A DECADE OF ARIZONA WILDLIFE-HIGHWAY RESEARCH: A SYNTHESIS OF WHAT WE'VE LEARNED

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ABSTRACT

Over the past decade, the Arizona Game and Fish Department has conducted intensive wildlife-highway interactions research along 8 highways across northern Arizona, cooperatively conducted and funded by the Arizona Department of Transportation (ADOT). This research has been (and continues to be) conducted under rigorous before-after-control experimental designs with consistent methodologies to allow comparison of highway permeability and wildlife-vehicle collision (WVC) patterns across highways and wildlife species. For 4 highways, data has been collected on the effectiveness of wildlife passage structures and fencing, while GPS telemetry movement assessments and WVC data for 6 highways have been used in data-driven development of strategies to promote permeability and to reduce WVC. This research has contributed to our collective understanding of road ecology relationships with far-reaching implications, as well as fostering new and cost-effective technologies for wide application.

Passage Structure Effectiveness: Our research underscored the effectiveness of passage structures in promoting wildlife passage across highways. Over 8 years of State Route 260 research, we recorded >15,000 animals (11 species) crossing through 6 underpasses, with a mean passage rate of 0.66 crossing/approach. While confirming the importance of structural and placement characteristics, we noted continual animal habituation over the length of monitoring. We found that funnel fencing was critical to underpass effectiveness; before fence passage rates averaged 0.12 crossings/approach compared to 0.56 after fencing. Toward understanding why underpasses work, we found that increasing traffic volume had minimal affect on below-grade ungulate passage rates versus the strong influence of traffic when crossing at grade. Underpasses and fencing improved highway permeability for elk by 58% and 533% for white-tailed deer; ungulate WVC incidence was reduced 84−97% following reconstruction.

Underpass Spacing: Our research provided empirical validation of theretofore theoretical recommendations for passage structure spacing. We compared elk GPS-determined highway passage rates (0.1−0.8 crossings/approach) among 3 phased SR 260 reconstruction sections with average underpass spacing of 1.0−2.7 km, and found a strong negative association (r = -0.986). The mean passage rate (0.44 crossings/approach) was attained at 1.6 km spacing.

(Revised November 2, 2012)

Traffic Relationships: The 8 highways on which we conducted intensive GPS-telemetry studies for 5 ungulate species ranged in AADT from 1,240 to 20,650 vehicles/day; automatic traffic counters were installed on each highway and bi-hourly data was linked to GPS data. Our research informed heretofore theoretical models of traffic impact to wildlife. Across 5 highways, we found a negative association between elk permeability and traffic (r = -0.870), with a threshold at 10,000 vehicles/day. The probability of elk occurring within 100 m of highways was inversely associated with traffic (r = -0.990), and above 10,000 vehicles/day, avoidance was nearly permanent. Across 8 highways for all 5 species, the association between AADT and passage rates was relatively weak (r = -0.448). However, recognizing a mix of nocturnal and diurnal species, we compared "active period" passages rates (when >90% of attempted crossings occurred) to traffic and that association was very strong (r = -0.894). An apparent permeability threshold for all species occurred at 5−6,000 vehicles/day, lower than for elk alone, owing to the traffic-sensitive nature of diurnal species.

BIOGRAPHICAL SKETCHES

Norris Dodd just recently filled a new Wildlife Connectivity Program Coordinator position with Arizona Department of Transportation's Environmental Services, where he will be coordinating statewide connectivity planning and integration into ADOT projects. Prior to that, Norris was employed by AZTEC Engineering as a senior natural resource specialist where he focused on planning and implementation of innovative strategies to resolve wildlife-highway conflicts with ADOT and other partners. He retired from the Arizona Game and Fish Department in 2008 after 29 years; as a wildlife research biologist his last 10 years with the Department, his research focused on wildlife relationships to highways across northern Arizona and helped raise recognition of the ability to meet both transportation and ecological objectives with highway construction. He received B.S. and M.S. degrees from Arizona State University, and is a past president of The Wildlife Society Arizona Chapter. He lives in Pinetop with his wife, Rebecca, with whom he as 2 daughters.

Jeff Gagnon has worked for AZGFD since 1998, currently as a Research Biologist focusing primarily on wildlife-highway interactions throughout Arizona, including State Route 260 and US Highway 93 wildlife crossing projects. Jeff received his B. S. and M. S. from Northern Arizona University where he studied the effects of traffic volumes on elk movements associated with highways and wildlife underpasses.

Ray Schweinsburg has been a research program supervisor with the department for 20 years. He received his Ph.D. from the University of Arizona and currently focuses on enhancing wildlife habitat connectivity throughout Arizona.