

The Maricopa County Wildlife Connectivity Assessment: Report on Stakeholder Input January 2012



(Photographs: Arizona Game and Fish Department)

Arizona Game and Fish Department



In partnership with the Arizona Wildlife Linkages Workgroup

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RECOMMENDED CITATION

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PARTNERS

Arizona Wildlife Linkages Workgroup:

Arizona Department of Transportation, Arizona Game and Fish Department, AZTEC Engineering, Bureau of Land Management, Defenders of Wildlife, Northern Arizona University, Sky Island Alliance, US Department of Transportation Federal Highway Administration, US Fish and Wildlife Service, USDA Forest Service

STAKEHOLDER ORGANIZATIONS AND AFFILIATIONS

Workshop Sponsors:

Arizona Game and Fish Department, Arizona Department of Transportation, Arizona State University Global Institute of Sustainability, Flood Control District of Maricopa County (workshop host), Maricopa County Department of Transportation, Maricopa County (Board of Supervisors, Andy Kunasek), Northern Arizona University, Sonoran Institute

Participant affiliations: For a complete list of workshop participants and their affiliations see Appendix II. Participating government and non-government organizations included: Arizona Army National Guard, Arizona Department of Environmental Quality, Arizona Game and Fish Department, Arizona State Land Department, Arizona State Parks, Arizona Zoological Society, Arizona Wilderness Coalition, City of Goodyear, City of Scottsdale, City of Surprise, City of Tempe, DMJM Harris, HDR Inc., EcoPlan and Associates, Inc., W Holdings, Logan Simpson Design, Maricopa County Parks and Recreation, One Green World, Phoenix College, Pima County Natural Resources Parks and Recreation, Pulte Homes Corporation, Rose Law Group, Sonoran Desert National Monument, SWCA, Kimley-Horn and Associates Inc., Town of Buckeye, Wilderness Society

EXECUTIVE SUMMARY

This report and the accompanying Geographic Information System (GIS) datasets summarize the results of the stakeholder workshop held in Phoenix, Arizona, hosted by the Flood Control District of Maricopa County, in 2008. At this workshop, stakeholders representing a broad range of organizations and interests identified and mapped the locations of important wildlife linkages across Maricopa County. Participants included biologists, land managers, planners and other professionals from federal, state, tribal, private, and non-governmental organizations. The workshop was supported by a partnership between the Arizona Game and Fish Department (AGFD), the Arizona Wildlife Linkages Workgroup (AWLW), and the Maricopa County Wildlife Connectivity Workgroup (MCWCW). This multi-agency, multi-disciplinary effort was undertaken to encourage biologists and non-biologists alike to incorporate information about wildlife linkages and strategies for their conservation into land use decisions. The workshop provided a forum for stakeholders to learn more about wildlife connectivity, outline the general locations of wildlife linkages on large maps, and provide descriptive information about each linkage on datasheets. Participants also identified the locations of barriers such as highways and railroads that can interfere with wildlife movements. The hand-drawn linkages and barriers were then digitized with GIS software at the workshop and presented to stakeholders for review. The linkages were further refined to eliminate redundancy for this report.

This report provides background information on the importance and benefits of conserving wildlife linkages for both people and wildlife in Maricopa County, and describes the methods used in our stakeholder workshops and in developing the accompanying GIS products. It includes a series of maps generated from the digitized stakeholder data that depict the general locations of wildlife linkages and potential barriers to wildlife movement. The maps are followed by tables with descriptive information about the habitat areas each linkage connects, the species each linkage serves, and known threats and potential conservation opportunities associated with each linkage and barrier. The information in this report reflects the views and expertise of workshop participants and likely does not represent an exhaustive mapping of all important wildlife linkages and barriers across Maricopa County. It should instead be considered an initial assessment of wildlife movement patterns to be supplemented in the future by further analysis and refinement that includes additional expert input, GIS-based linkage modeling, and research studies of wildlife movement patterns. Maps illustrate approximate locations of wildlife movements on the landscape and should be regarded as the starting point for further consultation with AGFD and other wildlife and land management agencies, preferably during the early stages of project planning. The report and associated GIS data provide a framework for professionals across a range of disciplines to begin to identify opportunities for maintaining and enhancing wildlife connectivity within their project areas in Maricopa County. We hope this report stimulates detailed planning and collaborative on-the-ground actions for conserving wildlife linkages through land acquisition and open space conservation, habitat restoration, creation of crossing structures for wildlife, and other approaches.

DEFINITIONS

*Note: Terms in this list are highlighted in **bold** where they first appear in the text.*

Arizona Missing Linkages- A linkage design plan that was developed utilizing GIS methods (developed by Northern Arizona University; see CorridorDesign.org) that identifies the biologically best corridors for a suite of species and is adequately refined for implementation at the local level. Each linkage design plan represents a linkage(s) that was previously identified by stakeholders within the Arizona Wildlife Linkages Assessment (Arizona Wildlife Linkages Workgroup 2006) or at subsequent county level workshops.

Habitat fragmentation - The process through which previously intact areas of wildlife habitat are divided into smaller disconnected areas by roads, urbanization, or other barriers.

Habitat block – A relatively large and unfragmented area of land capable of sustaining healthy populations of wildlife into the foreseeable future.

Habitat connectivity – The extent to which an area of the landscape facilitates ecological processes such as unrestricted movement of wildlife. Habitat connectivity is reduced by habitat fragmentation.

Wildlife linkage – An area of land used by wildlife to move between or within habitat blocks in order to complete activities necessary for survival and reproduction. Also referred to as a “wildlife movement area” or “wildlife corridor.”

Wildlife corridor – This term is often used interchangeably with “wildlife linkage” as we do in this report. Some biologists define the term “corridor” more narrowly to represent features such as canyons, ridgelines, riparian areas, and other landscape features that constrain or “funnel” wildlife movements in more restricted paths.

Diffuse movement area - A type of wildlife linkage in which animals move *within* a habitat block across a relatively broad area, rather than *between* habitat blocks through a well-defined linkage.

Landscape movement area – A type of wildlife linkage in which animals move between distinct habitat blocks; the area may be relatively broad or through a well-defined linkage.

Riparian movement area – A type of wildlife linkage that includes vegetation, habitats, or ecosystems that are associated with bodies of water (streams or lakes) or are dependent on the existence of perennial or ephemeral surface or subsurface water drainage. Riparian linkages facilitate movement of both terrestrial and aquatic wildlife species. These can also include xeroriparian habitats (washes) that potentially only have surface water for a brief period (ie. few hours a year) but may contain densely associated vegetation.



(Photographs: Arizona Game and Fish Department)

BACKGROUND

WHY WE NEED WILDLIFE LINKAGE PLANNING IN MARICOPA COUNTY

WILDLIFE AND HABITAT CONNECTIVITY

The growth of Arizona's human population and expanding infrastructure has consequences for Maricopa County's wildlife species and the habitats on which they depend. While human activities can adversely affect Maricopa County's wildlife by causing direct loss or degradation of habitat, the disruption of wildlife movement patterns is a less obvious but equally important consequence. All animals move across the landscape to varying extents in order to acquire the resources necessary for survival: food, water, protective cover, and mates. Mountain lions, black bears, and mule deer roam over vast expanses that can encompass thousands of acres, while smaller animals such as desert tortoise and kit fox engage in essential movements on a much smaller scale. There is also variation in the temporal patterns of animal movement: some animal movements occur on a daily basis, while seasonal migrations may occur annually, and the dispersal of young from their natal sites to secure new breeding territories happens only once in an individual's lifetime. Man-made barriers such as roads, urban areas, utility-scale solar projects, and railroads can affect each of these movement patterns and may pose a threat to the long-term persistence of wildlife populations (Noss 1983, Wilcox and Murphy 1985, Noss 1987, Bennett 1999, Henle et al. 2004, Noss and Daly 2006; *Figure 1*).

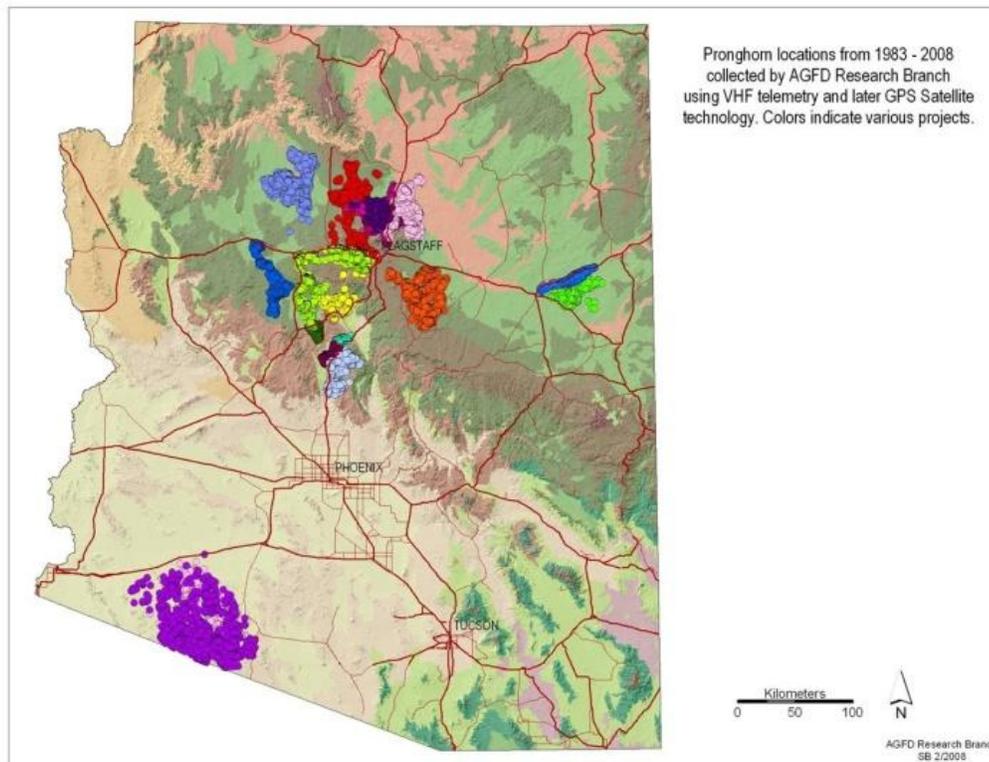


Figure 1: Radio and satellite telemetry studies by the Arizona Game and Fish Department's Research Branch reveal that major roadways can act as barriers to pronghorn movement. This barrier effect can effectively isolate populations, potentially reducing genetic diversity and reproductive success over time. Colors indicate groups of animals studied in separate projects.

POPULATION GROWTH

Blessed with abundant sunshine and great natural beauty, Arizona draws large numbers of new residents and visitors alike every year. The state has grown rapidly in recent decades and its human population is expected to more than double from almost 6½ million in 2010 to greater than 14 million by 2050 (Arizona Department of Transportation 2010a, US Census Bureau 2011). While much of that growth will likely be concentrated throughout the “Sun Corridor” connecting Tucson, Phoenix, and areas of central Yavapai County, communities in other areas of the state are also expected to grow.

Maricopa County is located in south-central Arizona and encompasses approximately 9,200 square miles with an estimated 415 persons per square mile (US Census Bureau 2011). The population of each of the twenty-five municipalities and the three Native American communities within the county range from less than 2,000 to over 1 million people. Most of the county’s municipalities are located adjacent to or near the greater Phoenix metropolitan area. The population as of 2010 is the largest of any county in Arizona, at an estimated 3.8 million, or 60% of Arizona’s total population and is expected to double in population by 2050. It ranks fourth nationally in population and includes four municipalities that have ranked within the 10 fastest-growing cities in the US, with a population growth of 24.2% since 2000 (US Census Bureau 2011).

TRANSPORTATION INFRASTRUCTURE

The most significant rates of new development affecting large expanses of currently undeveloped land are in the far reaches of the west and east valley, beyond the existing Phoenix metro area. The cities of Goodyear, Surprise, Peoria, and the Town of Buckeye have annexed large expanses of land beyond their current developed footprints. In the eastern part of the County, a large block of Sonoran desert habitat, collectively referred to as the Superstition Vistas Area, is slated for development across roughly 275 square miles of undeveloped Arizona state trust land. As a result of anticipated urban development, transportation planners have significantly ramped up plans to construct freeways, parkways, and arterial networks that will support increased traffic demands. As part of the statewide 50-year transportation planning process, called *Building a Quality Arizona*, the Maricopa Association of Governments (MAG) conducted transportation framework studies for the Maricopa County area. Two of these regional framework studies propose new freeways (such as Loop 303; Hassayampa, White Tanks, and Williams-Gateway Freeways; State Route 801) as well as numerous 6-8 lane parkways (see *I-10/Hassayampa Valley Framework Study* and *I-8 and I-10/Hidden Valley Framework Study*). These future transportation plans are available at: <http://bqaz.org/>.

UTILITY INFRASTRUCTURE

In recent years, the push for locating new alternative energy sources has focused on areas of the west rich in renewable resources such as solar. The desert southwest receives a great deal of sunlight and this has resulted in the beginning of large-scale concentrated solar power development in portions of Maricopa County. These developments have the potential to compete with municipalities for significant amounts of land, water, and infrastructure requirements. They also have the potential to irreversibly convert large tracts of public lands that currently provide natural desert habitat and act as linkages for wildlife in the County. As of 2009, there are

approximately 800,000 acres of federal, state and private lands proposed for solar development in Arizona (Arizona Game and Fish Department 2009).

For all of these reasons Maricopa County faces potentially significant losses of wildlife habitat and connectivity in parts of the county that are as yet undeveloped. The complexity of issues facing wildlife in the County are compounded by the fact that neighboring counties to the south, north, and west also face unprecedented urban growth and development rates as part of the “Sun Corridor” within the context of North American economic development (Arizona State University 2009). With many land use decisions made at a local level, the cumulative effects at a landscape or ecoregional level are not adequately addressed, but the potential for loss of existing natural habitats could be significant. For example, AGFD calculated potential habitat loss of existing creosote-bursage and desert scrub in the Sonoran Desert as a result of predicted population growth for 2050 and current proposed solar developments to be as much as 31%.

ECOLOGICAL RESOURCES

Southwestern deserts are defined by extremely arid conditions and limited rainfall though they can hardly be considered barren wastelands. Maricopa County is located within the Sonoran Desert ecoregion of the United States and Mexico (Brown and Lowe 1982). The Sonoran desert is the wettest of all North American deserts with a bimodal rainfall pattern, and when combined with the local basin and range physiography and close proximity to higher elevation biomes, it's not surprising that it supports high biodiversity. In fact, it is considered to be one of the Earth's most biologically-valuable but also most vulnerable ecoregions on a global scale (Olson and Dinerstein, 1998, Conservation Biology). The combination of spectacular scenery and a comfortable climate also create the conditions most desired for urban development. As a result, the characteristics of some of the region's most beautiful and ecologically-productive landscapes are being dramatically altered through human development.

Maricopa County lies at the confluence of five major waterways: the Gila, Salt, Verde, Hassayampa, and Agua Fria rivers. Together, these rivers drain nearly one-half of the state's land area as they flow through Maricopa County in a generally northeast to southwest direction. An extensive system of washes drains into these major rivers and contributes the means to an interconnected network of habitat for wildlife. Riparian habitats associated with the major rivers support many species designated at the state or federal level as threatened, endangered, or otherwise sensitive; including the bald eagle, Yuma clapper rail, and many species of native fish. In and of themselves, these rivers and washes provide crucial habitat and movement corridors for a large variety of desert wildlife including desert mule deer, javelina, bobcats, mountain lion, as well as a diversity of other small mammals, birds, reptiles, and amphibians. Overall, the diversity of wildlife associated with Sonoran desert biotic communities and riparian habitats in Arizona are some of the highest in the United States (Hoffmeister 1986; Marshall et al. 2000).

The regional topography is breath-taking, marked by mountain masses that rise abruptly from the broad plains of dry valleys. The mountain ranges contain peaks that vary in altitude from a few hundred to more than seven thousand feet above sea level. In many cases these mountain ranges form the core habitat for many wider-ranging species such as bighorn sheep, mule deer, and mountain lions. The highest peaks are located in the Mazatzal Mountain range, which forms a portion of the northeastern boundary of the County. In Maricopa County, the mountains

represent an important open space resource due to their scenic value and capability to support recreational uses and wildlife habitat.

Natural resources are truly an amenity for the residents of Maricopa County. The County's park system is the largest regional park systems in the United States, covering approximately 120,000 acres. Ten of the parks border the Phoenix metropolitan area. Currently, some of these parks are connected to more distant wildland blocks by large tracts of relatively undisturbed open space managed by the Arizona State Land Department (ASLD), the Bureau of Land Management (BLM), or the USDA Forest Service (USFS). These wildland blocks include 12 federally designated wilderness areas, encompassing almost 500,000 acres. However, the boundary of the greater metropolitan area is being pushed further and further outward as urban development, transportation systems, and alternative energy development reach out into the previously untouched desert ecosystem. For Maricopa County's parks to maintain viable wildlife populations, it will be critical to preserve their connection to larger wildland blocks through connectivity planning.

WHY WILDLIFE CONNECTIVITY IS IMPORTANT

The process through which previously intact areas of habitat are divided into smaller disconnected areas by roads, urbanization, and other barriers is known as **habitat fragmentation**, which decreases the degree of **habitat connectivity** of the landscape for wildlife. The disruption of animal movement by habitat fragmentation presents problems for Arizona's wildlife ranging from direct mortality on roadways to the genetic isolation of fragmented populations, and negatively impacts human welfare by increasing the risk of vehicle collisions and the frequency of unwanted "close encounters" with wildlife. However, the effects of habitat fragmentation can often be mitigated by identifying and protecting areas that wildlife use for movement, known as **wildlife linkages** or **wildlife corridors** (Beier and Noss 1998, Bennett 1999, Haddad et al. 2003, Eggers et al. 2009, Gilbert-Norton 2010). Ridgelines, canyons, **riparian** areas, cliffs, swaths of forest or grassland, and other landscape or vegetation features can serve as wildlife linkages. Animals may also move across a relatively broad area rather than through a well-defined corridor, a type of wildlife linkage we identify as a **diffuse movement area**. Wildlife linkages are most effective when they connect (or are located within) relatively large and unfragmented areas referred to as **habitat blocks** (also called **wildland blocks**). Habitat blocks are areas large enough to sustain healthy wildlife populations and support essential biological processes into the future (Noss 1983, Noss and Harris 1986, Noss 1987, Noss et al. 1996).

Wildlife linkage planning should include conservation of wildlife linkages and the habitat blocks they connect, and can include a range of strategies. Land acquisition, community planning for developments, open space conservation, habitat restoration, and installation of roadway mitigation features such as wildlife crossing structures and fencing intended to funnel wildlife to crossing structures (*Figures 2a, 2b, and 2c, Figures 3a, 3b, 3c, and 3d*) can all help to maintain habitat connectivity on the landscape, particularly if considered early in the planning process for transportation and development projects.



Figures 2a, 2b and 2c: a and b) Along Arizona State Route 260 near Payson, ungulate-proof fencing linking a series of highway underpasses effectively increased the permeability of the highway by 60% while reducing elk-vehicle collisions by greater than 80% at an estimated cost savings of \$1 million dollars annually (Dodd et al. 2007). c) Along SR 87 near Sunflower, a 1-mile stretch of fine mesh fencing was installed to prevent Desert tortoise, a species protected under the Endangered Species Act, from accessing the highway in an effort to reduce roadway mortality and population effects to that species (Photographs: Arizona Game and Fish Department).

BENEFITS OF WILDLIFE LINKAGE PLANNING

Identifying and conserving habitat connectivity by maintaining wildlife linkages can provide many important benefits for both humans and wildlife.

BENEFITS TO WILDLIFE. By preserving the ability of wildlife species to move between or within habitat blocks, linkages allow animals to access essential resources such as food and water needed during their daily activities. They also enable longer seasonal migratory movements between summer and winter habitats and facilitate the movement of animals in search of breeding sites. Linkages that connect otherwise isolated populations help prevent small populations from extinction (Laurance 1991, Beier and Loe 1992), help maintain genetic diversity, and reduce the risk of inbreeding (Beier and Loe 1992, Bennett 1999). Habitat connectivity also helps ensure that critical ecological processes such as pollination and seed dispersal, which often depend on animal intermediaries, are maintained. In some cases the linkages themselves may sustain actively reproducing wildlife populations (Perault and Lomolino 2000, Beier et al. 2007). Linkages are also expected to play an important role in helping animal populations adapt to and endure the effects of climate change by allowing

animals to shift their range with latitude or elevation as vegetation communities change their distribution and suitable environmental conditions shift on the landscape (Hannah et al. 2002, Glick et al. 2009).



Figures 3a, 3b, 3c, and 3d: (a) Wildlife overpasses, like the one in this artist rendering proposed by the Arizona Department of Transportation and Arizona Game and Fish Department biologists to facilitate pronghorn passage over US Highway 89 or (b and c) the newly constructed overpass on US Highway 93 for bighorn sheep and d) wildlife underpasses are important parts of wildlife connectivity planning by increasing the permeability of a road or railroad for wildlife while greatly reducing the threat of vehicular collisions. Crossing structures are most effective when they are designed to meet the needs of species known to be using the linkage. (Photograph: Arizona Game and Fish Department).

BENEFITS TO PEOPLE. Maintaining an interconnected network of wildland blocks will provide benefits to the local human communities as well. While scientific evidence suggests that some species are sensitive to the presence of humans (Clevenger and Waltho 2000, Taylor and Knight 2003), passive recreation could be an important component of connectivity planning, especially through urban areas. In fact, classic conservation reserve design describes three components of a reserve network – protection of large core habitat blocks, corridors between habitat blocks, and buffer zones surrounding habitat blocks and corridors (Noss and Cooperrider 1994). Buffer zones are designed to protect the wildland network from potentially damaging external influences. By their definition, buffer zones are considered transitional areas that include human activities such as hiking, hunting, fishing, watching wildlife, or providing educational opportunities while maintaining the important ecological processes within corridors and core wildland blocks. Incorporating rural and urban greenways and/or open spaces in municipal planning efforts also offers aesthetic enjoyment and maintains the natural vistas that many people living in or visiting Arizona value. The overwhelming sense of place experienced by

residents of Arizona stems largely from an attraction to the state's natural splendor (Gallup Inc. 2010). Conserving linkages is an important step to protecting this natural heritage.

Identifying and implementing designated wildlife linkages can also benefit public safety. It has been estimated that approximately 20% of the U.S. land area is ecologically affected by the country's road network (Forman 2003). The implications of this widespread impact include threats to connectivity and hazards to motorists (Forman and Alexander 1998). Wildlife-vehicle collisions (WVCs) cost motorists money and in some cases, lives. One study estimated that each year more than 200 motorists are killed and approximately 29,000 are injured as a result of WVCs in the United States (Conover 1995). Such collisions can cost \$2 billion annually (Danielson and Hubbard 1999 in Schwabe and Schuhmann 2002). Implementing designated wildlife linkages directs the movements of a variety of wildlife species to specific locations, thereby making mitigation efforts such as wildlife directional fencing and road crossing structures both cost effective and biologically effective. Wildlife crossing structures have been shown to make roads safer for motorists and wildlife by reducing WVCs and maintaining wildlife connectivity (Clevenger et al. 2001, Dodd et al. 2007). Along Arizona's State Route 260, for example, ungulate-proof fencing linking a series of highway underpasses effectively increased the permeability of the highway by 60% while reducing the elk-vehicle collisions by greater than 80% at an estimated cost savings of \$1 million dollars annually (Dodd et al. 2007). Similar projects have been completed on US Highway 93 near the Hoover Dam to reduce collisions with bighorn sheep, and are proposed along State Route 77 to reconnect the Santa Catalina Mountains with the Tortolita Mountains (*Figures 2a and 2b*). Along State Route 87, fencing was installed to prevent desert tortoise WVCs in a population core area (*Figure 2c*).

The economic value associated with fish and wildlife-related recreation is significant for Maricopa County and contributes greatly to Arizona's economy. A national survey of fishing, hunting, and wildlife-associated recreation has been conducted about every five years since 1955 to evaluate national trends. The survey provides information on the number of participants in fishing, hunting, and wildlife watching (observing, photographing, and feeding wildlife), and the amount of time and money spent on these activities. In 2006, state resident and nonresidents spent \$2.1 billion on fishing, hunting and, watchable wildlife related recreation in Arizona (USDI 2006). In 2001, a county-level analysis of the national survey data revealed that in Maricopa County watchable wildlife activities generated a total economic effect of \$690 million; supporting 6,603 jobs, providing residents with \$193 million in salary and wages and generating \$4.8 million in state tax revenue (Southwick Associates 2003). Fishing and hunting recreation generated a total economic effect of \$515 million for the County; supporting 5,382 jobs, providing residents with \$103 million in salary and wages and generating \$21 million in state tax revenue (Silberman 2003). These economic benefits illustrate that conserving habitat and linkages for our wildlife populations is also good for business in the County.

REGIONAL PLANNING EFFORTS ACKNOWLEDGE THE IMPORTANCE OF CONSERVING WILDLIFE LINKAGES

There is a growing appreciation among local governments, land management agencies, transportation departments, conservation organizations, energy and utility companies, and citizens across Maricopa County of the importance of conserving wildlife linkages and mitigating the impacts of barriers to wildlife movement. The Federal Highway Administration and the Arizona Department of Transportation (ADOT) recognize WVCs as a serious problem along major northern Arizona roadways, and have supported collaborative research with Department biologists to identify wildlife movement patterns and to design effective mitigation strategies (Dodd et al. 2007, Dodd et al. 2009, Dodd et al. 2010, Gagnon et al. 2010, Gagnon et al. 2011).

Planning efforts in other areas of Arizona have also begun to incorporate information on wildlife linkages. For example, Pima County's Conservation Lands System (Pima County 2001), an outgrowth of the widely-acclaimed Sonoran Desert Conservation Plan and adopted as policy in the County's Comprehensive Plan, includes protection and restoration of wildlife linkages as a key objective in the evaluation of Plan amendments and all land uses requiring rezoning. The Town of Oro Valley incorporated the conservation of an important wildlife linkage in the Arroyo Grande planning area as an amendment to its General Plan (Town of Oro Valley 2008). Most recently, the City of Surprise incorporated the conservation of an important wildlife corridor as an amendment to the General Plan 2030, near the White Tank Mountains (City of Surprise 2011). The need to maintain habitat connectivity for wildlife will only grow as Arizona becomes more developed and populous in coming decades and the likelihood of habitat fragmentation increases. Given the relatively undeveloped status of the outermost regions of Maricopa County at present, it is not too late to integrate knowledge of wildlife linkages and mitigation strategies into land use and transportation planning in our region.

THE MARICOPA COUNTY WILDLIFE CONNECTIVITY ASSESSMENT

To assemble current knowledge of wildlife linkages and barriers to wildlife movement across Maricopa County and to help build collaborative partnerships with local jurisdictions for eventual implementation efforts, AGFD, the government of Maricopa County, and the Arizona Wildlife Linkages Workgroup (AWLW) initiated the Maricopa County Wildlife Connectivity Assessment. This project grew out of a prior initiative of the AWLW known as Arizona's Wildlife Linkages Assessment, which used a similar expert-based approach to create a statewide map of potential linkage areas and barriers at a coarse scale (*Figure 4*). The Maricopa County Wildlife Connectivity Assessment represents a continuation of the mission of this prior 2006 statewide effort. It is intended to identify wildlife linkages at a finer scale that may have been overlooked in the 2006 assessment and those that will be useful for regional and local planning efforts.

A principal activity of the Maricopa County Wildlife Connectivity Assessment was the convening of a stakeholder workshop in 2008. At this workshop a diverse range of participants

with an interest in maintaining habitat connectivity for wildlife shared their knowledge and outlined the general locations of wildlife linkages and barriers to wildlife movement on large maps. These hand-drawn maps were digitized using GIS tools in order to produce the maps found in this report. Future project activities will include using the information in this and other county-level reports to support the development of finer-scale, GIS-based wildlife corridor models using established methodology (see Majka et al. 2007 for more details). These models will further refine a subset of the stakeholder-identified linkage areas in this report based on habitat requirements of focal wildlife species that rely on each linkage and will help identify land parcels of highest conservation priority within the stakeholder linkages—both of which are necessary for successful implementation. We anticipate that the selection of sites for fine-scale GIS corridor modeling and collaborative conservation efforts will evolve over time as Arizona’s developed landscape changes and our knowledge of wildlife habitat use and movement patterns grows.

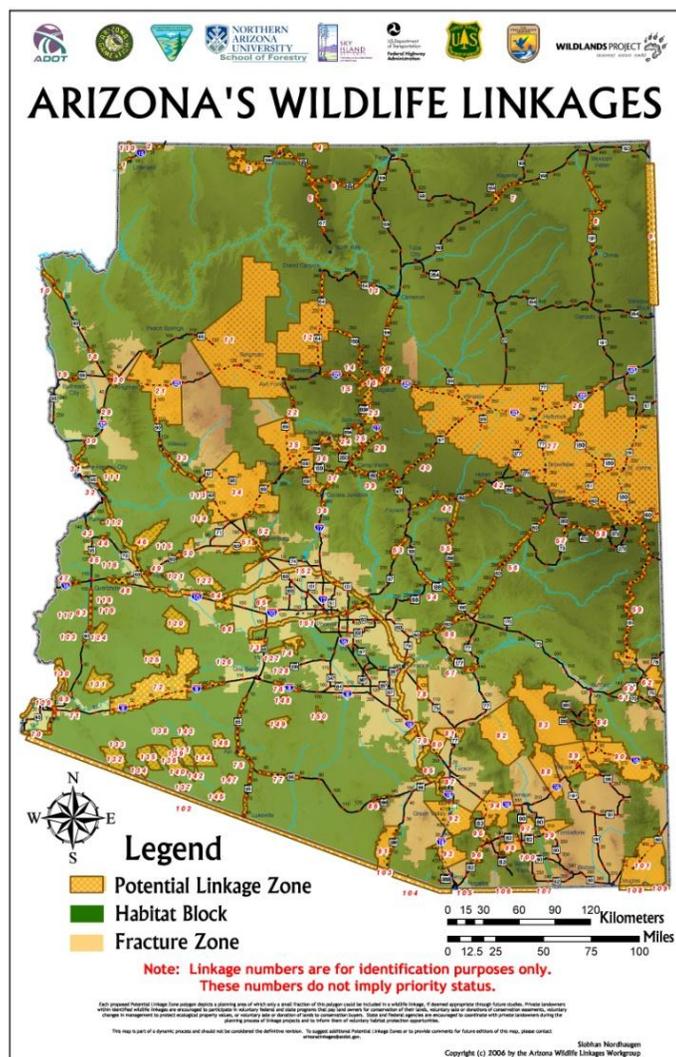


Figure 4: Statewide map of wildlife linkages and barriers created for Arizona’s Wildlife Linkages Assessment (2006).

HOW TO USE THIS REPORT AND ASSOCIATED GIS DATA

A SCREENING TOOL FOR WILDLIFE LINKAGE PLANNING

This report and the associated GIS datasets are intended to help planners, developers, land managers, biologists, and others incorporate knowledge of the location of important wildlife linkages and barriers into project planning. The wildlife linkages contained in the shapefile and shown on the maps are not intended to identify finite boundaries. Instead they illustrate the *general* locations of wildlife movements on the landscape, and should be regarded as the starting point for consultation with biologists from AGFD and other wildlife and land management agencies such as the US Fish and Wildlife Service (especially when federally-listed species may be affected) and the USDA Forest Service—ideally in the early stages of project planning. These materials thus comprise a *screening tool* to identify areas where linkage planning goals or concerns for wildlife connectivity may exist. After consulting with the appropriate agencies, the next step in the consultation process would likely include the creation of site-specific plans to address the movement needs of the wildlife in the area. It is crucial for the users of this report to understand that conservation of the habitat blocks that these movement areas are connecting is also essential for the long term health of wildlife populations in Maricopa County. While we have not delineated these habitat blocks on our maps, they are named in the table containing descriptions of each linkage.

It is also important to emphasize that the information in this report reflects the views and expertise of workshop participants, and that these participants had diverse expertise and varying degrees of individual familiarity with wildlife linkages and barriers in different areas of Maricopa County. Given that there may have been some areas of the County for which fewer expert participants were present at the stakeholder workshop or for which less is known in general about wildlife movement patterns, this report should not be regarded as an exhaustive mapping of all important wildlife linkages and barriers. While we have attempted to provide a comprehensive analysis, the information we present will benefit from further refinement through additional stakeholder input, GIS-based linkage modeling, and additional research on wildlife movement patterns.

Clarification should be given as to the species identified within linkages throughout this effort. While the stakeholders were asked to identify species known to the linkage area, these are not exhaustive lists, and may not include species of special concern as identified through AGFD's Heritage Data Management System or Environmental Online Tool (or by other federal natural resource agencies). Once a linkage is identified within the area of interest, we recommend utilizing the Environmental Online Tool and/or contacting AGFD for further identification and refinement of species for consideration within a project or planning area. More information on this and other available datasets is provided in the "Other Resources" section below.

To best integrate knowledge of wildlife linkages and barriers to wildlife movement into planning efforts we recommend a collaborative approach involving project proponents, municipal planners, transportation, wildlife, and land management agency specialists, citizen groups, and others with an interest in conserving habitat connectivity for wildlife in a manner compatible

with regional development goals. This effort should develop conservation goals for both wildlife linkage areas and the habitat blocks they connect.

GEOSPATIAL (GIS) DATASET

The geospatial dataset associated with this report should be used with GIS software to allow users to incorporate information about wildlife linkages into land use planning, development, or project-level spatial decision-making processes. As explained above, the borders of the linkages in the GIS dataset are not intended to show the exact boundaries of linkages, nor are the habitat blocks included in the shapefile. To obtain a copy of the GIS dataset for use in your local planning efforts please contact the Habitat Program at AGFD’s Mesa regional office at 480-981-9400 or the AGFD’s GIS Program at gis@azgfd.gov.

OTHER RESOURCES

Additional tools are available from AGFD to help planners identify wildlife resources in a project planning area. These tools include the *Species and Habitat Conservation Guide* (SHCG), a model depicting areas of wildlife conservation potential; and *HabiMap™ Arizona*, an online data viewing platform that serves as an exploration tool for AGFD’s wildlife datasets. Site-specific reports on wildlife species of concern and federally-listed threatened and endangered species are available through the *Online Environmental Review Tool*. All of these tools, along with additional resources such as helpful guidelines documents, can be accessed on AGFD’s “Planning for Wildlife” web page at <http://www.azgfd.gov/WildlifePlanning>.

For a description of GIS wildlife corridor modeling approaches and to download ArcGIS modeling tools developed by scientists at Northern Arizona University please see the Corridor Design website at <http://corridordesign.org>. Here you will also find a number of completed wildlife linkage designs produced by the Corridor Design team through funding provided by the Arizona Game and Fish Department’s Heritage Fund.



(Photographs: Arizona Game and Fish Department)

METHODS

STAKEHOLDER WORKSHOP

In the Spring of 2008, Maricopa County and AGFD, in partnership with the AWLW and others (refer to Appendix 1 for a complete list of partners and participants), hosted a workshop for stakeholders and experts in the fields of wildlife management and land use planning. Approximately 100 individuals participated, with attendees comprising private citizens and representatives from consulting groups, federal agencies, state agencies, non-profit organizations, and tribal and local governments. Several prominent individuals from the sponsoring agencies provided opening remarks for the workshop including:

- Tim Phillips, Chief engineer and General Manager, Flood Control District of Maricopa
- Andy Kunasek, Maricopa County Board of Supervisors
- Shannon Scutari, Policy Advisor for Growth and Infrastructure, Governors Office
- Duane Shroufe, Director, Arizona Game and Fish Department

These county and state leaders vocalized the desired collaboration between all sectors of society to address wildlife connectivity issues. The key message was that the maintenance of wildlife resources through connectivity and habitat conservation is directly linked to the quality of life in Arizona and it is our responsibility to ensure that future populations, both human and wildlife, are able to experience the same quality of life as our own.

Following a brief series of presentations on wildlife connectivity principles and the goals of the Maricopa County Wildlife Connectivity Assessment, stakeholders were instructed to visit one or more of six work stations where a portion of the county was displayed on a paper map. These maps displayed topography, locations of major roads, and labels designating cities, mountains, watercourses, and other prominent features. Participants mapped important wildlife linkages and areas of known wildlife movement, including diffuse movement areas within habitat blocks and locations where wildlife cross (or may have previously crossed) barrier features between habitat blocks. Participants were encouraged to use additional clear film overlays depicting vegetation type, conservation status, and land ownership as needed for reference. Some AGFD wildlife management personnel did not attend the workshop and contributed their input individually from remote work locations. These participants were given base maps with added game distribution information when hand-drawing species movements. The linkages they illustrated were then integrated with the information provided by other stakeholders during the workshop. For each wildlife linkage drawn and barrier feature noted, participants were instructed to fill out a datasheet describing wildlife movement patterns and existing or future land uses that may affect the wildlife in the area ([Appendix 1](#)).

A consequence of this voluntary, stakeholder-based approach is that not all geographic areas were equally represented by knowledgeable stakeholders and the information we were able to collect about wildlife linkages was more comprehensive in some areas than in others. There may be important wildlife linkages in areas of Maricopa County where none appear on our maps, so this absence should be interpreted with caution pending further study. Also, the type and amount of evidence on which each linkage was based varied from isolated personal observations to long-term empirical data from telemetry studies. This variation in the amount and source of stakeholder input available for each linkage and barrier is reflected in the level of detail we were

able to provide in the “Wildlife Linkage Descriptions” table below. Thus a relative lack of detail for a given linkage or barrier, in terms of species using the linkage, current or potential threats, or additional “Notes” (see below), should not lead to the conclusion that a linkage is not important. Additional information collected in the future should expand these descriptions, as well as point out locations of additional linkages and barriers across the County.

Numerous barriers were identified on datasheets throughout Maricopa County, but few were actually mapped by stakeholders. Some examples of the major types of barriers identified included: major roads, railroads, canals, cities, and more. The sheer numbers and extent of barriers in the county made it difficult to map these as individual features. Therefore, barriers are not represented on the maps, with the exception of the Central Arizona Project (CAP) canal. Please refer to the wildlife linkage descriptions for information on barriers and threats identified for individual linkages.

The CAP is recognized as both a barrier and a linkage opportunity within Maricopa County, and extends into adjacent counties. The footprint of the canal itself, along with its associated fences and roadways, currently create a barrier to wildlife movement. Right of way (ROW) easements on lands adjacent to the canal, if conserved and combined with more comprehensive community open space planning efforts, could function as a linkage for some wildlife species. These ROW lands are managed under an existing agreement (1989) for wildlife management and wildlife law enforcement on the Central Arizona Project ROW with the US Bureau of Reclamation and the Central Arizona Water Conservation District. This agreement includes operation and maintenance responsibilities specific to environmental commitments identified in compliance reports (*i.e.* maintaining wildlife canal crossings, fencing, etc.). In addition, an interim policy for ROW land use was implemented to incorporate those commitments related to basins in the ROW for mitigation needs that resulted from the construction of the CAP (*i.e.* destruction and degradation of wildlife habitat). Therefore, the CAP is uniquely identified on the linkage maps.

GIS DIGITIZING AND EDITING METHODS

Stakeholder linkages from this first workshop were digitized in GIS and their associated datasheets entered into a database. Project staff used the following guidelines when digitizing stakeholder drawings in GIS:

- Trace contour lines to digitize canyons or hills when a drawing or description indicates a topographic feature is being used.
- When a linkage polygon is drawn across a road but information from the datasheet indicates that stakeholder meant to identify a barrier only and not specify a linkage, define the stretch of road as a barrier.
- Where linkages overlap or fall inside larger linkages, keep only those shapes which provide unique information or show movement in contrasting directions. Otherwise merge the shapes and combine the information from each datasheet (e.g. species using linkage) into attributes for the single merged shape.
- Do not include linkages for which the data provided are insufficient. Follow up with stakeholders whenever possible to obtain needed information about the linkage.

- Use digitized locations of washes to replace hand drawn riparian movement areas and buffer 0.5 miles on either side for consistent representation on maps. Beier et al. (2007), used a minimum linkage width of 1 km and 1.5 km in many of their Arizona Missing Linkage designs. However, for the purpose of this report a minimum width of 1 mile was used to represent riparian movement areas in order to highlight the area and allow for refinement.
- Digitize barriers identified from the workshop (CAP was the only barrier mapped).

POST-WORKSHOP REFINEMENT

This report contains the final version of the information provided through the stakeholder workshop process.

Several linkages within this report have undergone a progression of development to refine their location and extent. Figures 9, 10, and 11 illustrate the progression of development to a scale that is implementable at the local level. As previously discussed, those stages of development included stakeholder identification at a coarse statewide scale in 2006 in the Arizona's Wildlife Linkages Assessment report. The statewide assessment was followed by the county-level stakeholder connectivity assessments as reported in this document. The county-level approach offers a scale more useful for regional planners since crossing structures and other conservation investments, such as corridors, are expensive to implement. Both statewide and county-level linkages can then be modeled through the same focal species habitat modeling methods developed by Beier et al. (2007) to provide on-the-ground implementation recommendations best suited for a particular area. These models should be designed to serve the movement needs of many species and ecological processes and should be located where the greatest need or opportunity exists.

A set of these stakeholder-input-based linkages have been modeled by the Corridor Design Team at Northern Arizona University, using a GIS wildlife corridor modeling approach for a suite of "umbrella or focal species" (Beier et al. 2007). A series of reports titled "*Arizona Missing Linkages*" and GIS datasets, produced by the Corridor Design team through funding provided by the Arizona Game and Fish Department's Heritage Fund can be found at <http://corridordesign.org> or <http://www.azgfd.gov/WildlifePlanning>. The following linkages within Maricopa County have undergone further development at this more refined scale, and are included in this report and identified as "*Arizona Missing Linkages*" in all linkage map illustrations:

- Gila Bend - Sierra Estrella Linkage Design (*Figure 10*; Beier, Garding & Majka 2008)
- Wickenburg – Hassayampa Linkage Design (*Figure 11*; Beier & Majka 2006)

Two additional linkages have undergone further development by AGFD staff at this more refined scale, utilizing the Corridor Design methodologies. However, the associated reports and GIS data are currently in draft form. Final reports and GIS data will be posted on AGFD's "Planning for Wildlife" web page at <http://www.azgfd.gov/WildlifePlanning> when they are available. For further information please contact the Habitat Program at AGFD's Mesa Regional office (480-981-9400) or the Department's GIS Program (gis@azgfd.gov) for the following linkages:

- White Tank – Belmont – Heiroglyphic Mountains Linkage Design (*Figure 12; in Draft 2012*)
- Buckeye Hills East – Maricopa Mountains Linkage Design (*Figure 10; in Draft 2012*)

MASTER LIST OF WILDLIFE LINKAGES AND HABITAT BLOCKSAND BARRIERS

EASTERN

LANDSCAPE MOVEMENT AREAS

Central Arizona Project Canal (CAP)
Superstition Mountains – Mazatzal Mountains
Mazatzal Wilderness – Four Peaks Wilderness
Goldfield Mountains – Superstition Mountains
Usery Mountains – Goldfield Mountains (Usery Pass)
McDowell Mountains – Superstition Mountains – Mazatzal Mountains
McDowell Mountain Preserve – Tonto National Forest (Tonto NF)
Two Bar Ridge – Roosevelt Lake
East Maricopa Floodway
Lake Pleasant Regional Park – New River
Cave Creek County Park – New River
Phoenix Mountains – Salt River
Black Canyon Trail
Bradshaw Mountains – Lake Pleasant Regional Park

RIPARIAN MOVEMENT AREAS

Agua Fria River (Lower)
Salt River – Saguaro Lake to Gila River
New River – Ganial Peak Wash
Cave Creek
Indian Bend Wash
Lower Verde River – Salt River
Reata Pass Wash – CAP
Skunk Creek
Queen Creek – Gila River Indian Community
Cave Creek Tributaries – Apache Wash

NORTHWESTERN

LANDSCAPE MOVEMENT AREAS

Harcuva Mountains – Vulture Mountains
Harcuvar Mountains – Harquahal Mountains
Vulture Mountains – Harquahal Mountains
Harquahal Mountains – Big Horn Mountains
Big Horn Mountains – Vulture Mountains – Desert Valley
Big Horn Mountains – Eagletail Mountains
Belmont Mountains – Bighorn Mountains
Big Horn/Burnt Mountain – Saddle Mountains
Belmont Mountains – Saddle Mountain – Gila Bend Mountains
White Tank Mountains – Buckeye FRS1

White Tank Mountains – Trilby Wash – Beardsley Canal
White Tank Flood Retainment Structures

RIPARIAN MOVEMENT AREAS

Centennial Wash – Gila River – Saddle Mountain
Tiger Wash
Jackrabbit Wash
Winters Wash
Hassayampa River
Wagner Wash

DIFFUSE MOVEMENT AREAS

Vulture Mountains East – West
Lake Pleasant – Hieroglyphic Mountains – Bradshaw Mountains

AZ MISSING LINKAGE

Wickenburg – Hassayampa
White Tank-Belmont-Heiroglyphic Mountains

SOUTHWESTERN

LANDSCAPE MOVEMENT AREAS

Eagletail Mountains – Gila Bend Mountains
Face Mountain – Oatman Mountain – Painted Rock Mountains
Buckeye Hills West – Buckeye Hills East
Estrella Mountains – Buckeye Hills
Estrella Mountains – South Mountain
North Maricopa Mountains – South Maricopa Mountains
Sonoran Desert National Monument – Palo Verde Hills
Maricopa Mountains – Table Top Mountains
Palo Verde Hills – Table Top Mountains
Sand Tank Mountains – Sonoran Desert National Monument
Northern Sank Tank Mountains – Javelina Mountains
Javelina Mountain – Table Top Mountain
Sauceda Mountains – Sand Tank Mountains
Crater Range – Sauceda Mountains
Crater Range – Childs Mountain
Crater Range – Growler Mountains
Aguila Mountains – Crater Range
Aguila Mountains – Granite Mountains
Northern Sand Tank Mountains – I-8

SOUTHWESTERN CONTINUED

RIPARIAN MOVEMENT AREAS

Gila River
Waterman Wash
Vekol Valley – Vekol Wash
Sand Tank Wash
Fourth of July Wash
Copper Wash
Ten Mile Wash

DIFFUSE MOVEMENT AREAS

Gila Bend Mountains
Vekol Valley – Rainbow Valley
Sentinel Plains
Estrella Mountain – Sierra Estrella Mountains

AZ MISSING LINKAGE

Buckeye Hills East – Sonoran Desert National Monument
Gila Bend Mountains – Sonoran Desert National Monument
Sierra Estrella Mountains – Maricopa Mountains

BARRIERS

Central Arizona Project Canal (CAP)

LINKAGES IDENTIFIED OUTSIDE OF COUNTY

Superstition Mountains – Devils Canyon – Gila River
Superstition Mountains – Mineral Mountains
Mazatzal Mountains – Sierra Ancha Mountains

REFERENCE MAPS

The following maps display linkage polygons and barriers to wildlife movement that were identified by stakeholders in the 2008 Maricopa county workshop. In addition to the countywide map, we provide six linkage maps, zoomed to varying extents, to aid the user in visualizing both larger landscape-scale and smaller, more localized wildlife linkages described by workshop participants. The first linkage map (Figure 5) is a County-wide map showing all stakeholder-drawn wildlife linkages and barriers to wildlife movement, while Figures 6 through 8 are larger-scale maps that provide greater detail for selected areas of Maricopa County. Several linkages within this report have undergone a progression of development to refine their location and extent, and are referred to as “Arizona Missing Linkages”. Figures 9, 10 and 11 illustrate the progression of development to a scale that is implementable at the local level, previously discussed on page 21.

Further inspection or analysis of the data should be conducted using GIS software. **The linkage polygons are intentionally symbolized with a gradient fill: the exact extent of each polygon and the shape of its edges are not intended to be sharply defined, but should in all cases be regarded as “fuzzy” (please see “How to use this report and associated GIS data” for further explanation).** Numeric labels for each linkage polygon or barrier correspond to numbered narrative descriptions that follow the maps, the source of which are the datasheets filled out by workshop participants for each linkage. Linkage descriptions include a name associated with the geographic location, the habitat types or features connected by the linkage, a list of species known or expected to use the linkage, threats to functional habitat connectivity in the linkage, and additional notes. Barrier descriptions include a name and additional notes focusing on current and future threats to connectivity and/or opportunities for conservation actions to improve connectivity in the area.

Figure 5. Maricopa County stakeholder-drawn linkages and barriers to wildlife movement

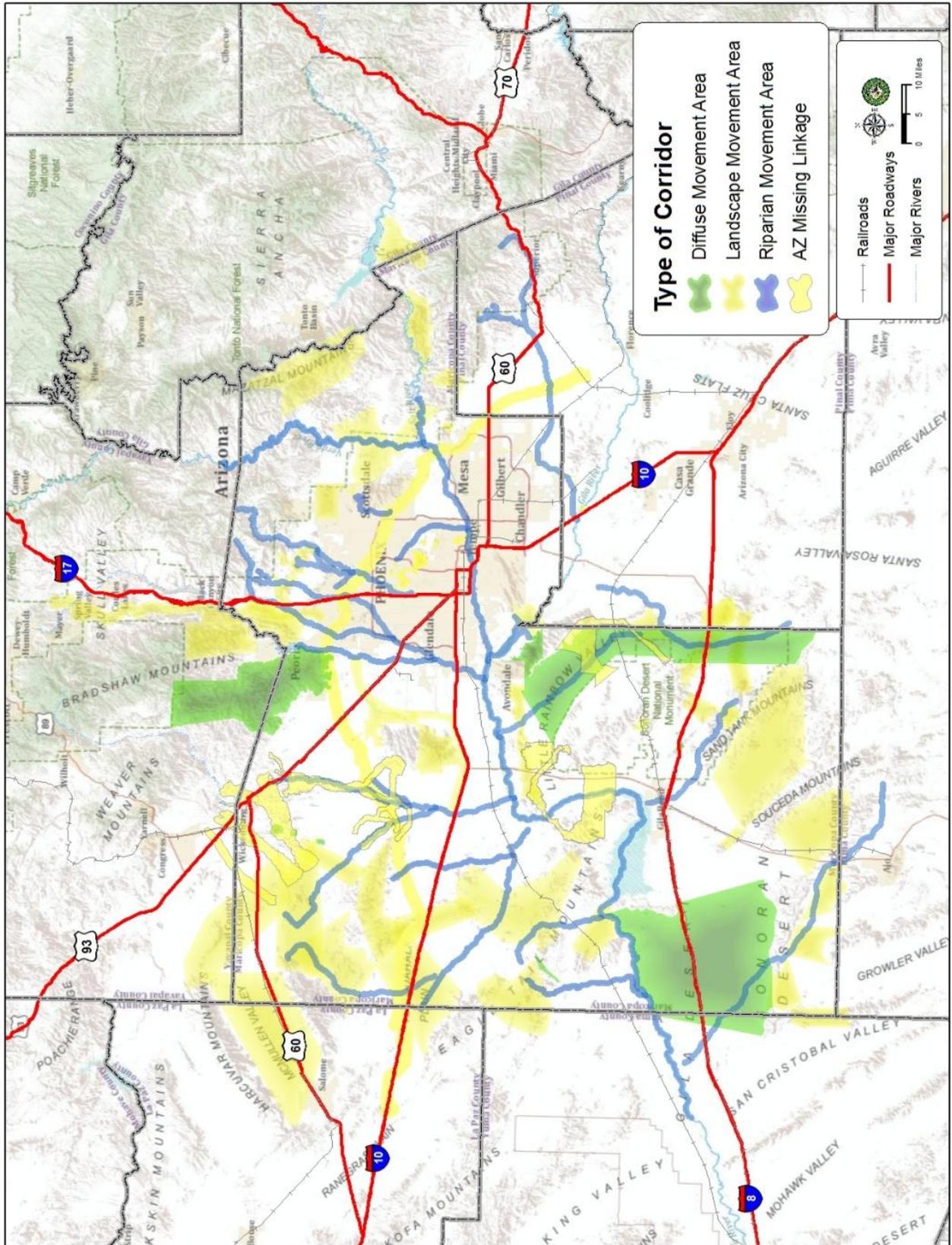


Figure 6. Eastern Maricopa County stakeholder-drawn linkages and barriers to wildlife movement

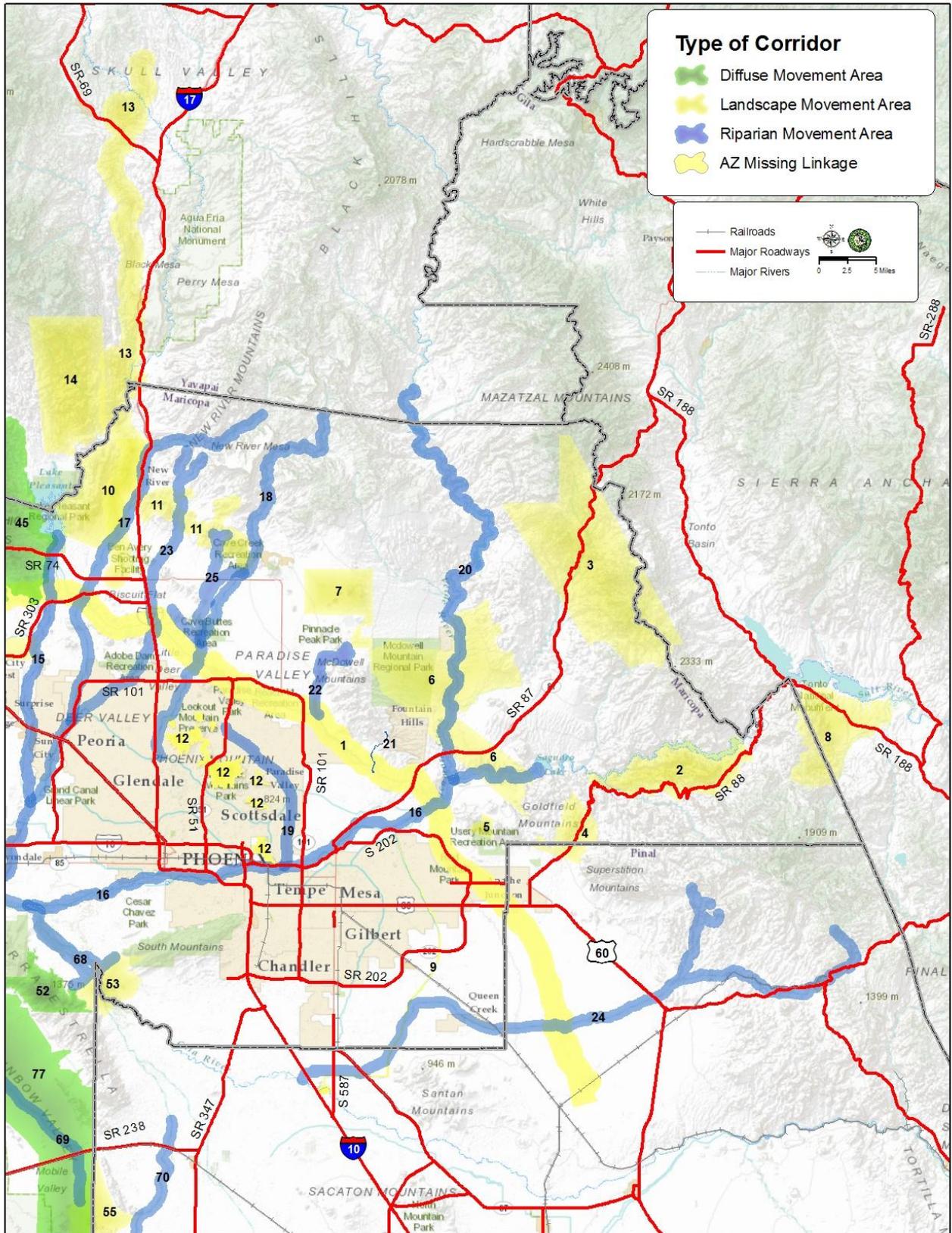


Figure 7. Northwest Maricopa County stakeholder-drawn linkages and barriers to wildlife movement

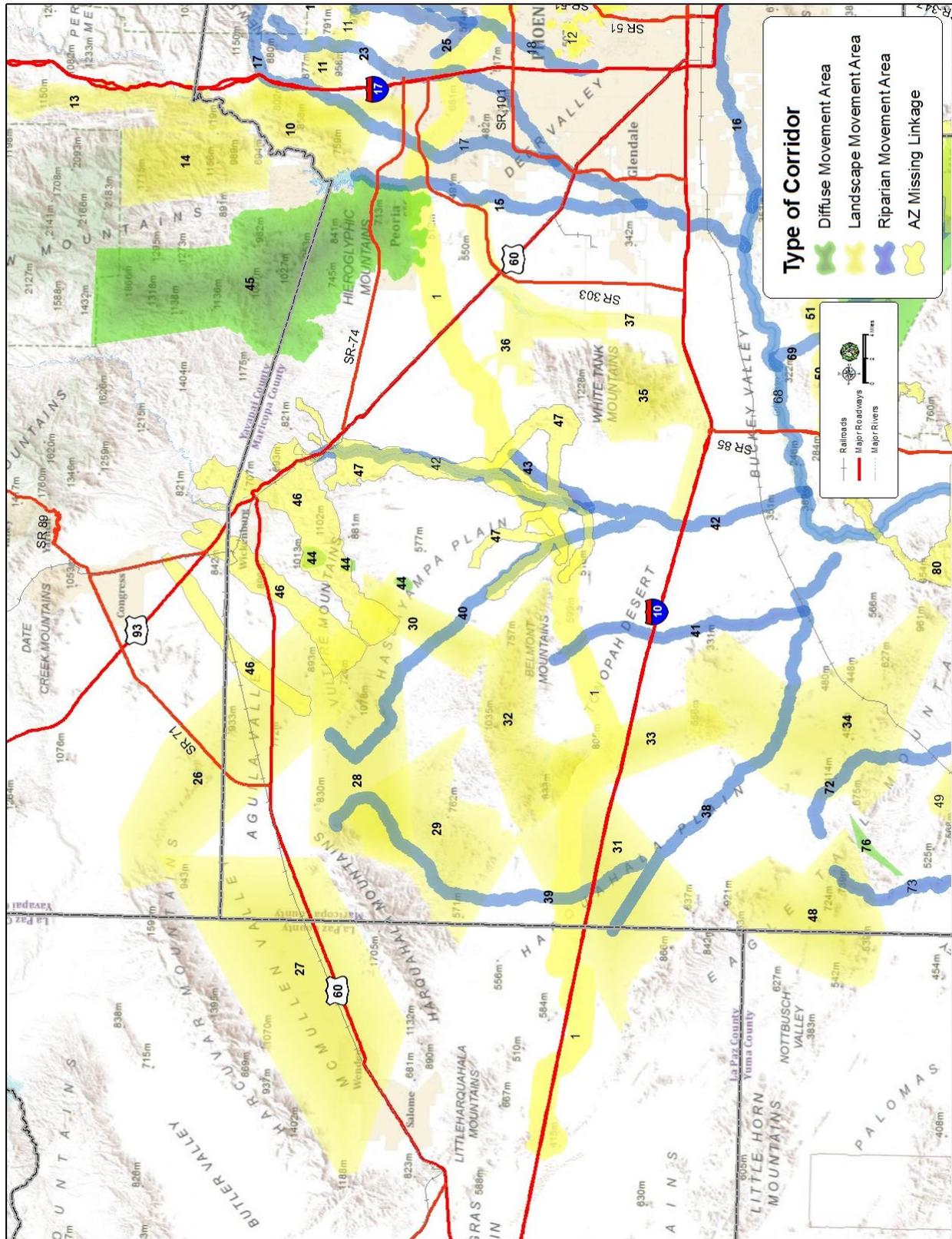


Figure 8. Southwest Maricopa County stakeholder-drawn linkages and barriers to wildlife movement

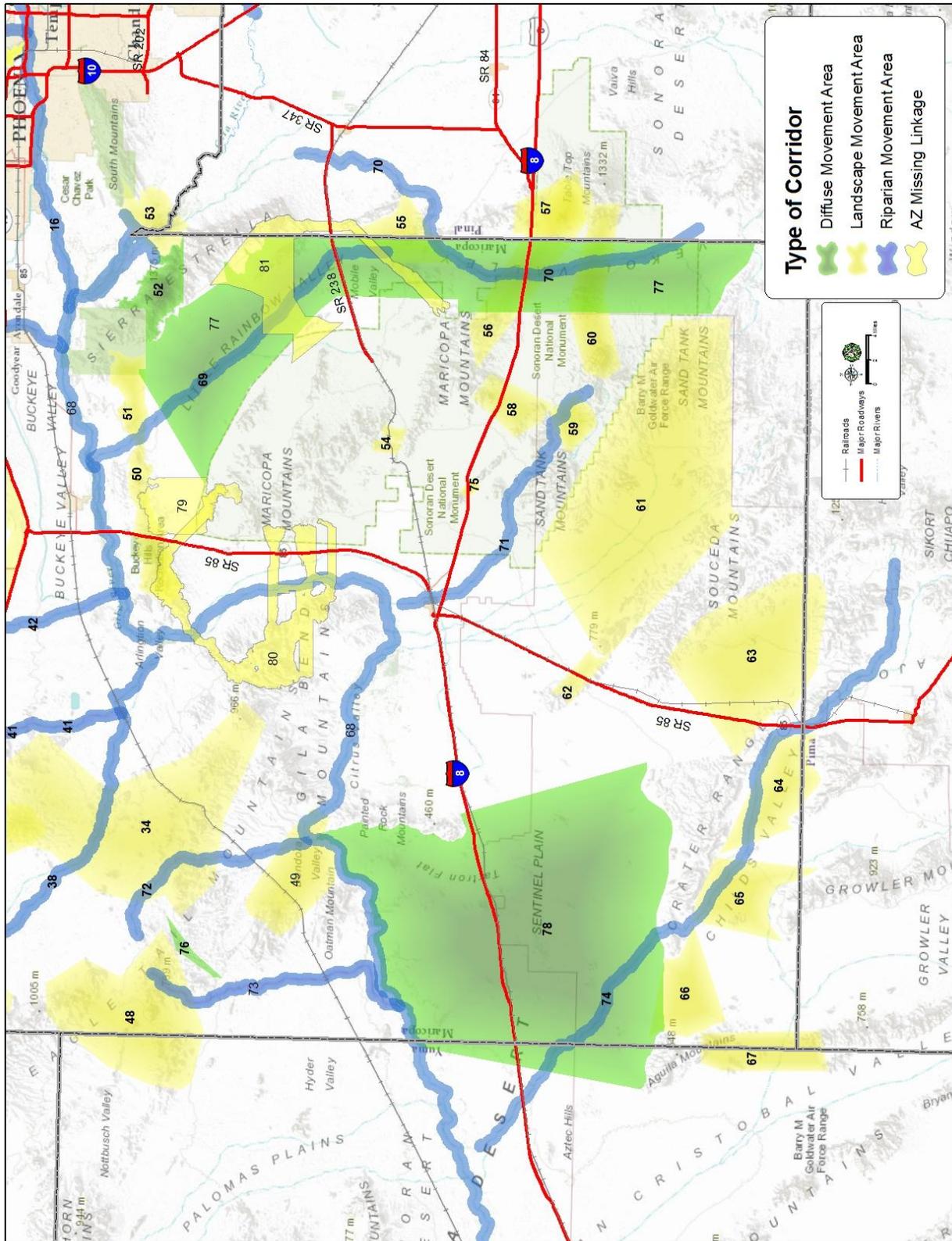


Figure 9. Arizona Missing Linkages – Southwest Maricopa County

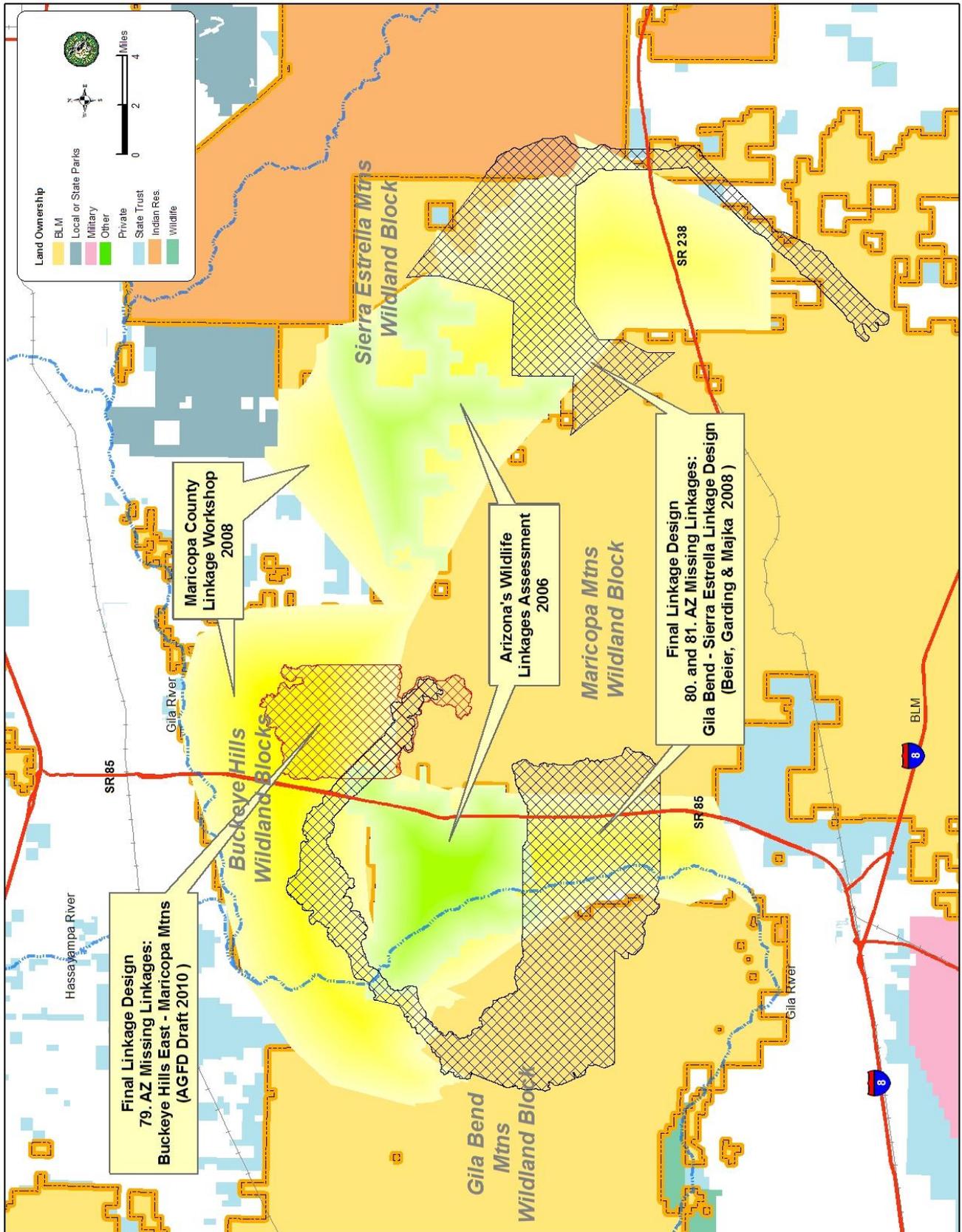


Figure 10. Arizona Missing Linkages – Northwest Maricopa County: Wickenburg-Hassayampa Linkage Design

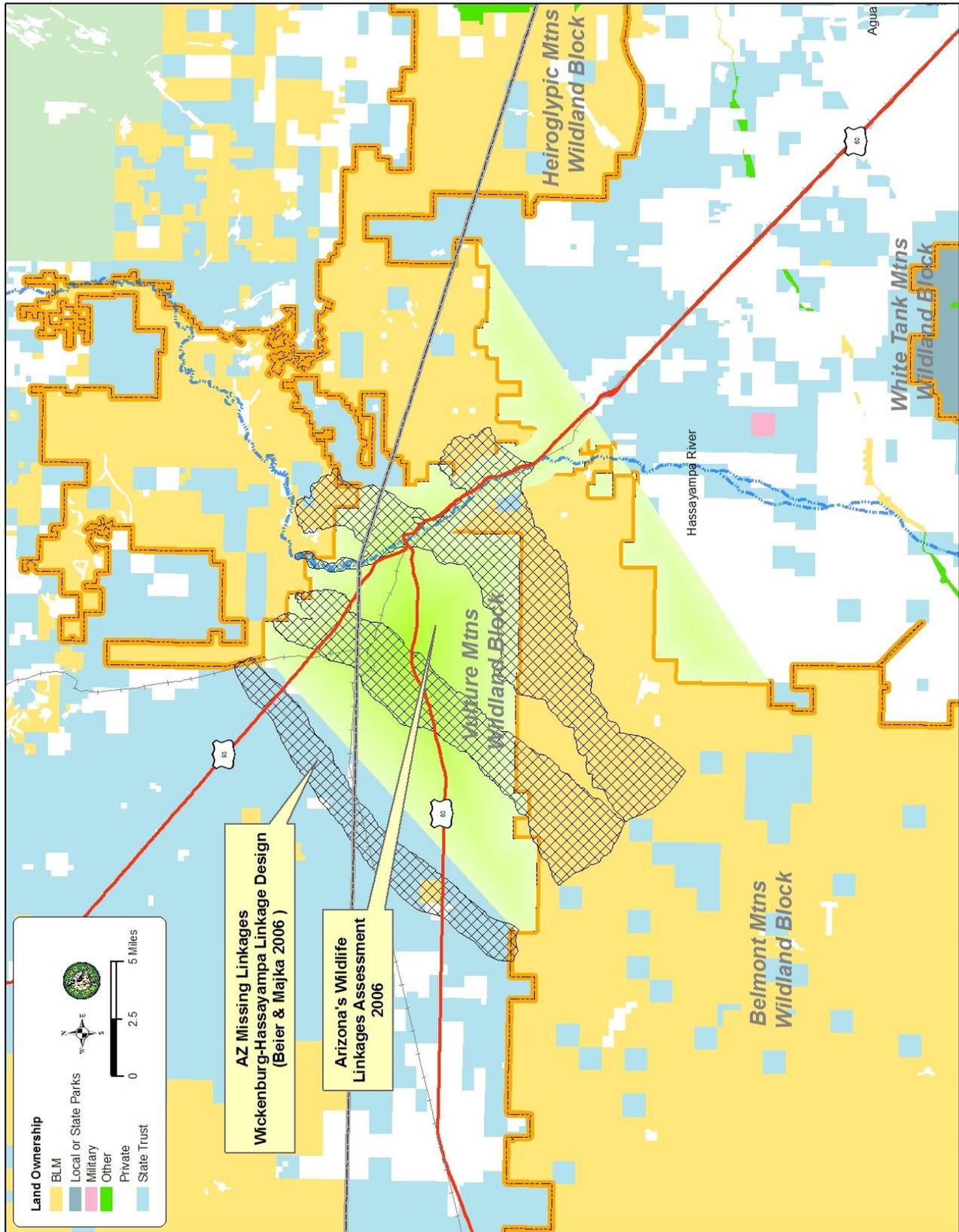
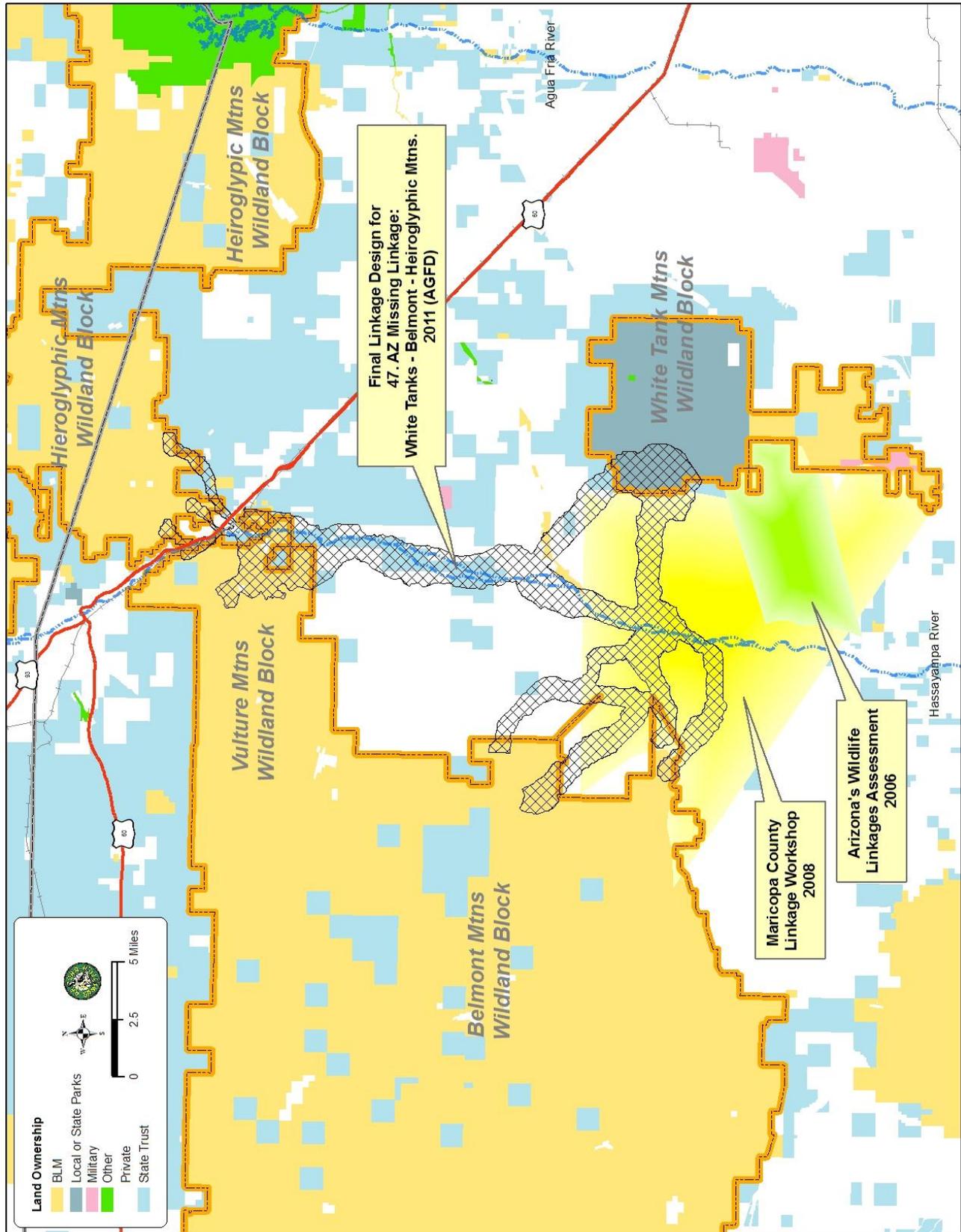


Figure 11. Arizona Missing Linkages – Northwest Maricopa County: White Tanks-Belmonts-Heiroglyphic Mountains Linkage Design



WILDLIFE LINKAGE DESCRIPTIONS

Eastern Maricopa County (Figure 6)

LANDSCAPE MOVEMENT AREAS

1. CAP – Central Arizona Project Canal

Habitat Blocks Connected: Linkage opportunity within floodplain set asides and CAP Right of Way lands adjacent to the canal; series of drainage basins and surface drainage crossings
Species Identified: Variety of species depending on location and adjacent habitat along the floodplain (ie. coyote, javelina, fox, badger, hawk, owl, deer)
Current Threats/Barriers: Urbanization now and future, agriculture, canal itself, various developments, roads, developed recreational facilities
Notes: Has broad support by various municipal & county organizations and CAWCD Administration, MAG, State Land Dept., Salt River Pima Maricopa Indian Community for conservation as open space and multiuse trail corridor

2. Superstition Mountains – Mazatzal Mountains

Habitat Blocks Connected: Superstition Mountain Wilderness to the Four Peaks Wilderness
Species Identified: Bighorn sheep, mule deer, white-tailed deer, javelina, black bear, mountain lion, bobcat, gray fox, coyote, numerous birds, reptiles and amphibians
Current Threats/Barriers: Dams/Salt River Lakes, expansion of Apache Trail (Hwy 88), recreation development along Salt River and lakes
Notes: Would benefit from enhancements to create wildlife crossings over dams and/or river to restore habitat connectivity lost when dams/lakes were created; Would require support from Tonto National Forest and Salt River Project

3. Mazatzal Wilderness – Four Peaks Wilderness

Habitat Blocks Connected: Lower Salt River and Superstition Mountains – Mazatzal Mountains (Mazatzal Wilderness - Four Peaks Wilderness)
Species Identified: Black bear, javelina, bobcat, mule deer, eagle, raptors, white-tailed deer, spotted owl, mountain lion, elk
Current Threats/Barriers: Widening of Hwy 87, recreation along the Salt River, potential new road between Hwy 87 and Rio Verde area west of the Verde River
Notes: Would benefit from restoring & maintaining connectivity across Hwy 87

4. Goldfield Mountains – Superstition Mountains

Habitat Blocks Connected: Goldfield Mountains – Superstition Wilderness
Species Identified: Bighorn sheep, mule deer, mountain lion, bobcat, javelina, fox, desert tortoise, mammals, birds, reptiles
Current Threats/Barriers: Expansion of Apache Trail (Hwy 88); increasing traffic volumes
Notes: Currently 2 lane paved but popular tourist destination & high traffic volumes

5. Usery Mountains – Goldfield Mountains (Usery Pass)

Habitat Blocks Connected: Goldfield Mountains - Usery Mountains
Species Identified: Mule deer, javelina, gray fox, coyote, desert tortoise, birds, mammals and reptiles
Current Threats/Barriers: Urbanization, Usery Pass Road & potential expansion, arterial roads for developments
Notes: Usery Pass Road is currently a 2 lane paved & 1 of 2 primary access roads to Salt River & Saguaro Lake; Usery Mountains are divided by Usery Pass Road;

6. McDowell Mountains – Superstition Mountains – Mazatzal Mountains

Habitat Blocks Connected: McDowell Mountains – McDowell Sonoran Preserve – McDowell Regional Park – Tonto National Forest – Camp Creek Wash – Mazatzal Wilderness – Sycamore Creek – Lower Verde River
Species Identified: Mule deer, javelina, mountain lion, bears, riparian obligate birds, bobcat, coatimundi, gray fox, bighorn sheep, desert tortoise, bats, coyote, raptors (eagles/hawks/owls)
Current Threats/Barriers: Urbanization, Dynamite Blvd., 136th St, fire, Hwy 87, canals, agriculture (Ft. McDowell orchards), Saguaro Blvd (Rio Verde), Alder Creek Hydro power, OHV recreation, Powerline corridor
Notes: Off-road vehicle recreation is of high concern

7. McDowell Mountain Preserve – Tonto NF

Habitat Blocks Connected: McDowell Sonoran Preserve – Camp Creek area
Species Identified: Mule deer, javelina, mountain lion
Current Threats/Barriers: Urbanization, Roadway expansion– E. Rio Verde Dr., Jomax, E. Happy Valley Rd., E. Dixileta Rd., 128 th St., 136 th St.
Notes: This linkage is drawn to represent current linkage plan for McDowell Sonoran Preserve (City of Scottsdale)

8. Two Bar Ridge – Roosevelt Lake

Habitat Blocks Connected: Superstition Mountains – Roosevelt Lake
Species Identified: Coyote, bear, deer, javelina, bobcat
Current Threats/Barriers: SR188
Notes: Wildlife access to Roosevelt Lake between Roosevelt Dam & Jct. Hwy 188 & 288

9. East Maricopa Floodway

Habitat Blocks Connected: Salt River North – Gila River South and natural wash tributaries
Species Identified: Black necked stilt, shore birds, raptors
Current Threats/Barriers: Urbanization in SE Valley, agriculture, roads, Flood Control District management
Notes: 26 mile long constructed earthen channel managed by Flood Control District; runs north-south between Salt and Gila river and has potential for greater wildlife value; connects to several natural washes including Queen Creek

10. Lake Pleasant Regional Park – New River

Habitat Blocks Connected: Bradshaw Mountains – Lake Pleasant Regional Park – New River Mountains – Cave Creek County Park
Species Identified: Desert tortoise, mule deer, white tailed deer, black bear, mountain lion, antelope, gila monster, javelina, desert pupfish, songbirds, kit fox
Current Threats/Barriers: New River Rd., urbanization, agriculture, other roads, realignments, I-17 expansion/realignment, utility corridors, developed recreation, nurseries
Notes: None

11. Cave Creek County Park – New River

Habitat Blocks Connected: East-West linkage between Cave Creek County Park and New River
Species Identified: Gila monser, rattlesnake, mule deer, javelina, mountain lion
Current Threats/Barriers: I-17 expansion/realignment, New River Rd Bypass, Cave Creek Rd., urbanization
Notes: Identified need for connectivity between county parks across north end of Phx metro – McDowell Mountains to Cave Creek area to Lake Pleasant Regional Park; connectivity between McDowell Mtns. and Cave Creek area has been severely impacted due to urbanization

12. Phoenix Mountains – Salt River

Habitat Blocks Connected: Phoenix Mountains (Preserve/Dreamy Draw Connection) – Mummy and Camelback Mountains south via Papago Park open space to the Salt River
Species Identified: Coyote, mountain lion, javelina, raptors
Current Threats/Barriers: SR 51, 202, urbanization, light rail along Washington St.
Notes: Residential areas and natural washes provide connectivity between mountains and Crosscut canal is only corridor south of Camelback to Papago Buttes

13. Black Canyon Trail

Habitat Blocks Connected: Central Arizona Grasslands (Mayer/Dewey area) south along Bradshaw Mountains to Sonoran desert near Lake Pleasant
Species Identified: Mule deer, mountain lion, javelina, bobcat, small game, white tail deer, desert tortoise
Current Threats/Barriers: OHV use, pipeline/powerlines, residential, high traffic gravel road
Notes: Designated trail corridor up to 1 mile wide; multiuse non-motorized recreation

14. Bradshaw Mountains – Lake Pleasant Regional Park

Habitat Blocks Connected: Bradshaw Mountains - Lake Pleasant and Lake Pleasant Regional Park
Species Identified: Mule deer, mountain lion, javelina, desert tortoise
Current Threats/Barriers: urbanization, Castle Hot Springs, Castle Hot Springs Rd., OHV, recreation
Notes: None

RIPARIAN MOVEMENT AREAS

15. Agua Fria River (Lower)

Habitat Blocks Connected: Lake Pleasant Regional Park - Gila River - Sierra Estrella along river corridor
Species Identified: Mule deer, coyote, javelina, waterfowl, quail, raptors, white-tailed deer, mountain lion
Current Threats/Barriers: urbanization, agriculture, roads, railroad, sand/gravel mining, Hwy 60 expansion, I-10
Notes: Corridor has a Master Plan for future multi-use enhancements

16. Salt River – Saguaro Lake to Gila River

Habitat Blocks Connected: Tonto NF/Salt River Lakes/Superstition wilderness to Gila River/Sierra Estrella Mountains
Species Identified: Beaver, muskrat, waterfowl, leopard frogs, bobcat, coyote, javelina, migratory birds, various other amphibians and reptiles
Current Threats/Barriers: Urbanization, flood control, sand and gravel operations, dewatering
Notes: Restoration of river corridor and flows would provide potential wildlife corridor/habitat and recreational values

17. New River – Graniel Peak Wash

Habitat Blocks Connected: Tonto NF - Agua Fria River corridor
Species Identified: Coyote, mule deer, badger, fox, javelina, hawk, owl
Current Threats/Barriers: Urbanization (Phoenix & New River), loop 303 and 101, SR74, I-17, CAP, railroad double tracking/commuter rail, Carefree Hwy expansion, sand and gravel operations, Upper New River Drainage Master Plan- flood control
Notes: None

18. Cave Creek

Habitat Blocks Connected: Spur Cross/Cave Creek Park/Tonto National Park - Phoenix Preserve/Cave Creek Wash/Cave Buttes Dam
Species Identified: Mule deer, coyote, javelina, quail, dove, numerous reptiles and small mammals, gray fox, bobcat, raptors, songbirds
Current Threats/Barriers: 101, Carefree Hwy, urbanization (Phoenix and Cave Creek), ASLD, grazing, , Cave Creek Buttes recreation area
Notes: None

19. Indian Bend Wash

Habitat Blocks Connected: Phoenix Mountain Preserve – Salt River
Species Identified: Javelina, waterfowl, coyote, raptors, reptiles, mountain lion, migratory songbirds, jackrabbits, cottontail rabbits
Current Threats/Barriers: Urbanization, agriculture, roads, Arizona canal
Notes: Well developed multi-use flood control channel through Scottsdale with high level of waterfowl/migratory bird use; preserve remaining channel as natural wash to maximize wildlife values

20. Lower Verde – Salt River

Habitat Blocks Connected: Lower Verde River – to confluence of Salt River on Fort McDowell Apache Reservation
Species Identified: Deer, javelina, bobcat, bear, eagles, fish, waterfowl, coyote, raptors, mountain lion
Current Threats/Barriers: Urbanization, agriculture, SR87, Rio Verde Road expansion across Verde River, Fort McDowell facilities
Notes: Verde Valley is an important migratory corridor from the Upper Verde River downstream to the Salt River and Granite Reef Diversion Dam; important linear corridor and opportunity for crossing between wildland blocks

21. McDowell Mountains – Salt River

Habitat Blocks Connected: McDowell Mountain - Salt River via wash corridor at 136th St. (Saddleback development) south to the CAP and to the Salt River
Species Identified: Bobcat, coyote, coatimundi, raptors (hawks, owls)
Current Threats/Barriers: Urbanization, agriculture, Beeline Hwy, Shea Blvd, CAP, highway widening
Notes: There are abutments on 136 th St. alignment that could be used for a wildlife crossing across the CAP to facilitate movement south across the Salt river Pima Maricopa Indian Community to the Salt River

22. Reata Pass Wash – CAP

Habitat Blocks Connected: McDowell Mountains - CAP corridor
Species Identified: Mule deer, javelina, coyote, hawk, owls/raptors
Current Threats/Barriers: urbanization (current and future), agriculture, the canal itself, various developments, roads, developed recreational facilities
Notes: Includes restored desert habitat along the wash

23. Skunk Creek

Habitat Blocks Connected: Skunk Creek/New River - Adobe Dam
Species Identified: Coyote, falcon, hawk, javelina, owl, fox, skunk, mule deer
Current Threats/Barriers: Urbanization, loop 101, Bell Rd., Sonoran Pkwy, I-17 expansion, Anthem, road projects east of I-17 and south of Carefree Hwy; mixed use/office development (USAA)
Notes: Fractured ownership in the New River area

24. Queen Creek – Gila River Indian Community

Habitat Blocks Connected: Queen Creek corridor from dam to Gila River Indian Community; includes Queen Creek tributaries
Species Identified: Coyote, hawk, mule deer, javelina
Current Threats/Barriers: Urbanization, agriculture, several roadways, railroad (Southern Pacific), golf courses, future freeway (Mesa to Florence), North/South Interstate (US 60 to I-10), master planned communities, sand & gravel operations, CAP, US60, Eastern canal, Flood Control District projects
Notes: None

25. Cave Creek tributaries – Apache Wash

Habitat Blocks Connected: Phoenix Mountain Preserve - Cave Buttes Recreation Area - Cave Creek County Park
Species Identified: Javelina, mule deer, mountain lion, great horned owls, Harris hawks & other raptors, bobcats
Current Threats/Barriers: Urbanization, Roads, grazing, future Parkway (I-17 to Cave Creek Rd)
Notes: None

Northwestern Maricopa County (Figure 7)

LANDSCAPE MOVEMENT AREAS

26. Harcuvar Mountains – Vulture Mountains

Habitat Blocks Connected: Harcuvar Mountains –Black Butte in the Vulture Mountains
Species Identified: Mule deer desert tortoise
Current Threats/Barriers: Agriculture, US 60 RR
Notes: New agricultural development and/or widening of US 60 will further isolate habitat blocks

27. Harcuvars Mountains – Harquahalas Mountains

Habitat Blocks Connected: Harcuvar Mountains - Harquahala Mountains
Species Identified: Bighorn sheep, mule deer, mountain lion, desert tortoise, rosy boa, chuckwalla, badger
Current Threats/Barriers: Agriculture, US 60, urbanization
Notes: None

28. Vulture Mountains – Harquahala Mountains

Habitat Blocks Connected: Vulture Mountains /Black Butte - Harquahala Mountains
Species Identified: Mule deer, Desert tortoise
Current Threats/Barriers: Roads, grazing, Eagle Eye Rd, Aguila Rd, potential SR74 extension, urbanization of state lands & development pressures on adjacent BLM lands
Notes: This linkage area is also a priority in the Sonoran Desert Protection Proposal (Sonoran Institute)

29. Harquahala Mountains – Big Horn Mountains

Habitat Blocks Connected: Bighorn Mountains - Harquahala Mountains
Species Identified: Bighorn sheep, Mule Deer, Desert tortoise
Current Threats/Barriers: Eagle Eye Road, Development on State Land
Notes: This linkage is identified in the BLM – Bradshaw-Harquahala Resource Mgmt Plan

30. Big Horn Mountains –Vulture Mountains – Desert Valley

Habitat Blocks Connected: Big Horn Mountains - Vulture Mountains and Hassayampa Plains between
Species Identified: Mule deer, desert tortoise, bighorn sheep, mountain lion, sidewinder, desert iguana, shovel-nosed snake
Current Threats/Barriers: US 60, Railroad, Agriculture
Notes: None

31. Big Horn Mountains – Eagletail Mountains

Habitat Blocks Connected: Harquahala Plain between Big Horn Mountains - Eagletail Mountains
Species Identified: Bighorn, mule deer, mountain lion, sidewinder, shovel-nosed snake, desert iguana, fox, badger, desert tortoise
Current Threats/Barriers: Agriculture in Harquahala Valley, I-10, CAP
Notes: Conservation of Harquahala Plain is a priority as well as linkage between habitat blocks

32. Belmont Mountains – Big Horn Mountains

Habitat Blocks Connected: Belmont Mountains - Hummingbird Springs/Bighorn Mountains
Species Identified: Bighorn Sheep, Mule Deer
Current Threats/Barriers: Proposed Bell Pkwy, Landscape Rock Mining
Notes: This linkage area is also a priority in the Sonoran Desert Protection Proposal (Sonoran Institute)

33. Big Horn/Burnt Mountains – Saddle Mountains

Habitat Blocks Connected: Burnt Mountain/Big Horn Mountains - Saddle Mountain
Species Identified: Bighorn sheep, mule deer, desert tortoise, kit fox, badger, mountain lion
Current Threats/Barriers: Urbanization south of I-10, CAP, Solar, Roads, Agriculture
Notes: Potential to utilize Flood Control District infrastructure south of I-10 to Saddle Mountain

34. Belmont Mountains – Saddle Mountain – Gila Bend Mountains

Habitat Blocks Connected: Belmont Mountains - Saddle Mountain - Gila Bend Mountains (including Woolsey Peak/Signal Mountain Wilderness)
Species Identified: Bighorn, mule deer, kit fox, desert tortoise
Current Threats/Barriers: I-10, Proposed parkway 801, Proposed 404/505, CAP, Solar, arterial roads, urbanization
Notes: Area is highly threatened by utility scale solar development and proposed housing developments

35. White Tank Mountains – Buckeye FRS1

Habitat Blocks Connected: White Tank Mtn Park - Buckeye Military Reservation -Buckeye Flood Retainment Structure #1 (Flood Control District lands)
Species Identified: Mule deer, desert tortoise, mountain lion, California leaf-nosed bats
Current Threats/Barriers: Illegal alien traffic, infantry operations, urbanization, McDowell Parkway
Notes: Department Research for Buckeye Military Reservation documents California leaf-nosed bats using mine shafts within linkage for roosting/breeding and linkage area for foraging

36. White Tank Mountains – Trilby Wash – Beardsley Canal

Habitat Blocks Connected: White Tank Mountain Regional Park - Trilby Wash - Beardsley canal
Species Identified: Mule deer, coyote, mountain lion, javelin, Desert tortoise
Current Threats/Barriers: Urbanization, OHV, Sun Valley Pkwy, Jackrabbit Rd. extension to Bell Rd., expansion of Bell Rd, Beardsley canal
Notes: Portions of Trilby Wash have been adopted as wildlife linkage in City of Surprise General Plan 2030

37. White Tank Flood Retainment Structures

Habitat Blocks Connected: Connectivity along flood control lands from McMicken Dam south to Buckeye FRS1 and the Hassayampa River
Species Identified: Mule deer, bobcat, javelina, various reptiles, game birds
Current Threats/Barriers: Urbanization, Sun Valley Parkway, future proposed parkways
Notes: Flood Control District Buckeye dam rehabilitation plans for Buckeye FRS1 include wildlife habitat improvements

RIPARIAN MOVEMENT AREAS

38. Centennial Wash

Habitat Blocks Connected: Arlington Wildlife Area/Gila River - Bighorn/Burnt Mtn - Saddle Mtn. via the Centennial Wash
Species Identified: Mule Deer, bighorn sheep, waterfowl, migratory shorebirds (Yuma clapper rail), coyote, burrowing owl, bats, LeContes Thrasher, javelina, mountain lion
Current Threats/Barriers: solar, Urbanization, loss of water rights from fallow agriculture, railroad, Roads, Hidden Water Parkway, Hassayampa Freeway, solar development, agriculture,
Notes: The washes function as both linkages and core habitat for some species

39. Tiger Wash

Habitat Blocks Connected: Harqualala Mountains, Bighorn Mountains, Harquahala Plain
Species Identified: Mule deer, javelina, birds, bighorn sheep, coyote, bats, LeContes Thrasher, mountain lion
Current Threats/Barriers: Eagle Eye Road, Urbanization, Agriculture, New Roads
Notes: None

40. Jackrabbit Wash

Habitat Blocks Connected: Black Butte/Vulture Mountains - Hassayampa River
Species Identified: Mule deer, javelina, birds, Desert Tortoise, mountain lion, various reptiles
Current Threats/Barriers: Urbanization, proposed Hassayampa freeway (CanaMex), proposed parkways (Hidden Waters North)
Notes: None

41. Winters Wash

Habitat Blocks Connected: Belmont Mountains - Arlington Valley - Tonopah Desert
Species Identified: Mule Deer, bighorn sheep, coyote, bats, LeContes Thrasher, javelina, mountain lion
Current Threats/Barriers: Urbanization, I-10, Agriculture, new roads, Salome Hwy, solar
Notes: None

42. Hassayampa River

Habitat Blocks Connected: Hassayampa River from Wickenburg south to Arlington and Gila River
Species Identified: Coyote, fox, mule deer, javalina, raptors, SW willow flycatcher, vireo, Western yellow-billed cuckoo
Current Threats/Barriers: I-10, Old US60, CAP, Union Pacific Railroad expansion to double track, APS transmission line substation (east bank), proposed Hassayampa freeway, Hidden Valley Parkway North, Bell Parkway, urbanization (proposed Douglas Ranch, Tartesso, Sun Valley), sand & gravel operations
Notes: Flood Control District is developing a River Course Master Plan for this area

43. Wagner Wash

Habitat Blocks Connected: White Tank Mountains – Hassayampa River
Species Identified: Mule deer, mountain lion, javelina, coyote, tortoise
Current Threats/Barriers: Sun Valley Pkwy, proposed Turner Parkway, Urbanization and new arterial roads, CAP, Festival Ranch
Notes: Contributes to connectivity between White Tank Mountains and Hassayampa River but does not directly connect the two areas

DIFFUSE MOVEMENT AREAS

44. Vulture Mountains East – West

Habitat Blocks Connected: Vulture Mountains East and West
Species Identified: Mule deer, javelina, kit fox, desert tortoise, mountain lion
Current Threats/Barriers: Vulture Mine Road, Canamex, OHV Recreation facilities, mining, Wickenburg Bypass
Notes: Addresses connectivity needs related to Vulture Mine Road and for proposed county park area; see also modeled corridor “AZ Missing Linkage Wickenburg – Hassayampa” Linkage #45

45. Lake Pleasant – Hieroglyphic Mountains – Bradshaw Mountains

Habitat Blocks Connected: Hieroglyphic Mountains north to Buckhorn Mountains and Bradshaw Mountains
Species Identified: Mule deer, bighorn, mountain lion, desert tortoise, Gila monster, songbirds, gray fox, lowland leopard frog, desert pupfish, topminnow
Current Threats/Barriers: Castle Hot Spr Rd, private/state land development, Peoria, recreation, SR74 expansion, CAP
Notes: Currently a large unfragmented landscape with some potential for fragmentation due to potential future development on private and state lands between federal lands;

AZ MISSING LINKAGE

46. Wickenburg – Hassayampa (Figure 10)

Habitat Blocks Connected: Wickenburg Mountains - Weaver Mountains - Date Creek Mountains Complex - Vulture Mountains
Species Identified: Bighorn sheep, mule deer, javelin, desert tortoise, black-tailed rattlesnake
Current Threats/Barriers: Roads, urbanization, OHV, equestrian, railroad, proposed widening of Hwy 93 Bypass
Notes: Workshop input has been refined with fine scale modeled linkage design; See previous discussion on AZ Missing Linkages and Figure 10 for illustration of original workshop stakeholder input; See AZ Missing Linkages report for further information (Beier and Majka 2006)

47. White Tank – Belmont – Heiroglyphic Mountains (Figure 12)

Habitat Blocks Connected: White Tank Mountains - Hassayampa River corridor - Belmont Mountains - Vulture Mountains - Heiroglyphic Mountains
Species Identified: Mule deer, mountain lion, javelina, bobcat, coyote, desert tortoise, red tail hawks & other raptors, ring-tailed cat, quail, dove, jackrabbit, cottontail, badger, desert tortoise, Gila Monster, kit fox, gray fox, small mammals, various reptiles
Current Threats/Barriers: Urbanization, agriculture, roads, several proposed parkways (Turner, Hidden Waters North, Beardsley), proposed Hassayampa Freeway, Sun Valley Pkwy, CAP, Johnson Rd., 323rd Ave
Notes: Workshop input has been refined with fine scale modeled linkage design; See previous discussion on AZ Missing Linkages and Figure 12 for illustration of original workshop stakeholder input; Final linkage report is currently in Draft (Arizona Game and Fish Department 2010)

Southwestern Maricopa County (Figure 8)

LANDSCAPE MOVEMENT AREAS

48. Eagletail Mountains – Gila Bend Mountains

Habitat Blocks Connected: Gila Bend Mountains/ Gila River/Painted Rock Mountains - to Eagletail Mountains/Kofa Mountains
Species Identified: Bighorn sheep, mule deer desert tortoise, mountain lion, javelina, bobcat, coyote
Current Threats/Barriers: Improvements to Agua Caliente Road and 579 Rd. , Hyder Rd., Centennial Rd, Union Pacific railroad, urbanization, agriculture, Painted Rock Dam, proposed connector between I-10 and I-8
Notes: None

49. Face Mountain – Oatman Mountain – Painted Rock Mountains

Habitat Blocks Connected: Face Mtn/Oatman Mtn/Signal&Woolsey Wilderness - Painted Rock Mtns/Sentinel Plains
Species Identified: Mule deer, bighorn sheep
Current Threats/Barriers: Solar, Union Pacific railroad, agriculture, Hyder Rd., proposed 404/505 (I-8/I-10 connector), Rocky Point Rd., urbanization, Agua Caliente Rd., additional roads, State land development
Notes: None

50. Buckeye Hills West – Buckeye Hills East

Habitat Blocks Connected: Buckeye Hills West – East; contributes to connectivity between Saddle Mountains and Buckeye Hills (Gila River Wildlife Area Complex) and Sierra Estrella Mountains
Species Identified: Bighorn sheep, mule deer, desert tortoise
Current Threats/Barriers: proposed Sonoran Parkway, sand and gravel operations, Buckeye Hills Shooting Range, SR 85, solar, urbanization (Goodyear/Buckeye), new roadways
Notes: Hwy 85 currently needs wildlife crossing structures; see “AZ Missing Linkages: Gila Bend - Sierra Estrella Linkage Design” (Beier, Garding & Majka 2008) for additional information

51. Sierra Estrella Mountains – Buckeye Hills

Habitat Blocks Connected: Buckeye Hills – Sierra Estrella Mountains
Species Identified: Bighorn sheep, mule deer, desert tortoise, javelina, mountain lion
Current Threats/Barriers: Urbanization (Goodyear), proposed Sonoran Parkway, Flood Control District plans for Waterman Wash & Tributaries (Rainbow Valley Drainage Master Plan)
Notes: This area is already highly developed and primary opportunities are preserving washes in natural state

52. Estrella Mountain – Sierra Estrella Mountains¹

Habitat Blocks Connected: Within habitat block linkage to preserve connectivity between Estrella Mountain County Park and BLM Estrella Wilderness across the Gila River Indian Community
Species Identified: Bighorn sheep, mule deer, mountain lion, javelina
Current Threats/Barriers: Urbanization, agriculture, illegal immigrant traffic
Notes: Currently an undeveloped landscape

53. Estrella Mountains – South Mountain

Habitat Blocks Connected: Estrella Mountain east across Gila River to South Mountain
Species Identified: Mule deer, javelina, coyote, various amphibians, mountain lion
Current Threats/Barriers: Urbanization, SR 801, loop 202, roads, canals, tribal land, agriculture
Notes: None

¹ Errata: Linkage #52 should have been categorized under “*Diffuse Linkage Areas*” on page 38; but will remain here to avoid renumbering.

54. North Maricopa Mountains – South Maricopa Mountains

Habitat Blocks Connected: North Maricopa Mountains with South Maricopa Mountains within the Sonoran Desert National Monument
Species Identified: Bighorn sheep, mule deer, javelina, tortoise
Current Threats/Barriers: Union Pacific Railroad – double tracking, SR 238 expansion
Notes: None

55. Sonoran Desert National Monument – Palo Verde Hills

Habitat Blocks Connected: Sonoran Desert National Monument - BLM/private lands into Pinal County
Species Identified: Mule deer, desert tortoise, bighorn sheep, mountain lion, bats, various reptiles
Current Threats/Barriers: Urbanization (Hidden Valley), future loop 303
Notes: None

56. Maricopa Mountains – Table Top Mountains

Habitat Blocks Connected: Maricopa Mountains across Vekol Valley to Table Top Mountains
Species Identified: Bighorn sheep, mule deer, javelina desert tortoise
Current Threats/Barriers: I-8
Notes: None

57. Palo Verde Hills – Table Top Mountains

Habitat Blocks Connected: Palo Verde Hills - Table Top Mountains
Species Identified: Bighorn sheep, mule deer, javelina
Current Threats/Barriers: I-8
Notes: None

58. Sand Tank Mountains – Sonoran Desert National Monument

Habitat Blocks Connected: Sand Tank Mountains – South Maricopa Mountains (SDNM)
Species Identified: Bighorn sheep, mule deer, javelina desert tortoise, mountain lion, white-tailed deer
Current Threats/Barriers: I-8, Hidden Valley development, OHV, border/drug smuggling impacts
Notes: None

59. Northern Sand Tank Mountains – Javelina Mountain

Habitat Blocks Connected: Sand Tank Mountains - Javelina Mountain; contributes to connectivity between South Maricopa Mountains (SDNM) - Sand Tank Mountains
Species Identified: Bighorn sheep, mule deer, javelina desert tortoise, mountain lion, white-tailed deer
Current Threats/Barriers: OHV, border/drug smuggling impacts
Notes: None

60. Javelina Mountain – Table Top Mountain

Habitat Blocks Connected: Javelina Mountain across Vekol Valley to Table Top Mountains
Species Identified: Bighorn sheep, mule deer, javelina, mountain lion, Desert tortoise
Current Threats/Barriers: Cattle grazing, OHV, recreation, border/smuggling impacts
Notes: None

61. Saucedo Mountains – Sand Tank Mountains

Habitat Blocks Connected: Sonoran Desert National Monument -Saucedo Mountains- Sand Tanks Mountains
Species Identified: Mule deer, javelina, bighorn sheep, Desert tortoise, white-tailed deer, mountain lion, kit fox,

bobcat, coyote
Current Threats/Barriers: SR 85, Military Range
Notes: Saucedo Valley area is also a priority in the Sonoran Desert Protection Proposal (Sonoran Institute)

62. White Hills – Saucedo Mountains

Habitat Blocks Connected: White Hills - Saucedo Mountains
species identified: Bighorn sheep, mule deer, mountain lion, California leaf-nosed bat, Long-nosed bat, Desert Iguana, Desert tortoise, sidewinder
current threats/barriers: SR 85, Military Range
Notes: None

63. Crater Range – Saucedo Mountains

Habitat Blocks Connected: Crater Range - Saucedo Mountains
Species Identified: Bighorn sheep, mule deer, mountain lion, sidewinder, California leaf-nosed bat, long-nosed bat, desert iguana, Desert tortoise,
Current Threats/Barriers: SR 85, railroads (Tucson-Cornelia-GilaBend), urbanization, agriculture
Notes: None

64. Crater Range – Childs Mountain

Habitat Blocks Connected: Crater Range - Child Mountain - Growler Mountains
Species Identified: bighorn sheep, bats, herps, lion, mule deer, Sonoran pronghorn
Current Threats/Barriers: Military Range 1 roads, active bombing, urbanization, agriculture
Notes: None

65. Crater Range – Growler Mountains

Habitat Blocks Connected: Crater Range - Growler Mountains
Species Identified: Bighorn sheep, mule deer javelina, mountain lion, California leaf-nosed bat, long-nosed bat, Desert iguana, sidewinder, Desert tortoise, Sonoran pronghorn
Current Threats/Barriers: Active Bombing Range, urbanization, agriculture, roads, canals, railroads
Notes: None

66. Aguila Mountains – Crater Range

Habitat Blocks Connected: Aguila Mountains- Crater Range
Species Identified: Bighorn sheep, mule deer javelina, Desert tortoise, Sonoran pronghorn, mountain lion, bats, badger, kit fox, desert valley amphibians and reptiles
Current Threats/Barriers: Active bombing range (NTAC), Barry Goldwater Range roads, urbanization, agriculture
Notes: None

67. Aguila Mountains – Granite Mountains

Habitat Blocks Connected: Aguila Mtns Granite Mtns
Species Identified: Bighorn sheep, mule deer, javelina, desert tortoise
Current Threats/Barriers: Military Range
Notes: None

RIPARIAN MOVEMENT AREAS

68. Gila River

Habitat Blocks Connected: Gila River corridor from the Salt River confluence to Colorado River
Species Identified: Waterfowl, migratory birds, beaver, muskrat, bobcat, coyote, gray fox, skunk spp., raccoon, various reptiles, amphibians and small mammals, osprey, javelina, mule deer, yellow-billed cuckoo, SW willow flycatcher, burrowing owl, bighorn sheep, Mississippi kite, Yuma clapper rail
Current Threats/Barriers: Urbanization, agriculture, diversion dams, water diversion, flood control projects (Tres Rios, El Rio), proposed freeways (ie. Loop 303, SR801 or other I-10 bybass)
Notes: River corridor has been dewatered from diversion dams, agriculture and municipal uses; restoration of wetted reaches for wildlife benefit would be the primary improvement required for the corridor and management of Flood Control District Right of way lands and PLO 1015 (USFWS/Department/BLM) lands adjacent to river corridor

69. Waterman Wash

Habitat Blocks Connected: Waterman Wash corridor from Vekol Valley/Vekol Wash north to the confluence with the Gila River
Species Identified: Sidewinder, Zebra-tailed lizard, Horned-tailed lizard, red tailed hawk, ground squirrel, jackrabbit, dove, burrowing owl
Current Threats/Barriers: Urbanization (Goodyear annexation and State land development, Mobil), agriculture, various arterials, Proposed 303, SR 238, railroad, proposed Sonoran Valley Parkway (Rainbow Valley), solar , proposed Hassayampa Freeway (SR 801?)
Notes: Flood Control District is currently developing the Rainbow Valley Drainage Master Plan which includes plans for Waterman Wash that use engineered and natural channel design elements

70. Vekol Valley – Vekol Wash

Habitat Blocks Connected: Vekol Wash and desert valley between eastern Maricopa Mountains (Sonoran Desert National Monument and western Sierra Estrella Mountains
Species Identified: Sonoran Green toad, great plains toad, AZ mud turtle, Sonoran desert toad, Couch's spadefoot toad, Great Plains Narrow-mouthed toad, red-spotted toad, Casque-headed toad, sidewinder, shovel-nosed snake, desert iguana, kit fox, badger, desert kangaroo rat, Desert tortoise, mule deer, javelina, mountain lion, bighorn sheep, gray fox, bobcat, badger, small mammals
Current Threats/Barriers: Urbanization (Goodyear, Mobile), roads, drug trafficking, illegal immigrant activity, I-8, loop 303, SR 238, I-10, proposed Sonoran Valley Parkway & current Rainbow Valley Road
Notes: This linkage was described to include wash habitat as well as adjacent Vekol Valley habitat

71. Sand Tank Wash

Habitat Blocks Connected: Sand Tank Wash - Gila river
Species Identified: Mule deer, javelina, birds
Current Threats/Barriers: I-8, SR85, railroad, Military Range activities
Notes: None

72. Fourth of July Wash

Habitat Blocks Connected: Gila Mountains - Painted Rock Mountains - Gila River corridor
Species Identified: Mule Deer, bighorn sheep, javelina, birds, desert tortoise
Current Threats/Barriers: Urbanization, solar, roads
Notes: None

73. Copper Wash

Habitat Blocks Connected: Eagletail Mountains - Gila River
Species Identified: Mule deer, javelina, birds
Current Threats/Barriers: Solar, urbanization, railroad
Notes: None

74. Ten Mile Wash

Habitat Blocks Connected: Sikort Chuap, Childs - Crater Batamote Mountains - Childs Valley - Sentinel Plain
Species Identified: Bighorn Sheep, mule deer, javelina, Desert tortoise, birds
Current Threats/Barriers: Roads, Military Activity, UPRR, Feed Lot, SR 85, railroads
Notes: None

75. Northern Sand Tank Mountains – I-8²

Habitat Blocks Connected: Sand Tank Mountains across I-8 corridor
Species Identified: Bighorn sheep, mule deer, javelina
Current Threats/Barriers: I-8
Notes:

DIFFUSE MOVEMENT AREAS

76. Gila Bend Mountains

Habitat Blocks Connected: GilaBend Mountains – Agua Caliente Road
Species Identified: Bighorn sheep, mule deer, desert tortoise, Gila monster
Current Threats/Barriers: Potential to pave and realign Agua Caliente Rd
Notes: Within habitat block threat

77. Vekol Valley – Rainbow Valley

Habitat Blocks Connected: Lower Vekol Valley north through Rainbow Valley; Maricopa Mountains (Sonoran Desert National Monument) – Sierra Estrella Mountains – Buckeye Hills
Species Identified: Sonoran Green toad, great plains toad, AZ mud turtle, Sonoran desert toad, Couch's spadefoot toad, Great Plains Narrow-mouthed toad, red-spotted toad, Casque-headed toad, sidewinder, shovel-nosed snake, desert iguana, kit fox, badger, desert kangaroo rat, desert tortoise, big horn sheep, mule deer, mountain lion, javelina
Current Threats/Barriers: Urbanization (Goodyear annexation and State land development, Mobile), agriculture, Maricopa Road, SR238, I-8, railroads, future 303, Hidden Valley growth, illegal immigrant activities
Notes: This area serves wildlife as both a habitat block as well as a diffuse movement area. Stakeholders identified the area as core desert valley habitat for many wildlife species; at the same time the area is identified as important as diffuse movement area between mountain ranges that surround the desert valley habitat.

78. Sentinel Plain

Habitat Blocks Connected: Sentinel Plain
Species Identified: Mule deer, Sonoran pronghorn, shovel-nosed snake, badger, various reptiles and amphibians
Current Threats/Barriers: I-8, UPRR, solar
Notes: This area serves wildlife as both a habitat block as well as a diffuse movement area. Stakeholders identified the area as core desert valley habitat for many wildlife species; at the same time the area is identified as important as diffuse movement area between mountain ranges that surround the desert valley habitat.

² Errata: Linkage #75 should have been categorized under “*Landscape Movement Areas*” on page 34; but will remain here to avoid renumbering.

AZ MISSING LINKAGE

79. Buckeye Hills East – Sonoran Desert National Monument (Figure 9)

Habitat Blocks Connected: Buckeye Hills and Gila River Wildlife Area complex – Maricopa Mountains (Sonoran Desert National Monument); part of a connectivity plan to preserve linkages between Gila Bend Mountains,
Species Identified: Mule deer, bighorn sheep, desert tortoise, kit fox, gray fox, bobcat, badger, mountain lion, javelina, Gila monster, desert iguana, shovel-nosed snake and other reptiles, Sonoran desert toad and other amphibians, bats, black-tailed jackrabbit and other small mammals, western burrowing owls, roadrunner, LeContes thrasher and other birds
Current Threats/Barriers: SR85, Sonoran Solar development, future Hassayampa Freeway, transmission lines/power substations, mining, OHV, recreation
Notes: Workshop input has been refined with fine scale modeled linkage design; See previous discussion on AZ Missing Linkages and Figure 9 for illustration of linkage design progression including original workshop stakeholder input; Final linkage report is currently in Draft (Arizona Game and Fish Department 2010).

80. Gila Bend Mountains – Sonoran Desert National Monument (Figure 9)

Habitat Blocks Connected: Gila Bend Mountains (Woolsey Peak/Signal Mountain Wilderness) with Gila River corridor with Buckeye Hills West/Buckeye Hills County Park and Gila River Wildlife Area Complex (Robbins/Powers Butte, Arlington WA) with Maricopa Mountains (Sonoran Desert National Monument)
Species Identified: Bighorn sheep, desert tortoise, mule deer, javelina, mountain lion, gila monster, desert iguana, rosy boa, shovel-nosed snake and numerous reptiles (see linkage report), bats, Gambel’s quail, roadrunner, western burrowing owl, LeConte’s thrasher and other birds
Current Threats/Barriers: SR 85, Enterprise Rd, Gila River, Painted Rock Dam, Old US Hwy 80, Paloma Rd., Gila Bend Canal and Enterprise Canal, railroad, urbanization, agriculture, Lewis Prison, Painted Rock Dam, proposed Hidden Waters Pkwy, Sonoran Solar development and other potential, proposed Hassayampa Freeway, transmission lines/power substations, mining, OHV, recreation, landfills
Notes: Workshop input has been refined with fine scale modeled linkage design; See previous discussion on AZ Missing Linkages and Figure 10 for illustration of linkage design progression including original workshop stakeholder input; See AZ Missing Linkages report for further information (Beier, Garding and Majka 2008) and revisions to the linkage design on file with the Department.

81. Sierra Estrella Mountains – Maricopa Mountains (Figure 9)

Habitat Blocks Connected: Sierra Estrella Mountains (Estrella Wilderness & Estrella Mountain Park) - Maricopa Mountains (Sonoran Desert National Monument)
Species Identified: Bighorn sheep, desert tortoise, mule deer, javelina, mountain lion, gila monster, desert iguana, rosy boa, shovel-nosed snake and numerous reptiles (see linkage report), bats, Gambel’s quail, road runner, western burrowing owl, LeConte’s thrasher and other birds
Current Threats/Barriers: Urbanization (Goodyear, Mobile), natural gas pipeline and Gas Pipeline Road, Union Pacific railroad solar, transmission lines/power substations, proposed SR 303L extension, proposed Hassayampa Freeway, proposed Sonoran Valley Parkway, SR 238, Rainbow Valley Road
Notes: Workshop input has been refined with fine scale modeled linkage design; See previous discussion on AZ Missing Linkages and Figure 10 for illustration of linkage design progression including original workshop stakeholder input; See AZ Missing Linkages report for further information (Beier, Garding & Majka 2008) and revisions to the 2008 linkage design on file with the Department.

Identified Barriers to Wildlife Movement

1. CAP – Central Arizona Project Canal

Habitat Blocks Connected: Linkage opportunity within floodplain set asides and CAP Right of Way lands adjacent to the canal; series of drainage basins and surface drainage crossings
Species Identified: Variety of species depending on location and adjacent habitat along the floodplain (ie. coyote, javelina, fox, badger, hawk, owl, deer)
Current Threats/Barriers: Urbanization now and future, agriculture, canal itself, various developments, roads, developed recreational facilities
Notes: Has broad support by various municipal & county organizations and Central Arizona Water Conservation District Administration, Maricopa Association of Governments, Arizona State Land Deptment, Salt River Pima Maricopa Indian Community for conservation as open space and multiuse trail corridor

Linkages Identified Outside of Maricopa County

The following linkages were identified by stakeholders at the Maricopa workshop, however the linkages fall within Pinal and Gila counties. These linkages will be illustrated in the appropriate county reports in the future. The following descriptions should aid in understanding where these linkages are located and why they were identified. Please contact the Habitat Program at the Department’s Mesa Regional office (480-981-9400) or the Department’s GIS Program (gis@azgfd.gov) for further information.

Superstition Mountains – Devils Canyon – Gila River

Habitat Blocks Connected: Superstition Mountains/Wilderness - Gila River
Species Identified: mule deer, black bear, coyote, fox, coatimundi, ocelot, bobcat, mountain lion, hawk, owl, javelina
Current Threats/Barriers: US 60, mining expansion, agriculture, urbanization, railroad (Southern Pacific spur)
Notes: Development of new mines and expansion of old mines could cause major disruption

Superstition Mountains – Mineral Mountains

Habitat Blocks Connected: Superstition Mountains/Wilderness (Tonto National Forest) - Mineral Mountains/White Canyon Wilderness (Bureau of Land Management)
Species Identified: Bighorn sheep, mule deer, white-tailed deer, javelina, mountain lion, bobcat, coyote, desert tortoise, small mammals, birds, reptiles
Current Threats/Barriers: US 60, Hwy 177, urbanization, Town of Superior expansion
Notes: North-south movement for many species

Mazatzal Mountains – Sierra Ancha Mountains

Habitat Blocks Connected: Mazatzal Mountains & Wilderness - Sierra Ancha Mountains & Salome and Sierra Ancha Wilderness areas
Species Identified: Bighorn sheep, mule deer, white-tailed deer, javelina, black bear, mountain lion, eagles, SW willow flycatcher, native fish, Mexican gartersnake, narrow-headed gartersnake, Mexican spotted owl, waterfowl, migratory birds, bats, numerous small mammals, reptiles and amphibians
Current Threats/Barriers: Urbanization, agriculture, SR 188, gravel mining, future expansion of A Cross Rd., Punkin Center and Tonto Basin development
Notes: SR 188 is a major connection between Globe, Roosevelt Basin and Payson

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APPENDIX 1 – SAMPLE DATASHEET USED IN STAKEHOLDER WORKSHOPS

LINKAGE DATA SHEET

Linkage Number: _____ (as referenced on the map)

Linkage Name: _____
 (Create a name that reflects the areas connected, e.g., "Peloncillo-Chiricahua Linkage" or a name that reflects a major feature in the linkage, e.g., "Davidson Creek")

Wildland Blocks Connected by the Linkage

We want to be explicit about what we are connecting. Please provide a brief description.

Wildland Block 1 (example: Robbins Butte State Wildlife Area, Buckeye Hills Regional Park, and adjacent BLM and ASLD land in the Buckeye Hills)	Wildland Block 2 (example: about 20,000 acres of private land in two ranches, plus 800 acres adjacent farmland in the Gila River near Pima Butte")

What are the **main threats** to the linkage? Use a separate line for each major paved road crossing the linkage.

Threat	Severity (1-5) [†]		Details (particular areas under threat; # lanes current & planned)
	Now	Future	
Urbanization			
Agriculture			
Road Name: _____			
Road Name: _____			
Canal Name: _____			
Railroad: _____			

Describe federal, state, or local support for conserving the linkage, willing land sellers, agencies interested in acquisition, formal conservation planning for the linkage. If you have information you would prefer not appear in print but that you are willing to discuss, provide your name and contact information.

Provide details on FUTURE or PROPOSED highway or road projects.

Name of Project	Description (e.g., "realign 20 mile of existing road, 2 lanes each way," or "add passing lanes along 30 miles of road")	Funded?	Estimated start date	Env. review completed?	Contact person, affiliation (e.g., "Nancy Paxton, ADOT PHX")
		Yes/No		Yes/No	
		Yes/No		Yes/No	
		Yes/No		Yes/No	

Provide details on FUTURE or PROPOSED development projects.

Name of Project	Description (e.g., "20,000 new homes, plus commercial and industrial areas," or "1,000 acre industrial park")	Entitled?	Env. review completed?	Jurisdiction (e.g., "City of Chandler")	Contact person, affiliation (e.g., "Nancy Paxton, City of Chandler")
		Yes/No	Yes/No		
		Yes/No	Yes/No		
		Yes/No	Yes/No		
		Yes/No	Yes/No		

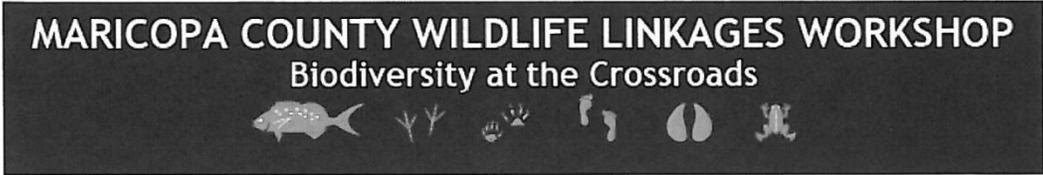
Provide any other helpful information (e.g., location, number, and size of key parcels in the linkage).

Key contacts for this linkage: Please provide the names of 1 or more persons we can contact for additional information and future planning efforts.

Name	Affiliation	Phone	Email

APPENDIX 2 – WORKSHOP AGENDA AND STAKEHOLDER ORGANIZATIONS AND AFFILIATIONS

| OF 2



SAVE THE DATE!

February 14th, 2008

8:00 am - 5:00pm

Hosted at

The Flood Control District of Maricopa County

2801 W. Durango Street
Phoenix, AZ 85009

THE GOAL is to exhaustively identify all wildlife connectivity areas (wildlife linkages) within Maricopa County. We need to have participation from interested organizations/agencies/individuals countywide so that we can build partnerships and work toward a unified plan in the conservation/management of wildlife. We intend to make the resulting wildlife linkages map widely available to planners for incorporation into mitigation activities including wildlife crossings, land protection measures and community planning.

EXPERTISE IS NEEDED from agencies, universities and other organizations to identify existing and potential wildlife linkages that are vital to maintaining wildlife biodiversity in Maricopa County. The workshop will provide a forum for gathering local and regional knowledge about wildlife movement patterns across the County. Experts who attend the workshop should be familiar with the Arizona landscape and various taxonomic groups (e.g. carnivores, ungulates, birds, small mammals, herps, etc.). Participants will work in small groups to map the most important linkage areas for different wildlife species.

Come and be a part of a comprehensive approach to protect and maintain Arizona's wildlife connectivity!

Lunch will be provided at the Workshop

Courtesy of the Sonoran Institute

Please register by responding to this e-mail with your name and contact information.

Our Supporters:

Arizona Department of Transportation

Arizona Game and Fish Department

Arizona State University Global Institute of Sustainability

Flood Control District of Maricopa County

Maricopa County Department of Transportation

Northern Arizona University

Sonoran Institute

MARICOPA COUNTY WILDLIFE LINKAGES WORKSHOP

Biodiversity at the Crossroads



February 14th, 2008

Hosted at the Flood Control District of Maricopa County
2801 West Durango Street, Phoenix, AZ 85009

- Registration/Coffee**.....8:00 a.m. – 8:30 a.m.
- Welcome/Introduction**.....8:30 a.m. – 8:40 a.m.
Moderator: *Jon Loxley*, Landscape Architect Planner, Flood Control District of Maricopa County
- Opening Remarks**8:40 a.m. – 9:10 a.m.
- *Tim Phillips*, Chief Engineer and General Manager, Flood Control District of Maricopa County
 - *Andy Kunasek*, Maricopa County Board of Supervisors, Maricopa County
 - *Shannon Scutari*, Policy Advisor for Growth and Infrastructure, Governor's Office
 - *Duane Shroufe*, Director, Arizona Game and Fish Department
- From Y2Y to your back yard: identifying and planning wildlife corridors in North America**.....9:10 a.m. – 9:30 a.m.
Paul Beier, Professor, Northern Arizona University
- Break**.....9:30 a.m. – 9:45 a.m.
- Mapping Linkages Breakout Sessions**.....9:45 a.m. – 12:00 a.m.
- *Objectives & Goals for Breakout Session: Dave Grandmaison*, Research Biologist, Arizona Game and Fish Department
 - *Overview of Available Maps: Siobhan Nordhaugen*, Office of Environmental Services, Natural Resources Management Group, Arizona Department of Transportation
 - *Introduction of the Facilitators: Ray Schweinsburg*, Research Biologist, Arizona Game and Fish Department
- Lunch**.....12:00 a.m. – 12:30 a.m.
- Mapping Linkages Breakout Sessions**.....12:30 a.m. – 2:30 a.m.
- Break**.....2:30 p.m. – 2:45 p.m.
- Mapping Linkages Breakout Sessions**.....2:45 p.m. – 4:15 p.m.
- Break**.....4:15 p.m. – 4:30 p.m.
- Presentation of Digitized Linkages**.....4:30 p.m. – 4:45 p.m.
Siobhan Nordhaugen, Office of Environmental Services, Natural Resources Management Group, Arizona Department of Transportation
- Closing Remarks**.....4:45 p.m. – 5:00 p.m.
Ray Schweinsburg, Research Biologist, Arizona Game and Fish Department



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Maricopa County Wildlife Linkages Workshop

Initials	First Name	Last Name	Affiliation	e-mail	Badge #
FM	Fareed	Abou-Haidar	Maricopa County Parks and Recreation	fareedabouhaidar@mail.maricopa.gov	23
AM	Todd	Atwood	Arizona Game and Fish Department	TAtwood@azgfd.gov	42
KB	Kerry	Baldwin	Pima County Natural Resources, Parks and Recreation	kerry.baldwin@pima.gov	35
BB	Bonnie	Bariola		bbariola@cox.net	7
BB	Paul	Beier	Northern Arizona University	Paul.Beier@NAU.EDU	41
BB	Bill	Burger	Arizona Game and Fish Department	bburger@azgfd.gov	28
BB	Brett	Burningham	City of Goodyear	Brett.Burningham@goodyearaz.gov	59
VC	Victoria	Carella	Arizona State Land Department	Vcarella@land.az.gov	20
EC	Emily	Christ	Arizona Department of Transportation	echrist@azdot.gov	64
SC	Stephen	Cleveland	The Sonoran Institute	sscleveland@gmail.com	42
TC	Ted	Cordery	Bureau of Land Management	Ted.Cordery@blm.gov	10
MB	Michael	Dings	Arizona Department of Transportation	mdings@azdot.gov	25
SE	Steven	Earl	Arizona State University	Steven.Earl@asu.edu	14
RE	Anne	Ellis	Arizona State University	anne.ellis@asu.edu	
RE	Russ	Engel	Arizona Game and Fish Department	rengel@azgfd.gov	32
CG	Charles	Enos	DEQ Water Quality Program	caenos@gilanet.net	
KG	Kris	Gade	DMJM Harris/AECOM	kris.gade@dmjmharris.com	58
EG	Eleanor	Gladding	SWCA Environmental Consultants	Egladding@swca.com	48
EG	Eric	Gorsegner	The Sonoran Institute	EGorsegner@Sonoran.Org	57
DA	Dave	Grandmaitson	Arizona Game and Fish Department	dgrandmaitson@azgfd.gov	5
DB	Kevin	Grove	HDR Inc.	kevin.grove@hdrinc.com	44
CH	Chris	Haas	SWCA Environmental Consultants	chaas@swca.com	47
CH	Matt	Haberhorn	Phoenix College Biology Department	Matt.haberhorn@pcmail.maricops.edu	
CH	Don	Hadder	City of Scottsdale	dhadder@scottsdaleaz.gov	60
CH	Jon	Hanna	Arizona Game and Fish Department	jhanna@azgfd.gov	
CH	Russ	Haughey	Arizona Game and Fish Department	rhaughey@azgfd.gov	
CH	Bob	Henry	Arizona Game and Fish Department	bhenry@azgfd.gov	65

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Tom	Hildebrandt	Arizona Game and Fish Department	thildebrandt@azgfd.gov	29
Tim	Hughes	Bureau of Land Management	Tim_Hughes@blm.gov	8
Nicolas	Jauregui	Pulte Homes Corporation	Nicolas.Jauregui@Pulte.com	12
Genevieve	Johnson	Arizona State Parks	gjohnson@azstateparks.gov	43
Sarah	Karas	Arizona Game and Fish Department	ijones@azgfd.gov	23
Vineetha	Kartha	Arizona Department of Transportation	skarasz@azdot.gov	62
Karen	Kelleher	City of Surprise	vineetha.kartha@surpriseaz.com	7
Ken	Kertell	Bureau of Land Management	Karen_Kelleher@blm.gov	
DeeDee	Kimbrell	SWCA Environmental Consultants	kkertell@swca.com	
LariBeth	Kirkendall	City of Tempe - Rio Salado	deede.kimbrell@tempe.gov	51
Bill	Knowles	City of Surprise	LariBeth.Kirkendall@surpriseaz.com	
Rebecca	Knuffke	Arizona Game and Fish Department	bknowles@azgfd.gov	
Justin	Ladd	The Wilderness Society	rebecca_knuffke@tws.org	26
Major John	Ladd	Kimley-Horn and Associates, Inc	justin.ladd@kimley-horn.com	56
Paul	Langdale	Arizona Army National Guard	John.ladd@azdema.gov	54
Andy	Laurenzi	Arizona Department of Transportation	plangdale@azdot.gov	67
Susannah	Lerman	The Sonoran Institute	ALaurenzi@Sonoran.Org	3
Jon	Loxley	Arizona State University	slerman@nsm.umass.edu	55
Don	Meserve	Flood Control District of Maricopa County	jonloxley@mail.maricopa.gov	
Henry	Messing	City of Scottsdale	dmeserve@scottsdaleaz.gov	61
Mayra	Moreno	Bureau of Reclamation	hmessing@lc.usbr.gov	6
Siobhan	Nordhaugen	Arizona Department of Transportation	mmoreno@azdot.gov	24
Danica	Norris	Arizona Wilderness Coalition	snordhaugen@azdot.gov	
Carolyn	Oberholzer	Rose Law Group	danica@azwild.org	21
Tim	Oliver	Maricopa County Department of Transportation	coberholzer@roselawgroup.com	67
Pike	Palmer	W Holdings	TimOliver@mail.maricopa.gov	
Bruce	Peck	Logan Simpson Design Inc.	pike@wholdings.com	21
Fran	Pinto	Arizona Army National Guard	bpalmer@lsdaz.com	49
Theresa	Pinto	Flood Control District of Maricopa County	Fran.Peck@azdema.gov	
Joe	Ridgely	Maricopa County Department of Transportation	timp@mail.maricopa.gov	
Elizabeth	Ridgely	One Green World	joepinto@mail.maricopa.gov	
			eridgely@cox.net	

(Involved)

wants to know if materials (ie maps) will be circulated via email.

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Natalie	Robb	Arizona Game and Fish Department	nrobb@azgfd.gov	
Joanne	Roberts	Arizona State Parks	jroberts@azstateparks.gov	
Iris	Rodd	Pima County Natural Resources, Parks and Recreation	iris.rodden@pima.gov	34
Ray	Schweinsburg	Arizona Game and Fish Department	rschweinsburg@azgfd.gov	16
Jason	Scott	Kimley-Horn and Associates, Inc	Jason.Scott@kimley-horn.com	
Eyal	Shohat	Arizona State University	eyal.shohat@asu.edu	13
Dave	Showen	Town of Buckeye	dshowen@buckeyeaz.gov	11
Philip	Smith	Arizona Game and Fish Department	psmith@azgfd.gov	
Mark	Stewart	Arizona Game and Fish Department	mstewart@azgfd.gov	50
Diana	Stuart	Flood Control District of Maricopa County	dms@mail.maricopa.gov	
Valerie	Swick	Flood Control District of Maricopa County	vas@mail.maricopa.gov	
Ian	Tackett	Logan Simpson Design Inc.	itackett@LSDAZ.com	
Mark	Turner	Kimley-Horn and Associates, Inc	mark.turner@kimley-horn.com	
Dan	Urquidez	Arizona Game and Fish Department	Durquidez@azgfd.gov	40
Tim	Wade	EcoPlan Associates, Inc.	twade@ecoplanaz.com	15
Dana	Warnecke	Arizona Game and Fish Department	dwarnecke@azgfd.gov	53
Greg	Williams	City of Scottsdale	gwilliams@scottsdaleaz.gov	
Jeff	Williamson	Arizona Zoological Society	williamson@thephxzoo.com	
John	Windes	Arizona Game and Fish Department	jwindes@azgfd.gov	38
Hobar	Wingard	City of Surprise	hobart.wingard@surpriseaz.com	
Lori	Young	Sonoran Desert National Monument	Lori_Young@blm.gov	49
Brenda	Zambelli	Maricopa County Department of Transportation	BrendaZambelli@mail.maricopa.gov	
John	Di Bari	Sonoran FCD	jdibari@sonoran.org	4
GARY	SHAPIRO	MCARD Maricopa Tm. 1	GHS@MAIL.MARICOPA.GOV	17
CHRIS	COOPER	City of Pima	ccooper@mail.maricopa.gov	18
KAT	SHOUP	AZ GFD	jeff.shoup@pimaaz.gov	30
Diane	SHOUP	AZ GFD	dkshoup@azgfd.gov	31
Nancy	Coranally	Pima County NRAC	nancy.coranally@pimaaz.gov	37
Kathleen	Teran	AZ Game & Fish	cteran@azgfd.gov	33
Scott	Richardson	USFS (see other sheet)	scott.richardson@fas.gov	39
Daniel	Nelson	AZ Game & Fish	dnelson@azgfd.gov	41
Darren	Julian	AZ Game & Fish	djulian@azgfd.gov	52

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