Drought and Water Usage in the USA

Drought means 'not enough water', true.
Drought is the Natural Disaster that stalks up silently.
BUT I was surprised that my initial understanding was WAY off the real meaning.

What do you know about Drought?
Follow along to see what I learned.

The data showed me that Georgia had more Drought than Arizona ... I was incredulous. Confused. Is the data wrong, I wondered?

Turns out the data was excellent, I needed to learn more about how and what Drought was.

This is about that journey and it is about finding ways to have enough water to live well now and in the future.

My hope is that together we will find solutions, innovations and ways to save and reuse water.
Water is Life, so my hope is that we will all have more life.

US Drought Data:

U.S. Drought Monitor: https://droughtmonitor.unl.edu
National Drought Mitigation Center (NDMC)

#DATA: https://droughtmonitor.unl.edu/Data/DataDownload/ComprehensiveStatistics.aspx
#ABOUT: https://droughtmonitor.unl.edu/About/AbouttheData/StatisticsExplanation.aspx

Produced weekly, however,
Limited to the range of the Water Usage Data (2011 – 2015)
Continental USA county level status by week

```
RangeIndex: 843378 entries, 0 to 843377
Data columns (total 12 columns):
 #   Column      Non-Null Count   Dtype
---  ------      --------------   -----
 0   MapDate_P   843378 non-null  int64
 1   FIPS        843378 non-null  int64
 2   County      843378 non-null  object
 3   State       843378 non-null  object
 4   None_P      843378 non-null  object
 5   D0_P        843378 non-null  object
 6   D1_P        843378 non-null  object
 7   D2_P        843378 non-null  object
 8   D3_P        843378 non-null  object
 9   D4_P        843378 non-null  object
 10  ValidStart  843378 non-null  object
 11  ValidEnd    843378 non-null  object
dtypes: int64(2), object(10)
```

Water Usage Data:

The U.S. Department of Agriculture (USDA)
Continental USA county level estimate sum (2011 -2015)

#https://water.usgs.gov/watuse/data/data2015.html
#Estimated Use of Water in the United States - County-Level Data for 2015
#Publication Date: 2017-09-28
#Citation: Dieter, C.A., Linsey, K.S., Caldwell, R.R., Harris, M.A., Ivahnenko, T.I., Lovelace, J.K., Maupin, M.A., and Barber, N.L., 2018, Estimated Use of Water in the United States County-Level Data for 2015 (ver. 2.0, June 2018): U.S. Geological Survey data release, https://doi.org/10.5066/F7TB15V5.

The data set was originally 124 Columns, 31 Columns used

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RangeIndex: 3223 entries, 0 to 3222
Data columns (total 31 columns):
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 0   STATE       3223 non-null   object
 1   COUNTY      3223 non-null   object
 2   FIPS        3223 non-null   int64
 3   TP-TotPop   3223 non-null   float64
 4   PS-Wtotl    3223 non-null   float64
 5   DO-PSDel    3223 non-null   float64
 6   DO-PSPCp    3219 non-null   float64
 7   DO-WDelv    3223 non-null   float64
 8   IN-Wtotl    3223 non-null   float64
 9   IR-WFrTo    3223 non-null   float64
 10  IR-IrTot    3223 non-null   float64
 11  IC-WFrTo    3223 non-null   object
 12  IC-IrTot    3223 non-null   object
 13  IG-WFrTo    3223 non-null   object
 14  IG-IrTot    3223 non-null   object
 15  LI-WFrTo    3223 non-null   float64
 16  AQ-Wtotl    3223 non-null   float64
 17  MI-Wtotl    3223 non-null   float64
 18  PT-Wtotl    3223 non-null   float64
 19  PT-RecWW    3223 non-null   object
 20  PT-PSDel    3223 non-null   object
 21  PT-CUTot    3223 non-null   float64
 22  PO-Wtotl    3223 non-null   float64
 23  PO-PSDel    3223 non-null   object
 24  PO-CUTot    3223 non-null   float64
 25  PC-Wtotl    3223 non-null   float64
 26  PC-PSDel    3223 non-null   object
 27  PC-CUTot    3223 non-null   float64
 28  TO-WGWTo    3223 non-null   float64
 29  TO-WSWTo    3223 non-null   float64
 30  TO-Wtotl    3223 non-null   float64
dtypes: float64(20), int64(1), object(10)
```

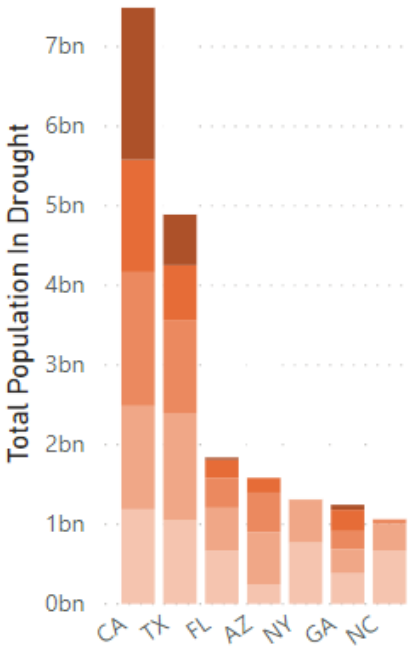
Drought and Water Usage in the USA

Executive Presentation

A World of Opportunity to the Research & Development **Innovators that Provide Technologies** aimed at **Drought Mitigation, Water-Saving and Water Reuse**

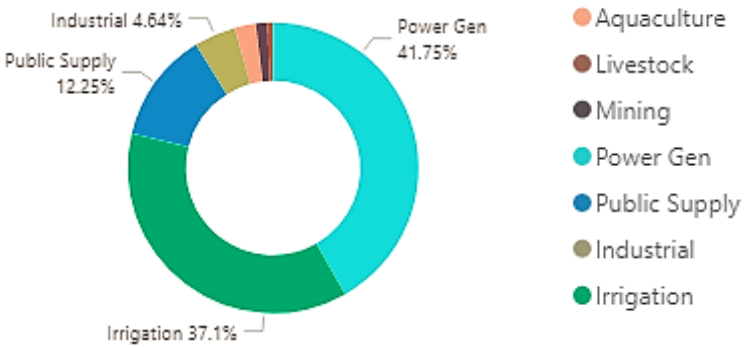
Population

Drought Levels by State



Between 2011 and 2015,
California had over **7 Billion People** experiencing Drought.
Texas had **50 Million Acres** in drought.

5-year Estimate shows **79**% is:
Power Generation and **Irrigation**
Public Water Supply is only
12% of Total Water Use



Total US Water Usage **percent of whole**

Quantify: What if we could save only 5% of our water?

What Ideas Do You Have to **Develop and Provide** Ways to **Save and Reuse Water?**

Total US Water Usage

Est. Water Usage Million Gal/day

		5%
Livestock	2.00K	of **2,000** mgd = 100 mgd
Mining	4.00K	of **4,000** mgd = 200 mgd
Aquacult...	7.55K	of **7,550** mgd = 378 mgd
Industrial	14.79K	**14,790** mgd = 740 mgd
Public Su...	39.00K	**39,000** mgd = 1,950 mgd
Irrigation	118.13K	**118,130** mgd = 5,907 mgd
Power Gen	132.94K	**132,940** mgd = 6,647 mgd

15,922

Million Gallons/Day = mgd

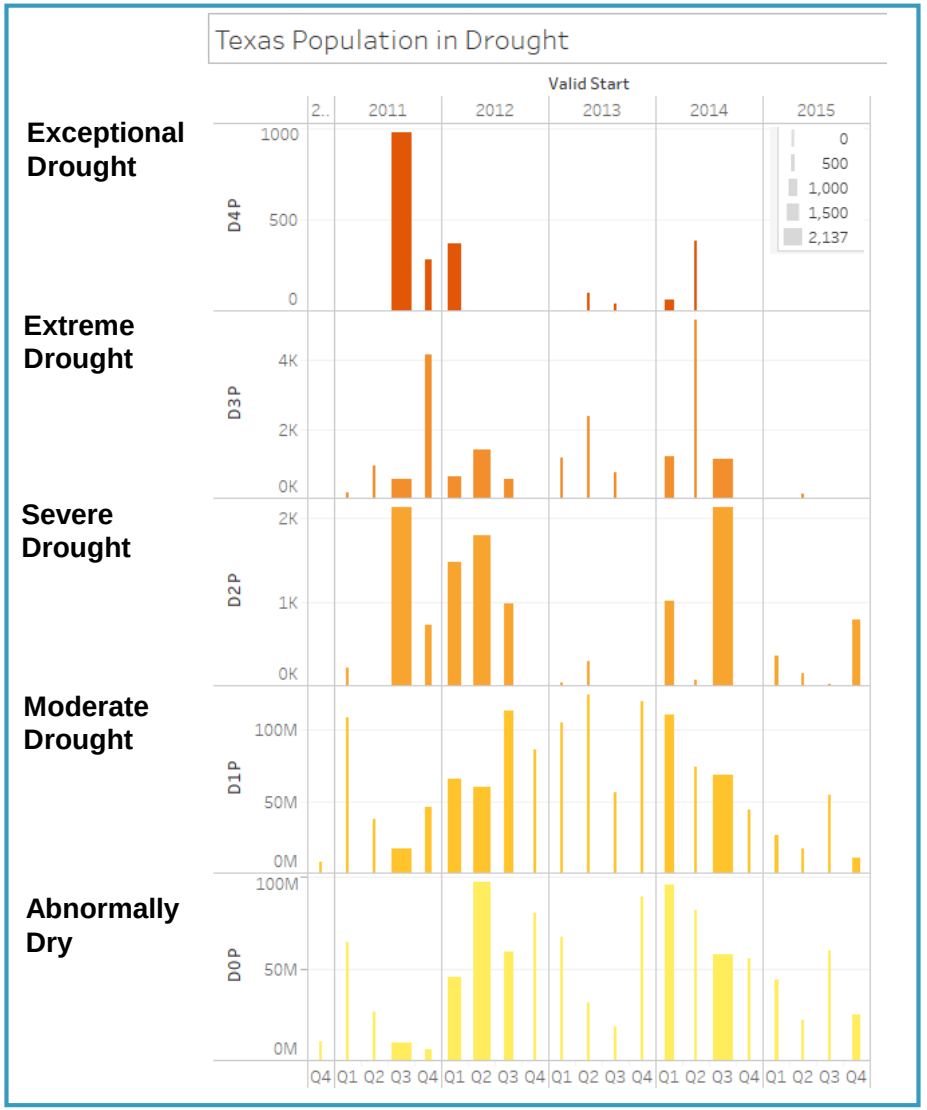
1-Million-Gallon Water-Tank

Drought is a natural disaster that creeps in quietly.

Drought is not a measure of aridity.
It is more about a **lack** of regular **sustaining moisture levels** according to each region's normal environment.

When we think of Drought,
we think of Failed Crops
or Thirsty Livestock
or Forest Fires…

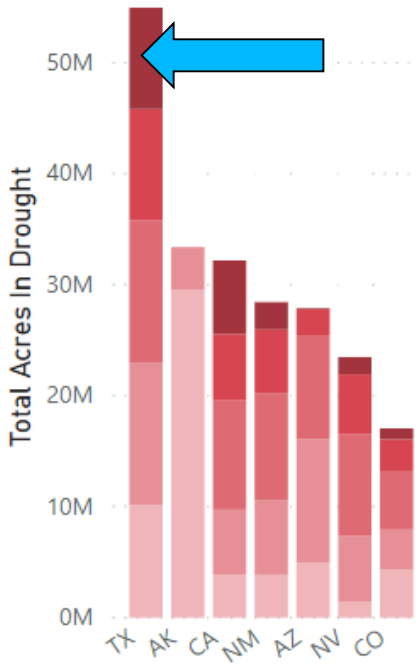
There are a lot of resources aimed at how to predict drought & rise awareness with quality data provided to the public.

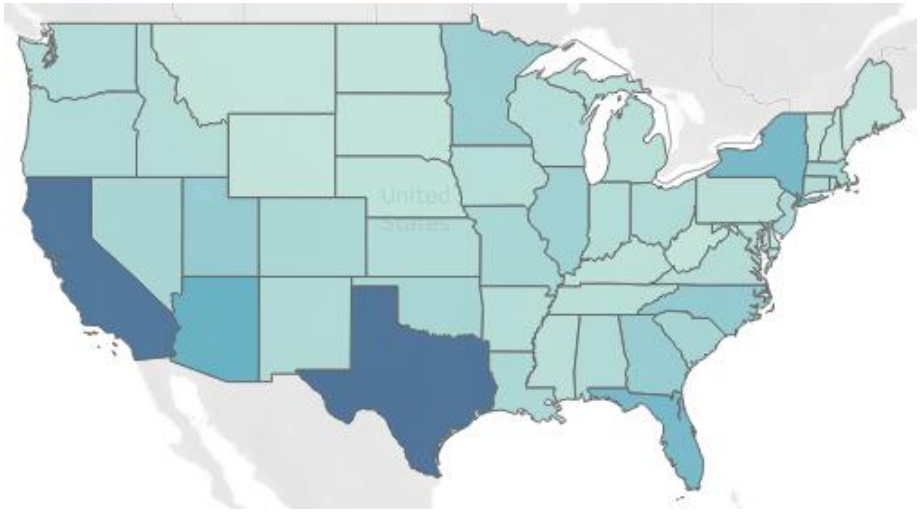


U.S. Drought Monitor: https://droughtmonitor.unl.edu
National Drought Mitigation Center (NDMC)
National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Agriculture (USDA)

Where in the USA has most Drought?

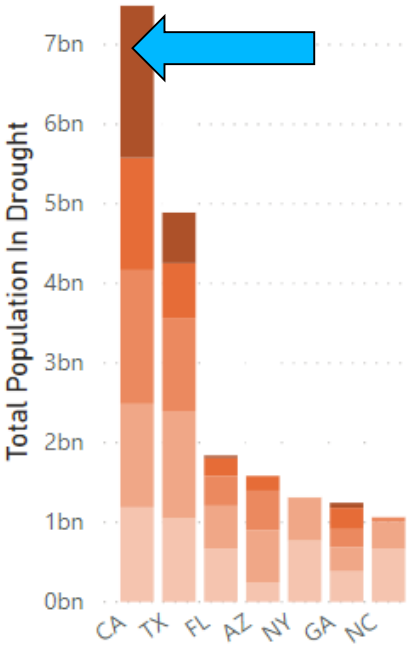
Area
Drought Levels by State





California has the most People experiencing Drought.
Texas has a large population in drought, but also by far the most land in drought.

Population
Drought Levels by State



50m Acres in TX in Drought; 7 bn People in CA in Drought

Drought and Water Usage in the USA

Non-Technical Presentation

Capstone 2 – Slide Deck Outline – NonTechnical

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we think of Failed Crops
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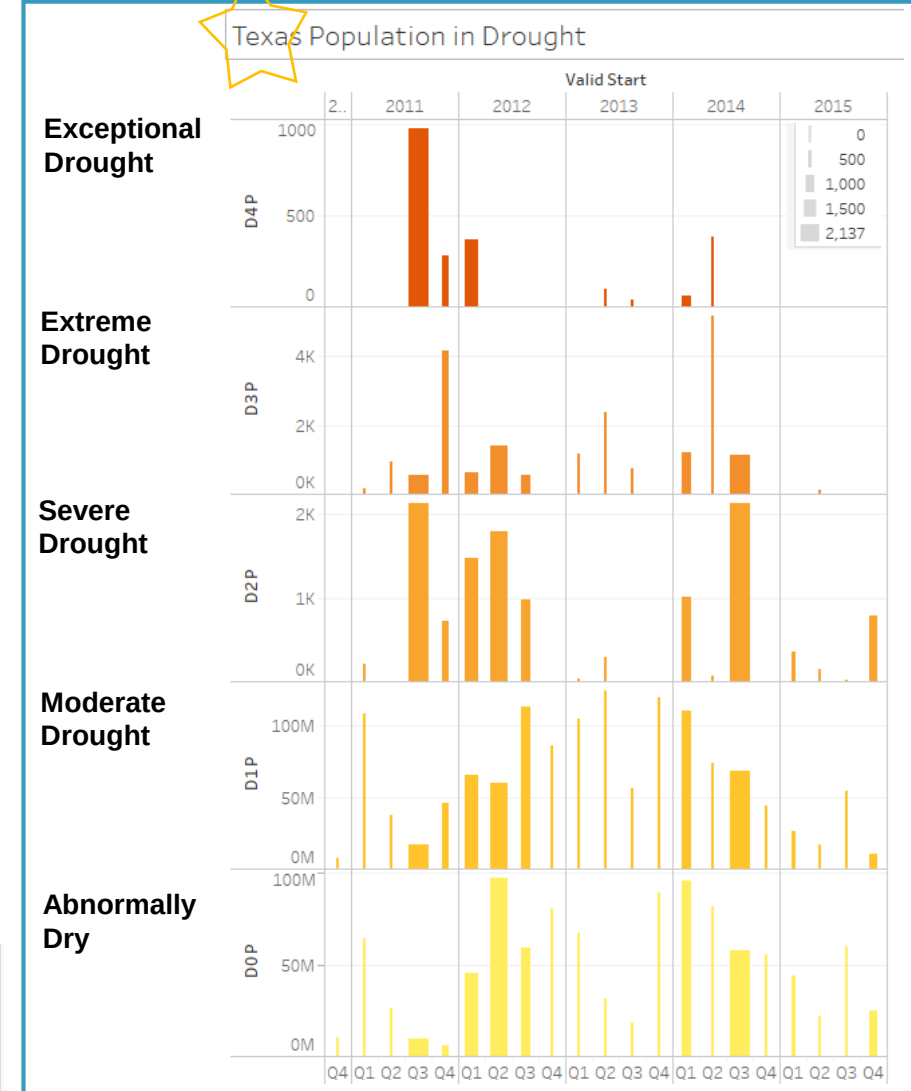
or Forest Fires…



Capstone 2 – Slide Deck Outline – NonTechnical

Water availability is an issue in the USA, not just far away

Reliable **access to**
sources of clean water
is increasingly the **divide** between the
affluent and **poor** as well as
a measure of one's **security**.

Palm Springs

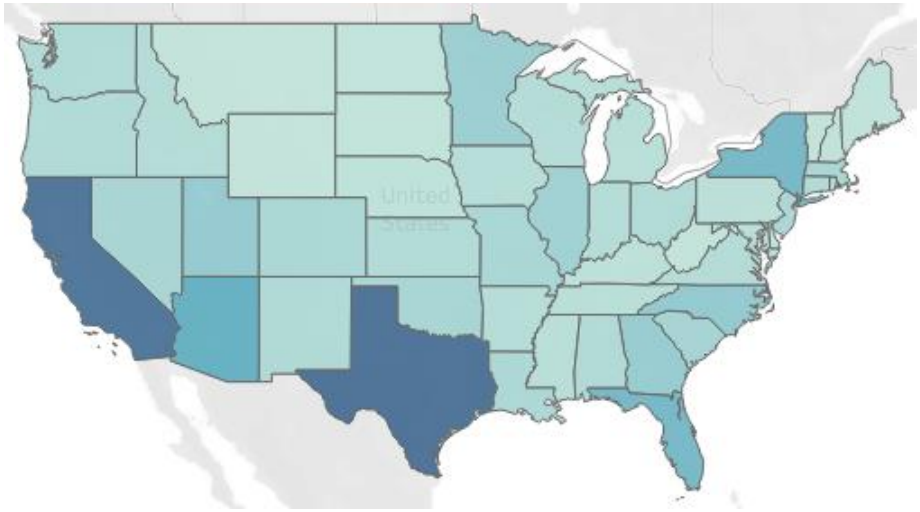
South Sudan

South Dakota

West Virginia

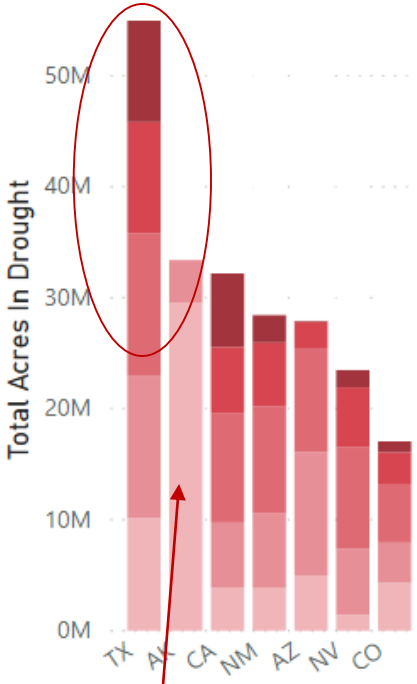
Capstone 2 – Slide Deck Outline – NonTechnical

Where in the USA has most Drought?



Area

Drought Levels by State



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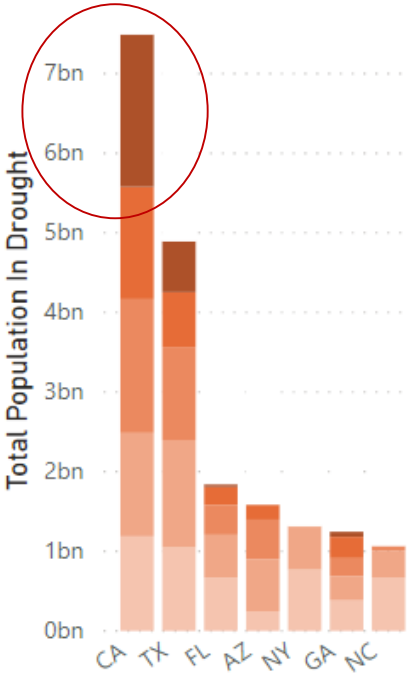
Drought Levels by State



California has the most People experiencing Drought. Texas has a large population in drought, but also by far the most land in drought.

AK is "Abnormally Dry" Where other states are showing Severe to Exceptional Drought

Capstone 2 – Slide Deck Outline – NonTechnical

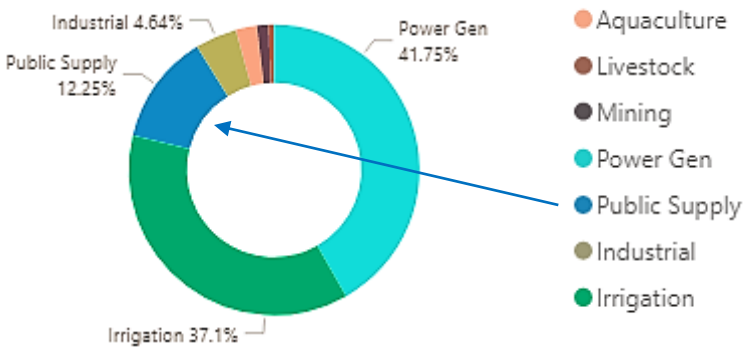
Public Water Supply is only 12% of Total Water Use

Develop and Provide Ways to Save and Reuse Water is:

Good for the Earth,
Good for People,
for Crops,
for Animals,
Good for All.

Where Does most of the water go?

5-year Estimate shows **79**% is:
Power Generation and **Irrigation**



Total US Water Usage percent of whole

Hint: Your County/City may have a chart unique from this one

Capstone 2 – Slide Deck Outline – NonTechnical

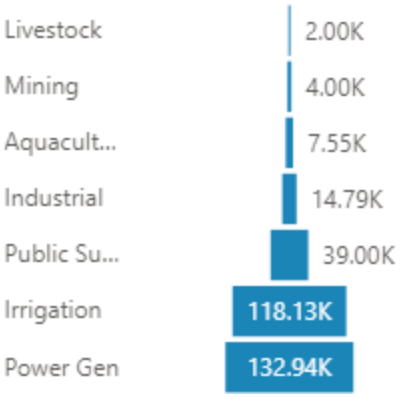
If we could save only 5% of our water usage, How much is that?

What Ideas Do You Have to **Develop and Provide** Ways to **Save and Reuse Water?**

1-Million-Gallon Water-Tank

Total US Water Usage

Est. Water Usage Million Gal/day



5% is:

of 2,000 mgd = 100 mgd

of 4,000 mgd = 200 mgd

of 7,550 mgd = 378 mgd

14,790 mgd = 740 mgd

39,000 mgd = 1,950 mgd

118,130 mgd = 5,907 mgd

132,940 mgd = 6,647 mgd

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Drought and Water Usage in the USA

Technical Presentation

Capstone 2 – Slide Deck Outline – Technical

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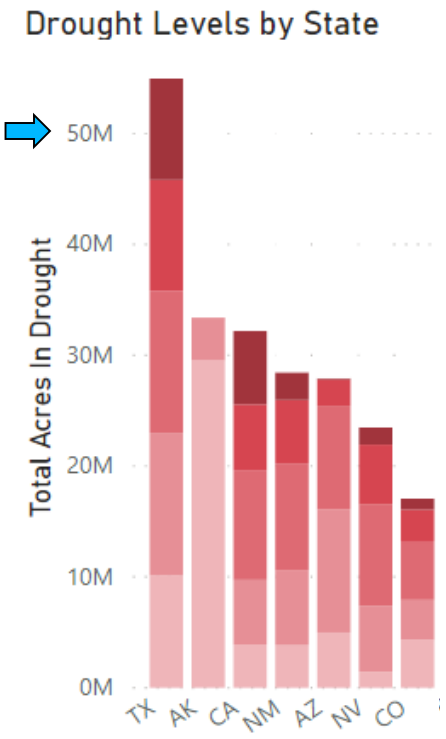
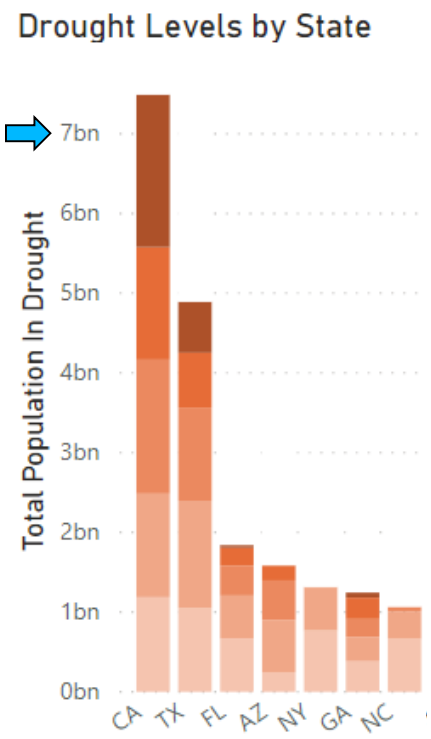
There are a lot of resources aimed at how to predict drought & rise awareness with **Quality Data** provided to the public.

The US Drought Monitor keeps great stats and provides a Weekly report of Drought levels by State and County.

California & Texas lead over more arid states like Arizona and Nevada.





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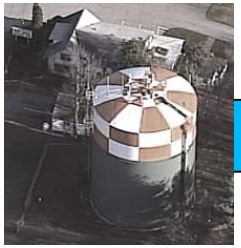
Capstone 2 – Slide Deck Outline – Technical

Saving Water May Help Drought Stressed Areas

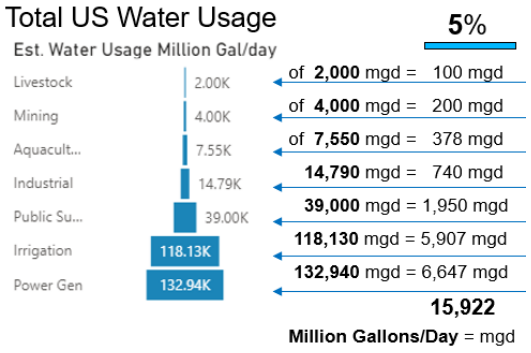
Discovery & **Development of** technologies
to **Save and Reuse Water**
Is essential to a Future that
Includes **Devastating Drought**

Only 5% Water Savings is:



1-Million-Gallon Water-Tank

✖ 15,922 every day



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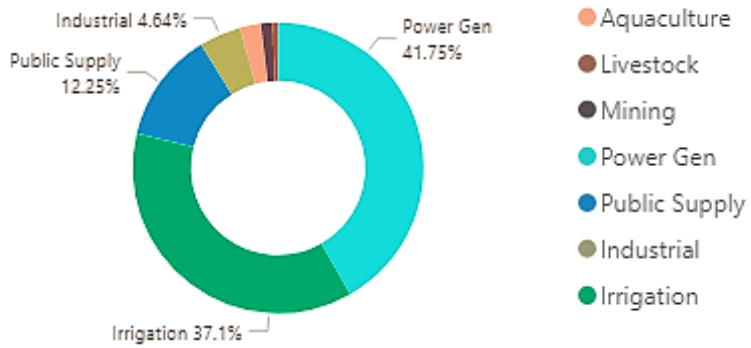


Total US Water Usage **percent of whole**

Hint: Your County/City may have a chart unique from this one …

github.com/CHegler/Drought-WaterUse

Capstone 2 – Slide Deck Outline – Technical

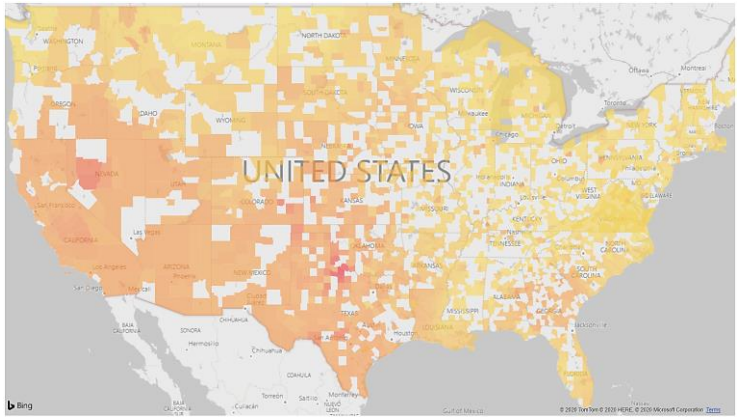
Drought is Hard to Quantify Simply – Hard to Spot

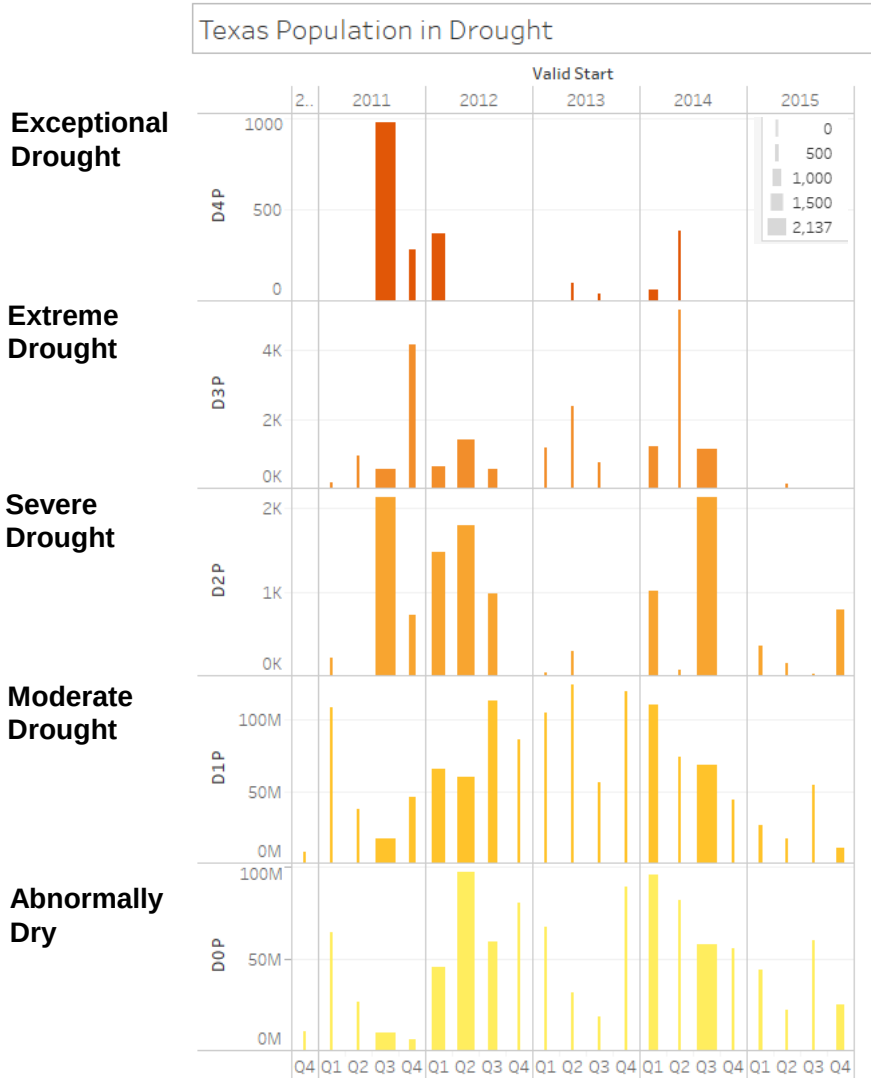
To the Right:

Drought History
for Texas 2011 – 2015
By severity level

Below:

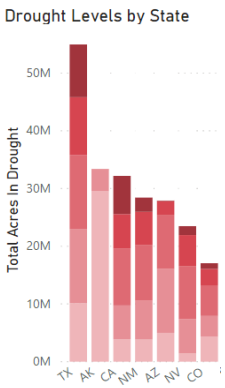
Map for Continental US
With a synthesized Metric
to show the Drought Severity
An easier visual to read…





Capstone 2 – Slide Deck Outline – Technical

Complex Drought Data Simplified



D0 Abnormally Dry

D1 Moderate Drought

D2 Severe Drought

D3 Extreme Drought

D4 Exceptional Drought

A Simple Metric

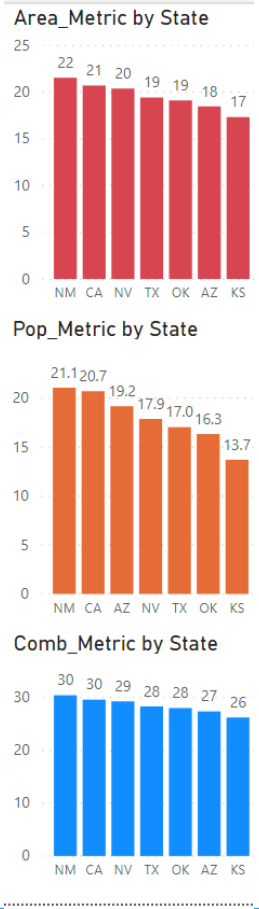
RankTAC can be charted against any other variable to dig deeper.

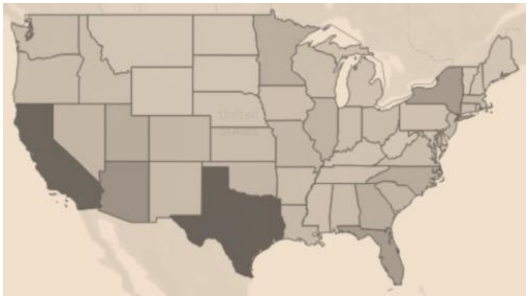
The resulting RankTAC creates a number **between 0 and 40** based on the percentage affected and the severity of drought.

##Rank for AREA in Drought
Sum (None + D0 + D1 + D2 + D3 + D4 + D5) = TAC 'Total Acres in County'
"None_A","D0_A","D1_A","D2_A","D3_A","D4_A"
Rank Steps: [where a=1, b=8]
None*a = tac0
D0*(tac0+b)=tac1
D1*(tac1+b)=tac2
D2*(tac2+b)=tac3
D3*(tac3+b)=tac4
D4*(tac4+b)=tac5
Sum ((tac0 + tac1 + tac2 + tac3 + tac4 + tac5)/TAC) = RankTAC

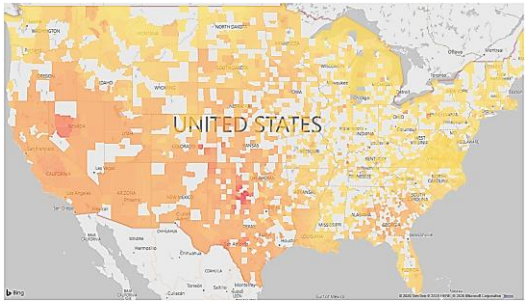
The Metric Balanced Area and Severity, Saw Consistent Results

The Top 6: NM, CA, NV, TX, OK, KS





Drought Grouped & Summed by State



Gradient based on Metric of Drought Levels

Capstone 2 – Slide Deck Outline – Technical

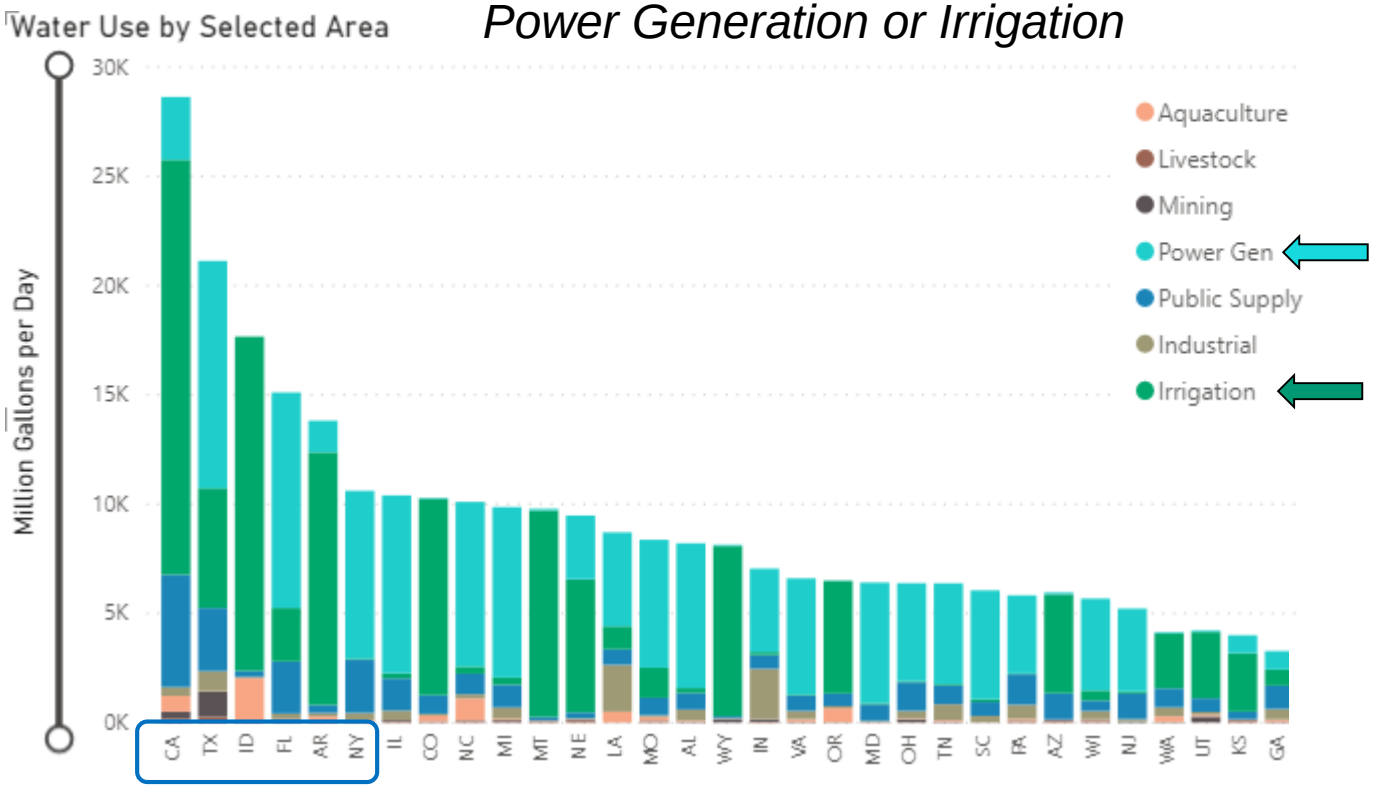
Strategic Focal Points for Drought Mitigation

Before Examining the Data the assumption was that Public Supply was the biggest Draw on Water Resources.

Water use in the 19 States Hit hardest by Drought

A water usage pattern is clear

Power Generation or Irrigation



Drought and Water Usage in the USA

Invitation to Participate

github.com/CHegler/Drought-WaterUse