Together
we can solve problems that are too big for any
one organization to solve alone

DESERT LCC
desert landscape conservation cooperative

Eastern Mojave LCD Partner Workshop
Indicators

Why do We Need Indicators?

- Spatial Analysis of:
  - Current conditions
  - Historic trends
- Determining appropriate conservation actions
  - Good Condition→Conservation?
  - Poor Condition→Restoration?
- Framework for monitoring and adaptive management
  - ➢ Assess effectiveness of management actions

Monitoring Landscape-Scale Condition
State of the South Atlantic
(see southatlanticlcc.org)

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3

Ecosystem indicators

Indicators provide a simple way to measure the overall condition of the South Atlantic's complex ecosystems. More than 200 people from at least 50 organizations actively participated in selecting, testing, and revising the current indicators. This first report establishes a baseline for evaluating future trends using the best science and region-wide spatial data available today.

Upland hardwood
- **Upland hardwood birds**: index of habitat suitability for seven upland hardwood bird species.
- **Urban open space**: index based on distance of urban areas from open space.

Pine & prairie
- **Longleaf pine extent**: overall acres of longleaf pine.
- **Pine & prairie birds**: index of habitat suitability for three pine and prairie bird species.
- **Pine & prairie amphibians**: Priority Amphibian and Reptile Conservation Areas within pine and prairie.
- **Regularly burned habitat**: acres of fire-maintained, open canopy habitat.

Forested wetland
- **Forested wetland extent**: overall acres of forested wetlands.
- **Forested wetland birds**: index of habitat suitability for six forested wetland bird species.
- **Forested wetland amphibians**: Priority Amphibian and Reptile Conservation Areas within forested wetlands.

Freshwater aquatic
- **Riparian buffers**: index of natural habitat near ri[...]
- **I[...]**: [...] w[...]

Fresh[...]
- **F[...]** fr[...]
- **F[...]** su[...]

Estua[...]
- **W[...]** w[...]
- **W[...]** e[...]
- **Coastal condition**: index of water quality, sediment quality, and benthic condition.

Maritime forest
- **Maritime forest extent**: overall acres of maritime forest.

Beach & dune
- **Beach birds**: index of habitat suitability for four shorebird species.
- **Beach alteration**: index of impacts from hardened structures like jetties, groins, and infrastructure.

Marine
- **Marine turtles & mammals**: index of highly productive areas for sea turtles, dolphins, and whales.
- **Potential hardbottom condition**: index of potential condition of deepwater corals and other hardbottom habitats.
- **Primary productivity**: index of ocean ecosystem productivity based on chlorophyll measurements.

Landscapes
- **Structural connectivity**: important hubs and corridors for ecological connectivity.
- **Low road density**: index of areas with few roads.
- **Resilient biodiversity hotspots**: index of mostly natural high-diversity areas potentially resilient to climate change.
- **Low-urban historic landscapes**: index of National Historic Register Sites surrounded by limited urban development.

Waterscapes
- [...] dex of dams [...] ivers and the [...]
- [...] of local [...] ecies.

[A] 100-80% in good condition
[B] 79-60% in good condition
[C] 59-40% in good condition
[D] 39-20% in good condition
[F] 19-0% in good condition
[ ] Not scored; baseline for future

Confidence
low ➡ high

[...]ator.
[...]apes
[...]iple
[...] the
[...] condition.
[...] final scores.

For more information

The conservation community, working through the South Atlantic Landscape Conservation Cooperative, regularly tests and improves the indicators. To explore geospatial indicator data and to stay up-to-date on future progress, please visit: *http://StateOf.SouthAtlanticLCC.org*.

State of the South Atlantic

C Confidence low high

South Atlantic ecosystem health scores

Overall, the South Atlantic scored a **C**. Piedmont areas scored the lowest, likely due to impacts from their major urban megaregions. The Marine region scored the highest; however, it did not include fishing impacts. The Coastal Plain scores were in the middle. These scores show that, while the South Atlantic is not completely healthy, there's hope for making future improvements.

North Piedmont: [D] Home to Charlotte, Raleigh, and large areas of upland hardwood forest. People who live and work in urban areas will help decide the future of this region.

South Piedmont: [D] Home to Atlanta and diverse watersheds draining into the Atlantic and Gulf. Balancing water needs for people and species continues to be a challenge.
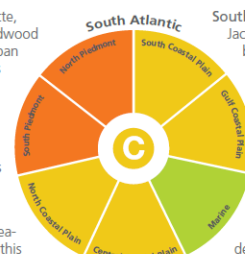
North Coastal Plain: [C] Home to the Outer Banks and extensive estuaries. Sea-level rise is predicted to heavily impact this particularly flat region.

Central Coastal Plain: [C] Home to Wilmington, Myrtle Beach, and large protected wetland areas. Sea-level rise, tourism, and changing agricultural practices continue to influence ecosystem health.
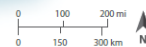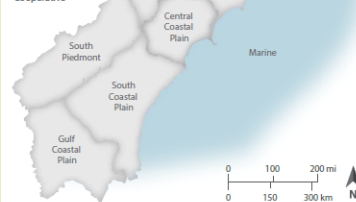
South Coastal Plain: [C] Home to Savannah, Jacksonville, and a network of protected barrier islands. Partnerships are working to conserve this region's largest river floodplains.

Gulf Coastal Plain: [C] Home to rural Southwest Georgia and extensive conservation lands in the Big Bend of Florida. Sea-level rise and upstream agriculture continue to impact coastal protected areas.

Marine: [B+] Home to rich fisheries, deepwater coral, diverse seabirds, and important migratory fish, whales, and turtles. Ocean acidification and increased energy development are major emerging threats.

(diagram: South Atlantic wheel showing subregions — North Piedmont, South Coastal Plain, Gulf Coastal Plain, Marine, Central Coastal Plain, North Coastal Plain, South Piedmont, with C in center)
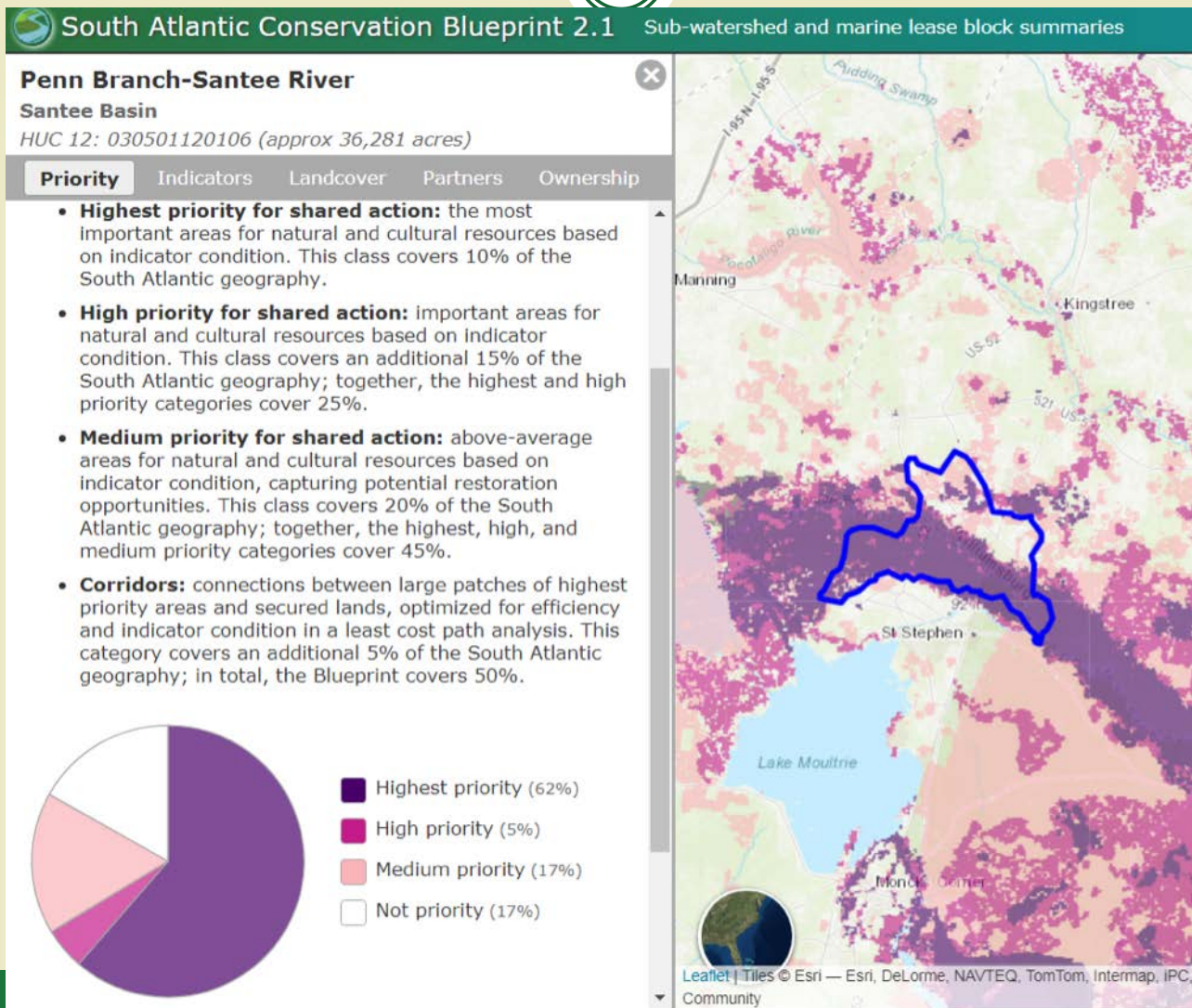
A snapshot in time

This assessment evaluates the ecological integrity of the South Atlantic using natural and cultural resource indicators. The indicators are scored across the entire region, for individual ecosystems, and within subregions following watershed and ecoregional boundaries. All indicators are regularly tested and revised, and this first report uses the best metrics available today.

Toward conservation action

Measuring these indicators communicates the status of the region's land and waters, helping develop a more unified vision for thriving ecosystems that support communities and economies. People and organizations are working together on cross-boundary conservation actions through the South Atlantic LCC to improve ecosystem health in the face of unprecedented changes to the natural world.

The seven subregions of the South Atlantic Landscape Conservation Cooperative

(map showing subregions: North Piedmont, North Coastal Plain, Central Coastal Plain, South Piedmont, South Coastal Plain, Gulf Coastal Plain, Marine)

0   100   200 mi
0   150   300 km   N

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Example Application

- **Goal 1: Ecosystem Integrity**
  - Integrity of Riparian Areas
    - Area of Cottonwood-Willow
    - Riparian Corridor Greenness
    - In-Stream Flow at Location X
- **Goal 2: Connectivity**
  - Fragmentation by Roads
    - Number of Wildlife Crossings
    - Density of Paved Roads

*The Goal: **3-5 indicators** per ecosystem or Connectivity/Biodiversity Sub-Goal*

- **Goal 3: Biodiversity**
  - Biodiversity Hotspots
    - Area Protected in Hotspot 1
    - Area Protected in Hotspot 2
- **Goal 4: Cultural Resources**
  - Structure To Be Determined
- **Goal 5: Socioeconomic Services**
  - Structure To Be Determined

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Indicator Selection Criteria

- **Indicators should be:**
  - Able to be analyzed spatially and/or represent conditions across the LCD geography
  - Useful for Informing management decisions
  - Able to detect changes resulting from management actions
- **Ecological Criteria**
- **Practical Criteria**
- **Social/Cultural Criteria**

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Referenced Documents

- Plans and reports for the Eastern Mojave
  - BLM Integrated Wildlife Monitoring Workshop Report
  - California State Wildlife Action Plan - Desert Province
  - Eastern Mojave Focal Resources List (draft)
  - Ecoregion-Based Conservation in the Mojave Desert Report
  - Mojave Basin and Range Rapid Ecoregional Assessment
  - NPS Mojave Desert Network Vital Signs Monitoring Plan
  - US Forest Service Broad-Scale Monitoring Strategy
- Additional Desert LCC workshops, meetings, etc.

Snapshot: Indicators in Existing Plans

	A	B	C	D	
1	Document	Geography	Relevant to Madrean?	Relevant to Mojave?	Relevant
2	CMQ 2 Stressor Survey	Mojave, Madrean, Dos Rio	Yes	Yes	Yes
3	https://drive....3V182SG8/view ↗	Sonoran	Yes	No	Yes
4	NPS Chihuahuan Monitoring Plan	Chihuahua	Yes	No	Yes
5	NPS Mojave Monitoring Plan	Mojave	No	Yes	No
6	Aguascalientes 2014 Meeting (not used/not found)	N/A	N/A	N/A	N/A
7	Pre-Madrean CMQ2 Survey (same as above?)	Madrean	Yes	No	No
8	LCPD workshop 2015 and pilot area nominations	AZ	Yes	Yes	Yes
9	DRAFT LCPD Goals Objectives Indicators and Measures	AZ,NM	Yes	Yes	Yes
10	Madrean Workshop Session 1 Notes: Goals and Objectives	Madrean	Yes	No	No
11	Madrean Workshop Session 2 Notes: Additional Focal Resources	Madrean	Yes	No	No
12	Madrean Session 3 Notes: Priority Resources & Stressors	Madrean	Yes	No	Yes
13	Madrean Workshop Session 4 Notes	Madrean	Yes	No	No
14	Madrean Workshop Priority Management Questions	Madrean	Yes	No	No
15	Madrean Workshop Priority Management Questions - Summary	Madrean	Yes	No	No
16	Madrean Workshop Pre-Workshop Survey Results	Madrean	Yes	No	No
17	Madrean Focal Resources Synthesis	Madrean	Yes	No	No
18	3/8/2017 CWP "State of the Cienega" Presentation	Cienega Watershed (in Ma	Yes	No	Maybe
19	Madrean Workshop Fundamental Objectives Synthesis	Madrean watershed	Yes	No	No

Source Bibliography ▾ | 1 Springs ▾ | 1 Streams ▾ | Riparian ▾ | 1 Grassland ▾ | Madrean Evergreen Woodland ▾ | Son

Cross-Referenced Playa Indicators

Additional Members of Project Team

- The University of Arizona:
  - Indicator research and spatial analysis support

- USGS Southwest Climate Science Center:
  - Scenario planning

Spatial Analysis Overview

- **UA TEAM - Kyle Hartfield, Mickey Reed, Craig Wissler, Wim van Leeuwen**
  a) Desert LCC focus areas - Madrean, Eastern Mojave, Dos Rios
  b) Landscape Scale Indicator data (e.g. ecological condition, stressors)
  c) Analysis – (e.g. trends, connectivity, biodiversity)

- **Iterative indicator selection/development with input/guidance from partners**

- **Summary of work accomplished to-date**

- **Spatial and temporal scale challenges and priorities**

SCHOOL OF
NATURAL
RESOURCES AND
THE
ENVIRONMENT
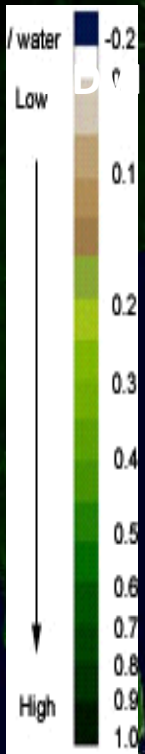
Contact: Leeuw@email.arizona.edu

http://droughtview.arizona.edu/

Initial Indicator List – Downloaded data & Geodatabase
Madrean Evergreen Woodland

	Indicator	Type	Scale of Analysis (m)	Data Available for Trend to Date	Temporal Interval of Data Available (yr)	Requires Analysis to Create	Data Source (blank=not yet found)
2	Madrean Evergreen Woodland – spatial extent	Extent	30	Y	1992, 2001, 2006, 2011	N	NLCD, LPDAAC, GAP, CEC
3	Fire regime departure class	Ecological condition	30	Y	2001, 2008, 2012, 2014	N	LANDFIRE
4	Fragmentation index	Ecological condition					
5	Patch Size	Extent					
6	Wildfire size, extent, and severity	Ecological condition	30	Y	1984-2015 (yearly)	N	MTBS
7	Prescribed fire treatments - Number and acreage	Ecological condition	30	Y	2008, 2010, 2012, 2014	Y	LANDFIRE
8	Tree die-back from insects and disease – spatial extent	Stressor	30	Y	2008, 2010, 2012, 2014	Y	LANDFIRE
9	Mexican Spotted Owl - presence/abundance	Ecological condition	30	N	2013	N	GAP
10	Mexican Spotted Owl - habitat intactness	Ecological condition					
11	Net primary productivity	Ecological condition	500	Y	2000 - 2014 (yearly)	N	LPDAAC
12	Fire risk – probabilities across the ecosystem	Ecological condition	30	Y	2001, 2008, 2010, 2012, 2014	Y	LANDFIRE
13	Carbon stocks	Extent	240	N	2000	N	NACP; WHRC
14	Vegetation phenology	Ecological condition	500	Y	2001 - 2014 (yearly)	Y	LPDAAC
15	Fuel loading	Ecological condition	30	Y	2001 and 2008	N	LANDFIRE
16	Risk to fire of structures in the Wildland-Urban Interface	Ecological condition					
17	Exotic invasive plants – spatial extent	Stressor					
18	Coarse woody debris - volume	Ecological condition					
19	Encroachment of forest species into grassland ecosystem	Ecological condition	30	Y	1992, 2001, 2006, 2011	N	NLCD

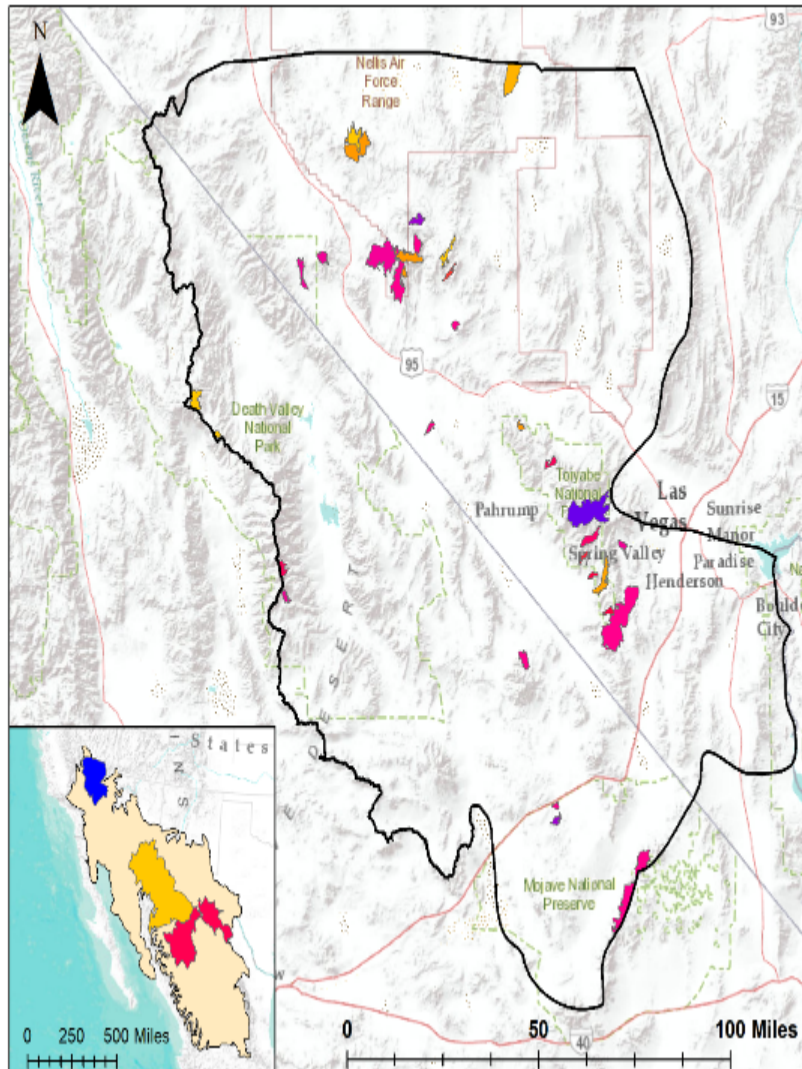Madrean Evergreen Woodland · Sonoran Desert Scrub · Springs · Streams · Grasslands · …

Product
Monitoring Trends in
Burn Severity

Fire Perimeters

Format
Polygons

Temporal Scale
1984-2015

**Monitoring Trends in Burn Severity
1984 - 2015 Fire Perimeters**

1984	1995	2006
1985	1996	2007
1986	1997	2008
1987	1998	2009
1988	1999	2010
1989	2000	2011
1990	2001	2012
1991	2002	2013
1992	2003	2014
1993	2004	2015
1994	2005	

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Product
Monitoring Trends in
Burn Severity

Levels of Burn Severity

Format
Raster

Temporal Scale
1984-2015

Spatial Resolution
30m
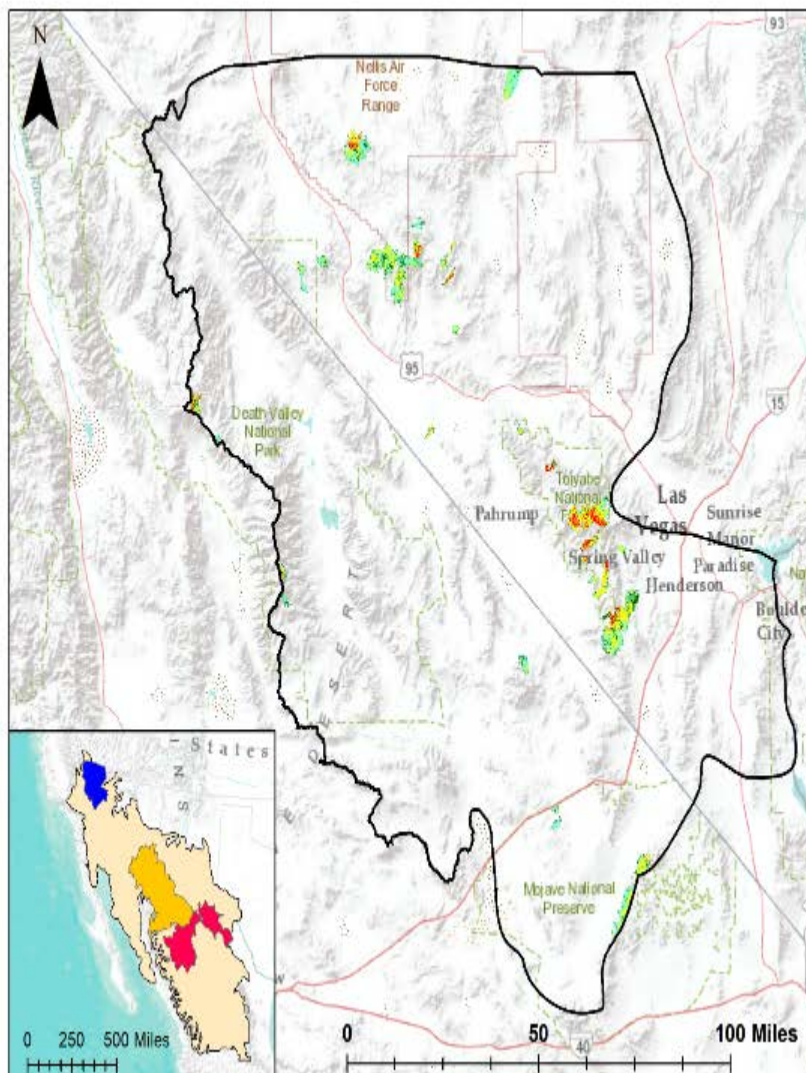
**Monitoring Trends in Burn Severity
1984 - 2015 Burn Severity**

■ Unburned to Low
■ Low
■ Moderate
■ High
■ Increased Greeness
□ Non-Processing Area Mask

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Product
National Landcover
Database

**Percent Developed
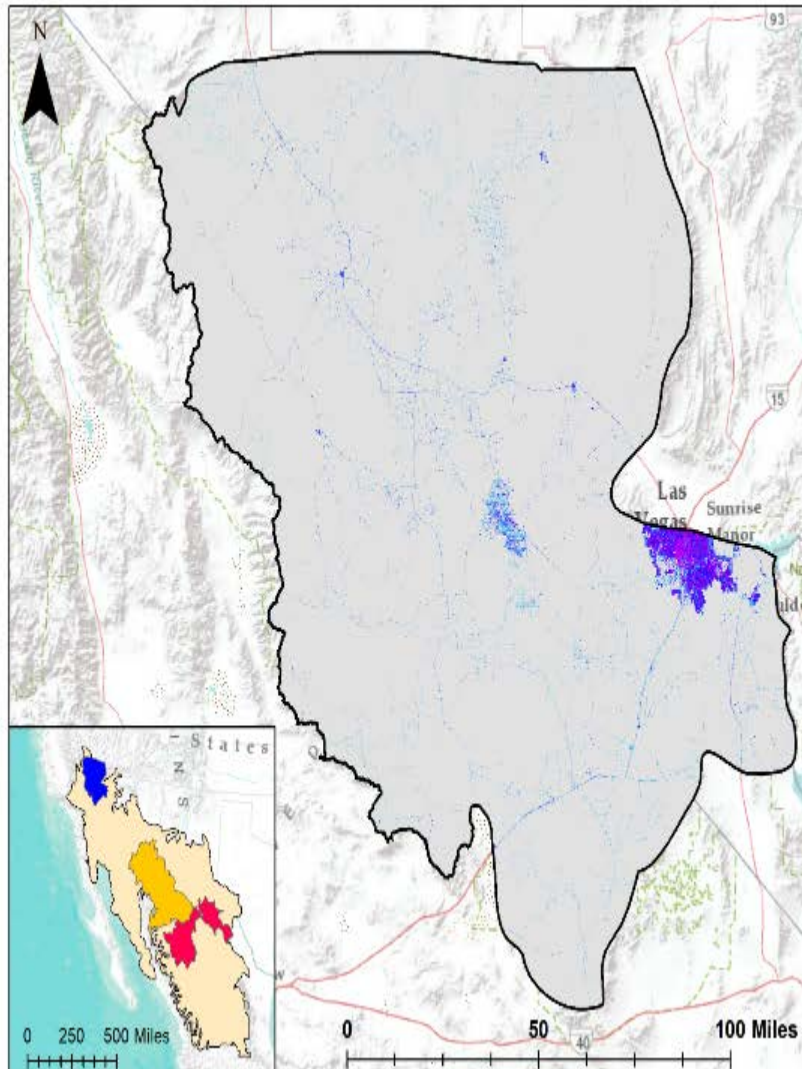Impervious**

Format
Raster

Temporal Scale
2001, 2006, 2011

Spatial Resolution
30m
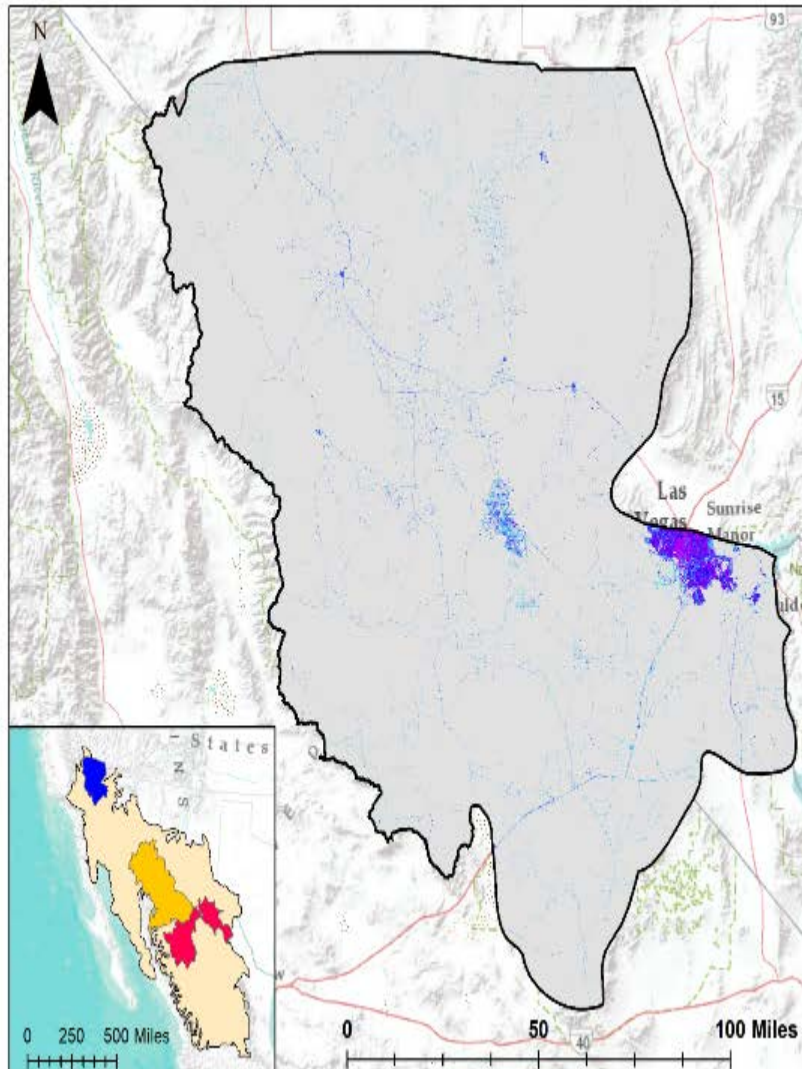
National Landcover Database
2001 Percent Impervious
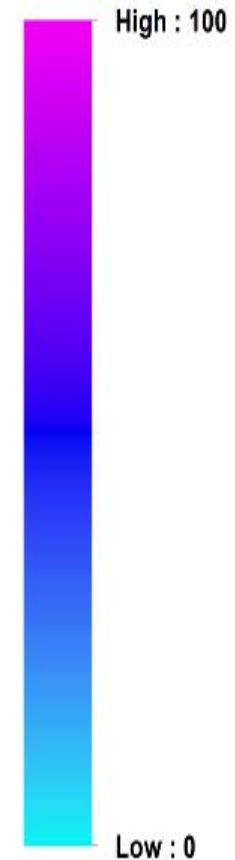
High : 100

Low : 0

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Product
National Landcover
Database

Percent Developed
Impervious

Format
Raster

Temporal Scale
2001, 2006, 2011

Spatial Resolution
30m

National Landcover Database
2011 Percent Impervious
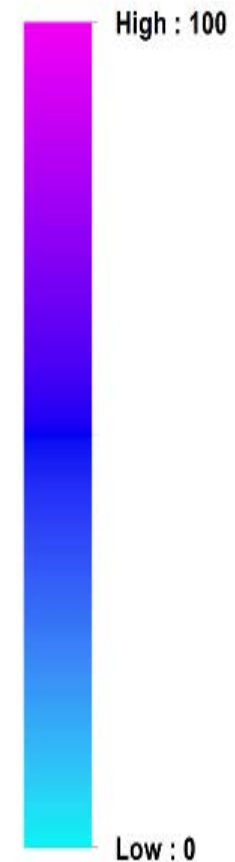
High : 100

Low : 0

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Product
MODIS Vegetation
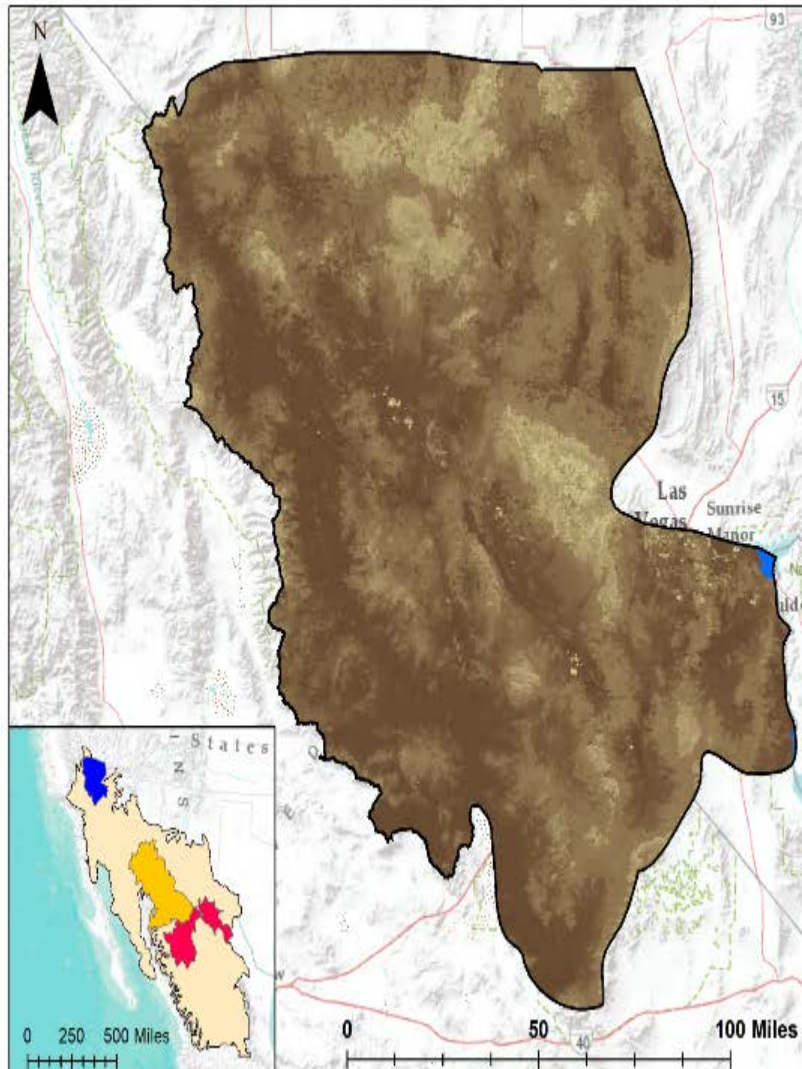Continuous Fields

Percent Bare Ground

Format
Raster

Temporal Scale
2000-2016
Yearly

Spatial Resolution
250m

MODIS Vegetation Continous Fields
Percent Bare Ground in 2016

High : 100

Low : 1

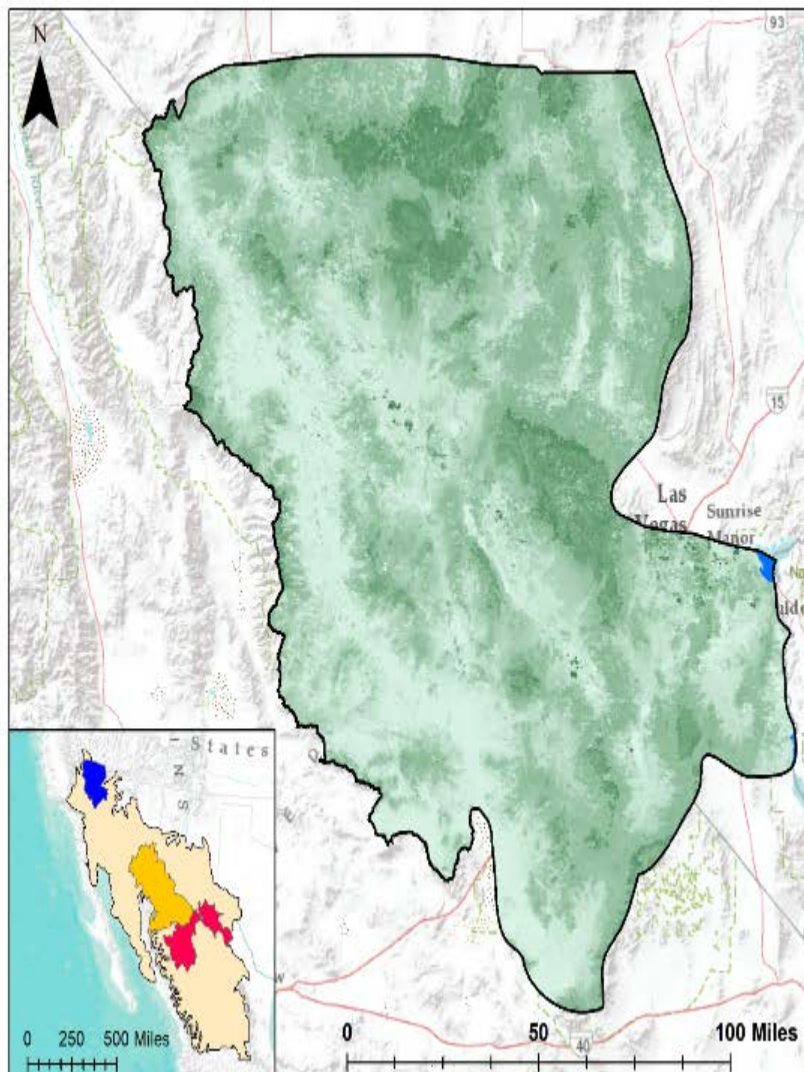Created 3/2018 Arizona Remote Sensing Center

Product
MODIS Vegetation
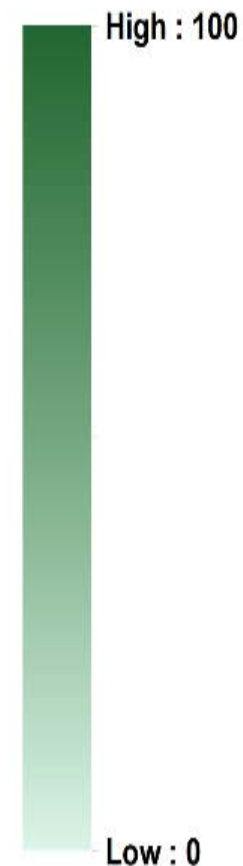Continuous Fields

Percent Non Tree
Vegetation

Format
Raster

Temporal Scale
2000-2016
Yearly

Spatial Resolution
250m

MODIS Vegetation Continous Fields
Percent Non Tree Vegetation in 2016

High : 100

Low : 0

Created 3/2018 Arizona Remote Sensing Center

Product
MODIS Vegetation
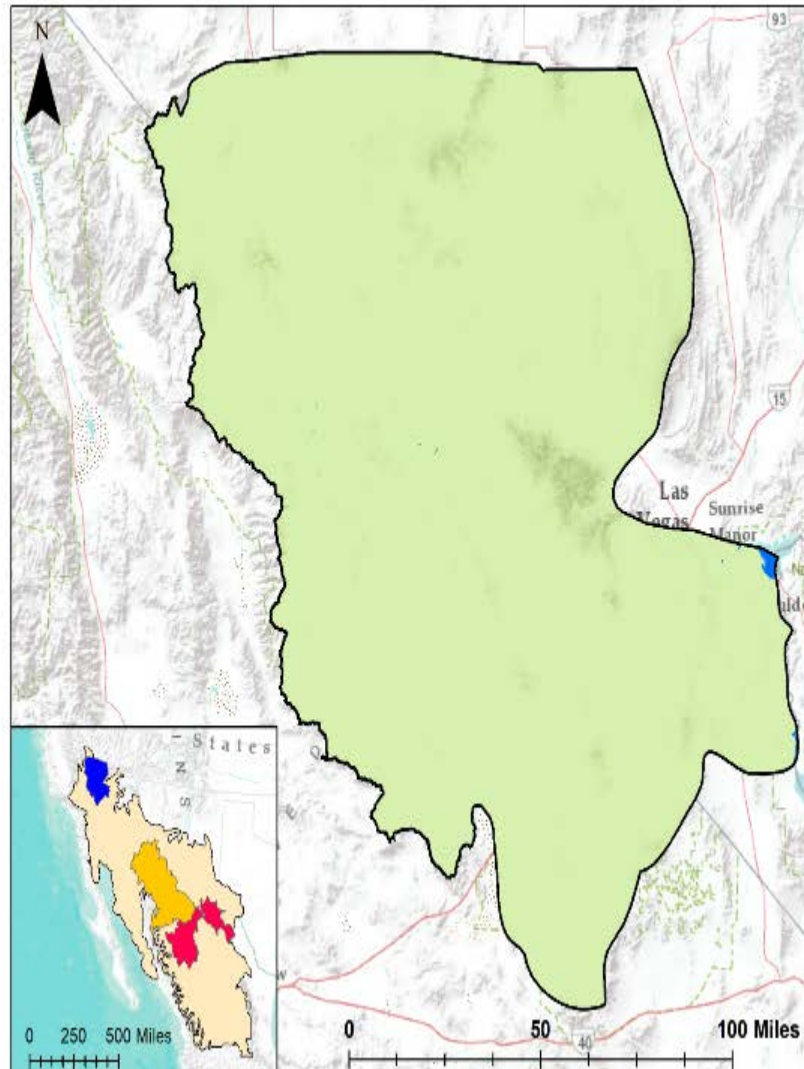Continuous Fields

Percent Tree Cover

Format
Raster

Temporal Scale
2000-2016
Yearly

Spatial Resolution
250m

MODIS Vegetation Continous Fields
Percent Tree Cover in 2016

High : 100

Low : 0

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Ecosystem Integrity Group Work

- What would characterize a "healthy" ecosystem?

- Refine current indicator lists:
  - What works?
  - Are the data available?

- How can land managers use the indicator information?