SECTION V ARIZONA'S WILDLIFE LINKAGES PRIORITIZATION

Arizona Wildlife Linkages Workgroup (AWLW) wished to develop a means that would assist in identifying proposed potential linkage zones for immediate action. Those linkages with the highest ecological value coupled with the most pressing threats were given the highest priority for consideration. In particular, we wanted to identify a set of about 30 linkages that would be candidates for development of linkage designs (*Section IX Future Directions*) based on fiscal and time constraints. Nevertheless, all the identified potential linkage zones are regarded as important. In the future, all potential linkage zones that have imminent plans for construction will need to be addressed whether or not they are deemed a priority through this process.

Following a process similar to that described by Beier et al. (2005), we scored each proposed potential linkage zone in two dimensions – Biological Value and Threat and Opportunity (*Figure 5-1*). The Biological Value was designed to reflect the overall importance of a potential linkage zone with some of the criteria specific to the associated habitat blocks. Threats refer to the known or perceived threats to the linkage caused by current or potential habitat alteration. Opportunity is considered to be active efforts to acquire land within a potential linkage zone or the presence of key landowners that are willing to collaborate on conservation.

Participants assigned rankings to the established criteria for each proposed potential linkage zone. It should be noted that the Biological Value scores are not added to the Threat and Opportunity scores. The highest priority linkages fall in the upper right quadrant reflecting the most important biologically with the highest associated threat.

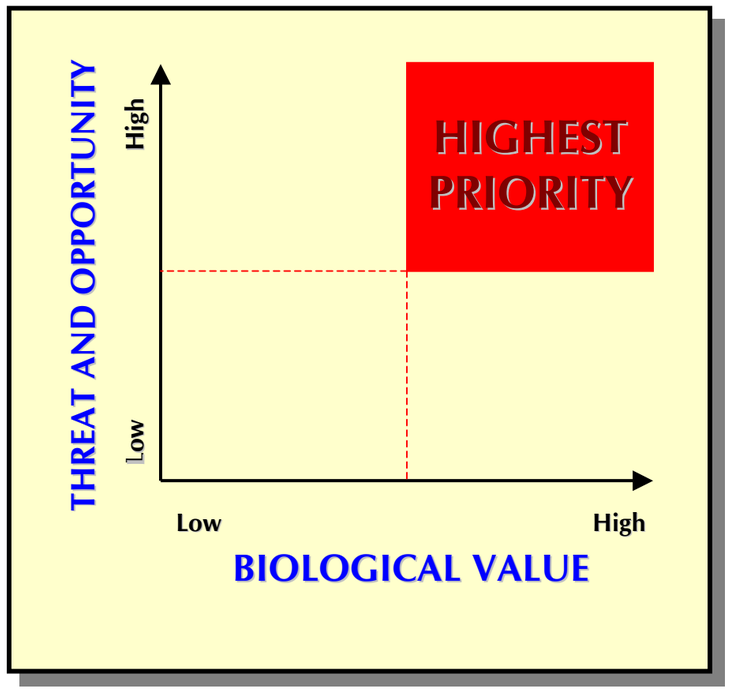

Figure 5-1. Prioritization Graph

Biological Value

Eight criteria were used to assess biological importance. Three of the criteria relate to the habitat blocks. The remaining five criteria assessing the biological value focused directly on the potential linkage zone itself.

The first of the criteria relating to the habitat blocks is in regards to relative size of the blocks. The relative sizes of the habitat block areas connected by the potential linkage zone (*Table 5.1*) were compared. A large habitat block is defined as greater than 772 square miles (2,000 km^2), a medium habitat block is greater than 23 square miles to 772 square miles (60 to 2,000 km^2) and a small habitat block is less than 23 square miles (60 km^2). The highest value of 100 points was given to proposed linkages that connect two large blocks. Lower scores were assigned for potential linkage zones between large and medium-sized habitat blocks, or between large and small habitat blocks, down to a low of 0 points for a proposed linkage between two small blocks. The 772 square miles and 23 square miles (2,000 km^2 and 60 km^2) thresholds correspond to the minimum areas required to support mountain lion, *Felis concolor*, (Beier 1993) or bobcat, *Lynx rufus*, (Crooks 2002), respectively, over the short term. In addition to being among the most area-sensitive species in an ecoregion, these high-level

carnivores can be considered important regulators of ecosystem function (Terborgh et al. 1999). One or both of these two species occur in all connected habitat blocks, and were thus more appropriate to consider than species that were present only in some habitat block areas.

HB1. Size of Habitat Blocks	Points
Large Habitat Block to Large Habitat Block	100
Large Habitat Block to Medium Habitat Block	75
Medium Habitat Block to Medium Habitat Block	50
Large Habitat Block to Small Habitat Block	33
Medium Habitat Block to Small Habitat Block	15
Small Habitat Block to Small Habitat Block	0

Table 5-1. HB1 Size of Habitat Blocks

The next criterion is the quality of existing habitat of the smaller habitat block (*Table 5.2*). This is considered on a scale of zero, severely impacted, to 100, unimpacted. "Unimpacted" is defined as dominated by or readily restorable to natural vegetation, relatively unfragmented, supports habitat for diverse array of native species, high area to perimeter ratio, low to moderate levels of urbanization and agriculture, and low to medium levels of invasive species. "Readily restorable" (on the scale between 50 and 100) means that the area still supports enough native soils and sufficient native seed sources that degraded areas can be returned to natural vegetative composition with active or passive habitat management. This might include fallow agricultural fields, but generally excludes extensive cut or fill slopes, paved areas and highly compacted soils. On the scale, "impacted" represents the condition where native vegetation is severely compromised by human activities. There is obvious fragmentation by roads, highways, urbanization and agriculture. High levels of invasive species are also present. "Severely impacted" refers to areas that have relatively little natural habitat or processes remaining, criss-crossed by roads, heavily urbanized and severe levels of invasive species.

HB2. Habitat Quality of the Smaller Block	Points
Unimpacted	100
Impacted	50
Severely impacted	0

Table 5-2. HB2 Habitat Quality of the Smaller Block

The presence of linkage dependent species is the third criterion for the habitat blocks (*Table 5-3*). A value of zero indicates that there are not any linkage-dependent species occurring in the habitat blocks. One or more non-state or federally listed linkage dependent species present is given the value of 50. The presence of one or more species with special status is 70. A value of 100 is where one or more threatened and endangered species is linkage dependent.

HB3. Presence of Linkage Dependent Species	Points
One or more threatened and endangered species is linkage dependent	100
One or more species with special status is linkage dependent	70
One or more non-listed linkage dependent species	50
No linkage dependent species	0

Table 5-3. HB3 Presence of Linkage Dependent Species

Whether or not the linkage is important as a seasonal migration corridor, such as for a migratory deer herd, is part of the biological value considerations for the potential linkage zone (*Table 5-4*). Migration is defined as a regular (twice a year) seasonal movement of animals between winter and summer ranges. It does not refer to juvenile dispersal or other animal movements.

L1. Facilitates Seasonal Migration	Points
Yes	100
No	0

Table 5-4. L1 Facilitates Seasonal Migration

Additional value is given to a linkage zone that contains significant riparian areas (*Table 5-5*). This includes perennial, intermittent, and ephemeral river classifications (See *Section VIII*). Each aquatic ecosystem is critical both as habitat and a linkage.

L2. Riparian Area	Points
Yes	100
No	0

Table 5-5. L2 Riparian Area

Conservation ownership was evaluated for each linkage zone (*Table 5-6*). As described in the definition of a habitat block (*Table 4-1*), land (State or private) that is under conservation management directly adjacent to a habitat block have been incorporated into the block boundaries. We assigned points for the percentage of conservation lands, including State and private land currently managed for conservation, that are located within a linkage zone.

The area of the linkage zone and the area of each parcel of land ownership within the linkage zone were calculated using GIS analysis. To calculate the percentage of land in the linkage zone in conservation ownership, the combined percentage of State Land and private land ownership is subtracted from 100 percent, indicative of the overall area of the linkage. The resultant is a percentage that is converted to a point value.

L3. Conservation Ownership	Points
100% – (Percentage of State Land in Linkage + Percentage of Private Land Ownership in Linkage) = Percentage of Land in Linkage Considered to be in Conservation Ownership	Percentage of Land in Linkage Considered to be in Conservation Ownership * 100 = Point Value

Table 5-6. L3 Conservation Ownership

The number and status of species living within the potential linkage zone is another criterion for biological importance. The rank of zero indicates a lack of species richness, diversity or sensitivity. The range of rankings is detailed in Table 5-7. The points are assigned based on presence of species holding status (both state and federal listings) in a given potential linkage zone.

L4. Special Status Species WITHIN the Linkage Zone	Points
Three or more species listed as threatened and endangered species or species with special status	100
One or two species listed as threatened and endangered species or species with special status	75
High species diversity, none listed as threatened and endangered or special status	50
Lack of species richness, diversity, or sensitivity	0

Table 5-7. L4 Special Status Species WITHIN the Linkage Zone

Finally, the degree to which the potential linkage zone is essential to the utility of the overall network of linkages is evaluated (*Table 5-8*). To some extent, "everything is connected to everything else" and every linkage is an important linkage in a chain. The important idea here is whether or not one or more linkages become non-functional if the linkage being evaluated is lost.

L5. Other Linkages Depend on This One	Points
Yes	100
No	0

Table 5-8. L5 Other Linkages Depend on This One

Biological Value Weighting

The associated weighting for each criterion in Biological Value is given in *Table 5-9*. The weighting among scores reflects an emphasis on ecosystem processes, and consequently area was given more importance than the particular habitats or habitat quality of the habitat blocks. This affords more protection for large areas that may support a wider range of species and their habitats. To ensure that the importance of the smaller blocks was not discounted, the quality of the smaller block was given the second highest weighting.

Weighting for Biological Value	
HB1 Size Blocks	35%
HB2 Quality of Smaller Block	13%
HB3 Linkage-Dependent Species	9%
L1 Seasonal Migration Corridor	9%
L2 Riparian Linkage	9%
L3 Conservation Ownership	9%
L4 Special Species WITHIN Linkage	9%
L5 Other Linkages Depend on This One	9%

Table 5-9. Weighting for Biological Values

Threat and Opportunity Value

Each proposed potential linkage zone also received a separate Threat and Opportunity score. At the workshops, the participants rated the severity of each of the five identified threats to connectivity (*Table 5-10*) to the potential linkage zone on a scale of zero, no threat, to five, severe threat requiring restoration to enhance permeability.

T1 – T5. Development Threats	Points
T1. Highway	0 to 5
T2. Urbanization	0 to 5
T3. Canal	0 to 5
T4. Railroad	0 to 5
T5. Border Security	0 to 5

Table 5-10. T1 – T5 Development Threats

Three types of opportunity were considered possible in the potential linkage zone. These include the prospect of cross-border jurisdictional cooperation, planned projects that would be conducive to the inclusion of mitigation measures to promote connectivity and the current conservation climate within the linkage zone.

Linkages that are critical to wildlife movement between states or countries present special opportunities and challenges due to the need for cooperation across jurisdictions. Potential linkage zones that border other states and Mexico were given the highest point value. Those potential linkage zones providing indirect connectivity to border linkages are also assigned a point value (*Table 5-11*).

O1. Linkage to other State or Mexico	Points
Direct link to Mexico	100
Direct link to other State or Indirect link to Mexico or other State	80
Not a cross-border link	0

Table 5-11. O1 Linkage to Other State or Mexico

Wildlife concerns can be integrated into construction design and highway upgrades if addressed early in the development and planning processes. Potential linkage zones that include projects listed in the ADOT 5-year and 20-year plans offer immediate opportunities for involvement (*Table 5-12*) and were weighted to represent those needs.

O2A. ADOT 5-Year Plan	Points
Yes	100
No	0

Table 5-12. O2A ADOT 5-Year Plan

O2B. ADOT Long Range (20-Year) Plan	Points
Yes	100
No	0

Table 5-13. O2B ADOT Long Range (20-Year) Plan

Opportunity is created if there is an active effort to conserve the linkage through land acquisition, easements, zoning, or other means, or a landowner is known to be receptive to conserving the land (*Table 5-14*).

O3. Active Conservation Efforts	Points
Yes	100
No	0

Table 5-14. O3 Active Conservation Efforts

Threat and Opportunity Value Weighting

The associated weighting for Threats and Opportunity Values (*Table 5-15*) placed the greatest emphasis on active transportation planning followed by the recognition of the importance of current conservation efforts. The threats of canals and railroads were given the least amount of weighting due to the lack of regular upgrades to these structures. This offers little opportunity to enhance permeability in those areas but it is recognized that these structures can be formidable barriers, which need to be addressed.

Weighting for Threats and Opportunities	
T1 Highway Threat	10%
T2 Urbanization Threat	10%
T3 Canal Threat	5%
T4 Railroad Threat	5%
T5 Border Security Threat	10%
O1 Linkage to Mexico or Other State	10%
O2A In ADOT Short-Term (5-yr) Plan	25%
O2B In ADOT Long-Term (20-yr) Plan	30%
O3 Active Conservation Effort/ Willing Landowner	20%

Table 5-15. Weighting for Threats and Opportunities

Top Priority Linkages

The resulting prioritization indicates how each proposed potential linkage zone scores relative to other zones with respect to Biological Value (which are plotted as the horizontal axis) and Threat and Opportunity Value (which are plotted as the vertical axis). The potential linkage zones that emerged in the upper right quadrant are clear priorities for more detailed planning and conservation actions depicted in *Figure 5-2*. It should be noted that we consider all of the identified potential linkage areas important. Future threats and opportunities could shift some potential linkages "upward" and new knowledge could increase our perception of the biological importance of some zones. Because the score of the ADOT 5 and 20-year plans in part drives these results, it is in our best interest to address these highest ranked potential linkages as soon as possible as some of them are slated for roadway development or expansion in the near future.

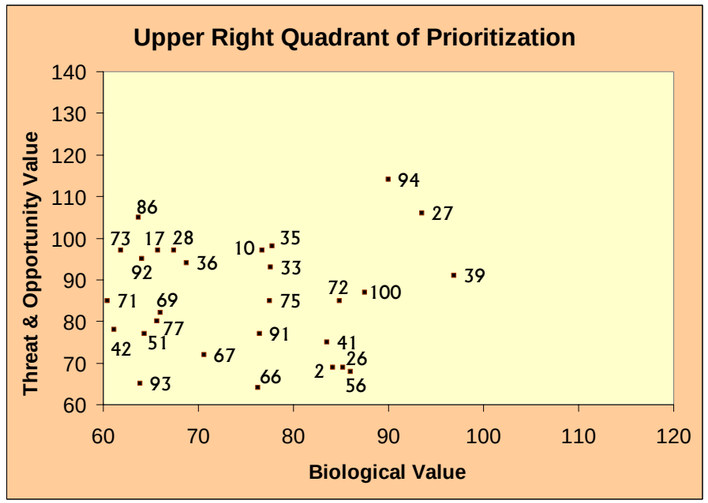

Figure 5-2. Upper Right Quadrant of Prioritization

The following potential linkage zones emerged as the highest priority. The order in this list does **not** reflect relative importance.

Linkage 2 Beaver Dam Mountains – Virgin Mountains
Linkage 10 Mt. Tipton - Mt. Perkins
Linkage 17 Deadman Mesa/Gray Mountain
Linkage 26 Northern I-17 Corridor
Linkage 27 Mogollon Rim - Navajo Nation
Linkage 28 Petrified Forest North & South
Linkage 33 Hualapai Mountains - Bagdad
Linkage 35 Prescott National Forest
Linkage 36 Yeager Canyon – Camp Verde
Linkage 39 SR 260 west from I-17 to SR 87
Linkage 41 SR 260 Payson to Heber
Linkage 42 Aripine-Cibecue
Linkage 51 Wickenburg
Linkage 56 US 60 7 Mile to 7 Mile East
Linkage 66 Superior to Miami US 60
Linkage 67 Gila River to El Capitan SR 77
Linkage 69 Lagunas-Muggins
Linkage 71 North Gila Mountains - South Gila Mountains
Linkage 72 Sentinel Plain
Linkage 73 Southeast Kofa to North Maricopas
Linkage 75 State Route 85
Linkage 77 Quijotoa Valley
Linkage 86 Kitt Peak
Linkage 91 Baboquivari - San Luis Mountains
Linkage 92 San Xavier to Sierrita - Santa Rita
Linkage 93 Tumacacori - Santa Ritas
Linkage 94 Galliuro – Winchester - Dragoons
Linkage 100 Ft. Huachuca to San Pedro Link