DroughtView:

combining on-the-ground know-how with remotely sensed data to assess drought impacts

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Pima County Local Drought Impact Group

July 13, 2016

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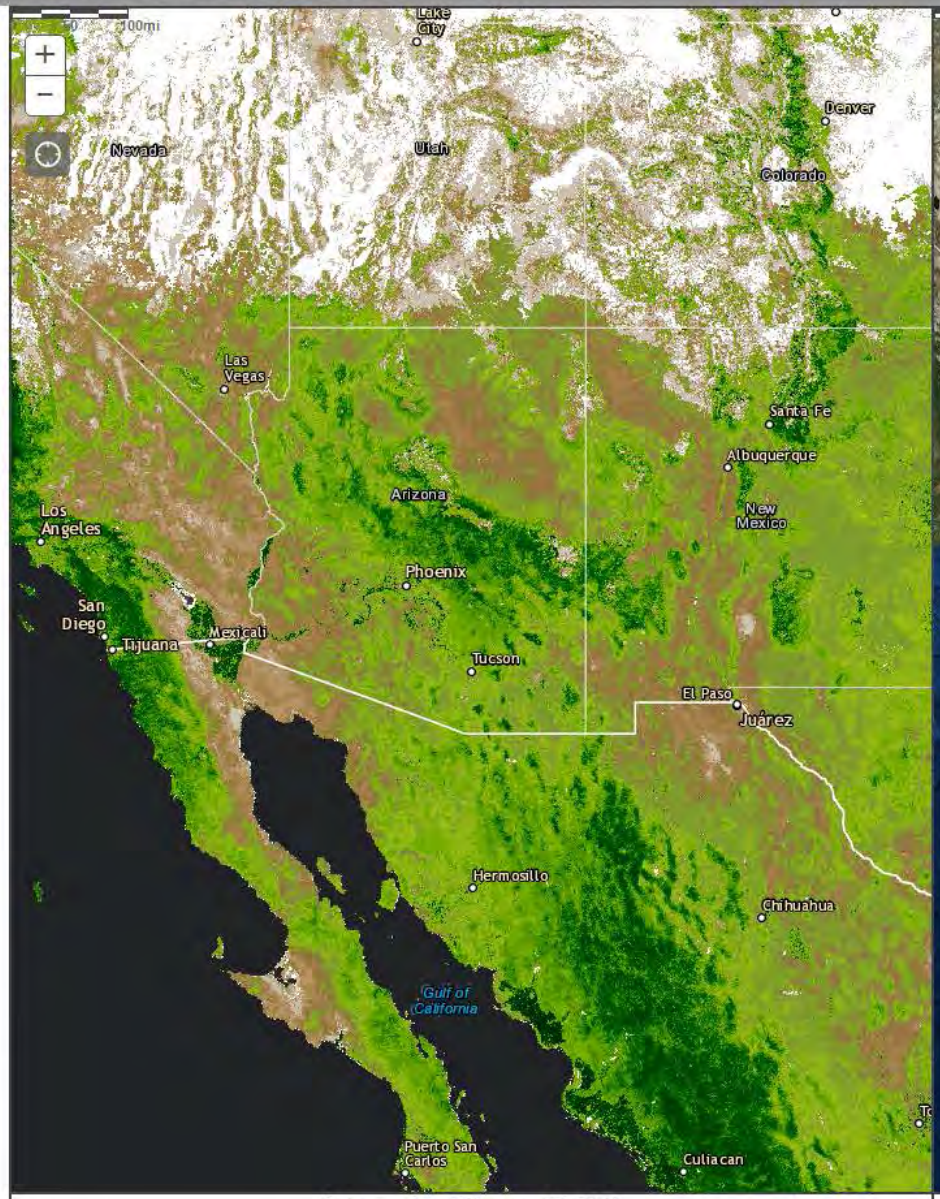
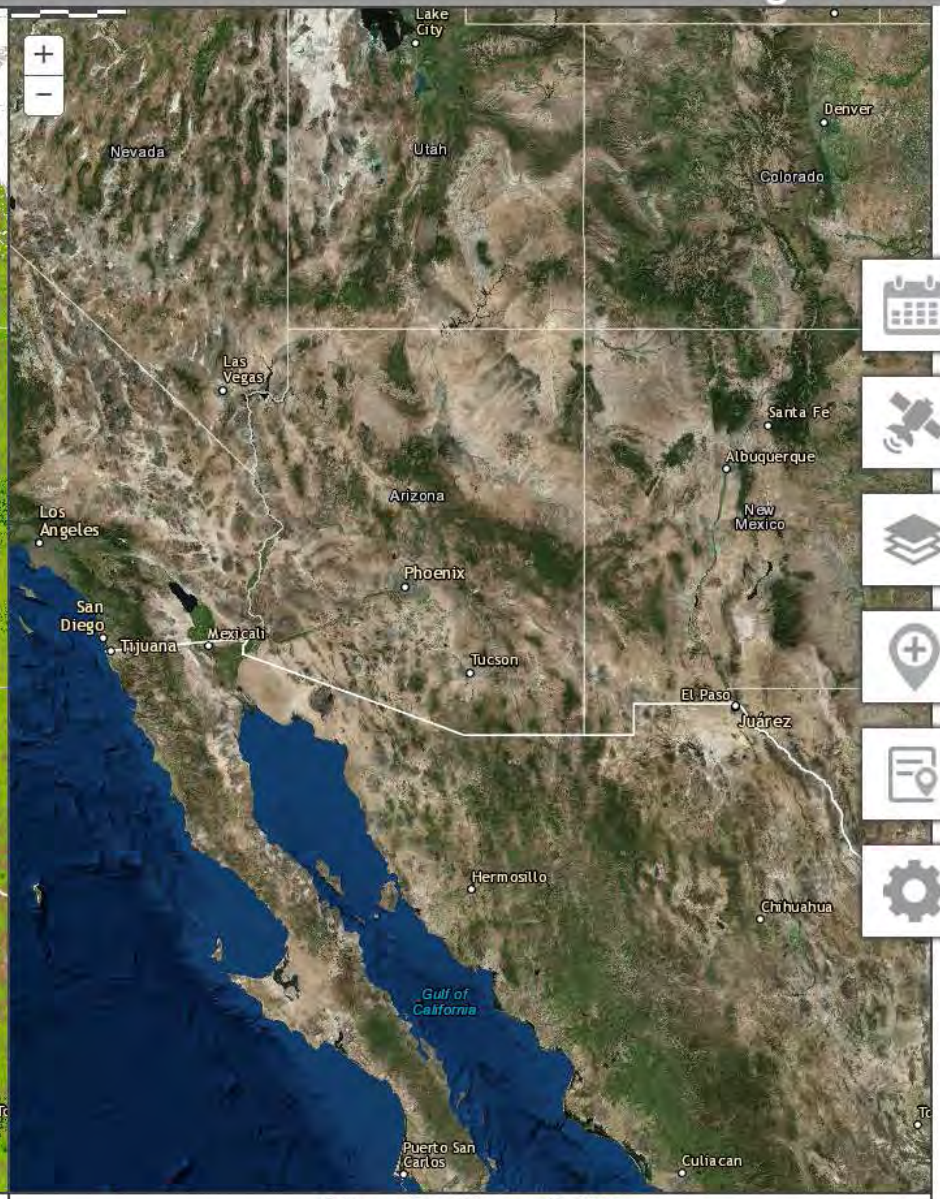


February 02 - February 17, 2016

Low NDVI Vegetation Greenness High



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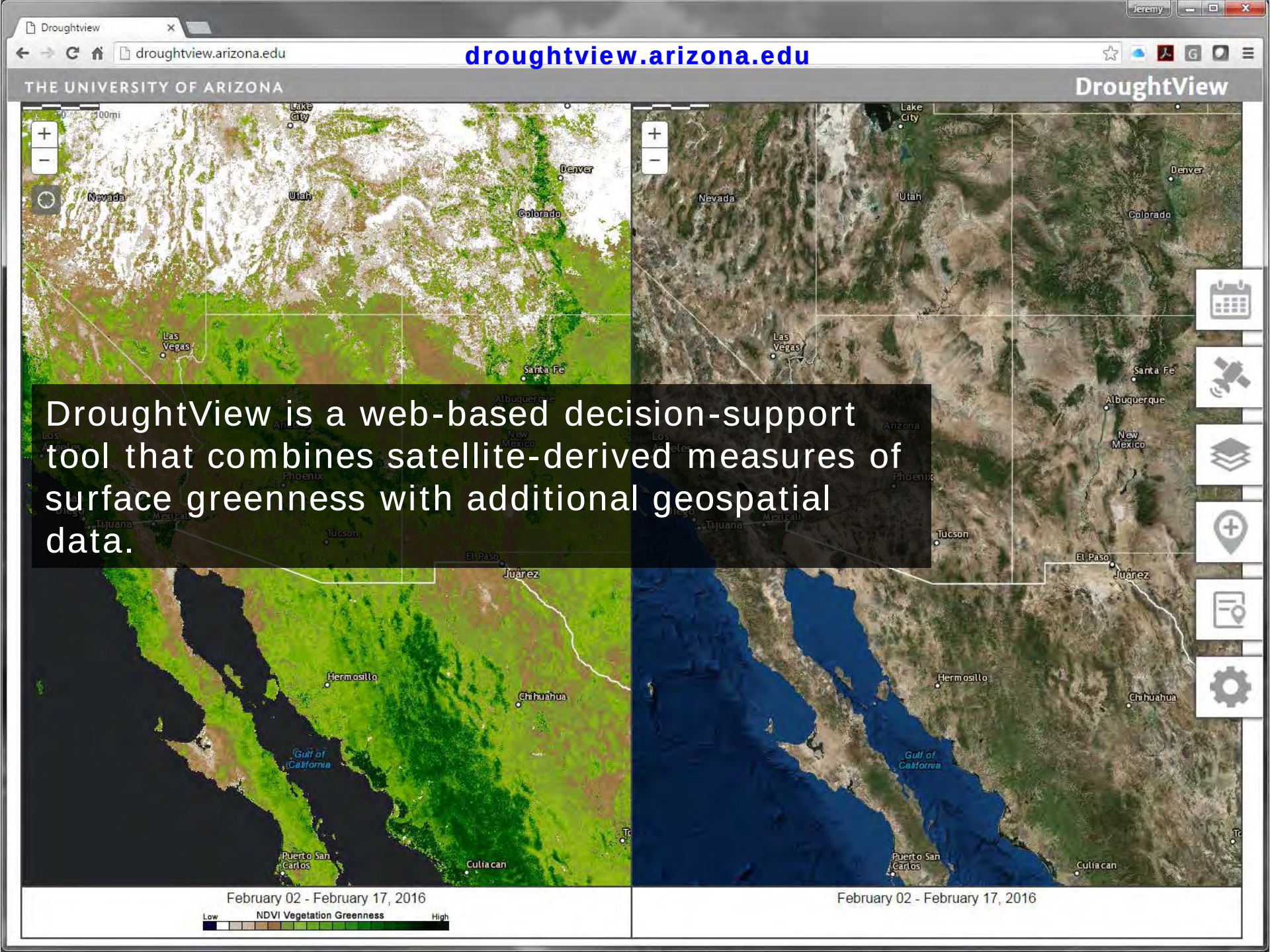
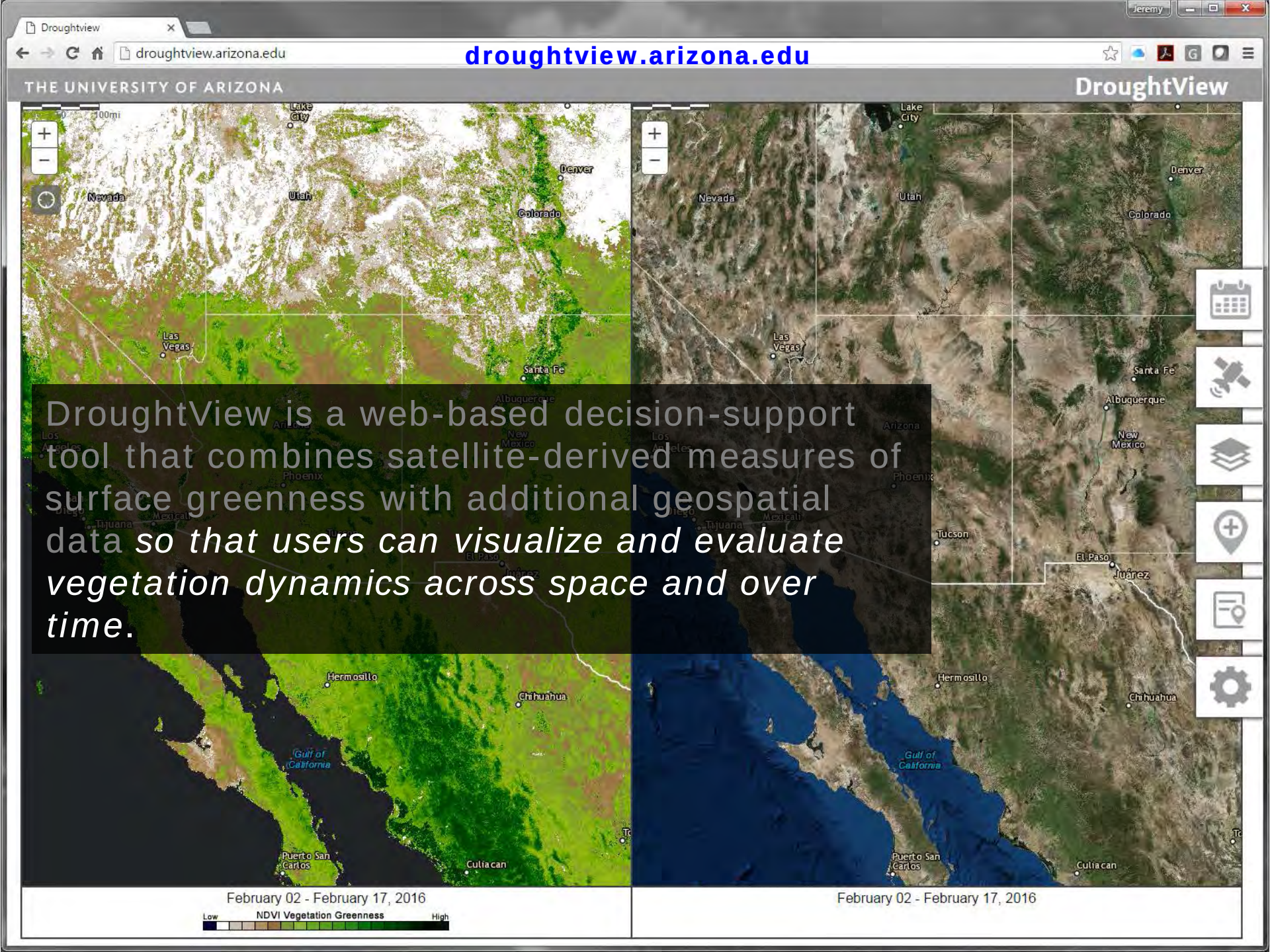


DroughtView is a web-based decision-support tool that combines satellite-derived measures of surface greenness with additional geospatial data.



DroughtView is a web-based decision-support tool that combines satellite-derived measures of surface greenness with additional geospatial data *so that users can visualize and evaluate vegetation dynamics across space and over time*.

We will cover DroughtView and its functionality by looking at examples of recent uses and new capabilities.

- determining rangeland conditions in southeastern Arizona
- timing vegetation surveys in the low deserts of Arizona and California

- reporting drought impacts
- sharing map information

Is Jeremy developing DroughtView all by himself?

- < ATTENDEE INPUT! >

Is Jeremy developing DroughtView all by himself?

- *Answer:* Of course not!

Michael Crimmins, *SWES*
Kyle Hartfield, *ARSC SNRE*
Pratima K C, *ARSC SNRE*
Stuart Marsh, *SNRE*
Matt Rahr, *CALS CCT*
Yuta Torrey, *CALS CCT*
Wim van Leeuwen, *ARSC SNRE / SGD*

What are some drought-related activities in which you have participated that have needed web map applications or remotely sensed data?

- < ATTENDEE INPUT! >

What are some drought-related activities in which you have participated that have needed web map applications or remotely sensed data?

- < ATTENDEE INPUT! >

Let's start by considering where DroughtView is in the current and broad landscape of data for environmental monitoring and modeling.

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Being compiled by scientists for scientists, environmental data can be formidable for non-specialists.

There is a wealth of data that, if appropriately analyzed and channeled, can inform decision making in agriculture and natural resources.

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We simply want to take these data and extract something meaningful.
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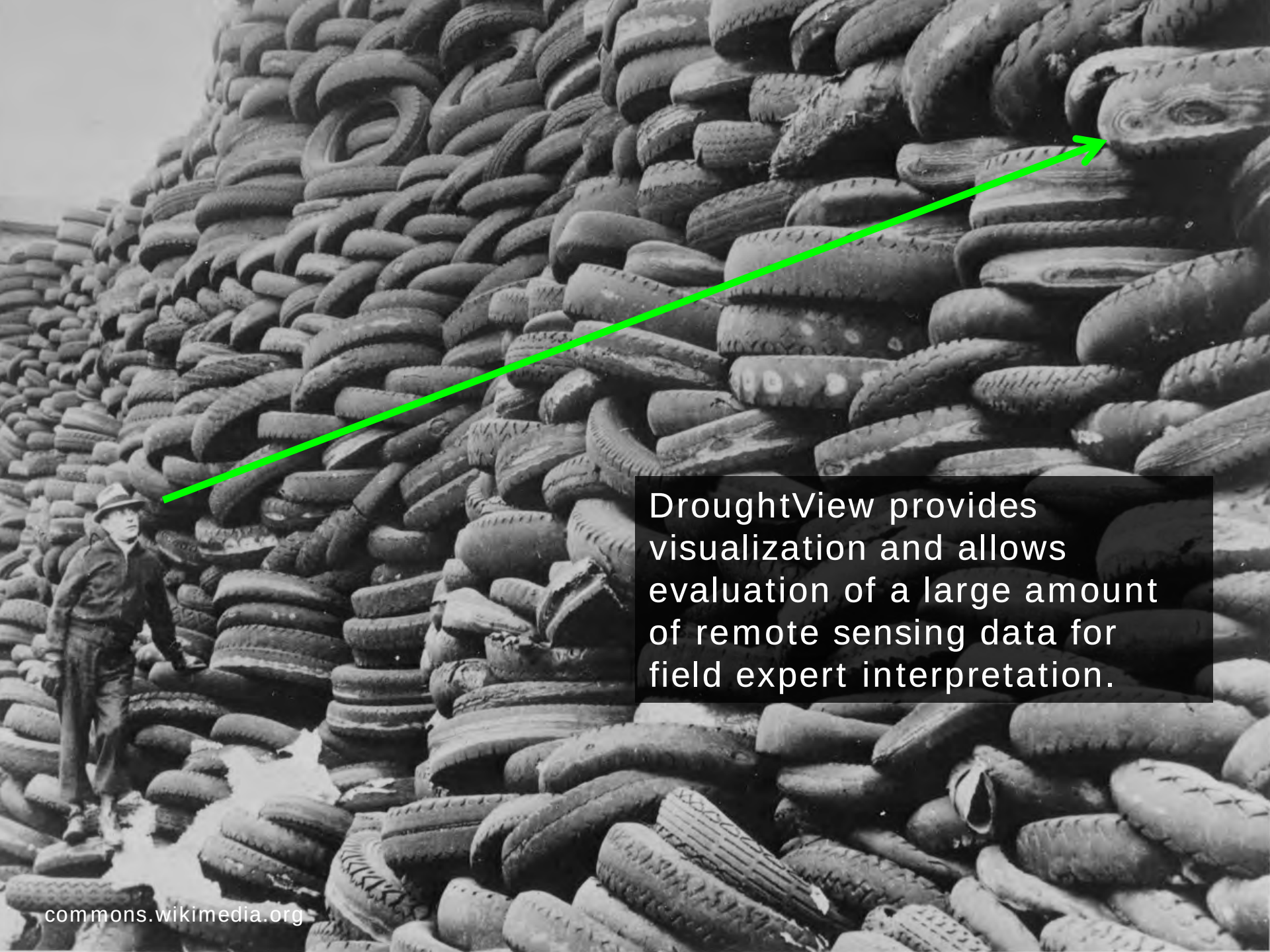
DroughtView provides visualization and allows evaluation of a large amount of remote sensing data for field expert interpretation.
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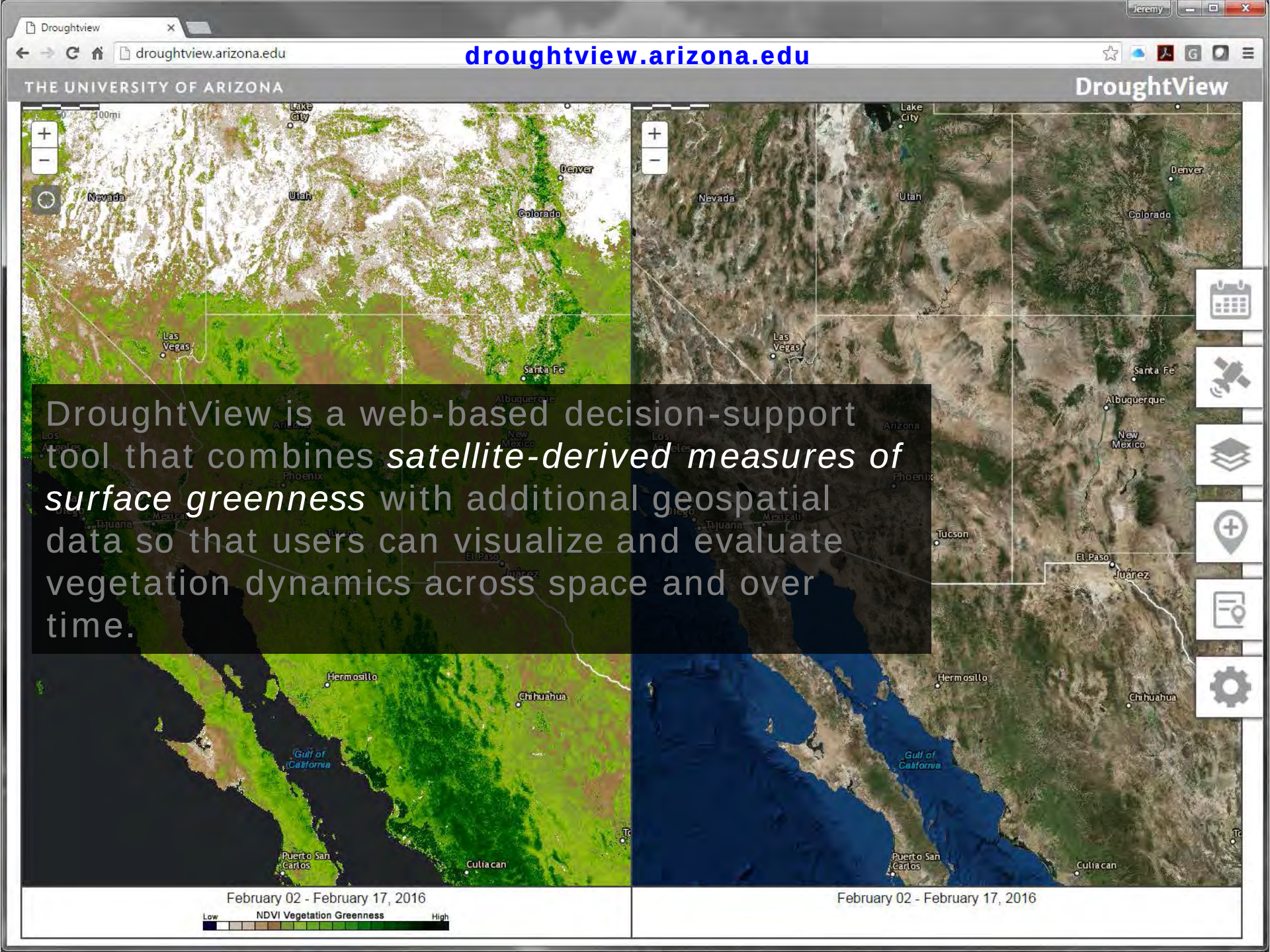
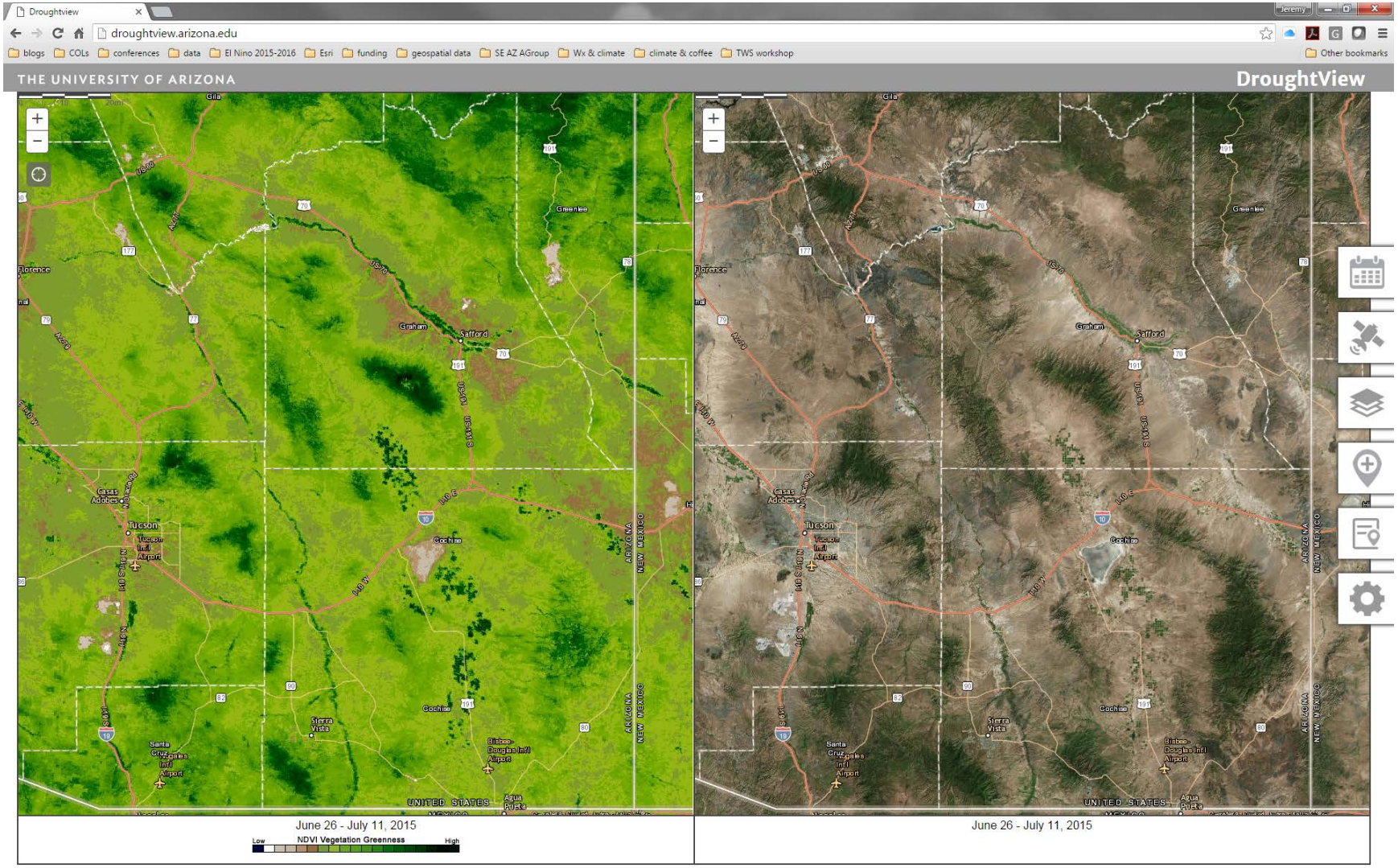


DroughtView is a web-based decision-support tool that combines *satellite-derived measures of surface greenness* with additional geospatial data so that users can visualize and evaluate vegetation dynamics across space and over time.

How are satellite measures of surface greenness (left) related to what we see in an aerial image (right)?



MODIS is a key sensor aboard the Terra and Aqua satellites that detects electromagnetic energy related to numerous atmospheric, land, and ocean phenomena.

- MODIS – Moderate Resolution Imaging Spectroradiometer
- a complete electromagnetic view of Earth every two days
- two satellites work in tandem to measure the same area in the morning and afternoon

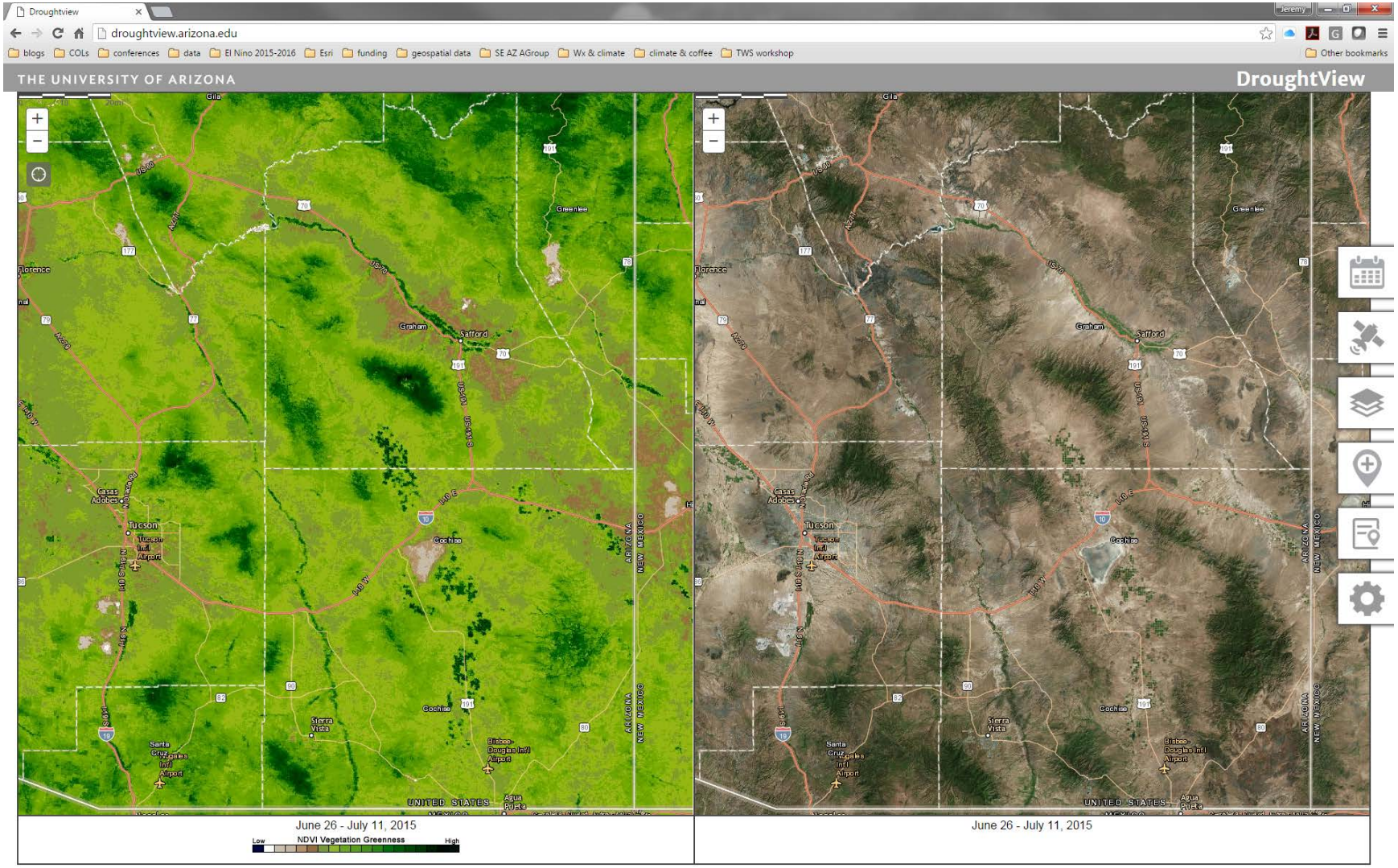
earthobservatory.nasa.gov, true-color composite

MODIS is a key sensor aboard the Terra and Aqua satellites that detects electromagnetic energy related to numerous atmospheric, land, and ocean phenomena.

- NDVI – Normalized Difference Vegetation Index
- compares amounts of the visible light and near-infrared parts of the electromagnetic spectrum reflected from Earth's surface
- plants reflect electromagnetic radiation differently relative to bare ground and water

earthobservatory.nasa.gov, true-color composite

Remotely sensed measurements of surface greenness are linked to several characteristics of vegetation.



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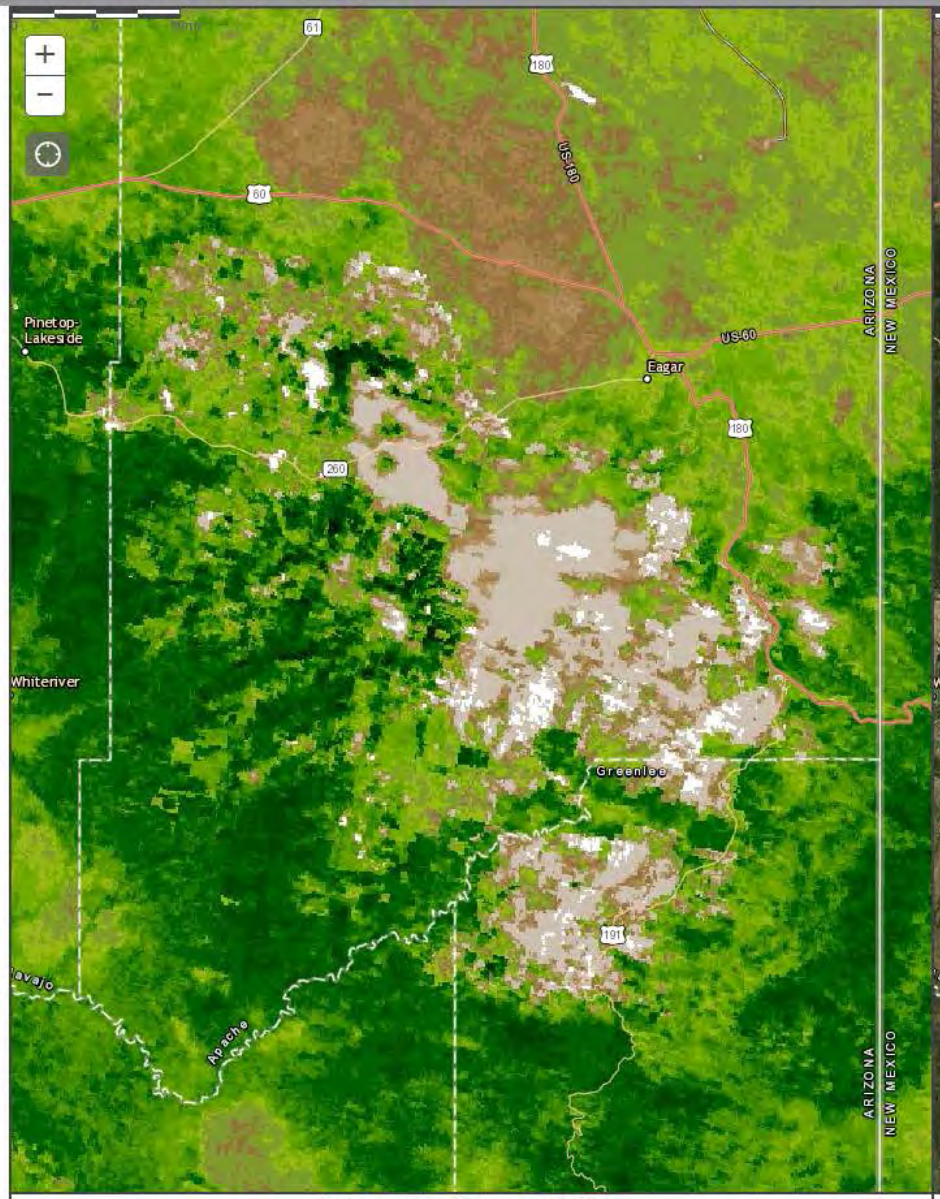

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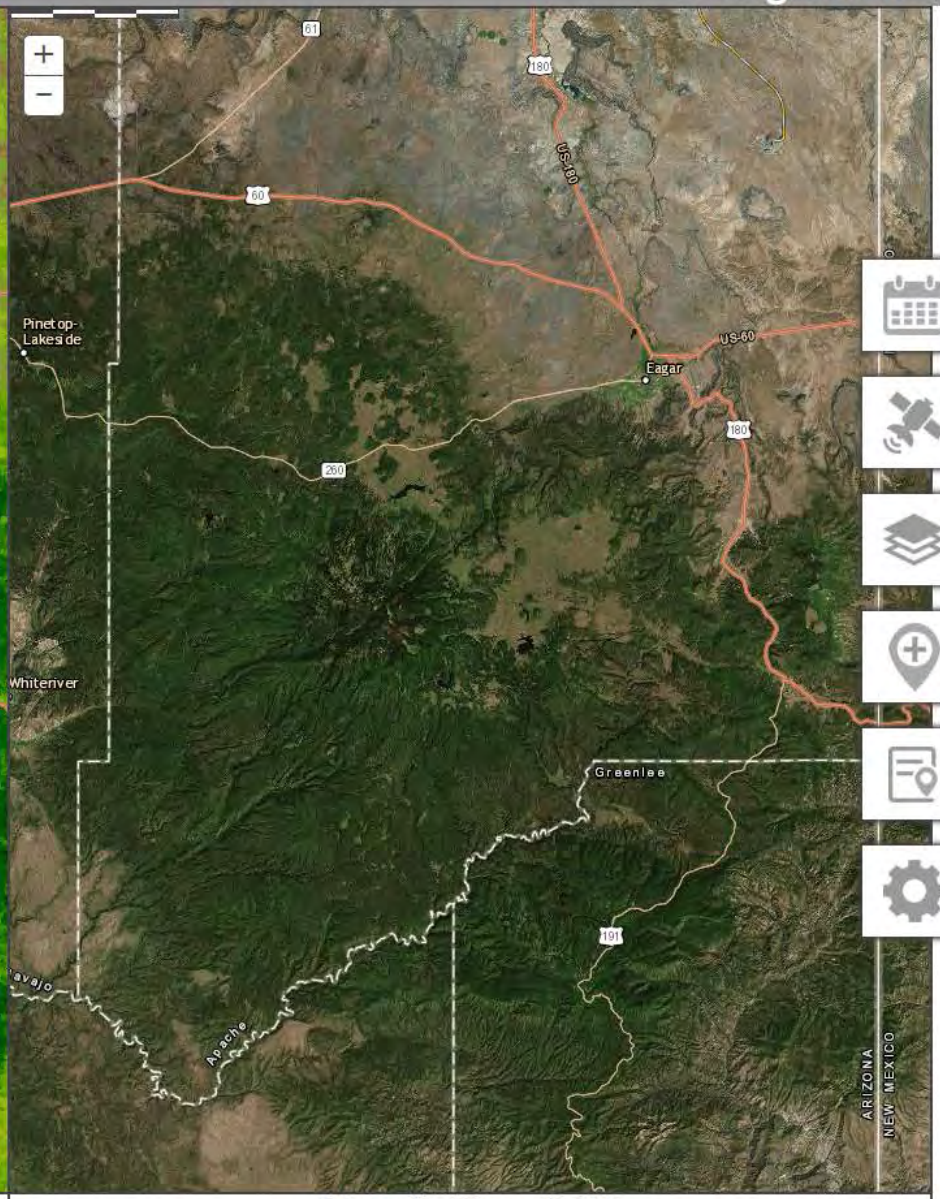

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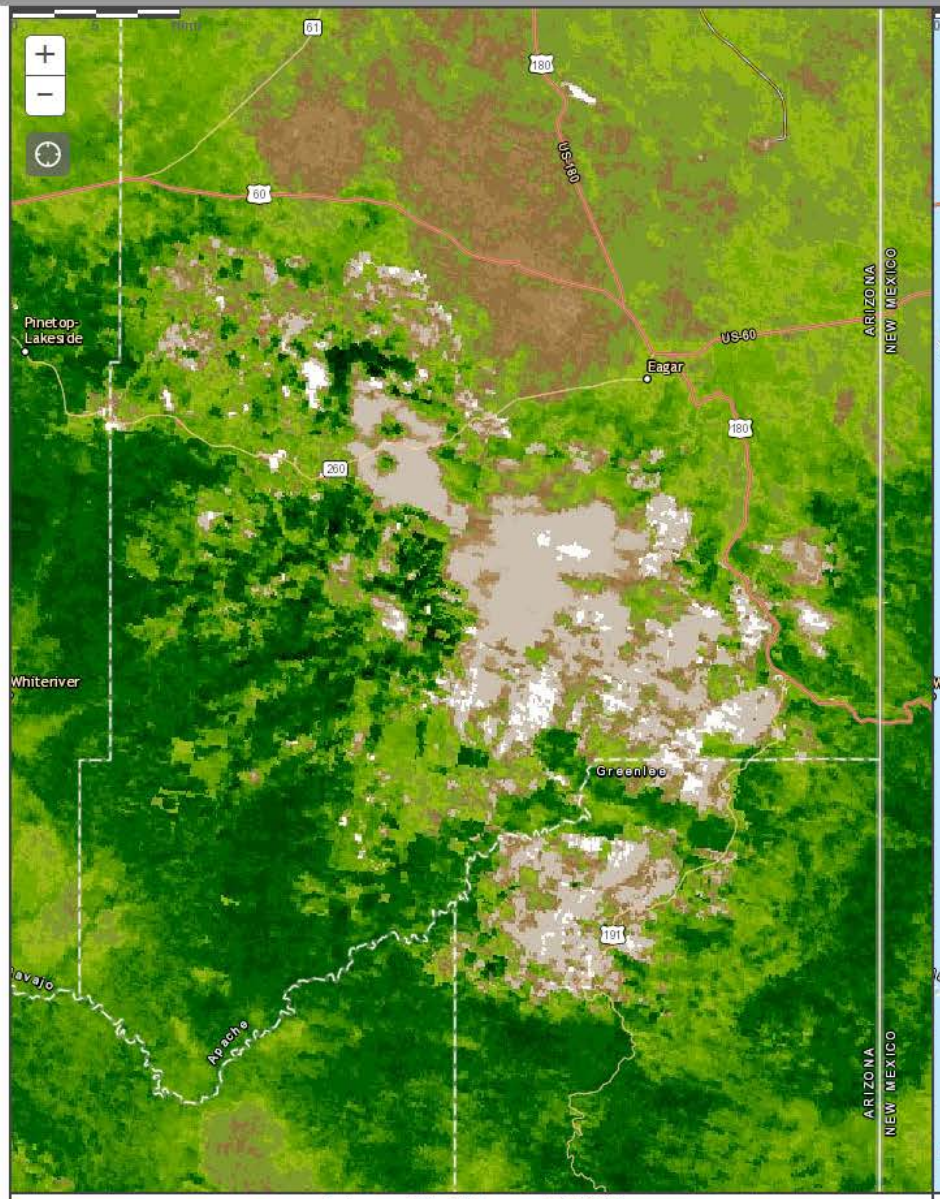

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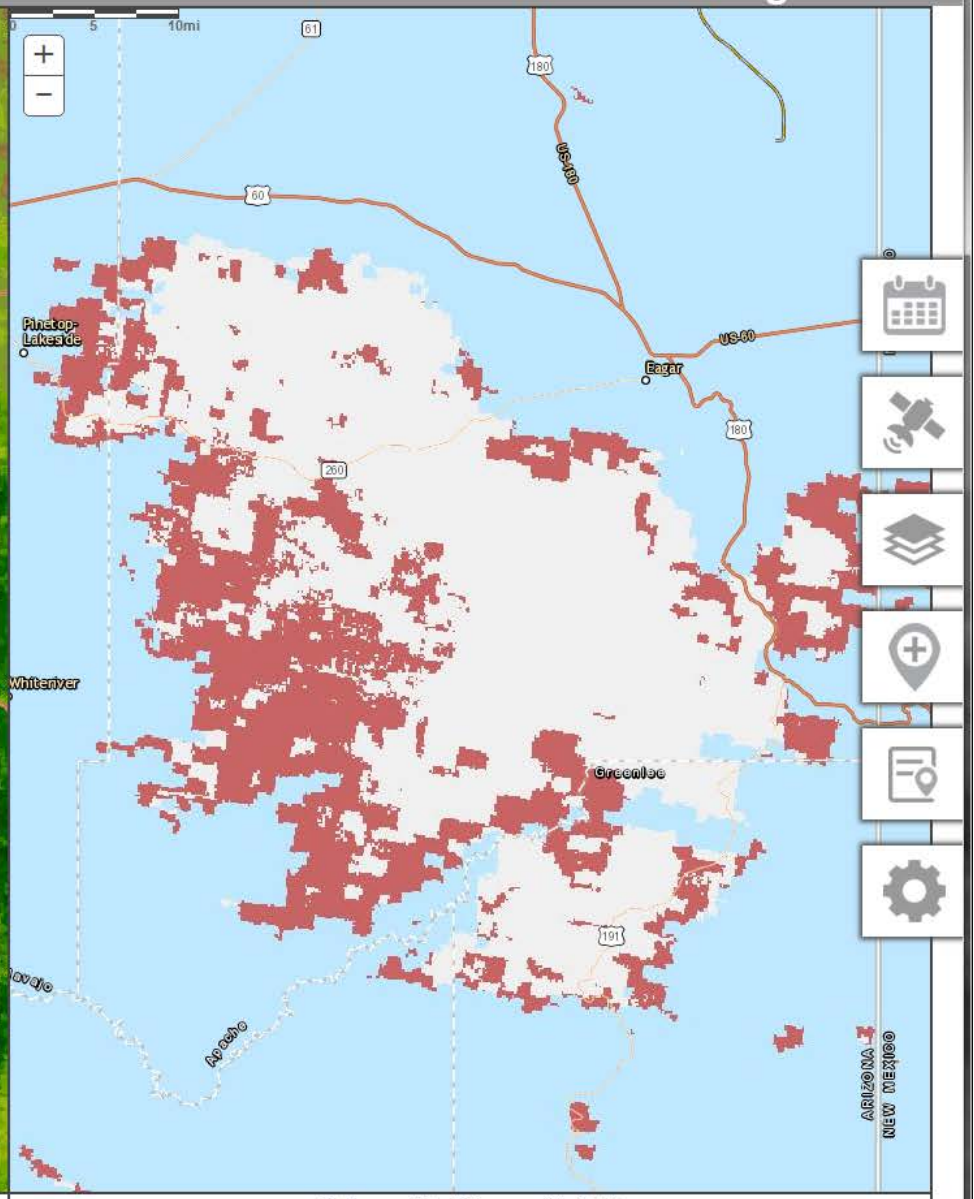
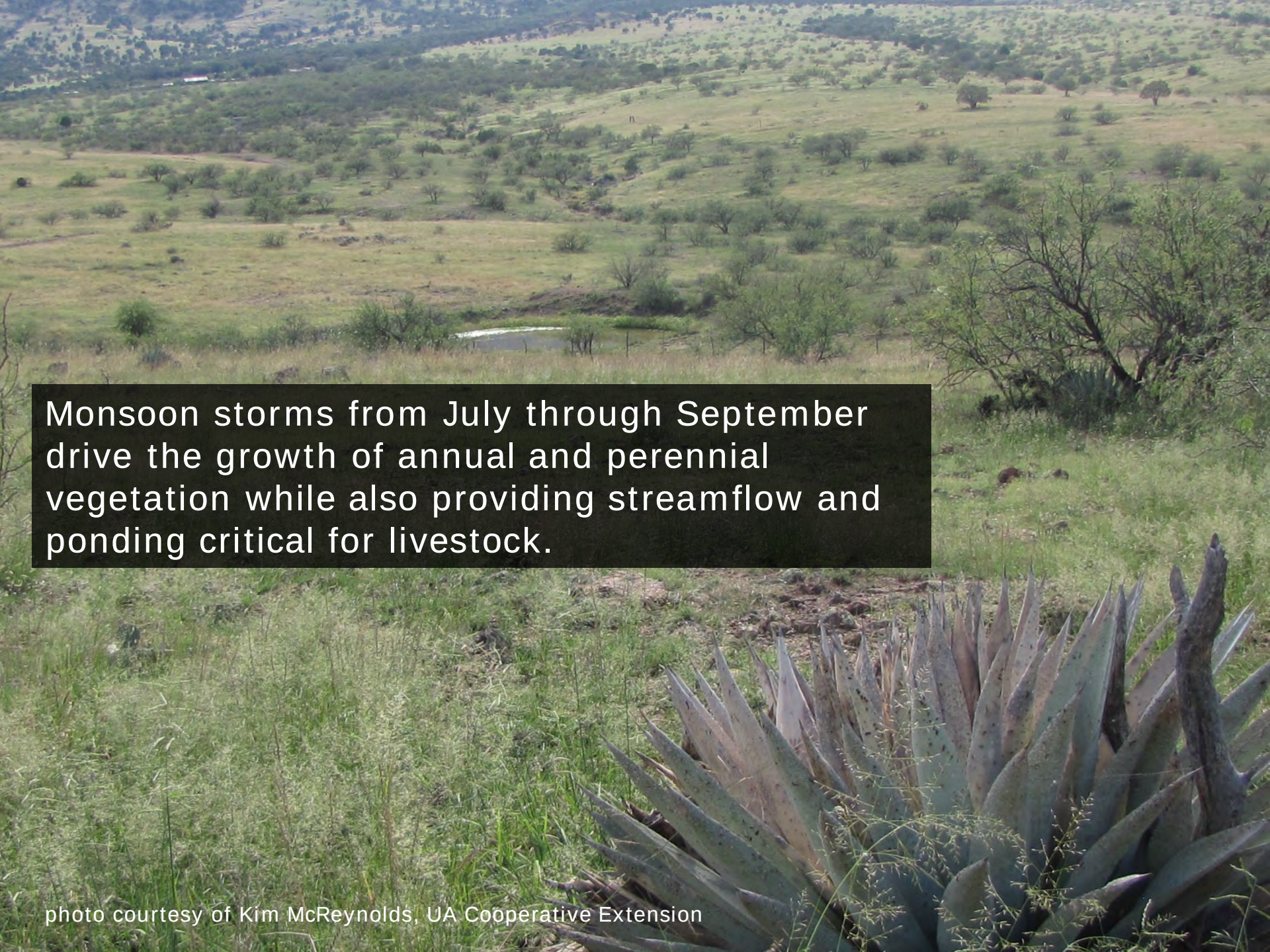


February 02 - February 17, 2016

Clouds and Snow

Good Data | Marginal | Snow/Ice | Clouds | No Data

photo courtesy of Kim McReynolds, UA Cooperative Extension



Monsoon storms from July through September drive the growth of annual and perennial vegetation while also providing streamflow and ponding critical for livestock.

photo courtesy of Kim McReynolds, UA Cooperative Extension

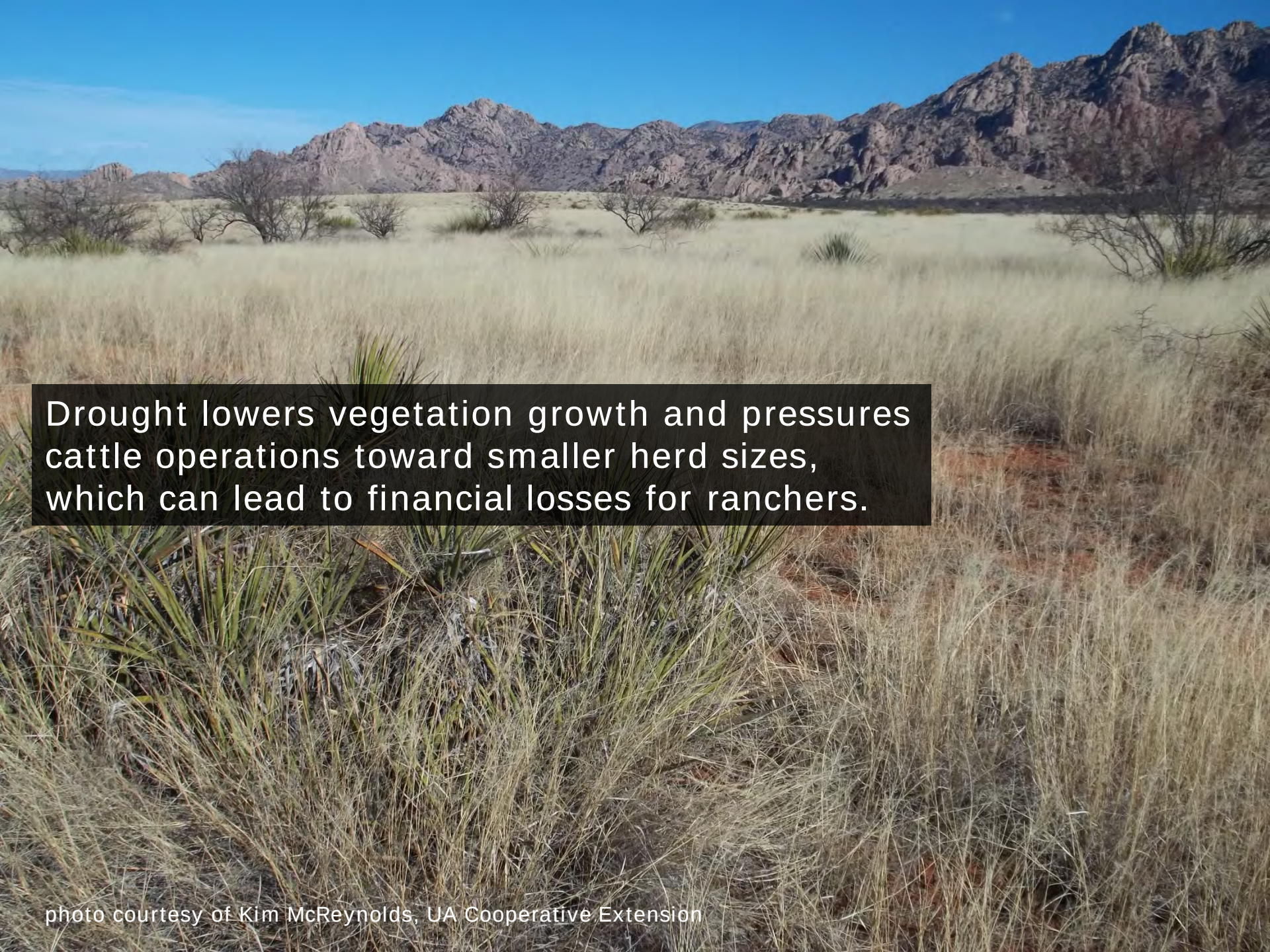
In rural southeastern Arizona, the beef industry is a key part of the regional economic base.

photo courtesy of Kim McReynolds, UA Cooperative Extension

County	Area (square miles)[1]	Population[1]	Estimated contribution (millions)[2]
Cochise	6,166	131,357	$59.1
Graham	4,623	37,220	$4.8
Greenlee	1,843	8,437	$3.3
Santa Cruz	1,237	47,420	$5.9

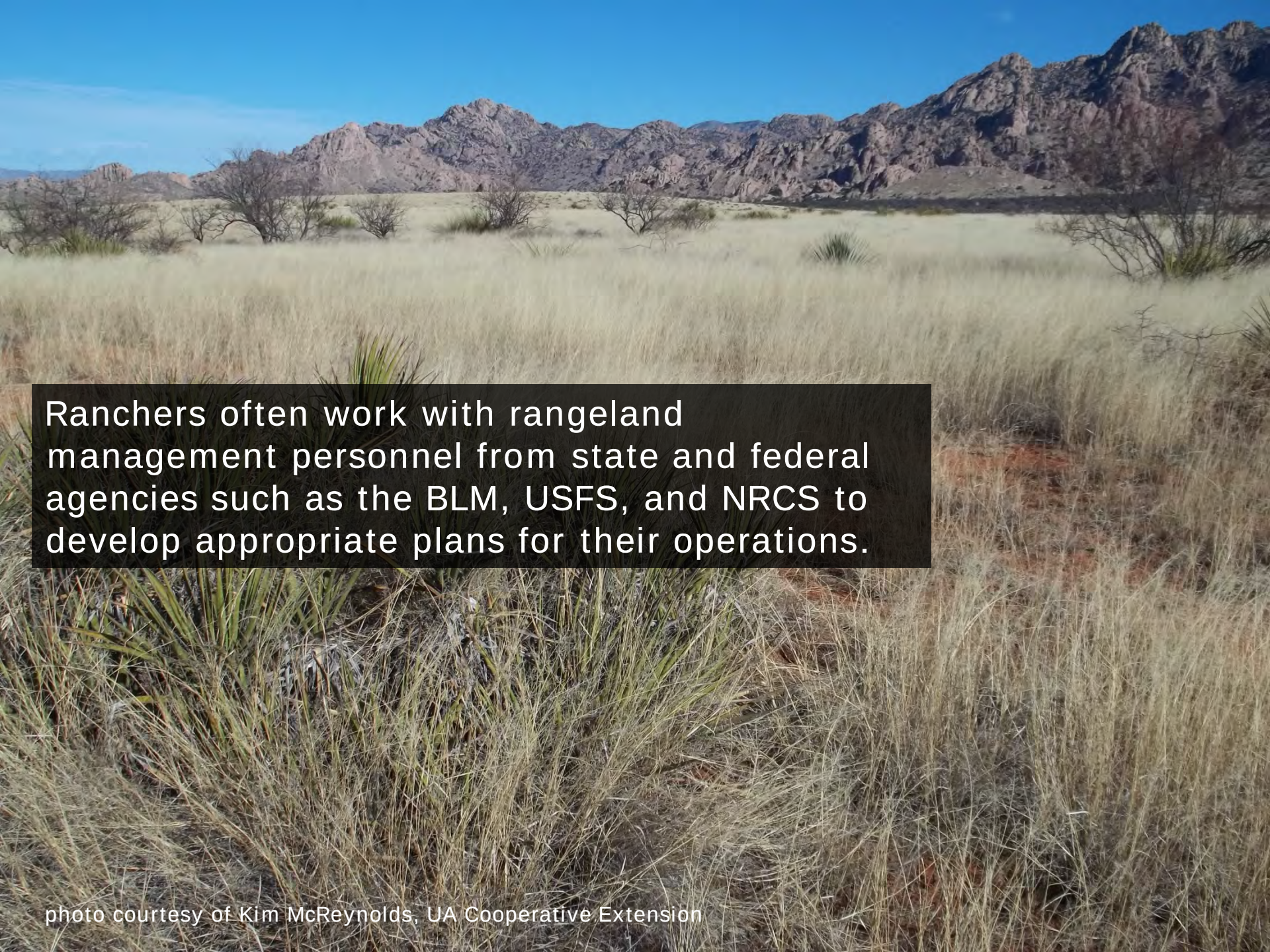
[1] for 2010, quickfacts.census.gov/qfd/index.html
[2] for 2011 (Kerna et al. 2014)

photo courtesy of Kim McReynolds, UA Cooperative Extension



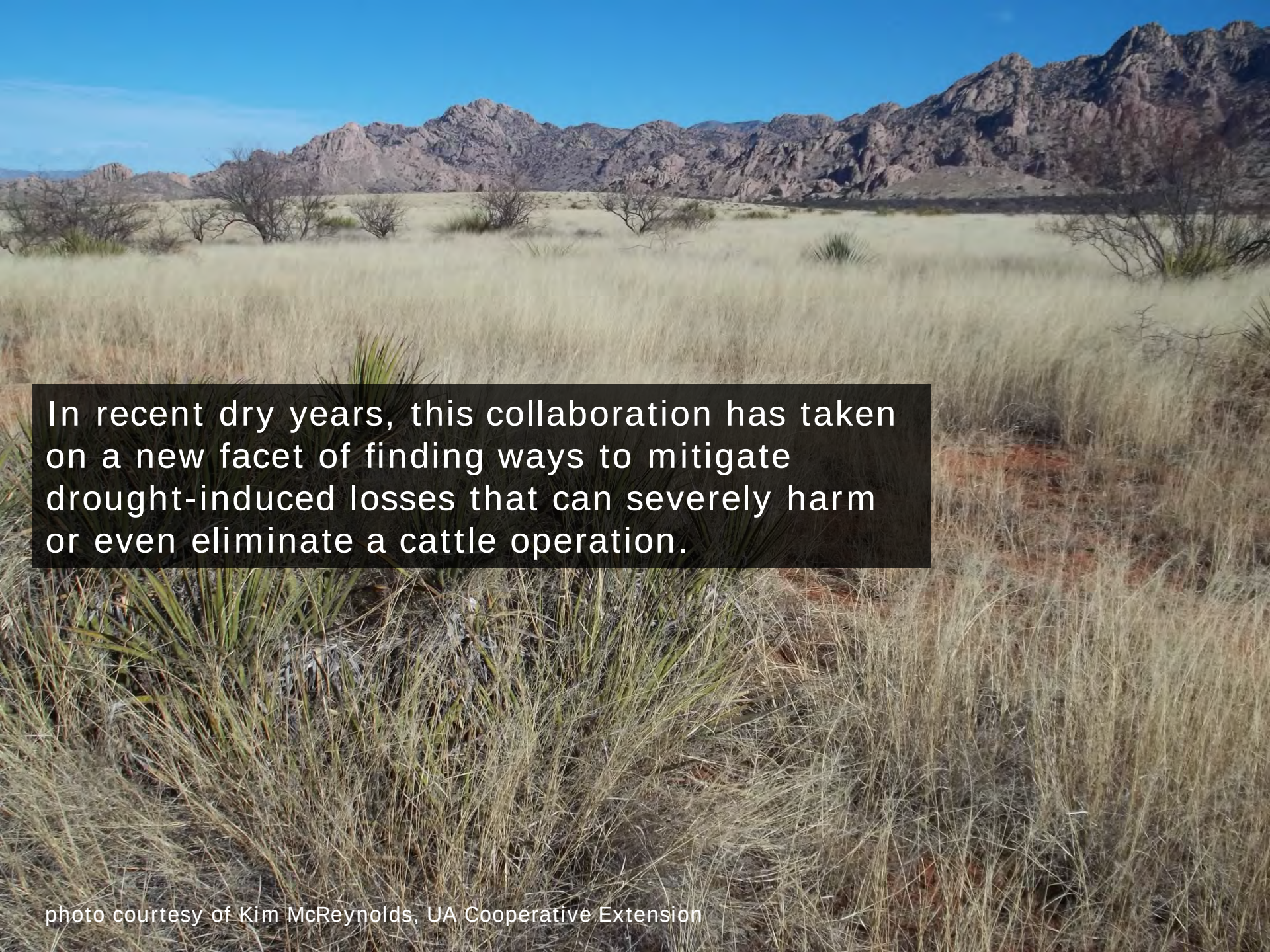
Drought lowers vegetation growth and pressures cattle operations toward smaller herd sizes, which can lead to financial losses for ranchers.

photo courtesy of Kim McReynolds, UA Cooperative Extension



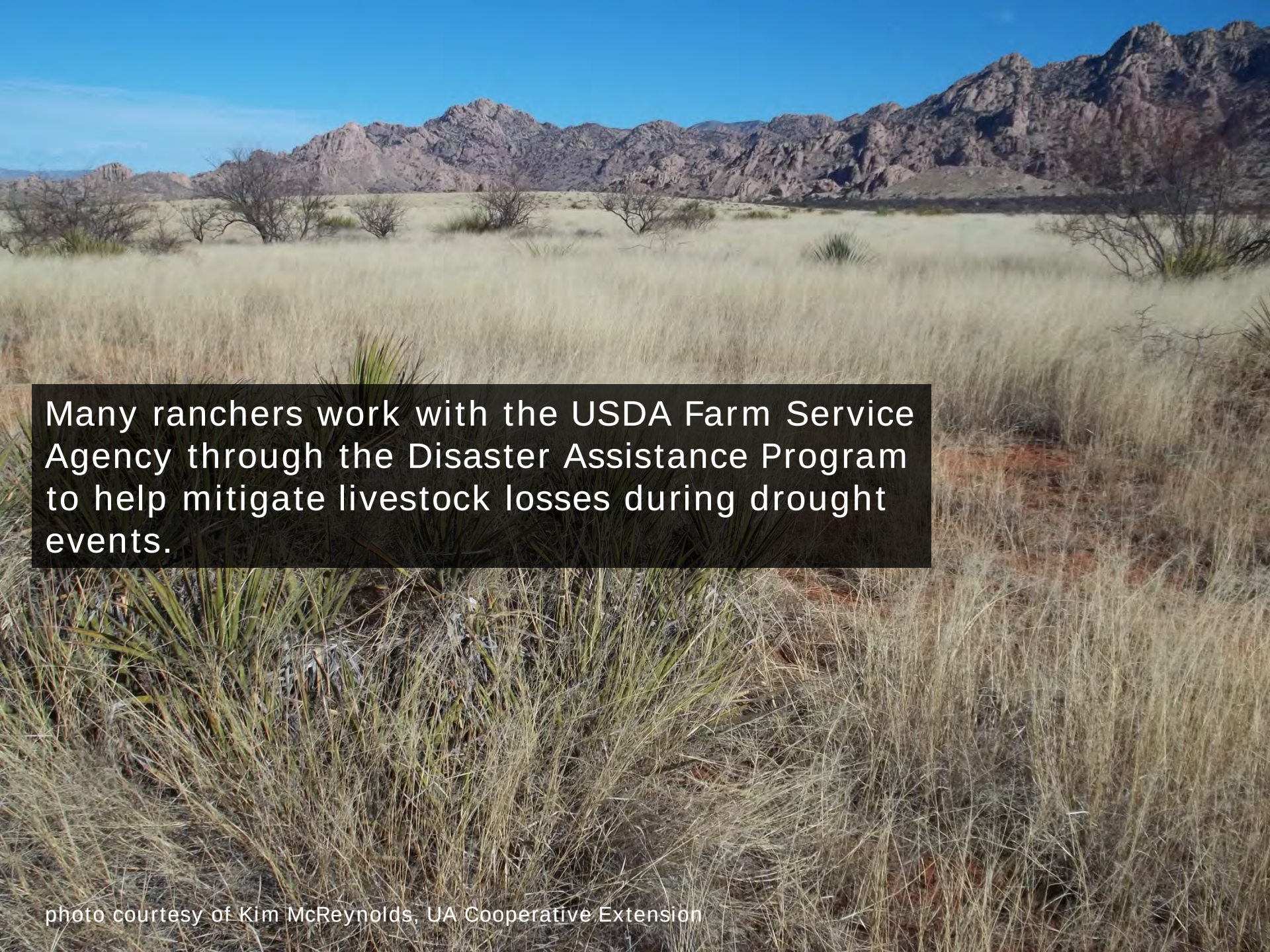
Ranchers often work with rangeland management personnel from state and federal agencies such as the BLM, USFS, and NRCS to develop appropriate plans for their operations.

photo courtesy of Kim McReynolds, UA Cooperative Extension



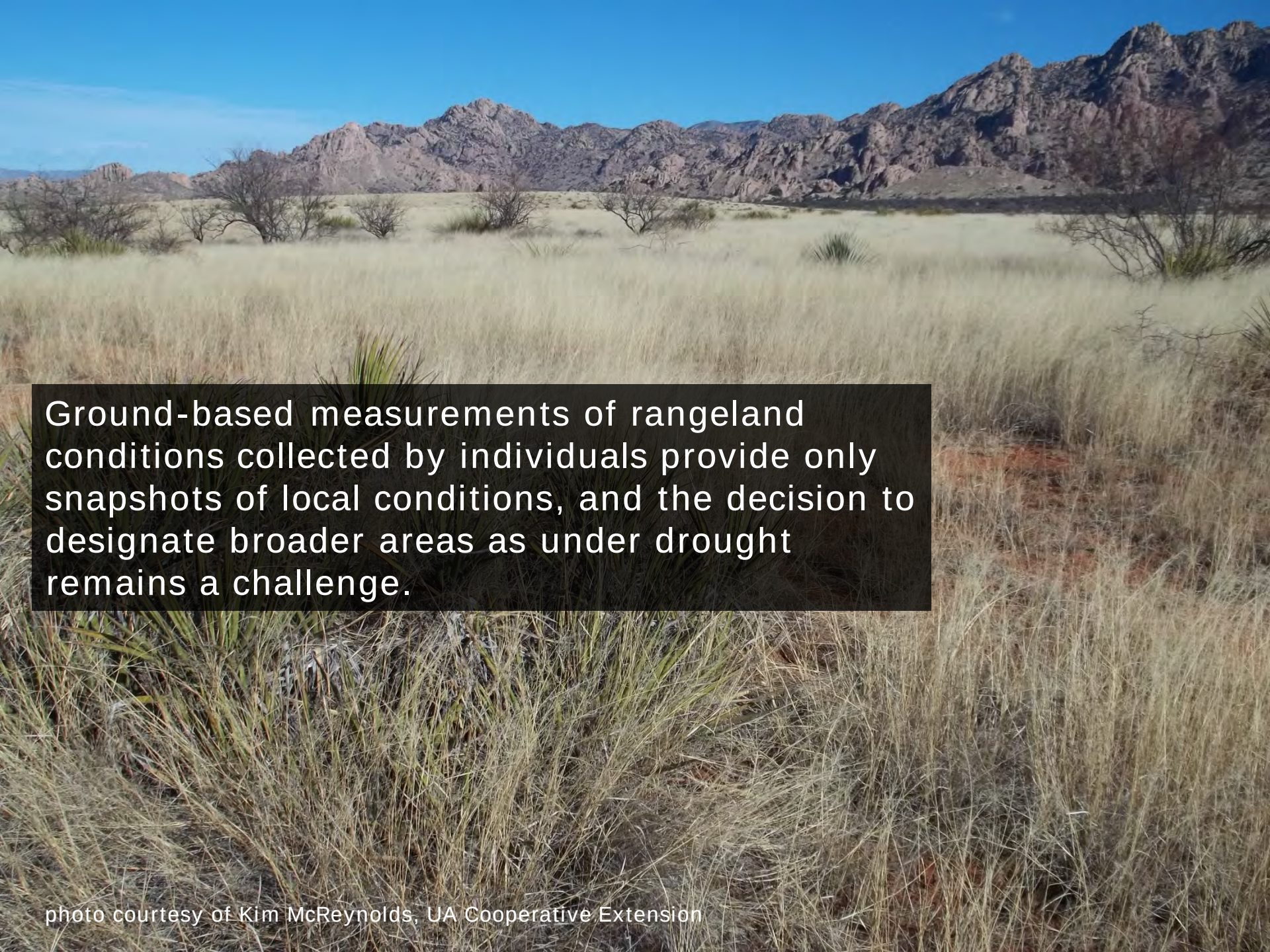
In recent dry years, this collaboration has taken on a new facet of finding ways to mitigate drought-induced losses that can severely harm or even eliminate a cattle operation.

photo courtesy of Kim McReynolds, UA Cooperative Extension



Many ranchers work with the USDA Farm Service Agency through the Disaster Assistance Program to help mitigate livestock losses during drought events.

photo courtesy of Kim McReynolds, UA Cooperative Extension



Ground-based measurements of rangeland conditions collected by individuals provide only snapshots of local conditions, and the decision to designate broader areas as under drought remains a challenge.

photo courtesy of Kim McReynolds, UA Cooperative Extension

photo credit : Jeremy Weiss

NAP drought assessment

March 9, 2016

Jeremy Weiss

Climate and Geospatial Extension Scientist

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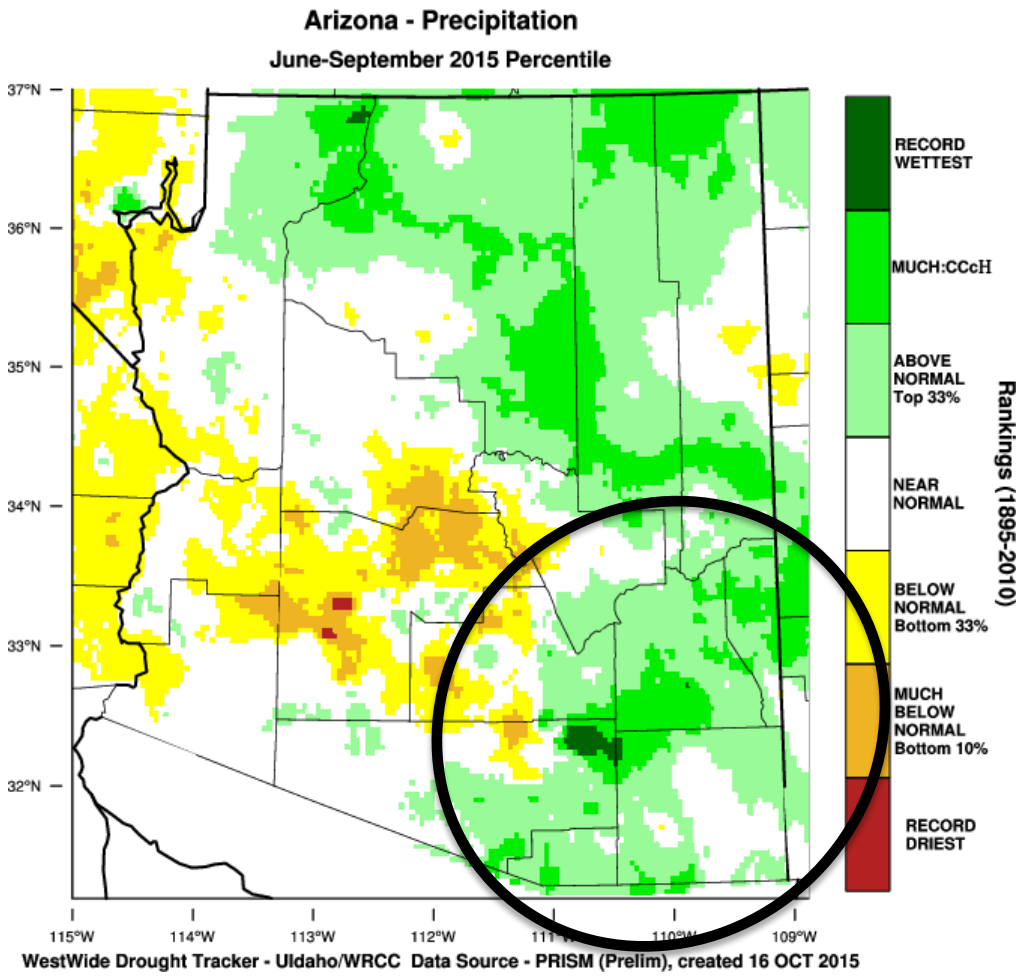
2015 HIGHLIGHTS

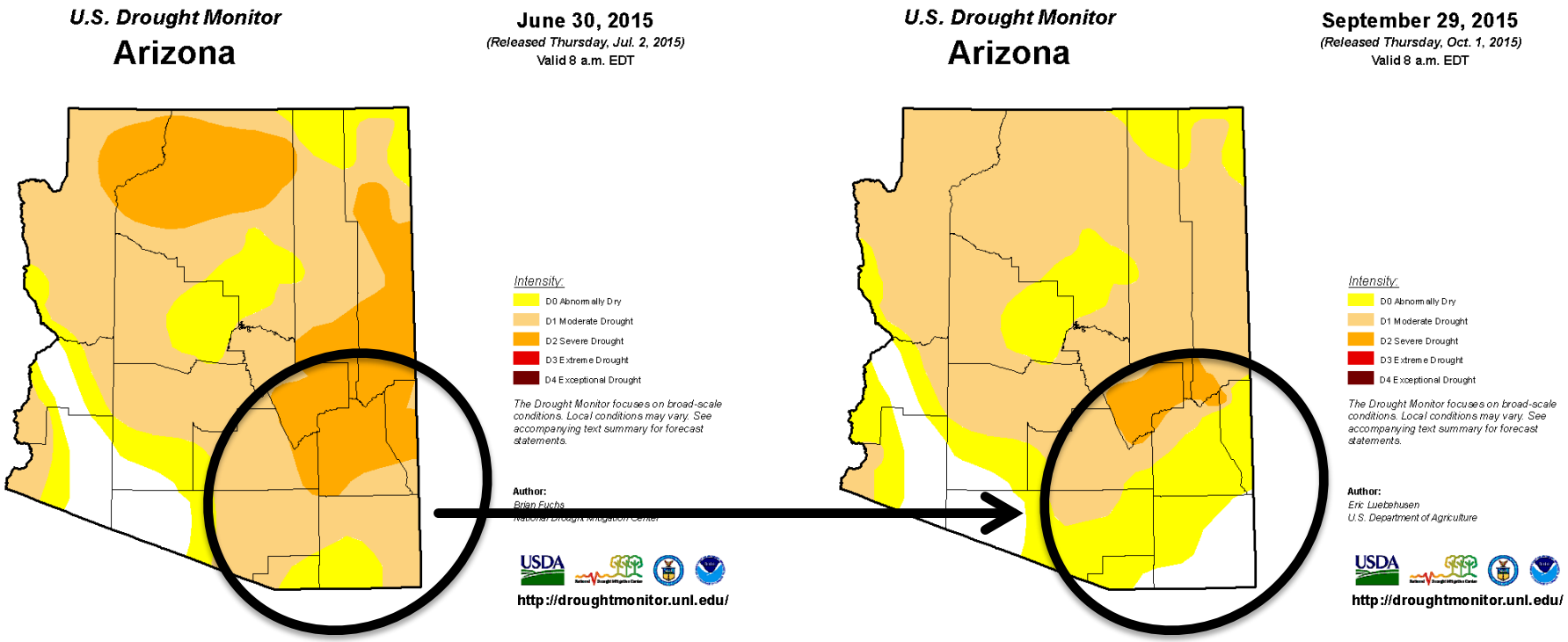
- annual precipitation was above normal for most of southeastern Arizona
- surface greenness was near or above average for much of the area at the start and end of the monsoon
- drought conditions improved over the area during the year

Most of SE AZ received above-normal precipitation during the monsoon, with a few areas receiving much-above-normal or near-normal amounts.



www.wrcc.dri.edu/wwdt/archive.php

Monsoon precipitation totals last year made noticeable improvements to drought conditions over SE AZ, with most of the area under abnormally dry conditions or no drought.



droughtmonitor.unl.edu/MapsAndData/MapArchive.aspx

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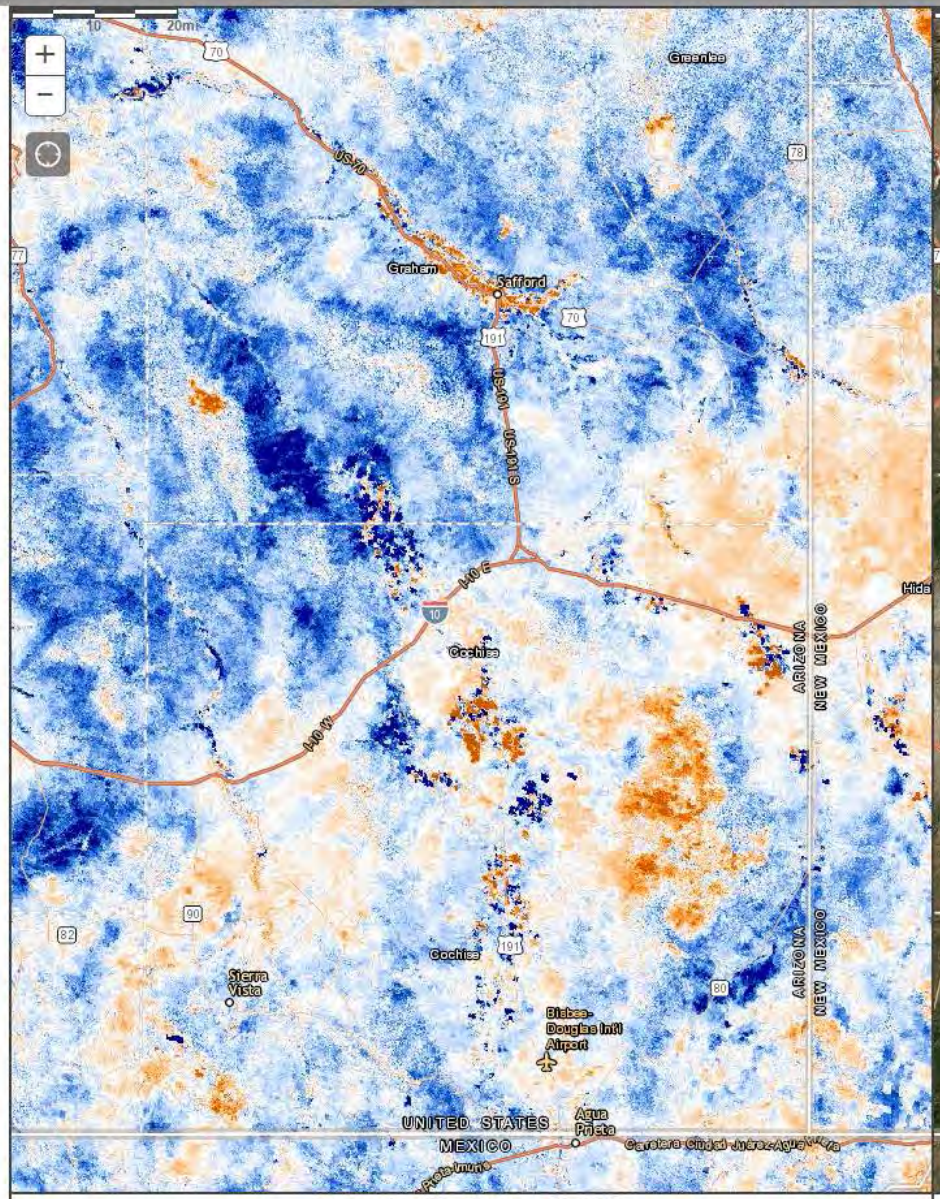

September 30 - October 15, 2015

Difference From Average

Less Green — Greener

September 30 - October 15, 2015

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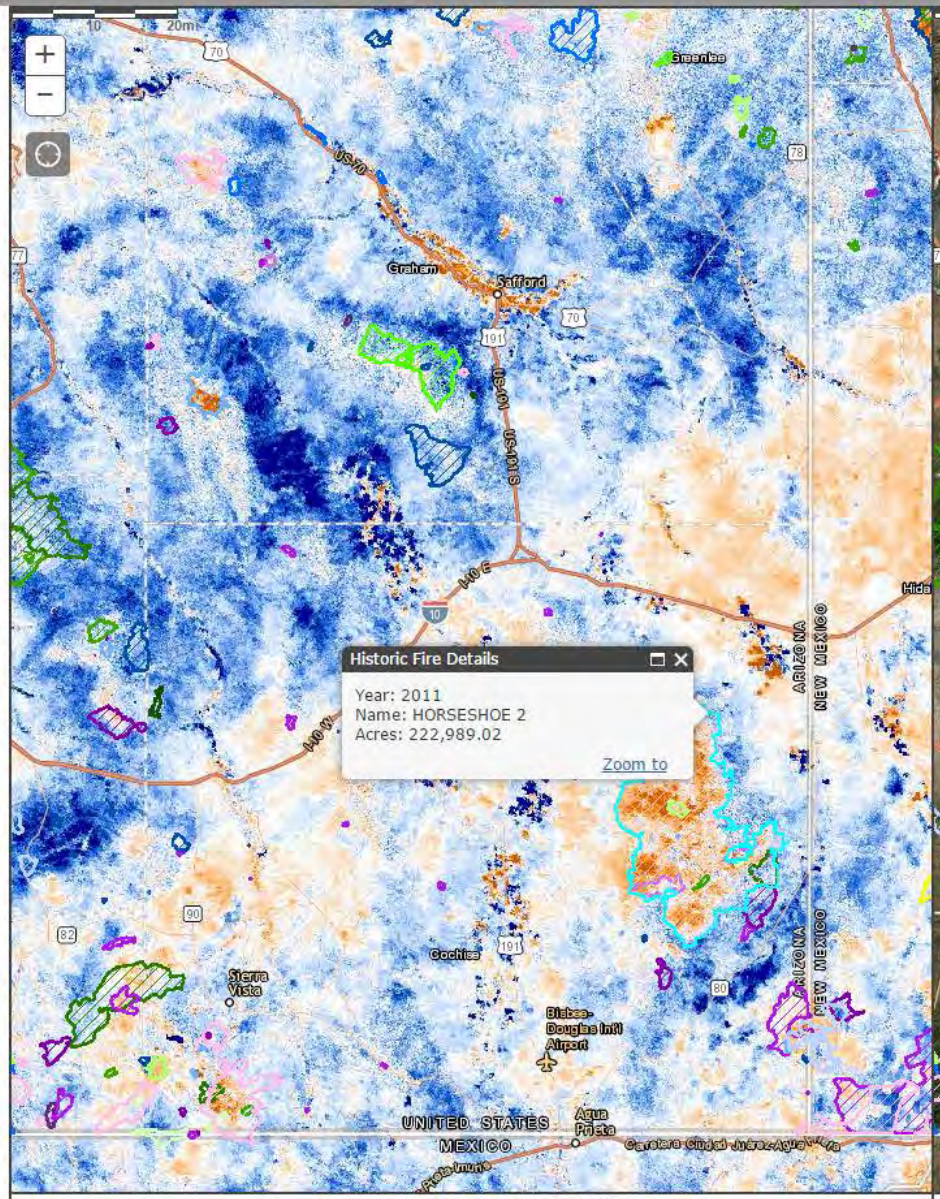

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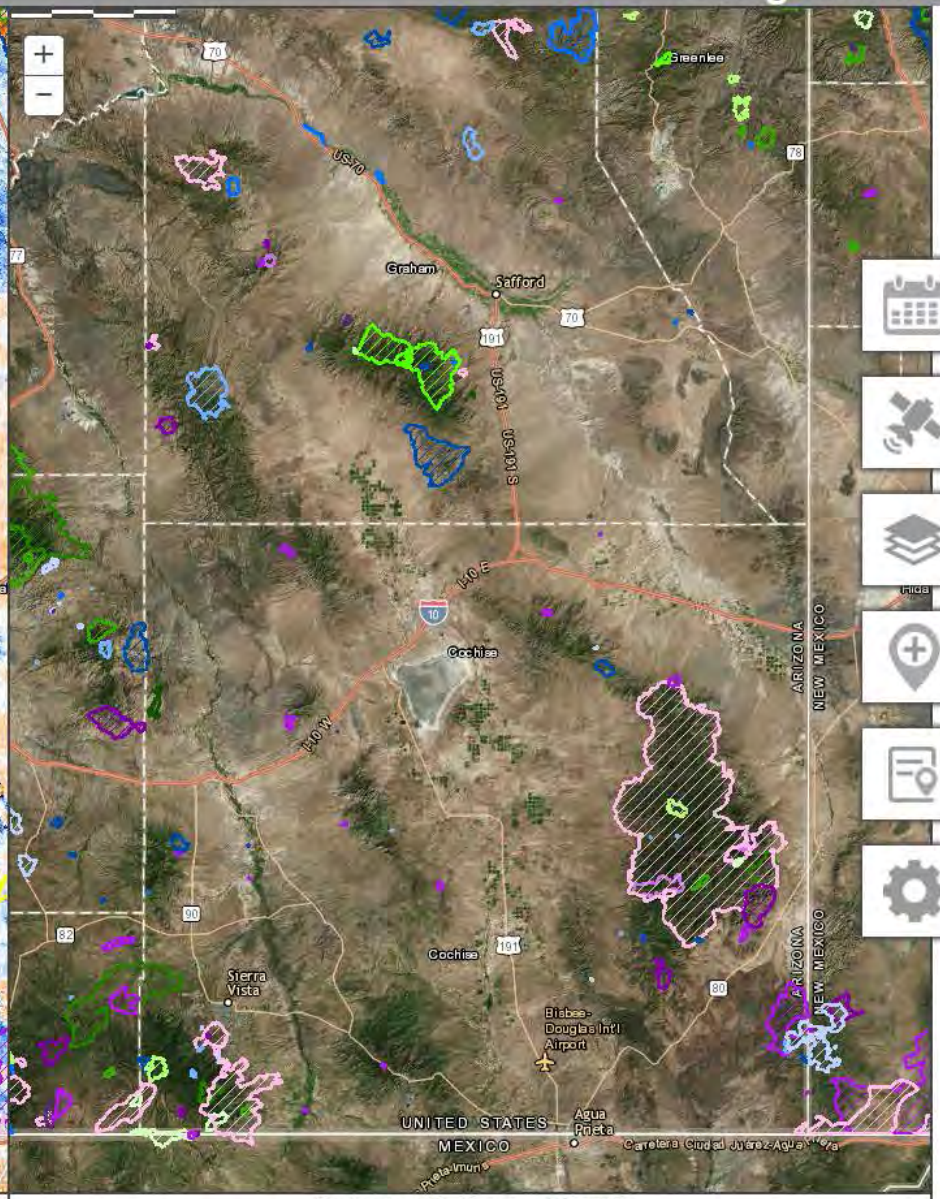


September 30 - October 15, 2015

Bringing together a variety of information proved useful for determining drought impacts to cattle operations in southeastern Arizona.

photo credit : Jeremy Weiss

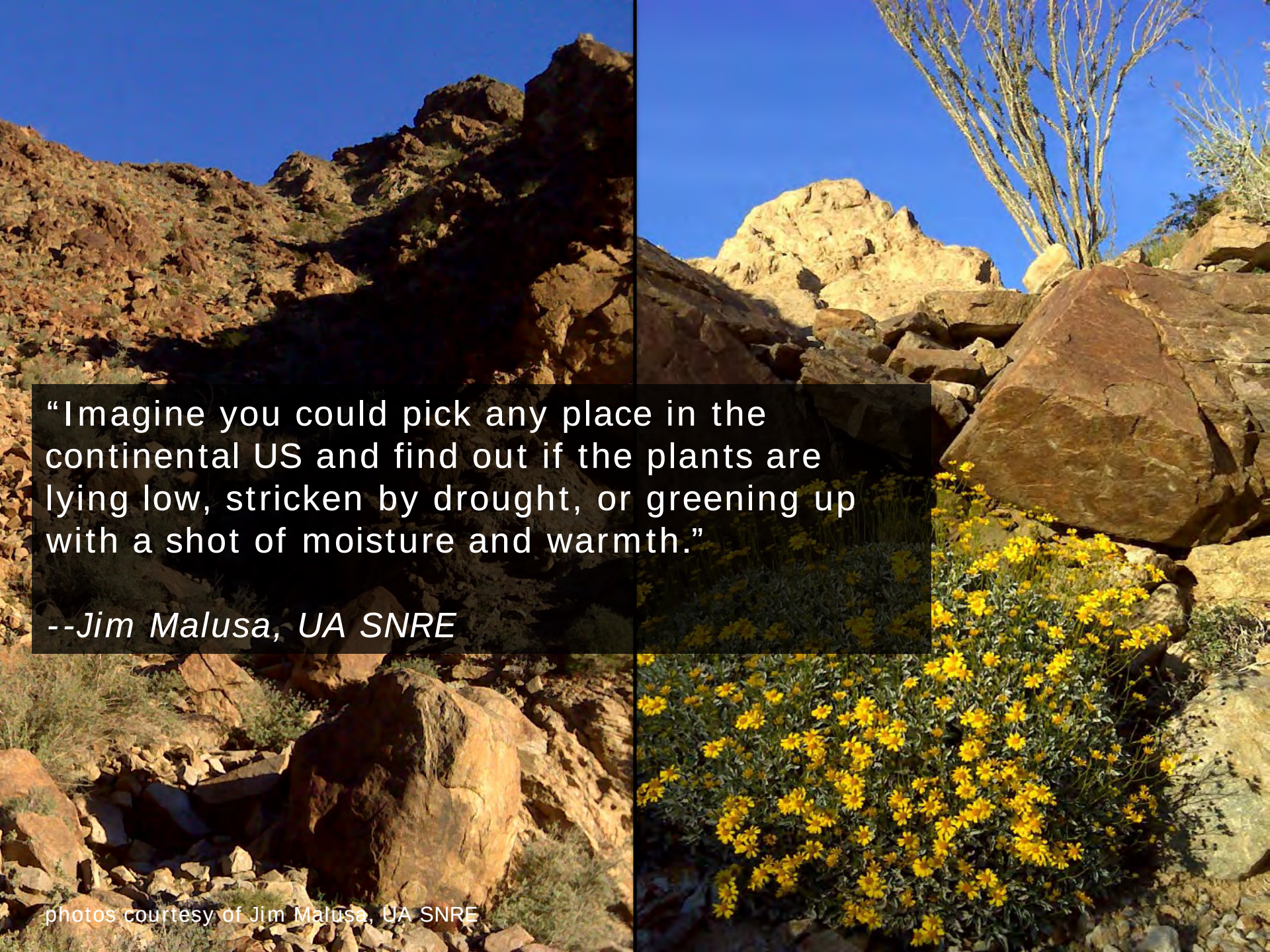
Ranchers and agency staff still contend with below-average precipitation ... new actions and solutions may be needed to cope with such challenging conditions.

photo credit : Jeremy Weiss

Nonetheless, retrospective and real-time monitoring, along with disaster assistance, improve the chances of cattle operations surviving dry periods.

photo credit : Jeremy Weiss

photos courtesy of Jim Malusa, UA SNRE



"Imagine you could pick any place in the continental US and find out if the plants are lying low, stricken by drought, or greening up with a shot of moisture and warmth."

--Jim Malusa, UA SNRE

photos courtesy of Jim Malusa, UA SNRE

“The latter is what interests me in my work on vast military ranges, where I’m chasing invasive plants in Arizona and making a flora in California.”

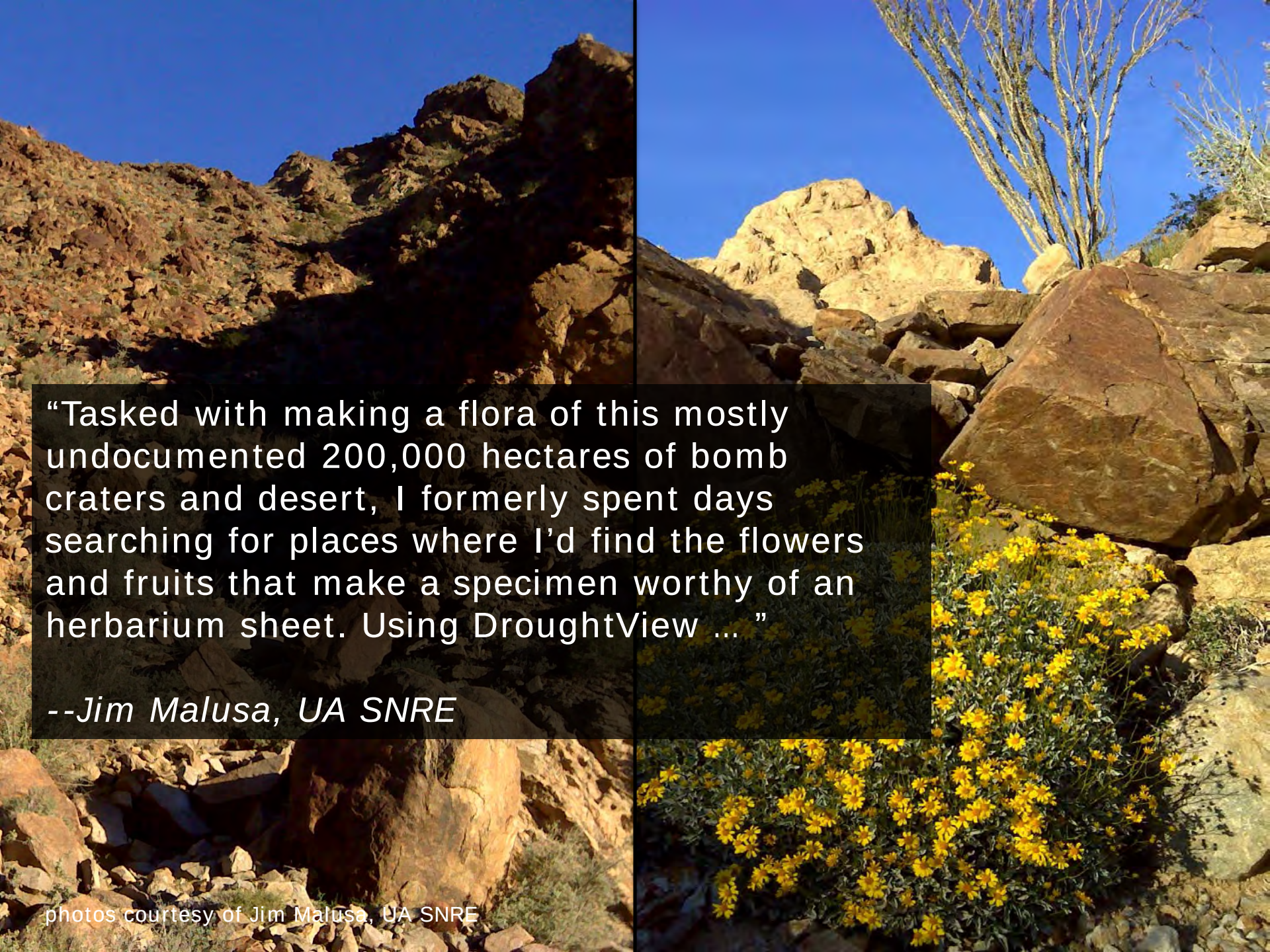
--Jim Malusa, UA SNRE

photos courtesy of Jim Malusa, UA SNRE

"I've long known that sensors on satellites can detect actively growing plants, but lacked the brains and money to utilize the data."

--Jim Malusa, UA SNRE

photos courtesy of Jim Malusa, UA SNRE



“Tasked with making a flora of this mostly undocumented 200,000 hectares of bomb craters and desert, I formerly spent days searching for places where I’d find the flowers and fruits that make a specimen worthy of an herbarium sheet. Using DroughtView … ”

--Jim Malusa, UA SNRE

photos courtesy of Jim Malusa, UA SNRE

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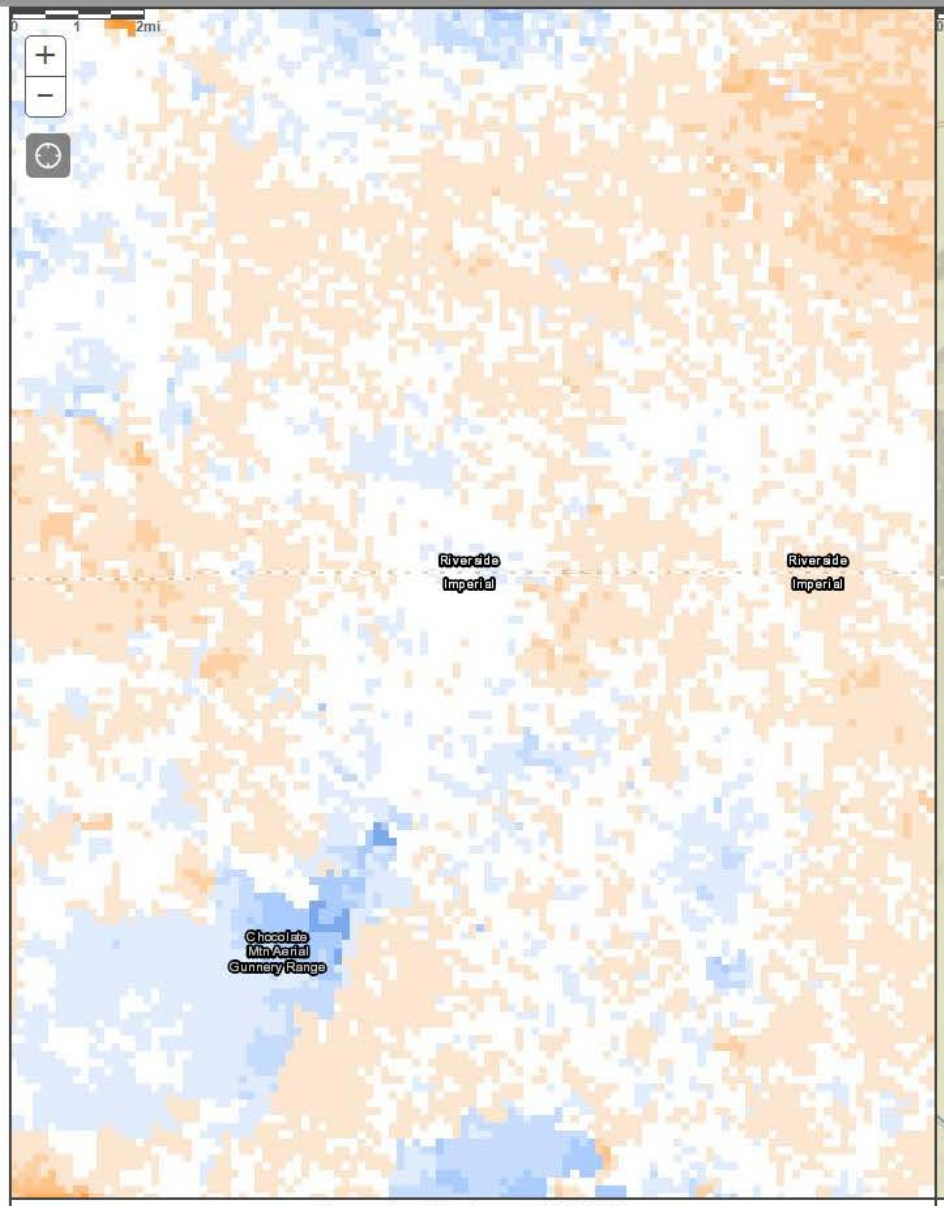
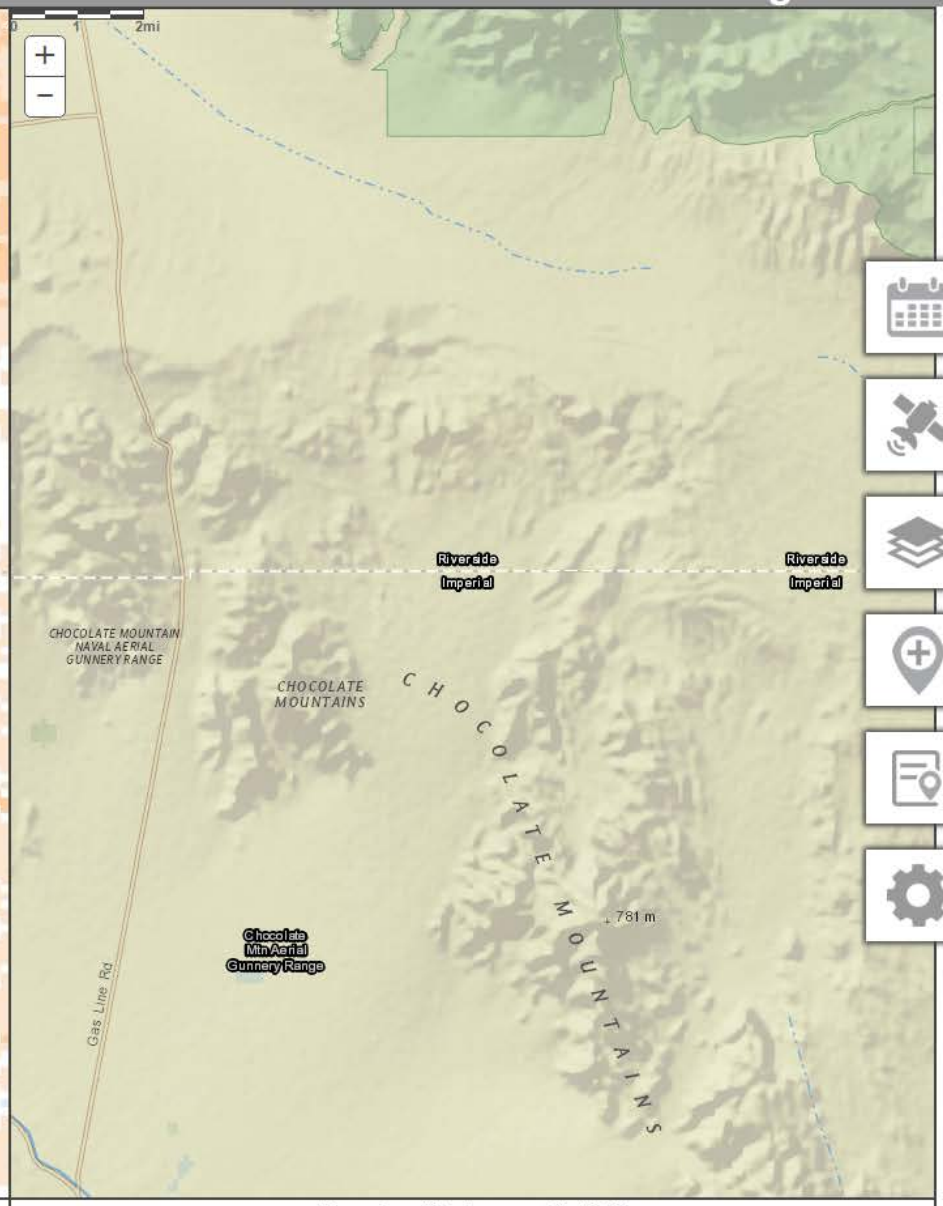


December 19 - January 03, 2016

Difference From Average

Less Green — Greener

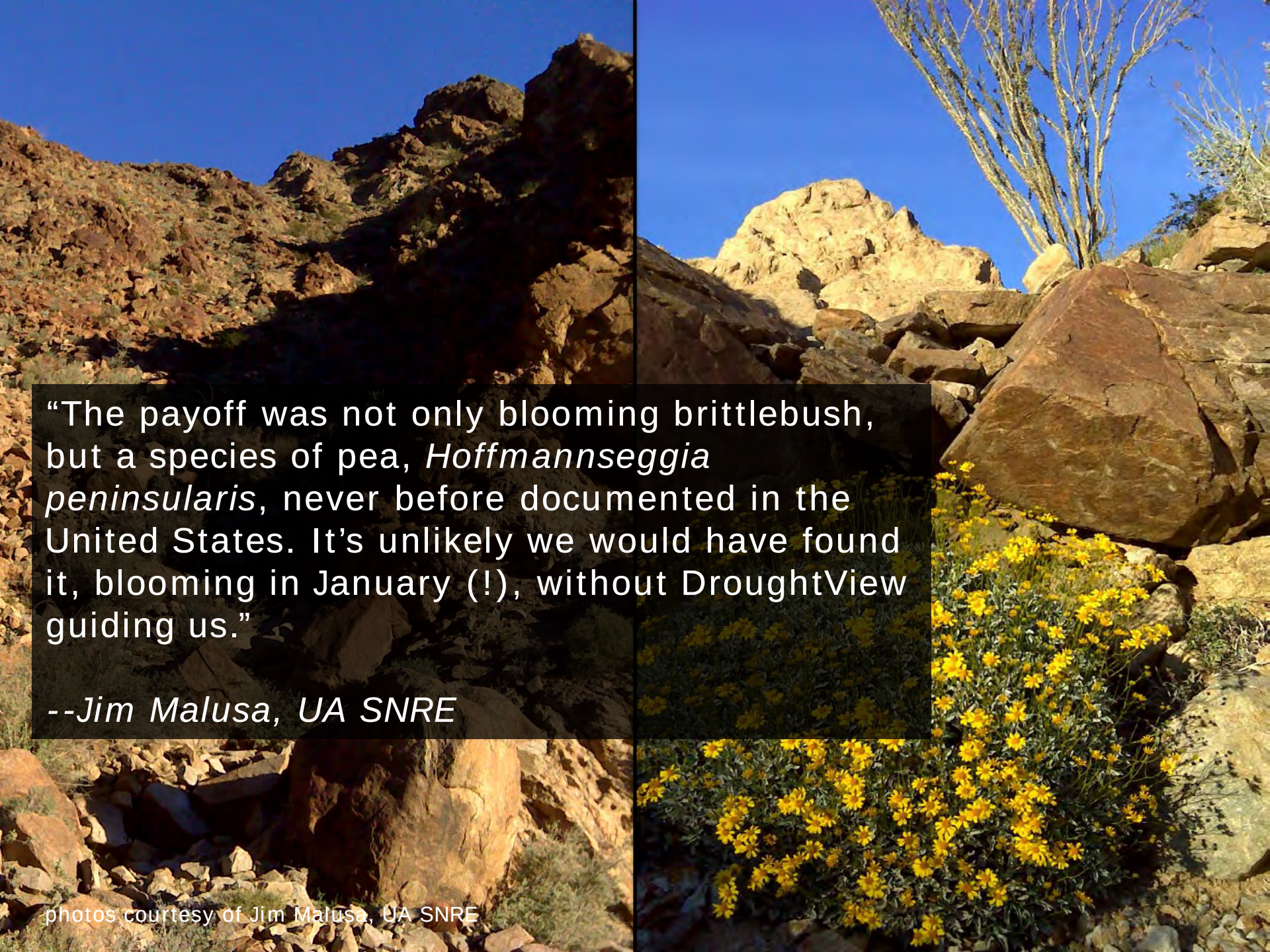


December 19 - January 03, 2016

“The area covered in this case was over 300 square miles. Along with Andy Sanders, curator for the University of California Riverside Herbarium, we headed straight for the blue (= greener) areas.”

--Jim Malusa, UA SNRE

photos courtesy of Jim Malusa, UA SNRE



“The payoff was not only blooming brittlebush, but a species of pea, *Hoffmannseggia peninsularis*, never before documented in the United States. It’s unlikely we would have found it, blooming in January (!), without DroughtView guiding us.”

--Jim Malusa, UA SNRE

photos courtesy of Jim Malusa, UA SNRE

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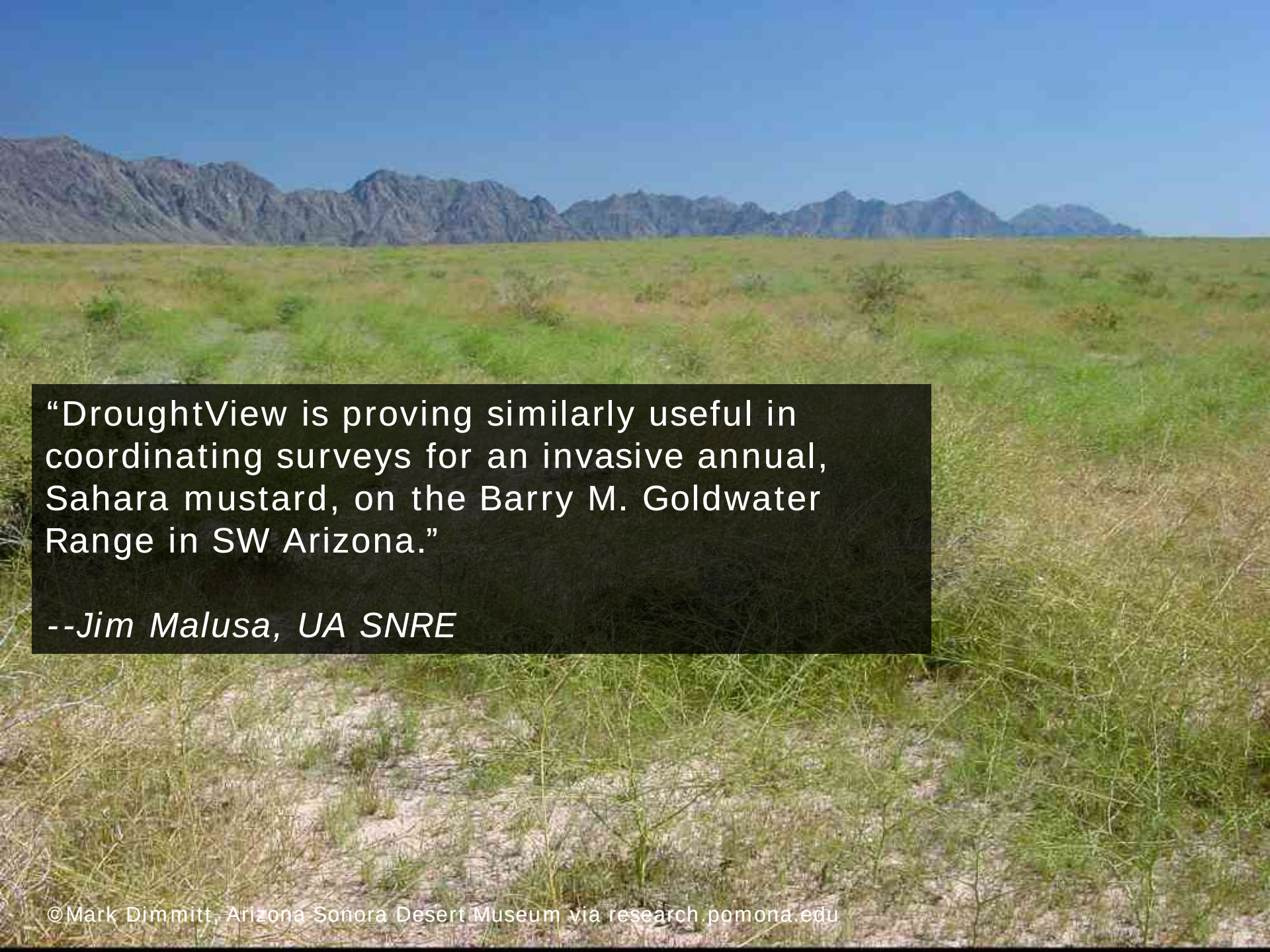

"DroughtView is proving similarly useful in coordinating surveys for an invasive annual, Sahara mustard, on the Barry M. Goldwater Range in SW Arizona."

--Jim Malusa, UA SNRE

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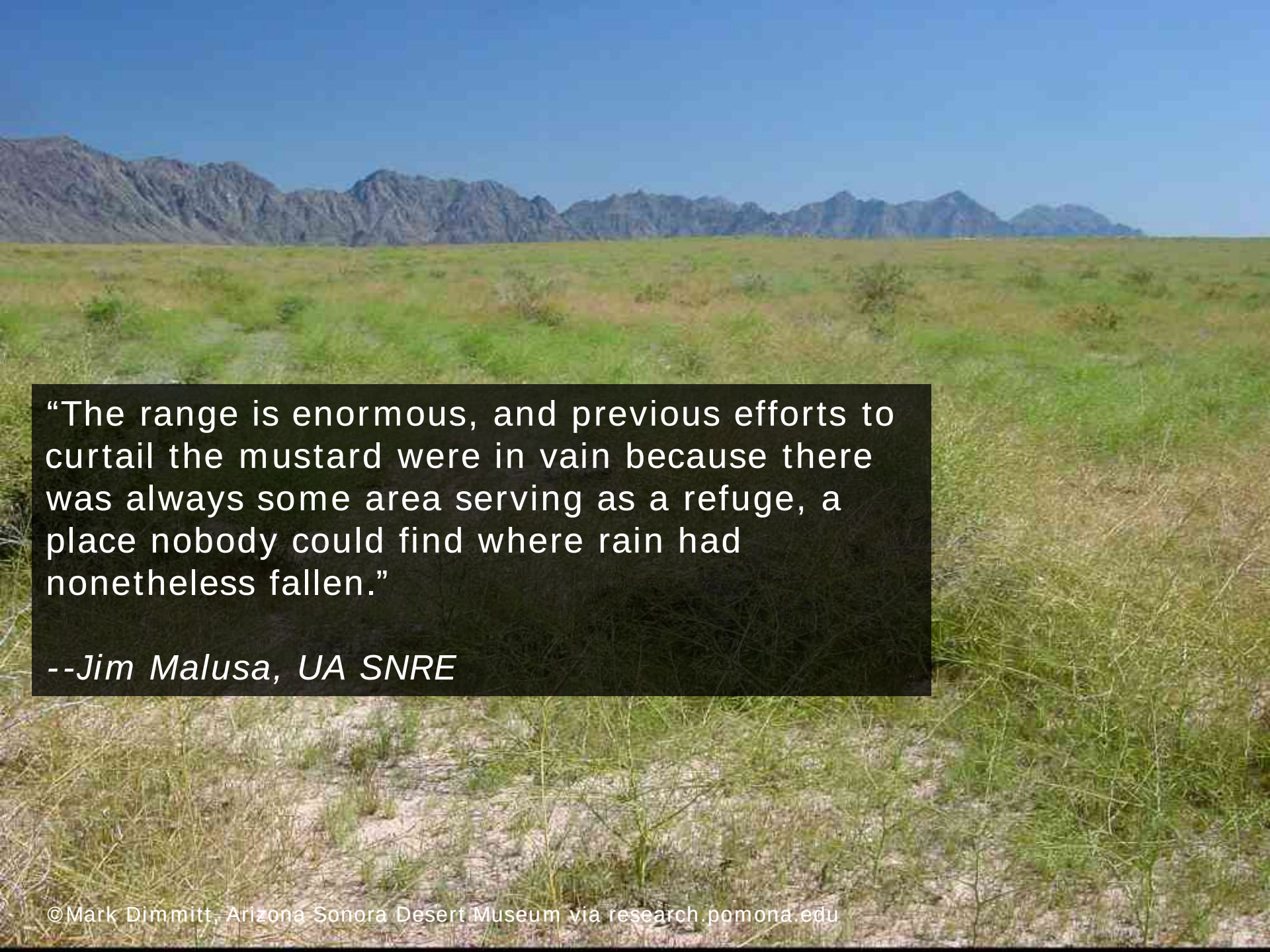

“The range is enormous, and previous efforts to curtail the mustard were in vain because there was always some area serving as a refuge, a place nobody could find where rain had nonetheless fallen.”

--Jim Malusa, UA SNRE

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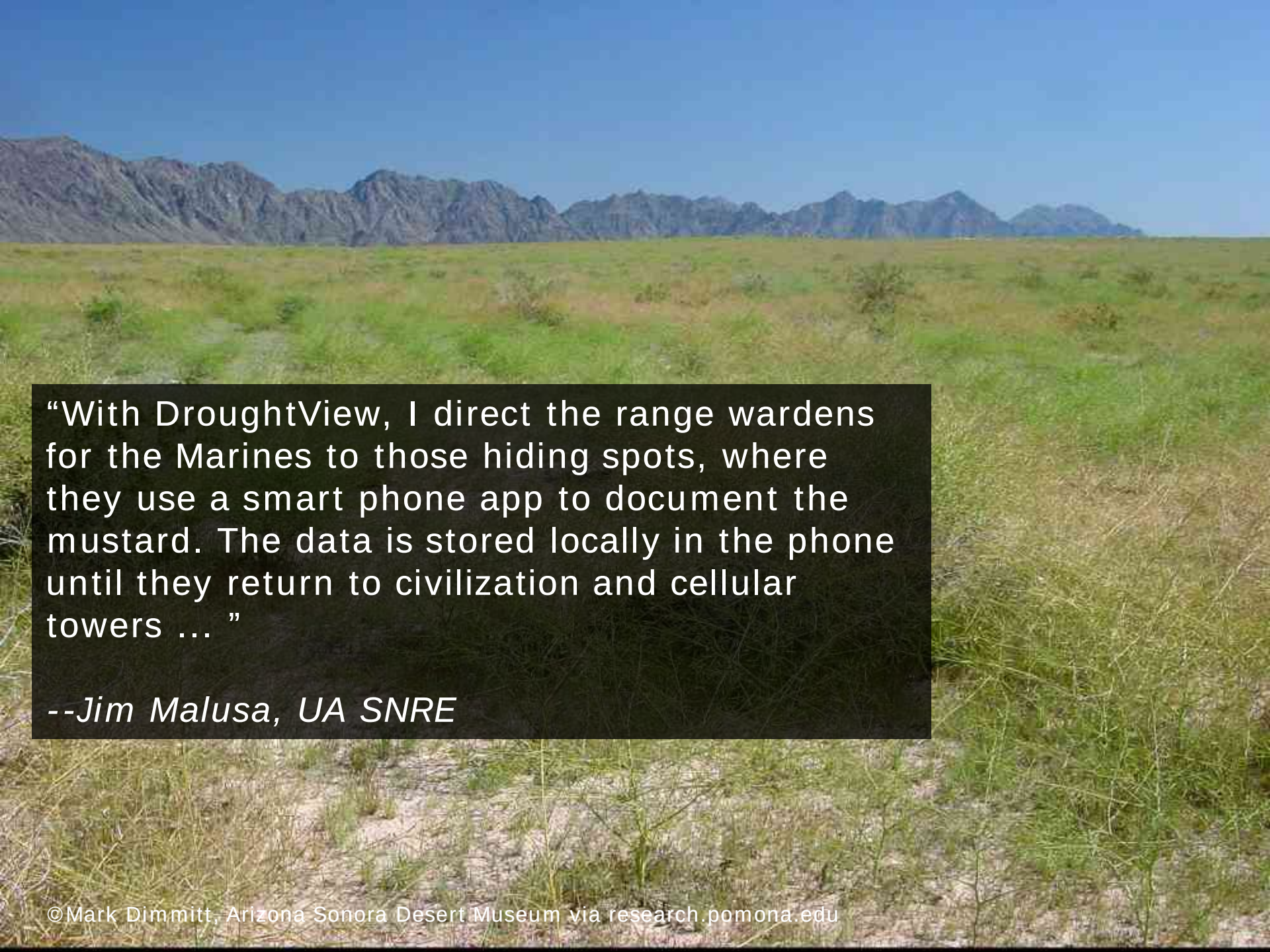

“With DroughtView, I direct the range wardens for the Marines to those hiding spots, where they use a smart phone app to document the mustard. The data is stored locally in the phone until they return to civilization and cellular towers … ”

--Jim Malusa, UA SNRE

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“The National Park Service Exotic Plant Management Team checks out the site before launching their spring assassinations. Thanks to DroughtView, they know exactly where to go.”

--Jim Malusa, UA SNRE

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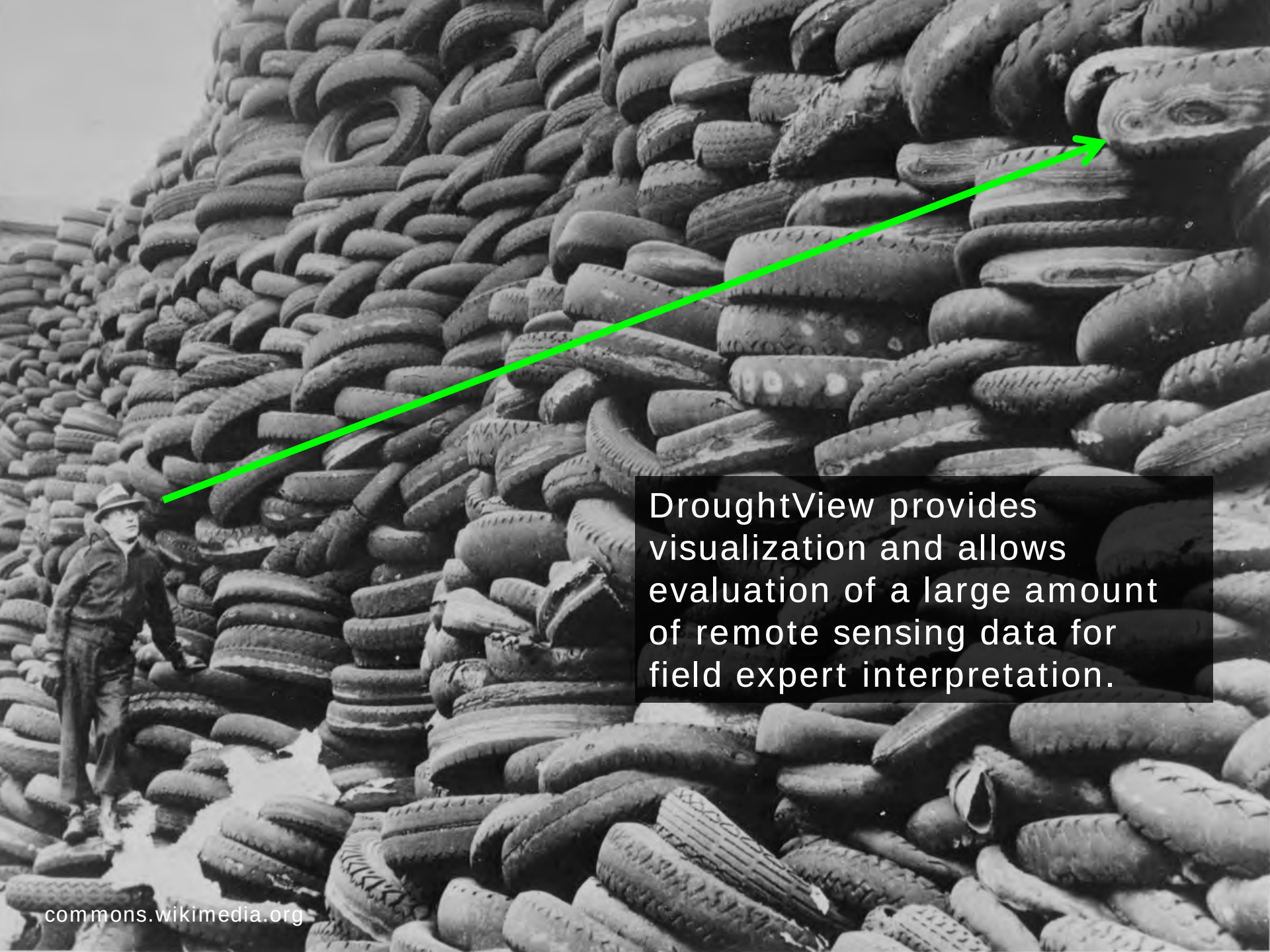
DroughtView provides visualization and allows evaluation of a large amount of remote sensing data for field expert interpretation.
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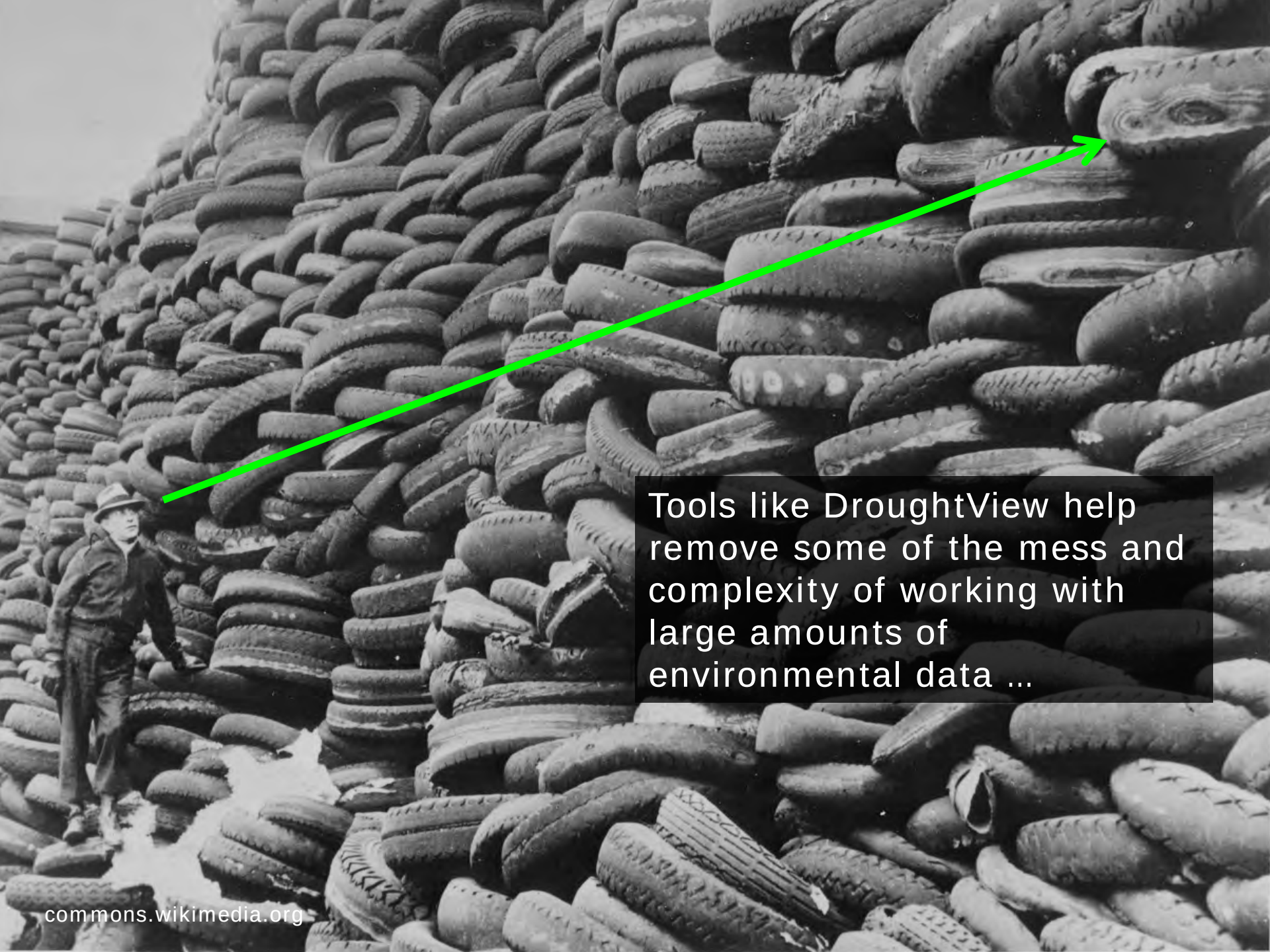
Tools like DroughtView help remove some of the mess and complexity of working with large amounts of environmental data …
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... and provide stakeholders with a more streamlined experience that will allow them to ask new questions and think through problems.
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“Your tool won’t tell the whole story; Context is key; The … magic combination for making … change with data is equal parts technical analysis and local context.”

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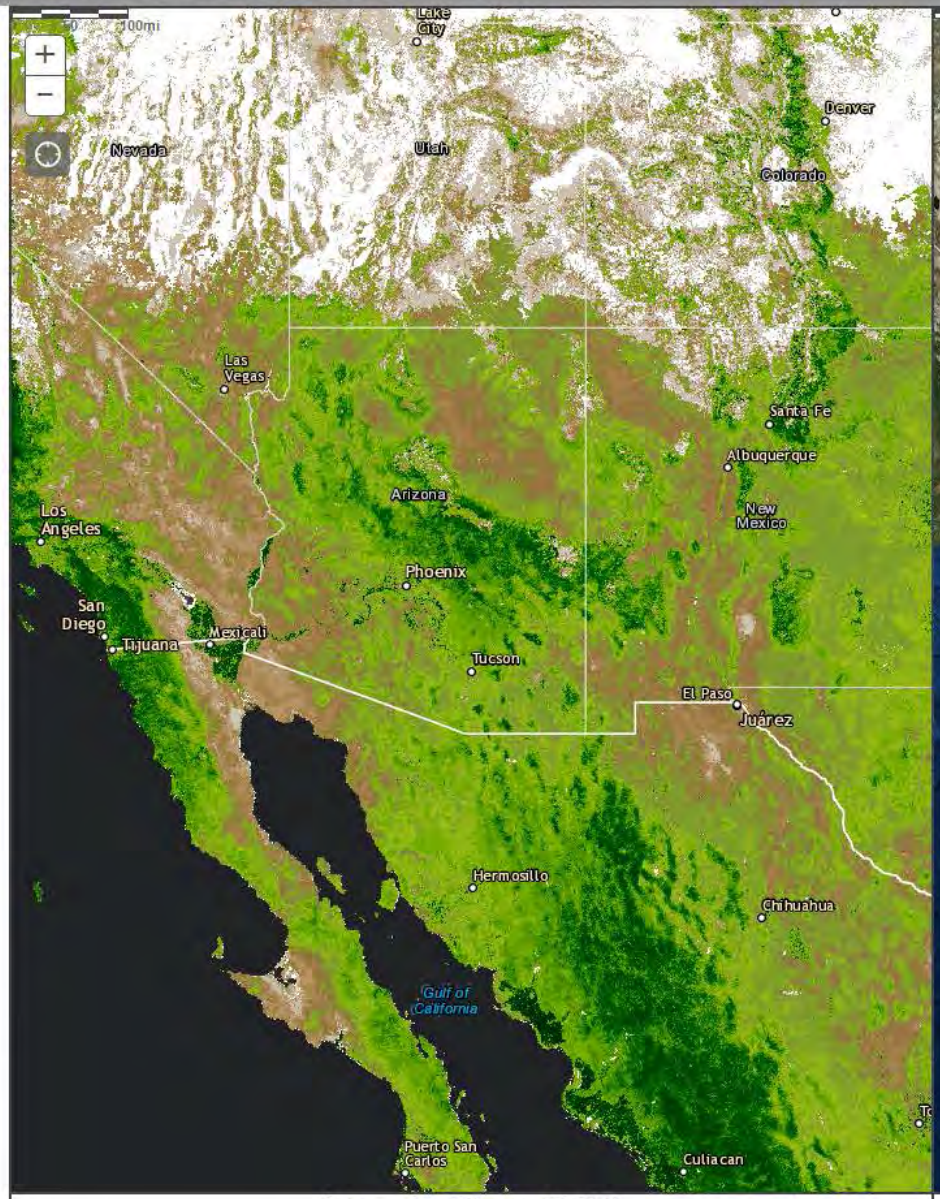

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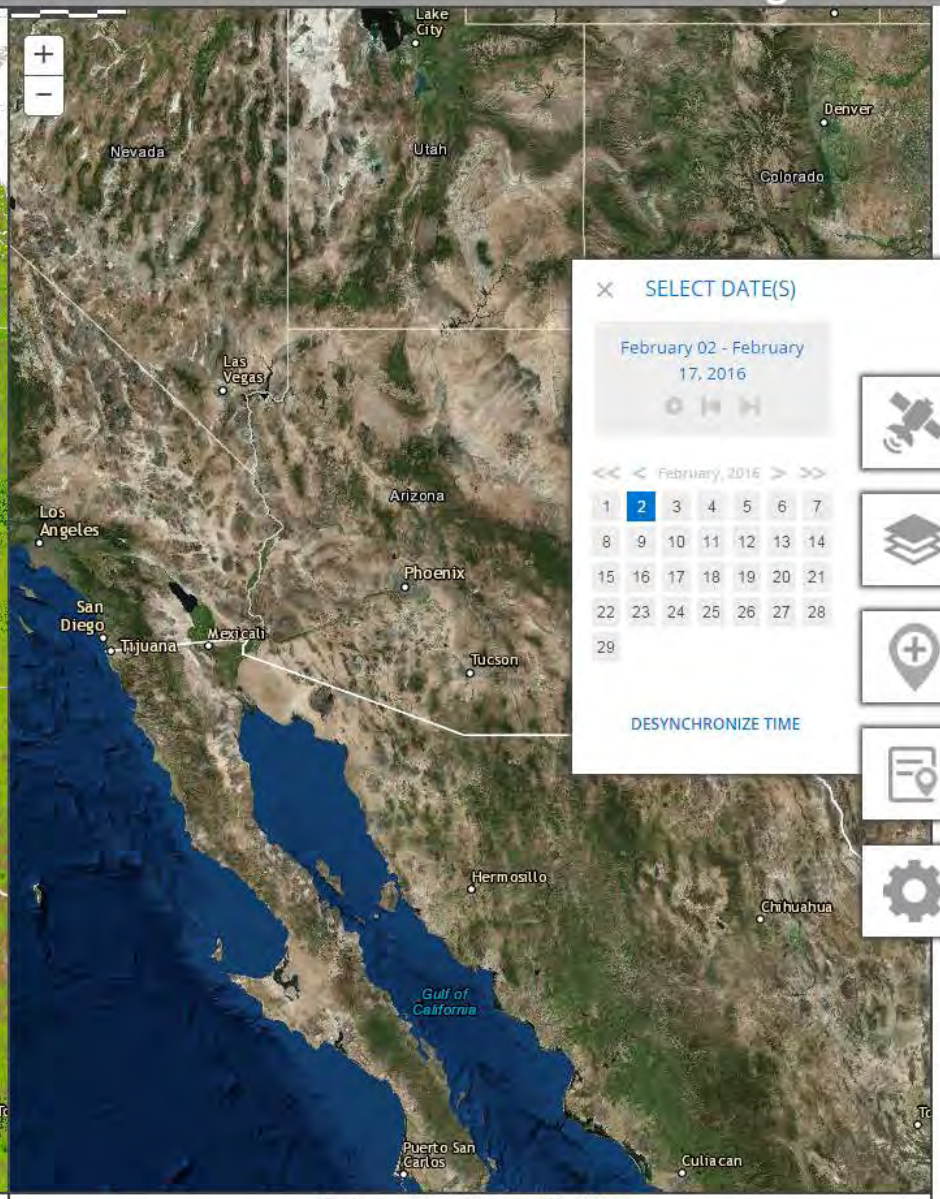

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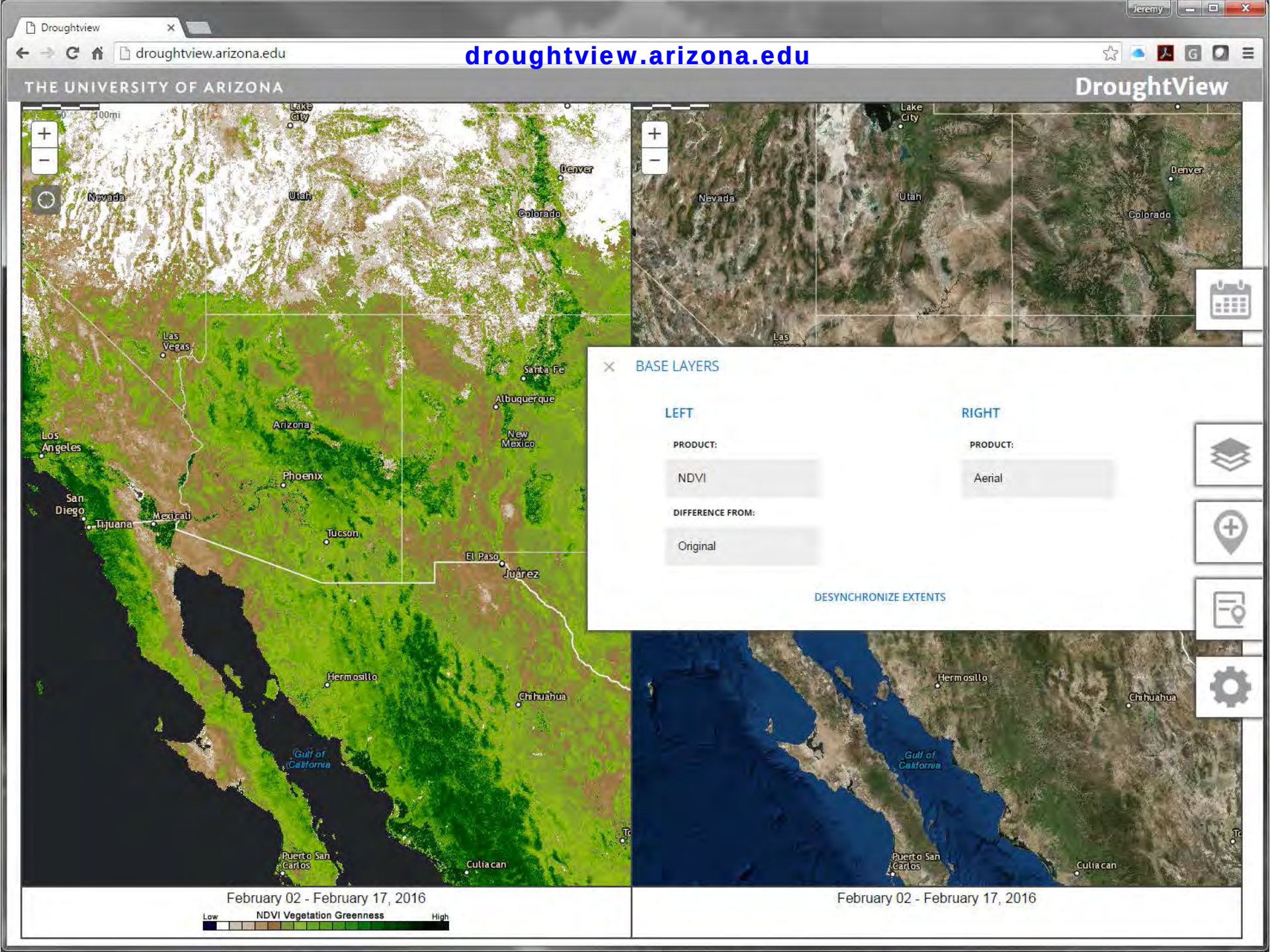
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El Paso
Juárez
Hermosillo
Chihuahua
Gulf of California
Puerto San Carlos
Culiacan
BASE LAYERS
LEFT
PRODUCT:
NDVI
DIFFERENCE FROM:
Original
RIGHT
PRODUCT:
Aerial
DESYNCHRONIZE EXTENTS
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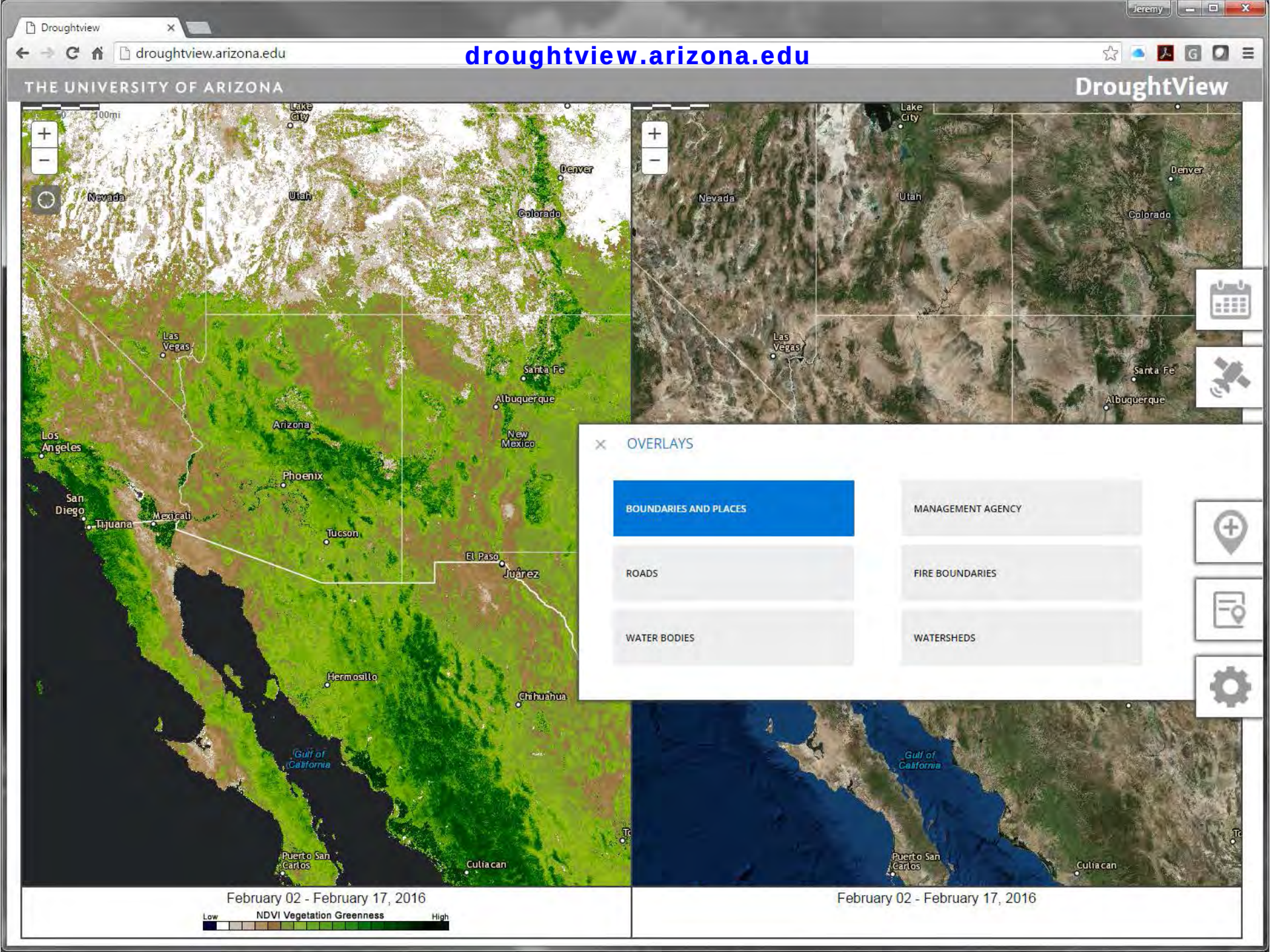
High
February 02 - February 17, 2016


Droughtview
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DroughtView
Lake City
Denver
Nevada
Utah
Colorado
Las Vegas
Santa Fe
Albuquerque
Arizona
New Mexico
Los Angeles
Phoenix
San Diego
Tijuana
Mexicali
Tucson
El Paso
Juárez
Hermosillo
Chihuahua
Gulf of California
Puerto San Carlos
Culiacan
OVERLAYS
BOUNDARIES AND PLACES
MANAGEMENT AGENCY
ROADS
FIRE BOUNDARIES
WATER BODIES
WATERSHEDS
February 02 - February 17, 2016
Low
NDVI Vegetation Greenness
High
February 02 - February 17, 2016

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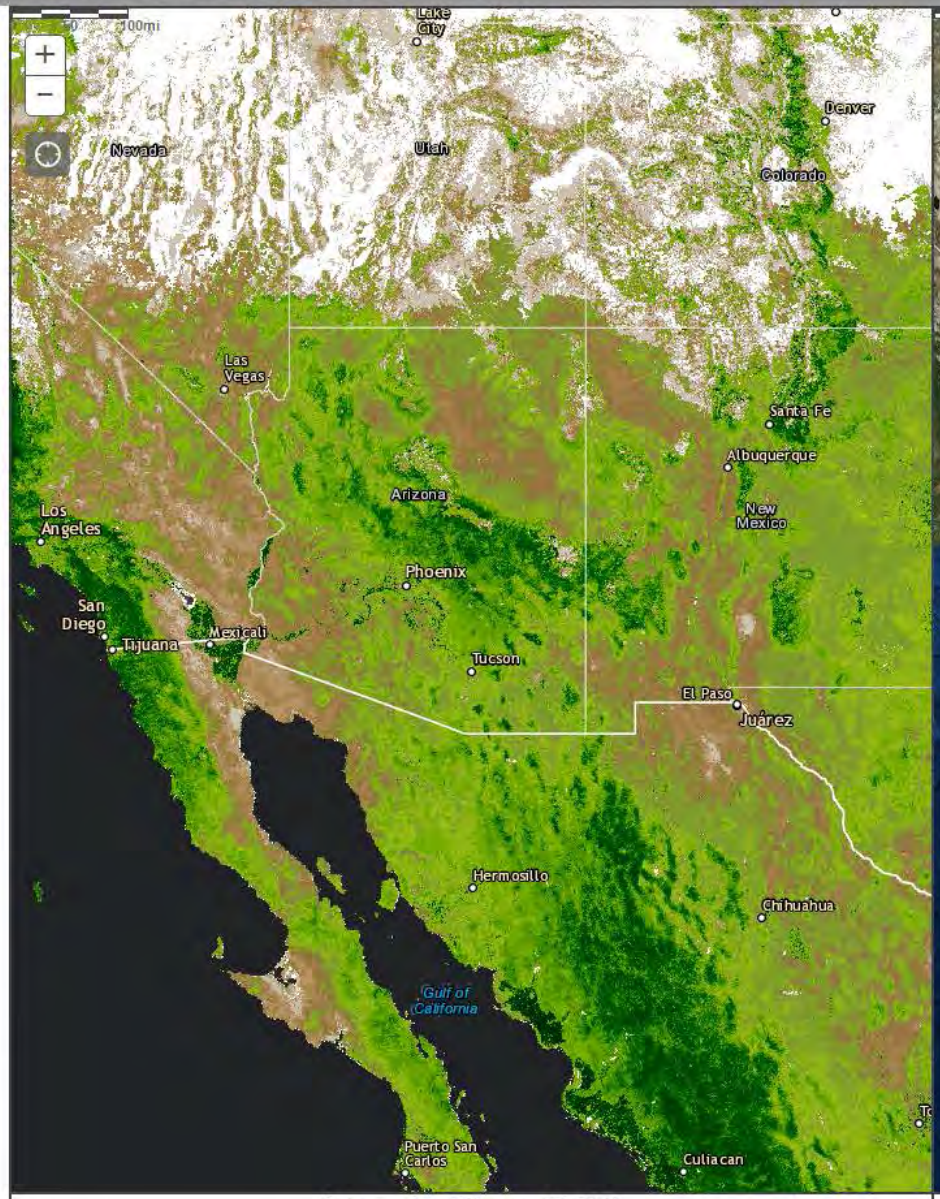
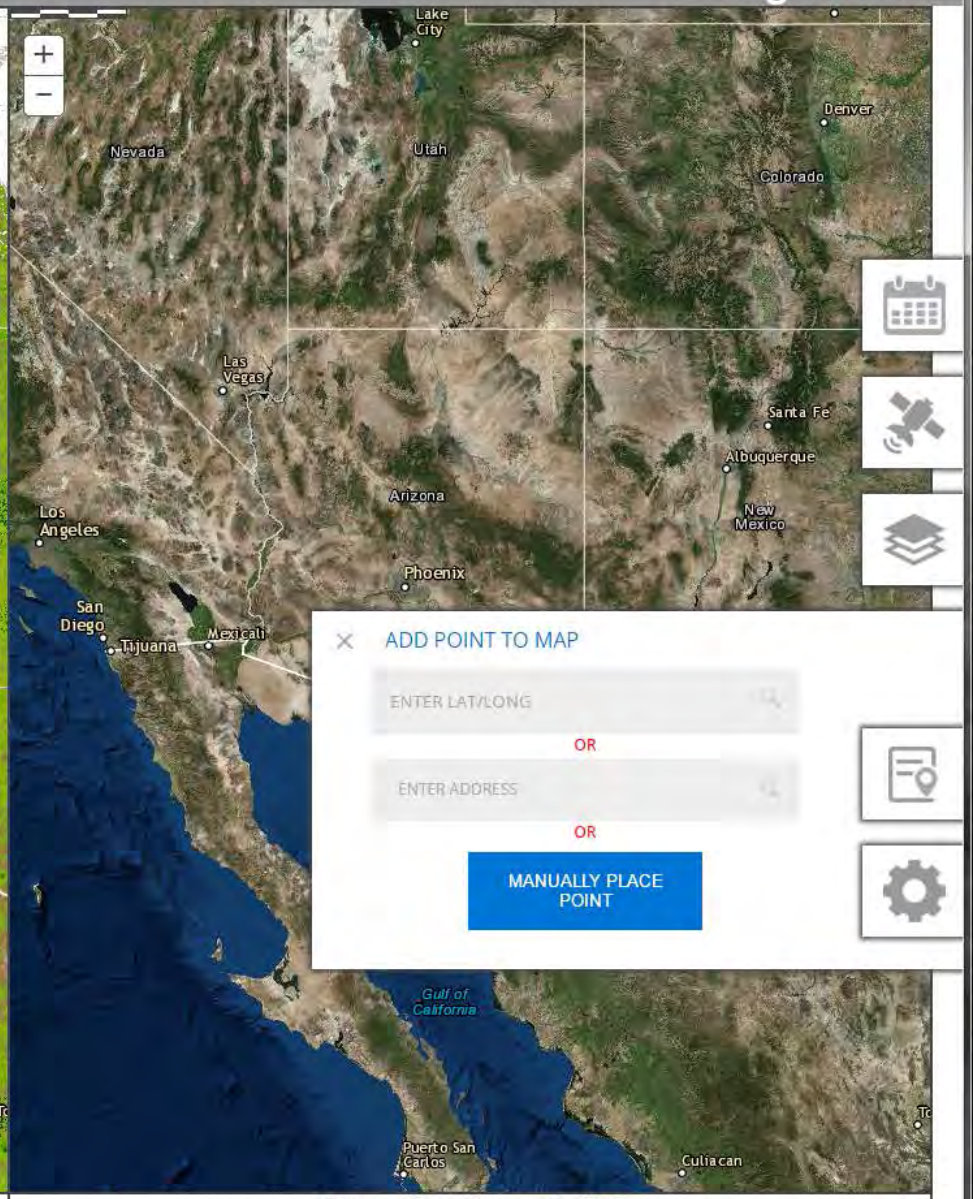
DroughtView

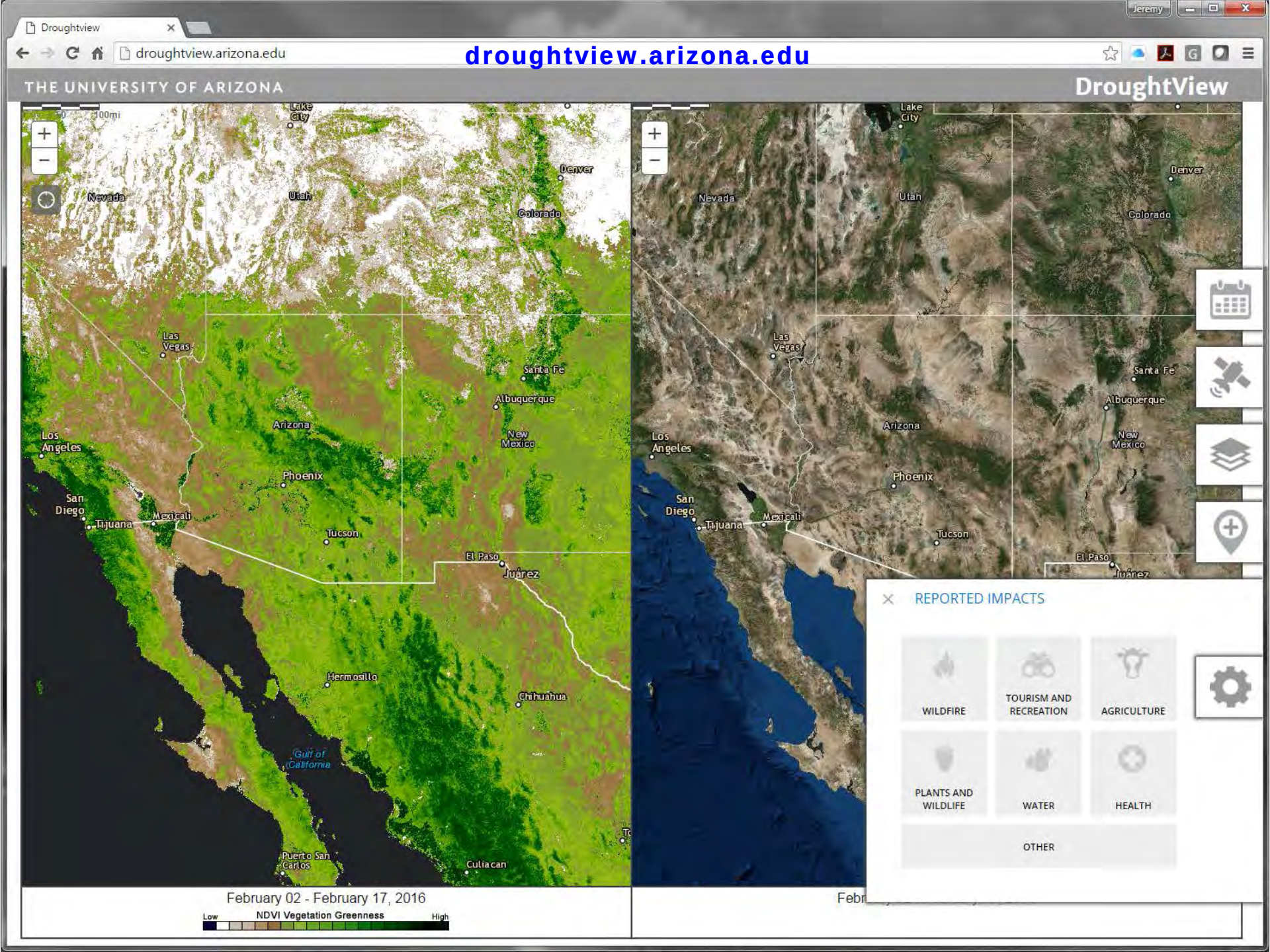


February 02 - February 17, 2016

Low NDVI Vegetation Greenness High



February 02 - February 17, 2016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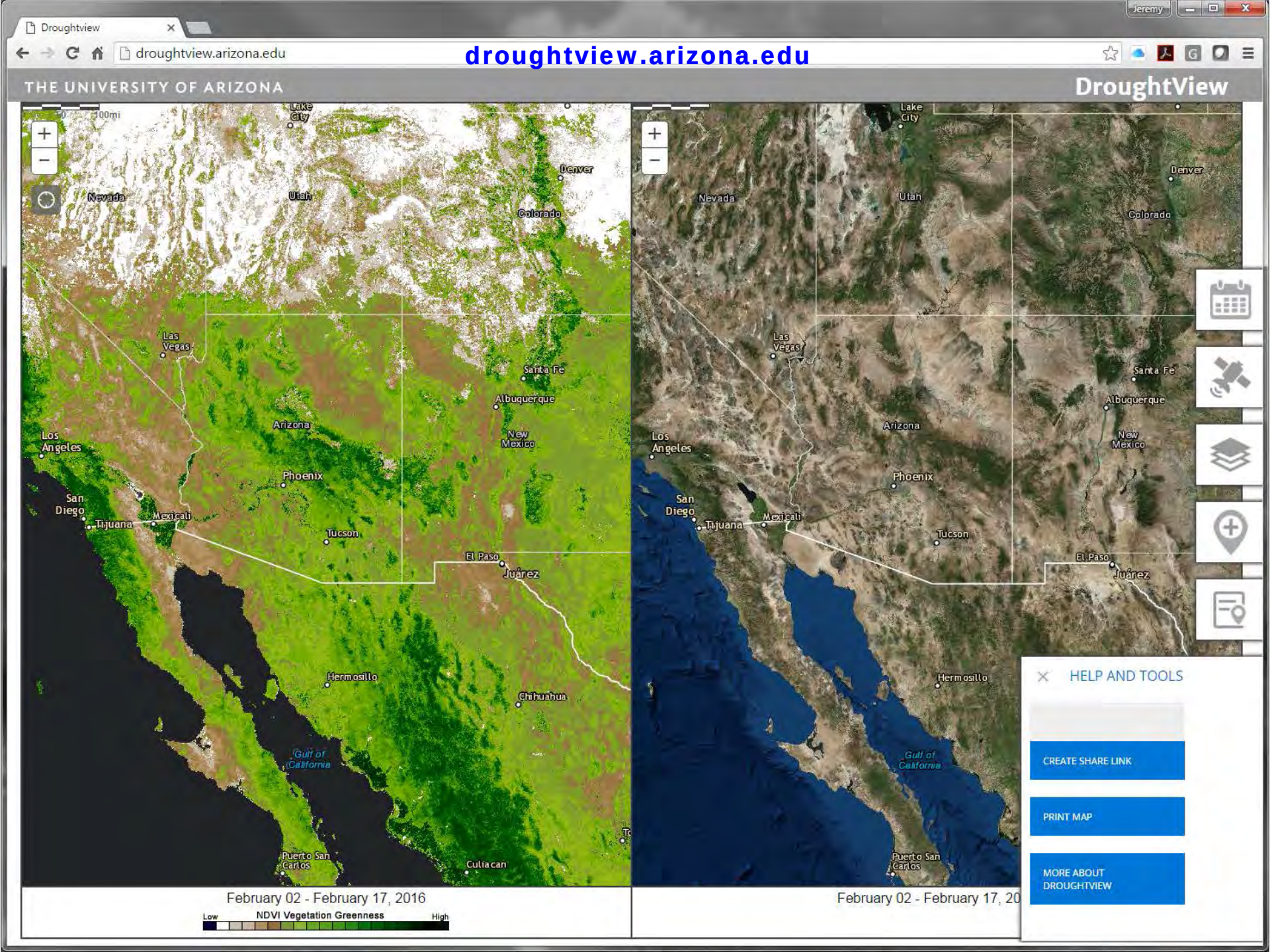
High
REPORTED IMPACTS
WILDFIRE
TOURISM AND RECREATION
AGRICULTURE
PLANTS AND WILDLIFE
WATER
HEALTH
OTHER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February 02 - February 17, 2016
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NDVI Vegetation Greenness
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HELP AND TOOLS
CREATE SHARE LINK
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MORE ABOUT DROUGHTVIEW

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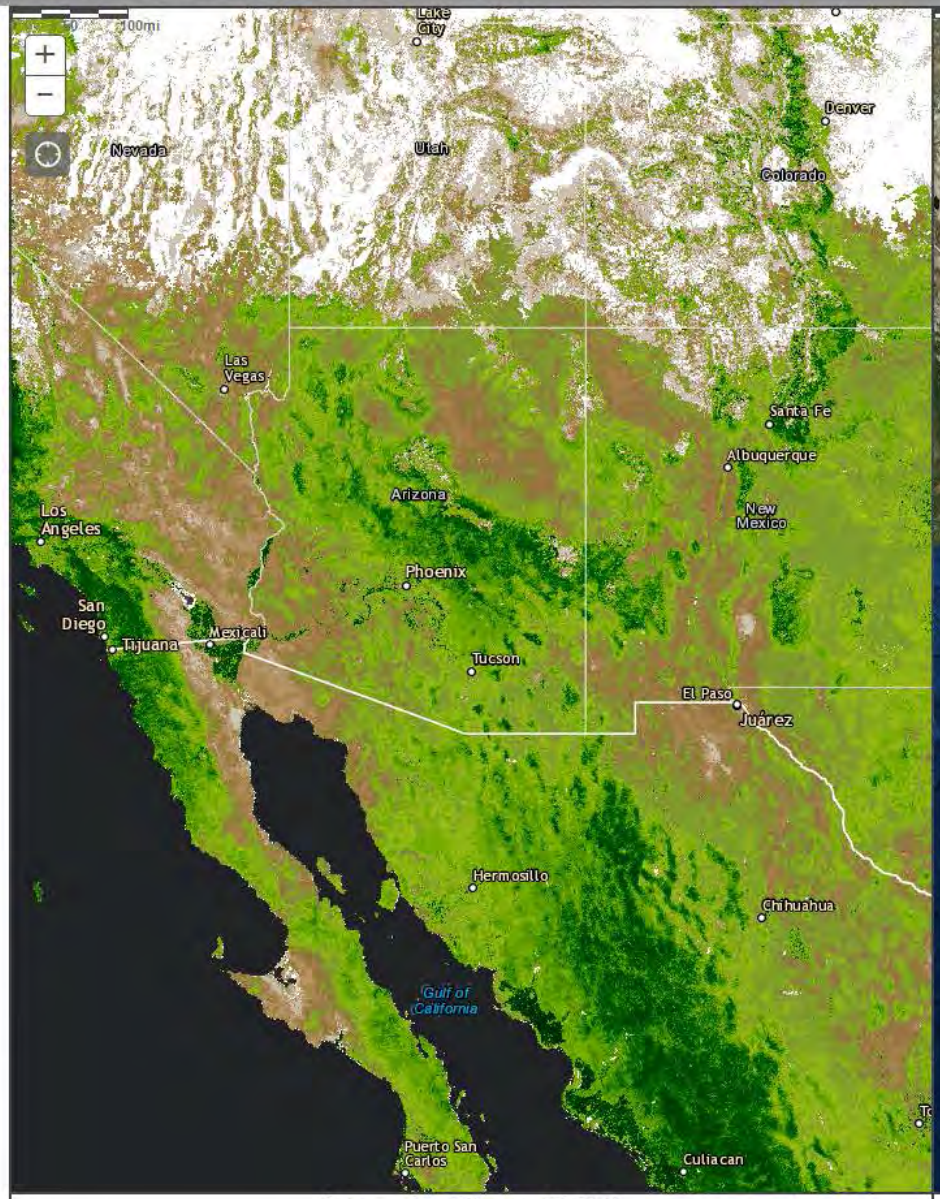
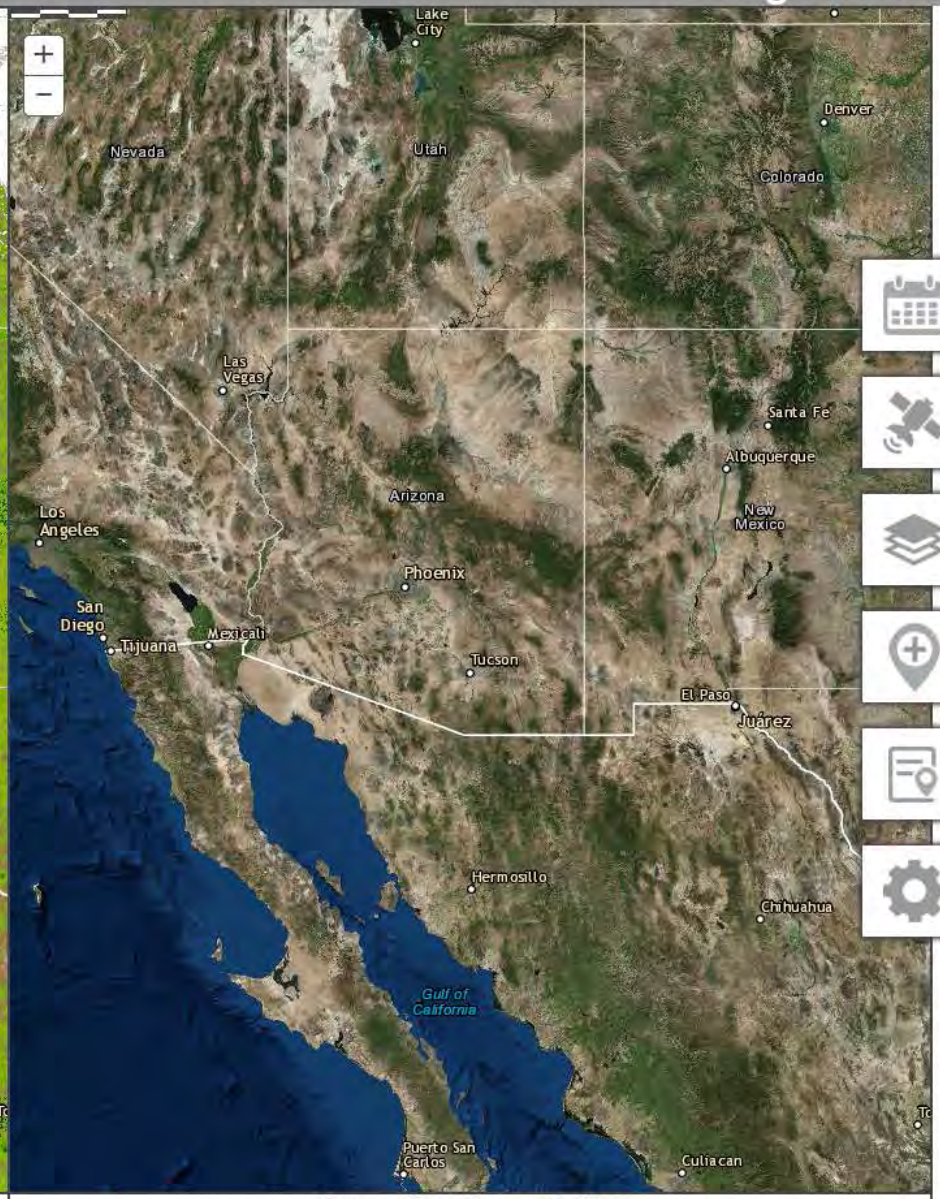


February 02 - February 17, 2016

Low NDVI Vegetation Greenness High



February 02 - February 17, 2016