Drought.gov
GIS Efforts

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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 😞

ArcGIS REST Services Directory

Home > services > nidis

JSON | SOAP

Folder: nidis
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:
**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)
Advancing Drought Science and Preparedness across the Nation

How is Drought Affecting your Neighborhood?
Enter your city or zip code for current conditions

Get Conditions

Where is drought this week?
October 10-16, 2018

20.5% of the US land area.

46.1 million people are experiencing drought.
Advancing Drought Science and Preparedness across the Nation

How is Drought Affecting your Neighborhood?

Current Conditions for Santa Barbara, California (Santa Barbara County)
Precip Total - Last 7 days | 0 in.
Average High Temp - Last 7 days | 86.86 °F
Report your drought impacts

Severe

here is drought is week? 20.5% 46.1 million

California Conditions
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 U.S. 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%
D0-04

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

8.8% of U.S.
20.4%
D1-04

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

7.5% of U.S.
11.6%
D2-04

**D3 - Exceptional Drought**
- Major crop/pasture losses
- Widespread water shortages or restrictions

3% of U.S.
4.1%
D3-04

**D4 - Exceptional Drought**
- Exceptional and widespread crop/pasture losses
- Shortages of water creating water emergencies

1.1% of U.S.
The drought outlook through January 2019.

The Climate Prediction Center’s (CPC) Seasonal Drought Outlook is issued monthly on the third Thursday of each month. The outlook predicts whether drought will emerge, stay the same or get better in the next three months, based on the U.S. Drought Monitor conditions when the outlook was released on October 18, 2018.

Learn more about the US Seasonal Drought Outlook

**Drought persists**
Drought present on October 18, 2018 is expected to continue through January 2019.

11.2% of U.S.

**Drought remains but improves**
Drought present on October 18, 2018 is expected to continue, but improve through January 2019.

5.5% of U.S.

**Drought removal likely**
Drought present on October 18, 2018 is expected to be removed from the map by the end of January 2019.

4.1% of U.S.

**Drought development likely**
Abnormally dry conditions on October 18, 2018 are expected to intensify by the end of January 2019.

Error of U.S.
Drought in California

Residents in drought: 23,463,000
10,769,000 more in abnormally dry areas.

This is: 63%
of the state's population,
29% more in abnormally dry areas.

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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 D0-04

D1 - Moderate Drought
- Some damage to crops, pastures
- Some water shortages developing
- Voluntary water-use restrictions requested
25.1% of State D1-04

D2 - Severe Drought
- Crop or pasture loss likely
19.9% 22.8%
Drought in California

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10,769,000 more in abnormally dry areas.

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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 D0-D4

D1 - Moderate Drought
• Some damage to crops, pastures
• Some water shortages developing
• Voluntary water-use restrictions requested
25.1% of State D1-D4

D2 - Severe Drought
• Crop or pasture loss likely
19.9% D2-D4
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.
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
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

Last Month

Last Week

Current

Report Impact

Last Month

Current

Last Week

Last Month

Last Month

Last Week
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
Data Integration: Public Health

Drought and Social Vulnerability Index

![Drought Intensity Map](image1)
![Social Vulnerability Index Map](image2)
Data Integration: Public Health
Data Integration: Public Health
Data Integration: Drought Indices from cMORPH

Monthly SPI: 9-Month

Standardized Precipitation Index (Pearson Type III distribution), 9-month scale

Time: 1999-01-01 00:00

[Map showing standardized precipitation index values across the globe]
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

Standardized Precipitation Index (Gamma distribution), 90-day scale

The map illustrates the standardized precipitation index across the United States, with a gamma distribution and a 90-day scale. The color gradient ranges from deep red (drought) to deep blue (no drought), indicating varying levels of drought conditions across different regions.
Data Integration: Drought Indices from cMORPH
Data Integration: Drought Indices from cMORPH

North American Drought Monitor
September 30, 2011
http://www.ncdc.noaa.gov/nadm.html

Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:
- S = Short-Term, typically <6 months (e.g., agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g., hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text for a general summary.

Regions in northern Canada may not be as accurate as other regions due to limited information.
NASA DEVELOP support

Fire Potential Matrix

- Daily Mean Temp. Anomaly
- Cumulative Precip.
- Palmer Drought Severity Index
- Max Daily Wind Speed
- Min Relative Humidity

Legend:
- Light background = Meets Fire Potential Threshold
- Dark background = Doesn’t Meet Fire Potential Threshold

Fire Potential:
- Low
- Medium
- High
From a dry Texas autumn to exceptional drought and back

Take a deeper look into five years of a Texas disaster, and the phenomenon that busted the drought. A multi-media profile from NOAA's Modeling, Analysis, Predictions, and Projections Program, highlighting MAPP-supported drought research.

Evolution of the 2010-2015 Texas Drought

LEFT: Lake Travis, Texas on September 28, 2013. The water level at full capacity should be at the tree line, but the lake was about 47 feet below its normal elevation.

(PHOTO CREDIT: Larry D. Moore, available through a Creative Commons License)

2010-2015 Texas Drought Time Series

This time series graph shows the percent area of the state affected by each of the drought severity categories from 2010-2015. Images: "United States Drought Monitor"
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.


After the "wet" season started in October of 2013, California received its first significant storm four months later in early February 2014, which brought 8-15 inches of water to a few counties north of San Francisco and to the western slopes of the Sierra Nevada. February also closed with a major storm falling most heavily on coastal and southern California, but missing several key watersheds.
Global Drought Information System - TEST
Global Drought Information System - TEST

Global Drought Monitor Data Products

- Station-Based SPI - generated from GHCN Monthly Data (data)
- GPCC Gridded SPI - generated from GPCC Precipitation Data (data)
- GPCC Drought SPI - similar to Gridded SPI product but highlights the Drought Categories (data)
- GPCC Drought Index - calculated as the mean of the SPI and SPEI (data)
- Global Climate at a Glance Temperature Anomalies - displays departures from a long-term average using a global 5°x5° grid (data)

Map Legend for Drought Layers
- Station-Based SPI Layers
- GPCC Gridded SPI Layers
- GPCC Gridded Drought SPI Data
- GPCC Drought Index Data
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?
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