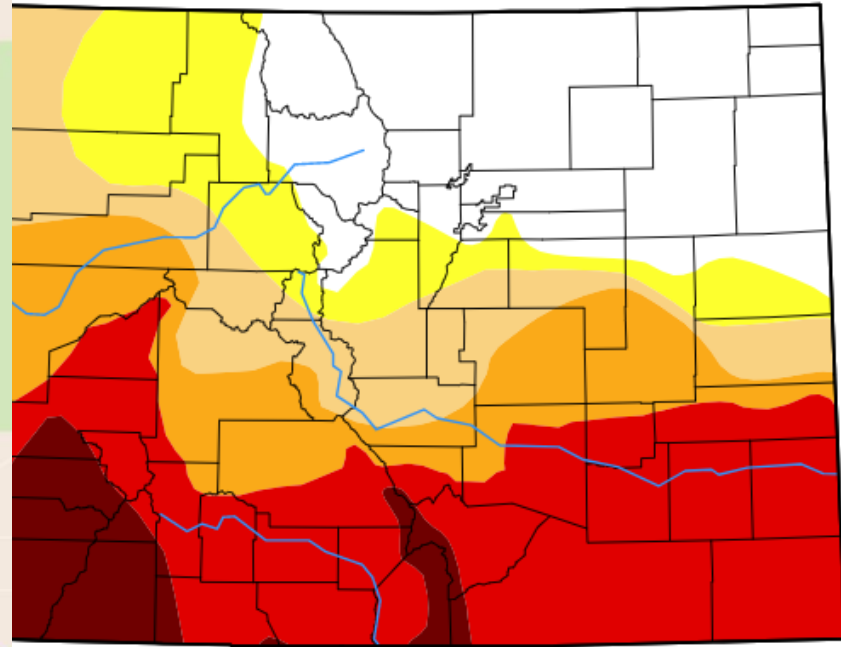
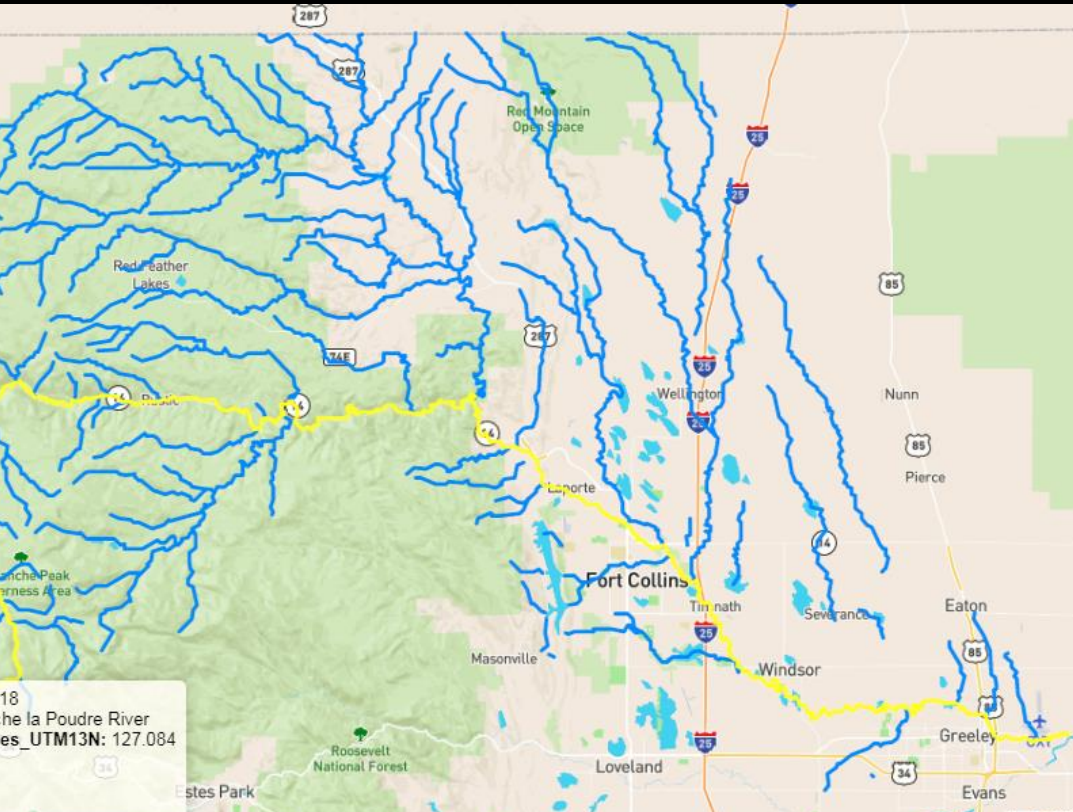


# Colorado WaterWise Open Source Resources

June 14, 2018



Steve Malers, Open Water Foundation  
[steve.malers@openwaterfoundation.org](mailto:steve.malers@openwaterfoundation.org)  
[www.openwaterfoundation.org](http://www.openwaterfoundation.org)

# Open Water Foundation

Social enterprise 501(c)3 nonprofit focusing on developing open source software and open data tools to help make better decisions about water resources. Water is a public resource, and water data and software tools should also be public.

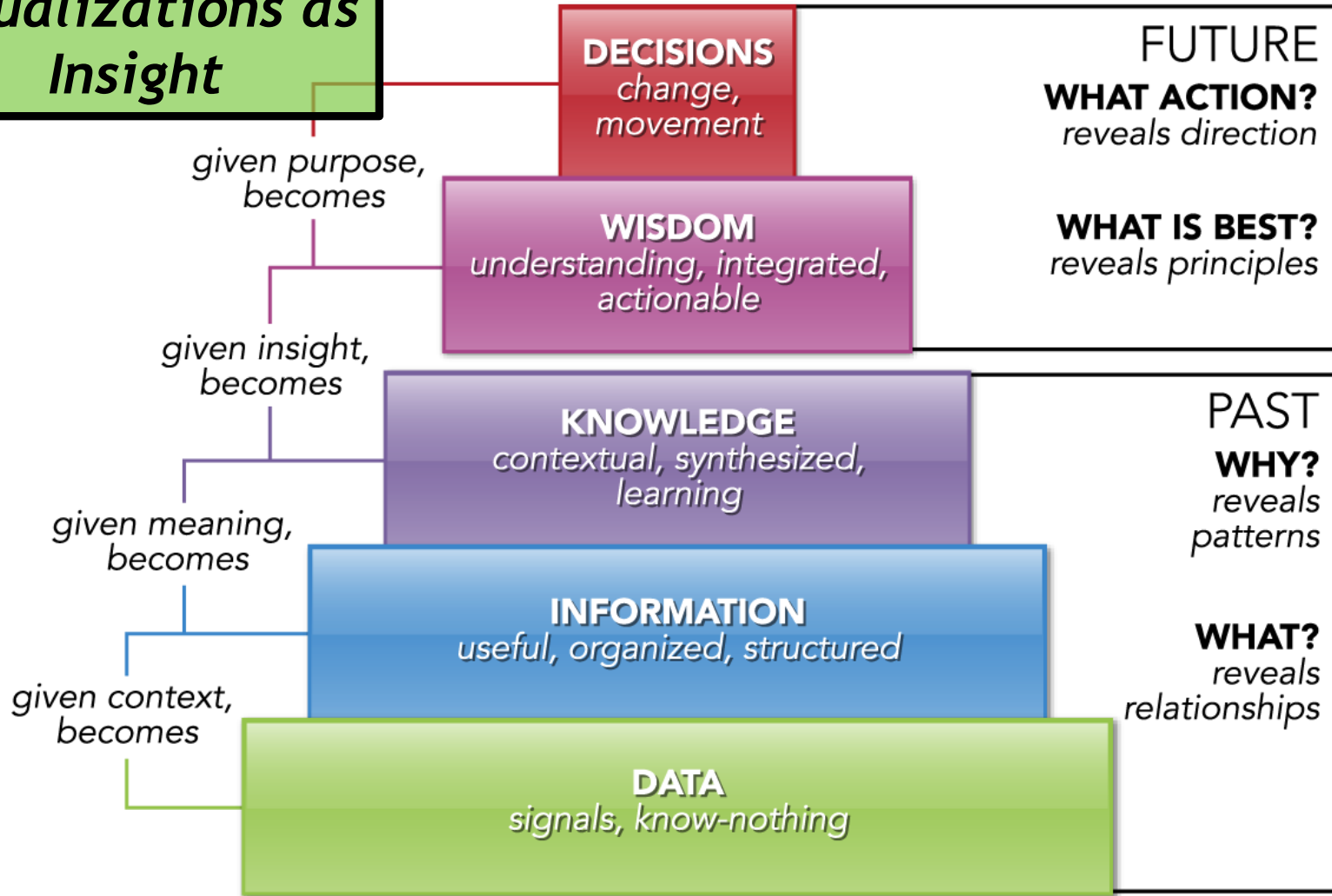


**open data | open software | open decisions**

[openwaterfoundation.org](http://openwaterfoundation.org)

# Open Data as Infrastructure for Innovation

**Visualizations as  
Insight**



**Data as Infrastructure**

# Open Collaboration



[open data](#) | [open software](#) | [open decisions](#)

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- [Software Tools](#) ▾
- [For Software Developers](#)
- [Resources](#) ▾



**Open Water Foundation**  
Open data. Open software. Open decisions.



Data



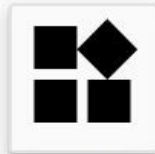
Visualizations



Stories



Learn



Models



Projects



Software

**Contact Us:**

970.286.7439 / [info@openwaterfoundation.org](mailto:info@openwaterfoundation.org)

**Address:**

320 E. Vine Drive, Suite 203 / Fort Collins, CO 80524



[Donate](#)



# Colorado WaterWise

The mission of Colorado WaterWise is to connect stakeholders, provide resources, and serve as the collaborative leader in efficient use of urban water in Colorado.

colorado  
waterwise

The logo for Colorado WaterWise features the word "colorado" in a black, lowercase, sans-serif font. Below it, the word "waterwise" is written in a blue, lowercase, sans-serif font. A graphic of three concentric blue circles, resembling a ripple in water, is positioned behind the "water" portion of the text.

# Context - Climate Change



## Latest

## Related

NASA Pinpoints Cause of Earth's Recent Record Carbon Dioxide Spike  
*3 months ago*

NASA, NOAA Data Show 2016 Warmest Year on Record Globally  
*a year ago*

NASA, NOAA to Announce 2016 Global Temperatures, Climate Conditions  
*a year ago*

NASA Plans Another Busy Year for Earth Science Fieldwork  
*a year ago*

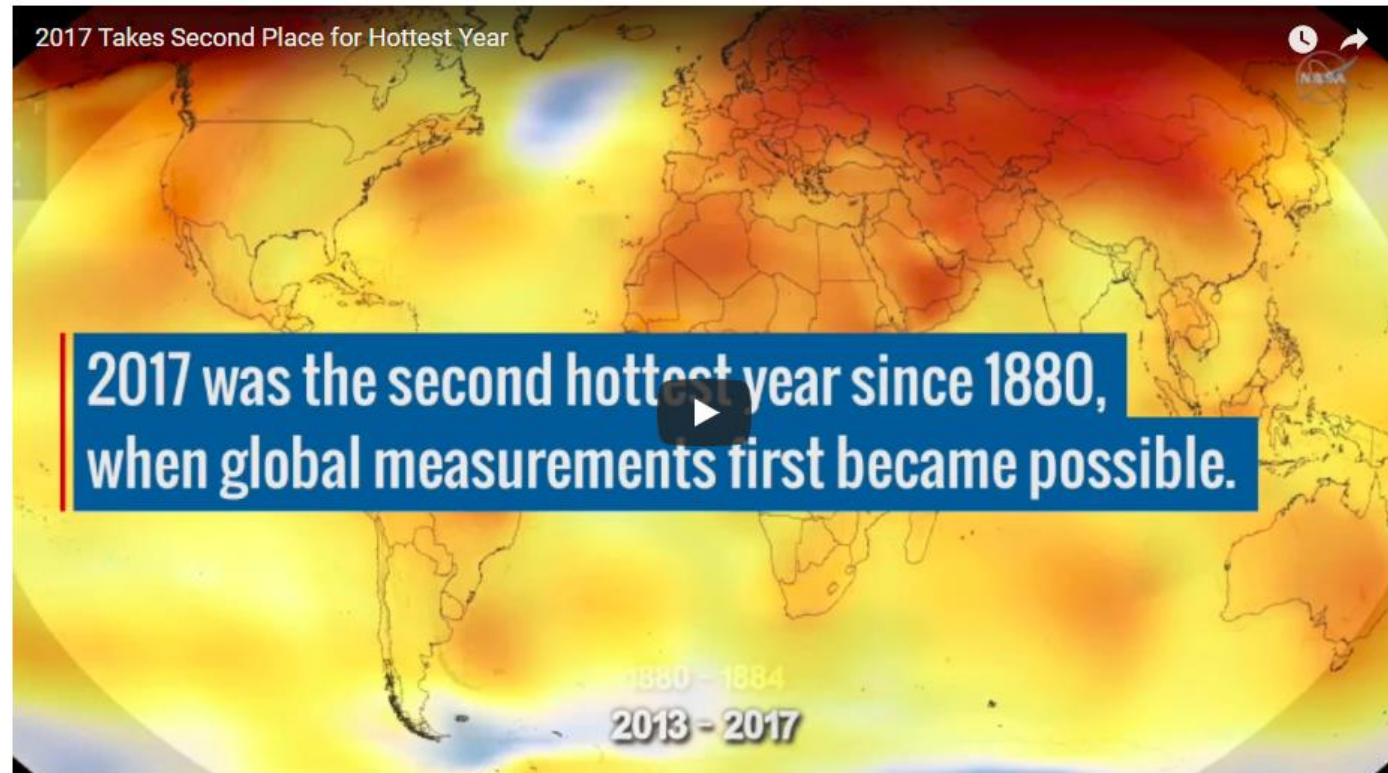
NASA Successfully Launches NOAA Advanced Geostationary Weather Satellite  
*a year ago*

From NYC to Rio: NASA Helps Cities Address Climate Risks  
*a year ago*

## Climate

Jan. 18, 2018  
RELEASE 18-003

## Long-Term Warming Trend Continued in 2017: NASA, NOAA



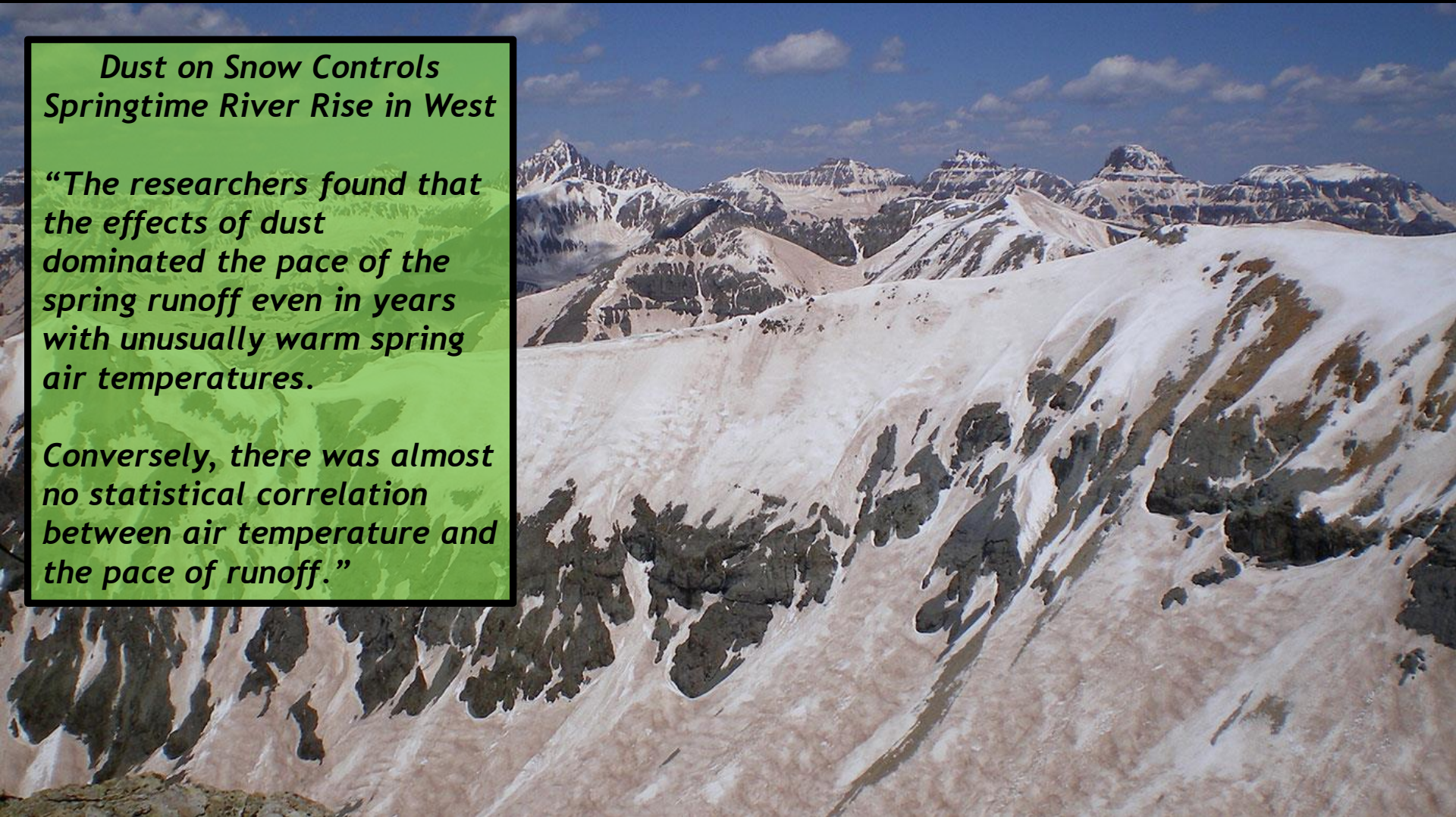


# Context - Dust on Snow

## *Dust on Snow Controls Springtime River Rise in West*

*“The researchers found that the effects of dust dominated the pace of the spring runoff even in years with unusually warm spring air temperatures.*

*Conversely, there was almost no statistical correlation between air temperature and the pace of runoff.”*



<https://www.jpl.nasa.gov/news/dust-on-snow-controls-springtime-river-rise-in-west>

Photo credit: NASA



# Context - World Risks

“Climate and tech pose the biggest risks to our world in 2018”



World Economic Forum:

<https://www.weforum.org/agenda/2018/01/the-biggest-risks-in-2018-will-be-environmental-and-technological>

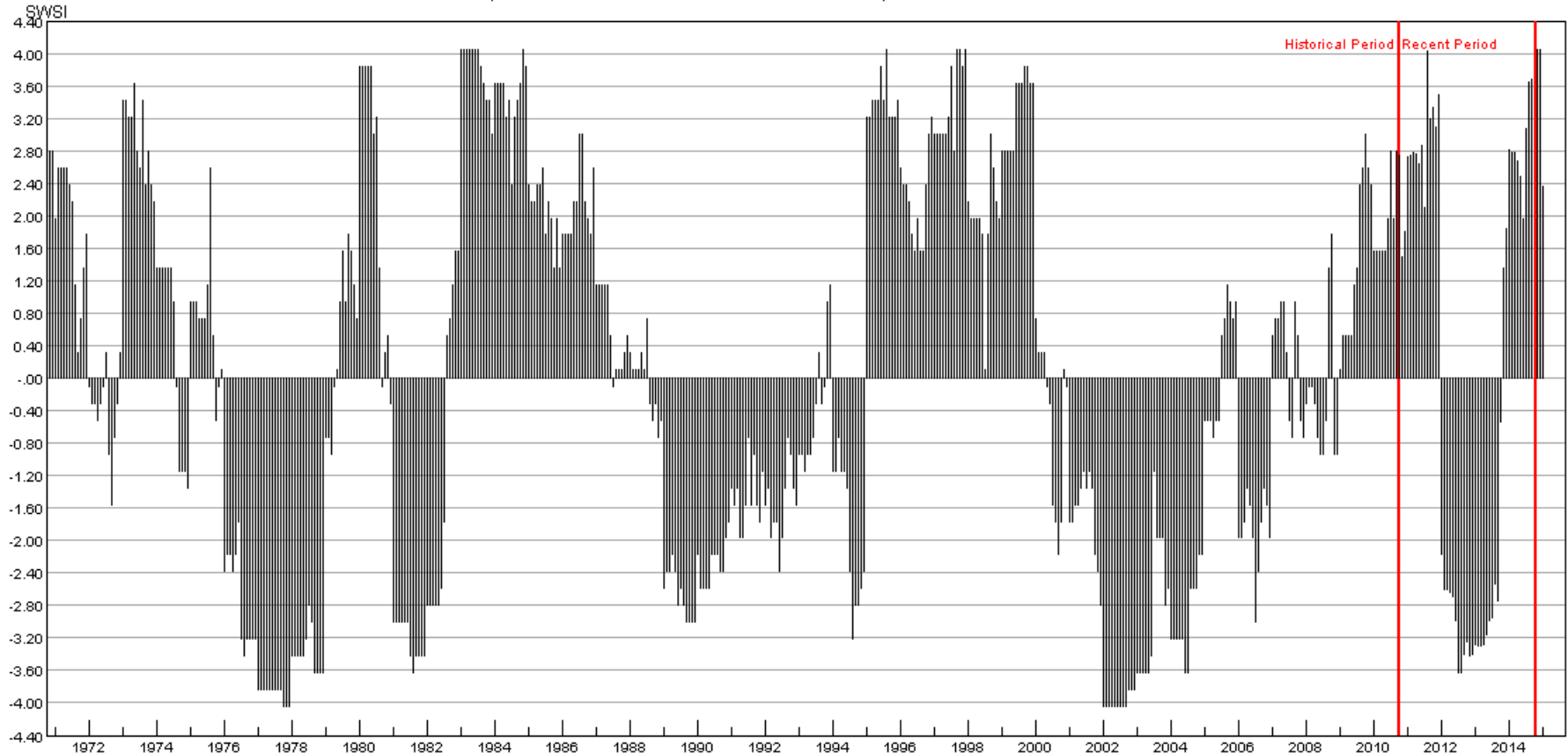
Photo by [Ross Stone](#) on [Unsplash](#)



# Surface Water Supply Index (SWSI)

## South Platte Basin SWSI History

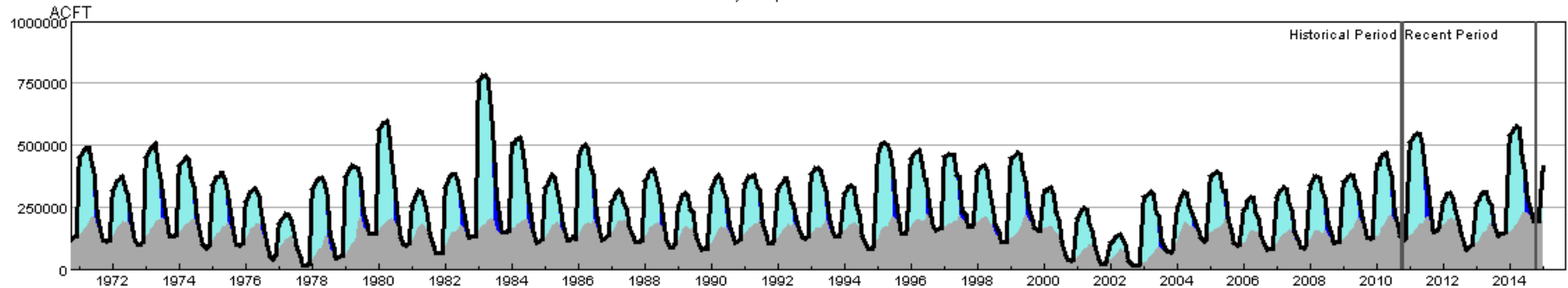
Historical period SWSI values establish the SWSI distribution to lookup recent and current SWSI values.



South Platte-DataComposite-SWSI

# SWSI at Hydrologic Unit Code Scale

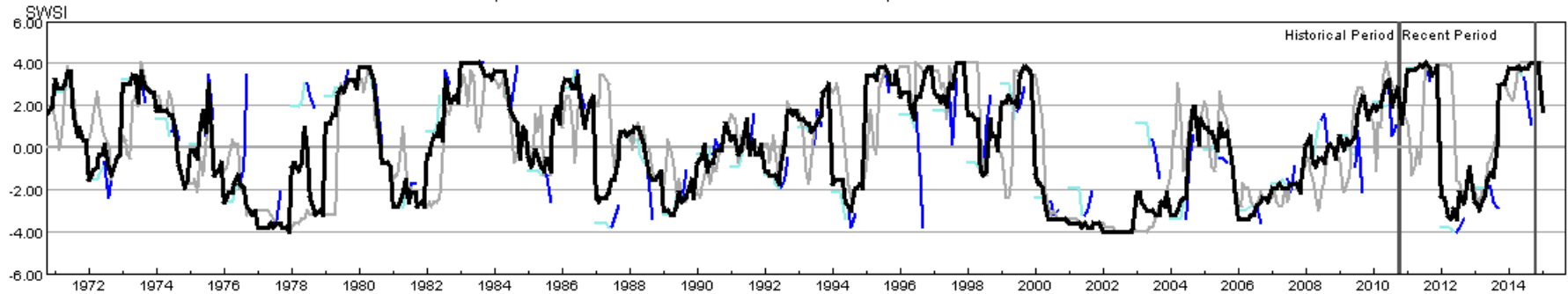
HUC 10190007 (Cache La Poudre) Surface Water Supply  
Monthly component volumes



- HUC:10190007-DataComposite
- HUC:10190007-Component-PrevMoStreamflow
- HUC:10190007-Component-ForecastedRunoff
- HUC:10190007-Component-ReservoirStorage

HUC 10190007 (Cache La Poudre) SWSI

Historical period SWSI values establish the SWSI distribution to lookup recent and current SWSI values.



- HUC:10190007-PrevMoStreamflow-SWSI
- HUC:10190007-ForecastedRunoff-SWSI
- HUC:10190007-ReservoirStorage-SWSI
- HUC:10190007-DataComposite-SWSI

# SNODAS Tools

projects.openwaterfoundation.org/owf-proj-co-cwcb-2016-snodas/prototype/index.html

## Colorado's Decision Support Systems (CDSS) SNODAS Tools

About Data Documentation

### Daily SNODAS Snowpack Products for Colorado Water Supply Basins

This website provides access to a historical archive of SNODAS data products for Colorado water supply basins. Snow Data Assimilation System (SNODAS) data from the National Operational Hydrologic Remote Sensing Center (NOHRSC) are processed daily to calculate Snow Water Equivalent (SWE) and Snow Coverage statistics for water supply basins in Colorado. Snow Water Equivalent is the estimate of the depth of liquid water contained within the snowpack. Snow coverage is a percent of the basin land surface covered by snow (water bodies in the basin are ignored). The national SNODAS gridded dataset has been processed to provide data products for Colorado. Mean SWE is displayed in the map using a legend similar to the National Weather Service. The SNODAS Tools website provides access to an archive of daily products.

- The website is best viewed on a widescreen display. If the layout does not clearly show a left panel with tabs, a center panel with map, and a right panel with date and basin selectors, try maximizing to fill the display. **Ctrl** and **minus** can be used to zoom out until the layout shows all components.
- Hover over a basin to see the daily mean SWE value and other daily statistics.
- Use the **Select Date** button to display historical data for a specified day.
- Enter animation start and end dates, press **Submit**, and then press the play button to view the animation of daily SWE data.
- Click on a basin in the map to select the basin or use the **Select Basin** to select from the basin list. Then click on buttons in the lower right to display graphs.
- Once a graph has been opened, click anywhere on the screen to close the graph view and return to the main screen.
- Reposition the map by holding the mouse button down and dragging.
- Zoom in and out of the map using the control

Mean SWE (in)

|           |
|-----------|
| 0-0.02    |
| 0.02-0.04 |
| 0.04-0.2  |
| 0.2-0.4   |
| 0.4-1     |
| 1-2       |
| 2-4       |
| 4-6       |
| 6-10      |
| 10-20     |
| 20-30     |
| 30-40     |
| 40-80     |
| 80+       |

Select Date **SNODAS Date: 2018-02-26**

### SNODAS Animation

Starting Date: (earliest available date: 2003-09-30)  
YYYY-MM-DD

Ending Date: (latest available date: 2018-02-26)  
YYYY-MM-DD

Increment (days): (Default is set to 1)  
value between 1 and 10

Submit

Select Basin

SNODAS Snow Cover Graph

SNODAS SWE Graph

SNODAS SWE Volume Graph

SNODAS SWE Upstream Total Volume Graph

SNODAS SWE 1 Week Change Graph

SNODAS SWE Volume Gain, Cumulative Volume Gain, Total Volume Gain, SWE Graph

**2018-02-26**

Daily Basin Statistics  
Hover over a basin

50 mi  
Amarillo 38.636°N : 100.94°W

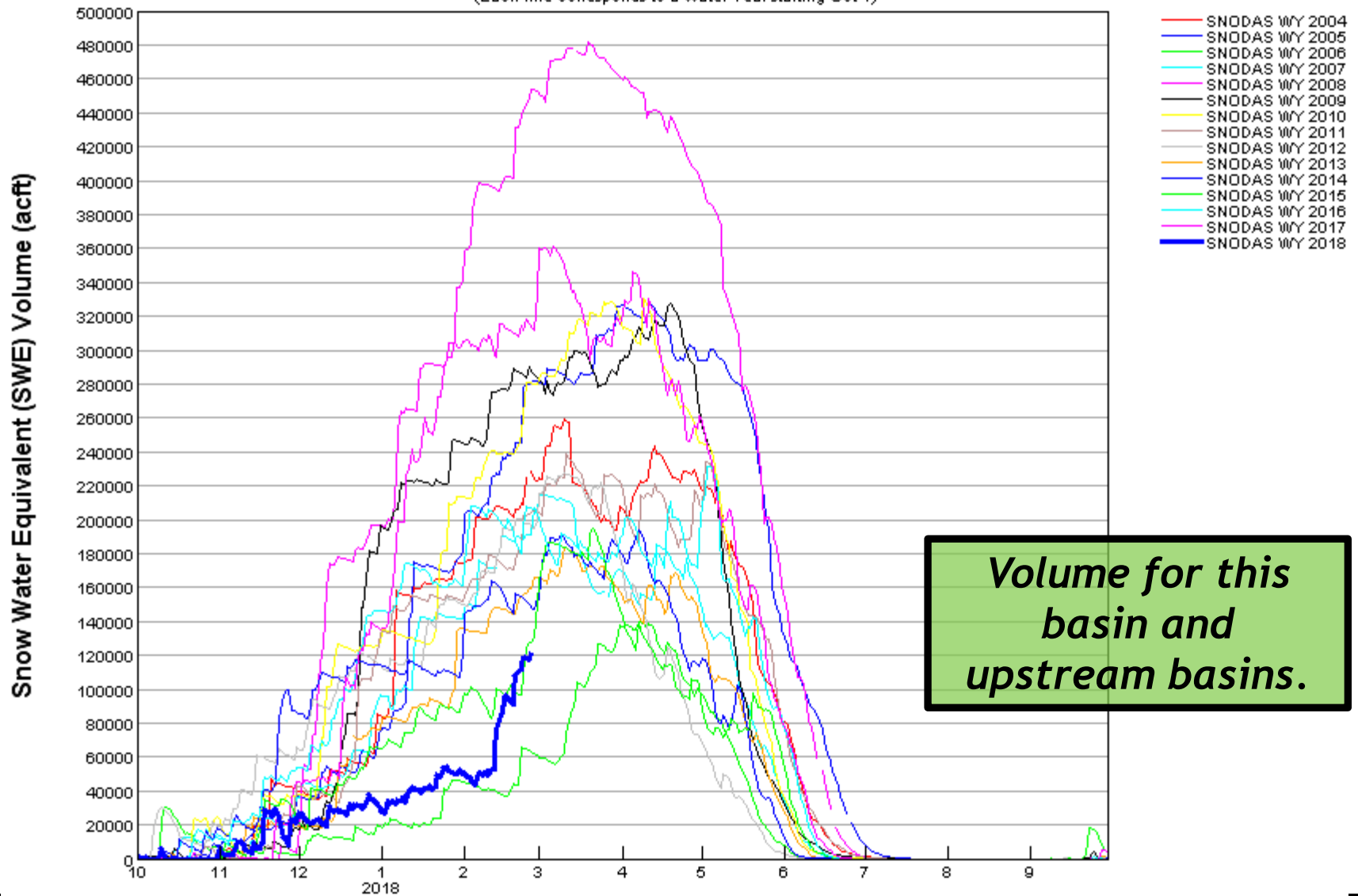
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

<http://snodas.cdss.state.co.us/app/index.html>



# SNODAS Total Upstream SWE Volume

CONEJOS RIVER NEAR MOGOTE, CO. (MOGC2) Upstream Total SNODAS SWE Volume  
(Each line corresponds to a Water Year starting Oct 1)



*Volume for this basin and upstream basins.*

# “Gapminder” Snowpack

viz.openwaterfoundation.org/co/owf-viz-co-snodas-gapminder/

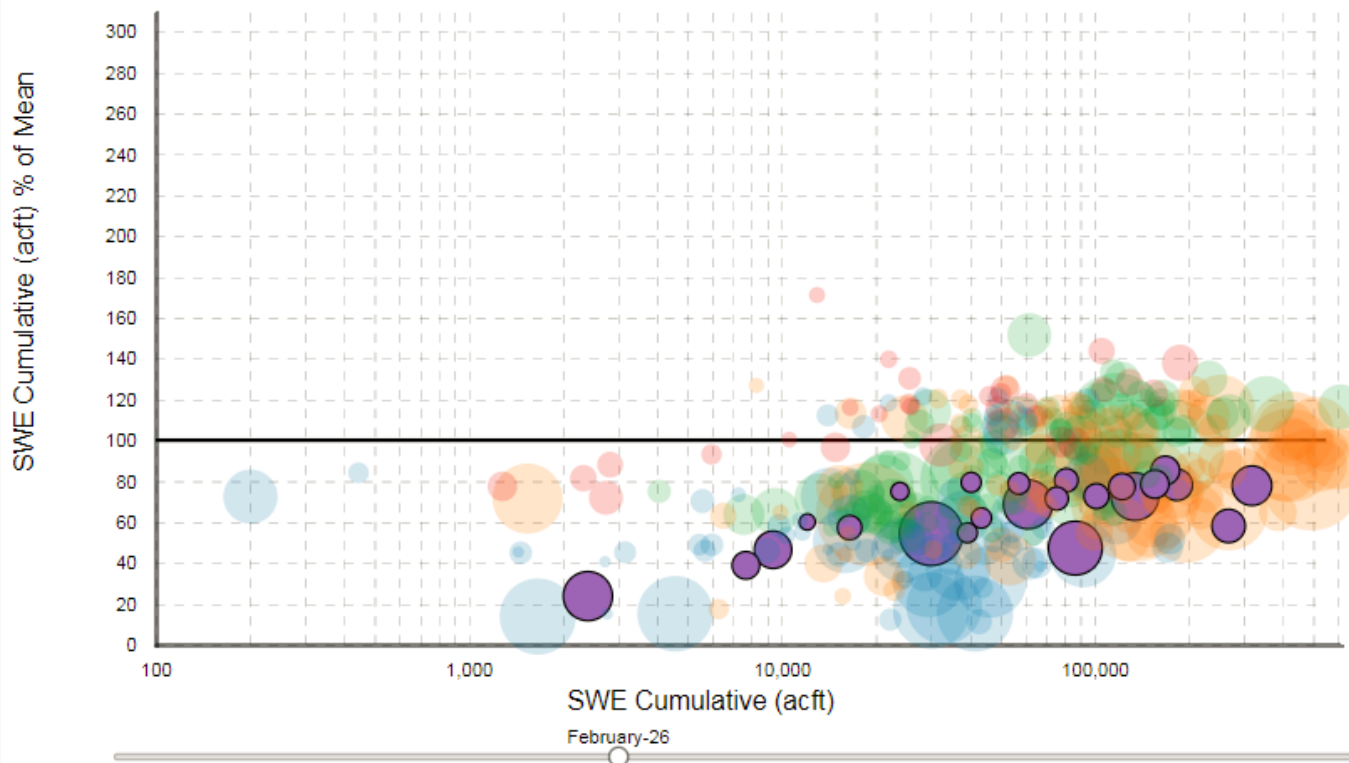


Gapminder Documentation Data Sources

## SNODAS Data

Feb-2018

SWE Cumulative(x), SWE Cumulative % of Mean(y), SWE Cumulative Upstream Total(size), Basin(color)



- Basin
- ABRFC
  - CBRFC
  - MBRFC
  - NCWCD
  - WGRFC

Select All Markers

Select Individual LOCAL\_ID

Turn Tracer On

Turn Annotations Off

Water Year: 2018

Oct-2017 Nov-2017 Dec-2017 Jan-2018 Feb-2018 Mar-2018 Apr-2018 May-2018 Jun-2018 Jul-2018 Aug-2018 Sep-2018



Speed:

<http://viz.openwaterfoundation.org>

LOCAL\_ID:

Date:

SWE\_Cumulative:

SWE\_Cumulative\_Percent\_of\_Mean:

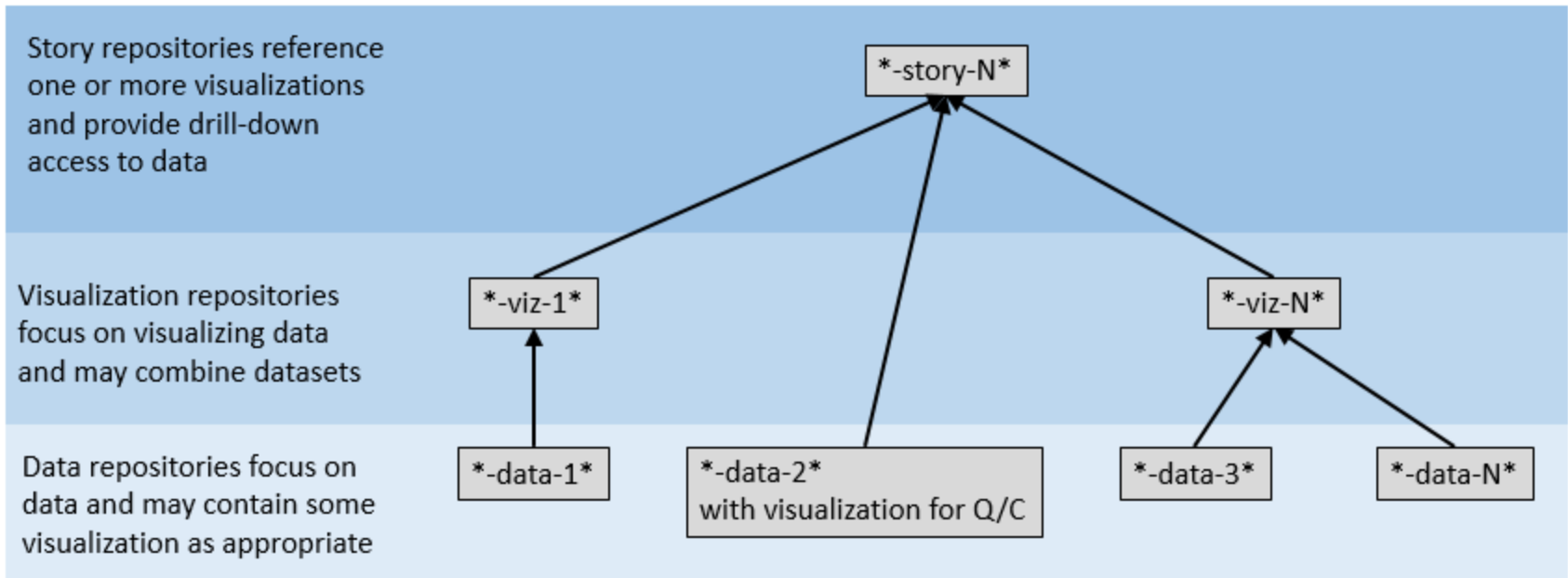
# Open Data Definition

- **Accessible to all** - the data becomes accessible outside of the organization that generated or collected it
- **Machine-readable** - data must be usable, which means it must be made available in formats that are easily used by third-party applications
- **Free - zero or low costs** for data access and openness
- **Unrestricted rights to use** - data that is unencumbered by contractual or other restrictions leads to the maximum potential of innovation
  - “Generating Economic Value through Open Data” in “Beyond Transparency”



# Data, Visualizations, Stories

## Hierarchy of Data / Visualization / Story Repositories



<https://github.openwaterfoundation.org>

# Data, Visualizations, Stories

## owf-data-co-municipal-water-providers

This repository contains the [Open Water Foundation \(OWF\)](#) dataset for Colorado municipal water providers. This is a foundational dataset that provides unique identifiers and other data for municipal water providers. The identifiers can be used to link other datasets, such as municipalities. OWF has created and is maintaining this dataset to facilitate work on various data analysis and visualization projects in Colorado.

The following sections provide a summary of the project repository:

- [Repository Contents](#)
- [Attribution](#)
- [Data Workflow](#)
- [How to Use the Data](#)
- [License](#)
- [Contributing](#)
- [Maintainers](#)
- [Contributors](#)

### Repository Contents

The repository contains the following.

<https://data.openwaterfoundation.org>

# Open Data for Water Use Efficiency

## owf-data-co-municipal-water-providers

This repository contains the [Open Water Foundation \(OWF\)](#) dataset for Colorado municipal water providers. This is a foundational dataset that provides unique identifiers and other data for municipal water providers. The identifiers can be used to link other datasets, such as municipalities. OWF has created and is maintaining this dataset to facilitate work on various data analysis and visualization projects in Colorado.

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- [Contributors](#)

### Repository Contents

The repository contains the following.

<https://data.openwaterfoundation.org>



# Water Use: California Drought Example

www2.pacinst.org/gpcd/map/



## California Urban Water Suppliers Water Use Map



[Hide Options](#)

Water Use:

Residential Per-Capita

Display:

Symbols

Hydrologic Region:

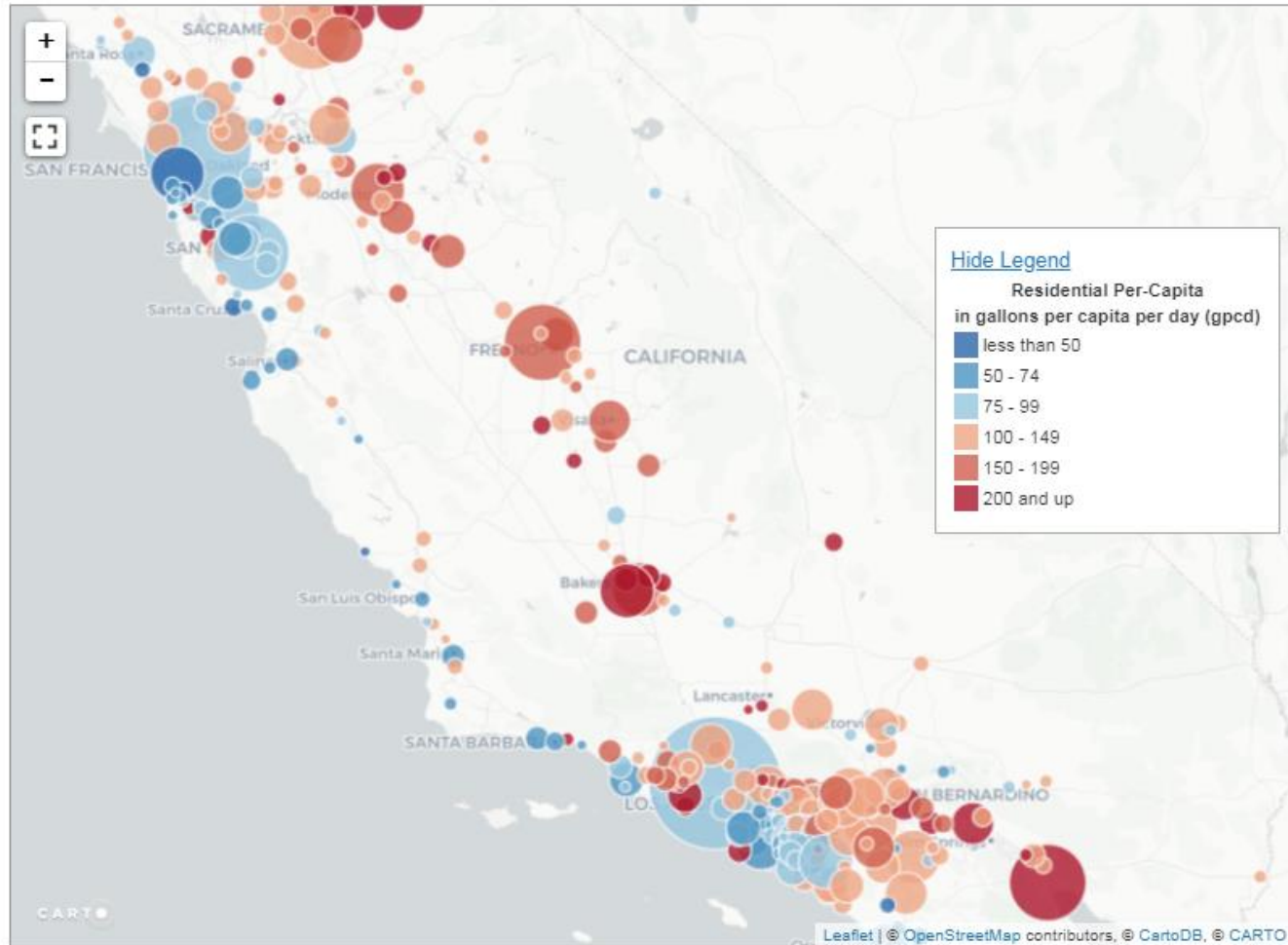
Select All

Month:

September 2017

Click on a water supplier to show charts of water use.

[About this data.](#)



Leaflet | © OpenStreetMap contributors, © CartoDB, © CARTO

# COLORADO RIVER URBAN WATER USE DATA AVAILABILITY AND METRICS



PREPARED BY:



openwater  
FOUNDATION

IN ASSOCIATION WITH

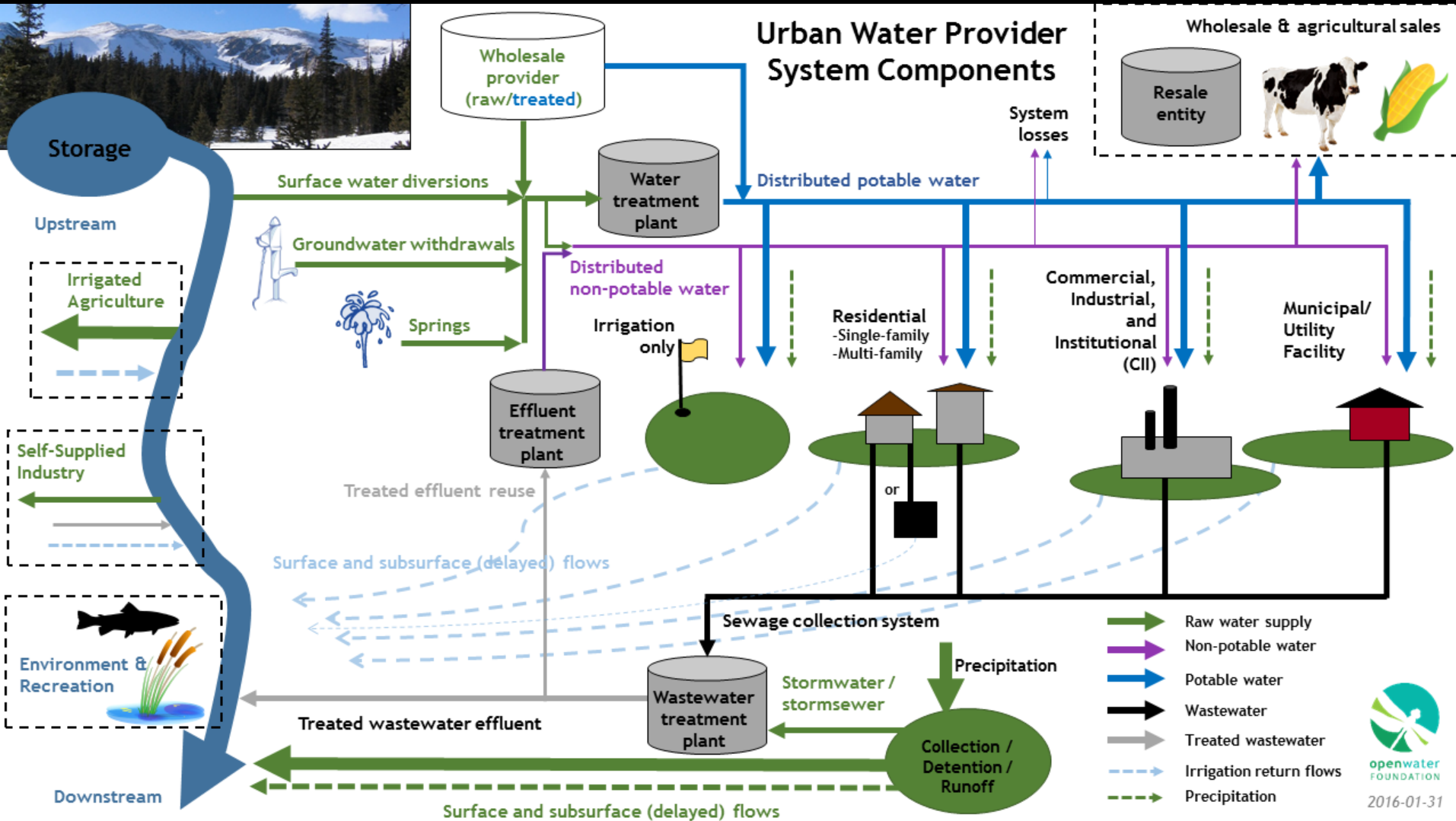


FEBRUARY 12, 2018

ORIGINAL VERSION:  
OCTOBER 23, 2015

<http://openwaterfoundation.org/resources/presentations-and-publications>

# Water Use in System



<http://viz.openwaterfoundation.org>



2016-01-31



# Water Efficiency Planning

cwcb.state.co.us/water-management/waterEfficiency/Pages/main.aspx



Colorado Department of Natural Resources

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## COLORADO Water Conservation Board Department of Natural Resources

Loans & Grants | Environment | **Water Management** | Legal | Technical Resources | Public Information | About Us

Home > Water Management > Water Efficiency

### Water Management

#### Water Efficiency

Water Efficiency Planning

Reporting of Water Use and Water Conservation Data (HB10-1051)

Water Conservation Technical Advisory Group

Drought

Flood

Water Supply

### Water Efficiency

#### What Is Water Efficiency?

Quite simply, water efficiency is doing more with less – not doing without. Water efficiency efforts include the practices, techniques and technologies that extend water supplies and other resources (e.g. energy) by either saving water or through substituting with alternative supplies such as reuse. This, in turn, frees up water supplies for other uses, such as new development, stored drought reserves, agricultural leases, and environmental uses (e.g. instream flows). Water efficiency is inclusive of water conservation and includes both system demands and customer water demands.



#### Additional Information

- Watch "Doing More with Less" Water Efficiency Film

**Need an open dataset of water efficiency plans**

#### Why Plan for Water Efficiency?

Colorado's water supply as demands increase from a growing population. As the Statewide Water Supply Initiative

AWWA Water Conservation Resource Community Financing and Smart Water Communities' Roadmap: Enhancing the Value of Water (2011)



# HB 10-1051 Water Use Efficiency Portal

cwcb.state.co.us/water-management/waterEfficiency/Pages/ReportingWaterUseWaterConservationData.aspx



Home > Water Management > Water Efficiency > Reporting of Water Use and Water Conservation Data (HB10-1051)

## Water Management

### Water Efficiency

Water Efficiency Planning

Reporting of Water Use and Water Conservation Data (HB10-1051)

Water Conservation Technical Advisory Group

Drought

Flood

Water Supply Planning

Basin Roundtables

Water Projects & Programs

South Platte Groundwater

Questions?

## Reporting of Water Use and Water Conservation Data (HB10-1051)

### Background

In 2010, the Colorado General Assembly adopted HB10-1051 which requires covered entities (retail water providers who sell 2,000 acre feet or more of water annually) to report, on an annual basis, water use and conservation data to be used for statewide water supply planning. The bill directed the CWCB to adopt guidelines regarding the reporting of water use and conservation data by covered entities (Guidelines), and to report to the legislature regarding the Guidelines.

HB10-1051 directed the CWCB to develop reporting Guidelines through a public participation process that included outreach to stakeholders from water providers with geographic and demographic diversity, nongovernmental organizations, and water conservation professionals.

The reporting Guidelines include clear descriptions of customer categories, uses, and measurements; how the Guidelines will be implemented; and how data will be reported to the Board.

### Goals

Statewide water supply planning efforts, such as the Statewide Water Supply Initiative (SWSI), which utilizes future statewide water demand projections with-and-without various levels of municipal and industrial water conservation, rely on statewide water use and water conservation data.

Data reported under HB10-1051 will further support statewide

### HB10-1051 Timeline



House Bill 10-1051 requires the following actions be completed no later than the indicated dates:

- **February 1, 2012:** CWCB adopts Guidelines and reports to legislature regarding the Guidelines.
- **June 30, 2014 through June 30, 2020:** Annual covered entity reporting for the previous calendar year.
- **February 1, 2019:** CWCB reports to legislature on the Guidelines and data collected under the Guidelines.
- **July 1, 2020:** Legislation sunsets.

**For Public Users:** In line with Colorado's Transparency Online Project and the next revision of the Statewide Water Supply Initiative (SWSI), the Colorado Water Conservation Board is opening the HB10-1051 data for research purposes to foster innovation. Colorado's water future is uncertain and a broader dissemination of water use and water conservation data will support more research arenas in defining and implementing solutions to the statewide water supply-demand gap.

### DISCLAIMER:

The purpose of the HB10-1051 data reporting, per Section 37-60-126(4.5)(a), C.R.S., is to provide water use and conservation data for statewide water supply planning. The data collection process is designed to provide better, more frequent, and more reliable data than currently available through standardized



Welcome!  
Colorado's open data at your fingertips

A white icon of a tractor on a blue square background.

Agriculture

A white icon of a bar chart with an upward arrow on a blue square background.

Business

A white icon of an open book on a blue square background.

Education

A white icon of a classical building with columns on a blue square background.

Government

A white icon of a medical cross on a blue square background.

Health

A white icon of a car on a blue square background.

Public Safety

A white icon of a person riding a bicycle on a blue square background.

Recreation

A white icon of a water drop on a blue square background.

Water

# “Gapminder” Water Use Efficiency

Visualization

Documentation

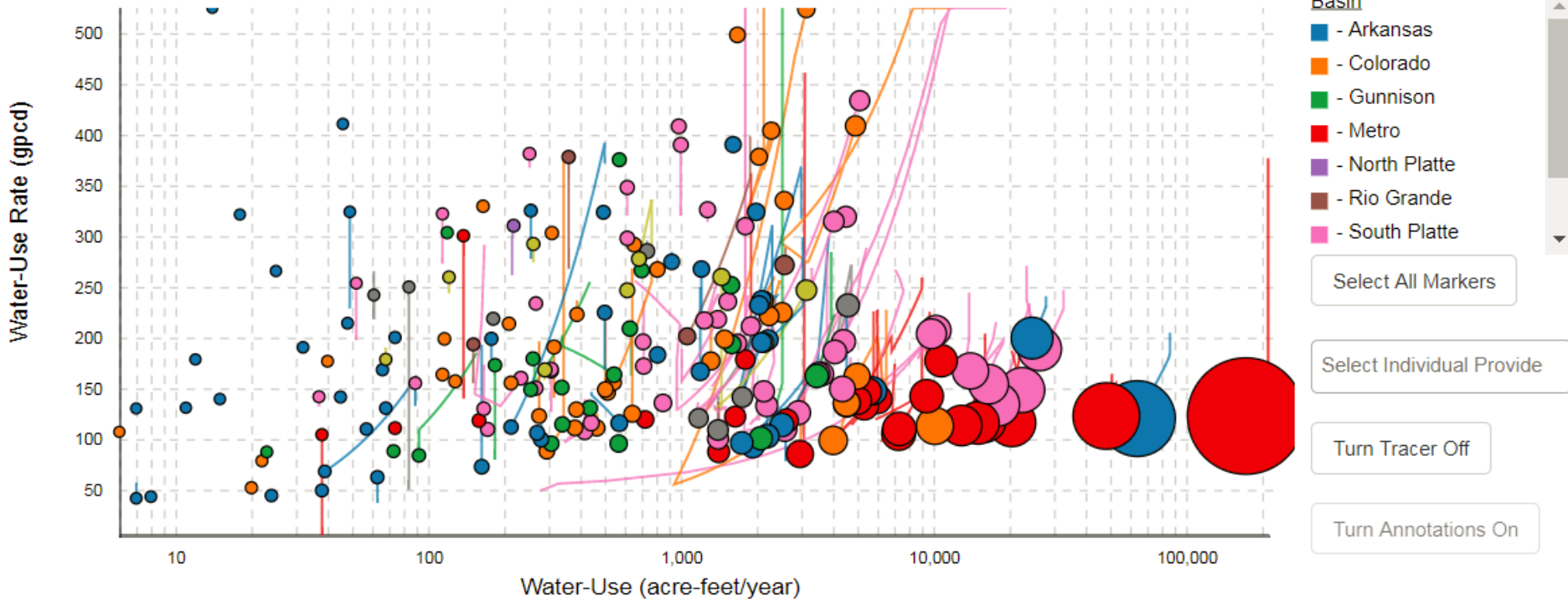
Data

Sources

## Water Providers in Colorado

2016

Population(size), Basin(color), Water-Use(x), and Water-Use Rate(y).



2016

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

▶ || ↺ ⏪ ⏩ Speed:

Provider: Town of Eagle

Year: 2016

WaterUse\_AFY: 1490.00

GPCD: 108.52

# Challenges and Opportunities

- Cross-jurisdictional datasets are difficult.
- Collaboration can save time and lead to great results...but also takes time.
- Funding is needed at all levels.
- How to measure conservation and efficiency?
- Opportunity to develop foundational open datasets and tools.
- Innovation and evolution comes from multiple entities.



# Share It

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**open data** | **open software** | **open decisions**  
[openwaterfoundation.org](http://openwaterfoundation.org)