



# Transboundary Madrean Watersheds Landscape Conservation Design

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Development of Indicators and Overview of Spatial  
Analysis Products

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# Transboundary Madrean Watersheds Mission

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The Madrean Watersheds initiative is a large landscape, international effort to maintain and enhance the interconnected system of mountains, grasslands, deserts, and waters that supports species diversity, promotes healthy watersheds, and maintains the overall ecosystem integrity that enriches the lives of human communities.





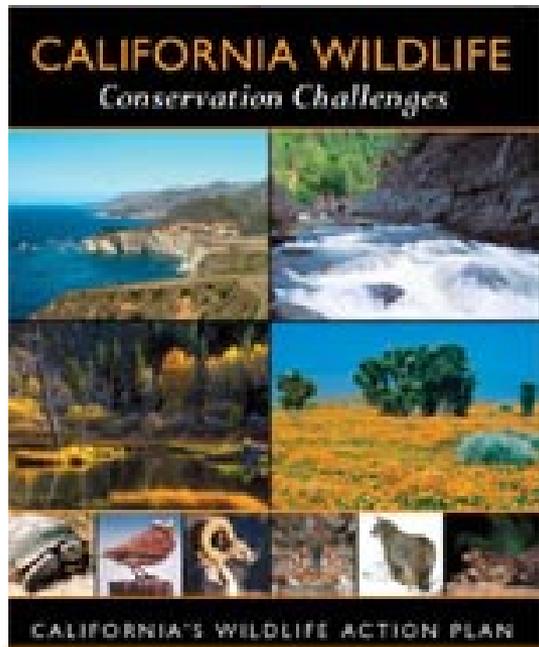
# Landscape Conservation Design

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- Conservation Planning
  - The “What” and “How Much”
- Conservation Design
  - The “Where” and “How”
- Develop Collaborative Partnership
  - Facilitate long-term implementation and adaptive management

# Landscape Conservation Design

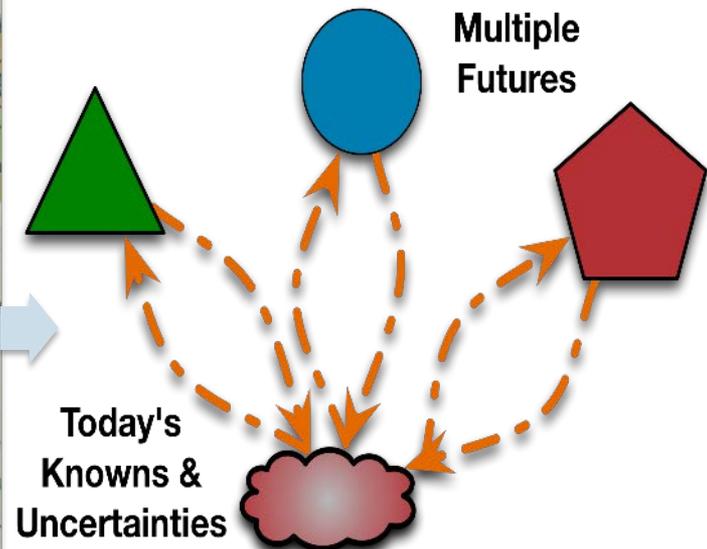
Produces information and tools needed by partners to meet common goals



Build on existing work



Assess current conditions



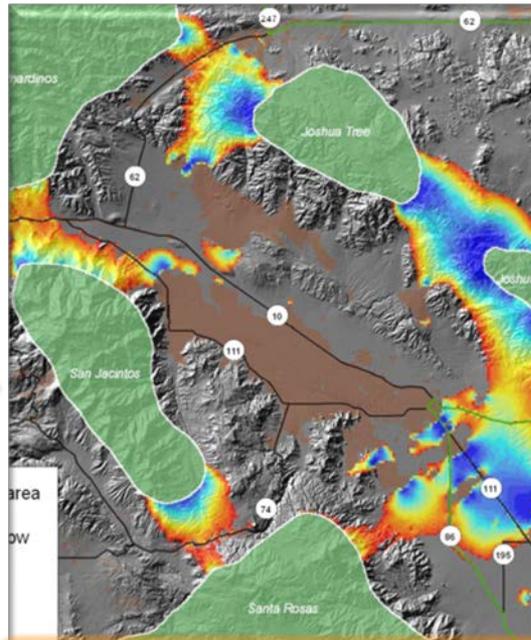
Develop future scenarios

# Landscape Conservation Design

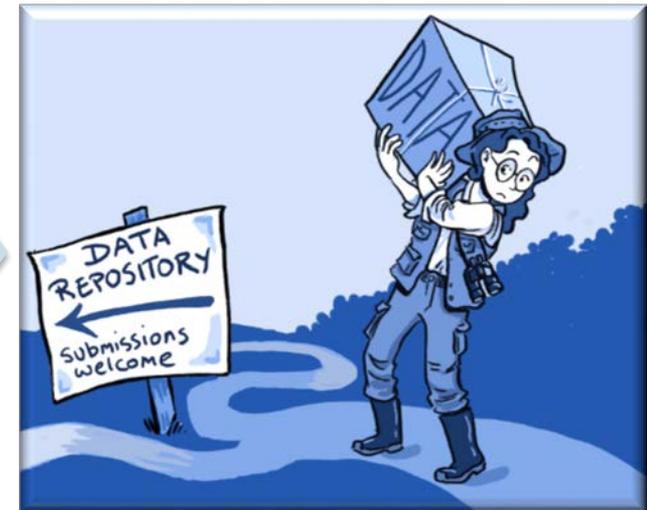
Relies on partners to implement actions within their authorities that collectively contribute to conservation goals



Identify suite of adaptation strategies



Design where actions best meet goals



Monitor & Revise

# Transboundary Madrean Watersheds Goals

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**Biodiversity** - Transboundary Madrean watersheds are a haven for the unique diversity of native and endemic species.

## Fundamental Objectives

- Maintain water and riparian systems
- Maintain and enhance native species and habitat
- Maintain populations of priority species



# Transboundary Madrean Watersheds Goals

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**Connectivity** - Enhanced linkages connect the diverse life zones of Sky Island ecosystems, from valley bottoms to mountain tops, from southern Sonora to the Gila River in Arizona, enabling persistence of migratory wildlife and allowing for the possible future shift of species and ecosystems in a changing climate.

## **Fundamental Objectives**

- Maintain/increase linkages for wildlife
- Maintain connected network of water sources for wildlife
- Increase/restore connectivity of habitat

# Transboundary Madrean Watersheds Goals

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**Socio-Ecological Services** - Healthy watersheds and functioning ecosystems deliver highly valued services to human communities and essential benefits to wildlife.

## **Fundamental Objectives**

- Optimize watershed benefits for humans, ecosystems, wildlife
- Value ecological services
- Maintain soil function/reduce erosion
- Increase human connection to place
- Support working landscapes for ecological benefit
- Prioritize ecosystem integrity/sustainability

# Transboundary Madrean Watersheds Goals

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Feasible set of indicators that accurately represents ecosystems across watersheds and has the power to detect changes relevant to management goals



# Developing Cross-Watershed Indicators

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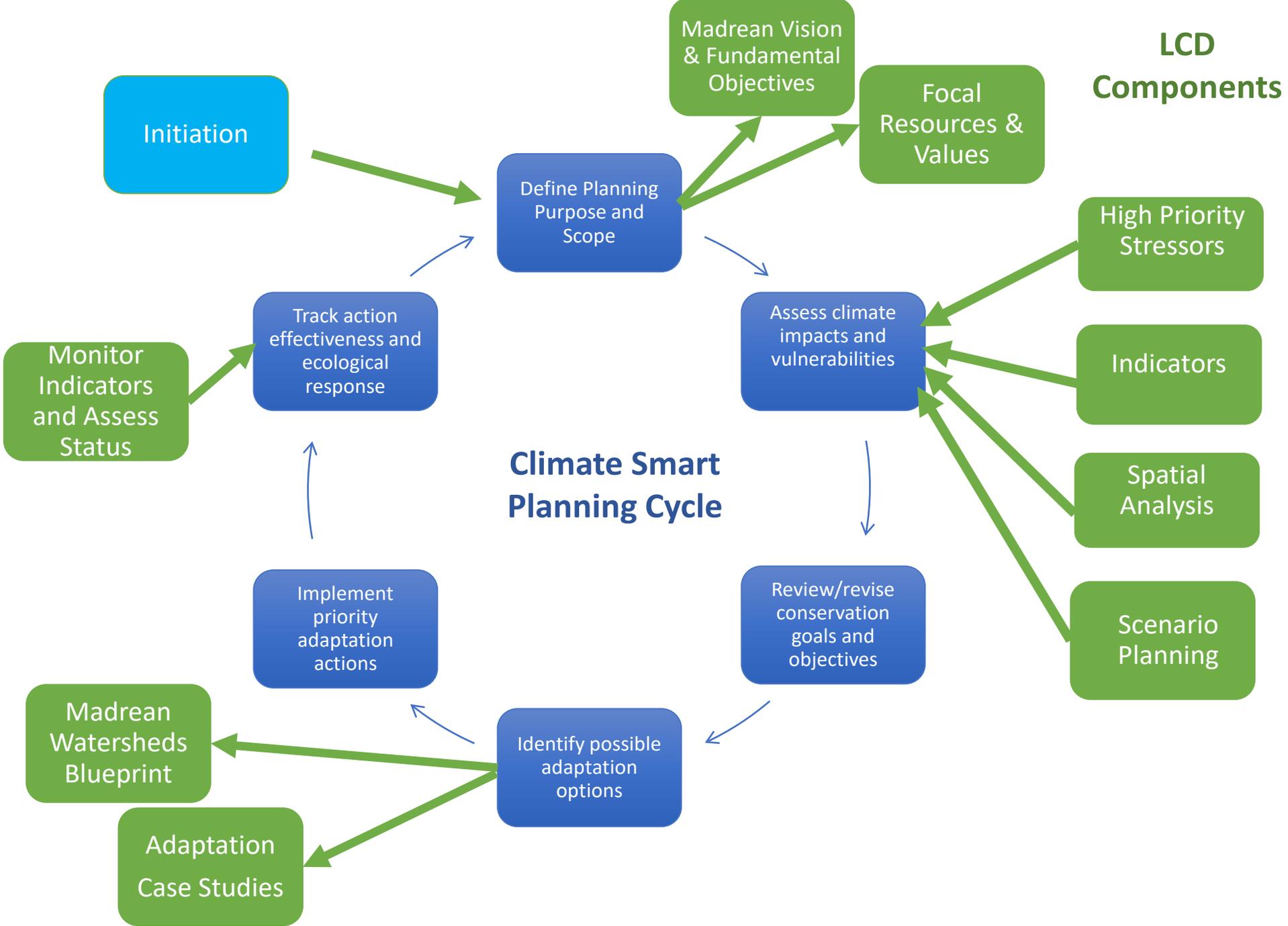
Feasible set of indicators that accurately represents ecosystems across watersheds and has the power to detect changes relevant to management goals

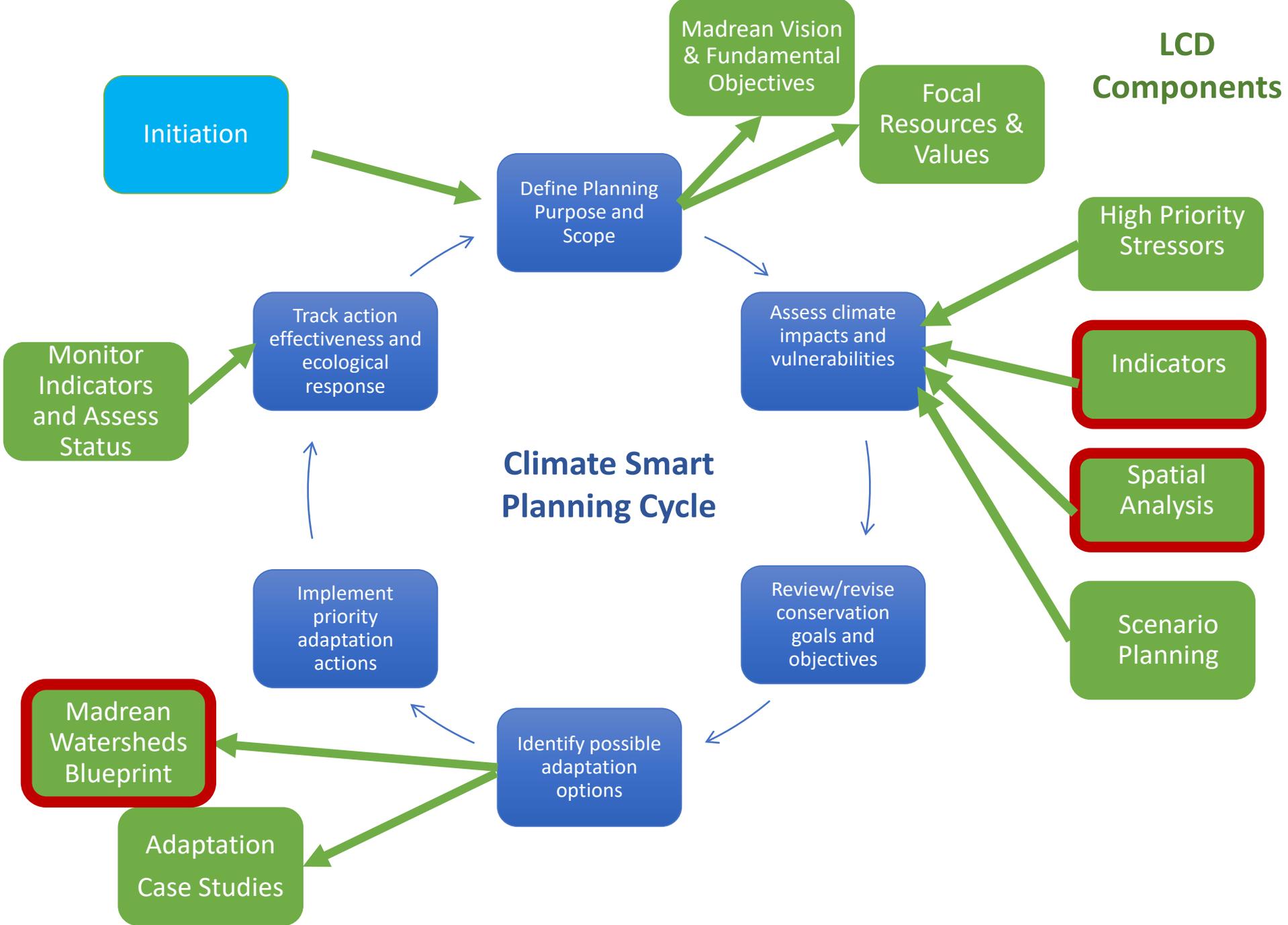


# Indicators

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- Measurable characteristics related to structure, composition, functioning of ecological systems
- Spatially explicit, ecologically and socially relevant, and relevant to partner goals
- Basis for spatial analyses to help partners determine where to conduct conservation, restoration, and climate adaptation





# Indicator Use

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- Ecosystem status and trends (spatial analysis)
- Cross-watershed information to support decision-making
- Inform conservation/adaptation actions
- Can be monitored to assess efficacy of management actions and change

# Why Are Indicators Important?

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- Are we doing the right things?
- Have we reached our goals?



# Why Are Indicators Important?

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- Spanning scales to inform big picture
  - Provide cross-watershed picture of ecosystem status
  - Provide context on how individual projects contribute to landscape goals
  - Provide context on how watersheds contribute to landscape goals (e.g. Cienega Watershed Partnership)

# What Has Been Done So Far?

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- Criteria to select indicators
  - Ecological, Practical, Social and Cultural
- Selection of indicators
  - Existing plans and documents
  - September 2016 expert-input workshop outputs
  - DLCC Monitoring Team stressors by ecosystem
  - January 2017 expert-input indicator development workshop
- Evaluation of potential indicators\*
  - 10-20 per focal ecosystem
  - Iterative process to assess indicators based on available spatial data

# Conservation Design Component Example

<b>Ecosystem</b>	<b>Grassland</b>
<b>High Priority Stressor</b>	Spread of Invasive and Non-native Species
<b>Management Questions</b>	Where do we invest in removing invasives?
<b>Indicator to understand current condition/trend</b>	Invasive versus native grasses - extent
<b>Remaining Uncertainties - Scenario Planning</b>	Are there areas that are particularly vulnerable to an invasive under potential future conditions?  Which invasives may invade an area in the future?
<b>Potential Adaptation Options</b>	High vulnerability – stop treatment  Low vulnerability – monitor for early invaders and treat aggressively

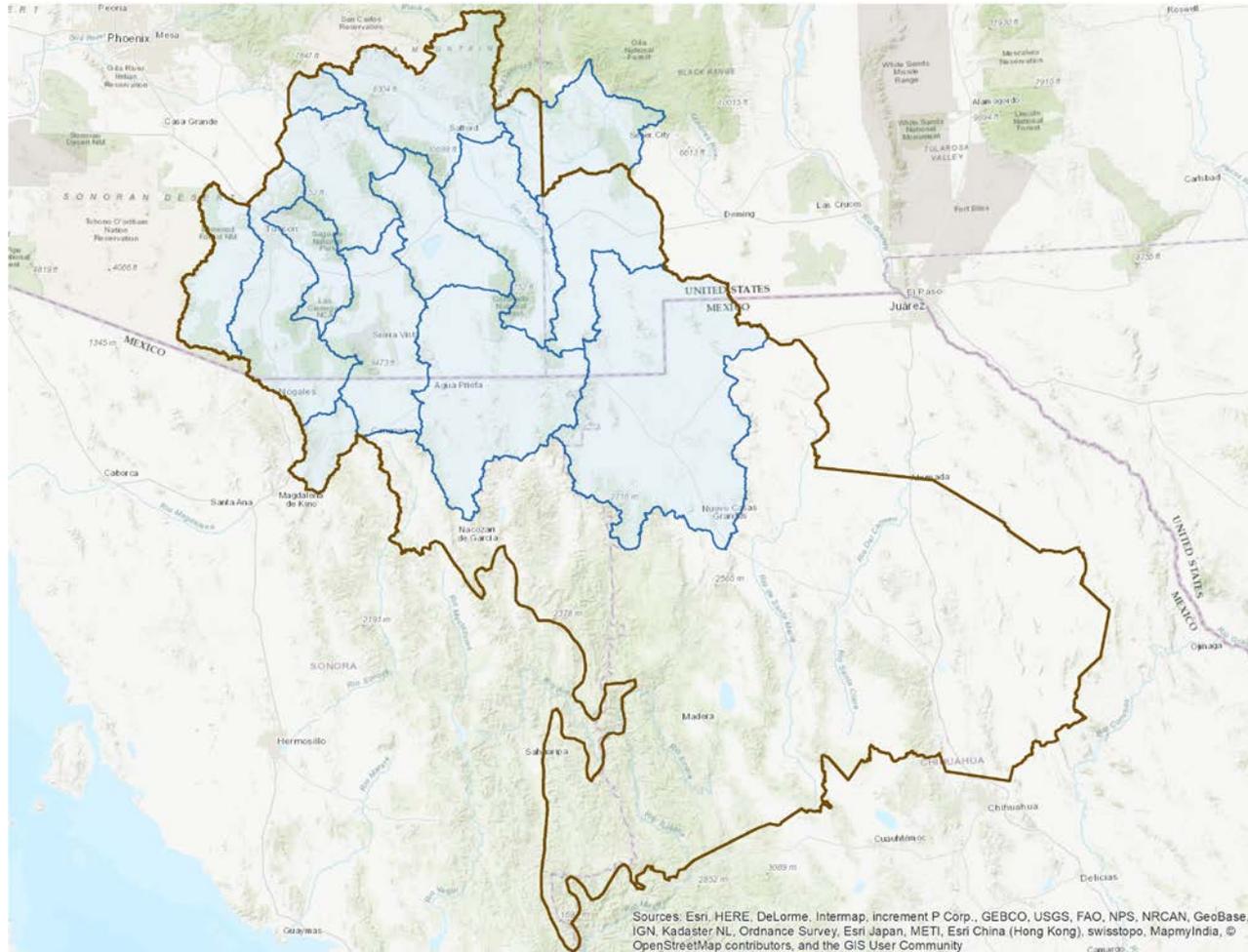
Indicator	HUC8	HUC12	Forest Core	Grassland Core	Connectivity Area
Vegetation Cover (MODIS, mean %)		x			x
Summer NDVI (MODIS, mean)		x			x
MEW+ (+ higher elev ecosystem) (%)	~		x		
Grassland (%)	~			x	
Mean Patch Size (of MEW+ or grass)	~		x	x	
Maximum Patch Size (of MEW+ or grass)	~		x	x	
Vegetation Cover (Tree+NoTree, %)				x	
Canopy Cover (Tree, %)	~	x			x
Nonwoody Cover (NoTree, %)				x	
Vegetation Cover (mean %) TREND 2000-2016		x			x
Summer NDVI (mean) TREND 2000-2017		x			x
Woody:Grass Ratio (Tree:NoTree) TREND 2000-2016				x	
Vegetation Cover (Tree+NoTree) TREND 2000-2016				x	
Nonwoody Cover (NoTree) TREND 2000-2016				x	
Past High Severity Fire (%)		x	x		x
High Fuel Load (% in class 7,9,10,12)		x	x		
Human Development (mean)		x			x
Croplands (%)		x			x
Modified (%)	~			x	
Number of Patches (Fragmentation) (of MEW+ or grass)			x	x	
Woody:Grass Ratio (Tree:NoTree)	~			x	
Perennial Stream Length - total within (m)	not complete	x			x
Perennial Stream Length - longest within (m)		x			x
Perennial Stream Length - connected to (m)		x			x
Topographic Roughness Index (mean)		x			
Elevation Range (meters)		x			
Protected (%)		x	x	x	x
Sonoran Desert Scrub (%)	x				
Sonoran Desert Scrub Modification (%)	x				
Sonoran Desert Scrub Bare Ground (%)	x				
Grassland (%)	x				
Grassland Modification (%)	x				
Grassland Woody:Herbaceous Ratio	x				
Grassland Invaded by Trees (%)	x				
Grassland Mean Patch Size	x				
Grassland Max Patch Size	x				
MEW (%)	x				
MEW Mean Patch Size	x				
MEW Max Patch Size	x				
Streamflow	x				
Depth to Groundwater	x				

# Analysis Methodology

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- Chose subset of 14 HUC 8 Watersheds
  - within U.S. or that cross U.S. – Mexico border
  - Contain major rivers in region

# Watersheds Selected for Analysis



# Example maps

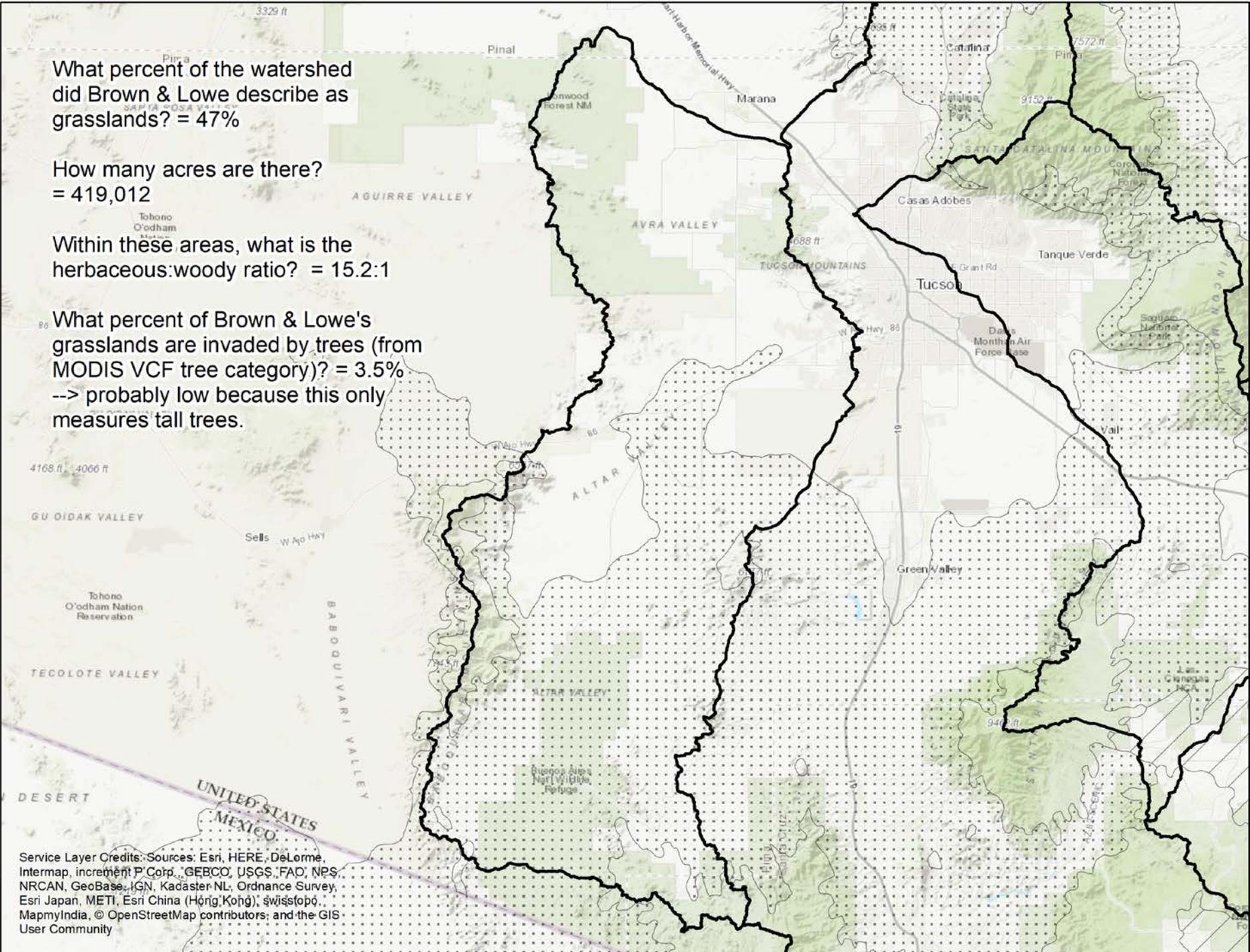
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What percent of the watershed did Brown & Lowe describe as grasslands? = 47%

How many acres are there?  
= 419,012

Within these areas, what is the herbaceous:woody ratio? = 15.2:1

What percent of Brown & Lowe's grasslands are invaded by trees (from MODIS VCF tree category)? = 3.5%  
--> probably low because this only measures tall trees.



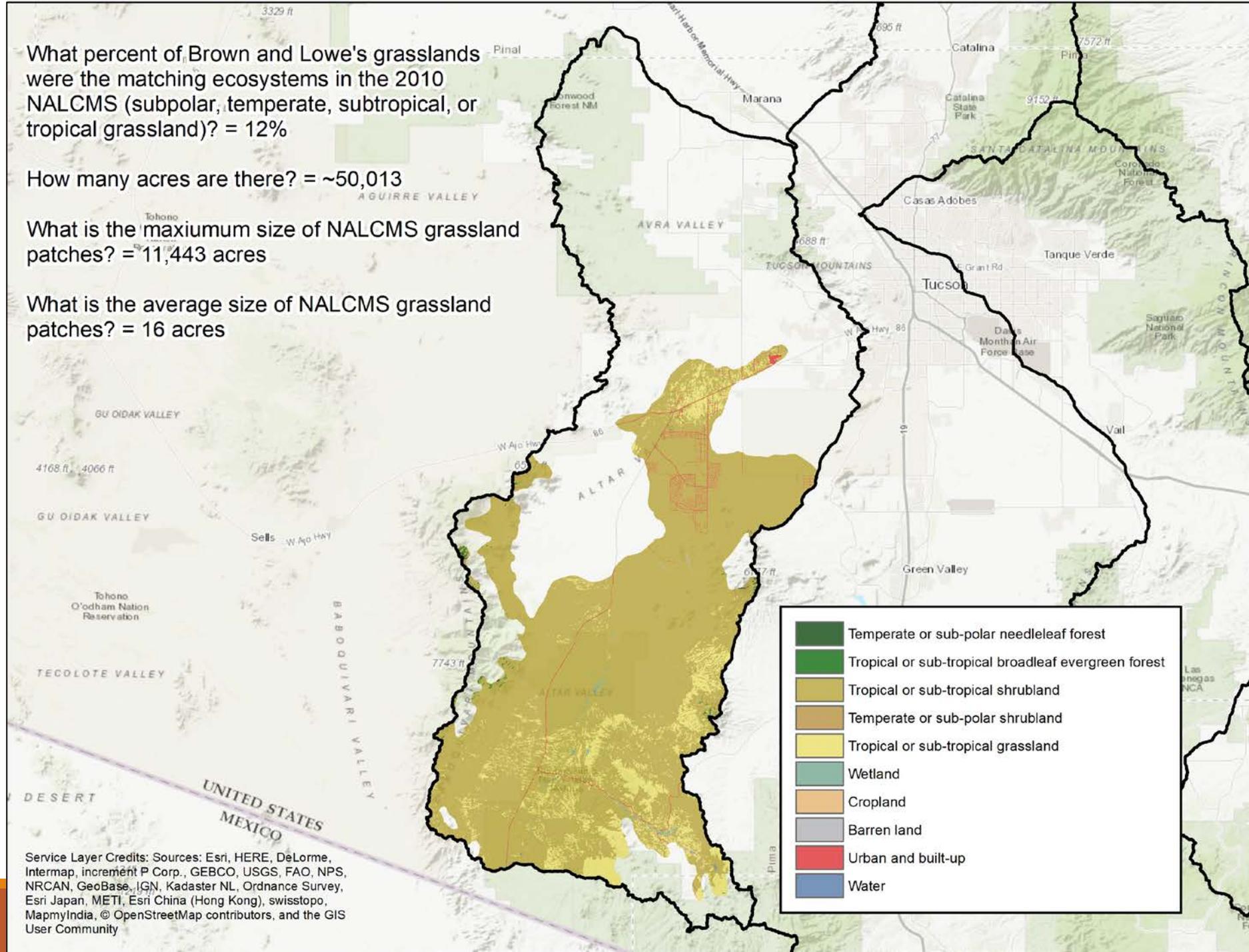
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

What percent of Brown and Lowe's grasslands were the matching ecosystems in the 2010 NALCMS (subpolar, temperate, subtropical, or tropical grassland)? = 12%

How many acres are there? = ~50,013

What is the maximum size of NALCMS grassland patches? = 11,443 acres

What is the average size of NALCMS grassland patches? = 16 acres

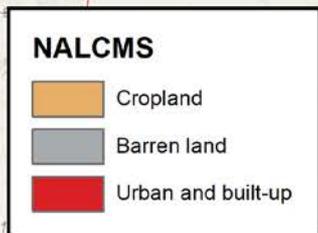


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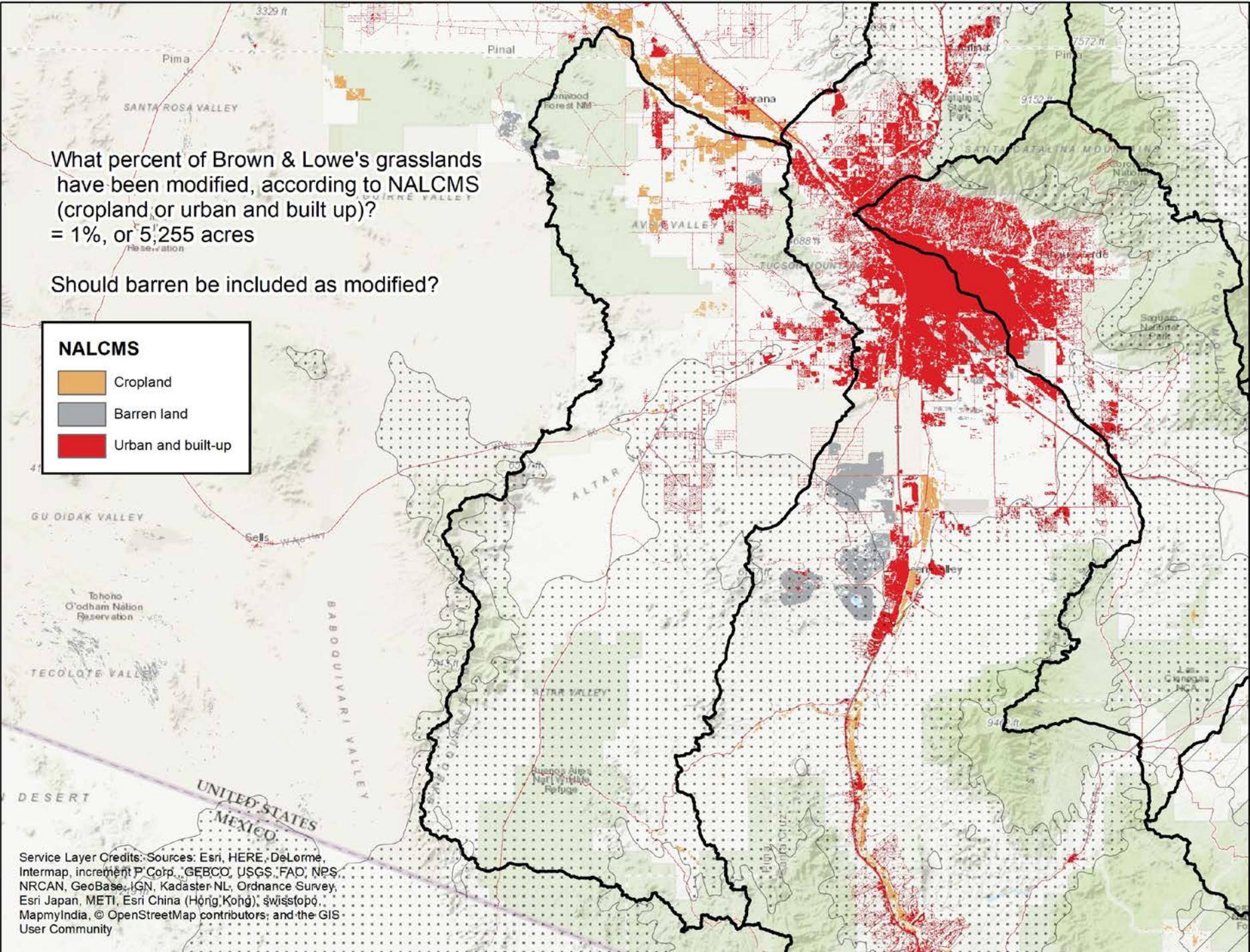
What percent of Brown & Lowe's grasslands have been modified, according to NALCMS (cropland or urban and built up)?

= 1%, or 5,255 acres

Should barren be included as modified?

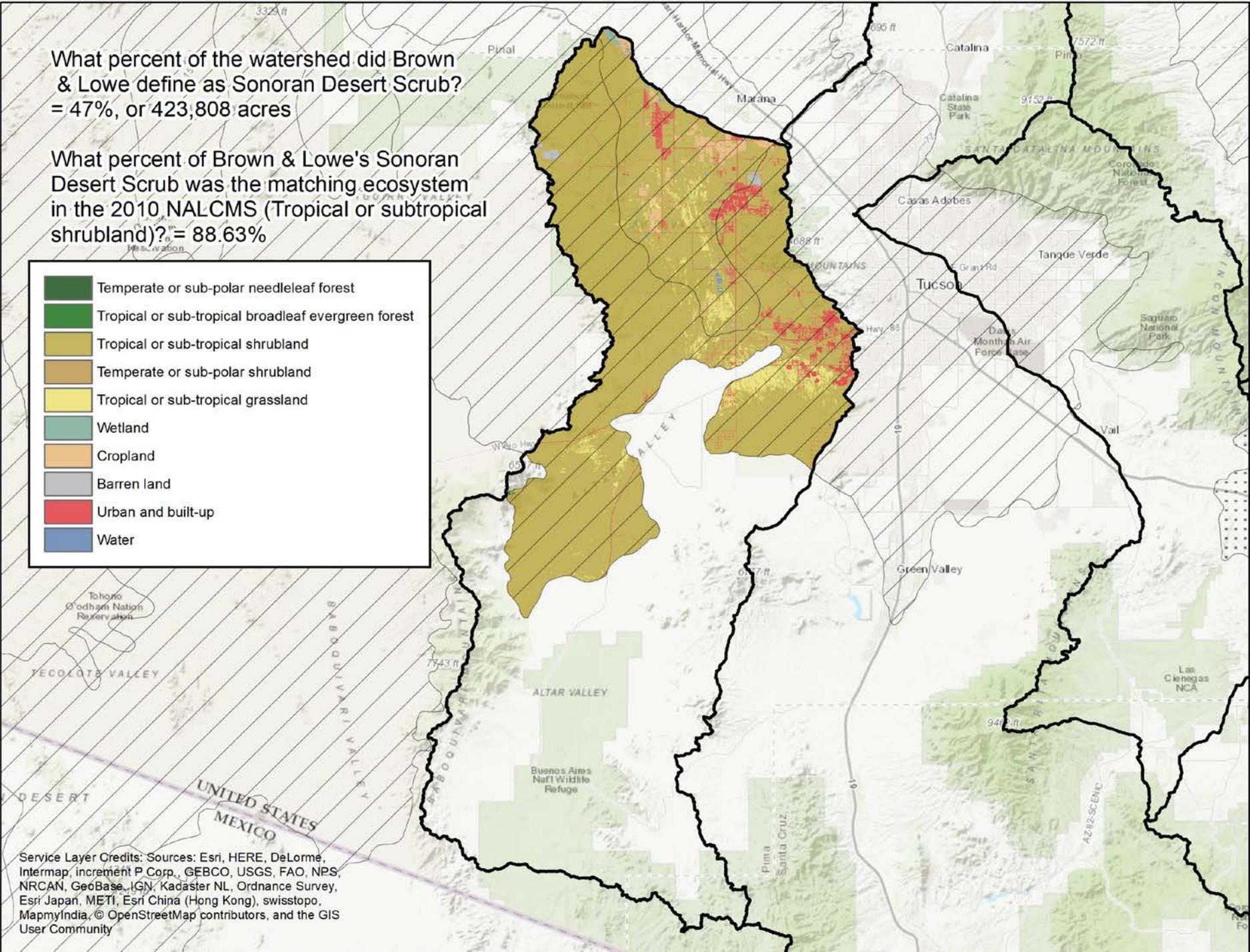
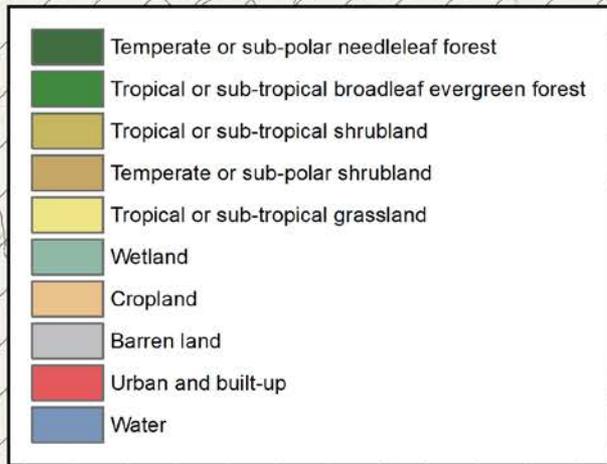


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What percent of the watershed did Brown & Lowe define as Sonoran Desert Scrub?  
= 47%, or 423,808 acres

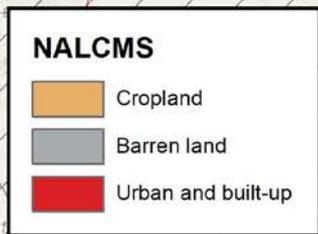
What percent of Brown & Lowe's Sonoran Desert Scrub was the matching ecosystem in the 2010 NALCMS (Tropical or subtropical shrubland)? = 88.63%



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What percent of Brown & Lowe's Sonoran Desert Scrub have been modified, according to NALCMS (cropland or urban and built up)?  
= 6%, or 26,987 acres

Should barren be included as modified?



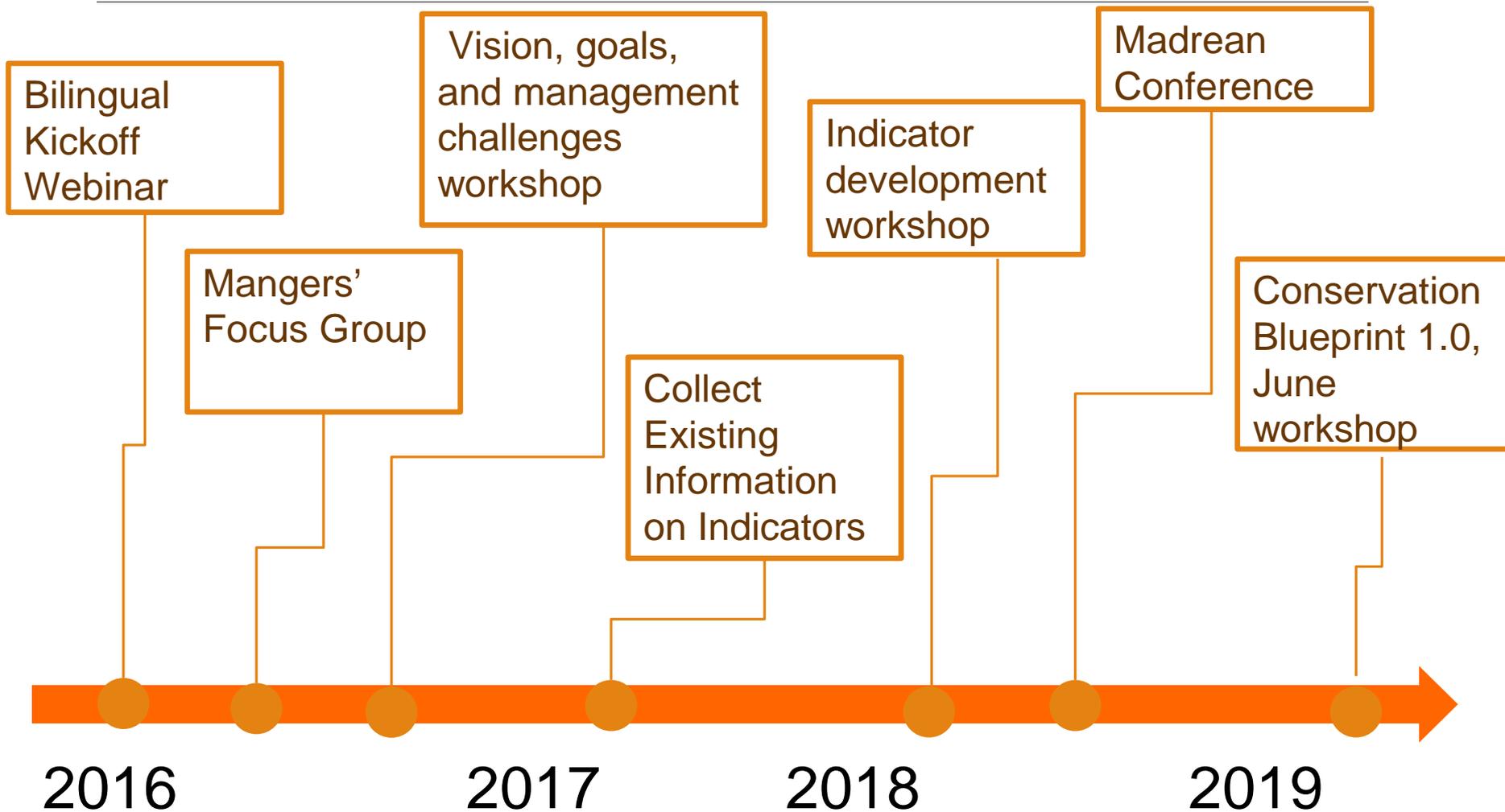
Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

# Interactive Data Viewer Overview

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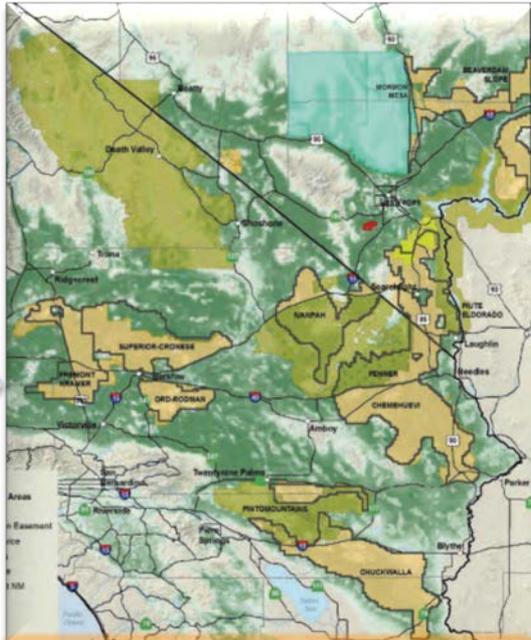
- <http://skyisland.maps.arcgis.com/home/webmap/viewer.html?webmap=d1a9c0b379904a118ee72d0d697c65db>

# Where We've Been....



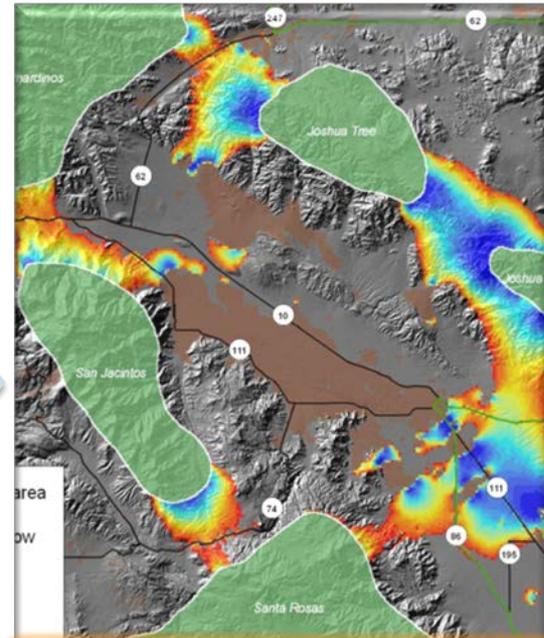
# Products

## State of Madrean Watersheds



Assess current conditions

## Version 1 - Conservation Blueprint & Management Tool Box



Design where actions best meet goals

## Next Steps

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Work with partners to determine how LCD products can be most effectively presented/utilized

- Inform how conservation actions should be prioritized



## Next Steps

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Determine how we best work together to achieve the Transboundary Madrean Conservation vision

- Where to next without the Desert Landscape Conservation Collaborative?



# Next Steps

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## Adaptive Management

- Identify and implement management & adaptation strategies
- Revisit the state of the Madrean/indicator status at regional events like the Madrean Conference

# Next Steps

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**Place-based work** in specific watersheds helps ensure the LCD is grounded in issues and priorities on the ground.

a) The Lower San Pedro watershed (AZ)

b) Tucson Basin / Santa Cruz River Watershed (AZ)



# SAVE THE DATES: Upcoming Events

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## **Webinar:** Monday **June 17**, 11:00 AM

- Management challenges and potential adaptation & management actions

## **Workshop:** Tuesday **June 25**, 8:30 – 5:00 PM, Tucson

- Share new data and tools for and gather feedback on them
- Share tools and build capacity to make decisions together as a collaborative
- Explore what we as a collaborative group can do together to advance landscape conservation in the Madrean Watersheds
- Determine how we are going to make needed decisions as a collaborative group over time

# Thank you!.....Questions?

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