HIP BONE CONNECTED TO THE THIGH BONE

Ray Schweinsburg
Research Program Supervisor
Arizona Game and Fish Department
WHY ARE ROADWAY ECOLOGY AND CONNECTIVITY IMPORTANT?
BECAUSE OF INCREASED HUMAN POPULATION

2000

2030

2050

17,000,000 in AZ

17,000,000 in AZ
URBAN SPRAWL
AGRICULTURE & FARMING
ALL OF THESE FACTORS IMPACT WILDLIFE
DIRECT IMPACTS OF ROADWAYS AND HUMAN POPULATION GROWTH ON WILDLIFE

• Loss of Permeability and Habitat Fragmentation
• Mortality from Vehicle Collisions and Conflict with Humans
• Loss and Alteration of Habitat
PERMEABILITY

• FREE MOVEMENT - The landscape’s ability to allow an animal’s free movement to all parts of its range

• HIGHWAY FILTERS - Different species have different tolerances to highways/developed areas, so highways act as ‘filters’ that change an area’s species mix
WHY IS HABITAT FRAGMENTATION IMPORTANT?

• LEADS TO ANIMAL POPULATION DECLINES AND EXTINCTION
  Globally 3,000 species/year being lost
• OTHER COSTS TO SOCIETY
  Lost wildlife
  Unhealthy ecosystems

DIRECT LOSS OF WILDLIFE

- Estimated 1 million vertebrates/day die in vehicle collisions

- In U. S. more animals killed by vehicle collision than in any other way

DIRECT ECONOMIC IMPACTS

- Human death, injury, property loss – Billions/Year
- 5% of wildlife/vehicle collisions result in human injury
- 0.2% result in human death
LOSS OF HABITAT

- An estimated area the size of Georgia is under pavement in U.S.
- "Road Effect" Zone - 15-20 times size of paved ROW
- 48 acres lost with every mile of Interstate
- 4 million miles of roadways in US
Now that we know some of the potential impacts of development....

What can we do about it???
AGFD/ ADOT RESEARCH
Current Development Related
AZ Game and Fish Research Projects

- SR 260 Crossing Structures, Fencing, and Automated Crosswalk Studies
- SR’s 93 and 68 Bighorn Sheep Crossing Studies
- I-17 and SR 64 Elk and Deer Crossing Studies
- SR 89 Pronghorn Crossing Studies
- Mountain Lions in Prescott, Payson and Tucson Area Studies
- Cactus Ferruginous Pygmy-owl Crossing Studies
- Flat-tailed Horned Lizard Culvert Study
- Statewide Wildlife Linkages Assessment
- Sun Valley Wildlife Corridor Study
- Road Kill “Hot Spot” Definition Studies
  - Camino de Manana
  - SDCP Connectivity Areas
FUNNEL CONCEPT

WILDLIFE

FENCES

CROSSING STRUCTURE

HIGHWAY
FENCING AND FENCING ALTERNATIVES
ELK CROSSINGS BY HIGHWAY SEGMENT (Highway 260)

3,057 crossings

Crossing frequency distribution not random
(Kolomogorov-Smirnov test $d = 0.01$ $P < 0.001$)

Mean crossings/segment (16.4)
Highway reconstruction completed December 2003
Reconstructed highway opened to traffic July 2004
Ungulate-proof fencing completed December 2004
Sign Treatment
US 93
DESERT BIGHORN SHEEP STUDY

Photo courtesy of George Andreiko
Black Mountains Bighorn Herd

- Largest desert bighorn sheep herd in Arizona
- Important source for transplants throughout the SW US
- Population decline of 54% between 2001 and 2004
U.S. Highway 93
Desert Bighorn Sheep
Study Area
Sheep without Hwy Crossings

Legend
- Milepost
- ID 3308
- ID 3307
- ID 3306
- ID 3305
- ID 3304
- ID 3303
- ID 3281
- ID 3277
- ID 3276
- ID 3267
- ID 3270
- ID 3272
- ID 3271
- ID 3269
- ID 3266
- ID 3264
- IU 3260
- ID 3259
- ID 3258
- ID 3256

Kilometers
0 2 4
N
RESULTS – COLLAR DATA

Bighorn cross at predictable locations; 99 of 113 crossings occurred within 5 areas:

- 60 between MP 2.8 to 3.5
- 22 between MP 4.8 to 5.5
- 6 between MP 7.5 to 8.0
- 7 between MP 11 to 11.8
- 4 between MP 14 to 15.4
AREA FOR BIGHORN CROSSING STRUCTURE
US 89 Pronghorn Antelope Study
Pronghorn Projects in Arizona from 1983 - 2005
Mountain Lion Movements in NW Tucson (Aug 2005 – late March 2006)
Use of Highway Underpass Crossing Structures by the Flat-tailed Horned Lizard (Phrynosoma mcallii)
RESULTS

Used all but the small lighted culverts
ROAD KILL STUDIES
During 34 days of surveys approximately 2,540 animals were found dead along the 20 miles of roadway. Amphibians made up the majority of the dead wildlife (55%), followed by Reptiles (26%), Mammals (14%), and Birds (5%).

The Ajo Way road segment had the greatest number of road killed wildlife.
The number of Amphibians (A), Reptiles (B), Birds (C), and Mammals (D) found dead along 2/10-mile segments of a five mile section of Ajo Way, in southern Arizona, 2004.
Research / Information Needs

Determine which type of culverts pass which type of wildlife species

- Testing experimentally multiple culvert designs
- Observational study of existing culverts

Size, Openness factor, Lighting, Moisture, Temperature, Noise, Substrate, Approaches ????
Wildlife Crossing Types

- Bridge Under Open Span
- Bridge Under Vertical Abutment
- Bridge Over
- Box Culvert
- Corrugated Metal Pipe Arch (CMPA)
- Corrugated Metal Pipe (CMP)
CHALLENGES FOR CROSSING STRUCTURE DESIGN

- ALLOW MOVEMENT FOR THE MAXIMUM NUMBER OF SPECIES WHILE ENHANCING HIGHWAY SAFETY

- SPECIAL CONSIDERATIONS
  - DESERT TORTOISE
  - PRONGHORN ANTELOPE
  - FLAT TAILED HORNED LIZARD
  - CACTUS FERRUGINOUS PYGMY OWL
DON’T FORGET THE BIG GUYS
Or the Limited Mobility Species
Determine what type of fencing/funneling material and escape structures are best suited for small animals.
Identify the major wildlife crossing areas within roadways identified on the Wildlife Priority Corridors List (i.e., where to place crossing structures)
Determine the necessary corridor width needed to pass wildlife safely to and from roadway wildlife crossings.
Does the land use (i.e., degree of urbanization) on either side of the roadway determine the type of wildlife species and therefore crossing structures needed?

Does a threshold of no concern exist?
DEFINE AREAS OF CONNECTIVITY

Wildlife Linkages
Work Group
Statewide Map
December 2006
Goal: Define area with lowest relative cost of travel for focal species between protected core areas.

DESERT SPACES – An Open Space Plan for Maricopa Association of Governments

While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments (MAG) disclaims liability for errors and omissions.

The Way We Worked

in the PAST
Why Engineers Need Biologists
Why Biologists Need Engineers
ECOLOGICAL ← COMMON DATA USED FOR 2 VERY DIFFERENT PURPOSES → SAFETY

ECOLOGISTS REALM

ENGINEERS REALM

NCHRP 25-27 FY04 INTERGRATED PROJECT

FIGURE 1: VISION FOR THE NCHRP 25-27 FY04 INTERGRATED PROJECT
THE END