Reducing Wildlife-Vehicle Collisions and Maintaining Habitat Connectivity

Presented to ADOT Board of Directors

By Arizona Game and Fish Department

Presentation Objectives

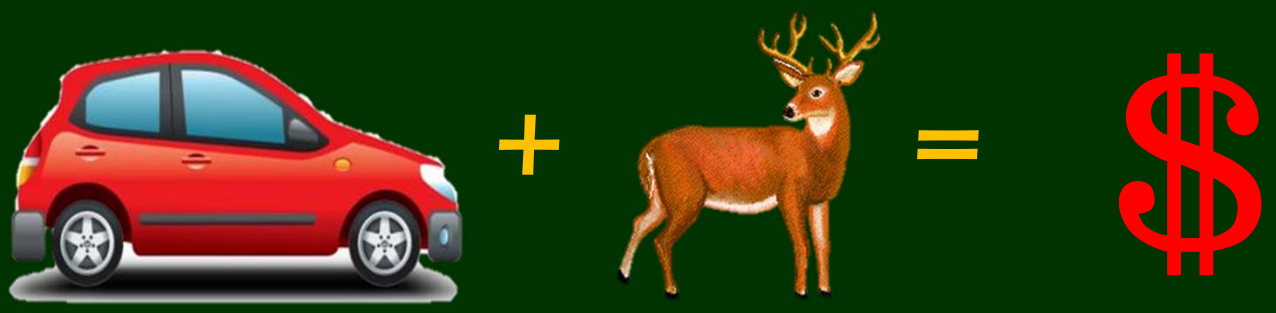
- Briefly Describe Effects of Highways on Wildlife
- Examples of ADOT and AGFD Collaborate to Overcome these Effects
- Future Opportunities and Collaboration

ADOT Mission

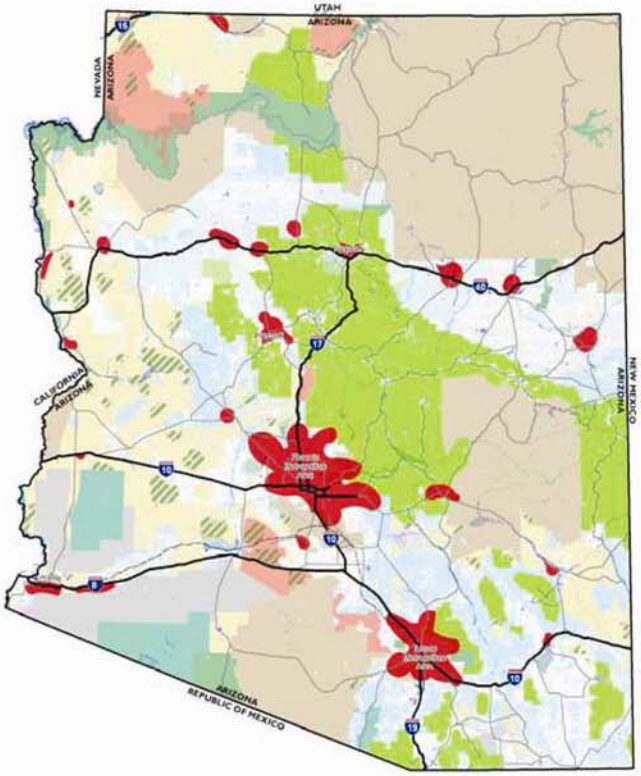
Provide Safe, Efficient, Cost-Effective Transportation Systems

AGFD Mission

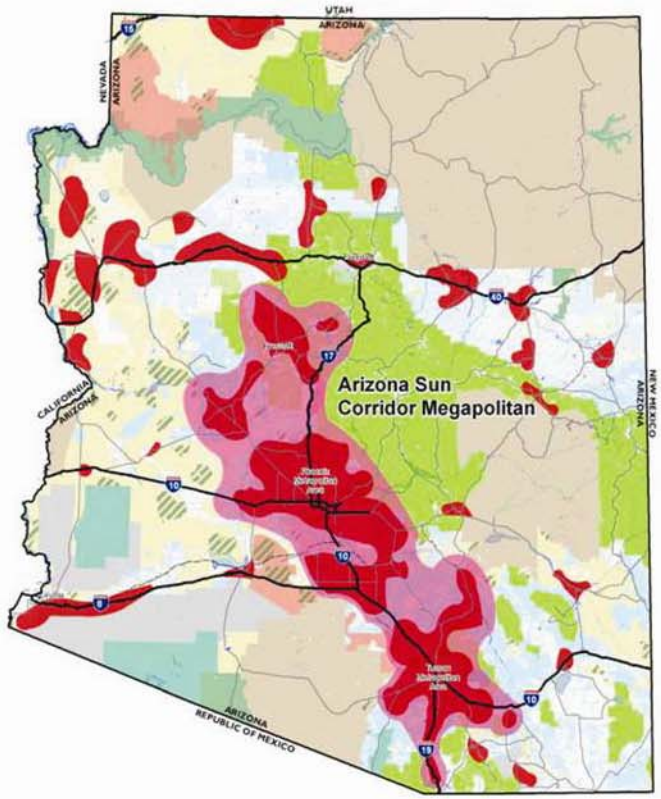
Conserve Arizona's Wildlife for Present and Future Generations



Arizona's Potential for Growth

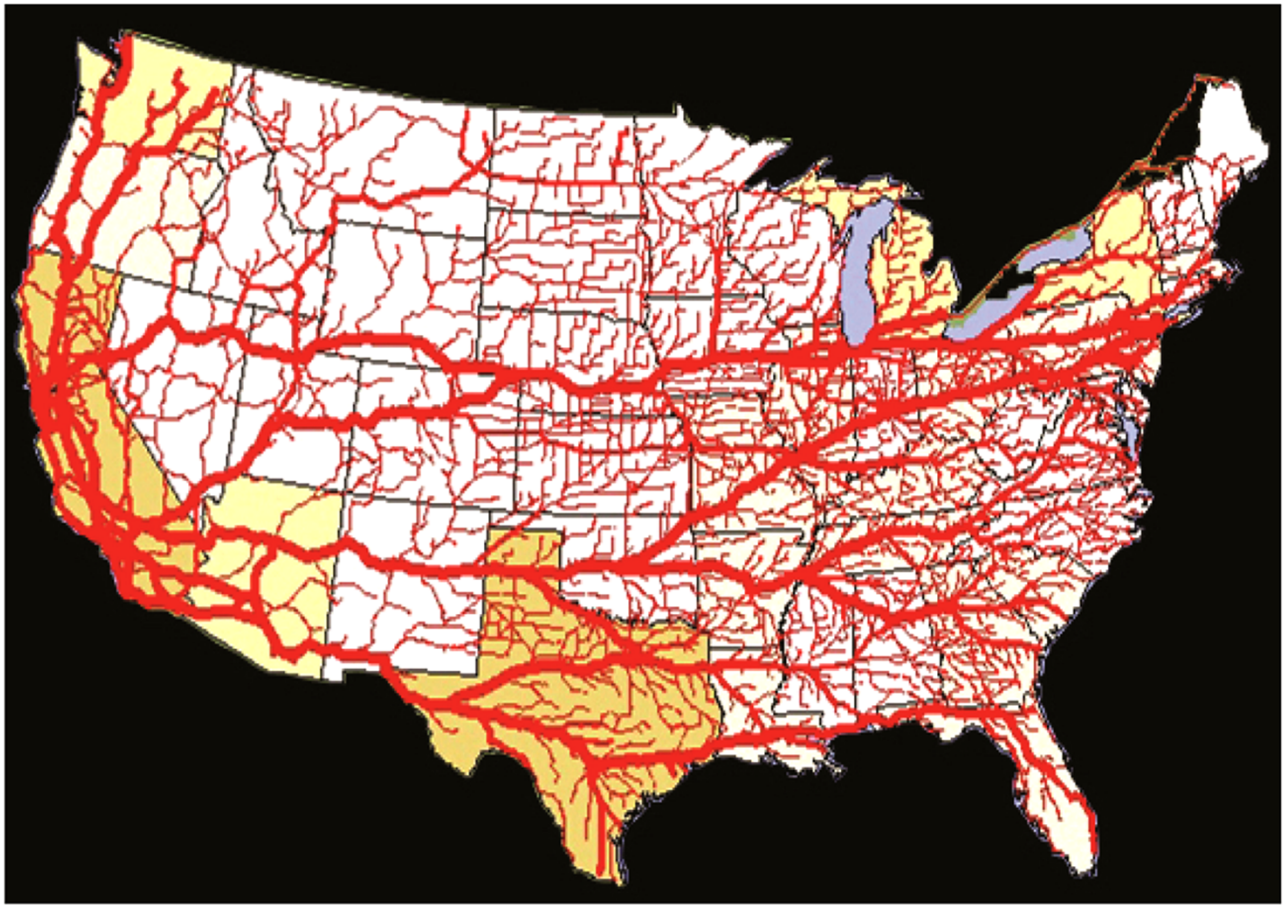


2005 Growth Areas
Population: 5.1 million

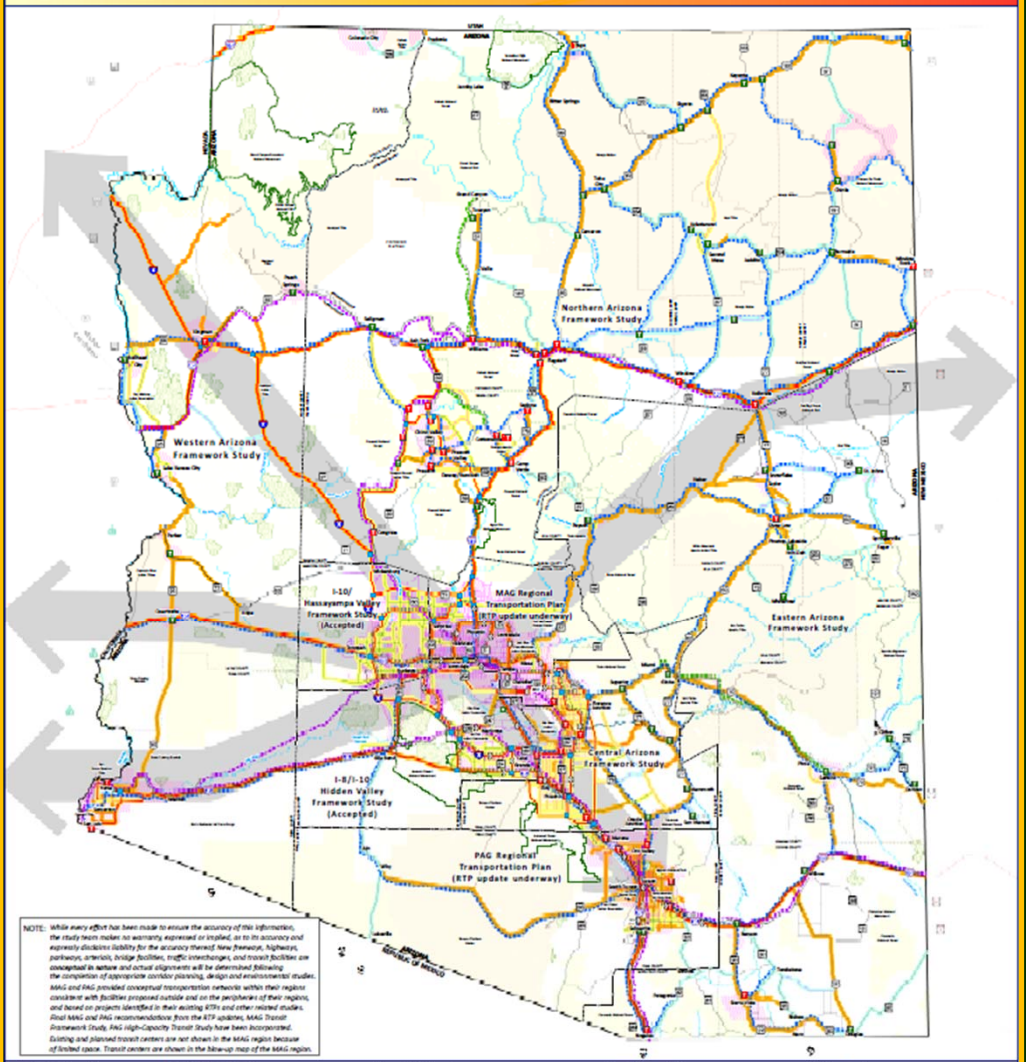


2050 Growth Areas
Population: 14.1 million

Arizona is a Major Gateway to the United States from California Ports



Statewide Transportation Planning Framework
2050 Recommended Scenario



NOTE: While every effort has been made to ensure the accuracy of this information, the study team makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof. New freeways, highways, parkways, arterials, bridge facilities, traffic interchanges, and transit facilities are conceptual in nature and actual alignments will be determined following the completion of appropriate corridor planning, design and environmental studies. MAG and PAG provided conceptual transportation networks within their regions consistent with facilities proposed outside and on the peripheries of their regions, and based on projects identified in their existing RTPs and other related studies. Final MAG and PAG recommendations from the RTP updates, MAG Transit Framework Study, PAG High-Capacity Transit Study have been incorporated. Existing and planned transit centers are not shown in the MAG region because of limited space. Transit centers are shown in the blow-up map of the MAG region.

Facility Type *
- Freeway
- State Highway
- AZ Parkway
- Principal Arterial
- Potential New Interstate

* Only Regionally Significant Corridors have been Illustrated.

0 10 20 40 Miles

Improvement Type
- Conceptual New Roadway
- Widen/Upgrade Roadway
- Improved Roadway (Shoulders, Passing Lanes, Drainage, etc.)
- New System Traffic Interchange
- Potential Southwest Interstate
- High Speed Rail Corridors

NORTH

Transit Network
- Express Bus
- Intercity Bus
- Passenger Rail
- Local Transit Service (Fixed Route, Community Circulator, Dial-A-Ride Service)
- Major Transit Center
- Minor Transit Center
- High Occupancy Vehicle (HOV) Lane

Land Ownership
- Bureau of Land Management
- State Trust Land
- National/State Park, USFS, USFWS
- Military
- Tribal Land
- Private

Existing Features
- Freight Railroad
- Tourist Railroad
- River
- Other Road
- Framework Study Boundary
- County Boundary
- National Monument
- Wilderness Area

Sources: ALRIS 2007, ADOT 2007

March 2010

Wildlife-Vehicle Collisions
A Nationwide Problem

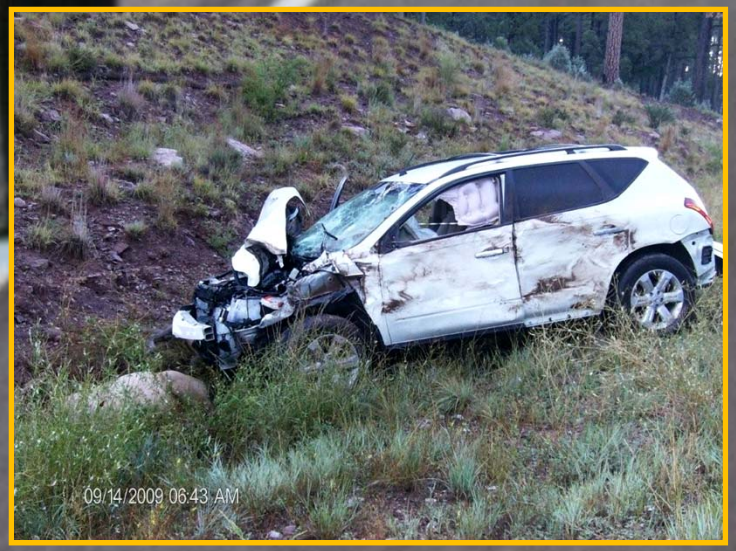
- Direct mortality from collisions
  - Have Increased >100% over the last decade
  - >200 fatalities/ year

Wildlife-Vehicle Collisions

A Statewide Problem

- National Average – 5% of Accidents Involve Wildlife
- Arizona – 20-50% of Accidents are with Wildlife along Key Stretches of Highways


US 180
Between Holbrook &
Springerville, AZ



SR 260
Near Christopher Creek, AZ

Cost of Elk and Deer Collisions to Society

Table 6: Summary of Estimated Costs of a Wildlife Vehicle Collision for a Deer, Elk, and Moose.

Description	Deer	Elk	Moose
Vehicle repair costs per collision	$1,840	$3,000	$4,000
Human injuries per collision	$2,702	$5,403	$10,807
Human fatalities per collision	$1,671	$6,683	$13,366
Towing, accident attendance and investigation	$125	$375	$500
Monetary value animal per collision	$2,000	$3,000	$2,000
Carcass removal and disposal per collision	$50	$100	$100
Total	$8,388	$18,561	$30,773

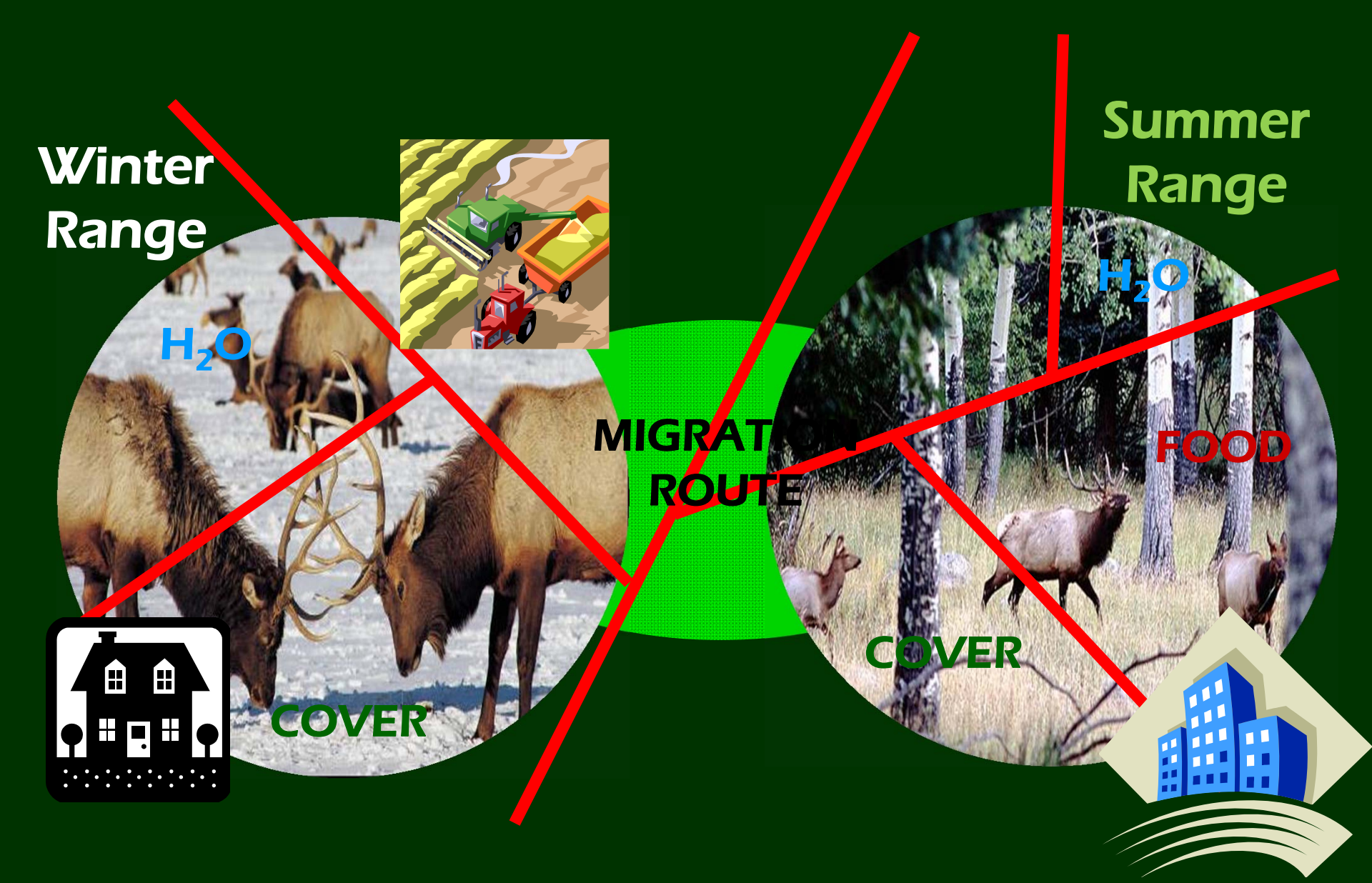
Interstate-17 (30 miles stretch):

- 18 Deer Vehicle Collisions per year
- 85 Elk Vehicle Collisions per year
- Cost to Society: **$1.73 million** per year

Cost of Wildlife-Vehicle Collisions to Society

….If the State is not Sued

Booth VS State of Arizona = $4,000,000!

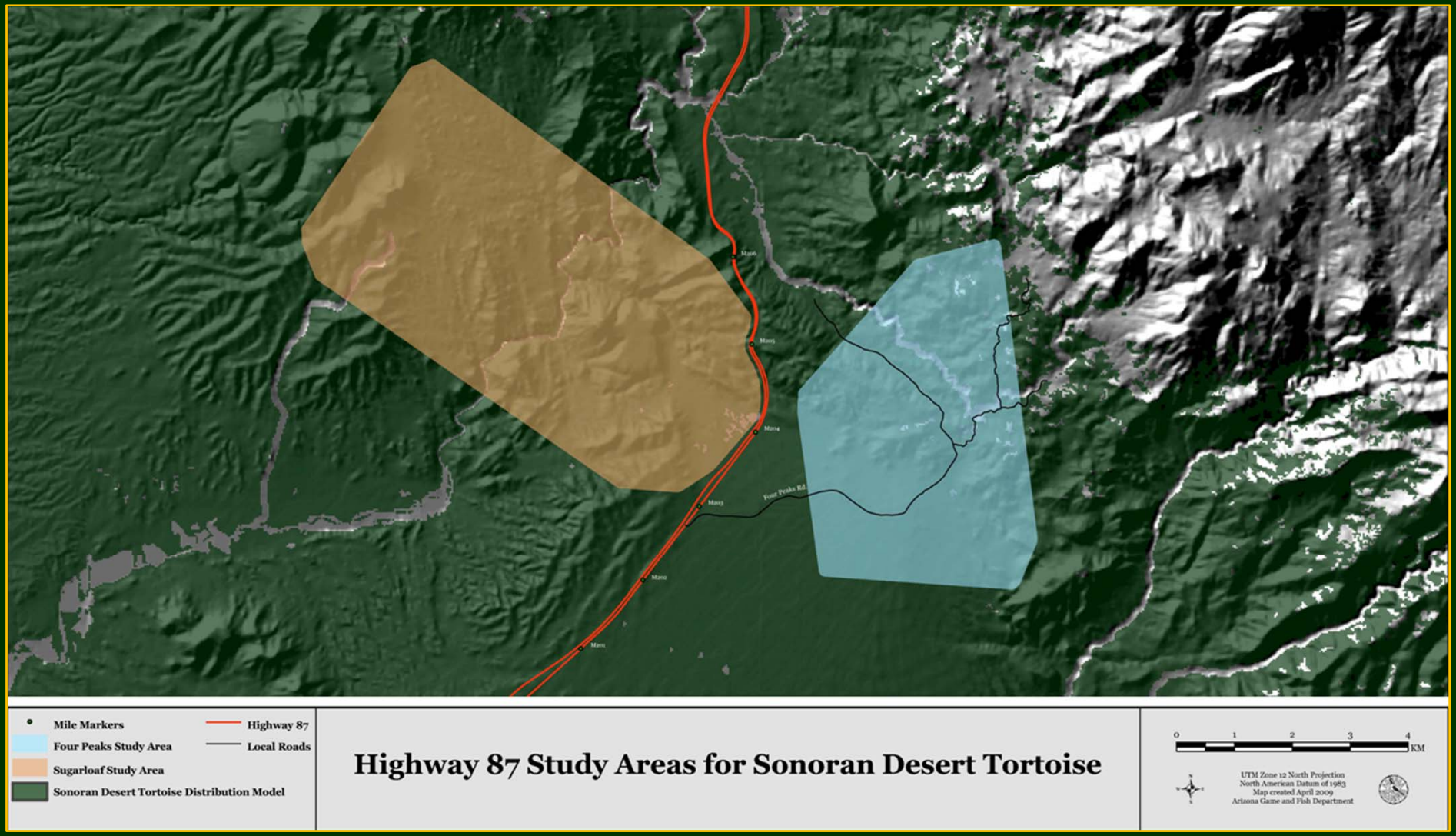


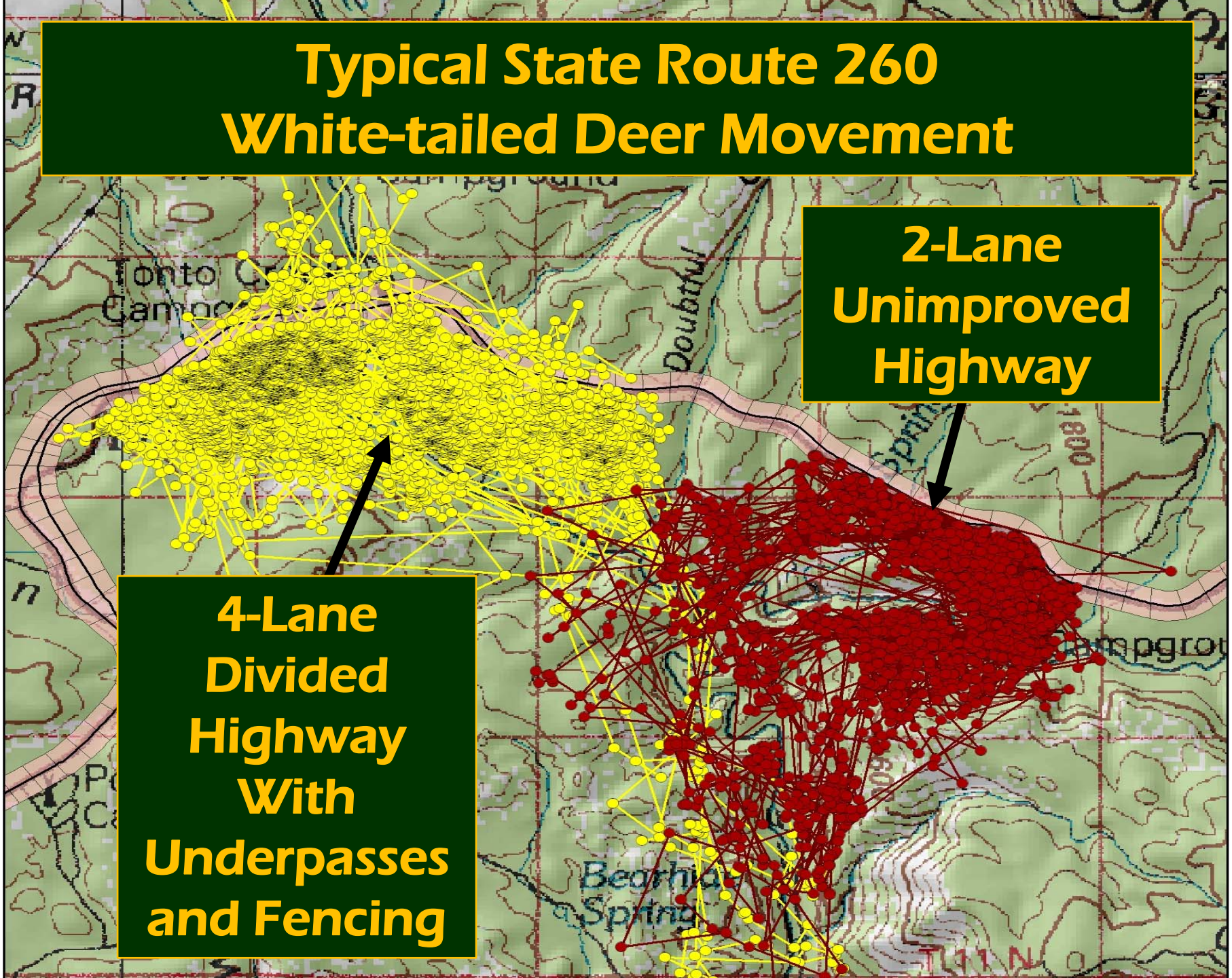
HABITAT FRAGMENTATION


STATEWIDE, WILDLIFE POPULATIONS
ARE ALREADY BEING FRAGMENTED

Hwy 87 Desert Tortoise Study

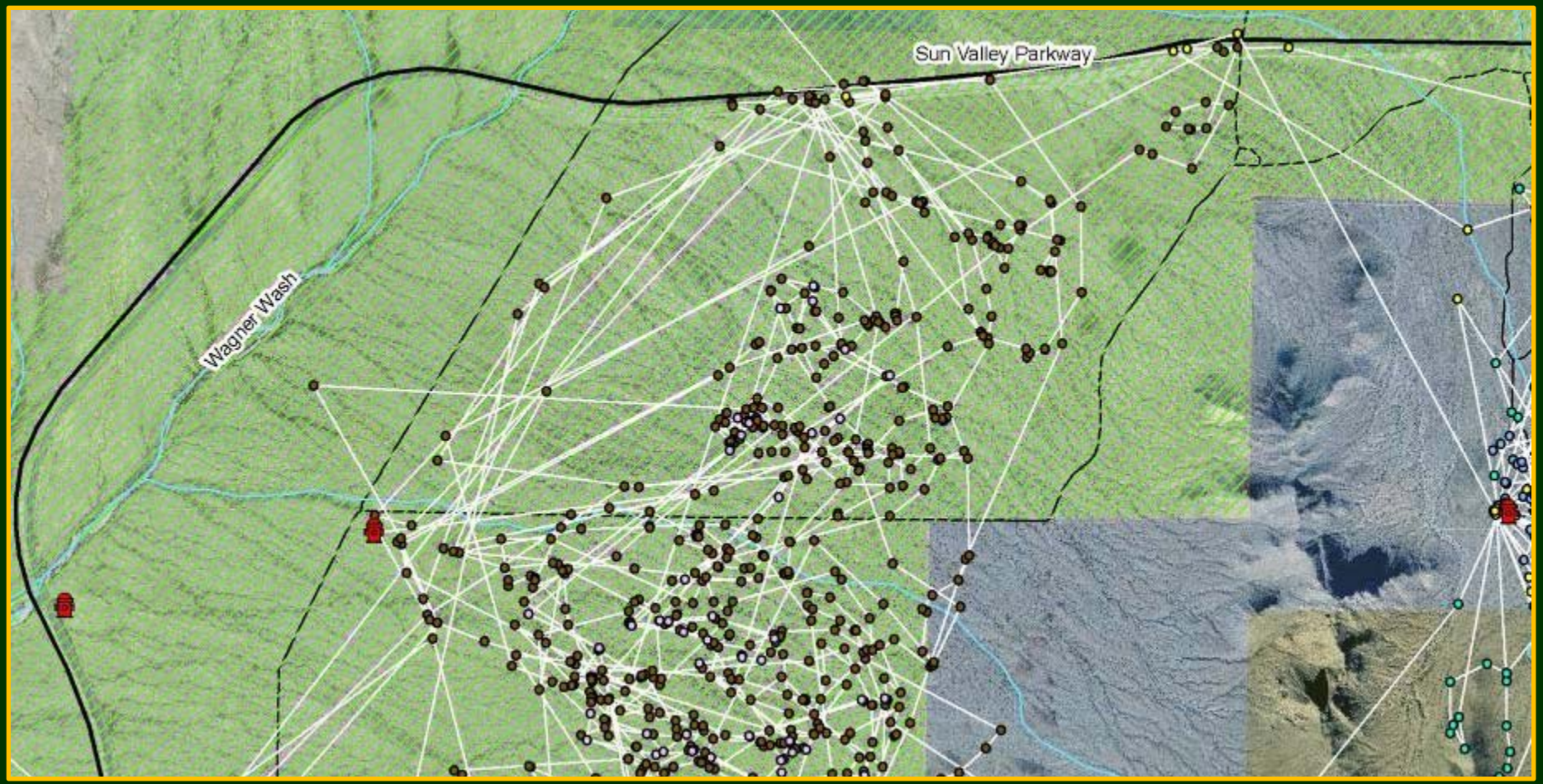
Hwy 87 Desert Tortoise Study




Typical State Route 260
White-tailed Deer Movement
2-Lane
Unimproved
Highway
4-Lane
Divided
Highway
With
Underpasses
and Fencing

Mule Deer Movements in the White Tank Mountains and the Sun Valley Parkway Corridor

Preliminary Results:



The Sun Valley Parkway is acting as a barrier to mule deer movement.

I-17 Elk Movement

Near Munds Park

100 Elk → 900 crossings

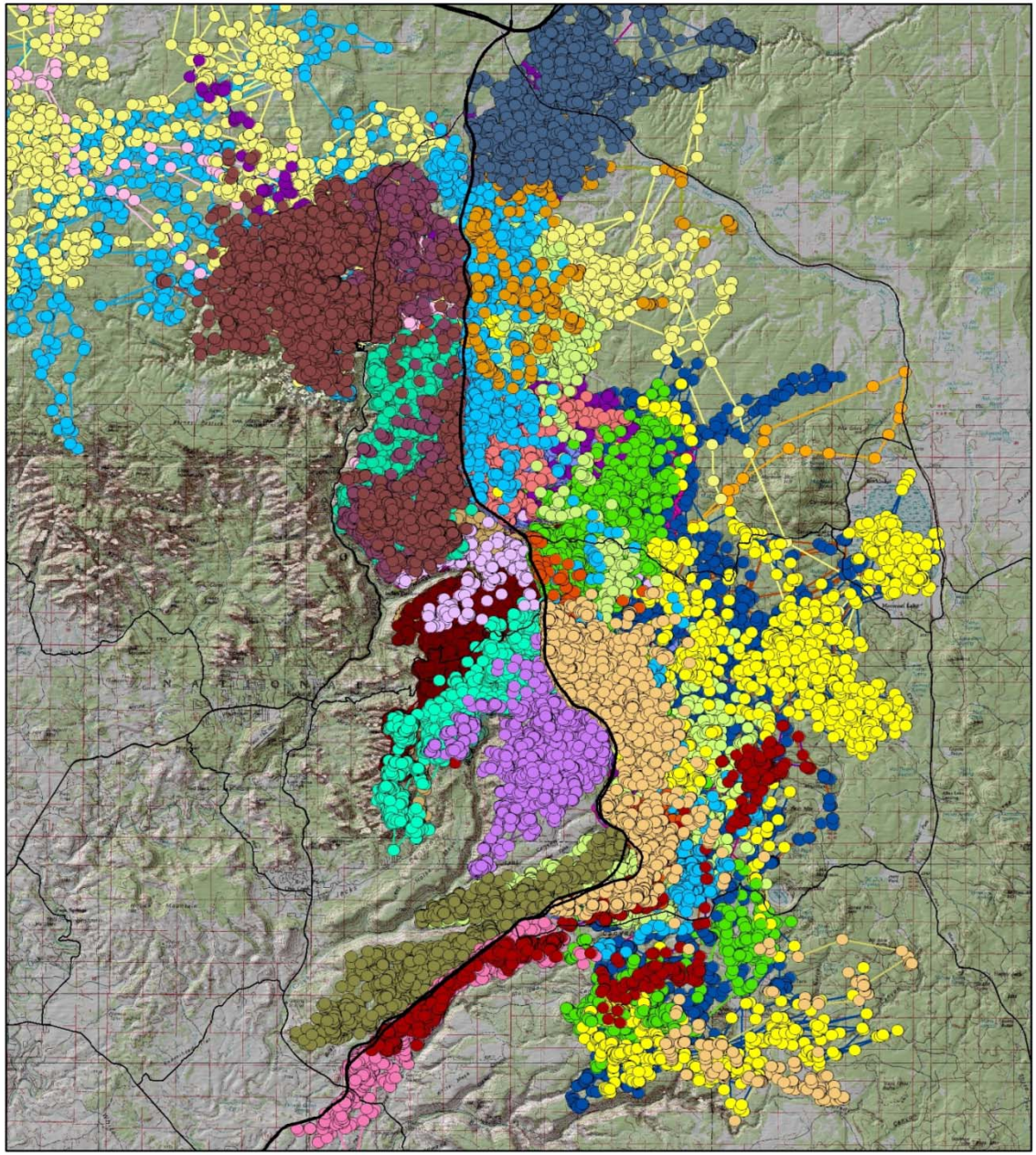
(AADT 17,000)

Compared to SR 260

Near Christopher Creek

110 Elk → 11,000 crossings

(AADT 8,000)



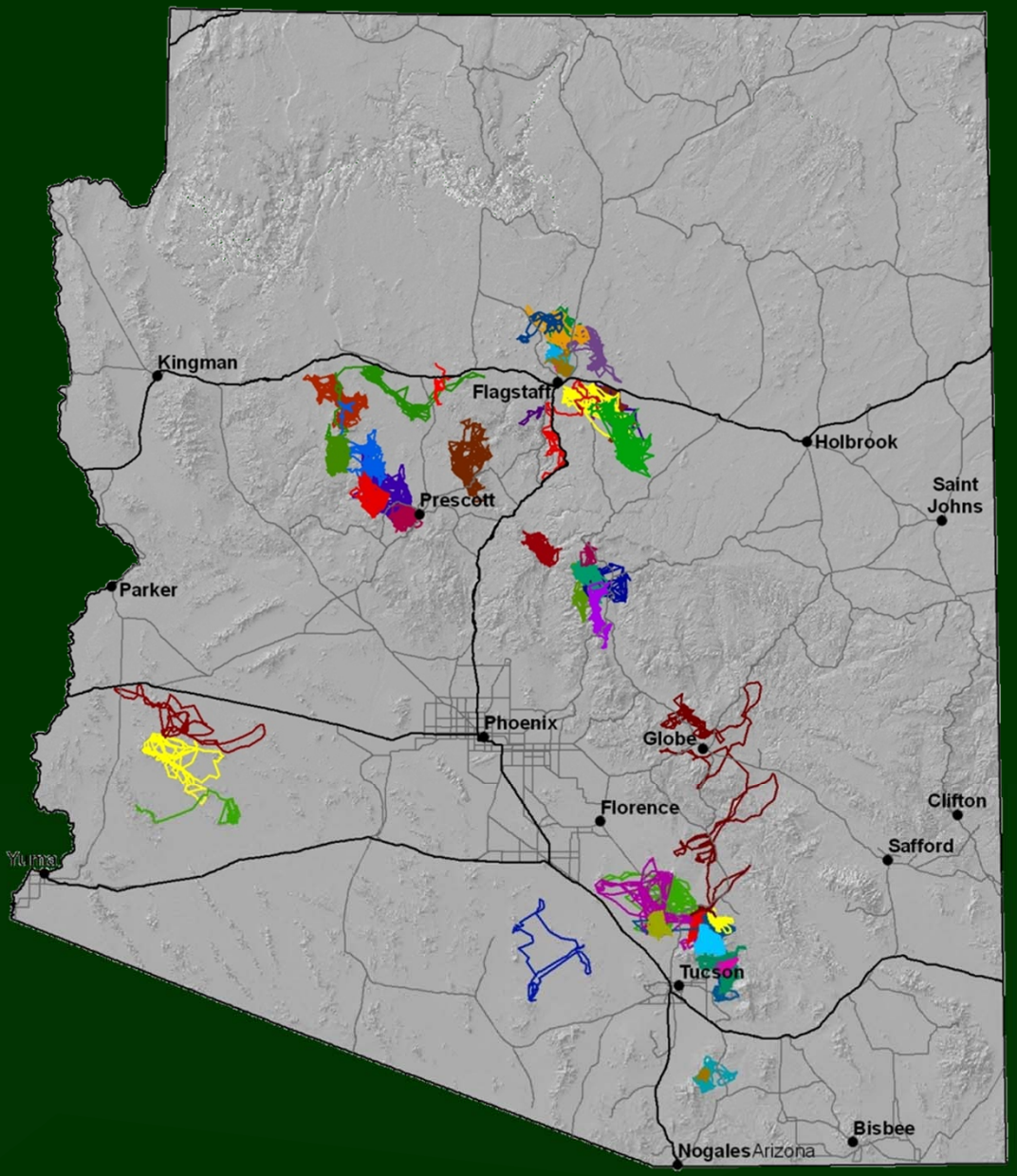
43 animals represented by different colors.

Elk Locations along I-17 near Munds Park 3/2006 - 1/2010

Kilometers 0 2 4 N

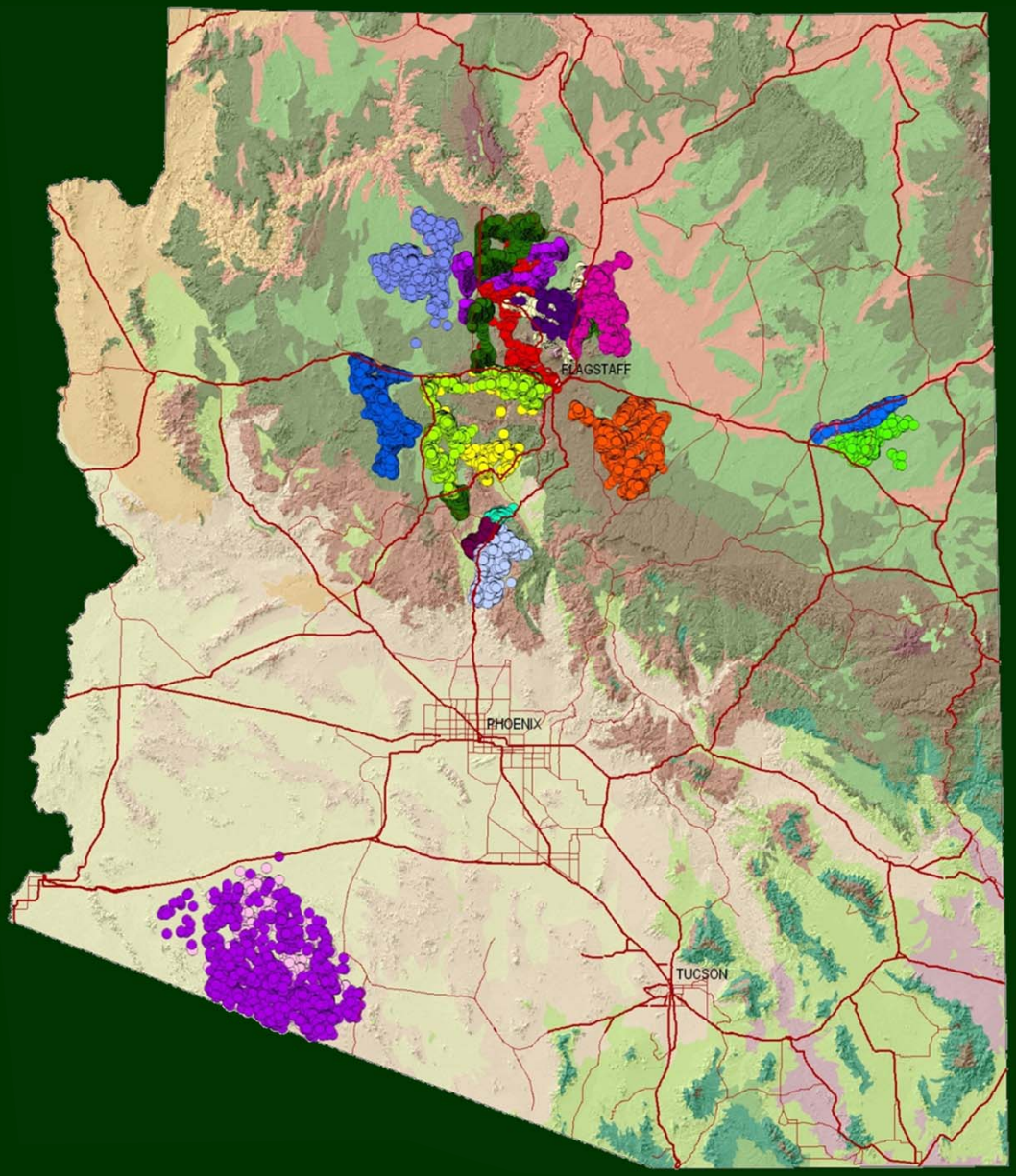
Statewide Mountain Lion Studies

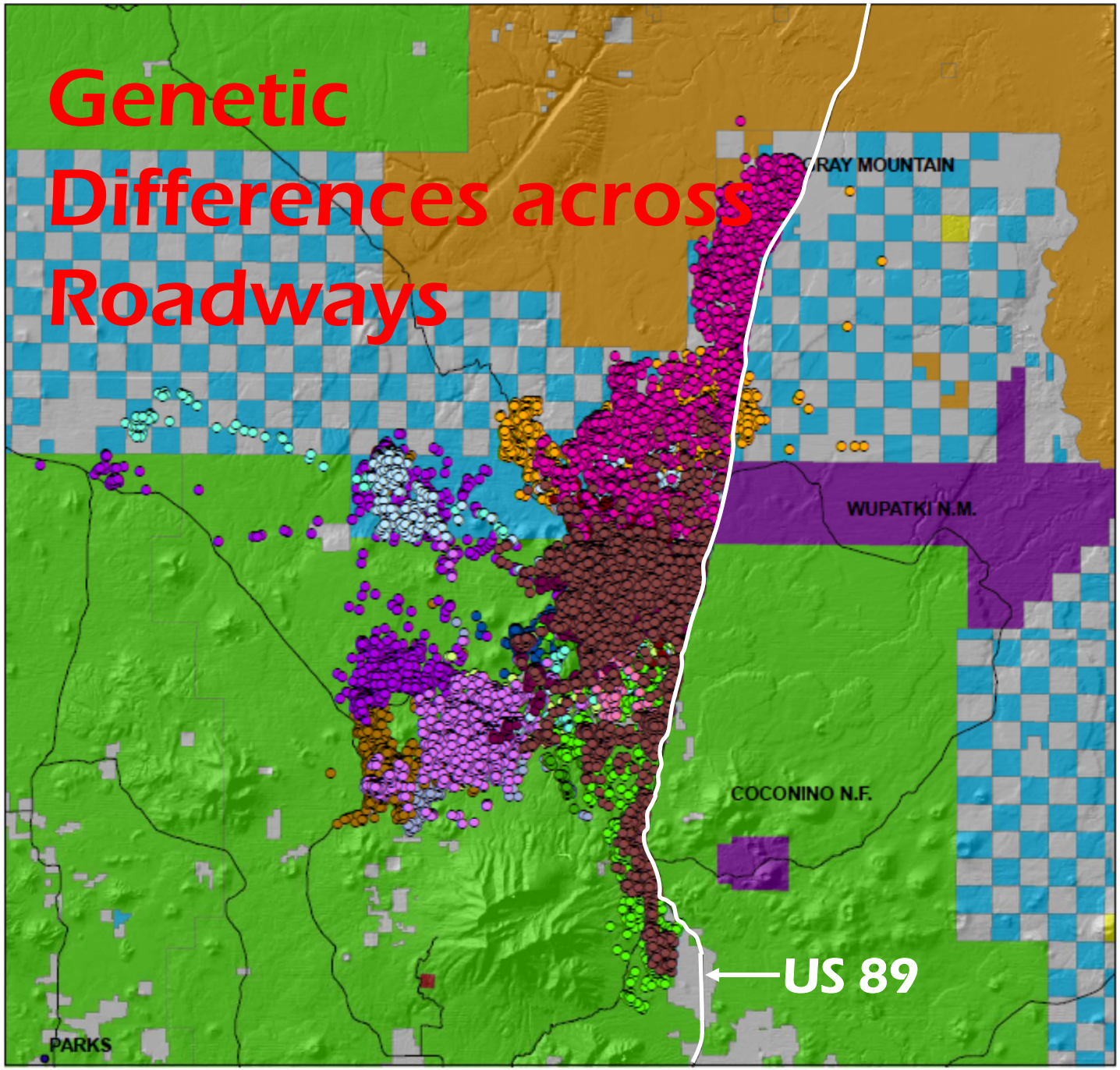
Statewide Mountain Lion Studies



Statewide Pronghorn Studies

Statewide Pronghorn Studies





Hwy 89 Pronghorn Study Area

Pronghorn locations
from 1/2007 - 12/2008
37 Animals
121,000 Locations

- Private
- BLM
- State Trust
- Forest
- Indian Res.
- Natl. Parks
- Game and Fish

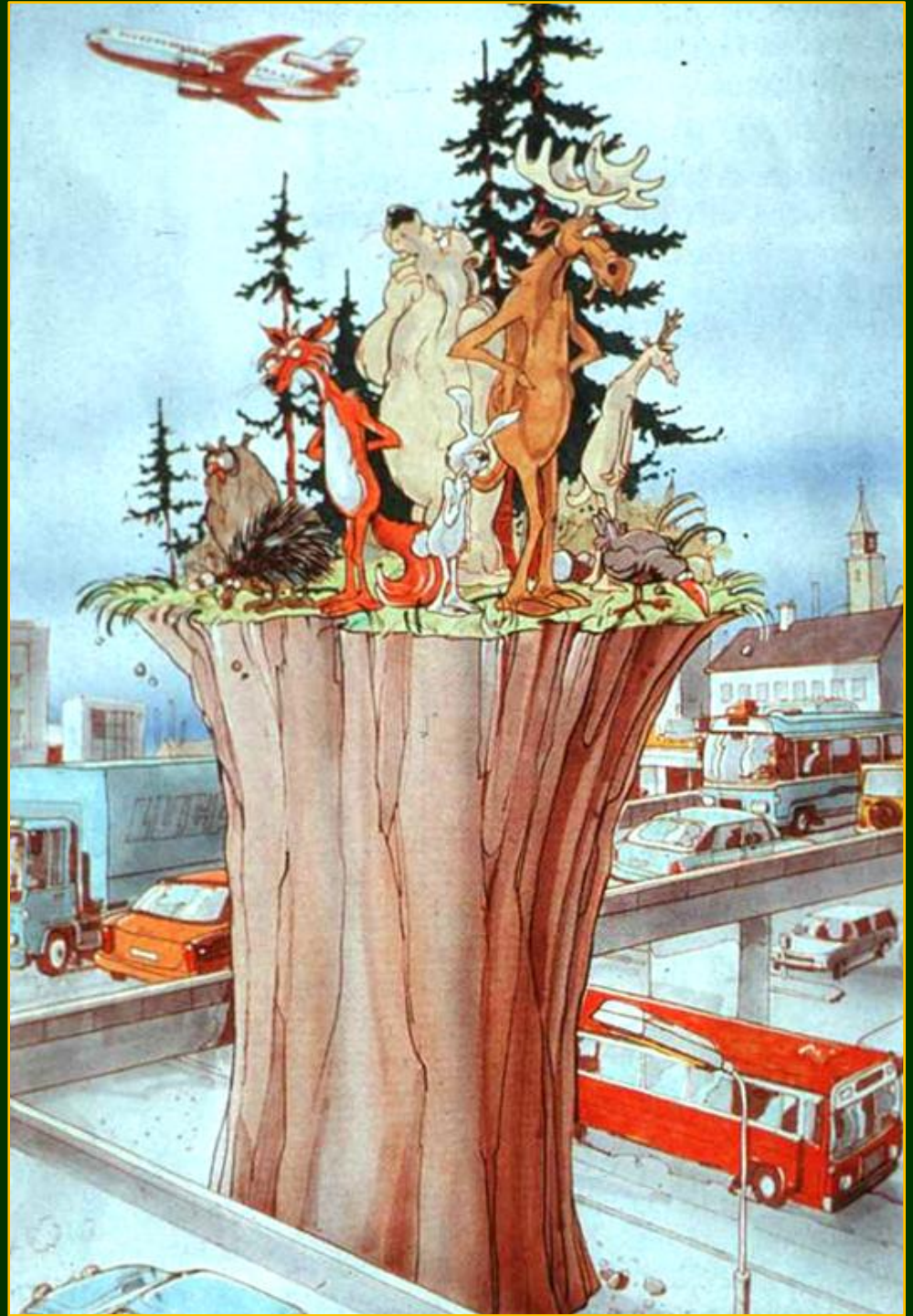
N

Kilometers

0 4 8

Now that we know some of the potential impacts of development....

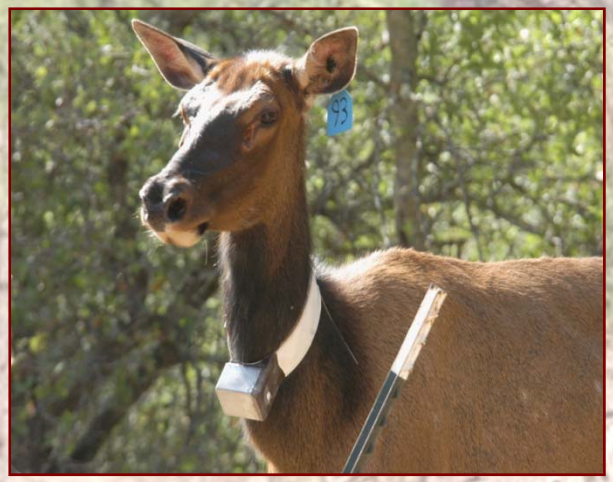
What can we do about it???




Why Engineers Need
Biologists


Why Biologists Need Engineers

Arizona State Route 260 Project

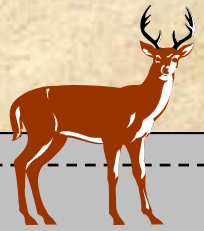


STATE ROUTE 260 RECONSTRUCTION STANDARD

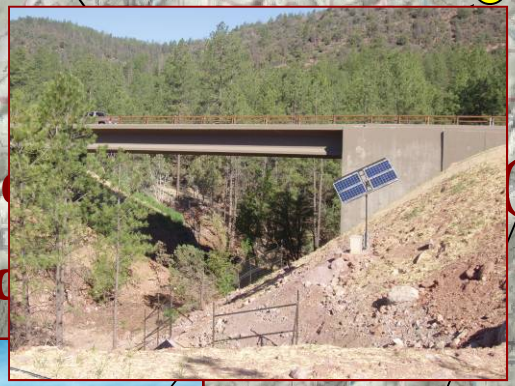
Existing 2-lane highway

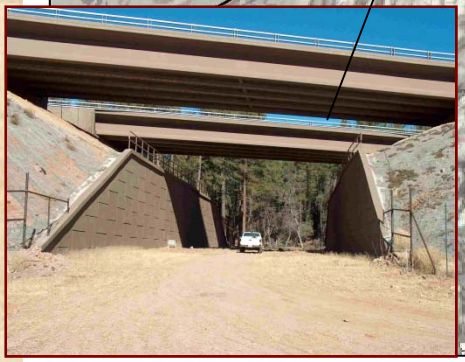
Reconstructed 4-lane highway

Reconstruction raises significant issues of maintenance of wildlife connectivity and permeability across highway



STATE ROUTE 260 PROJECT
Wildlife Underpasses
(Completed 2013)





- Wil (11)
- Bric

Legend
— HWY260

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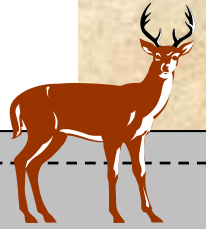
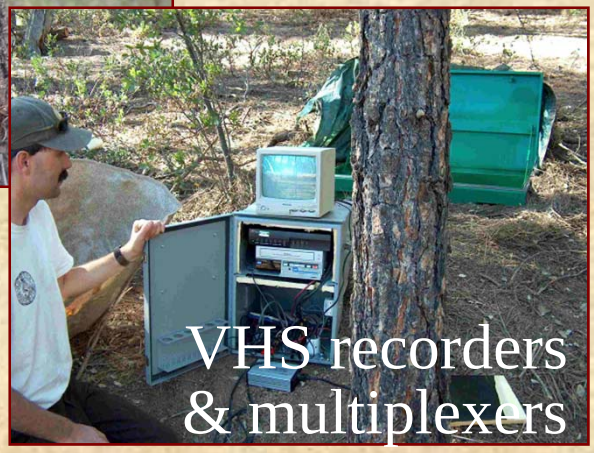


UNDERPASS VIDEO CAMERA SURVEILLANCE



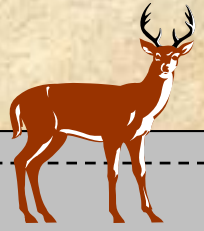
Integrated Infrared Video Camera Systems

•7 systems in place at underpasses - triggered systems (110 v AC and 12 v DC powered)

•Camera systems used to assess:

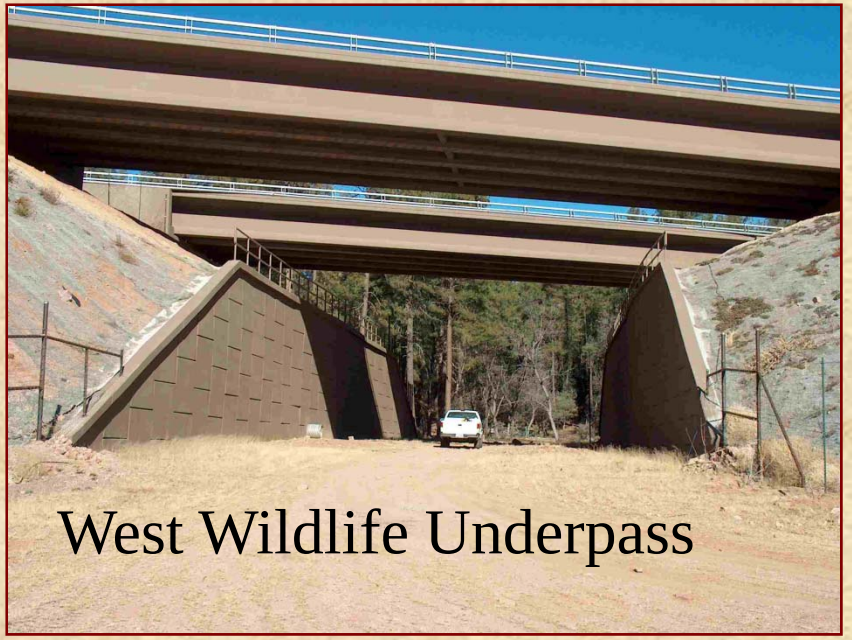
- ✓ **wildlife passage rates**
- ✓ **animal behavior**
- ✓ **relationship to traffic levels**

•>15,000 animals used underpasses

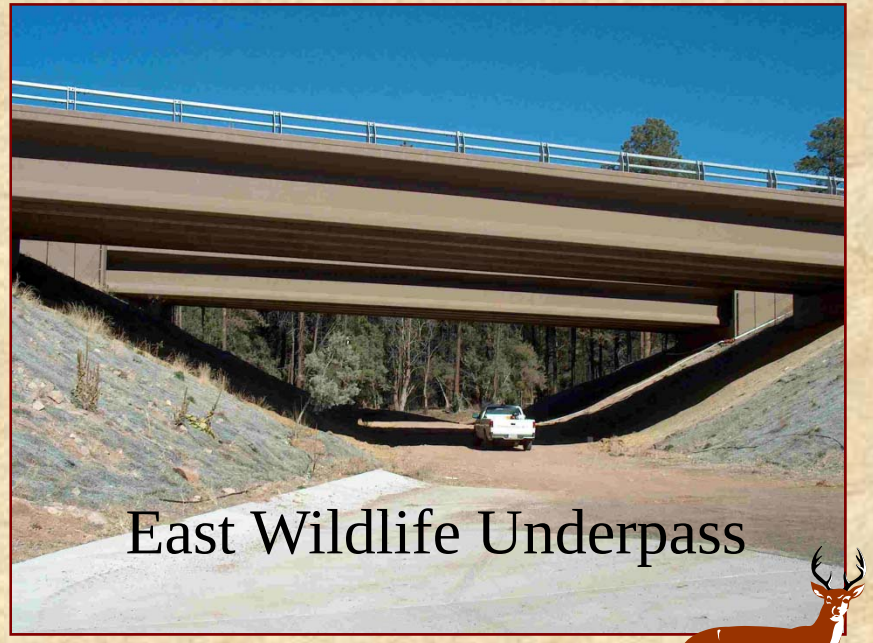


PREACHER CANYON SECTION
Wildlife Underpasses

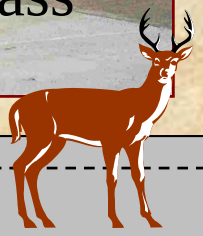
- 2 sets of wildlife underpasses (versus culverts for drainage)
- 0.4 mi of 8-ft elk-proof fencing to funnel wildlife toward underpasses (10% of section)



West Wildlife Underpass



East Wildlife Underpass

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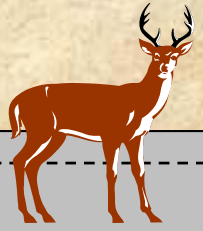
KOHLS RANCH SECTION

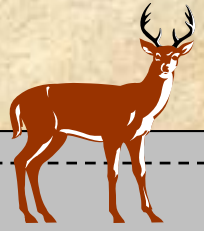
Wildlife Underpass



State Route 260 – Underpass Design

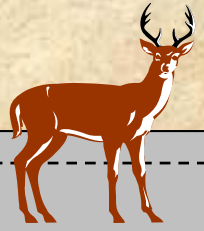
Bridge offset

Visual opening



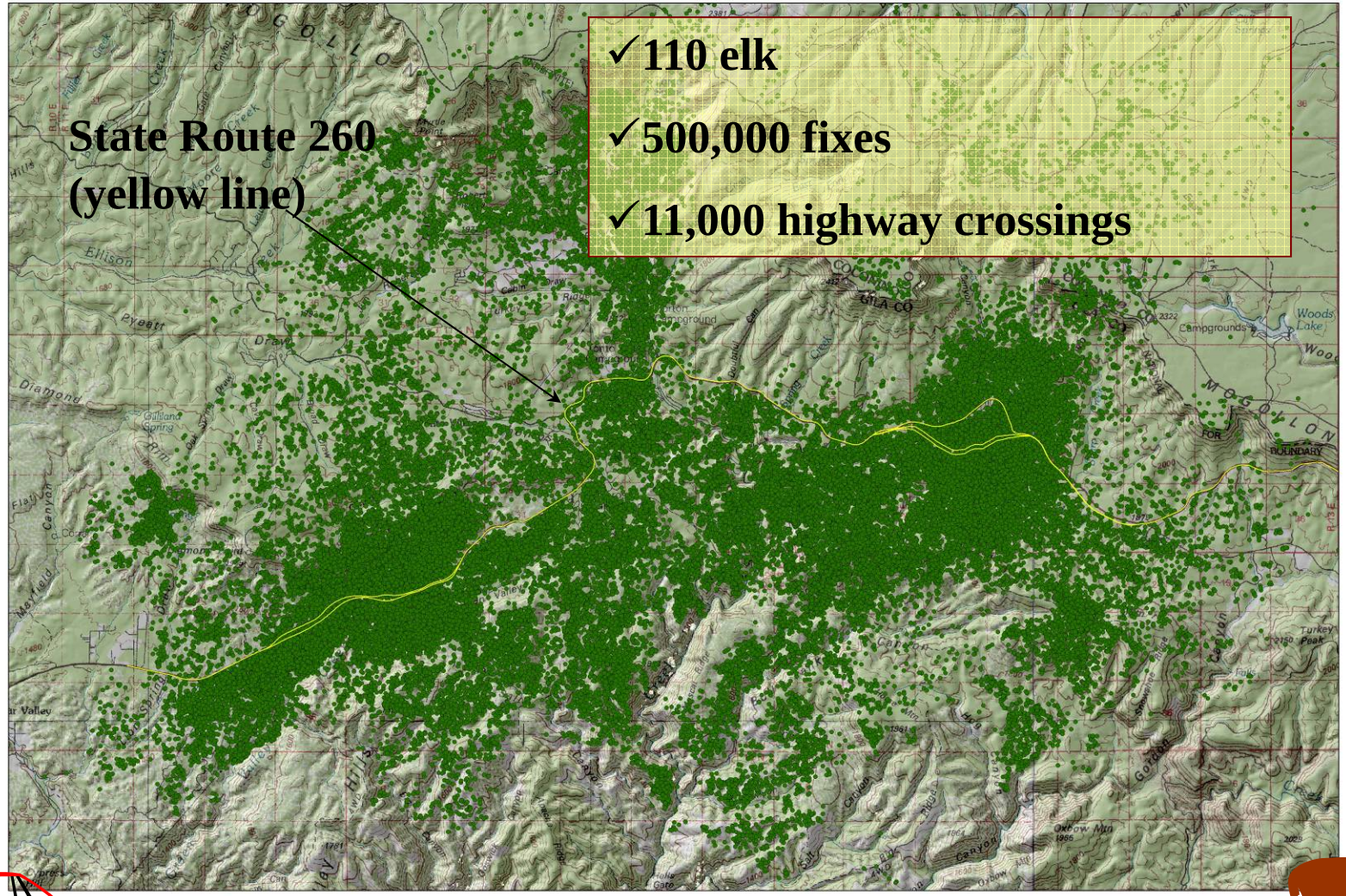
GLOBAL POSITIONING SYSTEM (GPS) TELEMETRY APPLICATION

- 110 elk fitted with GPS collars
  - 36 “Phase I” (2002-2004)
  - 42 “Phase II” (2004-2005)
  - 32 “Phase III” (2006-2008)
- Configured for 12 fixes/day for 22 months (≈ 8,000 fixes/elk)
- ± 10 m mean fix accuracy

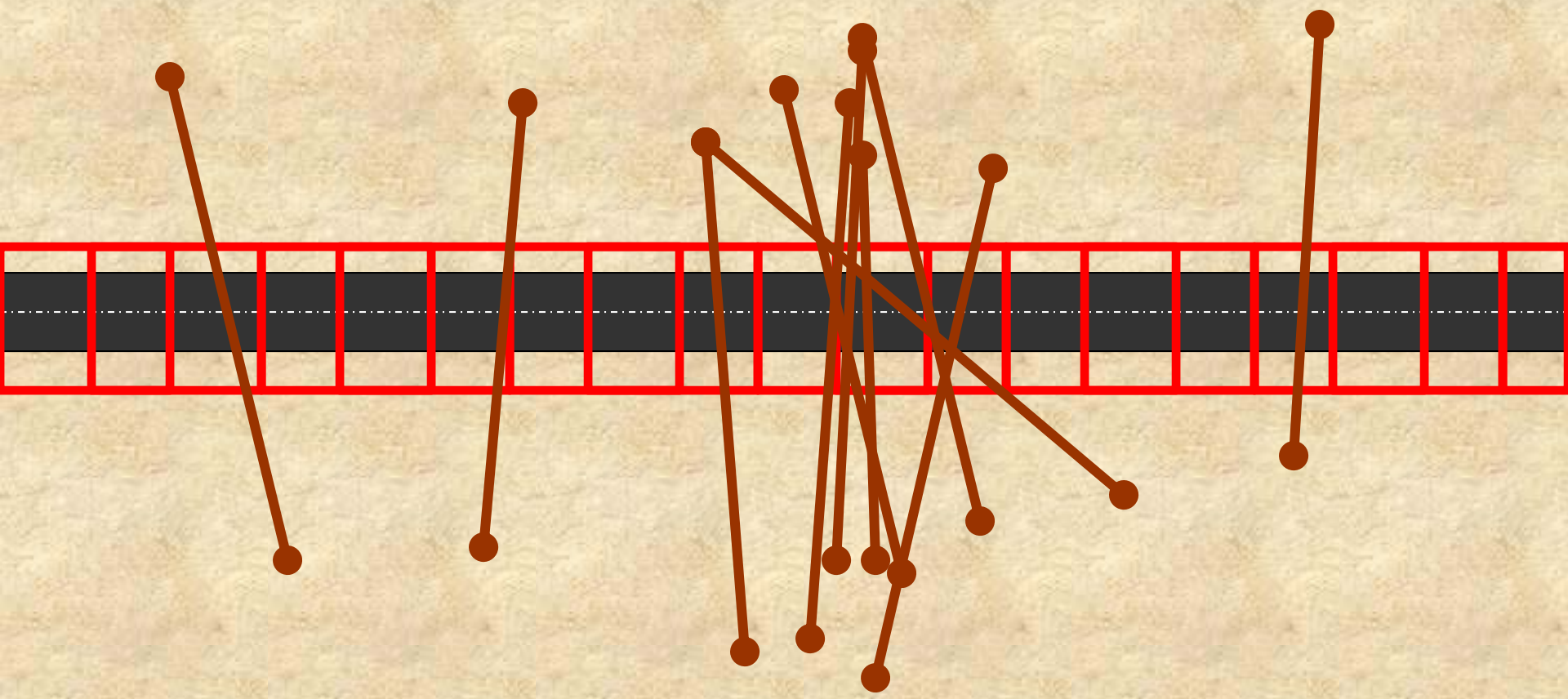



93

STATE ROUTE 260 GPS ELK LOCATIONS

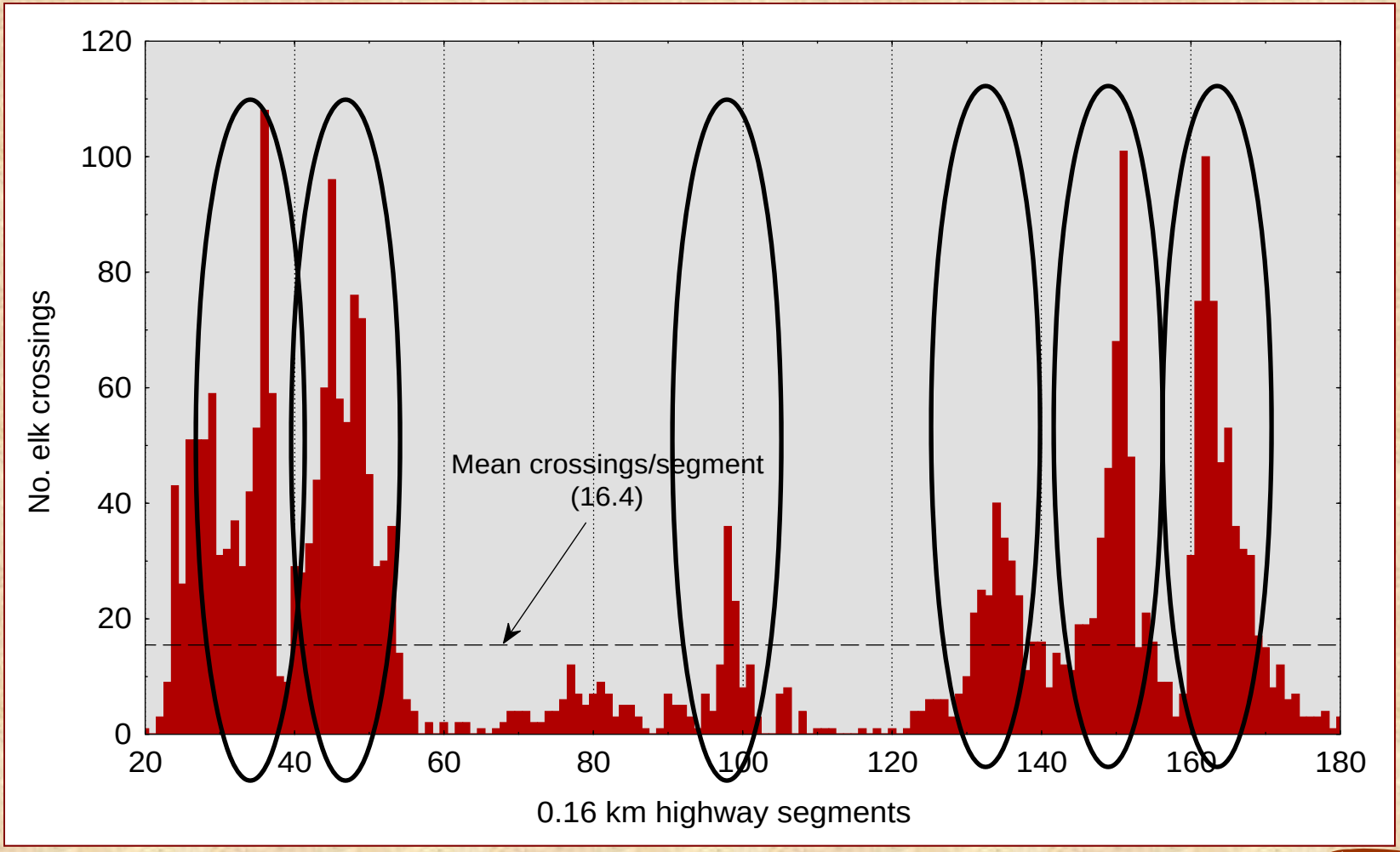


Assessing Crossing Locations (2 hours between locations!!)

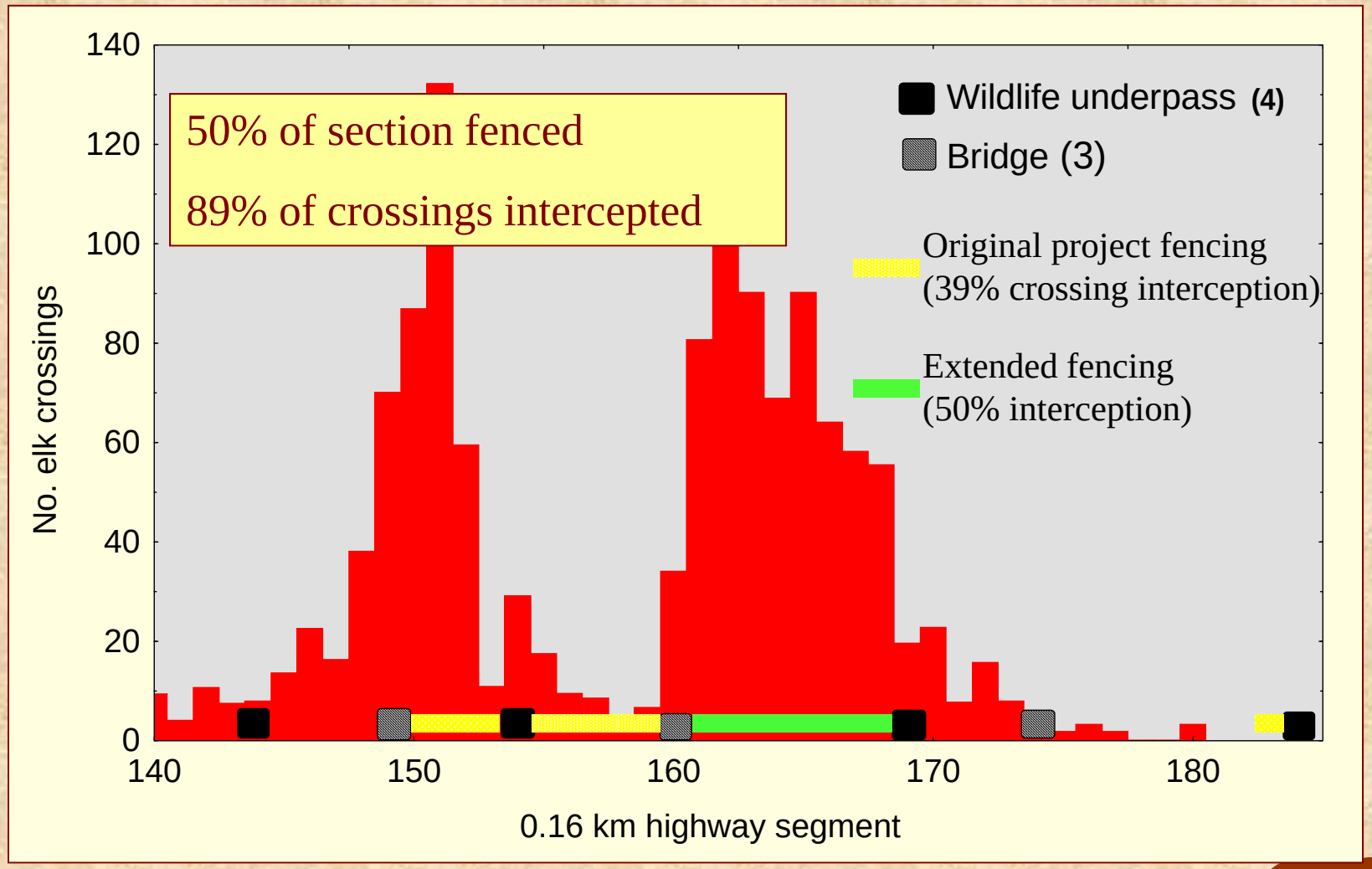


Highway Partitioned Into 1/10 mi Segments

ELK CROSSINGS BY HIGHWAY SEGMENT
Phase I Telemetry Project (2002-2004)



ELK CROSSINGS and INTERCEPTION BY FENCING
Christopher Creek Section



CHRISTOPHER CREEK SECTION

Before and After Ungulate-Proof Fencing Comparison

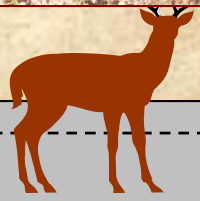
April-December 2003
Pre-fencing

January-December 2004
Post-fencing

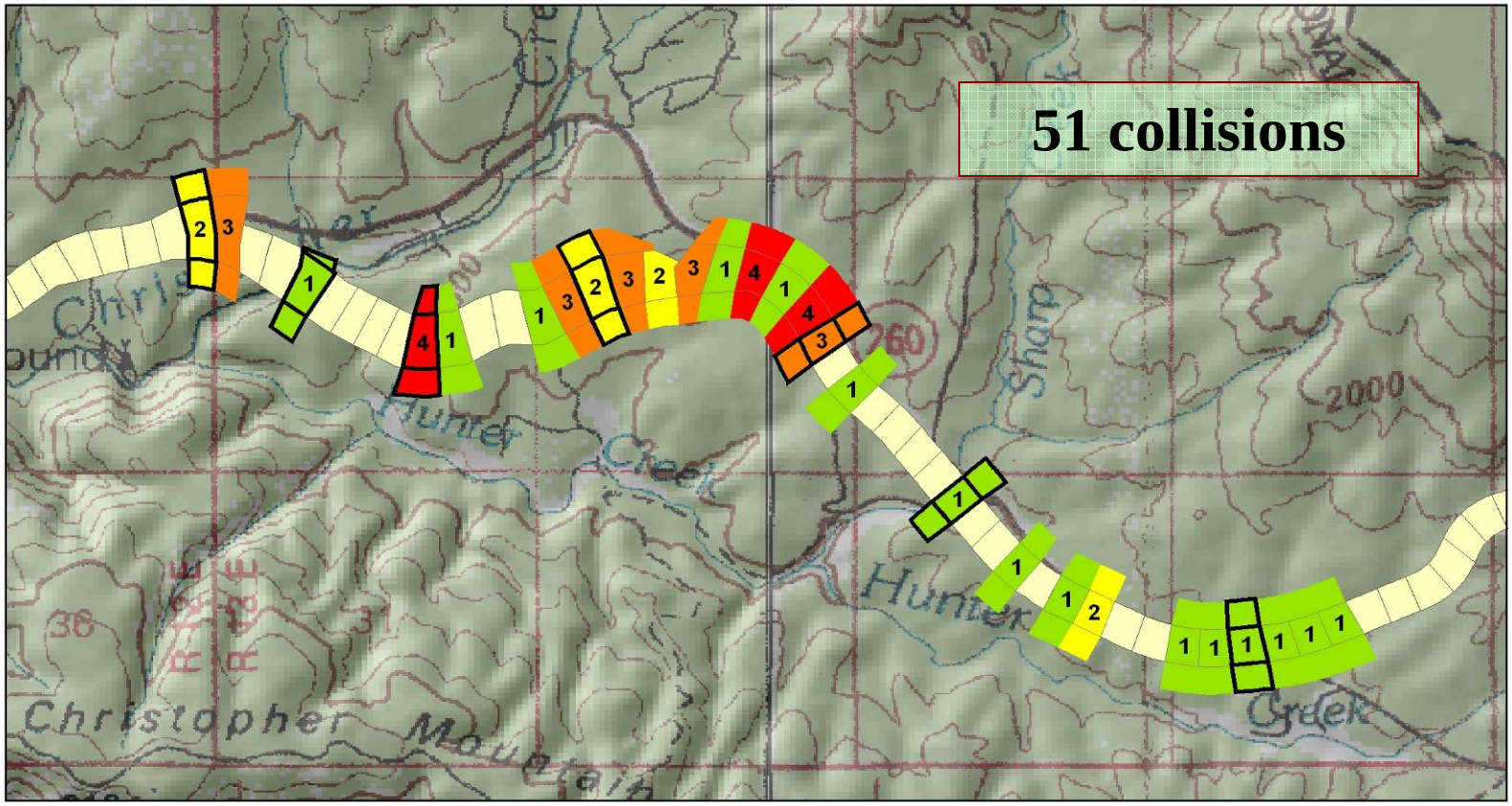
Before and after fencing comparisons:

- **Elk-vehicle collisions**
- **Wildlife underpass use**
- **Elk permeability**

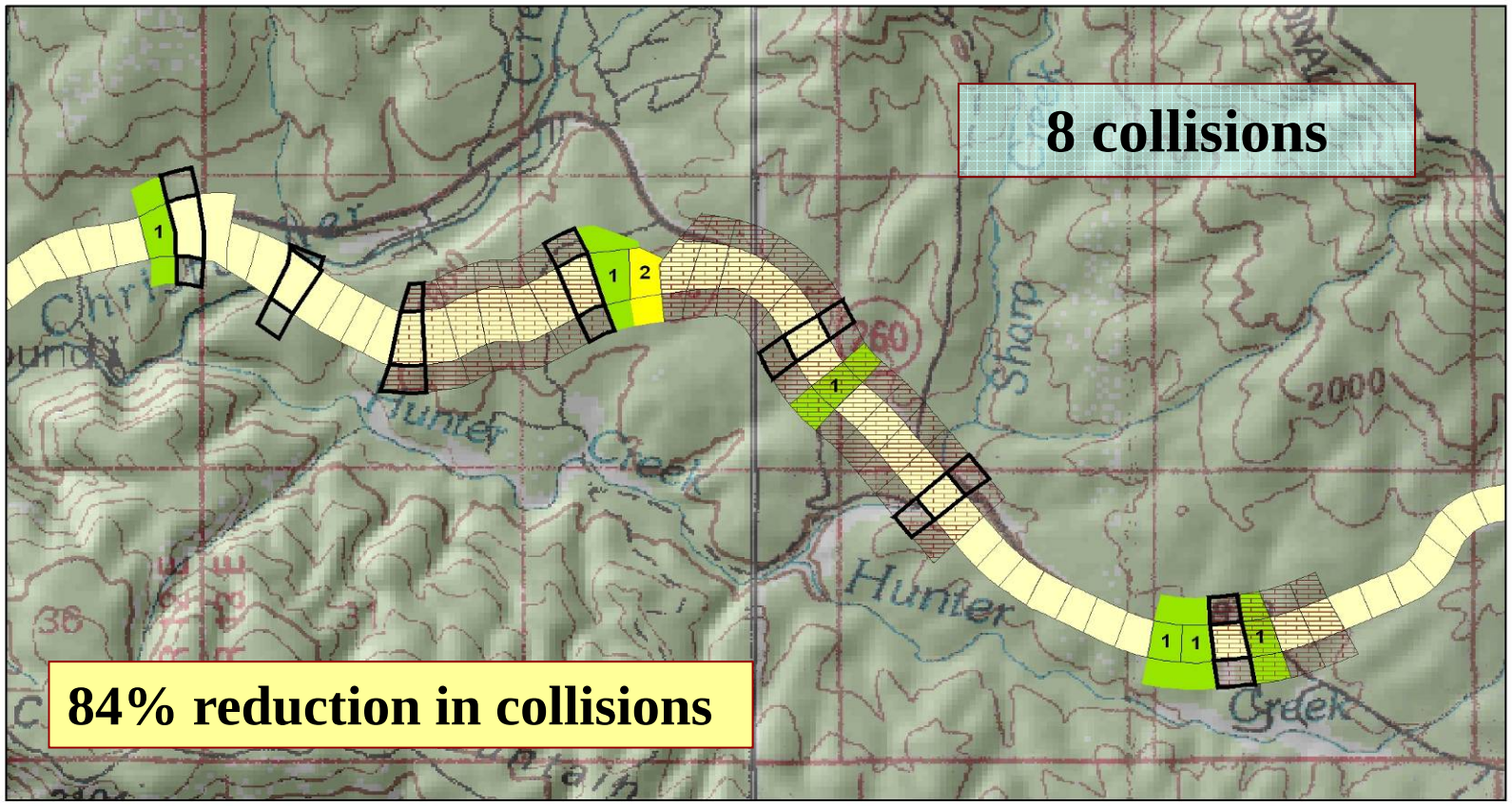
Note: Passage structures in place for 14 months before assessment



CHRISTOPHER CREEK SECTION
2004 ELK-VEHICLE COLLISIONS (Pre-Fencing)



CHRISTOPHER CREEK SECTION
2005 ELK-VEHICLE COLLISIONS (Post-Fencing)



Legend

- Passage Structure
- Fenced
- 1 Collision
- 2 Collisions

~$660,000 in fencing costs

~$798,000 in cost-savings from collision reductions for year 1.

2005 Collision Data
Christopher Creek Section
Hwy 260

Kilometers
0 1 2

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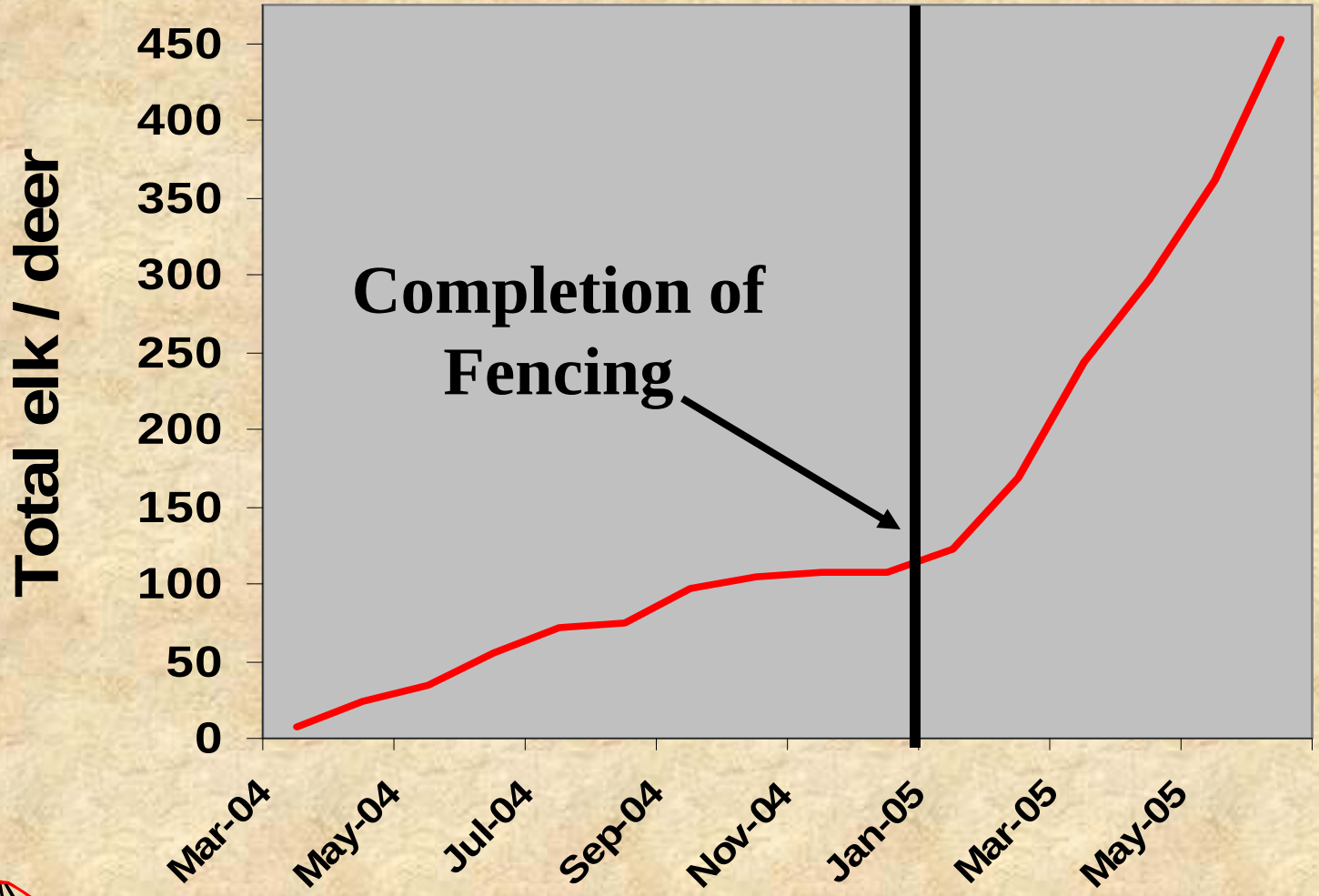
CHRISTOPHER CREEK SECTION

Pre- and Post-Fencing Wildlife Use of Underpasses



ELK PASSAGE RATES BY RECONSTRUCTION CLASS
Phase II Telemetry Results (2002-2006)

Controls (2)

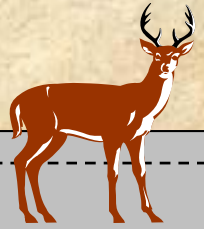
0.88

Reconstruction Complete

0.43

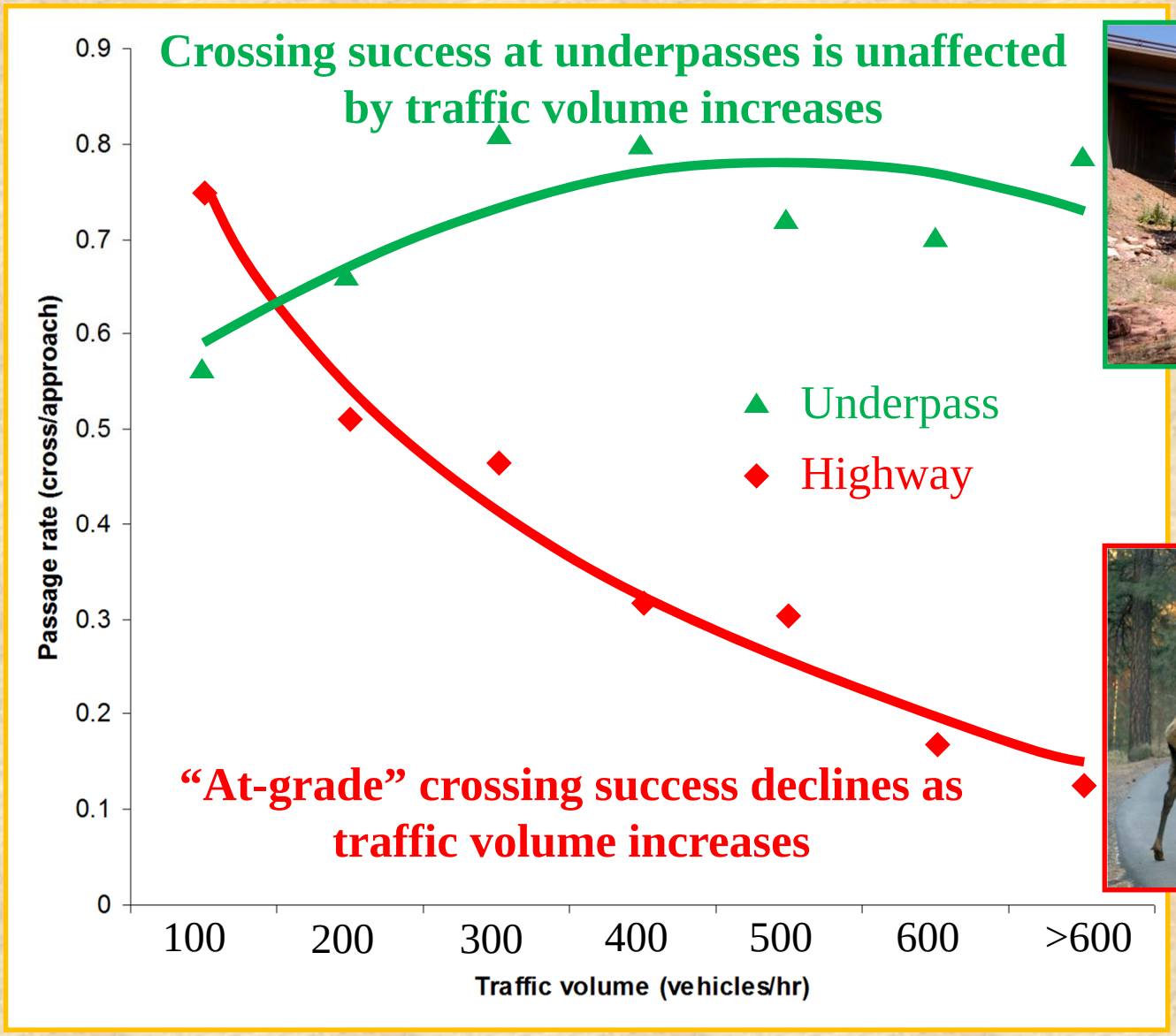
Fencing installed

0.84



Dodd et al. 2007. Assessment of elk permeability to elk by using GPS telemetry. *Journal of Wildlife Management* 71(4).

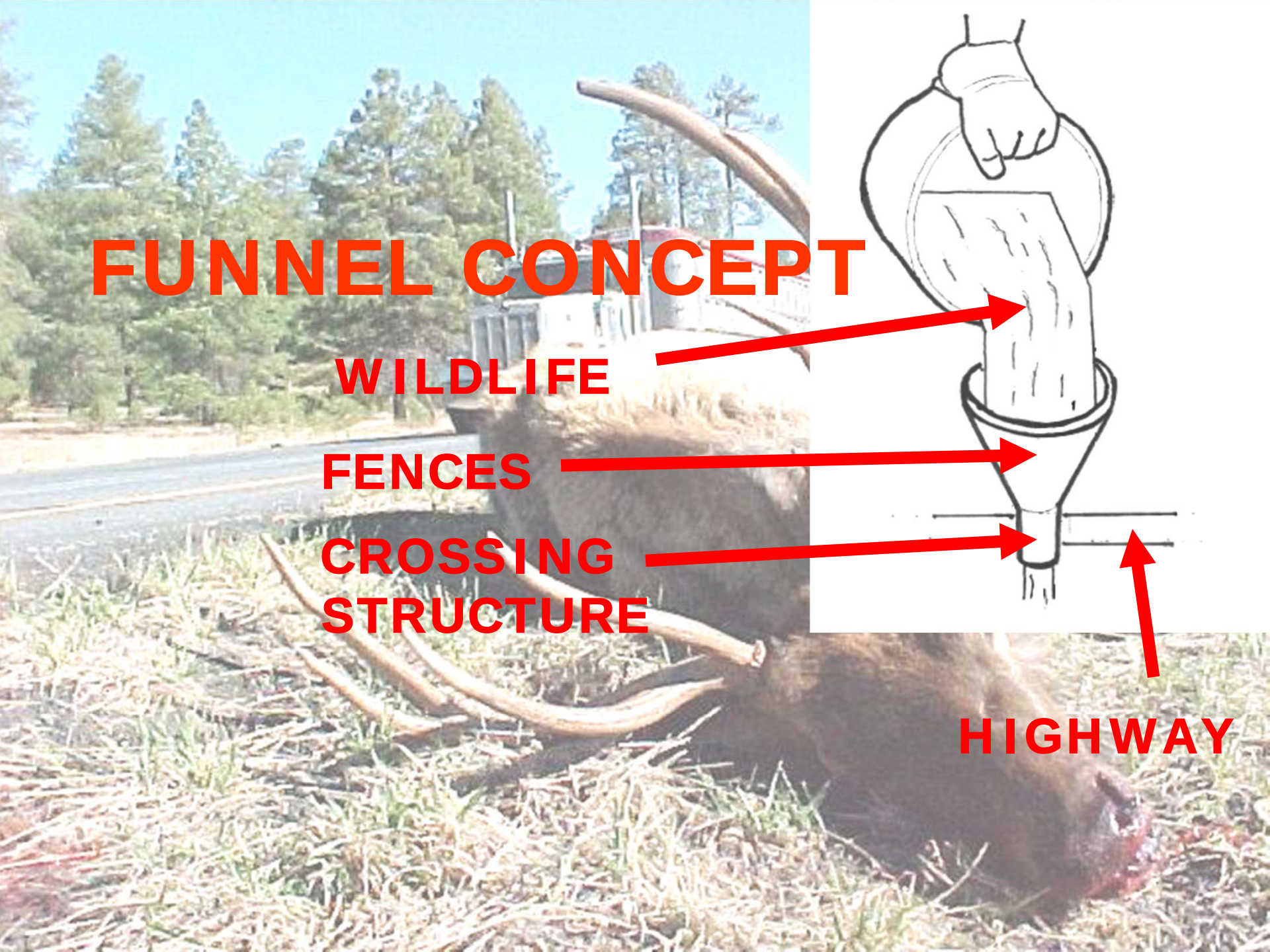
Influence of Traffic Levels on Elk - Highway and Wildlife Underpass Crossings

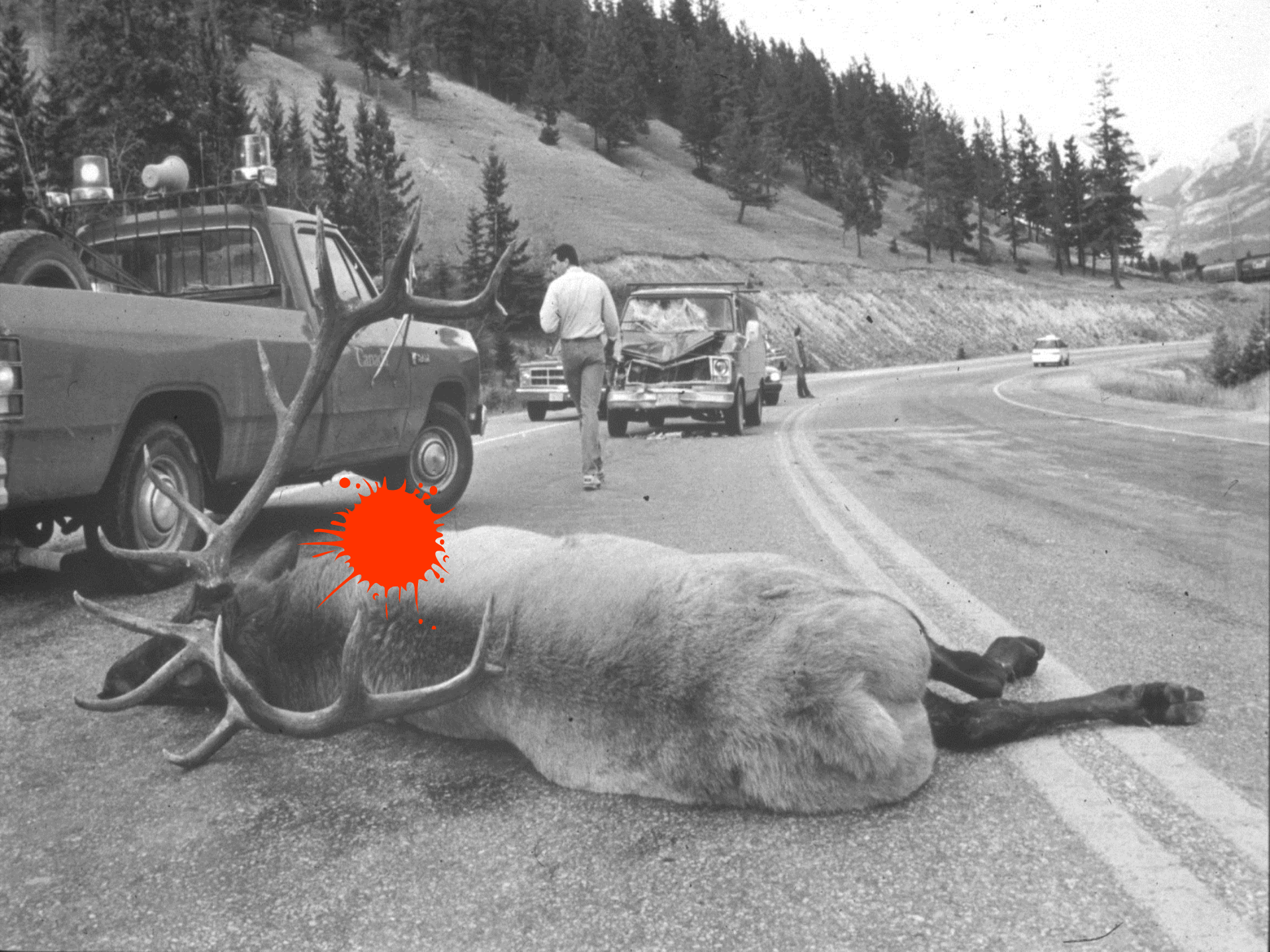


Attributes of a Successful Wildlife Crossing Structures

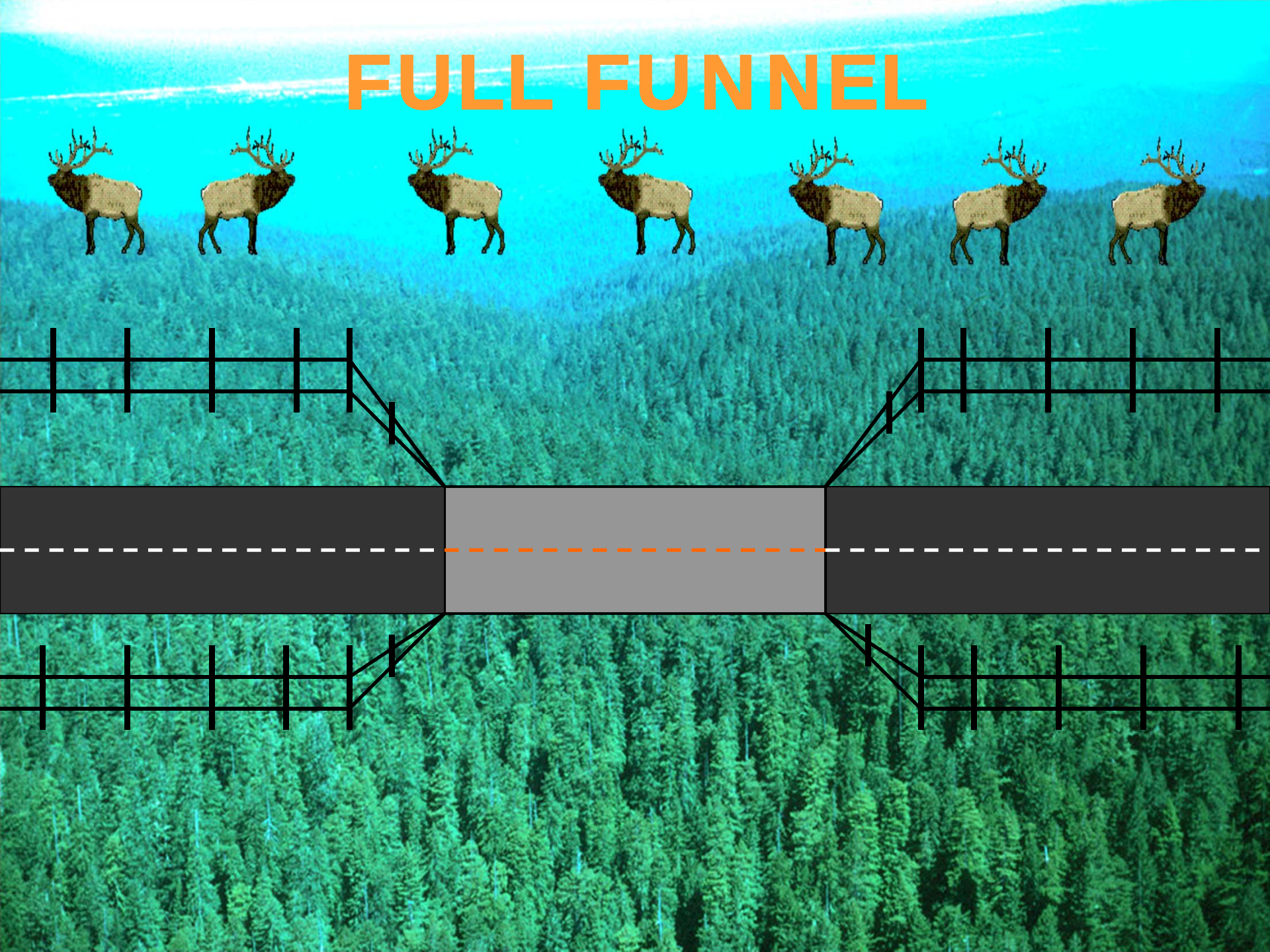
- **Placement**
- **Design – Species Specific**
- **Fencing – MOST IMPORTANT!**

FUNNEL CONCEPT

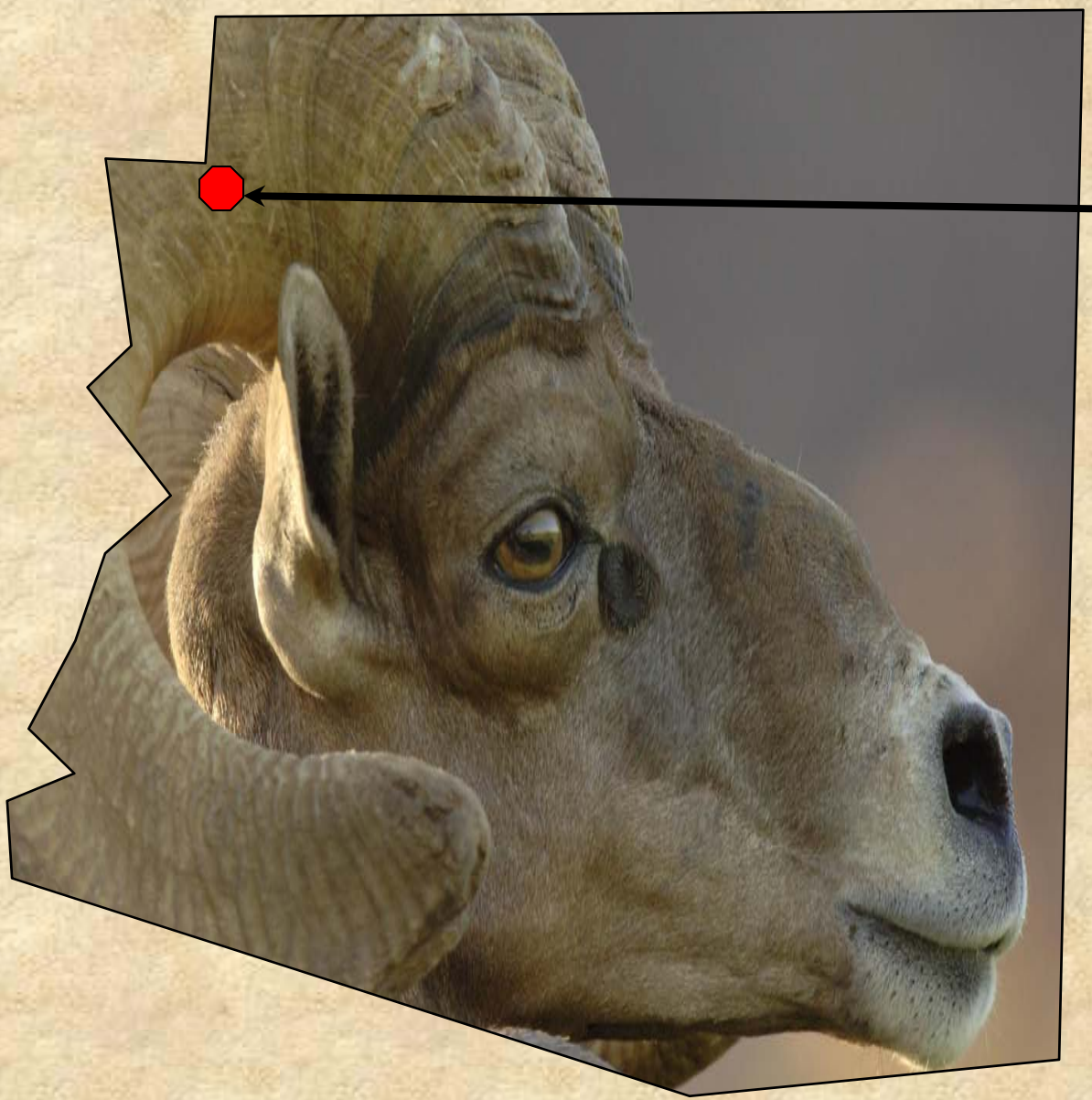




FULL FUNNEL



US Highway 93 Project



US Highway 93

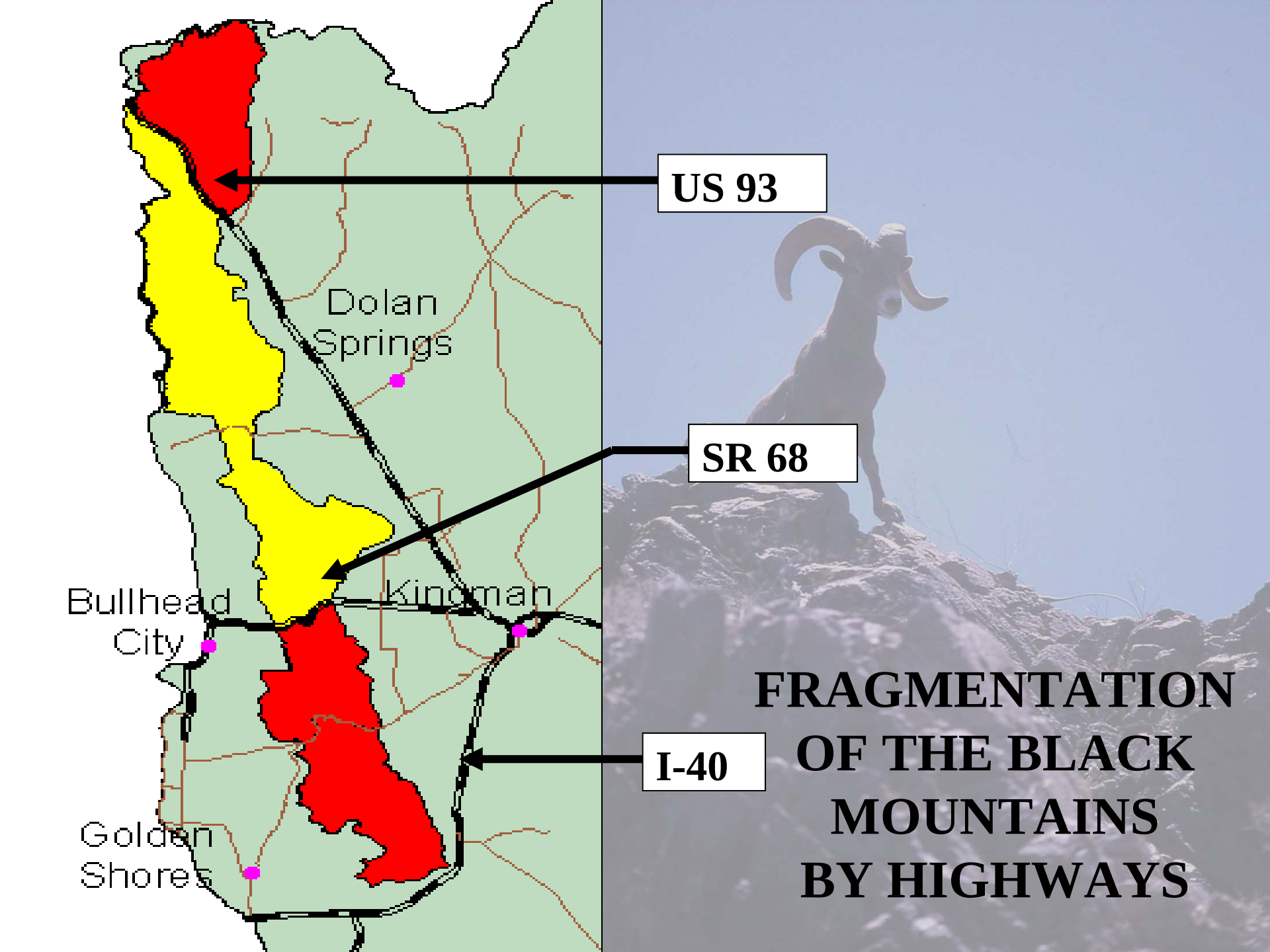
Project Location

Attributes of a Successful Wildlife Crossing Structures

- **Placement**
- **Design – Species Specific**
- **Fencing – MOST IMPORTANT!**

U.S. HIGHWAY 93

- **Main transportation corridor between Phoenix and Las Vegas, NV and a designated leg of CANAMEX Trade Corridor**
- **Average annual daily traffic volume:**
  - **9,300 in 1997**
  - **16,400 in 2014**
- **Reconstructed from a 2-lane to 4-lane divided highway to address traffic congestion**
- **Bisects Black Mountains desert bighorn sheep range**

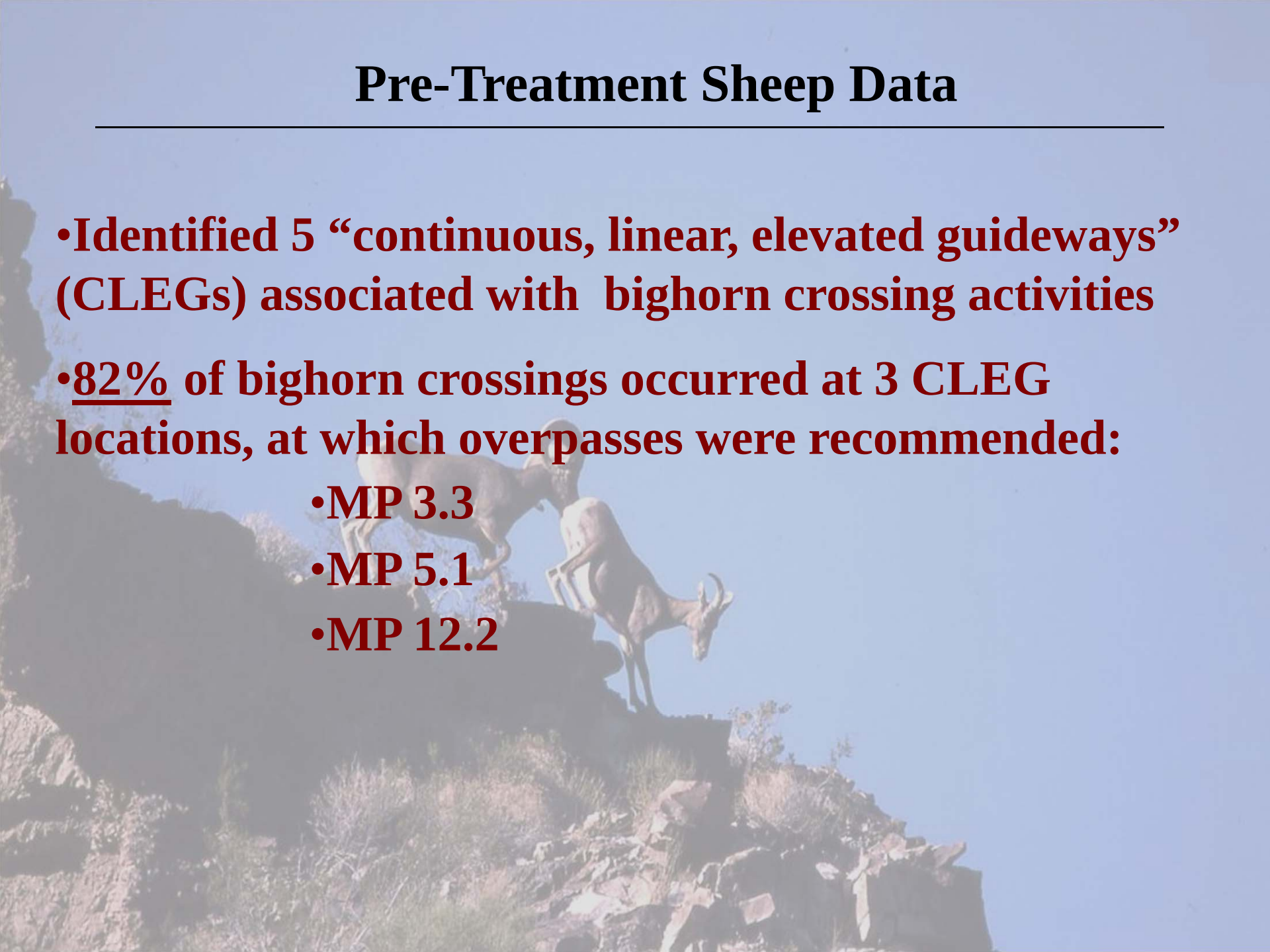

US 93
Dolan Springs
SR 68
Bullhead City
Kingman
I-40
Golden Shores
FRAGMENTATION OF THE BLACK MOUNTAINS BY HIGHWAYS

BLACK MOUNTAINS DESERT BIGHORN SHEEP POPULATION

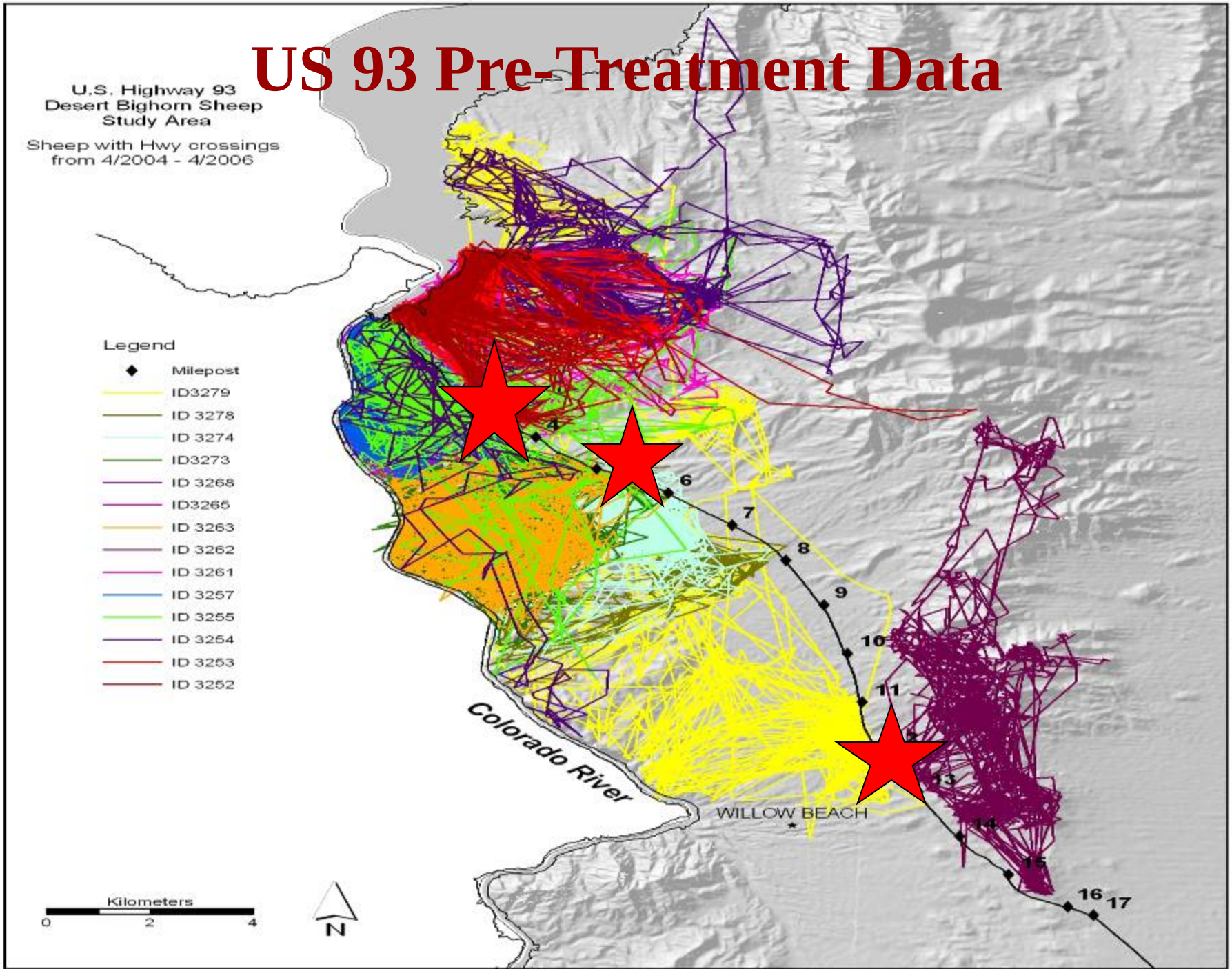
- State's largest bighorn sheep population (of 32 identified statewide) with 1,500-2,000 animals
- Accounts for >30% of state's total bighorn sheep
- Contributes to substantial recreational and economic benefit and has yielded numerous transplants
- Was a concern throughout the U.S. Highway 93 planning process
- Approximately 11 sheep-vehicle collisions/year

Pre-Treatment Sheep Data

- Identified 5 “continuous, linear, elevated guideways” (CLEGs) associated with bighorn crossing activities
- 82% of bighorn crossings occurred at 3 CLEG locations, at which overpasses were recommended:
  - MP 3.3
  - MP 5.1
  - MP 12.2



US 93 Pre-Treatment Data



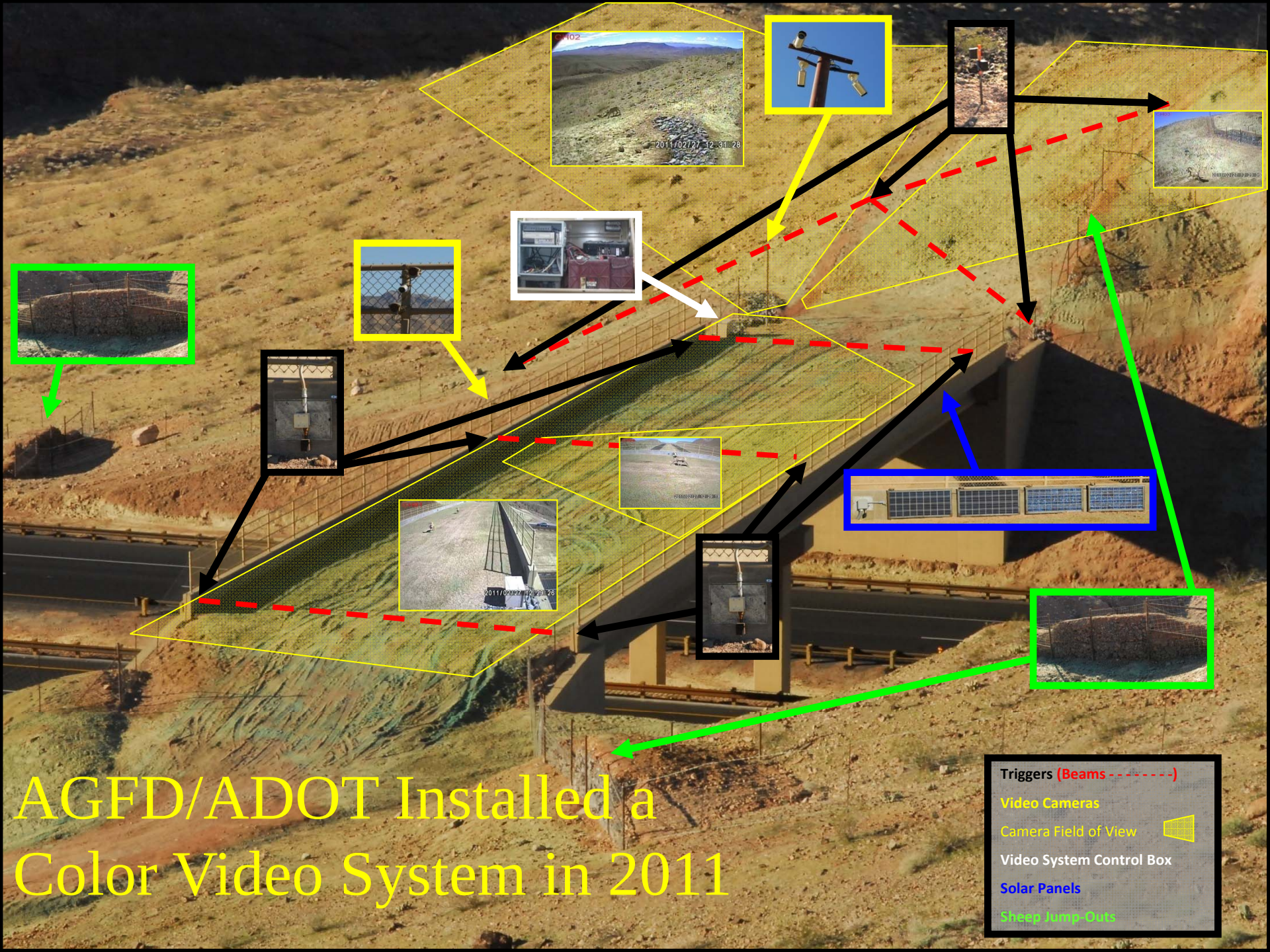
SR 68 – Sheep Underpasses

SR 68 – Sheep Underpasses

Underpasses Marginal – Only Two of Three Used By Bighorn Sheep and No Ewes Documented.

Led to Recommendations for Overpasses

Construction Completed 2010-11

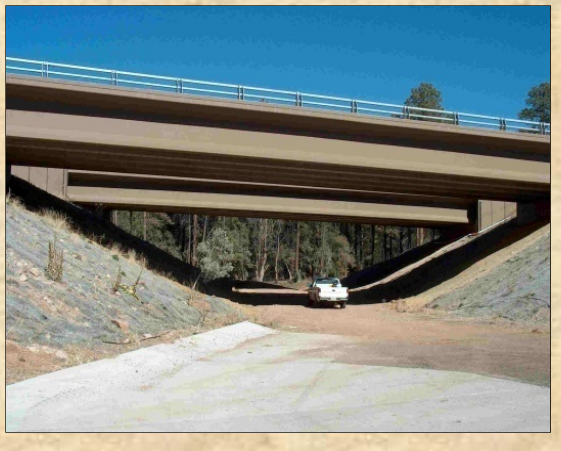

AGFD/ADOT Installed a
Color Video System in 2011
Triggers (Beams - - - - - - - -)
Video Cameras
Camera Field of View
Video System Control Box
Solar Panels
Sheep Jump-Outs


CH02
2011/02/01 08:12:17


2012/06/02 08:04:11


2015-03-06 07:57:02 M 3/5 44°F
>5000 Sheep Crossings!!!
Collisions Reduced by >85%
estimated savings of $470,000 from collision reductions
US93 OP2
RECONYX

Wildlife Crossings and Fencing Work….

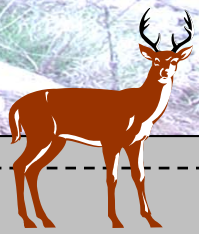


Why Even Consider Other Options?

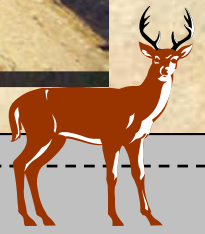
SAFETEA-LU

Retrofitting Existing Structures

Along I-17



85 Elk/Year Have Been Killed By Vehicles Since 2007 On I-17 Alone!!

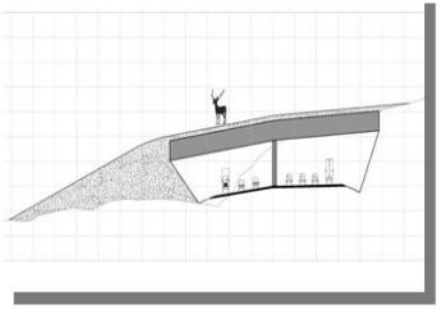


Prepared for:
Arizona Department of Transportation
Intermodal Transportation Division
Roadway Engineering Group
Predesign Section

Prepared by:
Stanley Consultants, Inc.
1661 E. Camelback Road, Suite 400
Phoenix, Arizona 85016

Stanley Consultants INC.

WILDLIFE ACCIDENT REDUCTION REPORT

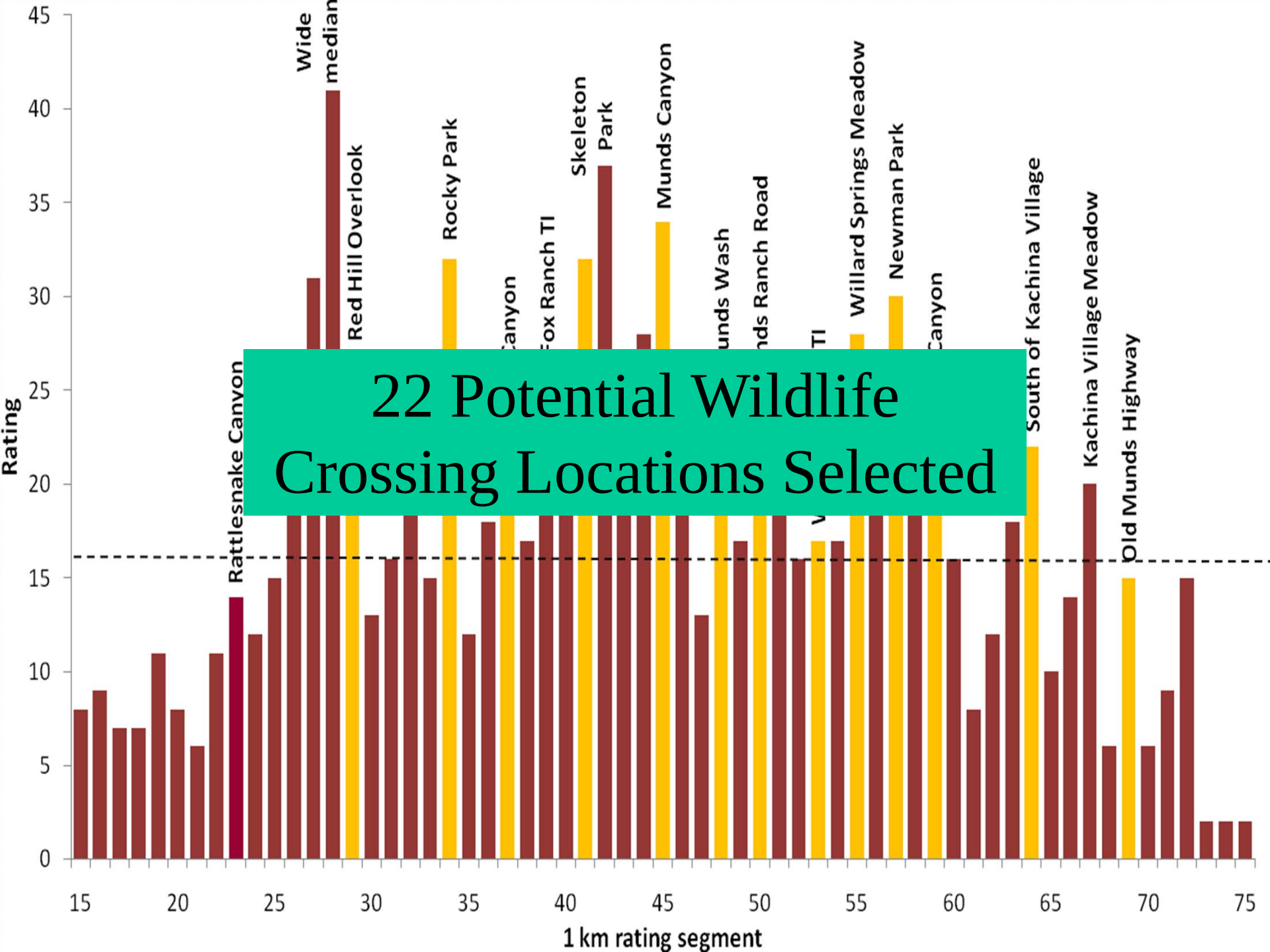


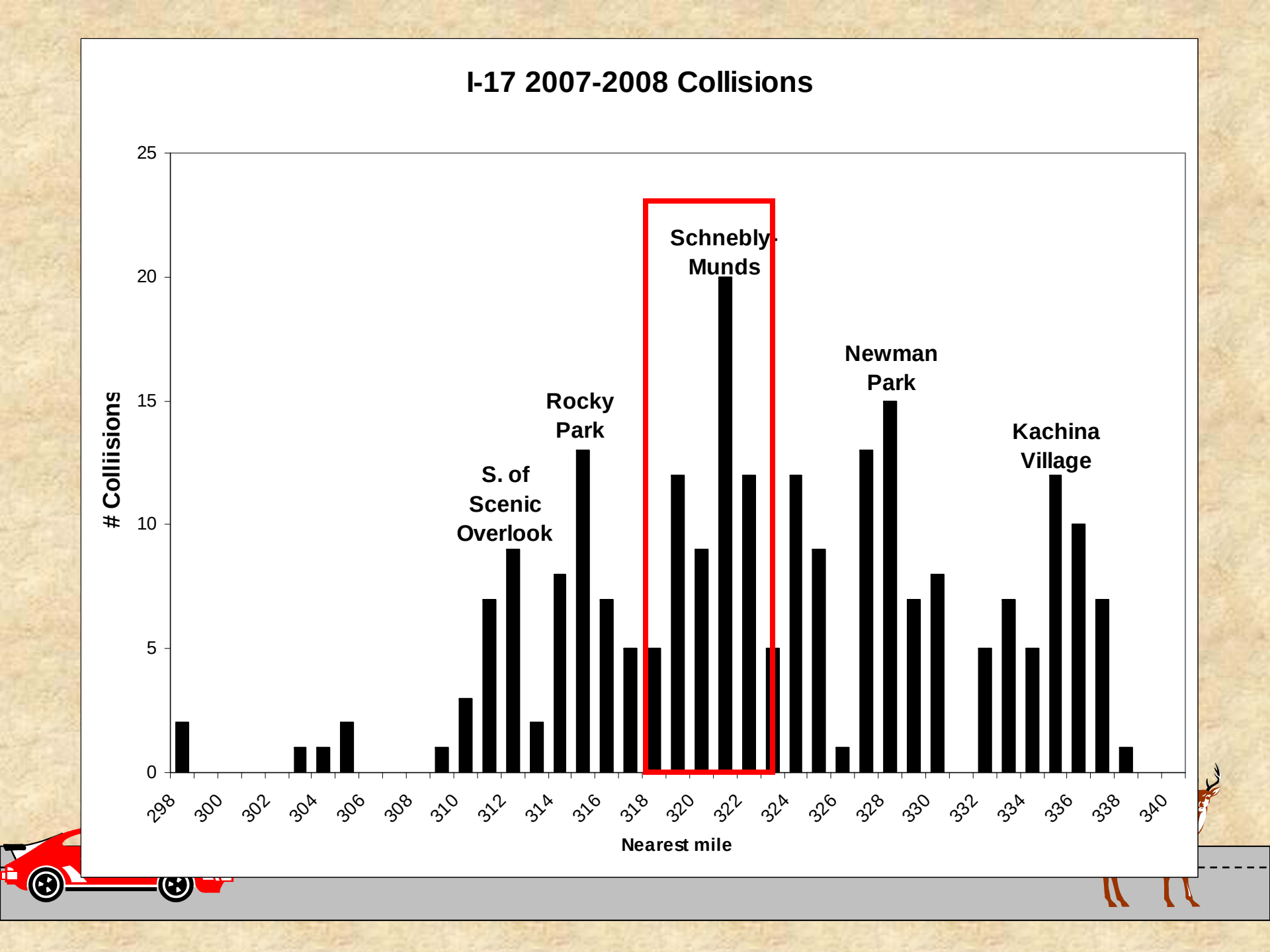
I-17, Jct. SR 179 to I-40 MP 298.5-340.0

ADOT Project No. 17 YV 298 H6960 01L
Federal Project No. NH-017-B(AUC)

Cordes Junction – Flagstaff Highway

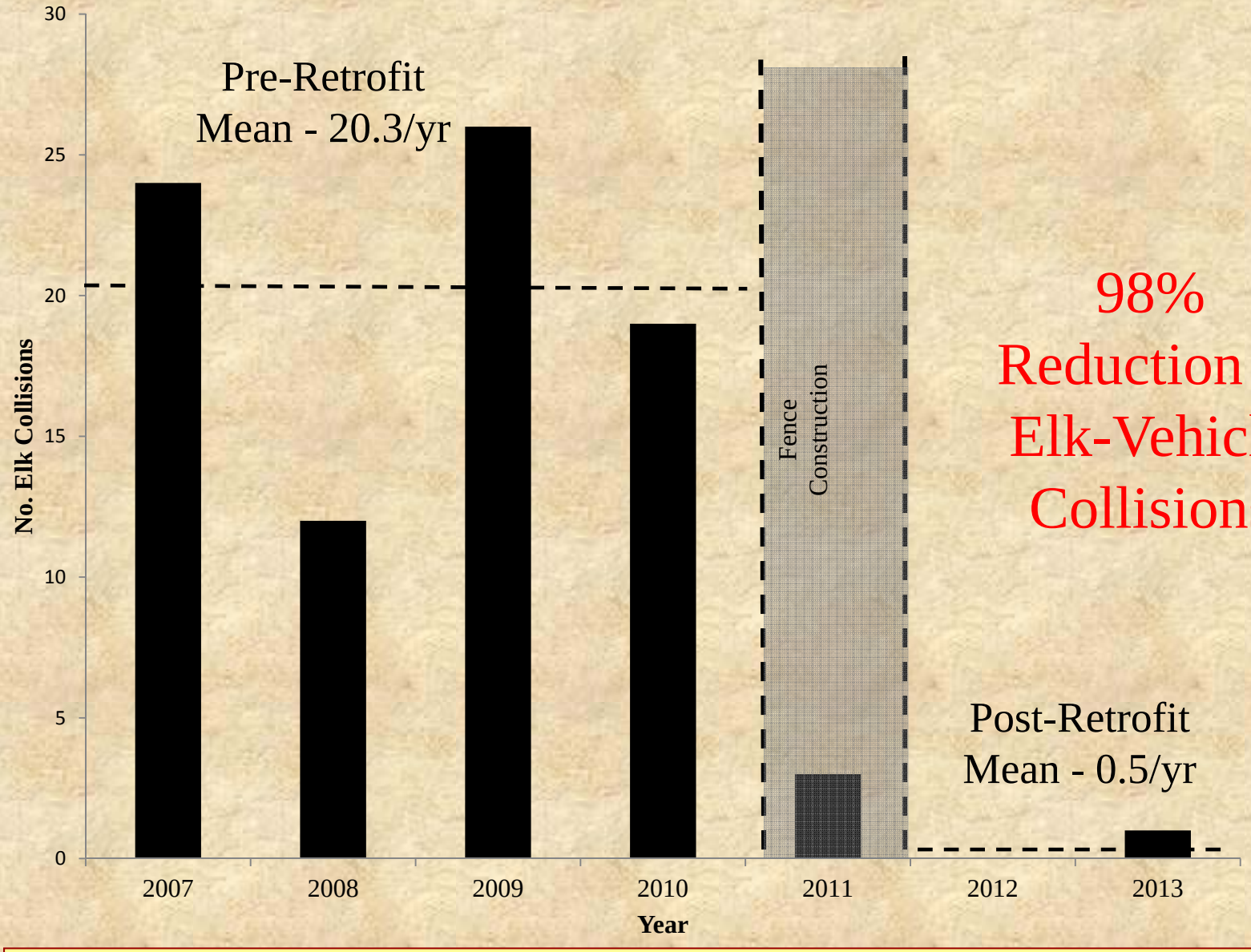
December 2011


22 Potential Wildlife Crossing Locations Selected
Rating
1 km rating segment
Wide median
Red Hill Overlook
Rocky Park
Skeleton Park
Munds Canyon
Willard Springs Meadow
Newman Park
South of Kachina Village
Kachina Village Meadow
Old Munds Highway
Rattlesnake Canyon


I-17 2007-2008 Collisions
Collisions
25
20
15
10
5
0
298
300
302
304
306
308
310
312
314
316
318
320
322
324
326
328
330
332
334
336
338
340
Nearest mile
S. of Scenic Overlook
Rocky Park
Schnebly-Munds
Newman Park
Kachina Village

Munds Canyon Bridge

Woods Canyon Bridge



98% Reduction in Elk-Vehicle Collisions

~$1.67 million in fencing/retrofit costs

Projected cost-savings from collision reductions is $1.84 million by the end of 2016

Use of Bridges by Elk and Deer

133%
Increase

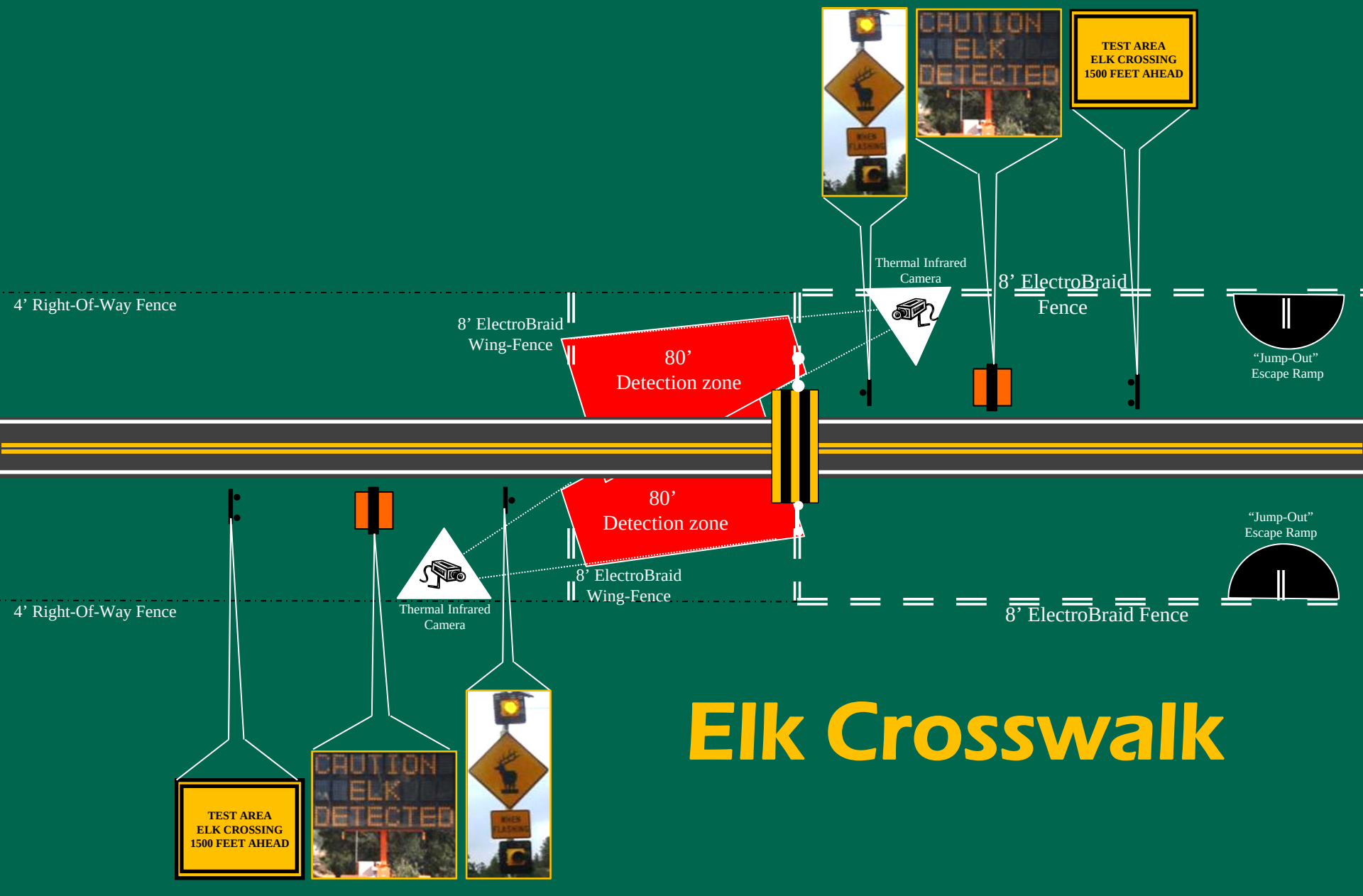
100%
Increase


2010-11-28 11:55:58 PM M 11/30 21°F
ARIZONA GAME & FISH
WWW.RECONYX.COM


2010-11-23 8:33:43 AM M 13/30 18°F
ARIZONA GAME & FISH WWW.RECONYX.COM

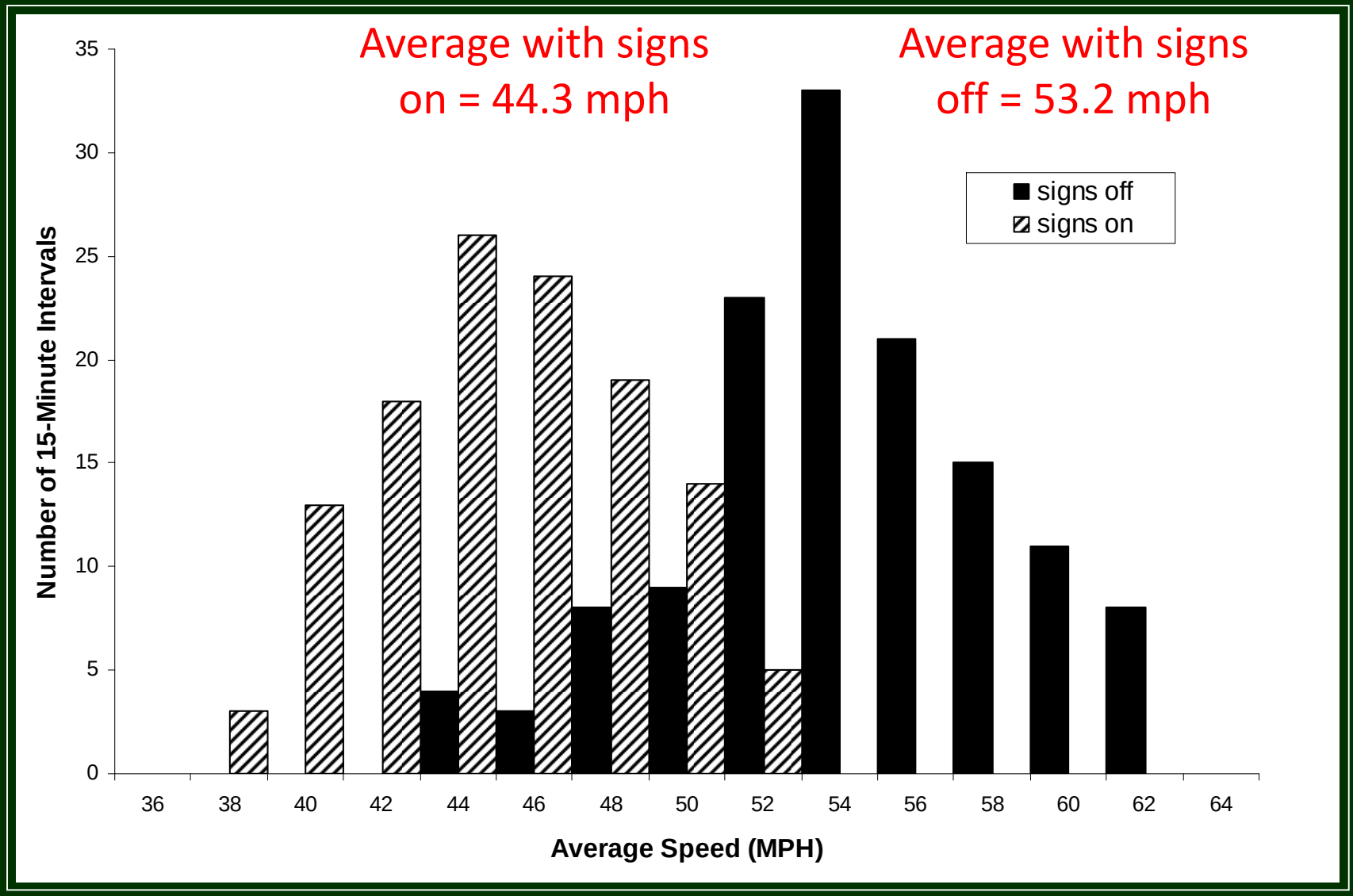

ZONA GAME & FISH
WWW.RECONYX.COM

PREACHER CANYON ENHANCEMENT PROJECT

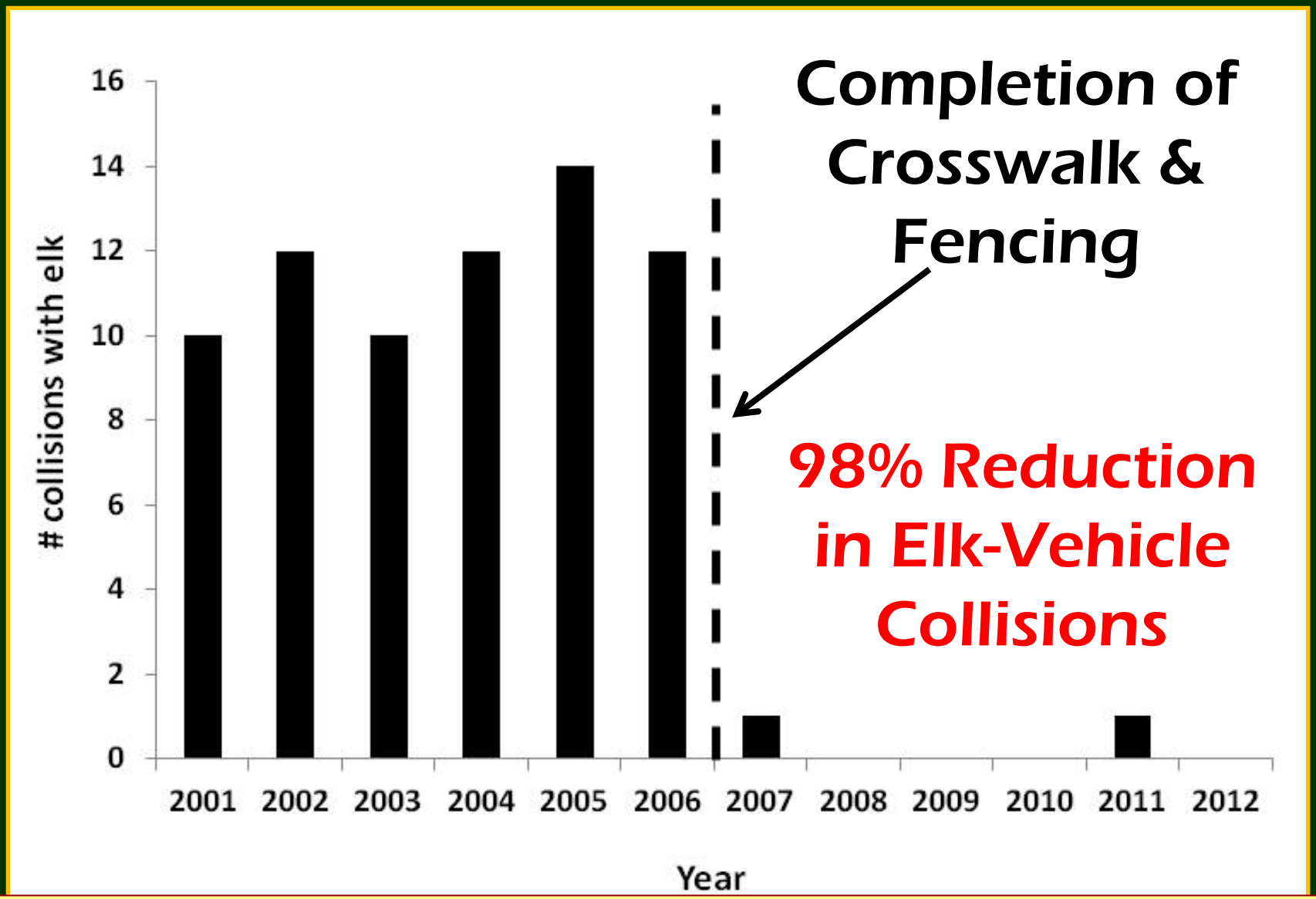


Elk Crosswalk

MOTORIST RESPONSE TO SIGNAGE - SPEED



An 11 MPH reduction in average speed occurred when signs were activated



Original grant of $750,000

Cost-savings from collision reductions covered this investment by the end of 2010

Cost-savings total ~ $1.7 million by the end of 2014

Saving $$

2003 - Booth VS State of Arizona =

$4,000,000!

2012 - Sayer VS State of Arizona =

$8,000,000!

Trial Highlighted Collaboration between ADOT and AGFD Throughout AZ

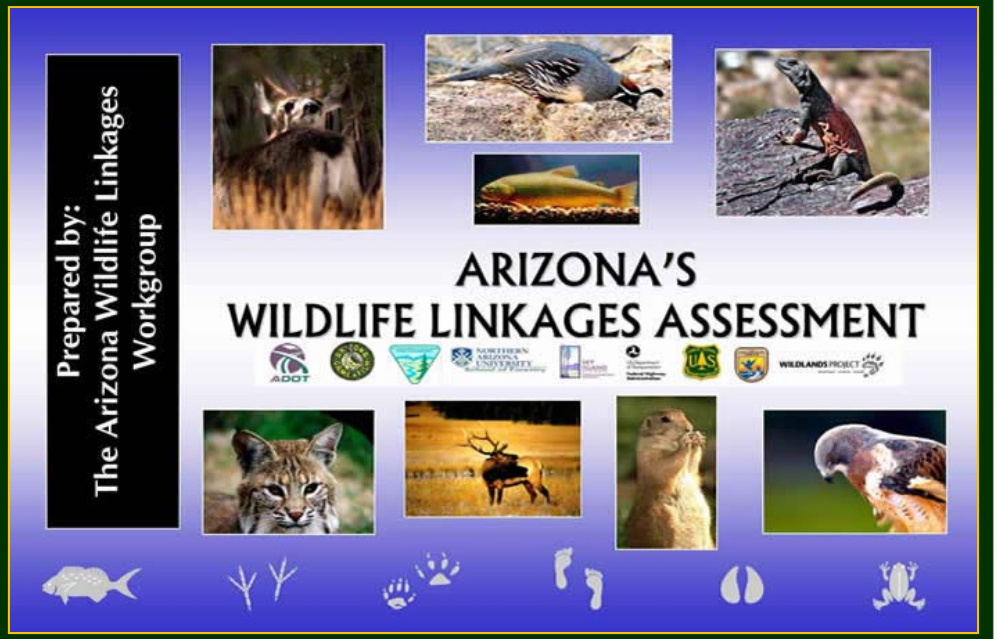
Saving $$

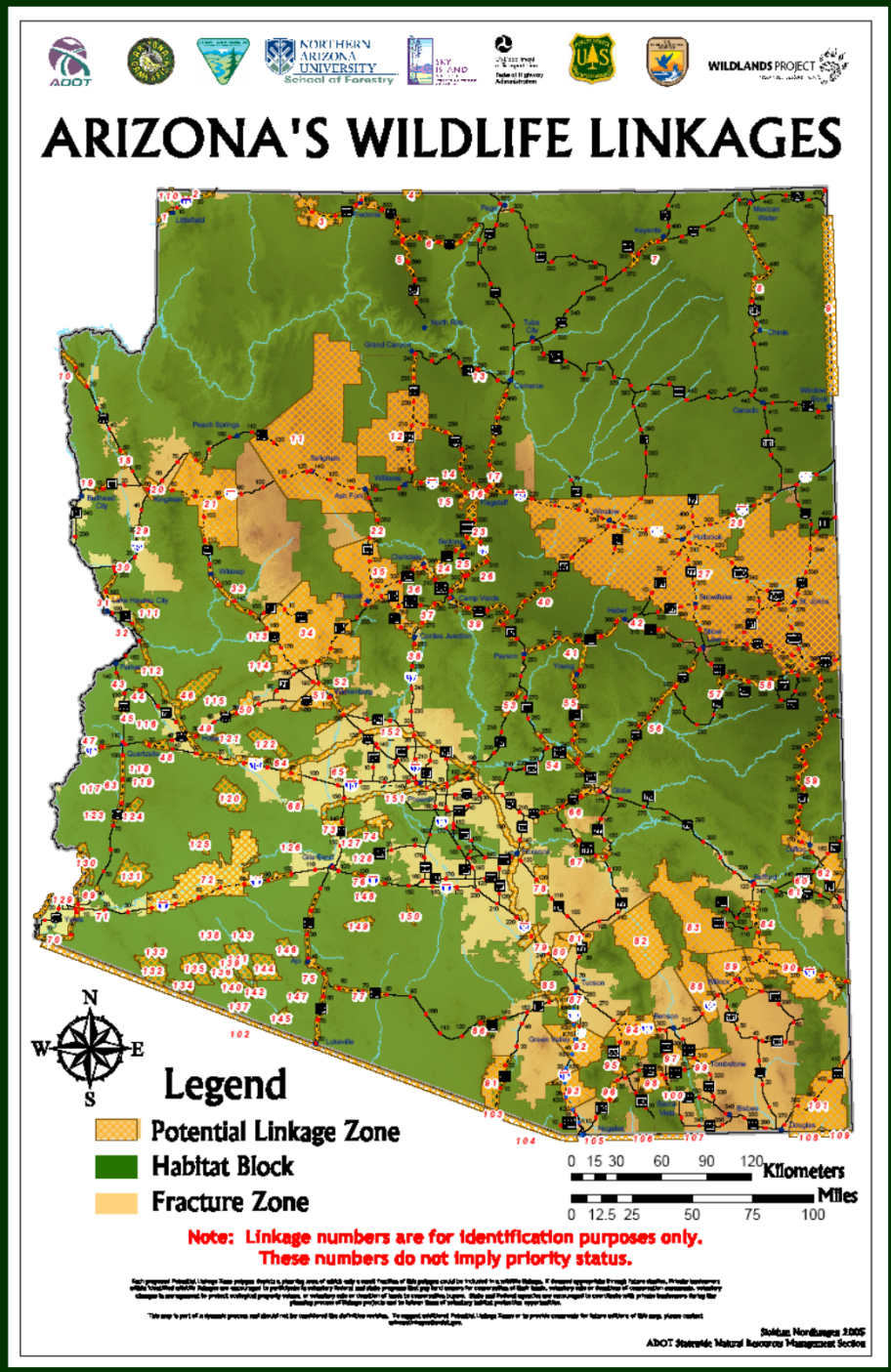
Proactive Compliance with USFWS

- **Mitigation can avert species listings**
- **ADOT Participation in Candidate Conservation Agreements (CCAs) substantially influences species listing decisions**
- **Participation in a CCA precludes project overhauls in response to a species status change**

DEFINE AREAS OF CONNECTIVITY

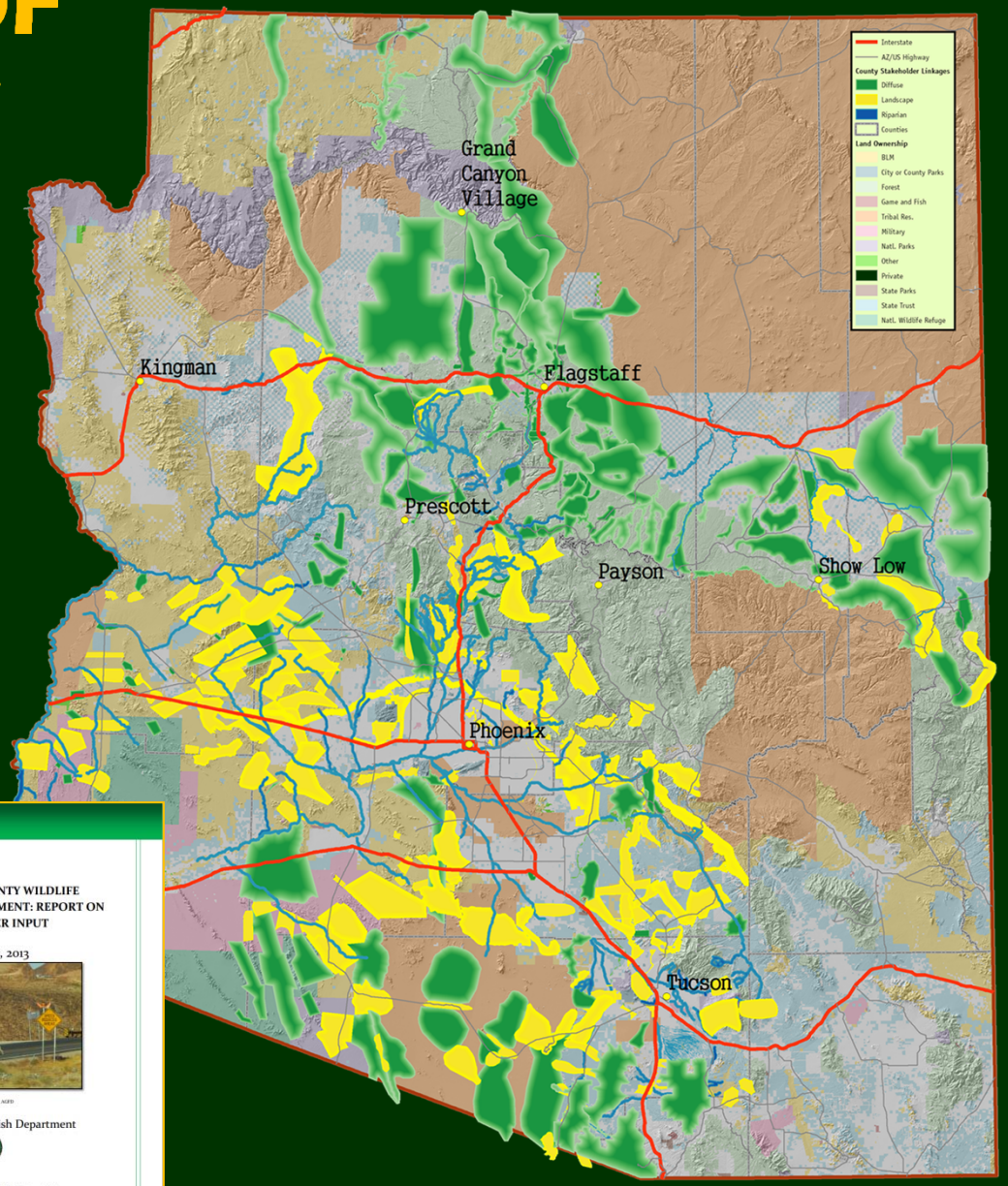
WLWG
Statewide Map
December 2006





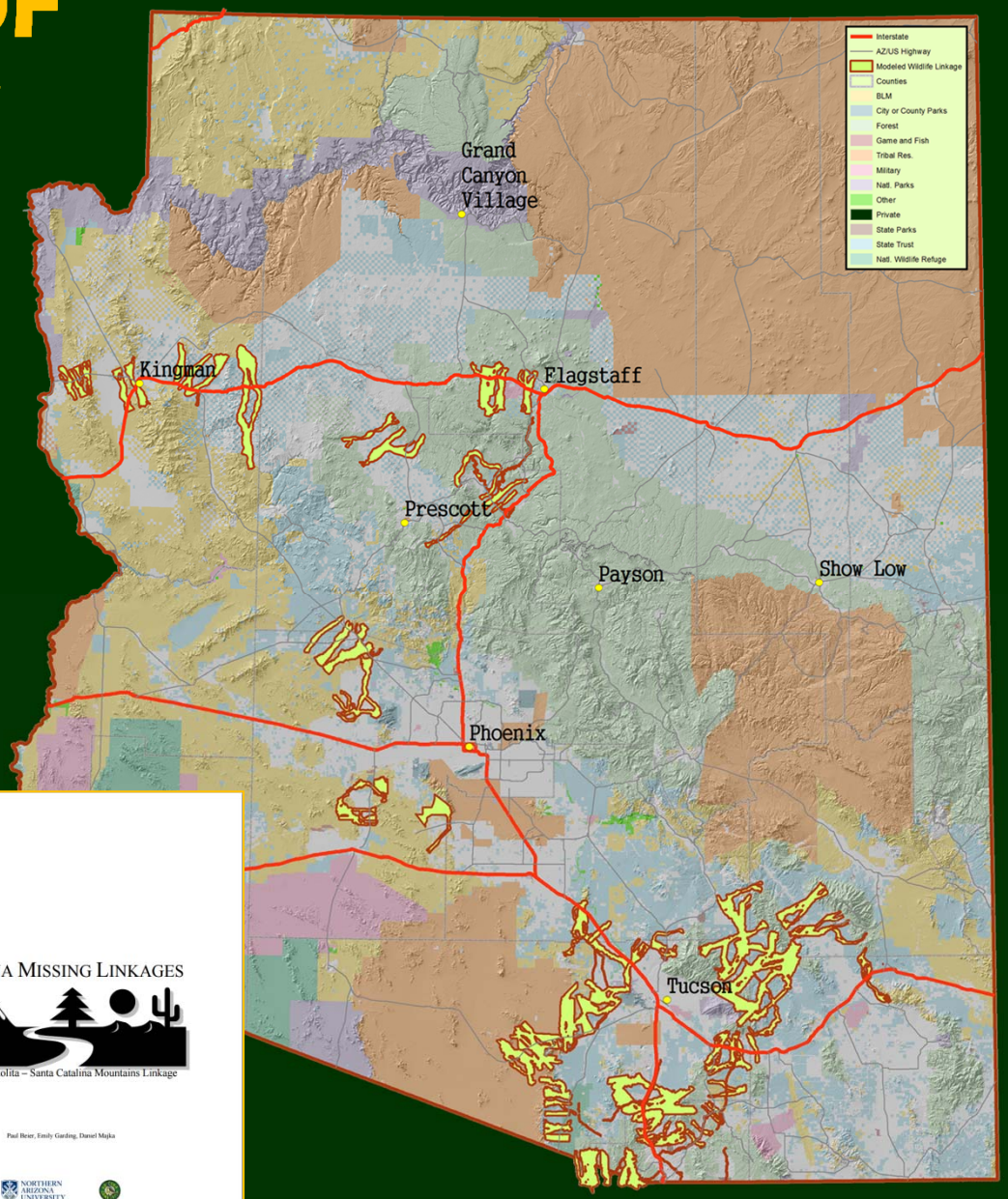
DEFINE AREAS OF CONNECTIVITY

County Level Stakeholder Reports



DEFINE AREAS OF CONNECTIVITY

Missing Linkages: Modeled Corridors



Continued Coordination Opportunities

- Upcoming ADOT/AGFD Coordination Meeting (October 2015)
- 2014 AZ Strategic Highway Safety Plan
- South Mountain Freeway (Loop 202)
- Future I-11 Corridor
- Right-of-Way Fencing Guidelines
- Additional Projects……

MAP-21

SEC. 1108. SURFACE TRANSPORTATION PROGRAM.

"…projects to mitigate hazards caused by wildlife"

SEC. 1112. HIGHWAY SAFETY IMPROVEMENT PROGRAM.

"…measures to eliminate or reduce crashes involving vehicles and wildli

Wildlife Concerns Need Funding Too

SEC. 111

"….improve public safety and reduce vehicle-caused wildlife mortality while maintaining habitat connectivity"

SEC. 1122. TRANSPORTATION ALTERNATIVES.

"….reduce vehicle-caused wildlife mortality or to restore and maintain connectivity among terrestrial or aquatic habitats."

Arizona is a Worldwide Leader

2003, 2006, and 2011 FHWA Exemplary Ecosystem Initiative Award

2003 Marvin M. Black Cooperators Award

2008, 2009, 2012 NAEP Awards

2014 Transportation Partnering Excellence Award

Hosted the 2013 ICOET Conference (21 Countries)

Other States and Countries Seek Guidance From AZ

Questions?