Ecosystem Services, Faunal Biodiversity and Vegetation Dynamics in Response to Forecasted Land-Use and Climate Change within the Upper Rio Grande

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Photo by Jason Bak

NSF

CASE Center for Applied Spatial Ecology
ACEQUIA

Community
Ecosystem
Hydrology
Ecosystem Services

The benefits humans derive from ecosystems (MEA 2005) as soil formation, photosynthesis, and nutrient cycling

<table>
<thead>
<tr>
<th>Provisioning</th>
<th>Regulating</th>
<th>Cultural</th>
<th>Supporting</th>
<th>Biodiversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food, Water, Fiber, Fuel</td>
<td>Climate, Flood, Disease, Water</td>
<td>Aesthetic, Spiritual, Educational, Recreational</td>
<td>Nutrient cycling, soil formation, primary production</td>
<td>Life on Earth Species Richness</td>
</tr>
</tbody>
</table>

Photo by Mike Alm

Photo by BISON-M
USGS Gap Analysis Program
Products and Data - Southwest Region

Deductive Terrestrial Vertebrate Habitat Models (817 spp)

- Knowledge based/expert based
- Wildlife Habitat Relationships
- Habitat based
- Top down - general to specific

Habitat Models

Land Ownership/Stewardship

Land Cover
20 Biodiversity Metrics
(Boykin et al. 2013)

**Total Vertebrate Species**
- Reptiles
- Amphibians
- Birds
- Mammals
- Bats

**Threatened and Endangered Species**

**Total Species of Greatest Conservation Need**
- Reptile Species of Greatest Conservation Need
- Amphibian Species of Greatest Conservation Need
- Bird Species of Greatest Conservation Need
- Mammal Species of Greatest Conservation Need
- Bat Species of Greatest Conservation Need

**Total Harvestable Species**
- Harvestable Upland Game Species
- Harvestable Big Game species
- Harvestable Small Game Species
- Harvestable Furbearer Species
- Harvestable Waterfowl Species

Ecosystem Diversity
Average Index Value
Average of each mapped pixel value in study area / highest mapped pixel value in area.
• Provides seamless land use scenarios for the conterminous United States consistent with IPCC emission storylines.

• Demography and population at county level

• Housing density allocated at 1 ha resolution
• Estimated % impervious surface at 1 km² resolution

(ICLUS: Integrated Climate and Land-Use Scenarios

(EPA Global Change Research Program
EPA/600/R-08/076F June 2009)
Total Threatened and Endangered Species Richness as Affected by Scenario A2
Across Scales
Alcalde, Rio Hondo, and El Rito Watersheds, New Mexico

- Biodiversity takes a regional approach
- Corridors
- Context

Richness Index
- 0
- 0.01 - 0.22
- 0.23 - 0.31
- 0.32 - 0.38
- 0.39 - 0.45
- 0.46 - 0.52
- 0.53 - 0.59
- 0.6 - 0.67
- 0.68 - 1
New Mexico meadow jumping mouse
(Zapus hudsonius luteus)
Current Perspectives

• USGS Gap Analysis Program data provides the regional perspective on wildlife, biodiversity, and related ecosystem services
• ICLUS provides the regional perspective on climate change and urban grow-out
• Systems Dynamic Model provides the information necessary at fine scales.
• What ecosystem services do acequias provide for wildlife?
Acknowledgements

Concurrent Projects

• Mapping Biodiversity Metrics at Multiple Scales

• Developing Spatially Explicit Biodiversity Metrics in Support of CEAP: A Focus on Wildlife

EPA
Britta Bierwagen
Philip Morefield

NSF Team
Sam Fernald
CNH Team Members

CASE, NMSU
Forrest East
Darin Kopp
Rachel Guy
Regional Study Area
Upper Rio Grande River Basin
Mesic Riparian Faunal Community

Intermediate Riparian Faunal Community

Xeric Riparian Faunal Community

Overlap

Figure from Brand et. al (2010)