Drought.gov
GIS Efforts

Steve Ansari [1], Kathryn Bevington [2], Rocky Bilotta [3], Alec Courtright [3], Nancie McCraw [3], Andrew Stowell [3]

[1] NOAA NCEI / NIDIS Drought.gov
[2] CIRES
[3] ERT, INC

NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

NIDIS Drought.gov

GIS and Drought.gov

- Strategy
- Evolution
- Implementation

We are in the middle of this journey…

GIS and Drought.gov

- GIS programming and infrastructure in support of Drought.gov website
- Support NIDIS partners and decision makers and general public
- Facilitates integration of data and information from a variety of drought information producers, a core Drought.gov mission
- Data management, visualizations, statistics
- Explore innovation, support NIDIS-funded research and transition to operations

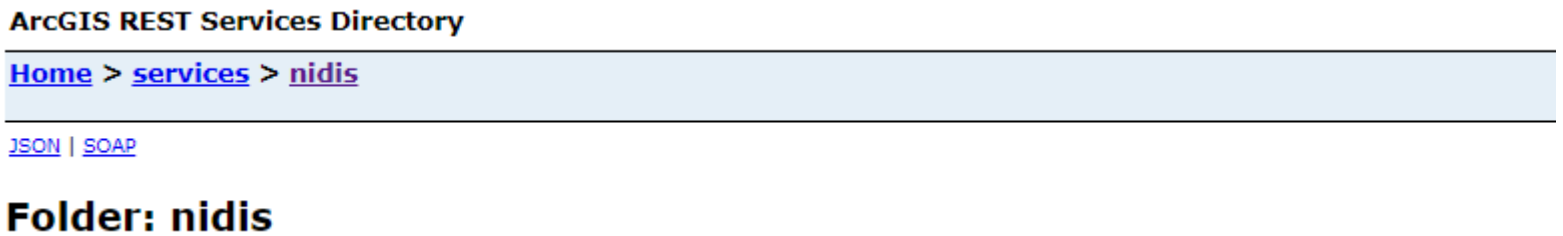
Strategy

- Our GIS strategy is evolving…
    - Simplicity
        - Less moving parts – simpler to implement and scale
    - Portability
        - Diverse solutions, right tool for the job
    - Support a better user experience
        - Faster, optimized maps
        - Usability testing
        - Improved accessibility and 508 compliance
    - Enablement
        - Easier to use and access drought data by non-GIS users

Evolution: Data Management

- **Data >>> NCEI Database & NCEI ArcGIS Server >>> NCEI Map Services**

  - Good integration with Desktop GIS users
  - Web Services ☺ - but hard and/or expensive to scale and keep performant ☹
  - More moving parts
  - Difficult to integrate into our Linux data processing and automation
  - Tools and services are harder for non-GIS users ☹



Evolution: Data Management

- Data >>> NCEI Database & NCEI ArcGIS Server >>> NCEI Map Services

  +

- Data >>> **Conda** (GDAL/TopoJSON/MapShaper)
  >>> Optimized GeoJSON/TopoJSON files,
  Raster/Vector tiles on file system (portable, cloud-ready)

- Data >>> **ArcGIS Online** >>> StoryMaps, OpsDashboard, Cloud GIS Services

Evolution: Data Management

- Data >>> **Conda** (GDAL/TopoJSON/MapShaper/RasterIO)
  >>> Optimized GeoJSON/TopoJSON files,
  Raster/Vector tiles on file system (portable, cloud-ready)

  - Easy to automate
  - Portable, easily replicate for dev, testing and production
  - Cloud-ready for serverless processing
  - Fits easily into existing Linux workflows (but cross-platform to Win. & Mac)
  - Large, diverse selection of tools available, compatible with scientific packages in python, R. Emerging compatibility with ESRI
  - Great performance

Evolution: Data Management

- Data >>> **Conda** (GDAL/TopoJSON/MapShaper/RasterIO)
  >>> Optimized GeoJSON/TopoJSON files,
  Raster/Vector tiles on file system (portable, cloud-ready)

```
> conda create –name my-test-environment
> source activate my-test-environment
> conda install –c conda-forge nco
> which ncks
~/anaconda3/envs/my-test-environment/bin/ncks
```

Evolution: Data Management

- Data >>> **Conda** (GDAL/TopoJSON/MapShaper/RasterIO)
  >>> Optimized GeoJSON/TopoJSON files,
  Raster/Vector tiles on file system (portable, cloud-ready)

  - GeoJSON and TopoJSON formats: vector formats compatible with a large selection of web mapping libraries.
  - Highly compress and optimize data: reduce unneeded vertices, use appropriate precision, remove spaces, enabled server compression

Evolution: Data Management

- Data >>> Conda (GDAL/TopoJSON/MapShaper/RasterIO)
  >>> Optimized GeoJSON/TopoJSON files,
  Raster/Vector tiles on file system (portable, cloud-ready)

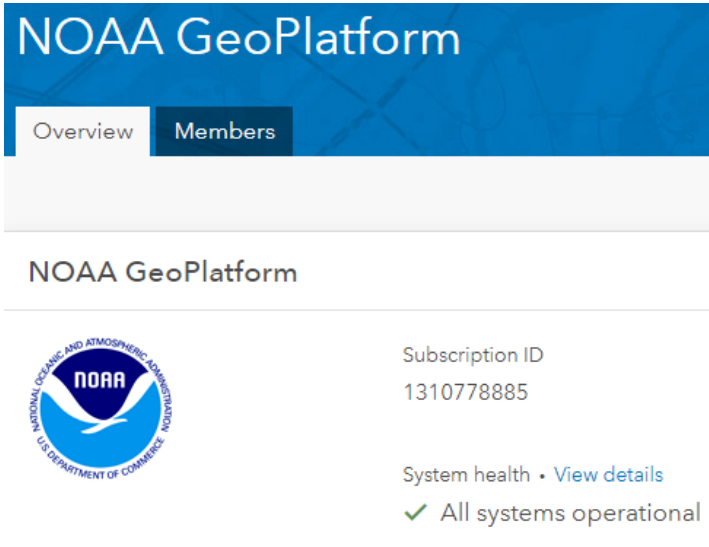
  - Original Shapefile: 1.3 MB compressed
  - Original GeoJSON: 2.2 MB
  - Simplified GeoJSON: 1.6 MB
  - Simplified TopoJSON: 589 KB
  - Compressed, simplified TopoJSON: 151 KB

- All data available from:
  https://www.drought.gov/drought/drought-data-download-and-services

Evolution: Data Management

- Data >>> ArcGIS Online >>> StoryMaps, OpsDashboard, Cloud GIS Services

  - Part of NOAA GeoPlatform (enterprise licensing with ESRI)
  - Rapid prototyping and development
  - Hosted data and content
  - StoryMaps: rapidly gaining popularity within NOAA
  - OpsDashboard:
  - Cloud hosting for layers
  - Working on automation

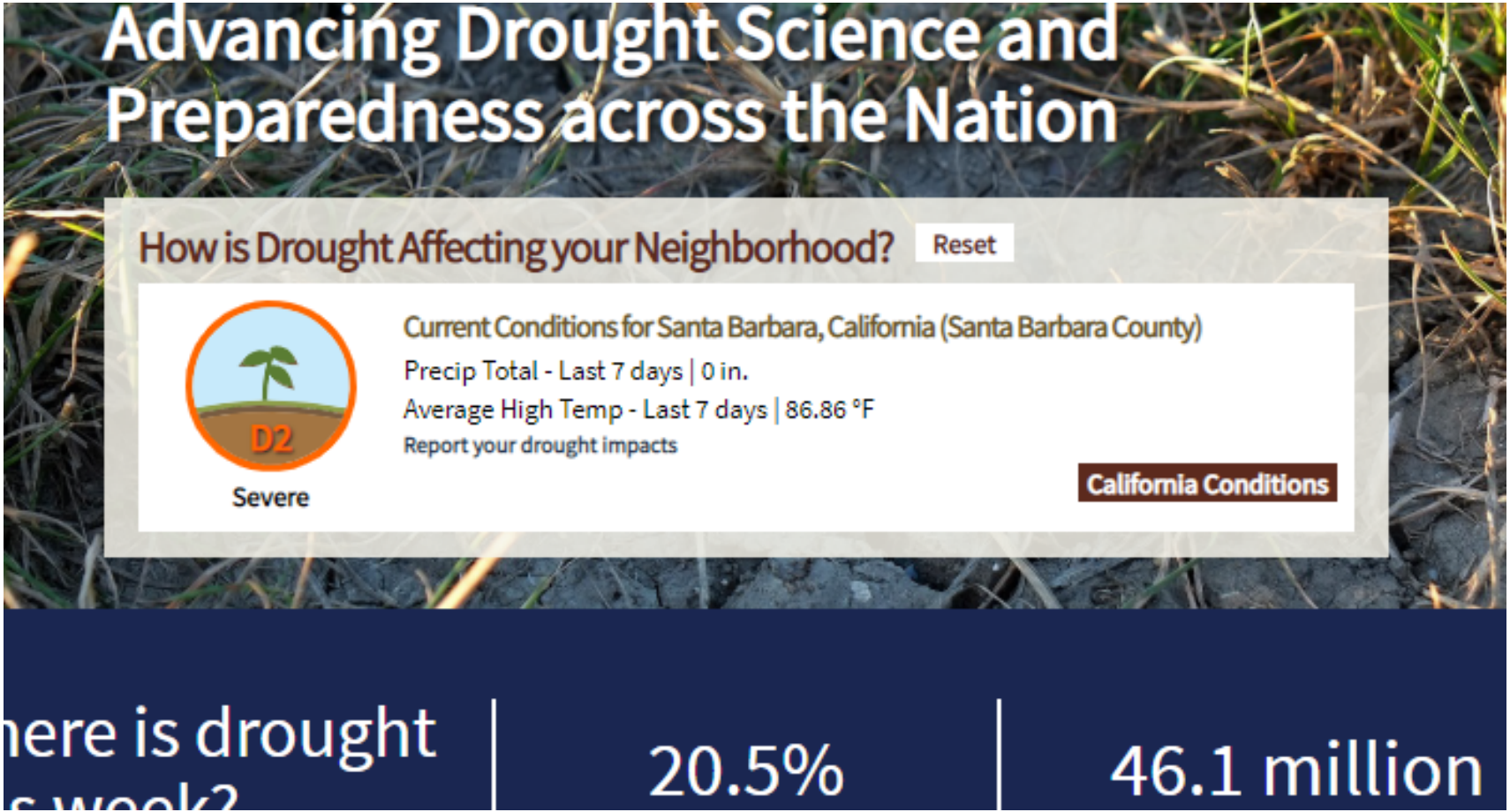


Evolution: Presentation

- From: Many layers and standalone tools
- To:
  - Curated collection, in context, supporting content of drought.gov web content
  - Iterative usability testing throughout development, not after
  - Consistency between mapping applications and main website
  - Integrated tools and maps in main website (Drupal CMS) – not a separate tool
  - Use projections for U.S. and Global Data
  - Eliminate need to transfer an image (or tiles) when zooming in and out
  - Emphasis on accessibility as part of usability. (not *just* 508 compliance)

Evolution: Presentation

Evolution: Presentation



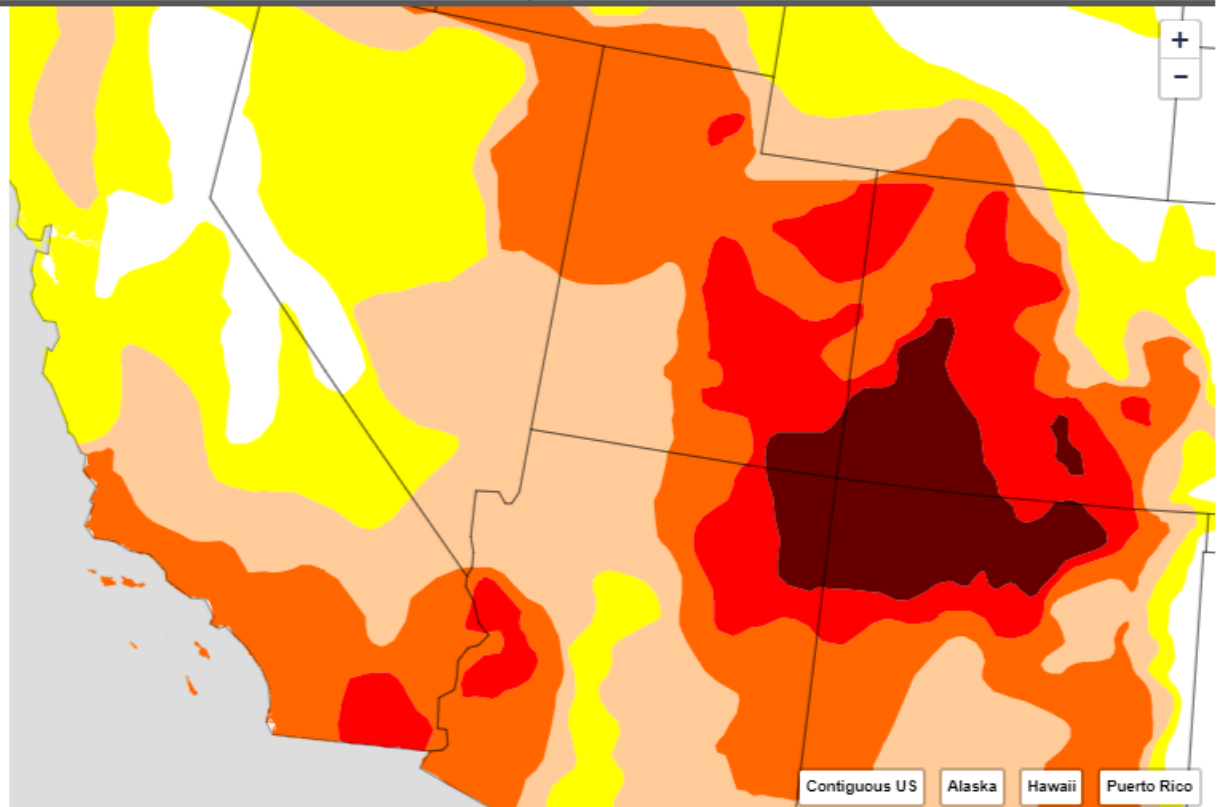
Evolution: Presentation

Current Drought Monitor | October Drought Outlook | Drought Outlook through January

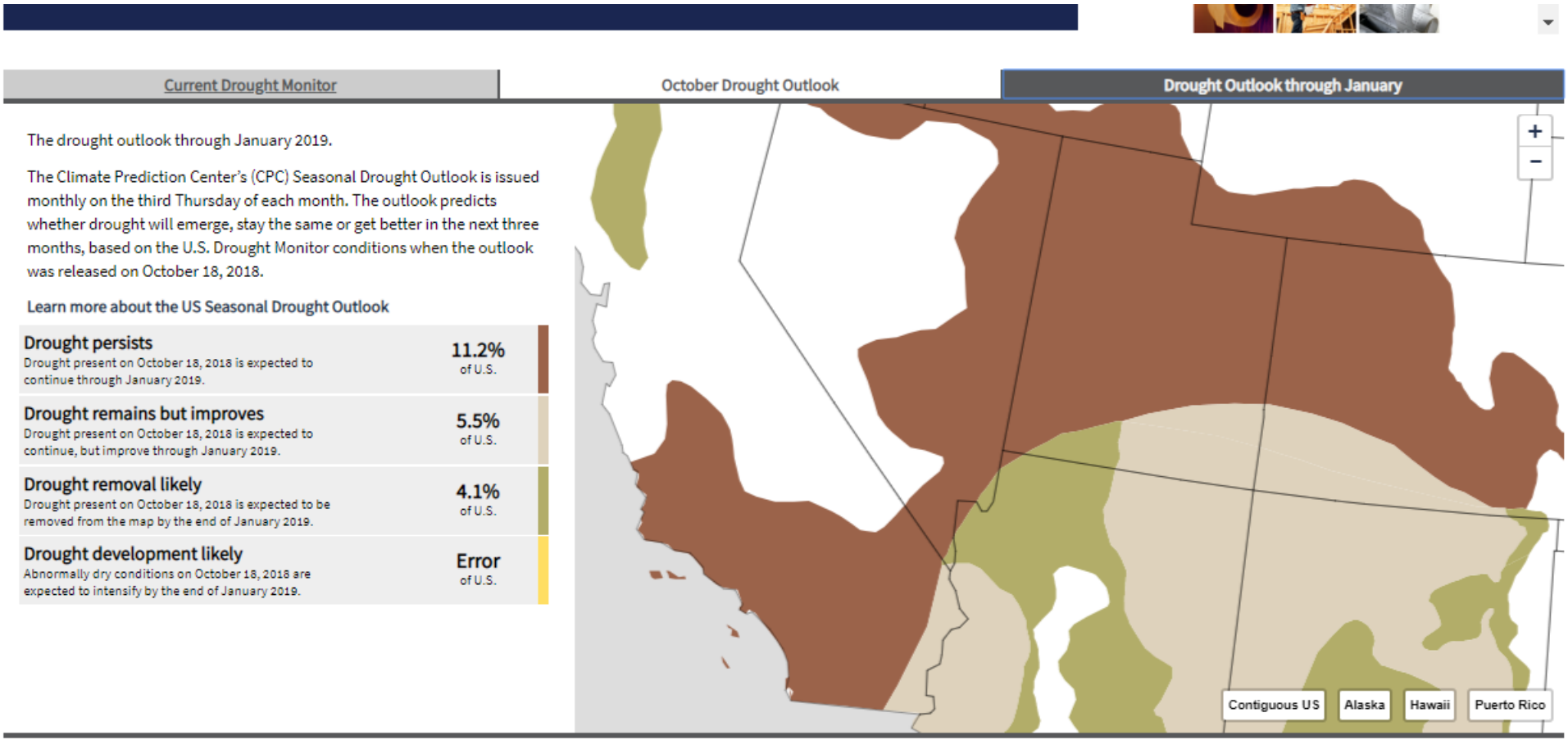
The U.S. Drought Monitor (USDM) is a map that shows the location and intensity of drought across the country. The data is updated each Tuesday and released on Thursday. This map shows the drought conditions on October 16, 2018.

Learn more about the US Drought Monitor

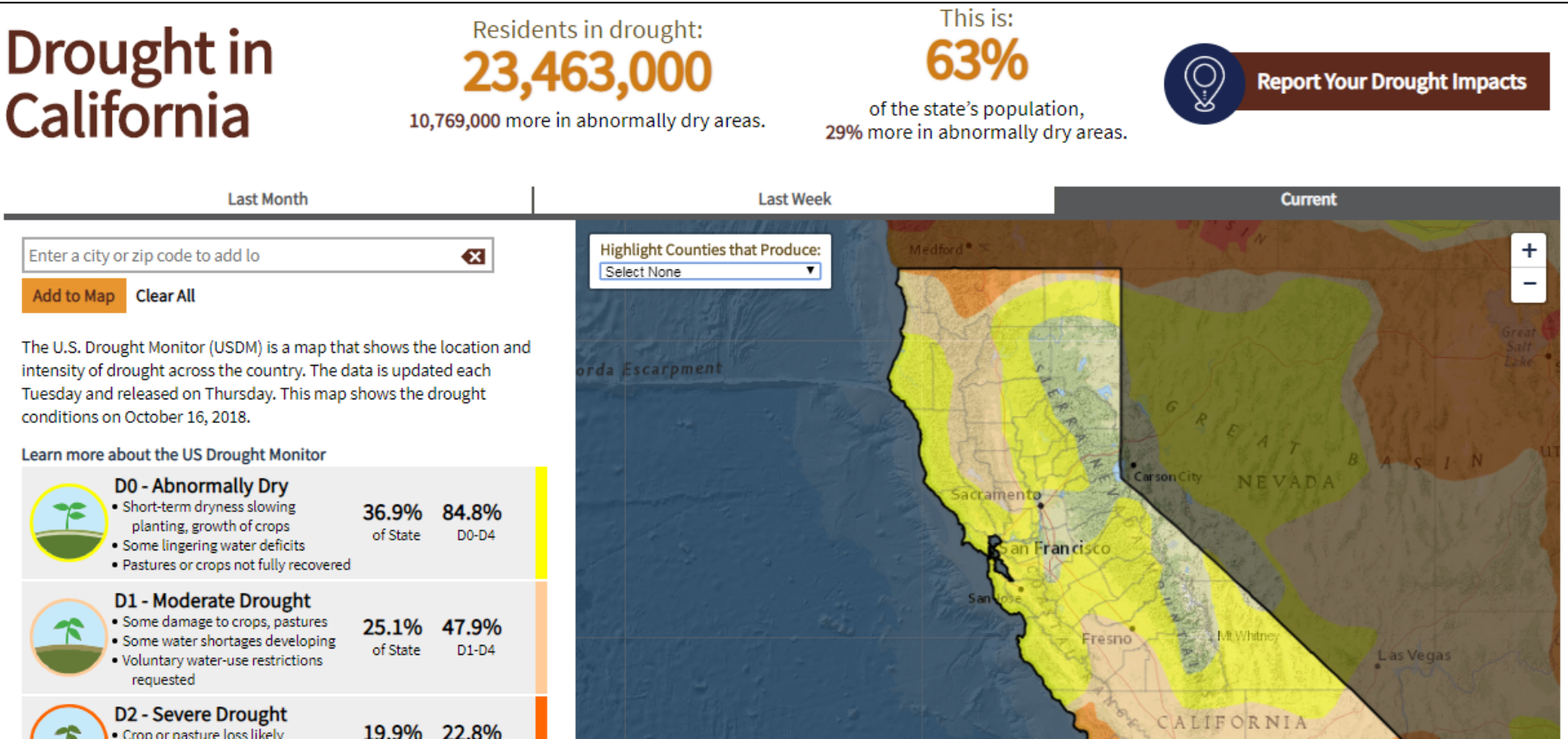
D0 - Abnormally Dry • Short-term dryness slowing planting, growth of crops • Some lingering water deficits • Pastures or crops not fully recovered	12.5% of U.S.	32.9% D0-D4
D1 - Moderate Drought • Some damage to crops, pastures • Some water shortages developing • Voluntary water-use restrictions requested	8.8% of U.S.	20.4% D1-D4
D2 - Severe Drought • Crop or pasture loss likely • Water shortages common • Water restrictions imposed	7.5% of U.S.	11.6% D2-D4
D3 - Extreme Drought • Major crop/pasture losses • Widespread water shortages or restrictions	3% of U.S.	4.1% D3-D4
D4 - Exceptional Drought • Exceptional and widespread crop/pasture losses • Shortages of water creating water emergencies		1.1% of U.S.



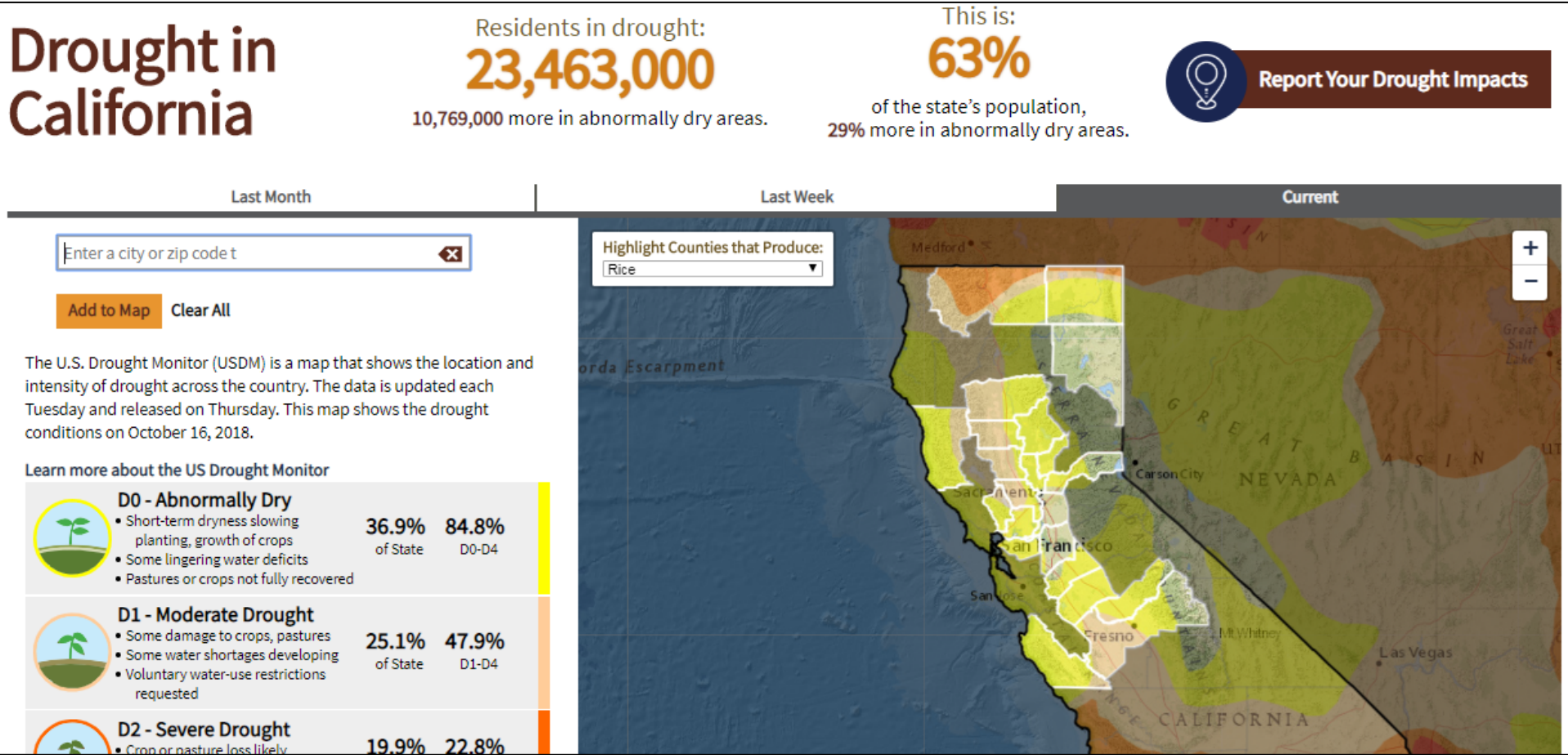
Evolution: Presentation



Evolution: Presentation



Evolution: Presentation



Evolution: Presentation

Santa Barbara, CA, USA

Add to Map Clear All

The U.S. Drought Monitor (USDM) is a map that shows the location and intensity of drought across the country. The data is updated each Tuesday and released on Thursday. This map shows the drought conditions on October 16, 2018.

Learn more about the US Drought Monitor

D0 - Abnormally Dry
- Short-term dryness slowing planting, growth of crops
- Some lingering water deficits
- Pastures or crops not fully recovered

36.9% of State 84.8% D0-D4

D1 - Moderate Drought
- Some damage to crops, pastures
- Some water shortages developing
- Voluntary water-use restrictions requested

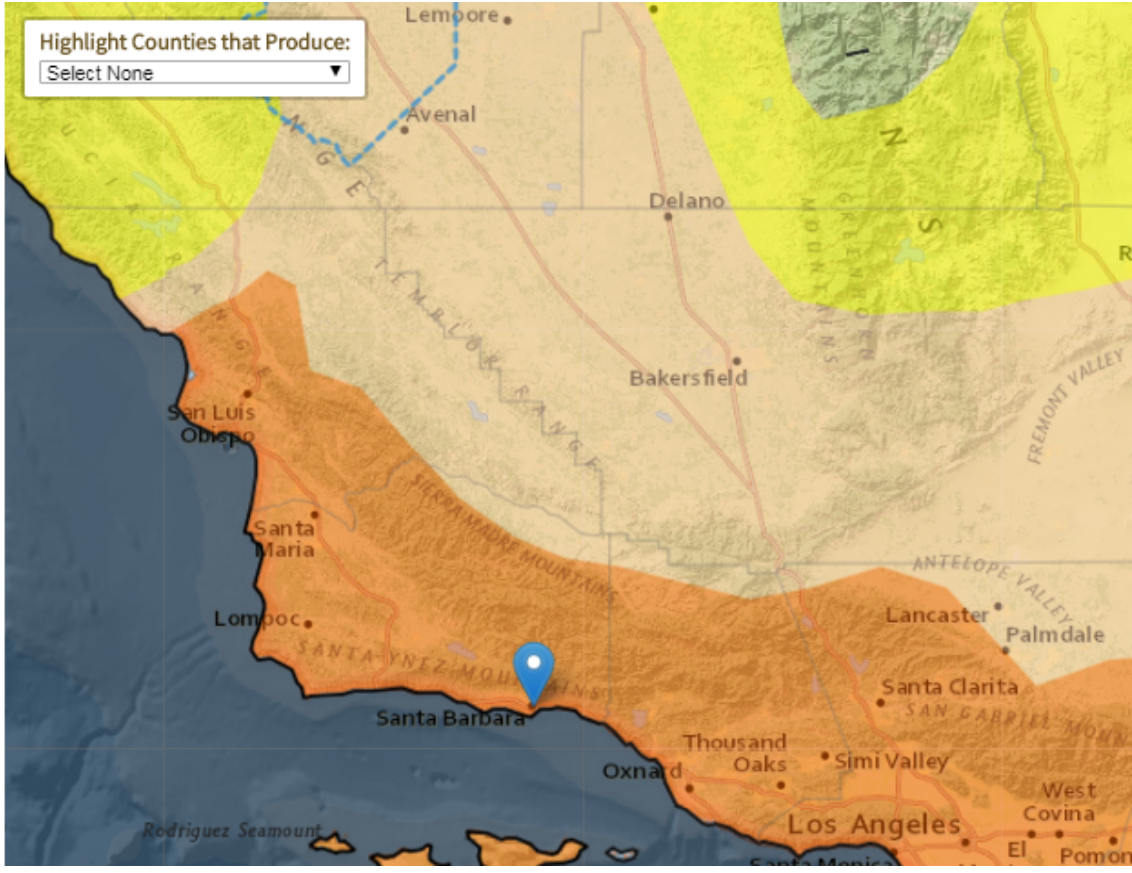
25.1% of State 47.9% D1-D4

D2 - Severe Drought
- Crop or pasture loss likely
- Water shortages common
- Water restrictions imposed

19.9% of State 22.8% D2-D4

D3 - Extreme Drought
- Major crop/pasture losses

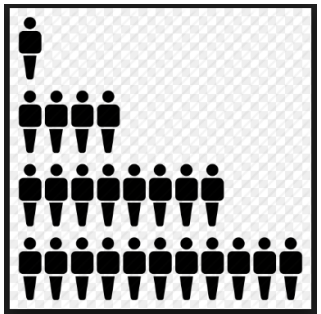
2.9% 2.9%

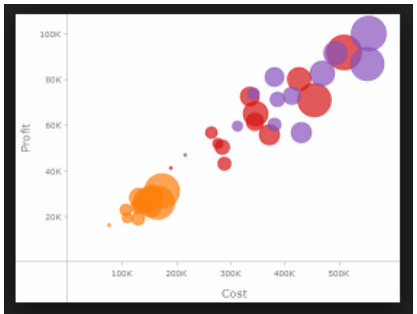


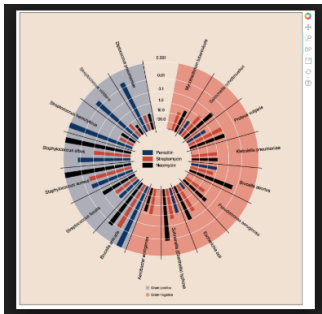
Evolution: Presentation

- What's the narrative?
- Just tell the users. They shouldn't have to guess, infer or figure it out.
- This is more usable and accessible.

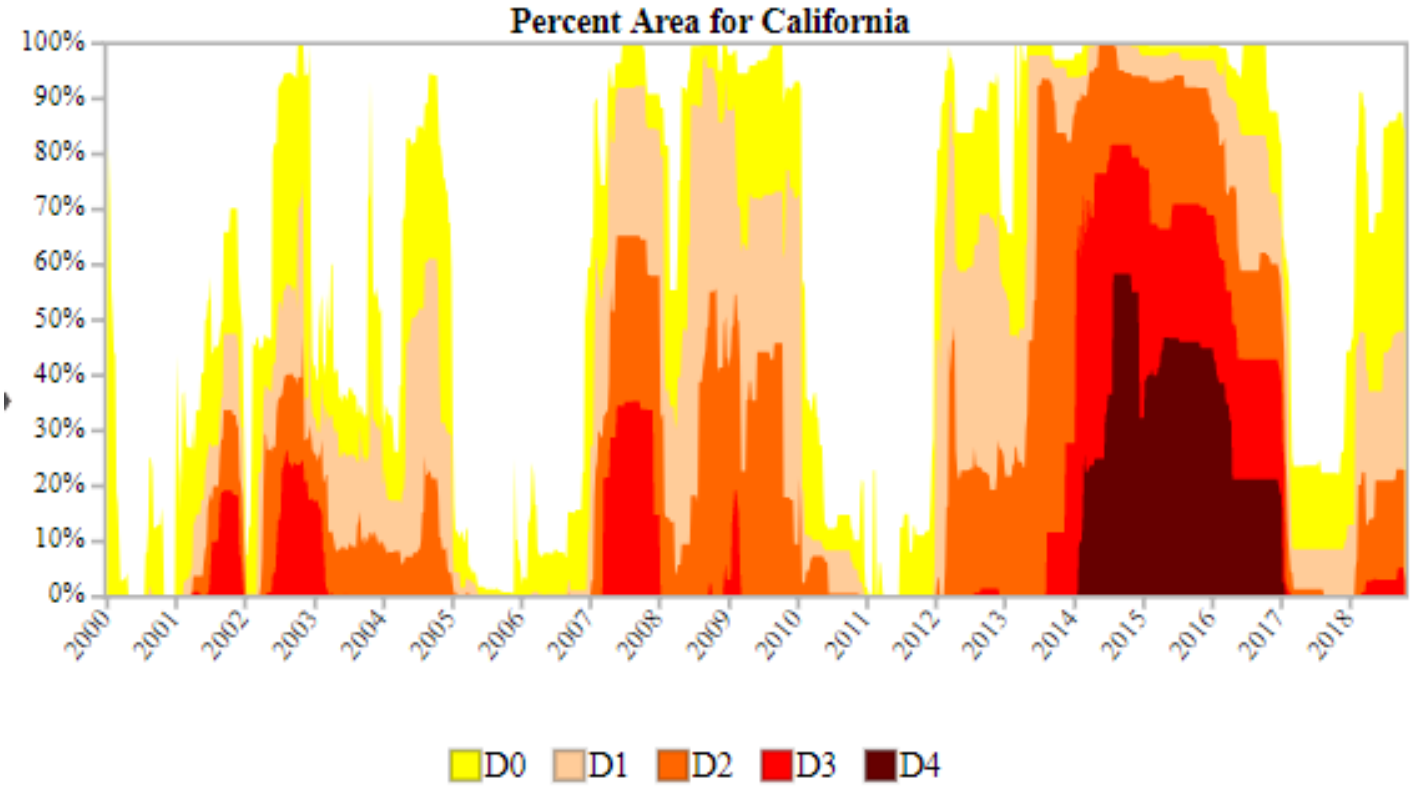
- Not just maps!
(but what else?)







Evolution: Presentation

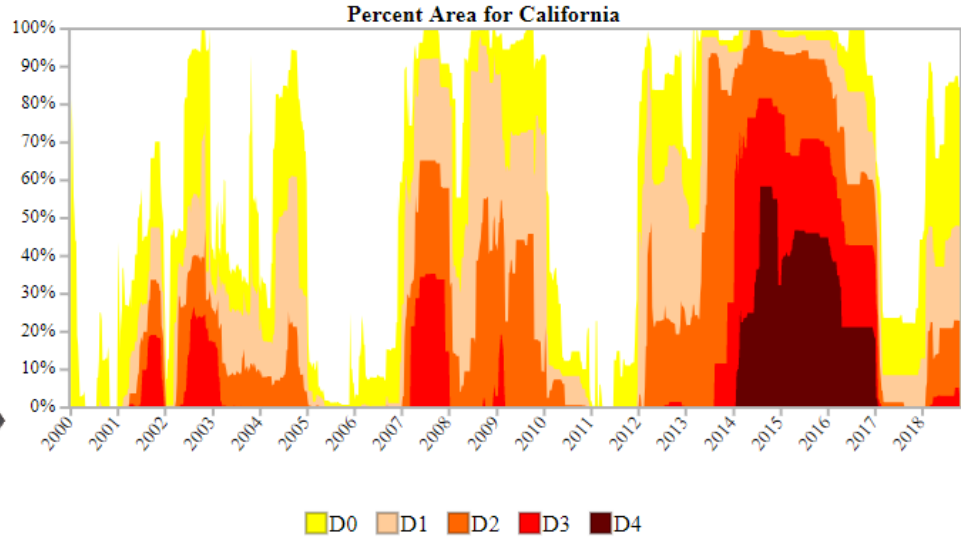


Evolution: Presentation

Drought in California from 2000 - 2018

The U.S. Drought Monitor started in 2000. Since 2000, California is currently experiencing the longest duration of drought (D1-D4), which as of October 16th, 2018 has lasted 356 weeks beginning on December 27, 2011. The most intense period of drought occurred the week of October 28, 2014 where D4 affected 58.41% of California land.

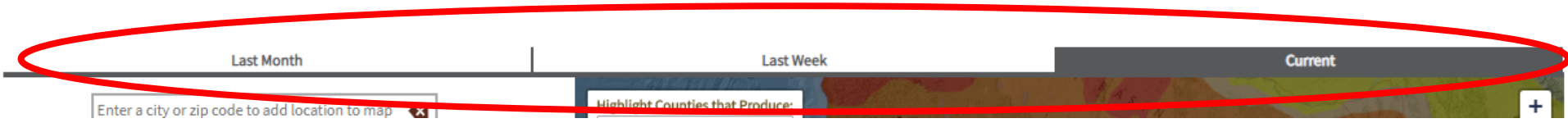
- **Drought from 2000**
- **Drought from 1895**

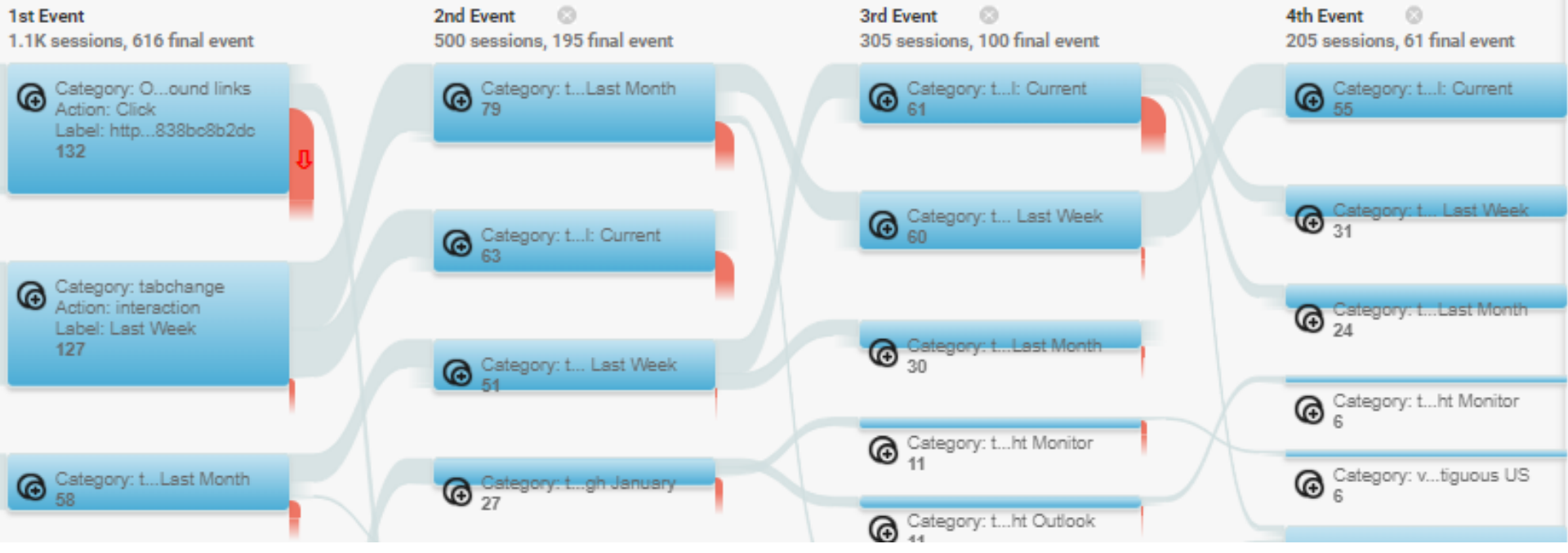


Evolution: Presentation

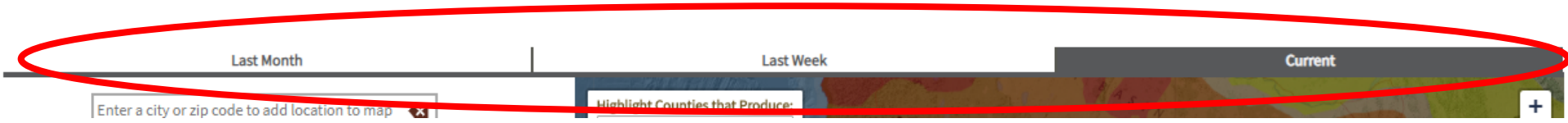
Analytics! - consistently monitor and learn

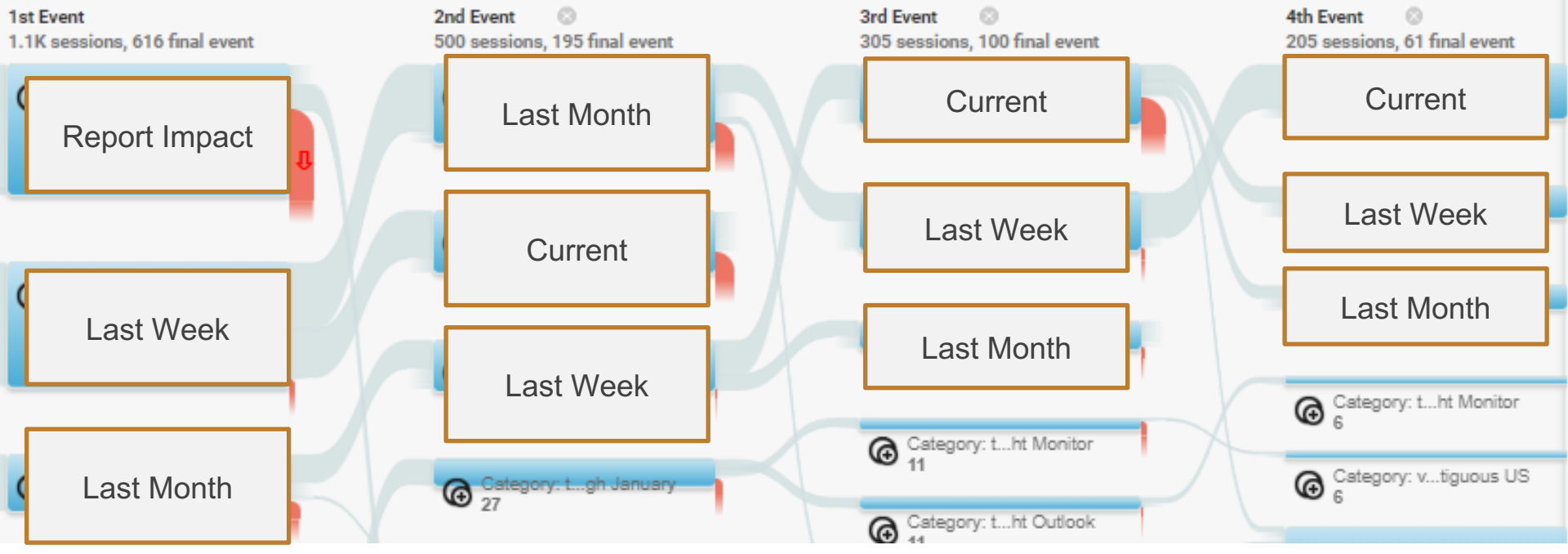
Evolution: Presentation





Evolution: Presentation

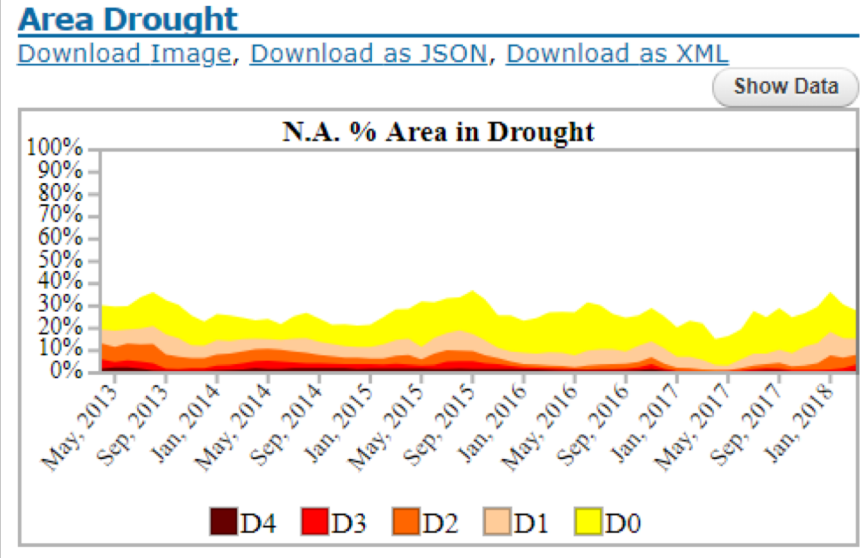


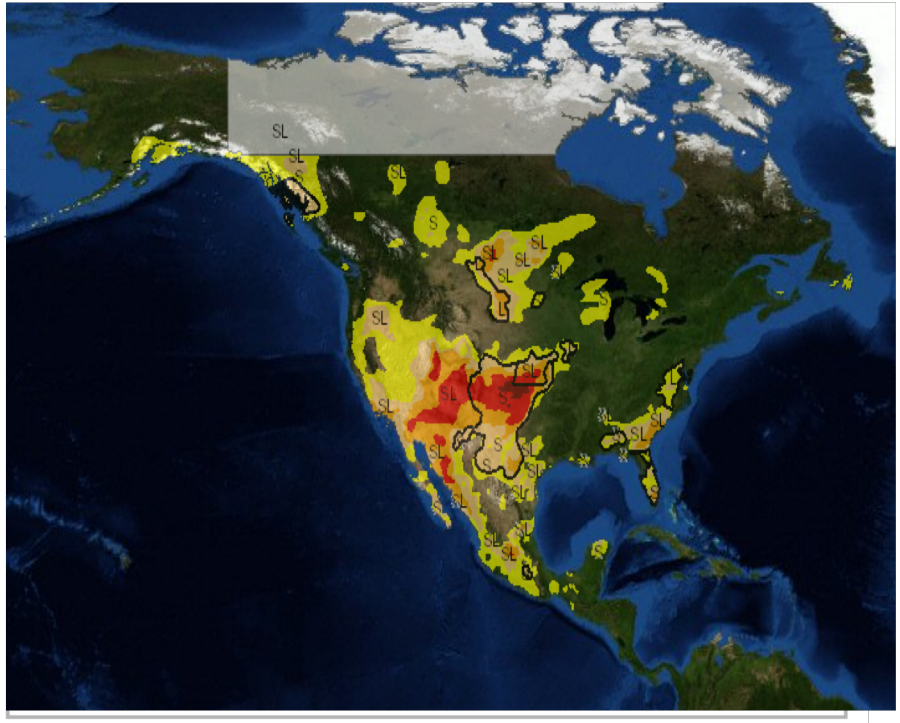


Data Integration: North American Drought Monitor

Python processing - *2 steps*:

- Preprocess
  - cleans, clips, merges files
- Post-process
  - cleans, statistics, database, FTP



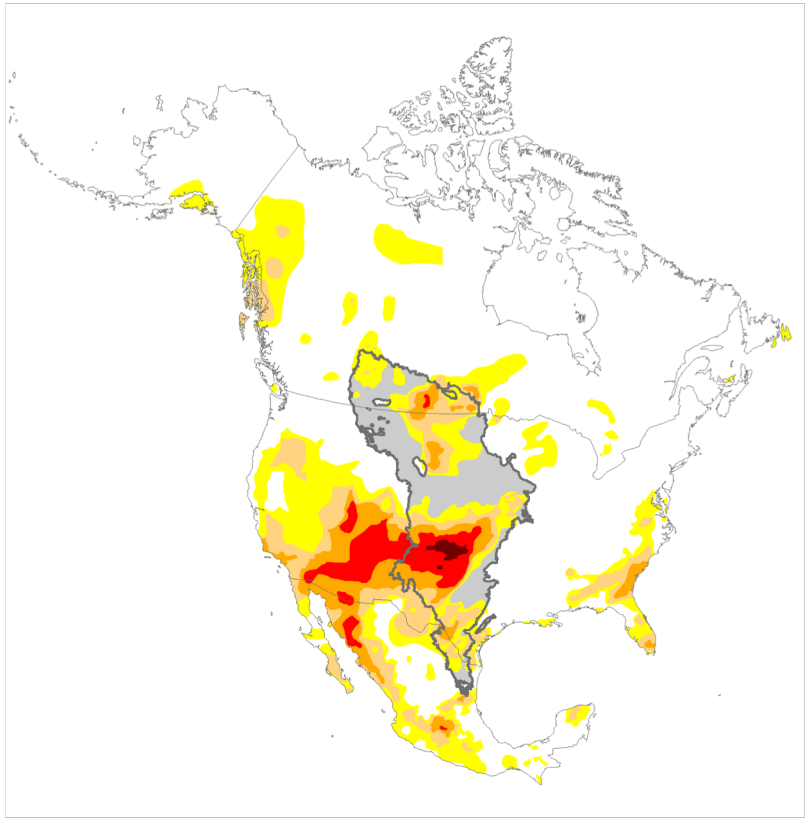


Data Integration: North American Drought Monitor

Shapefiles and Statistics

- *Columbia*
- *Great Lakes*
- *Rio Grande & Bravo*

- Ecoregions:
  - *South Central Semi-Arid Prairies*
  - *Tamaulipas-Texas Semi-Arid Plains*
  - *Temperate and West-Central Semi-Arid Prairies*
  - *Semi-Arid Prairies*
    - *South Central & West-Central Semi-Arid Prairies*
  - *Great Plains*
    - *Merge of all the above Ecoregions*

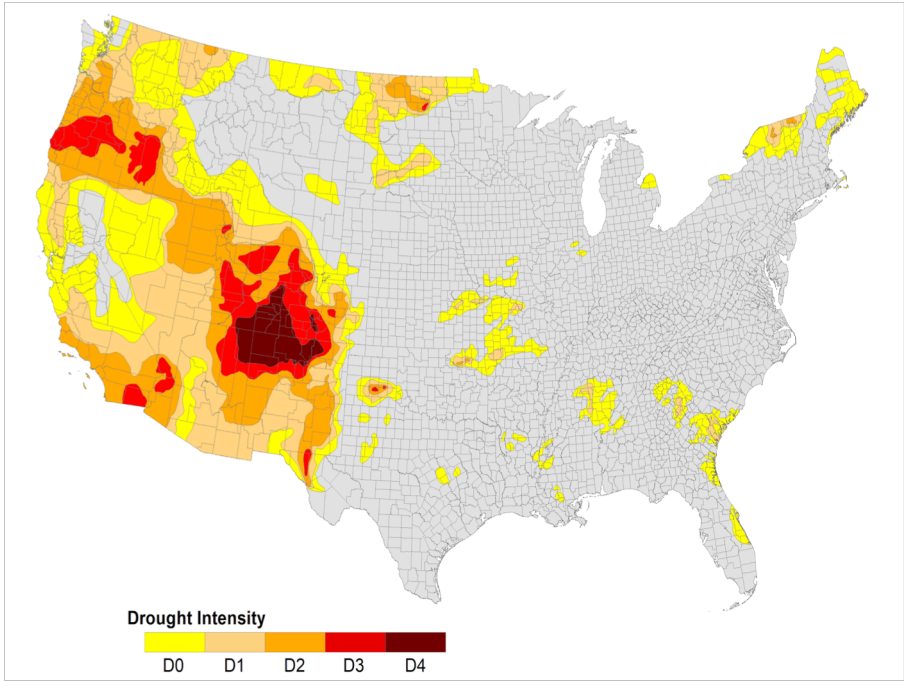


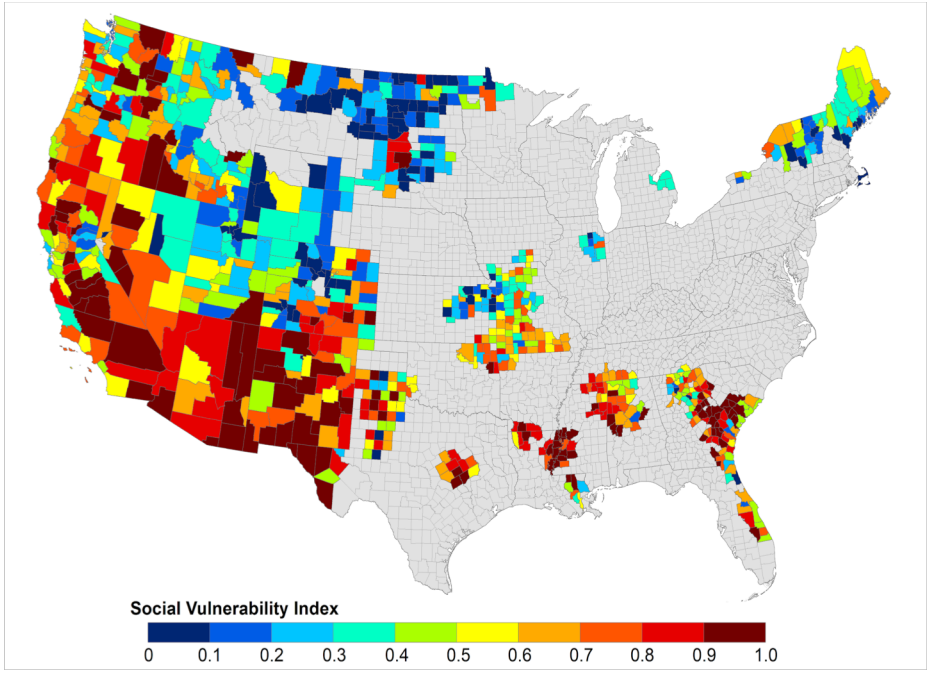
NADM_GreatPlains201803

FID	Shape	DroughtCat	Population	Pop_Pct	Year_Month	Area_SqMi	Area_Pct
0	Polygon	d0	10826900	34.0505	201803	223361	21.2888
1	Polygon	d1	4121770	12.963	201803	176263	16.7997
2	Polygon	d2	2022430	6.36054	201803	122037	11.6315
3	Polygon	d3	1100890	3.46228	201803	89391.9	8.52002
4	Polygon	d4	104193	0.327688	201803	17933.7	1.70928

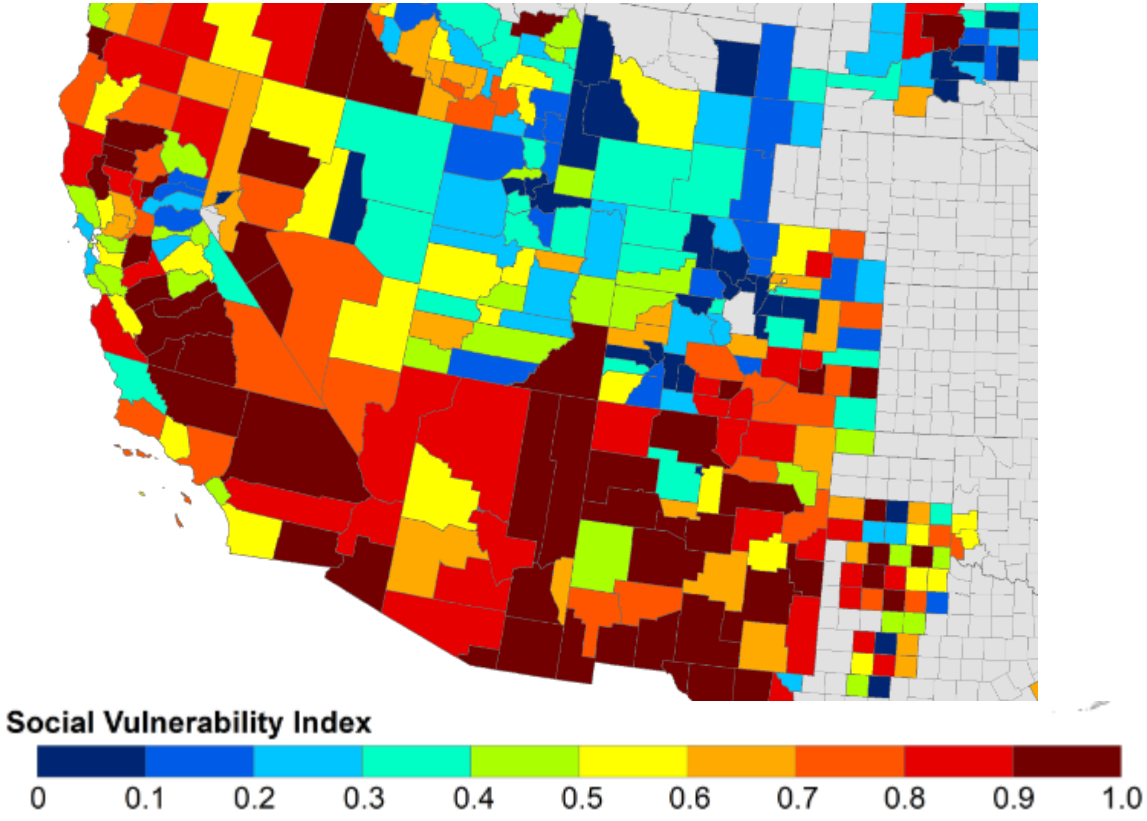
Data Integration: Public Health

Drought and Social Vulnerability Index

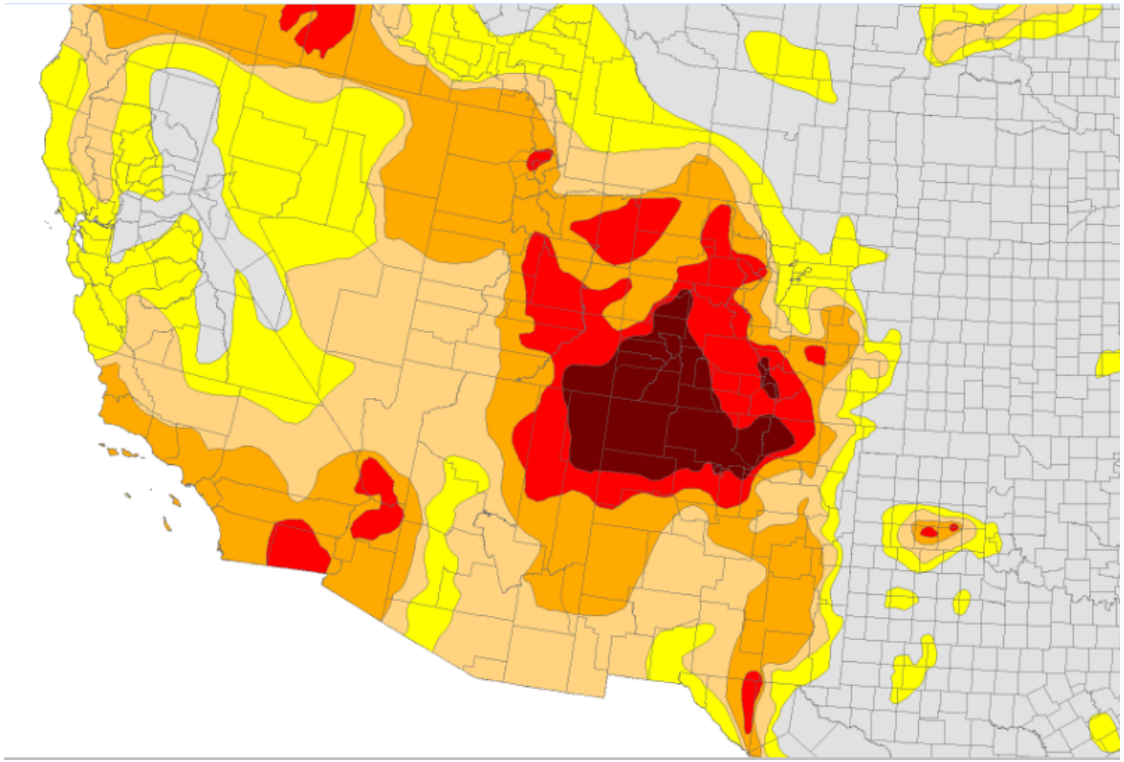




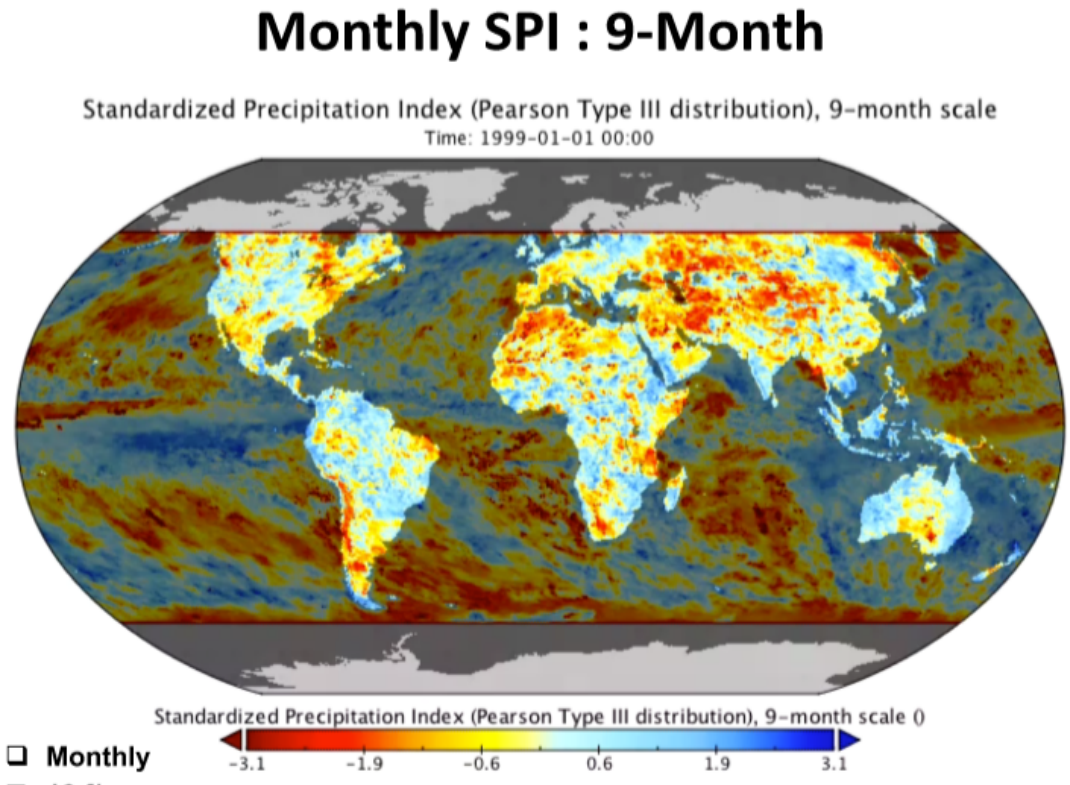
Data Integration: Public Health



Data Integration: Public Health



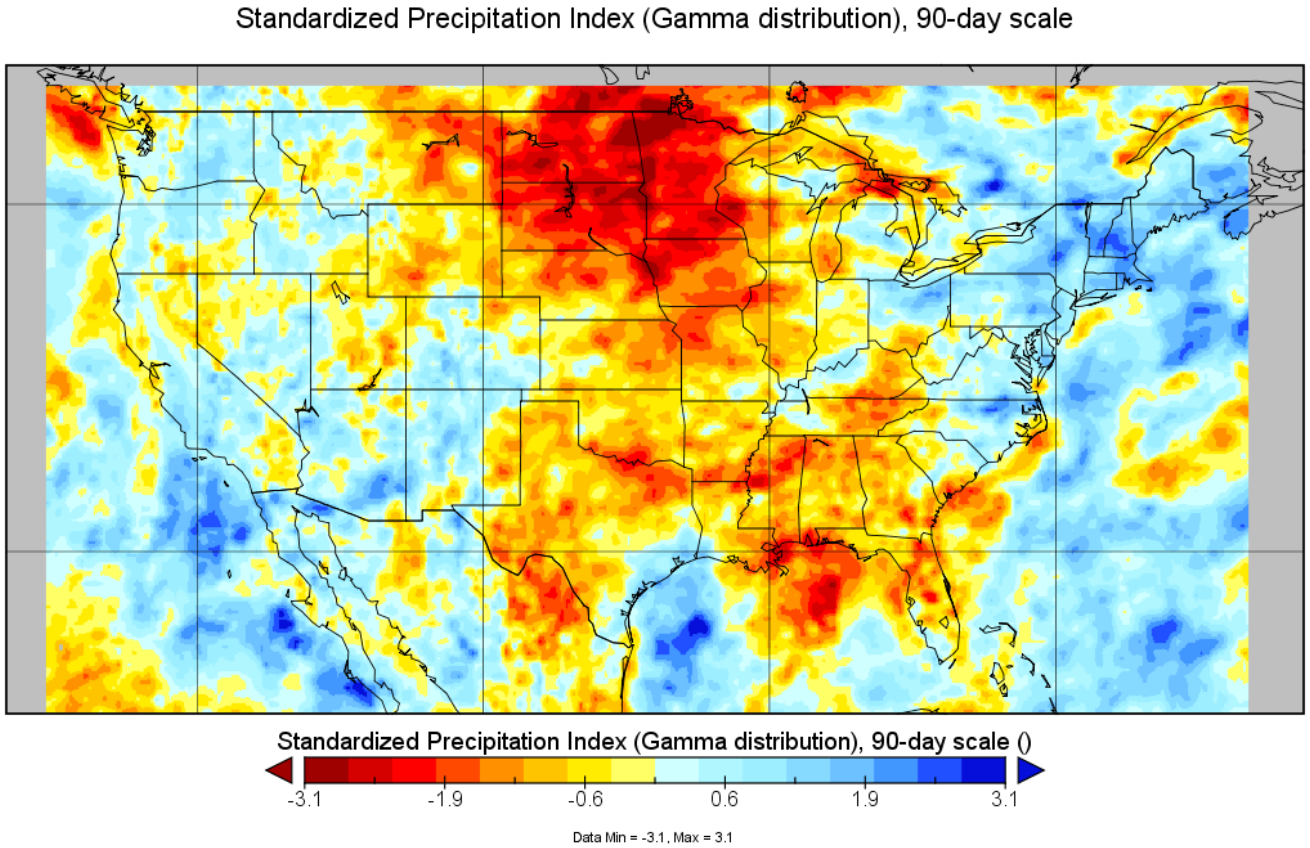
Data Integration: Drought Indices from cMORPH



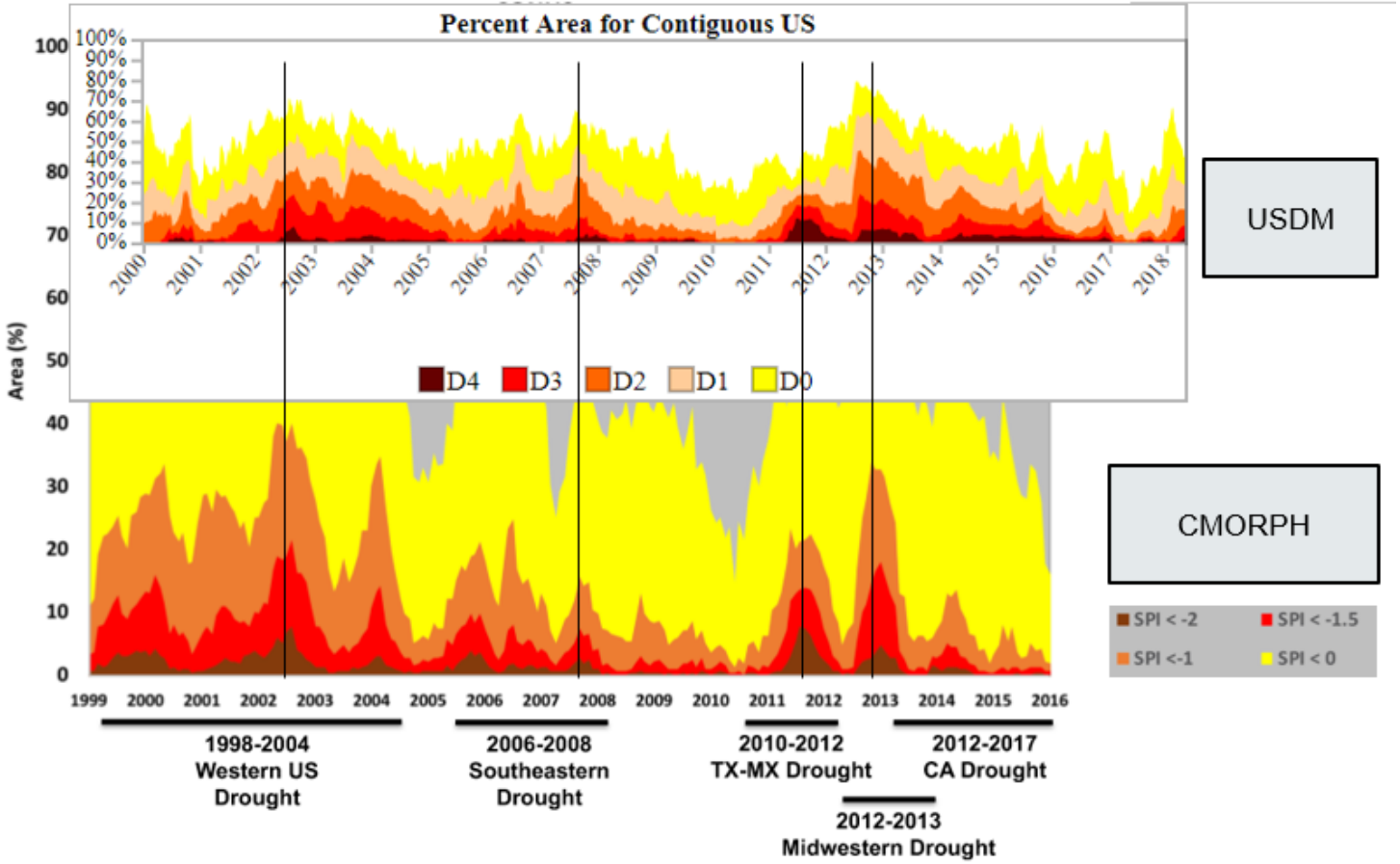
Data Integration: Drought Indices from cMORPH

- Why?
  - Fast updates support global drought monitoring
  - Monthly and Daily precipitation totals
  - Product based on ‘Gold-Standard’ operational dataset at NOAA NCEI and CPC.
  - Application of Python Climate Indices to a large, gridded, global dataset.

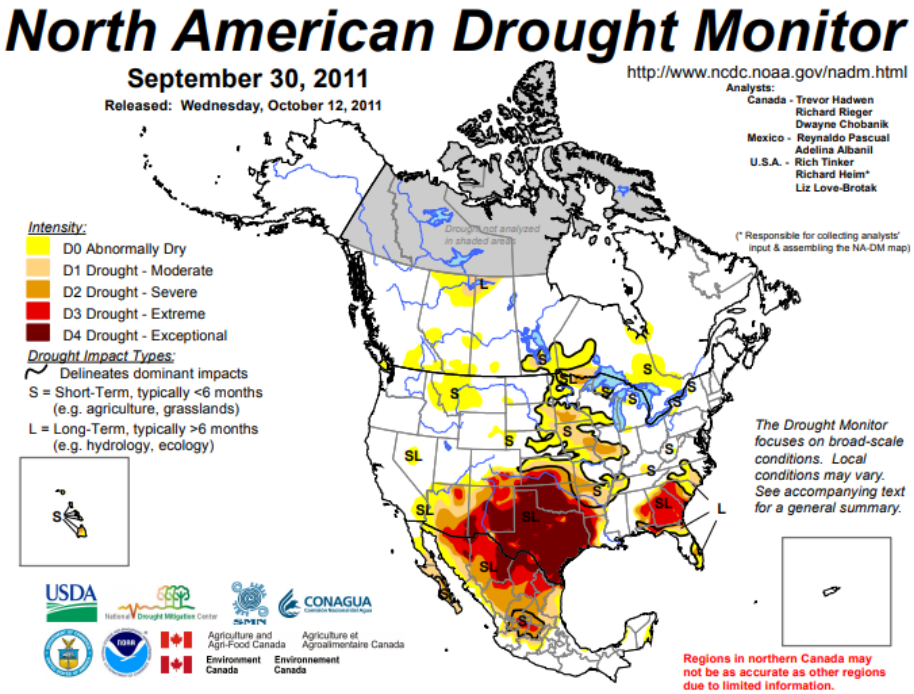
Data Integration: Drought Indices from cMORPH

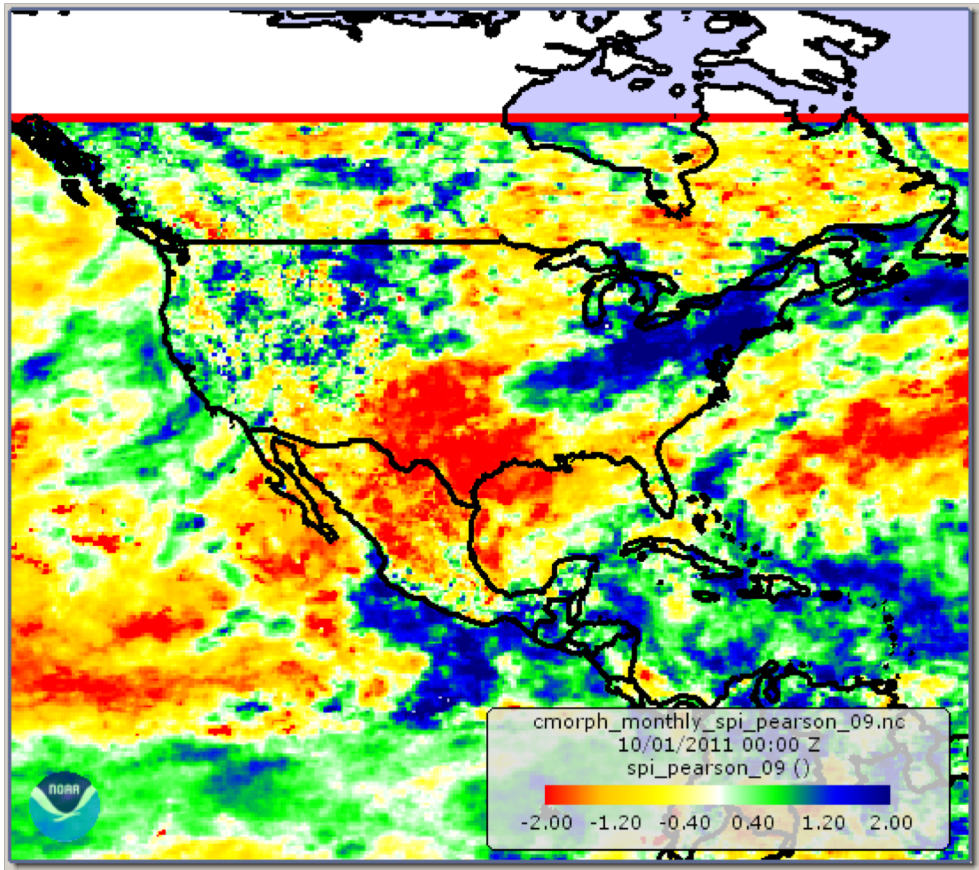


Data Integration: Drought Indices from cMORPH

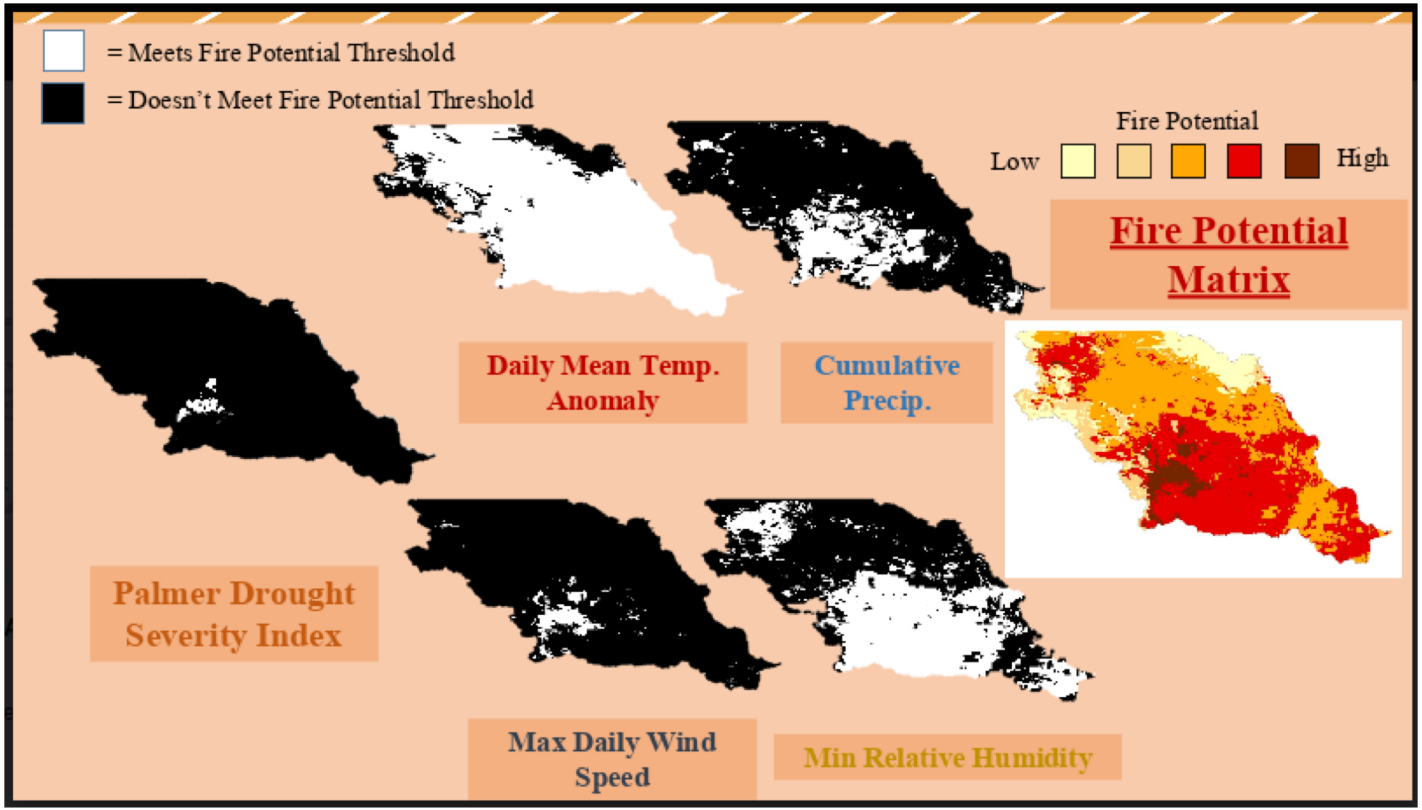


Data Integration: Drought Indices from cMORPH

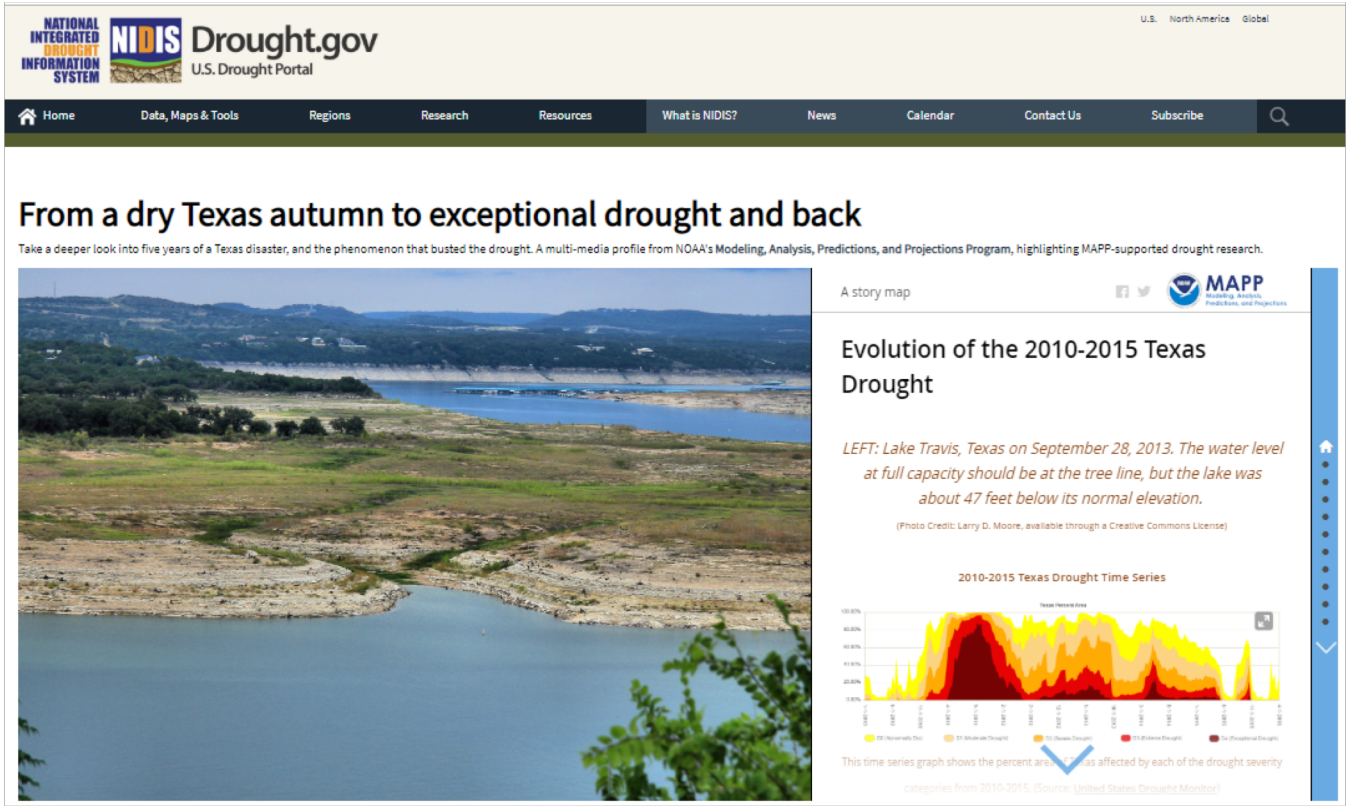




NASA DEVELOP support



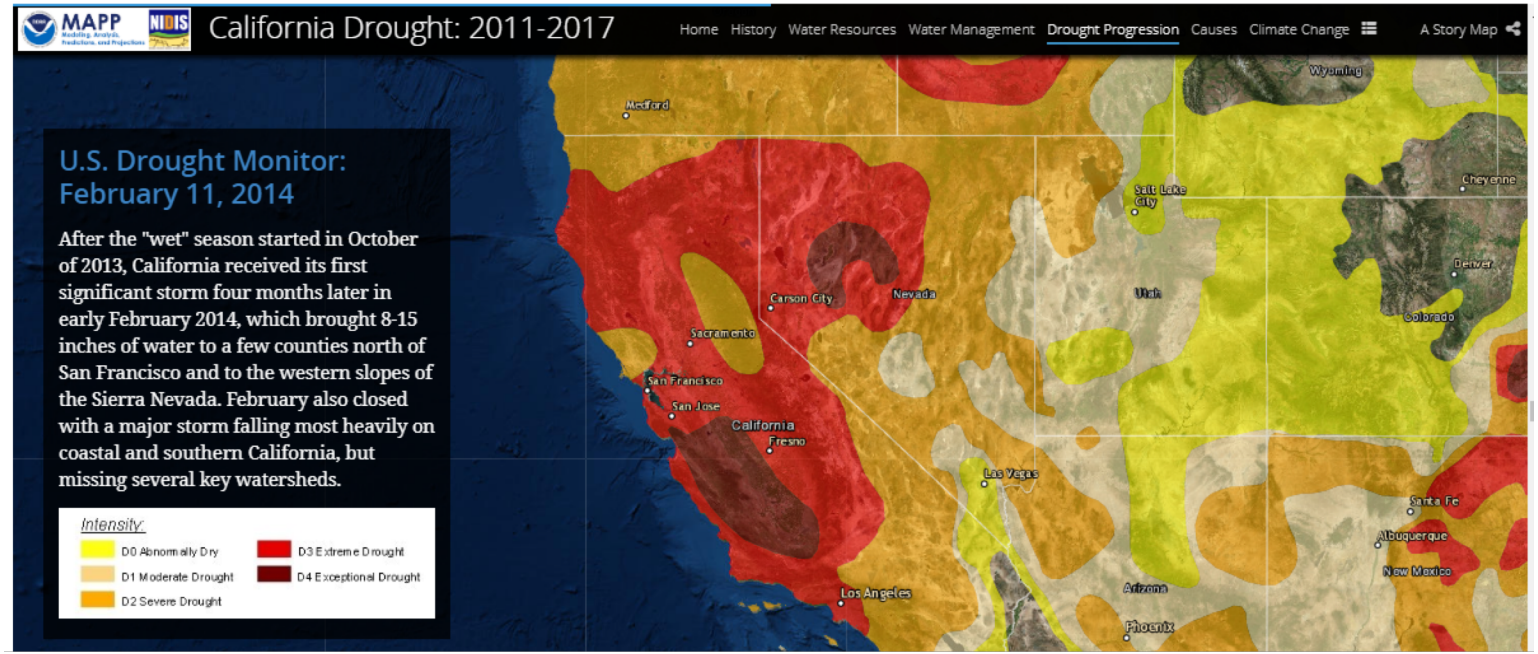
ArcGIS Online - StoryMap



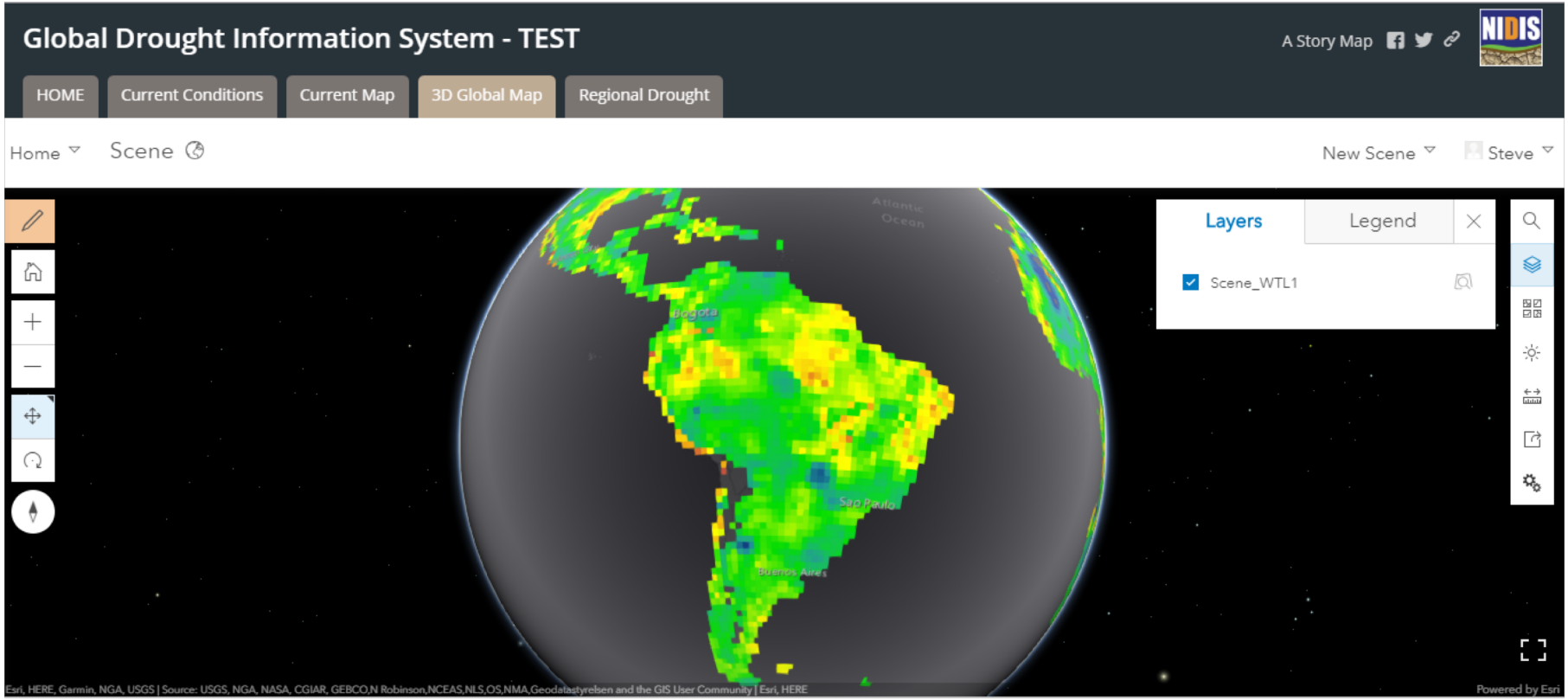
ArcGIS Online - StoryMap

California is no stranger to dry conditions, but the drought from 2011-2017 was exceptional

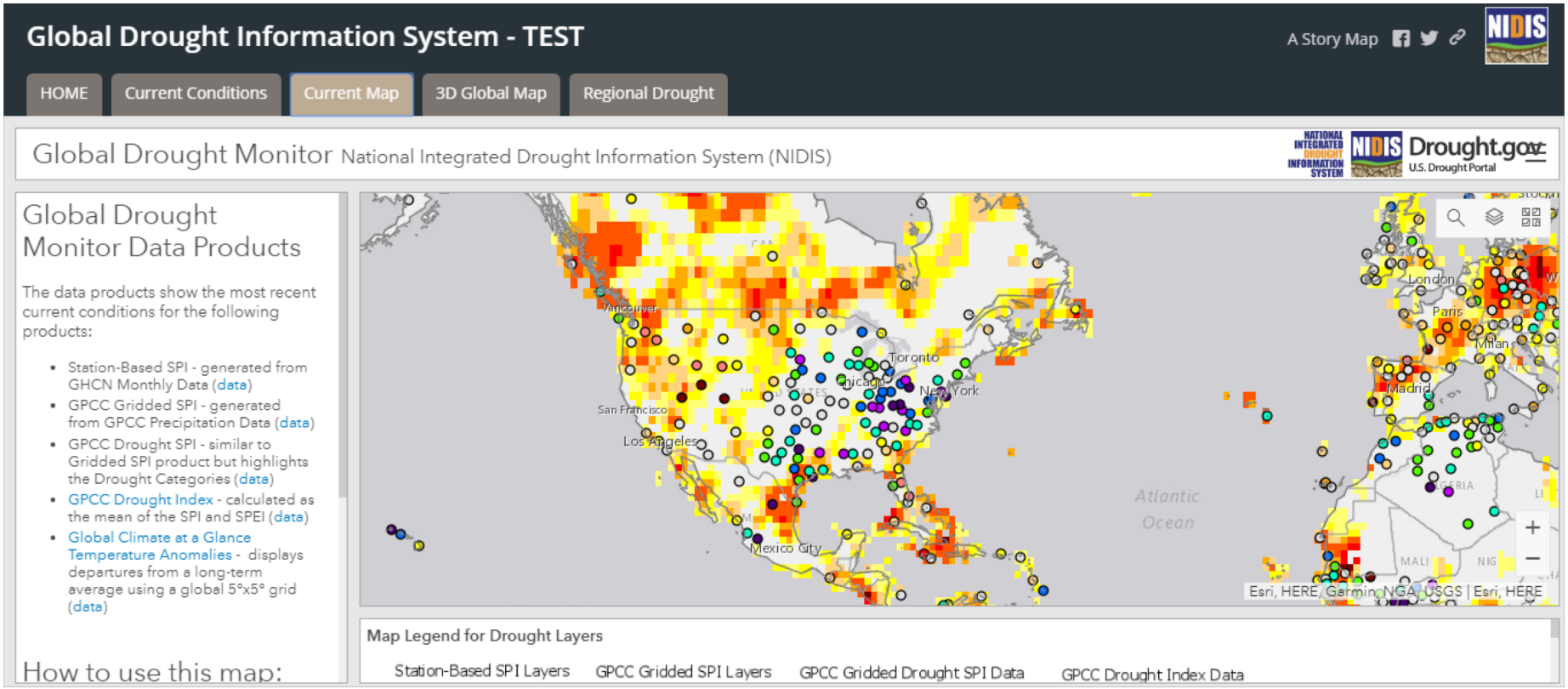
How did the 2011-2017 drought fit within California's history? This story map will address this question, as well as describe the evolution of the drought, its complex causes, and implications for the future. This story map is the product of a collaboration between NOAA's **Modeling, Analysis, Predictions, and Projections Program** (MAPP) and NIDIS.



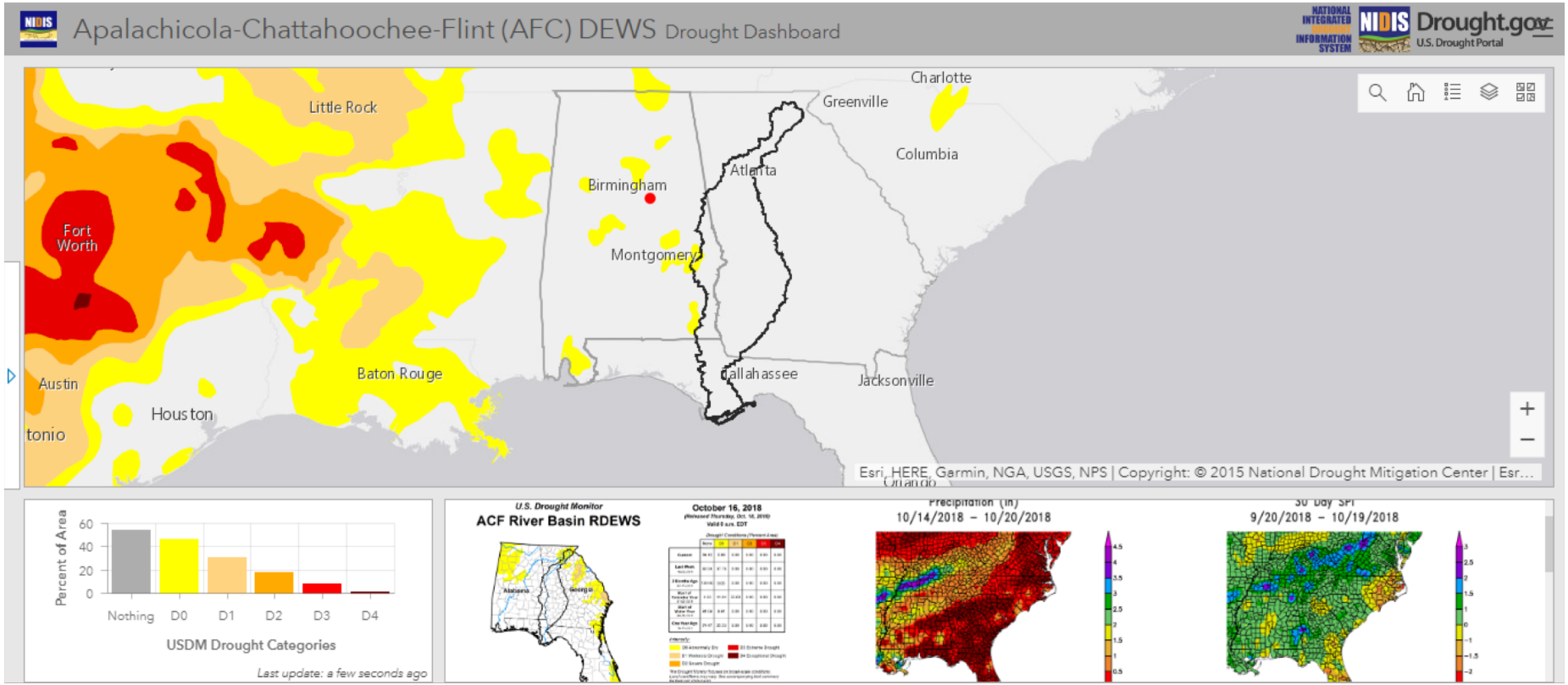
ArcGIS Online - StoryMap



ArcGIS Online - StoryMap



ArcGIS Online - Ops Dashboard



Conclusion

- Diversify, simplify, focus on portibility
- Constantly evolve
- GIS is integrated in our content – NOT just a separate system or tool
- ESRI StoryMaps and OpsDashboard are compelling tools for rapid development, focused dashboards for specific stakeholders and/or prototyping
- Focus on usability, through accessibility and performance

Thank You!
Questions?

Steve.Ansari@noaa.gov

Steve Ansari [1], Kathryn Bevington [2], Rocky Bilotta [3], Nancie McCraw [3], Andrew Stowell [3]

[1] NOAA NCEI / NIDIS Drought.gov
[2] CIRES
[3] ERT, INC

NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

NIDIS Drought.gov