MONITORING WILDLAND VEGETATION PHENOLOGY IN NEAR-REAL-TIME WITH *PhenoMap*

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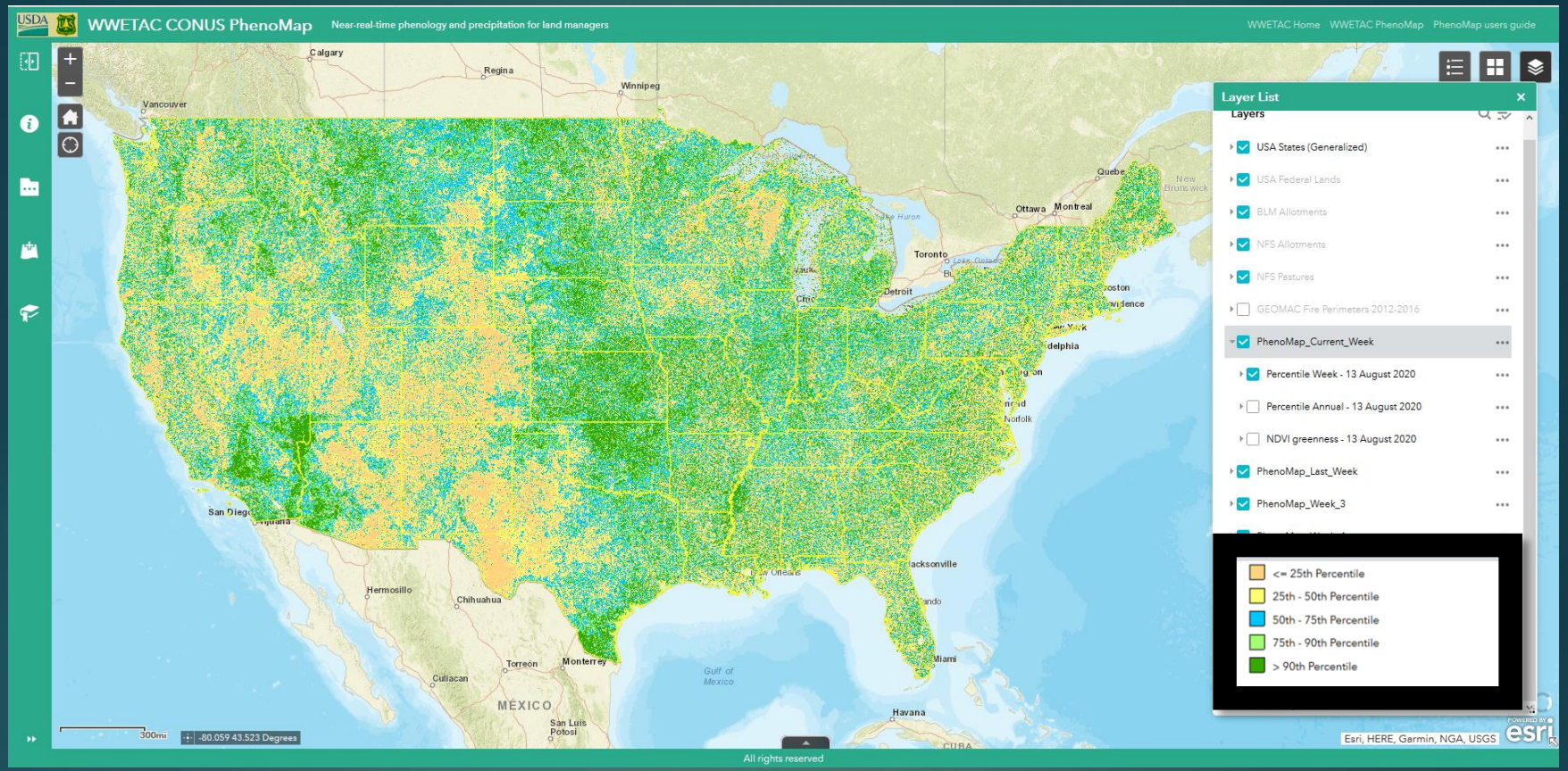
PhenoMap web mapping application



Phenology raster layers produced and updated weekly (Friday)..

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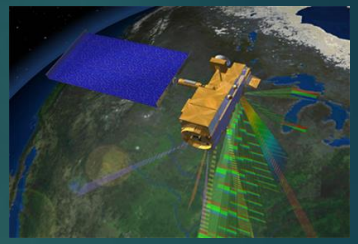
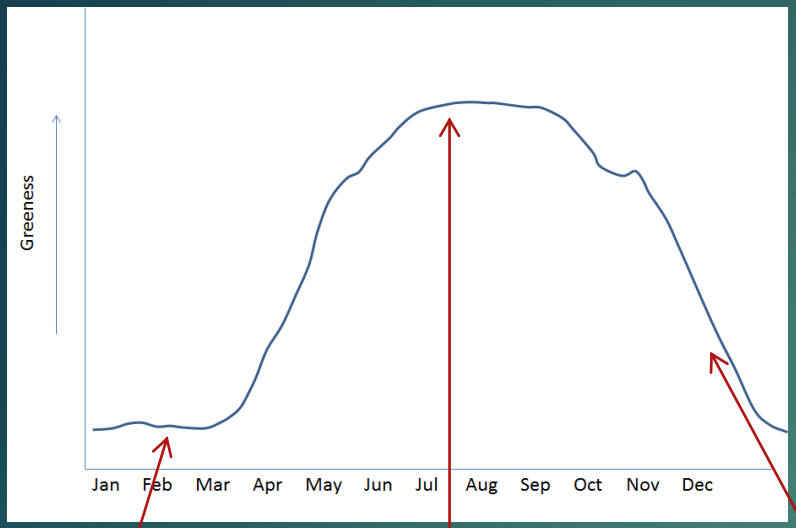
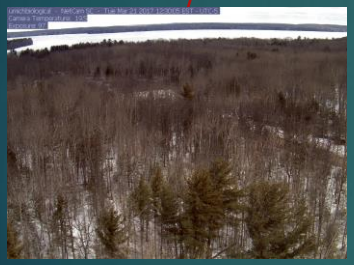
Monitoring annual vegetation condition…..from space







Images courtesy of PhenoCam

Satellite data can be used to monitor vegetation over large areas.

This information can be used to tell us when vegetation "green up" has occurred in spring, and when the growing season is over in the fall.

'Greenness' will be measured with the Normalized Differential Vegetation Index (NDVI) using the red and near-infrared bands from the MODIS sensor.

This is the *NDVI Greenness* layer in PhenoMap.

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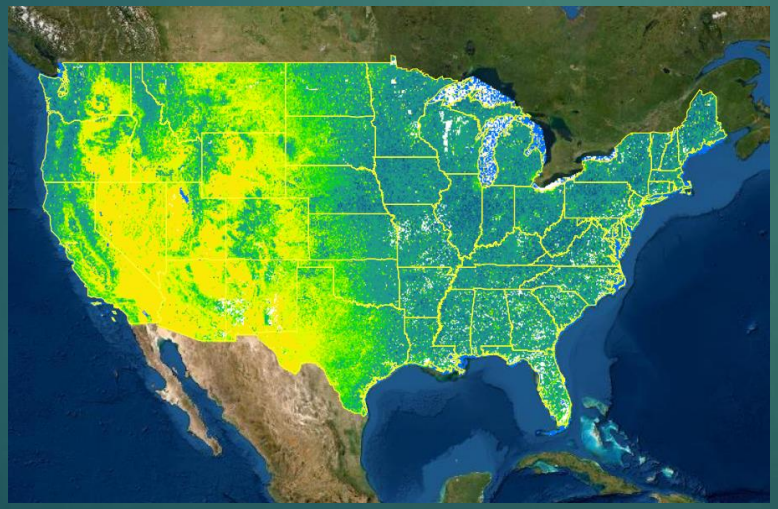
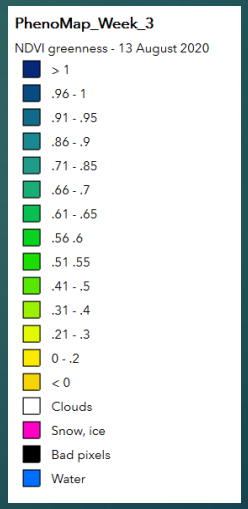
Placing greenness in context..

There are two ways *PhenoMap* places the current week's greenness in context historically using all the data collected from 2000-2019. We can compare this week's greenness to:

1) - The same week in previous years and

2) - All historical weekly values recorded.





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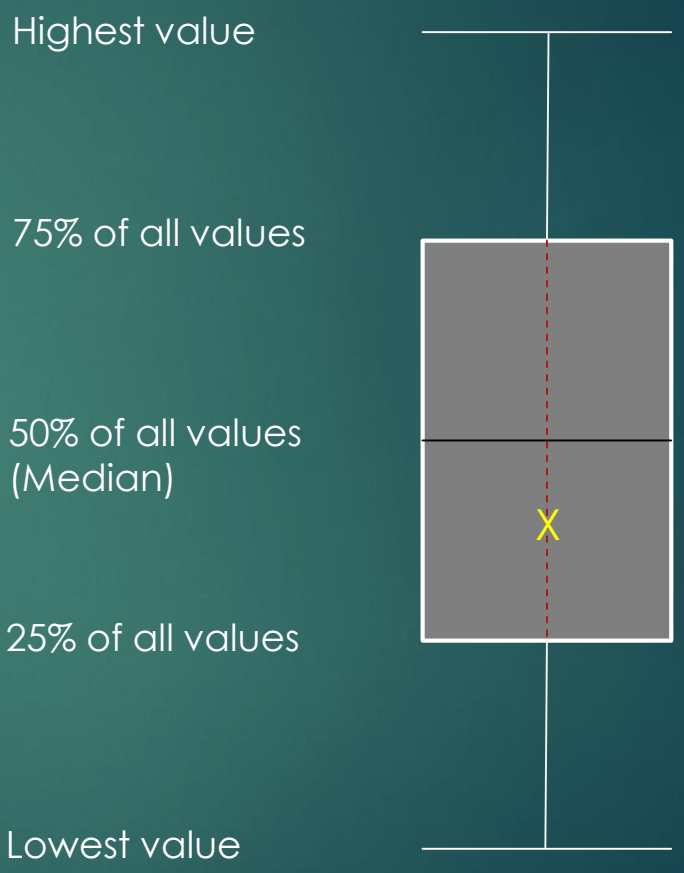
How green is it this week compared to the past values for the same week?

We calculated the 2000-2019 distribution of pixel greenness values for each week and expressed them as percentiles.

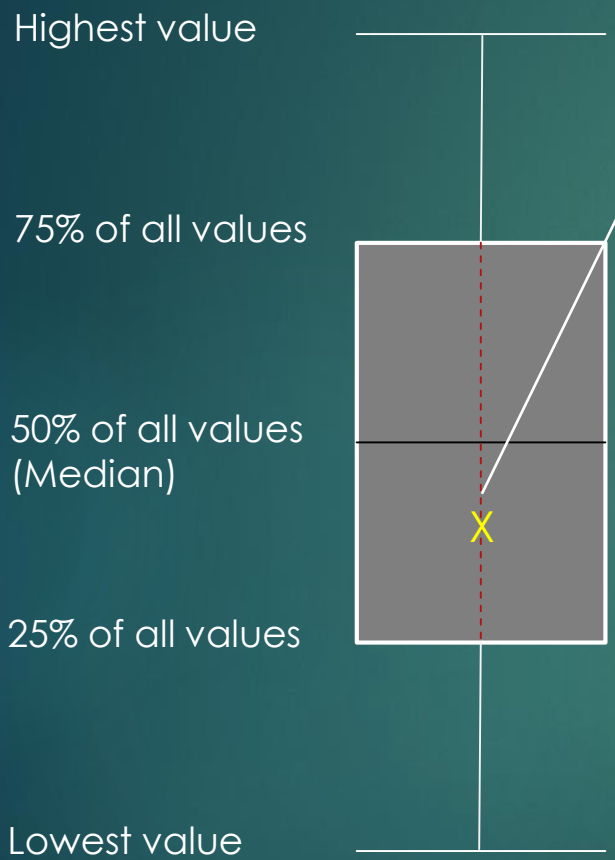
This box plot shows the range of all the greenness values for 15 June 2000—2019.

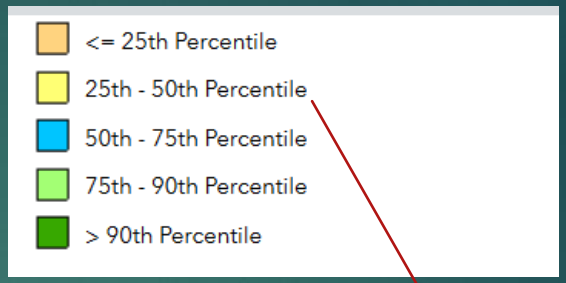
The 'X' represents the greenness value for 15 June 2020 which is between the 50th and 25th percentiles – greater than 25 percent of the historical observations for this week, but less than 50 percent.

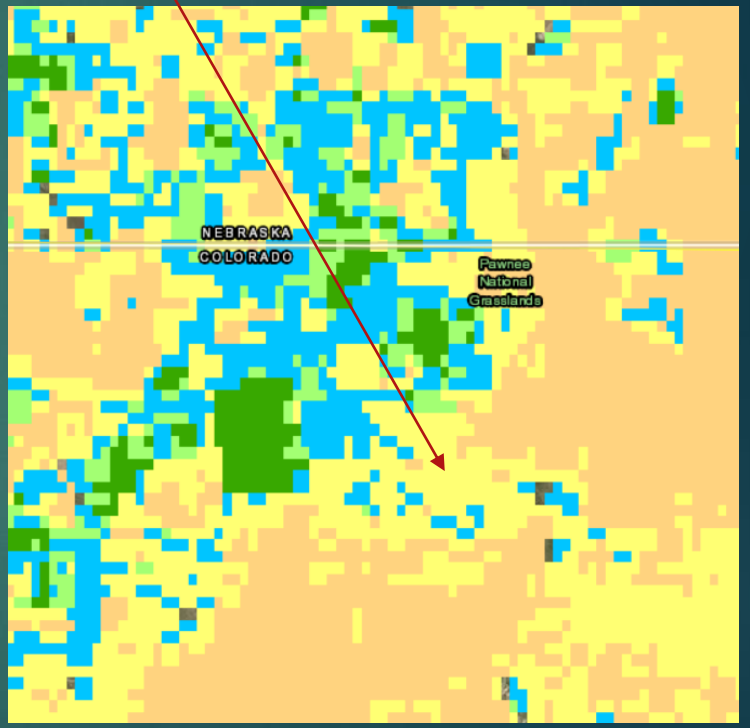
This is the *Percentile Week* value in PhenoMap.



Percentile Week in PhenoMap





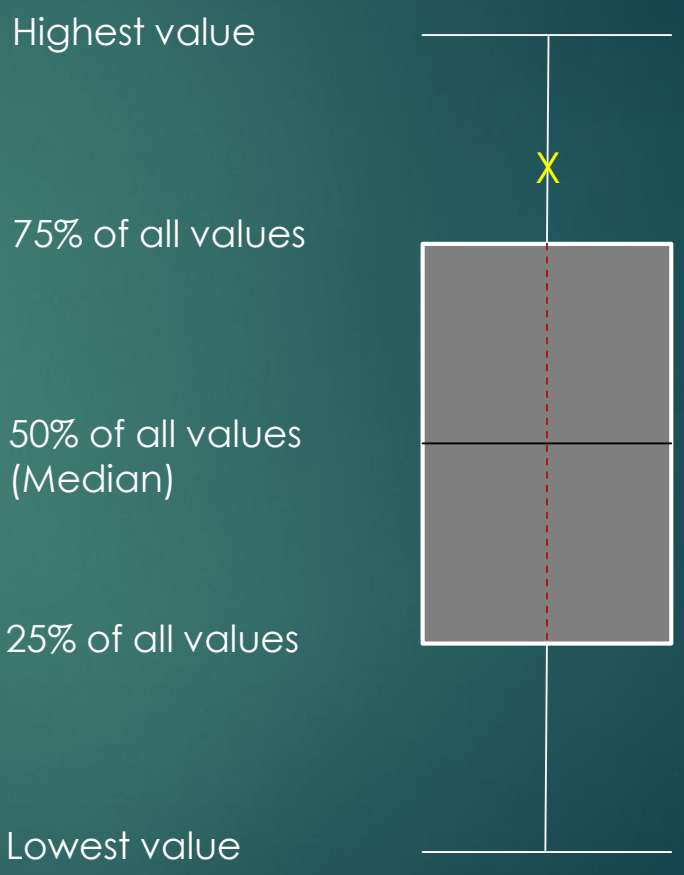


How does the current weeks' greenness compare to the historical values for the entire year for all years 2000-2019?

To answer this question we compiled the median NDVI pixel value for all weeks for each year of the historical period (2000-2019).

The distribution of these median pixel values is displayed as a box plot in this figure – a representation of the range of pixel NDVI values throughout the year. The 'X' represents the greenness value for 15 June 2020 which is between the 75th and 90th percentiles – greater than 75 percent of the historic observations for this pixel (all weeks), but less than 90 percent.

This is the *Percentile Annual* layer in PhenoMap.



Percentile Annual in PhenoMap

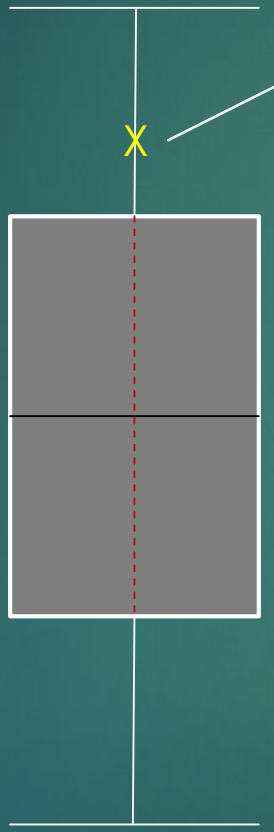
Highest value

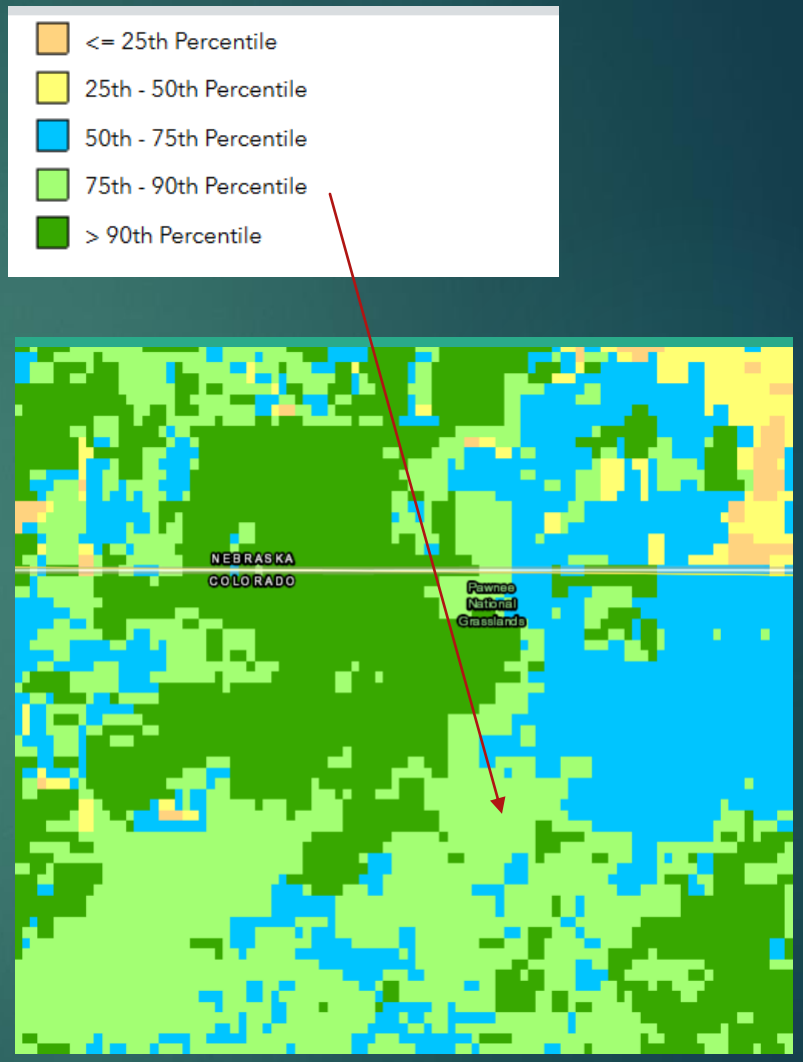
75% of all values

50% of all values (Median)

25% of all values

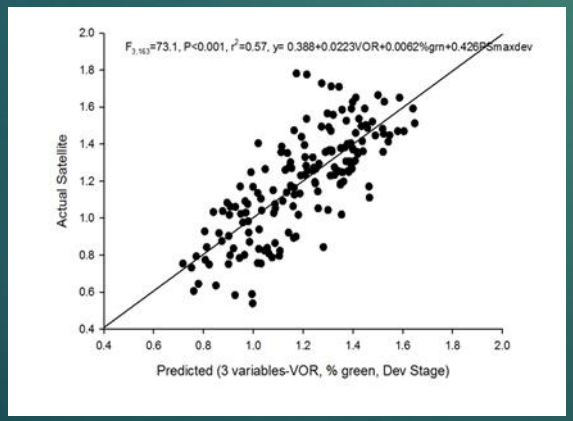
Lowest value





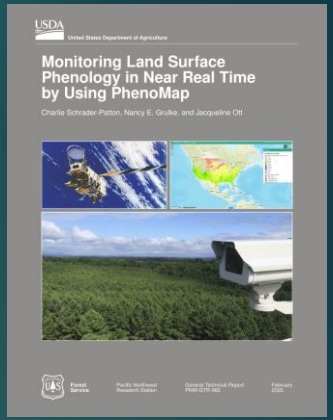
Validation – Buffalo Gap National Grassland

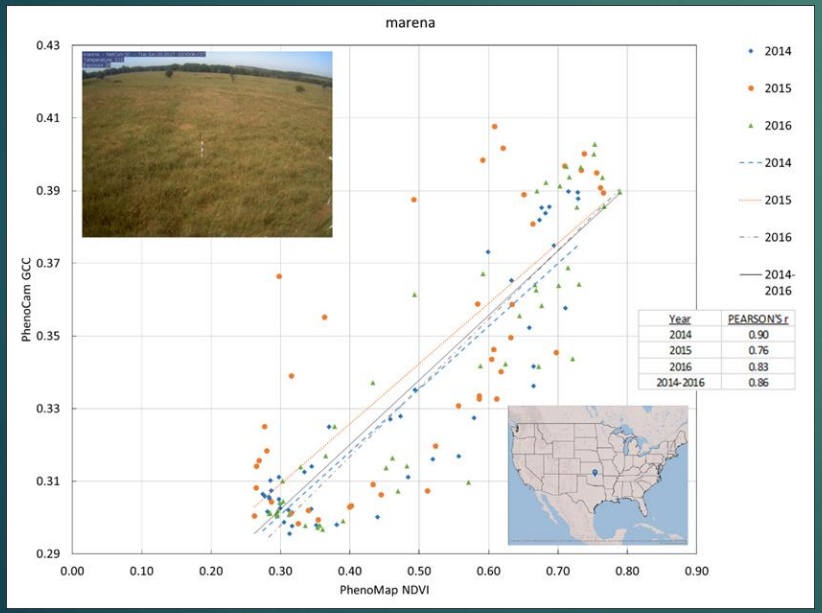
- Collected data at 16 sites bi-weekly during the 2016 growing season.
- Good positive correlation between satellite NDVI (greenness) and field measures of rangeland growth and productivity.

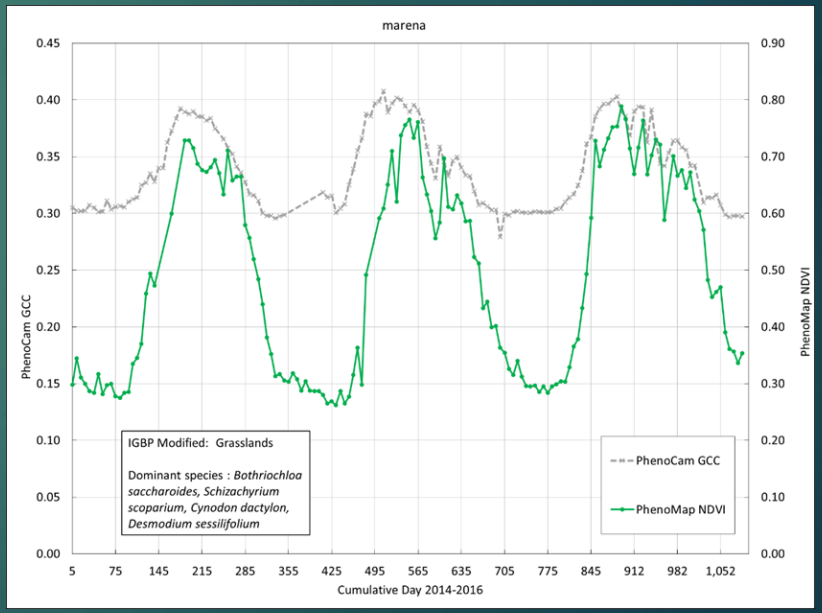


Validation with PhenoCam

- PhenoCam sites
  - Greenness derived from in-situ images.
  - 50+ sites – conifer/deciduous forest, grasslands, shrublands.
  - Strong correlation for grasslands, shrublands, deciduous forests.







PhenoMap and PhenoCam

In the next slide, we explore PhenoMap and PhenoCam data for a site on the Central Plains Experimental Range (ARS), on the Pawnee National Grassland in north central CO. The graphs and images are from the PhenoCam site (cperuvb) for four different points in the 2017 growing season.

Note how the *Percentile Annual* tracks the growing season reasonably well. The *Percentile Week*, however, does not.

Why? Because the *Percentile Week* is a measure of the current week's greenness compared to the historical greenness values of the same week. It provides insight into how the current greenness on the site compares to the same week in years past.

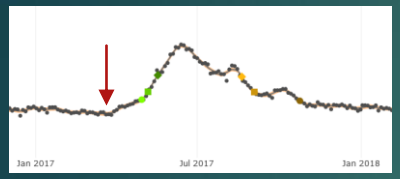
Percentile Annual indicates where the current week is the historical annual cycle. Thus in a relatively normal year the peak greenness should be > 90th annual percentile.

Percentile Annual

<= 25th Percentile

Percentile Week

25th - 50th Percentile

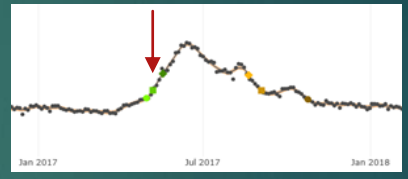


Percentile Annual

50th - 75th Percentile

Percentile Week

25th - 50th Percentile

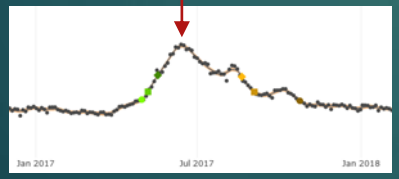


Percentile Annual

> 90th Percentile

Percentile Week

25th - 50th Percentile

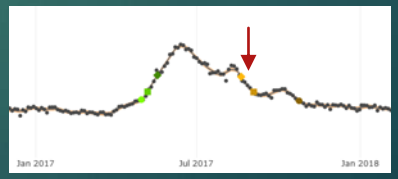


Percentile Annual

75th - 90th Percentile

Percentile Week

75th - 90th Percentile



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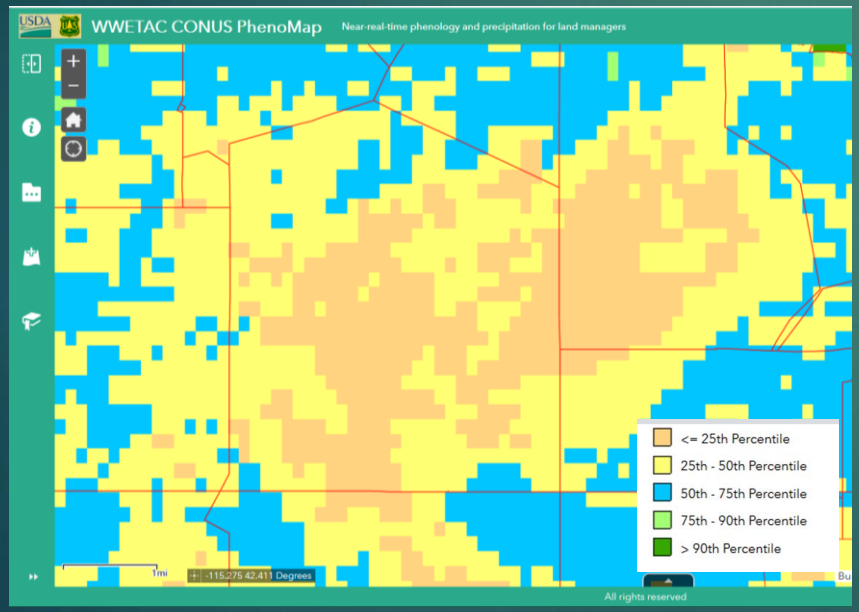
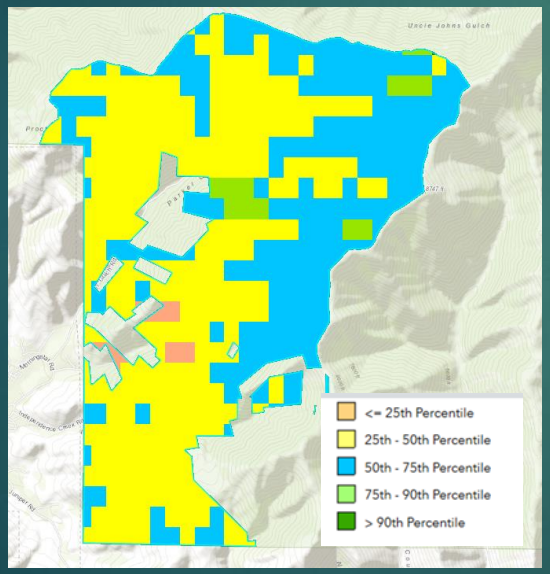
Scenario 1:

You are range manager and are requesting that a permittee decrease the number of animals on allotment XY due to a persistent drought. The allotment in question is below the 50th percentile of the historic greenness for that week and has been at that level for the previous 3 weeks. This gives the manager and permittee quantifiable evidence that the number of animals should be decreased to prevent resource damage.



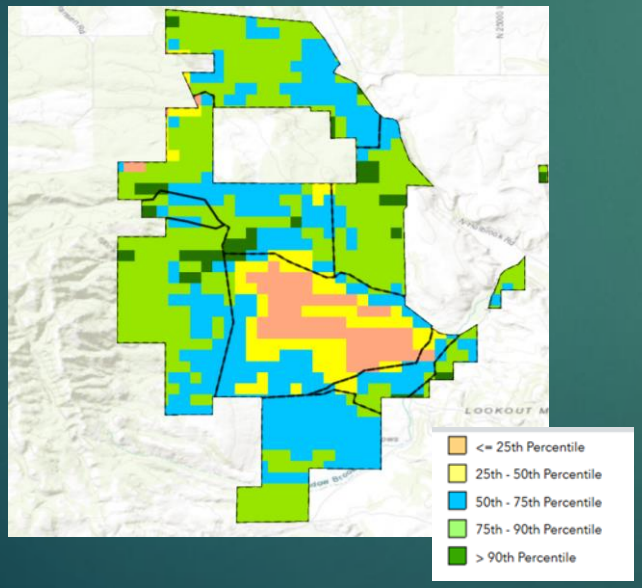
Scenario 2:

You are a wildlife manager and are concerned that a late spring on some allotments will mean that domestic sheep will be in close proximity to wild sheep, increasing the risk of disease transmission as the wild sheep will not move to higher pastures. PhenoMap shows that these areas are phenologically behind, bolstering the case to delay turn out of domestic sheep.

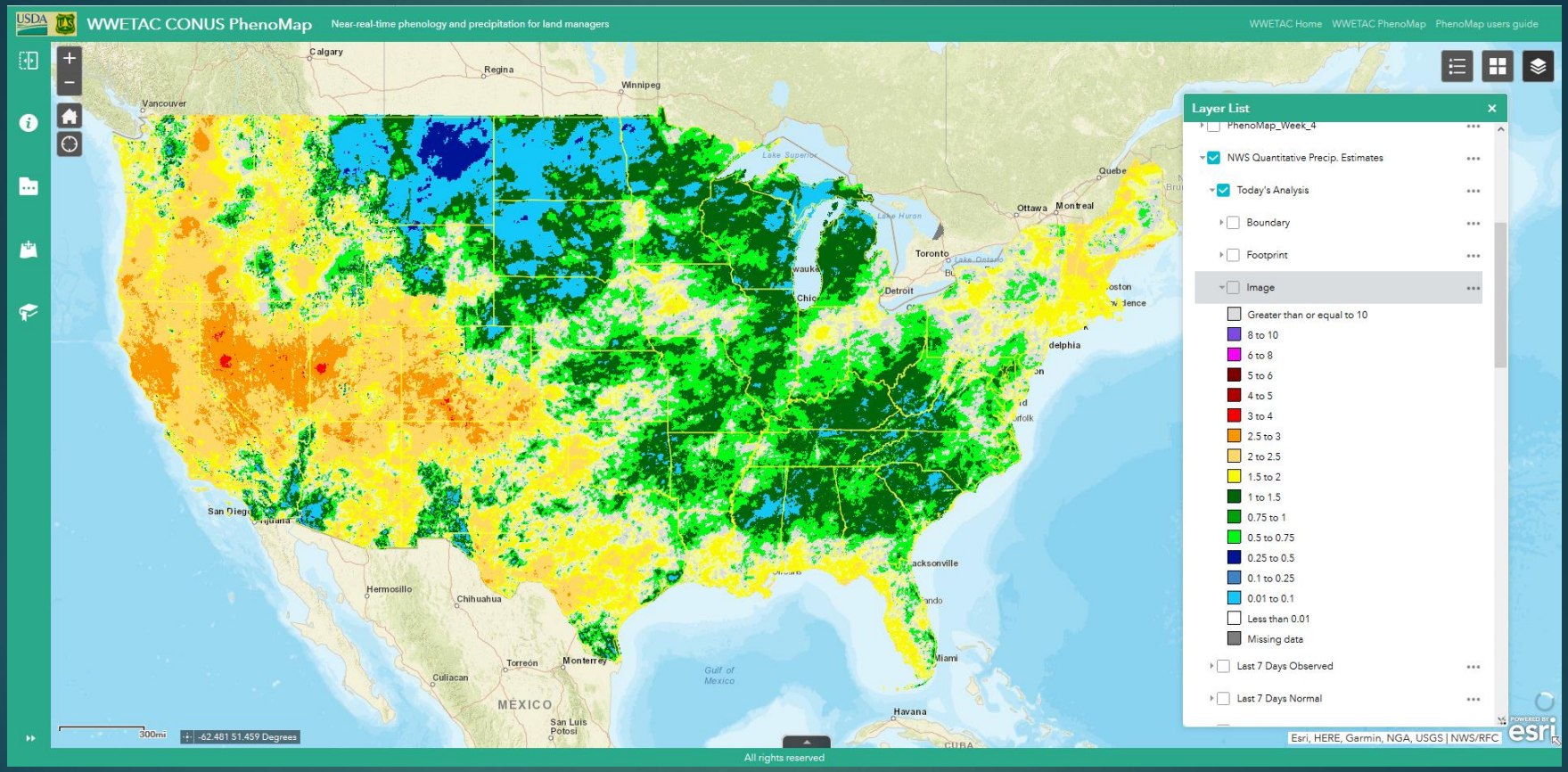


Scenario 3:

Two years ago, a fire burned some pastures. Are they now ready for stocking? Phenomap shows that one of these pastures is substantially behind (< 25th *Percentile Annual*) while neighboring pastures that also burned are greener (50th - 90th *Percentile Annual)*. This is evidence to rest this pasture for the current season.



PhenoMap also delivers other phenology-related data…



…including National Weather Service observed precipitation estimates….

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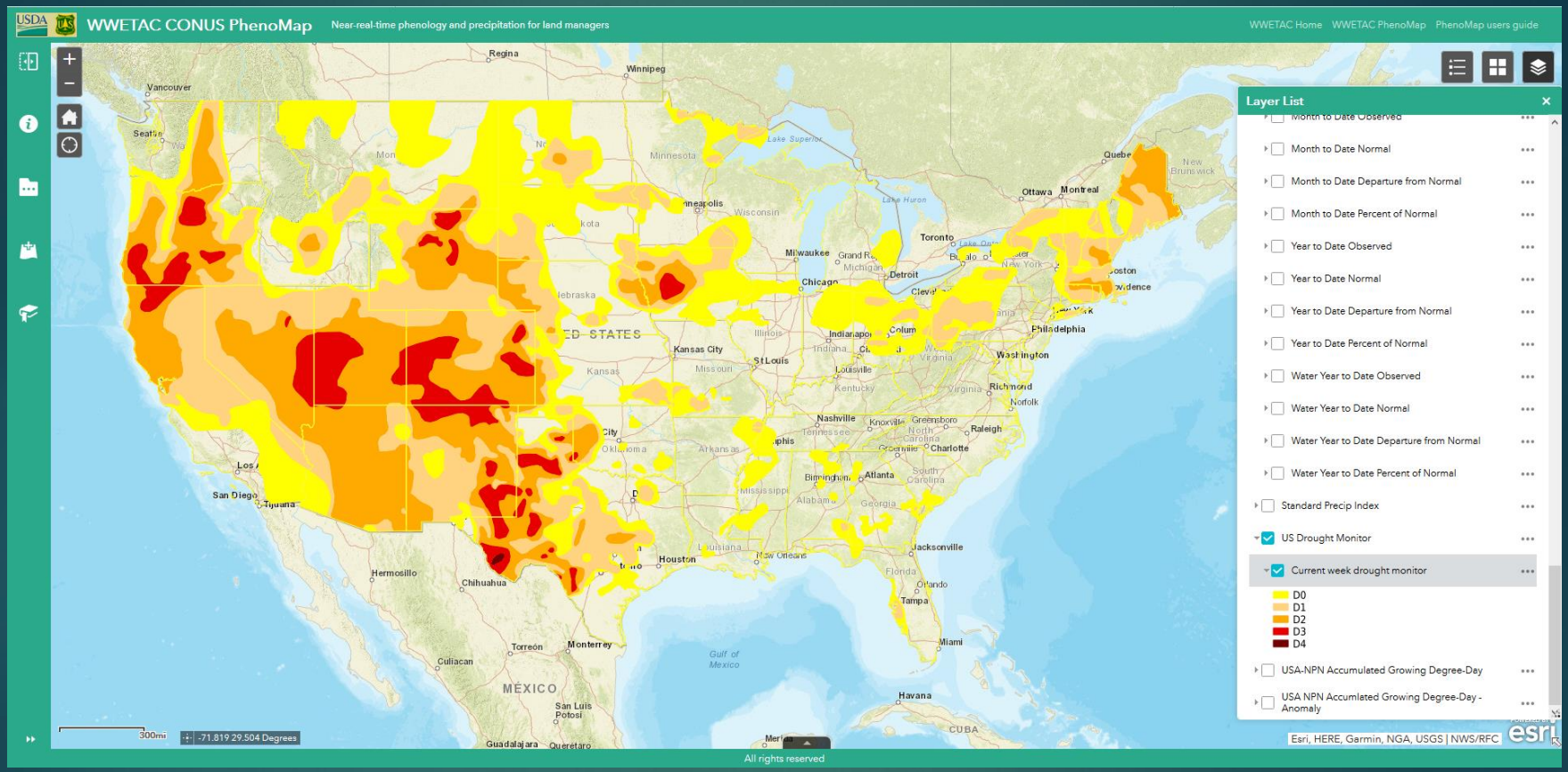
….the US Drought Monitor…



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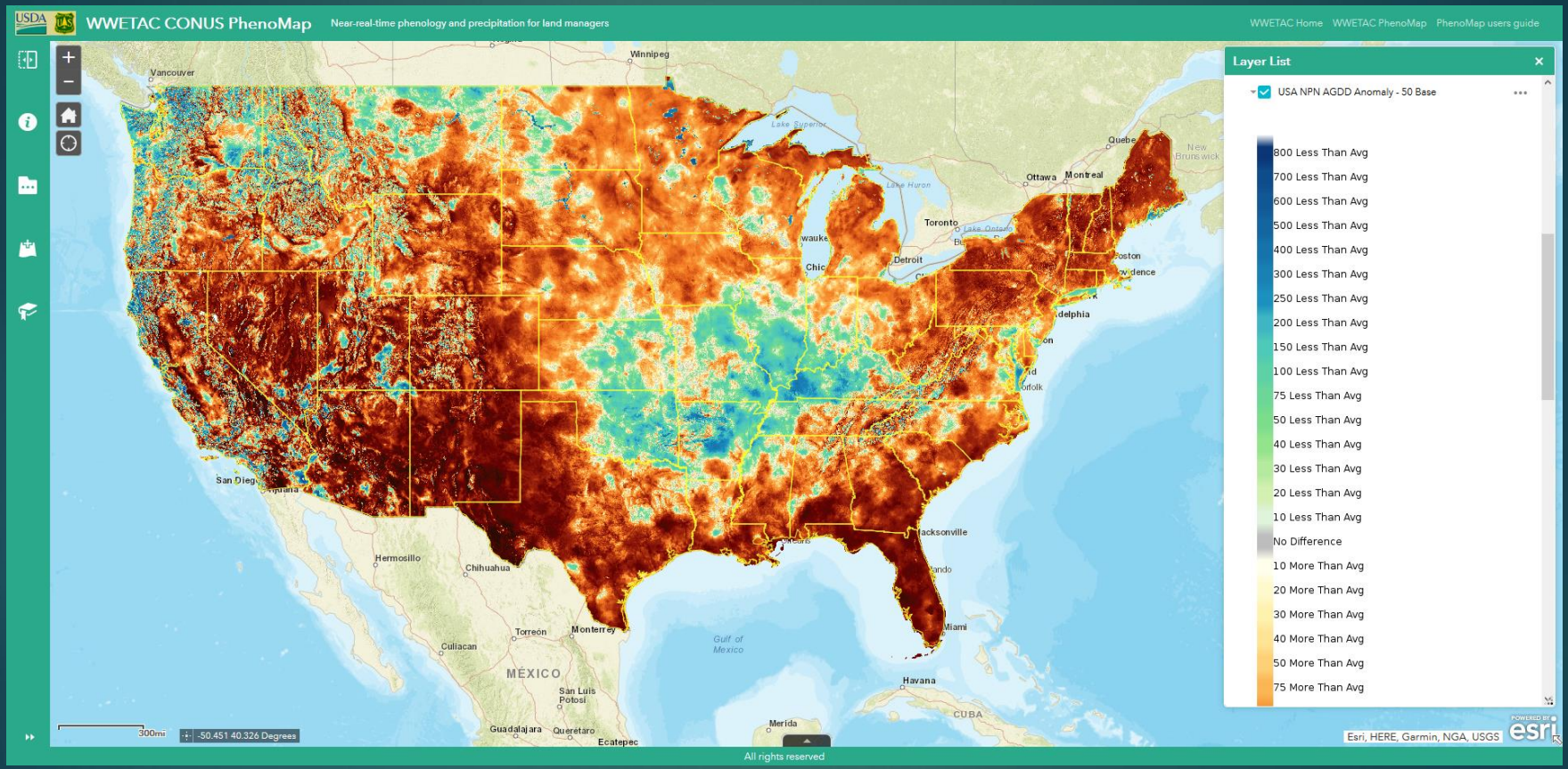
...and growing-degree-day data from the USA National Phenology Network.



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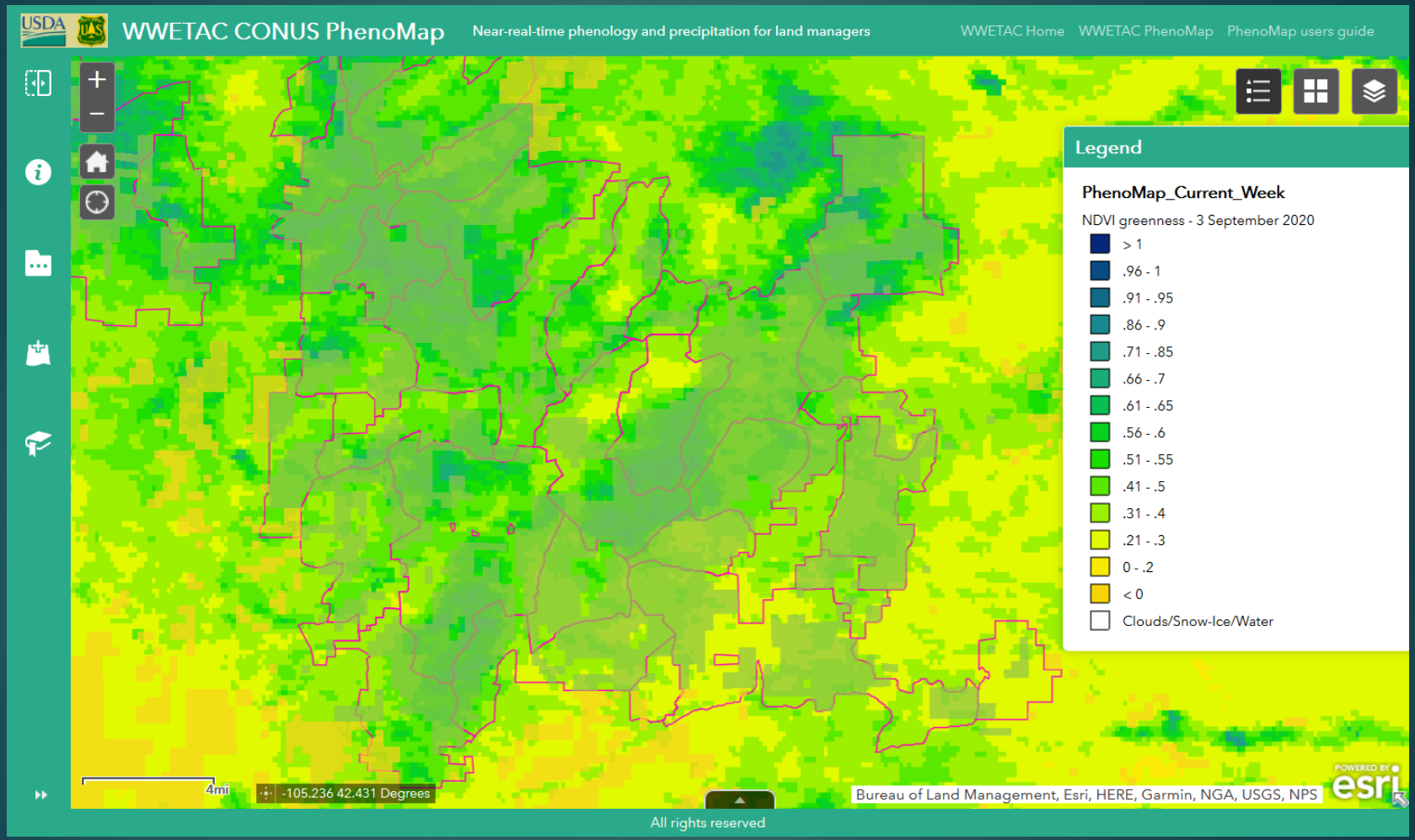
Reference data (allotments, federal lands) are also provided to focus phenology observations.



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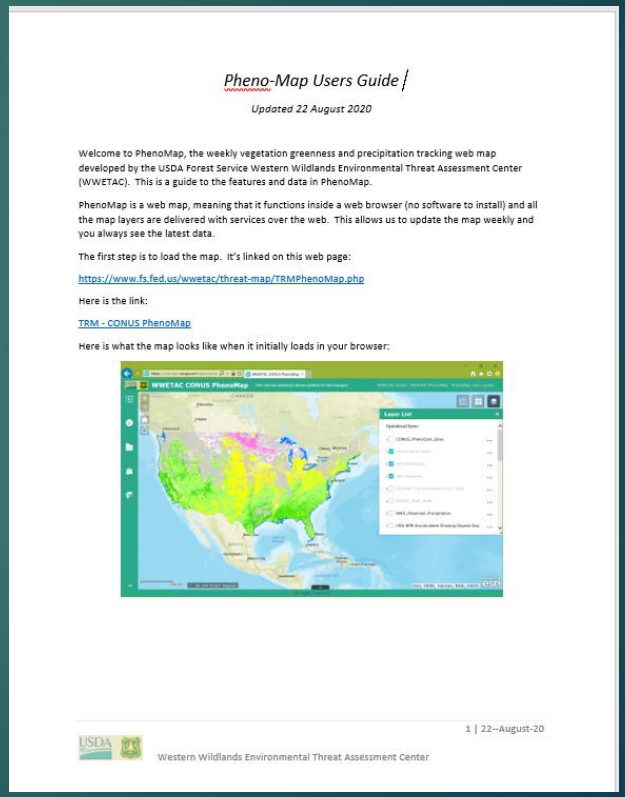
PhenoMap tools and features:

- Swipe between layers
- Add your local data
- Change basemaps
- Layers on/off
- Bookmarks
- Measure tool, print
- Map legend

For a more details on using PhenoMap, click here.



Pheno-Map Users Guide

Updated 22 August 2020

Welcome to PhenoMap, the weekly vegetation greenness and precipitation tracking web map developed by the USDA Forest Service Western Wildlands Environmental Threat Assessment Center (WWETAC). This is a guide to the features and data in PhenoMap.

PhenoMap is a web map, meaning that it functions inside a web browser (no software to install) and all the map layers are delivered with services over the web. This allows us to update the map weekly and you always see the latest data.

The first step is to load the map. It's linked on this web page:

https://www.fs.fed.us/wwetac/threat-map/TRMPhenoMap.php

Here is the link:

TRM - CONUS PhenoMap

Here is what the map looks like when it initially loads in your browser:

Explore the phenology data and let us know how well it describes vegetation green-up and senescence in your area.

CONUS PhenoMap

Let us know how we can improve this tool to help you do your job/research…

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