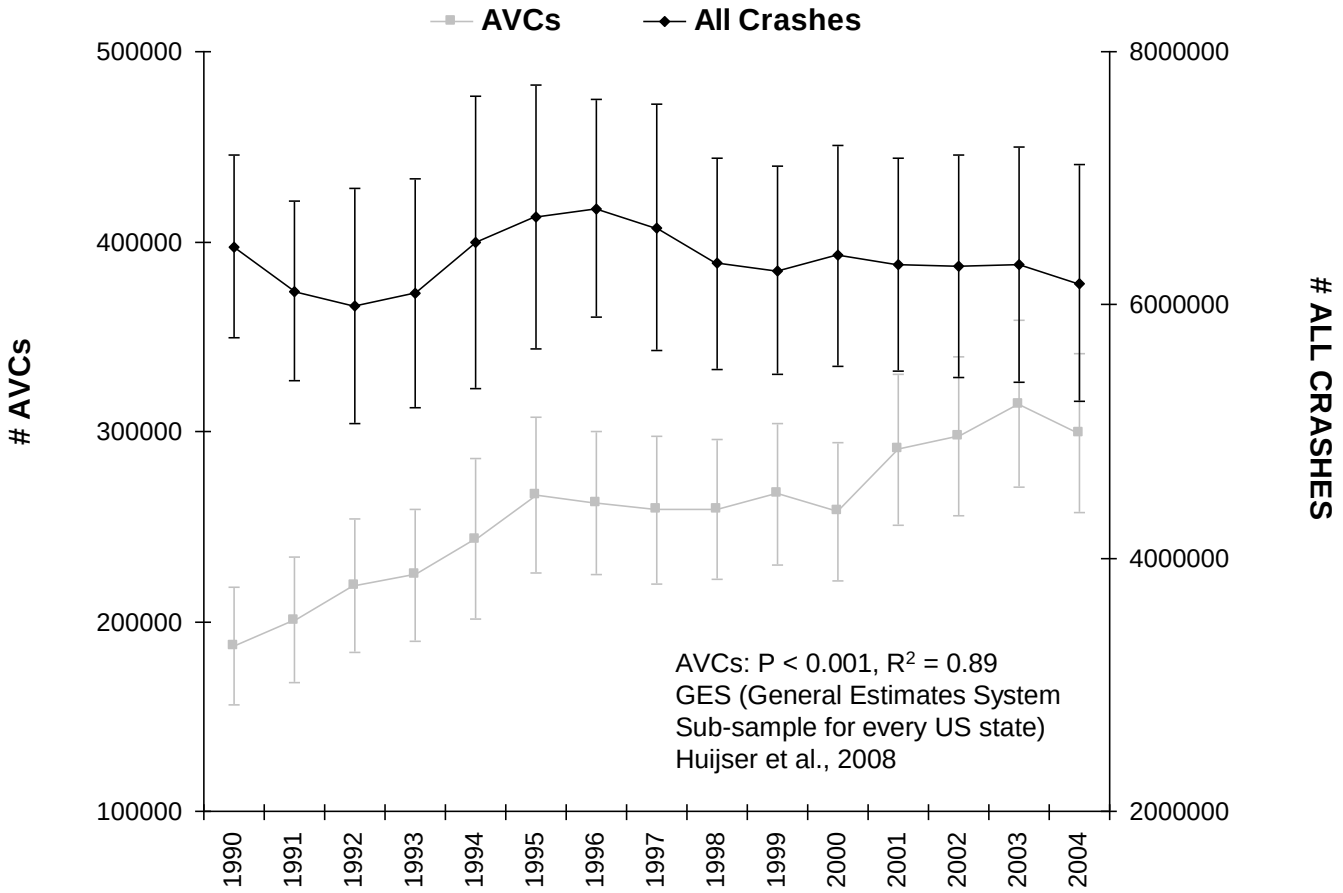
Wildlife-Vehicle Collisions

- 1-2 million large mammal-vehicle collisions/year US
- Mostly white-tailed deer, mule deer, elk, moose
- Affects:
  - Human safety
  - Injured or dead animals
  - Economic costs

Trend animal-vehicle collisions



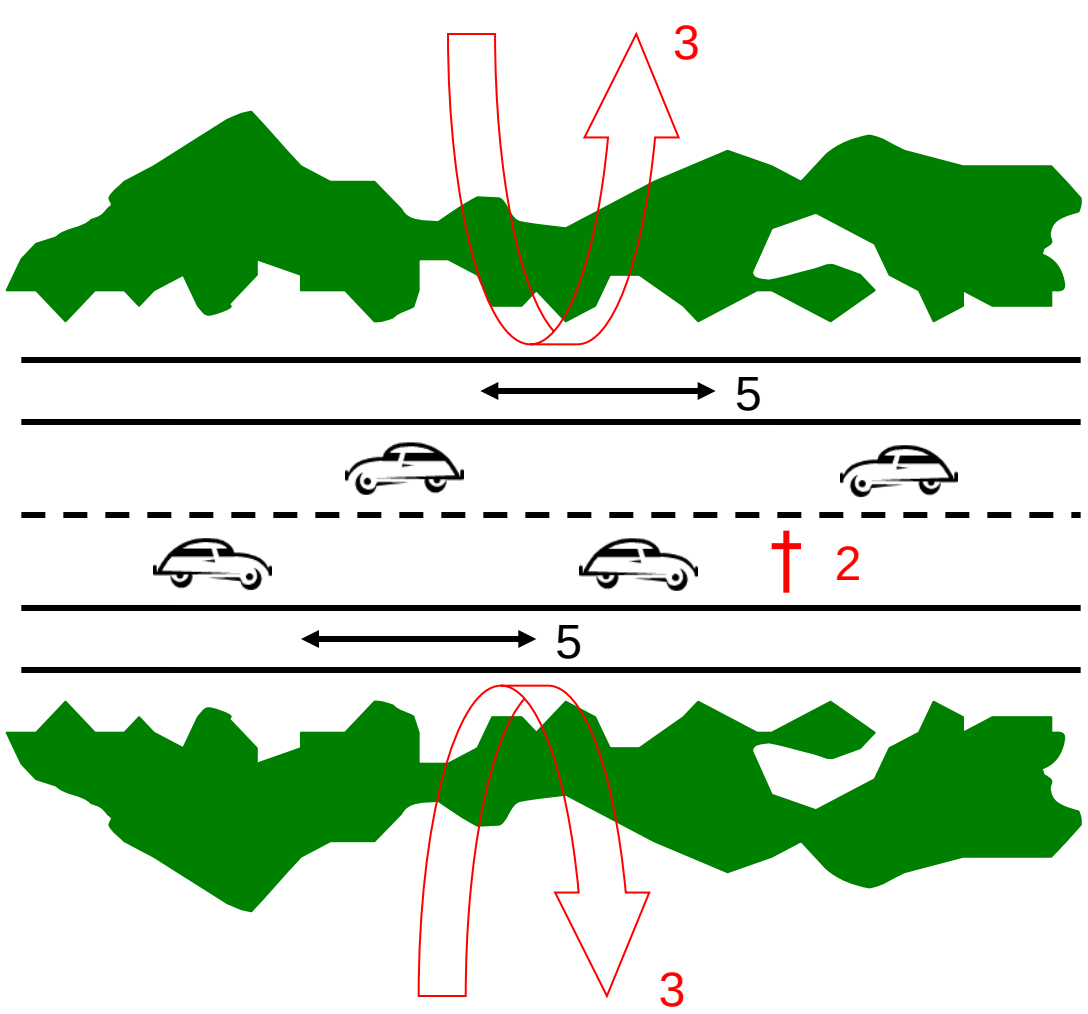
1-2 million ungulate-vehicle collisions / year in US (Huijser et al., 2008)

Records: Large Common Species

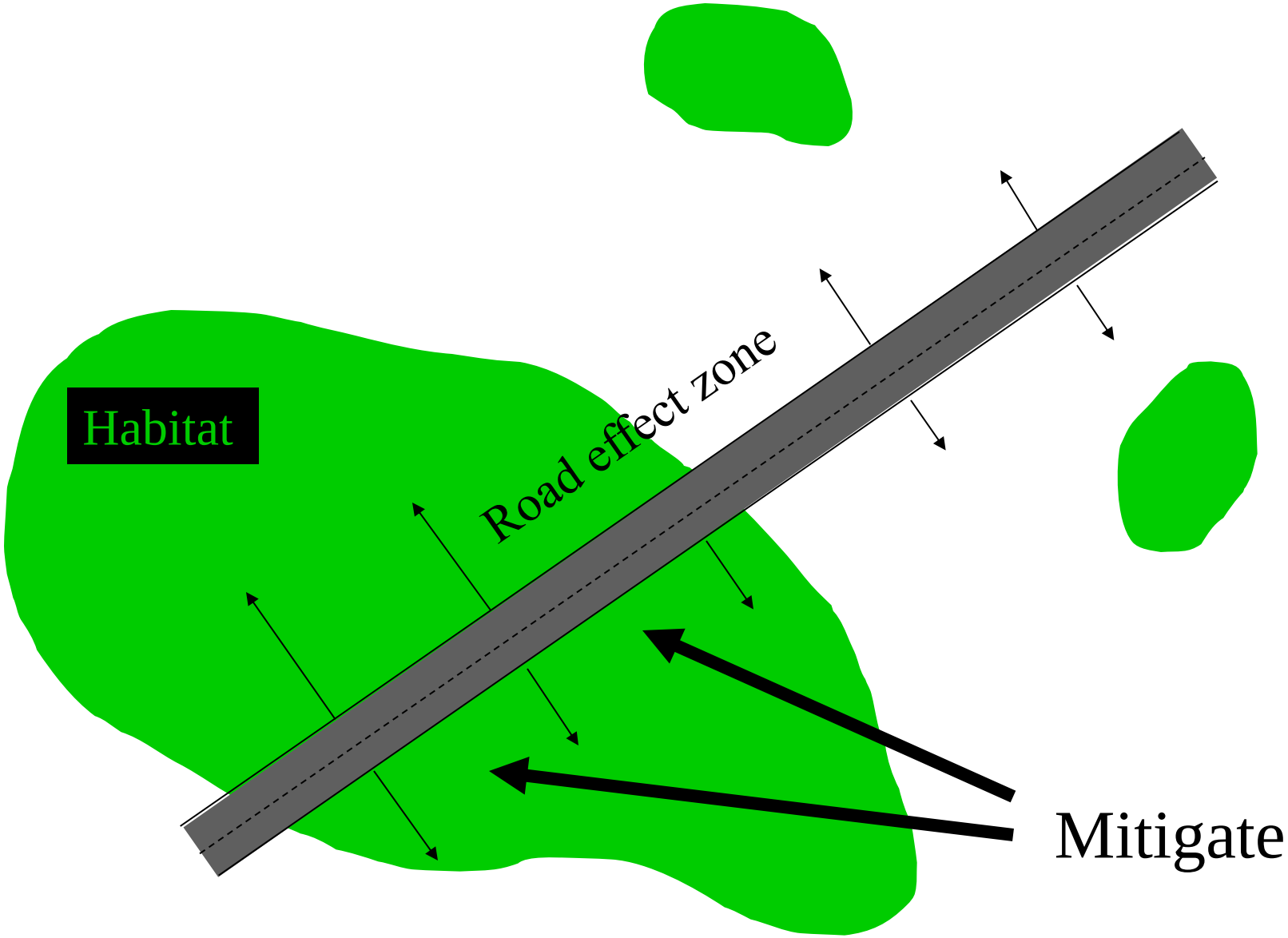
- Crash data:
  - Severe crashes
  - Large common species: deer, elk, moose
  - 10-50% compared to carcass data
- Carcass removal data
  - Dangerous or a distraction to drivers
  - Large common species: deer, elk, moose

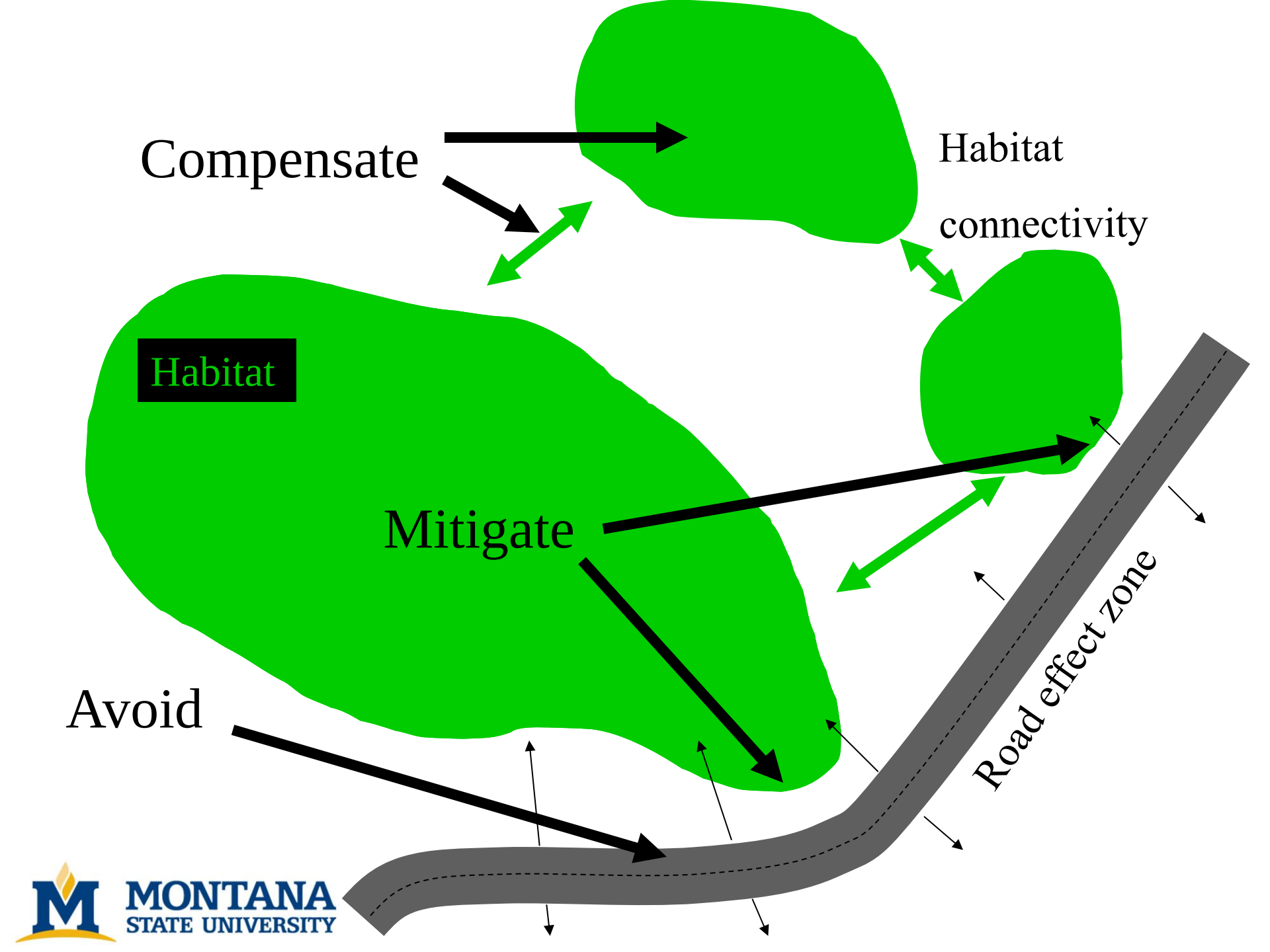
Methods not suitable for small or rare species

Ecological Impacts Roads and Traffic



1. Loss of wildlife habitat
2. Road mortality
3. Barrier effect
4. Decrease in habitat quality (disturbance, pollution)
5. Ecological function of verges


Habitat
Road effect zone
Mitigate



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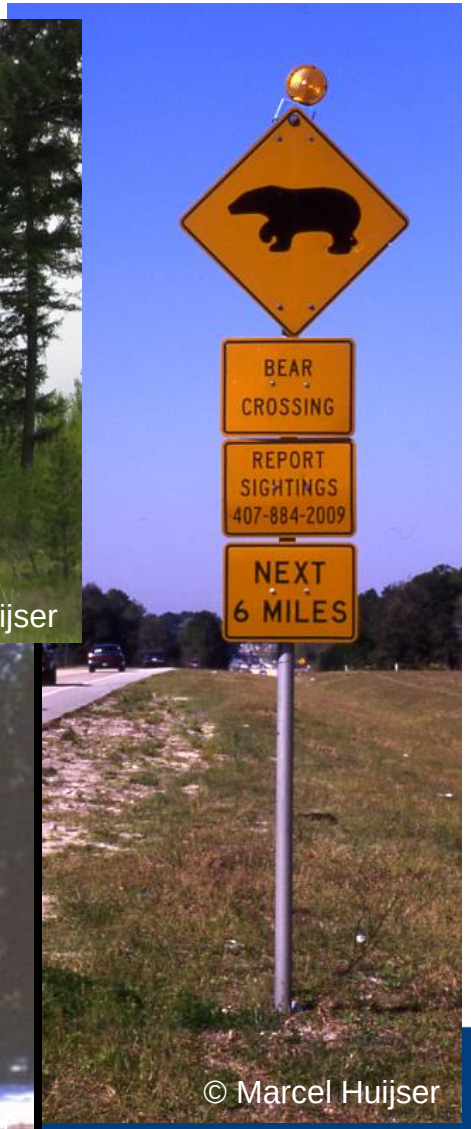
Reduce Collisions: Ineffective measures



Reduce Collisions: Effective Measures

Standard “ungulate” fence, 80-100%

33-100%

Animal detection systems

???

Detection systems

Pros
Low upfront costs
Hwy can be left intact / no traffic problems
Do not restrict where wildlife cross hwy

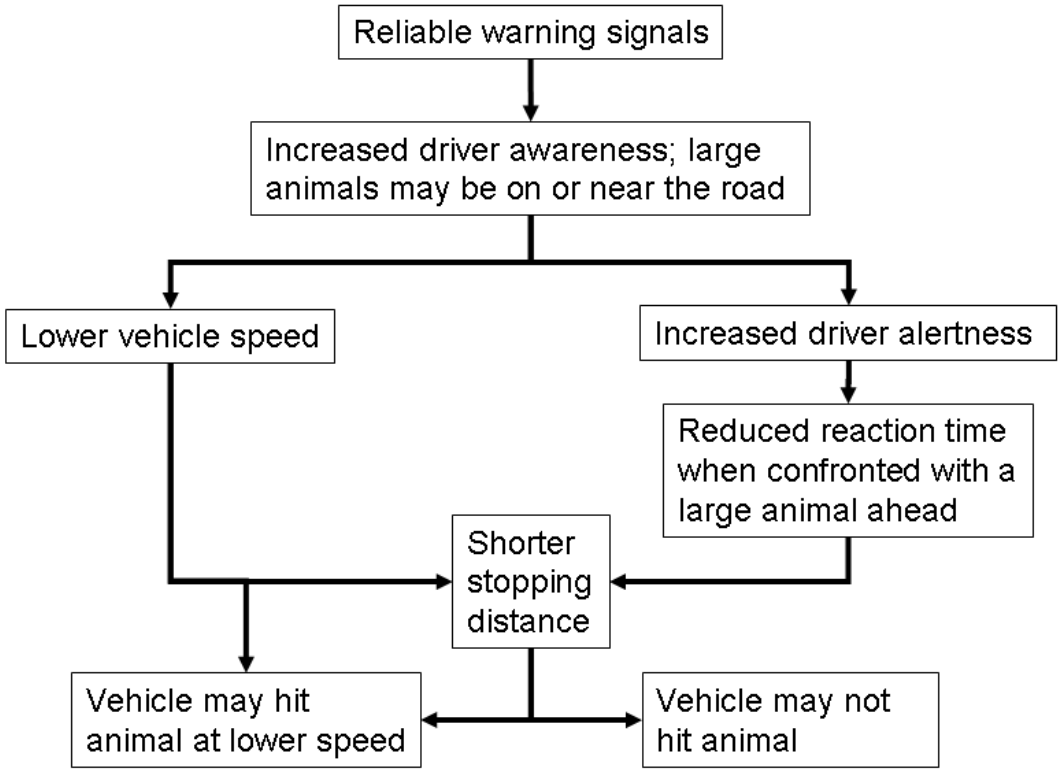
Cons
Risky
Variable effectiveness collision reduction
High long term costs
Do not reduce barrier effect

Fences and Crossing structures

Pros
Can be very effective coll. red.
Robust (predictable)
Can reduce barrier effect
Low long term costs

Cons
Restrict where wildlife cross hwy
High upfront costs
Major Hwy reconstruction /traffic flow

Animal detection systems and driver response



Huijser *et al.* 2015

The System: Area cover

Sloan Security Technologies

Doppler radar

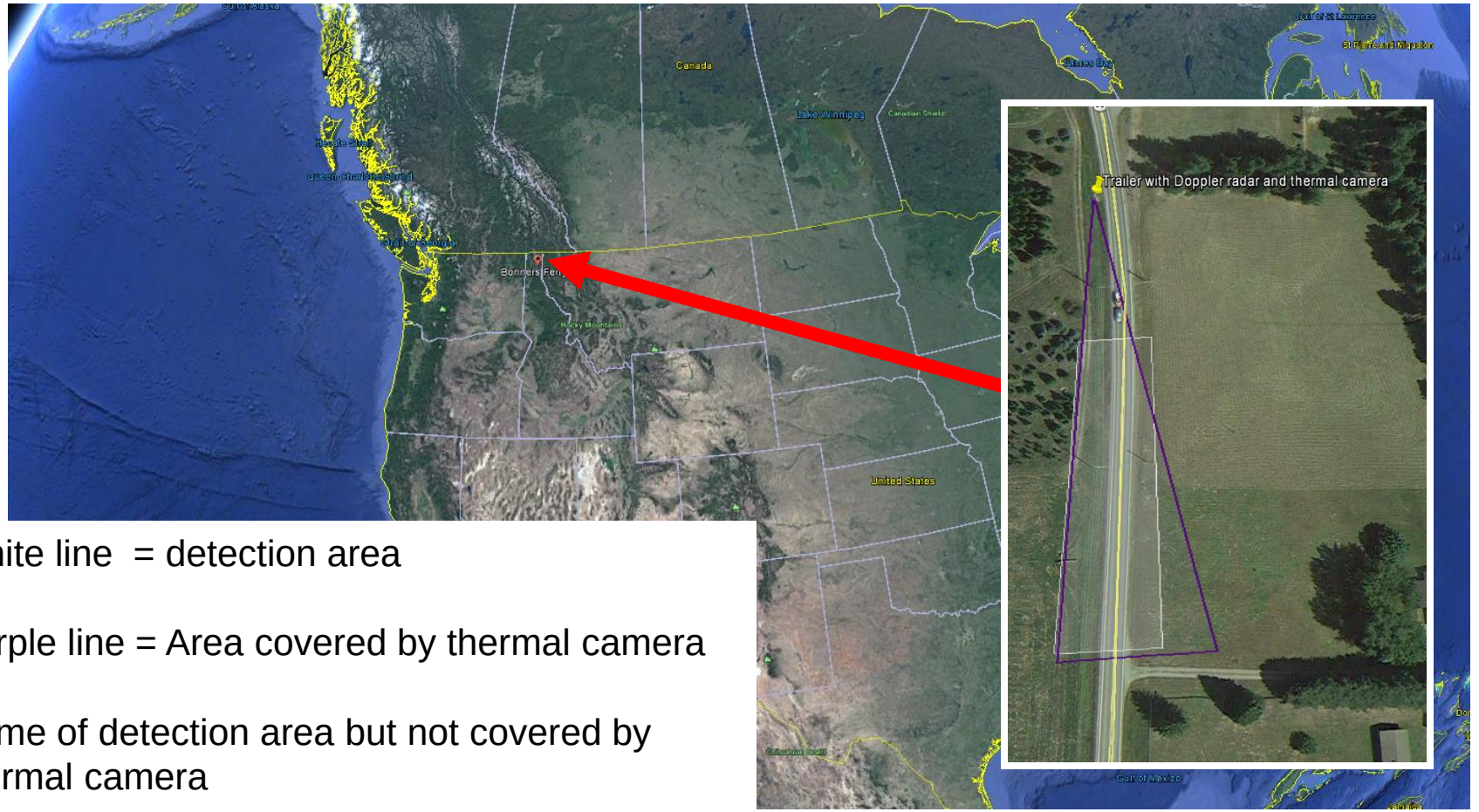
Thermal camera

Cellular antenna

Warning sign

Data processing and storage

Location: Bonners Ferry, Idaho



White line = detection area

Purple line = Area covered by thermal camera

Some of detection area but not covered by thermal camera

113 m (371 ft) long
22-37 m wide

Measure System Reliability

Correct detection:
Detection, large mammal is present

False positive:
Detection, large mammal is not present (not visible)

False negative:
No detection, large mammal is present

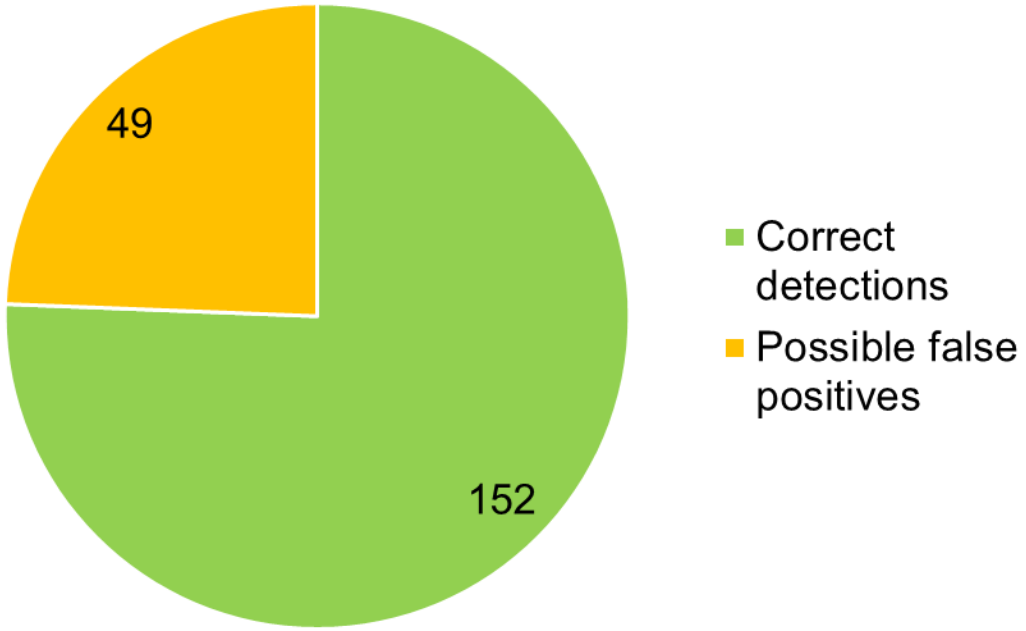
4 test periods (fall, winter, spring, summer)
Each test period is 10 consecutive days

Compare Detection Log to Images Thermal Camera

Radar alarming message starts: Within about 1 second the warning signs are activated.

Radar alarming message ends: Warning signs are active for another 38-41 seconds

Radar Detections
(4x10 days, 3 hrs/day, 120 hrs analyzed)



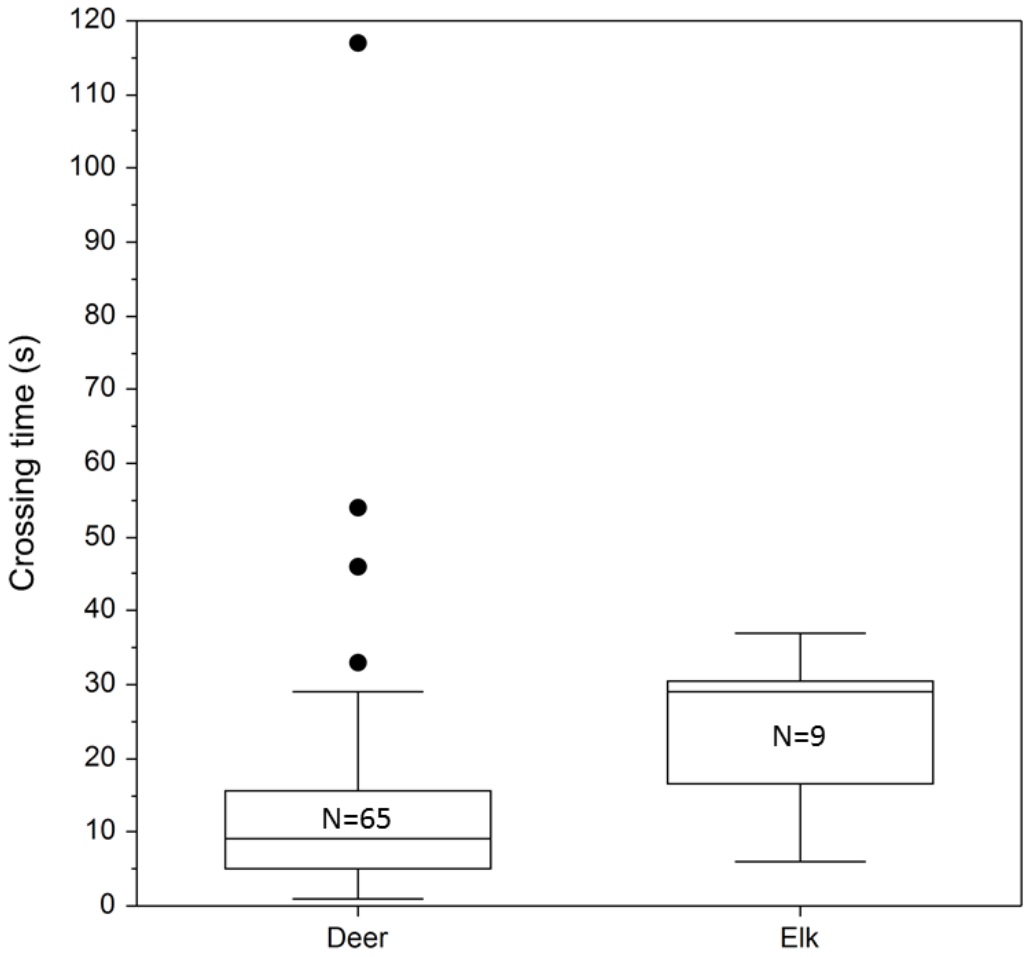
2 (2.47%) False negatives (deer)

Average radar detection 14.85 s (SD = 7.75)

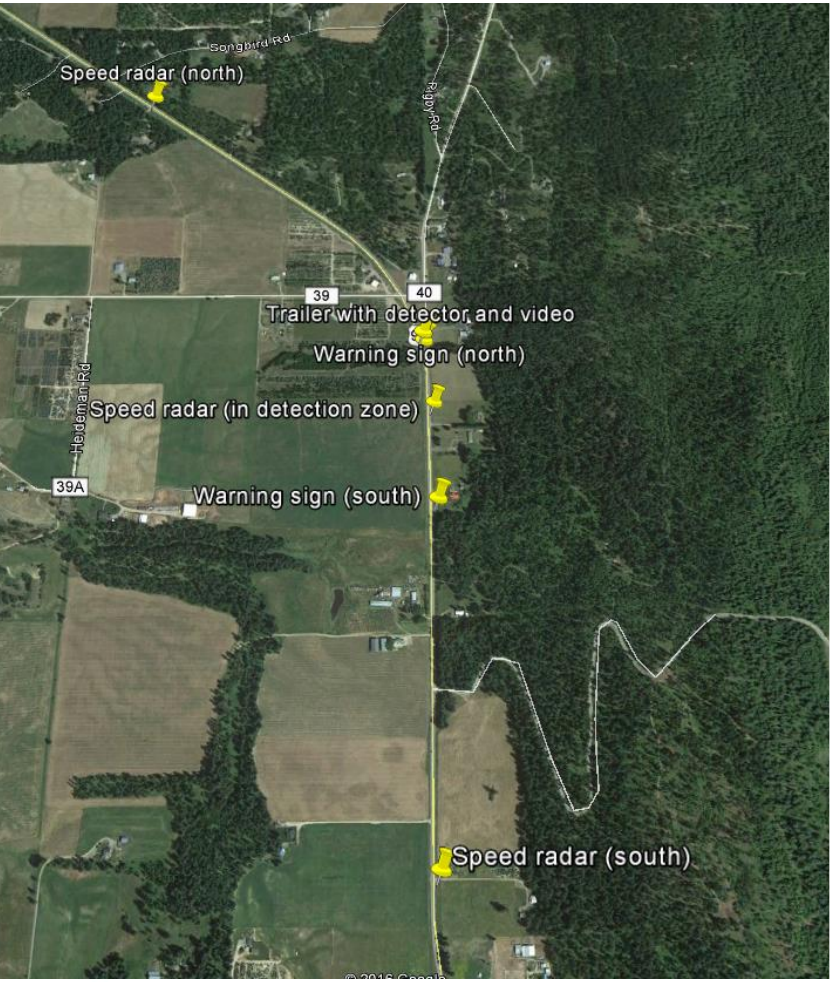
1.68 detections/hr

Warning signs activated 90.15 seconds per hour (2.5% of the time)

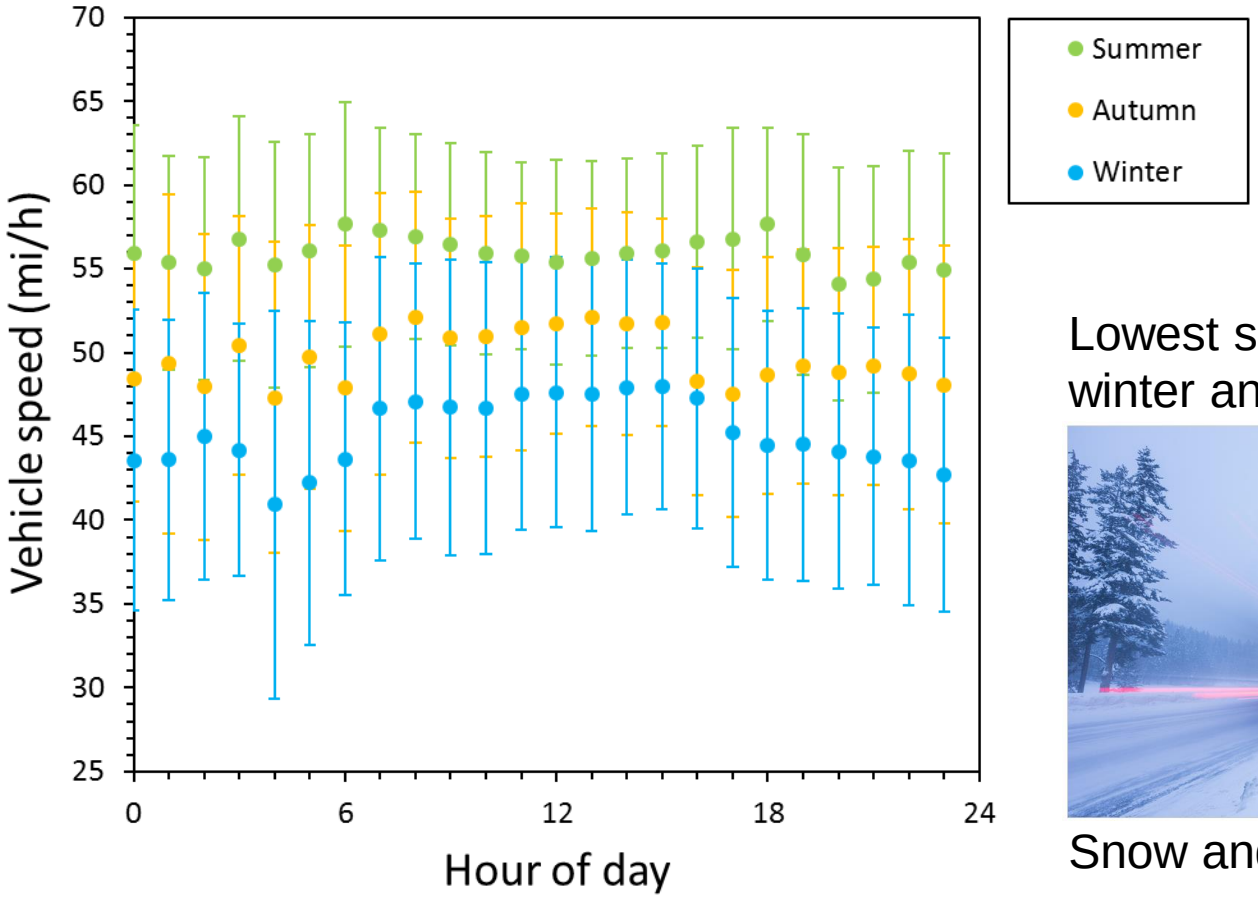
Crossing Time



Speed Radars



Speed by Season

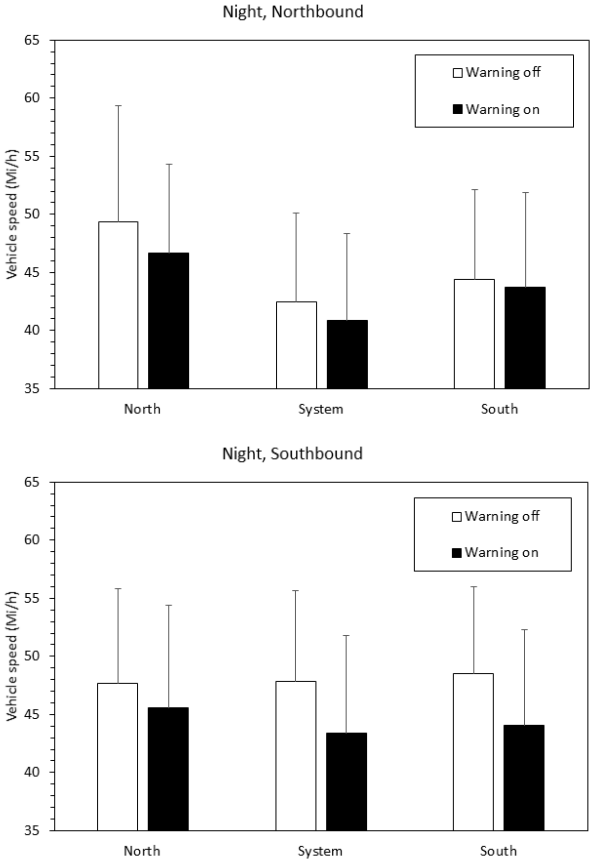


Lowest speed in:
winter and at night

Snow and ice covered road

Speed Lights On vs. Off

Winter



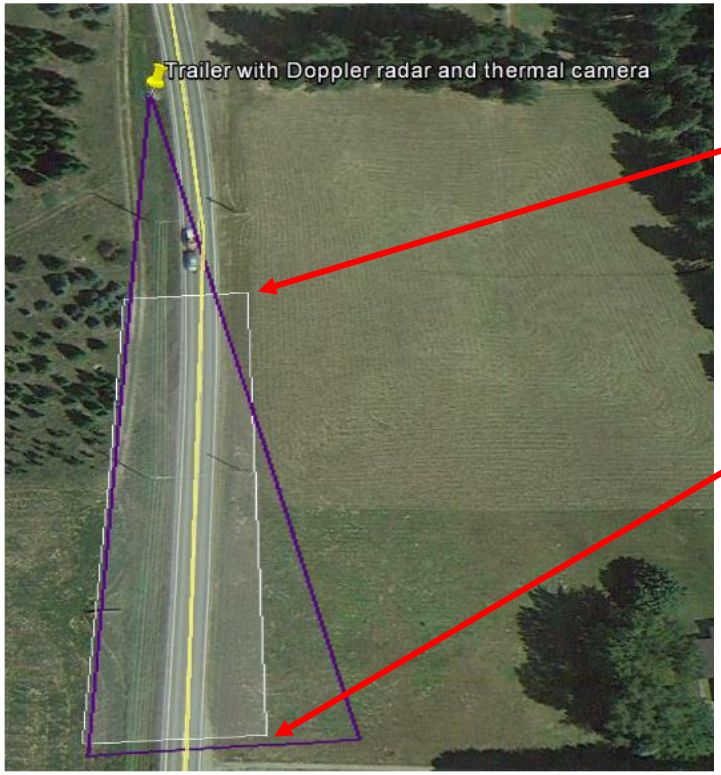
ANOVAs (*** P<0.001):

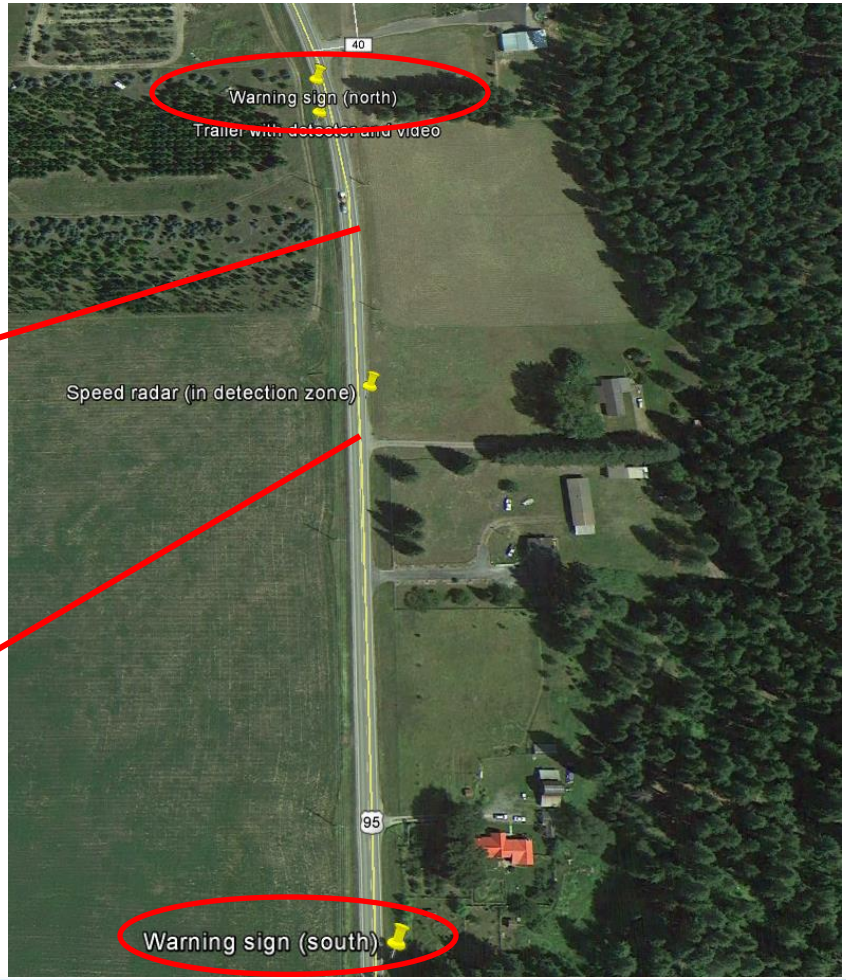
- Season***
- Location (North, System, South)***
- Travel direction***
- Night/Day***
- Lights On/Off***

Greatest effect:
Winter, night: 3.01 mi/h lower lights on vs. off***

Where are the Warning Signs?

Travel time warning signs - outer edges of detection area: 3.2-12.6 seconds





Warning Time for Drivers

Table 7. The warning time before deer or elk set first hoof on the pavement

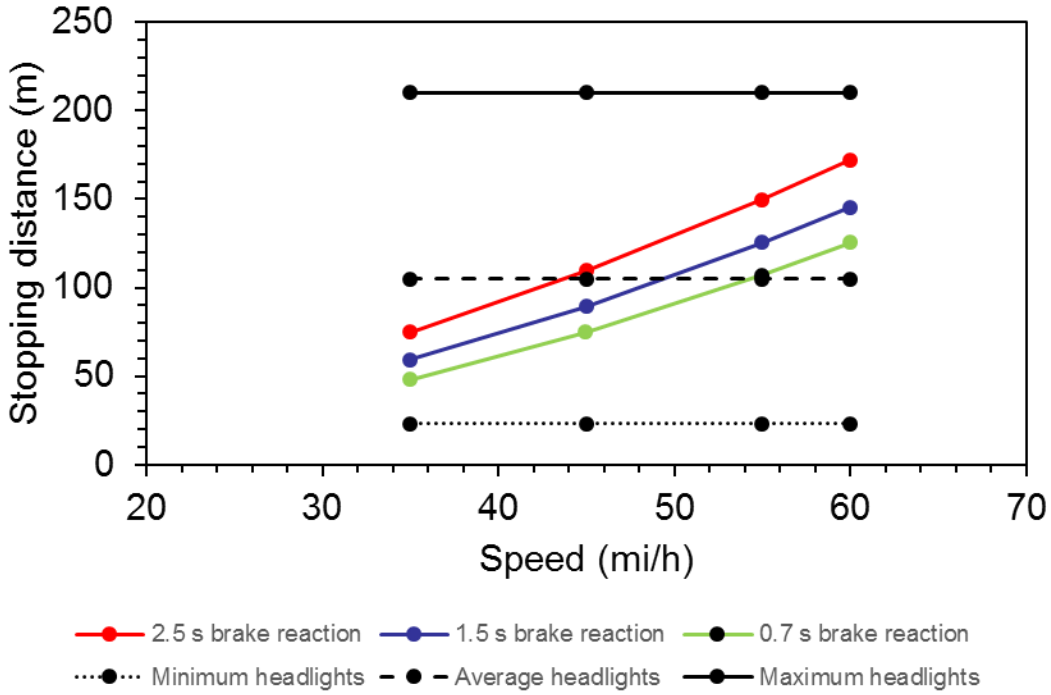
	Mean	SD	Median	Min.	Max.	N
Deer	35.35	46.05	15.5	0	226	72
Elk	268.44	155.13	330	39	457	9

58-68% of the deer detected sufficiently early for northbound drivers

70-85% of the deer detected sufficiently early for southbound drivers

Need additional signs closer and inside detection area

Stopping Distance – Maximum Vehicle Speed



Conclusions

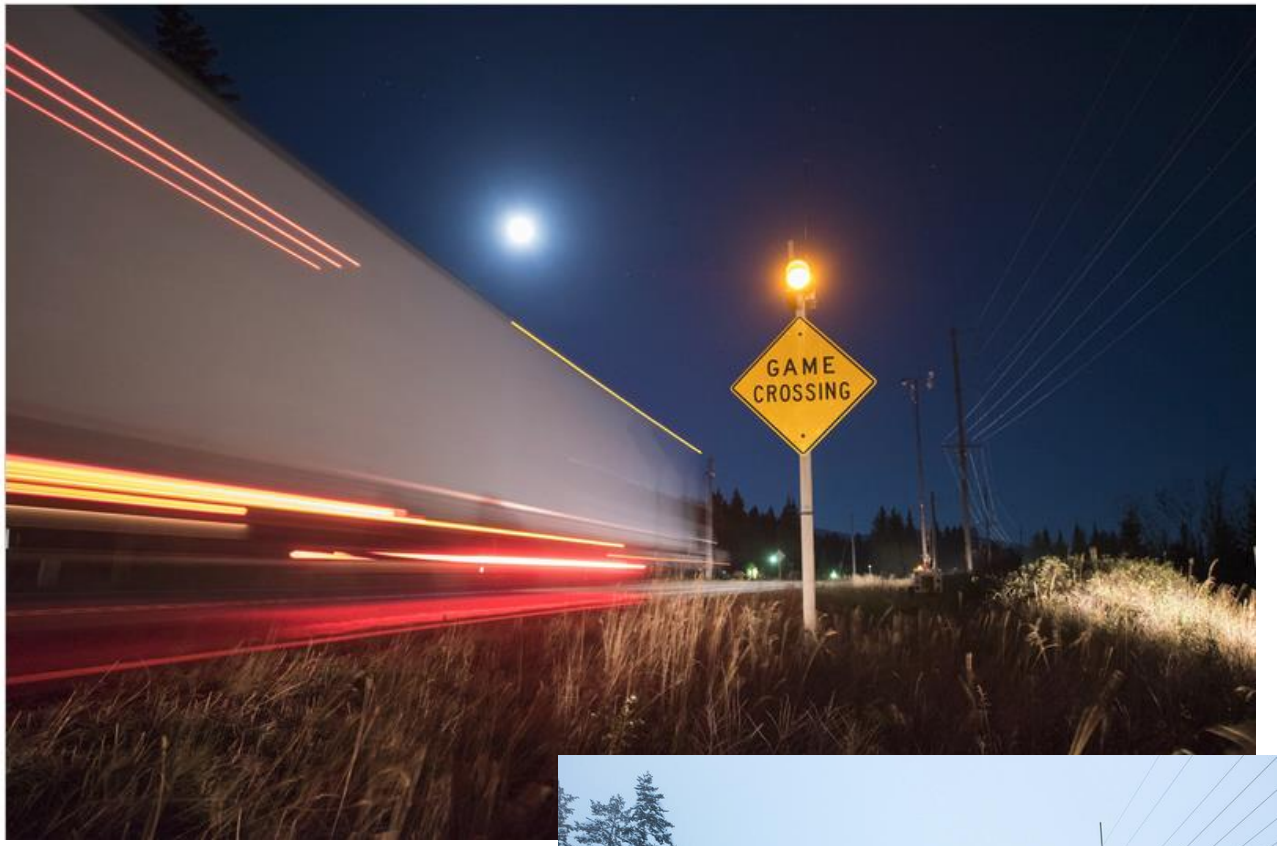
76-100% detections = large mammals
Few (if any) true false positives

Very few false negatives
2 out of 81 (2.4%) deer not detected

58-85% animals detected sufficiently early
Improve number and placement signs

Speeds still too high
Include maximum posted speed limit

LED
Only visible when activated



Questions:

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