COLORADO

Governor's Office of Information Technology

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Smart Data Analytics Challenge 2018

Water Supply

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1. Problem Solved

Water supply challenges occur at local, regional and statewide levels and are impacted by hydrological, legal, jurisdictional, operational and other factors.

In particular, the challenge of meeting municipal water demand in the fast-growing Front Range has a nexus with many sectors including energy, agriculture, environment and recreation.

How can we better understand municipal water demand and supply trends to evaluate progress and guide investment in new water supply solutions?

The Open Water Foundation's aim is to provide an open data platform with useful visualizations to integrate water data from multiple providers and government agencies to better understand issues, trends and relationships of water demand and supply at state, basin, regional and local levels.

2. Impact

Significant data regarding municipal water use are available. However, the format, resolution and accessibility of such data varies greatly. Metrics to evaluate water use efficiency, such as system gallons per capita per day (GPCD) are limited by data availability and it can be difficult to compare water providers using a general metric such as GPCD.

The Open Water Foundation solution utilizes available open data to emphasize trends in consistent cohorts of water providers, considering impacts of seasonal weather, in order to better understand trends in water use. A solution that is agile enough to be updated each year with new data can help evaluate systems that have the greatest need, so that grant programs can provide funding to systems that would generate the most impact, such as fast-growing systems on the Front Range.

2. Impact

While data on municipal water use are available via the Water Efficiency Data Portal, the data are only presented as “reports” for a single water provider for a single year, so it is difficult to make comparisons between water providers or even between the same provider over different years. No visual products, such as graphs or maps are available as outputs.

Our solution provides visual products to allow for comparisons in water use to be made. It also highlights potential errors in data submitted by water providers.

An integrated presentation of data can potentially increase the efficiency of State agencies, communities and the public in understanding water supply issues and provide benchmark data.

3. Methodology

Water use data from the Water Efficiency Data Portal (http://www.cowaterefficiency.com) were downloaded and processed into a more-usable Excel spreadsheet via TSTool, a data-processing tool developed by the Open Water Foundation that is part of Colorado's Decision Support Systems (CDSS).

Cohorts of similar water providers were identified representing similar characteristics in population and water use.

The period 2013 to 2016 was selected for analysis because water use data have only been available since 2013 in the Water Efficiency Data Portal.

Representative temperature and precipitation data were associated with example municipal water providers as potential drivers of water demand and use and to explain short term data variation.

Data products were created to evaluate trends across cohorts and identify opportunities for investment in water efficiency.

4. The Data

The following data were analyzed:

1. General municipal water provider data (names, identifiers, locations):
    i. Water Efficiency Data Portal (http://www.cowaterefficiency.com)
    ii. Municipal water provider dataset developed by OWF (https://github.com/OpenWaterFoundation/owf-data-co-municipal-water-providers)

2. Municipal water use and efficiency data:
    i. Water Efficiency Data Portal
    ii. Department of Local Affairs (DOLA) population data (https://demography.dola.colorado.gov/data/)
    iii. Water efficiency plans and other data from the water providers

3. Seasonal weather conditions for annual and outdoor season:
    i. NOAA Regional Climate Centers Applied Climate Information System (RCC-ACIS) (http://www.rcc-acis.org/)

5. Feasibility

The Open Water Foundation focuses on developing tools and processes to analyze water data. Evaluating municipal water supply issues is a finite problem because the number of municipalities and municipal water providers is finite.

Most large systems such as Denver Water are receiving significant attention from within those organizations, are funded by their rate-payers and may not need additional resources. Very small systems may be too small to warrant significant initial investment.

Consequently, there are opportunities to improve efficiencies of mid-sized systems, in particular fast-growing Front Range communities where innovation in new development is easier to implement than upgrading old systems. These systems also tend to have the most impact on reallocation of agricultural water supplies.

Scaling of the solution is possible because of the availability of statewide datasets and analysis tools. The pace of implementation depends on data availability for the entities selected for analysis. Funding and state programs can help overcome data accessibility issues.

6. Results

Preliminary analysis results (as indicated by the following images in this presentation) indicate the utility of the proposed solution and also the potential to use the platform to explore more complex issues.

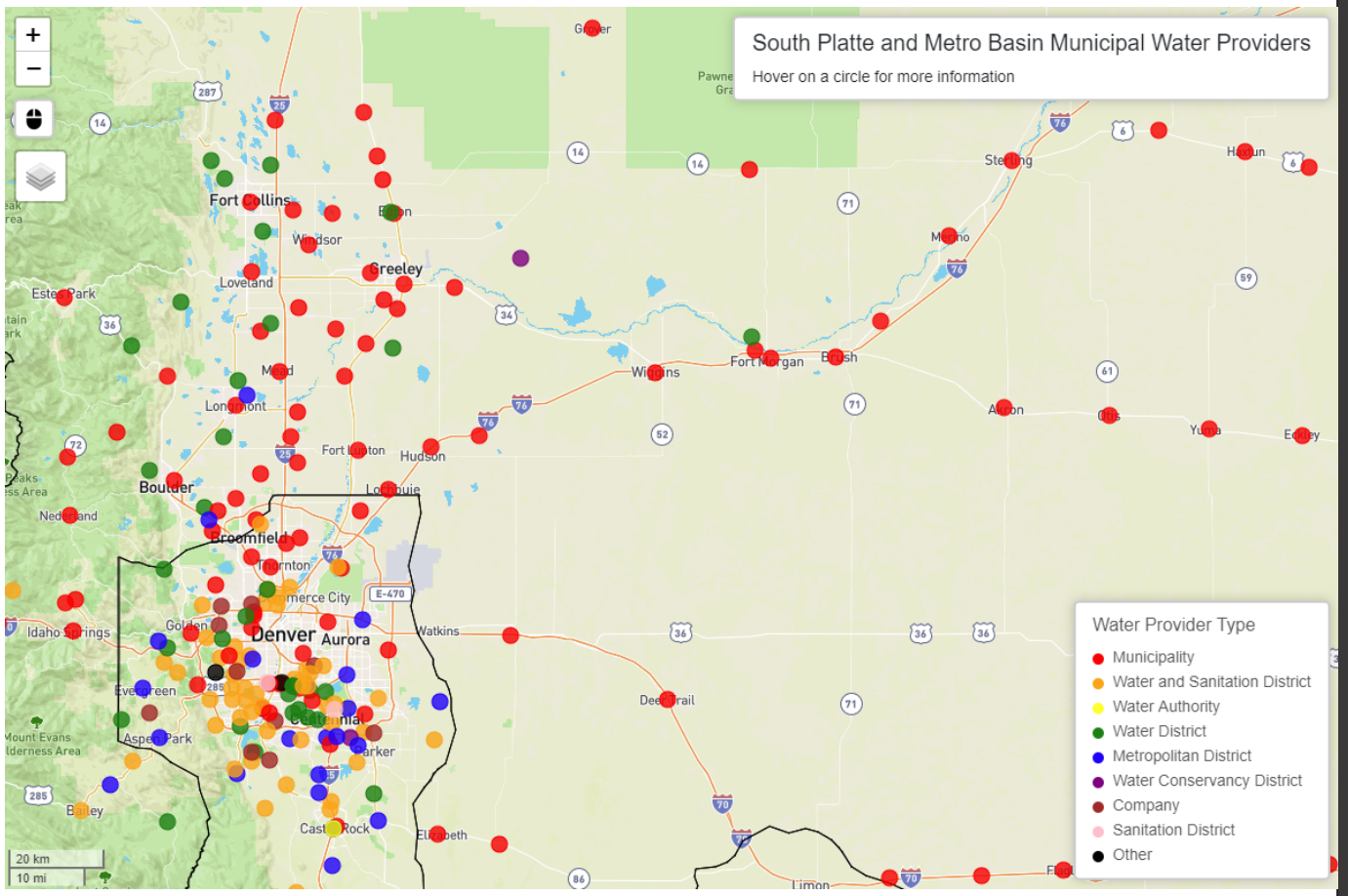
The concept presented in this presentation is also available as an interactive online story at:

http://stories.openwaterfoundation.org/co/smart-data-analytics-challenge-2018

6. Results

There are over 400 water providers in the state and can be in the form of a municipal utility, special district, private company, etc.

The Front Range has a large concentration of water providers.



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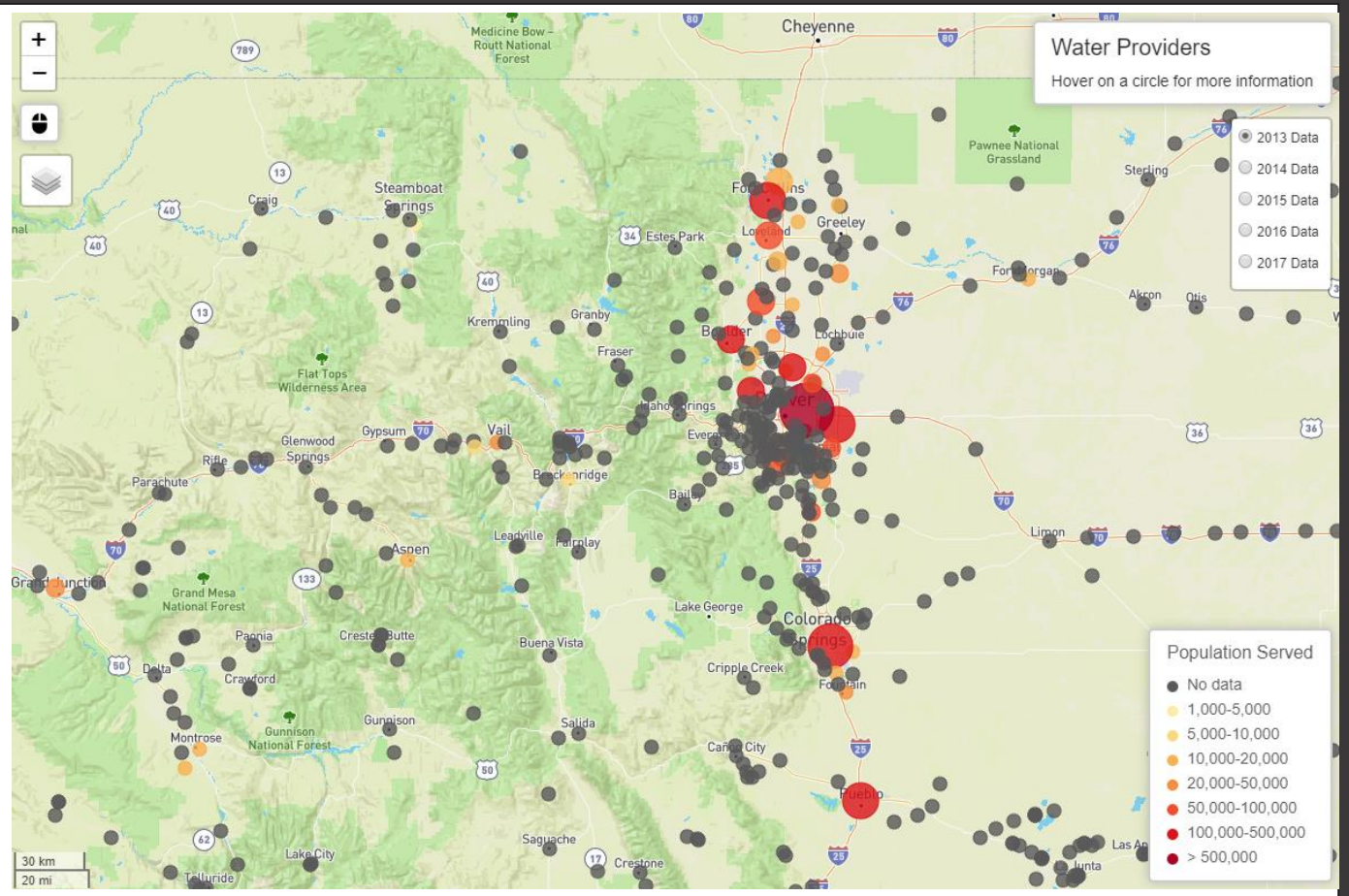
6. Results

Retail water providers that sell 2,000 acre-feet or more of water annually (termed covered entities) must report water use and conservation data on an annual basis. The data are publicly available from the [Water Efficiency Data Portal](#).

The map shows distributed potable treated water use (size of dot) and the population served (color of dot).

Most covered entities are along the Front Range.



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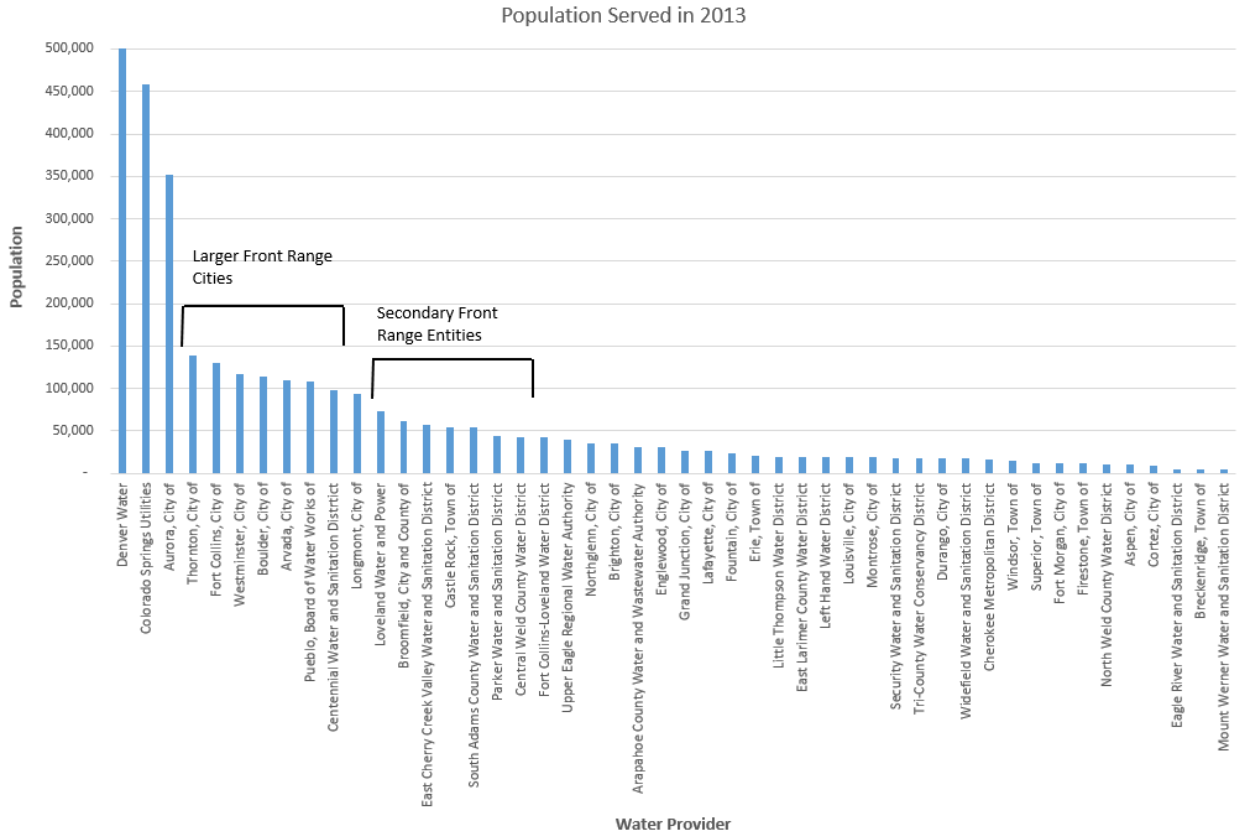
6. Results

The population served for each covered entity that submitted data in 2013 is shown at right.

Water providers can be grouped into cohorts based on population.

Three water providers can be clearly distinguished from the others: Denver Water, Colorado Springs Utilities and the City of Aurora.

Two other cohorts can also be created and consist of water providers along the Front Range.



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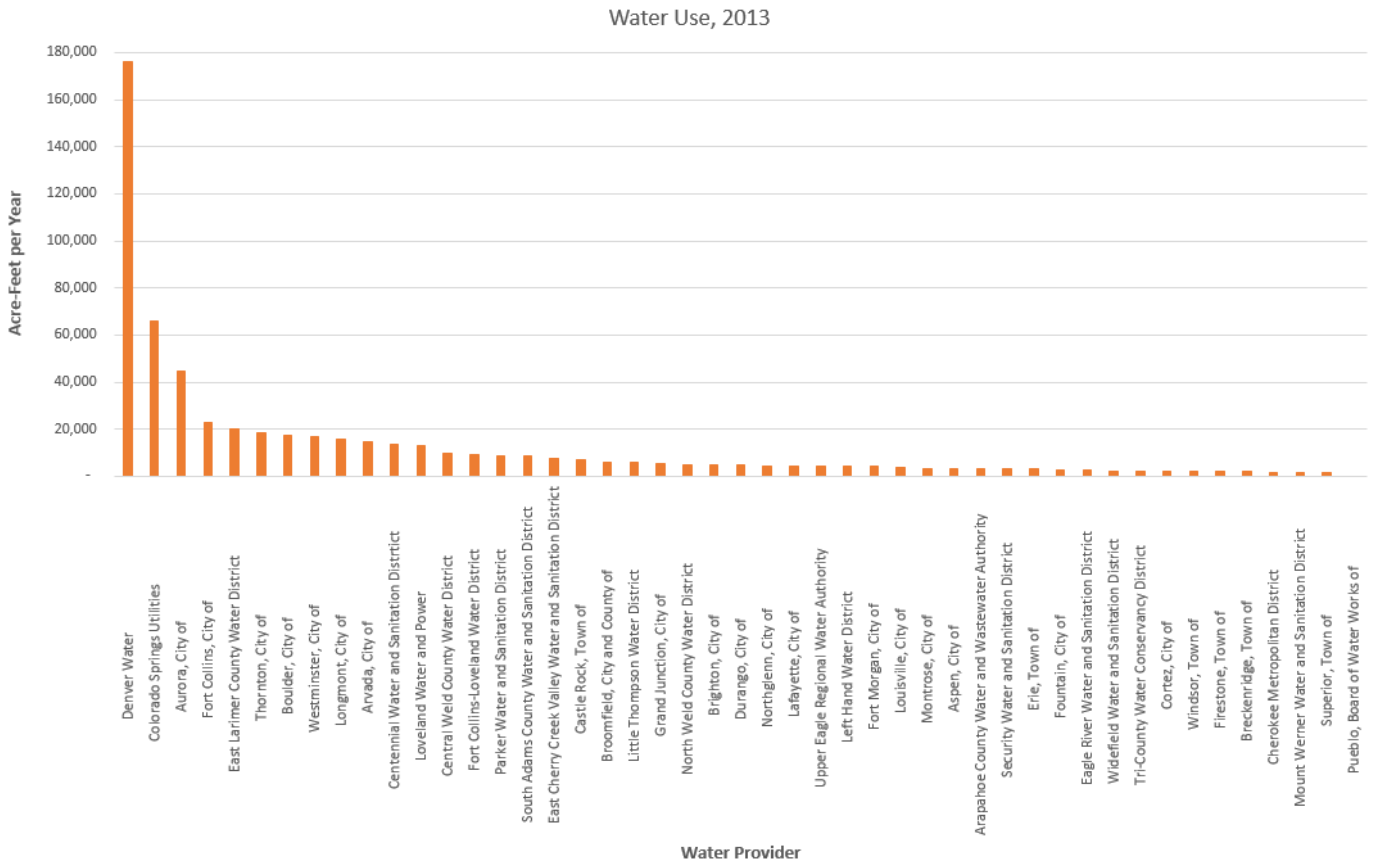
6. Results

The distributed potable treated water use of each covered entity that submitted data in 2013 is shown at right.

While not shown here, water use can be split into categories such as residential, commercial/industrial, municipal/utility, etc. and includes both indoor and outdoor use.

Three water providers can be clearly distinguished from the others: Denver Water, Colorado Springs Utilities and the City of Aurora.

The two other Front Range cohorts identified earlier also use large amounts of water relative to other water providers.



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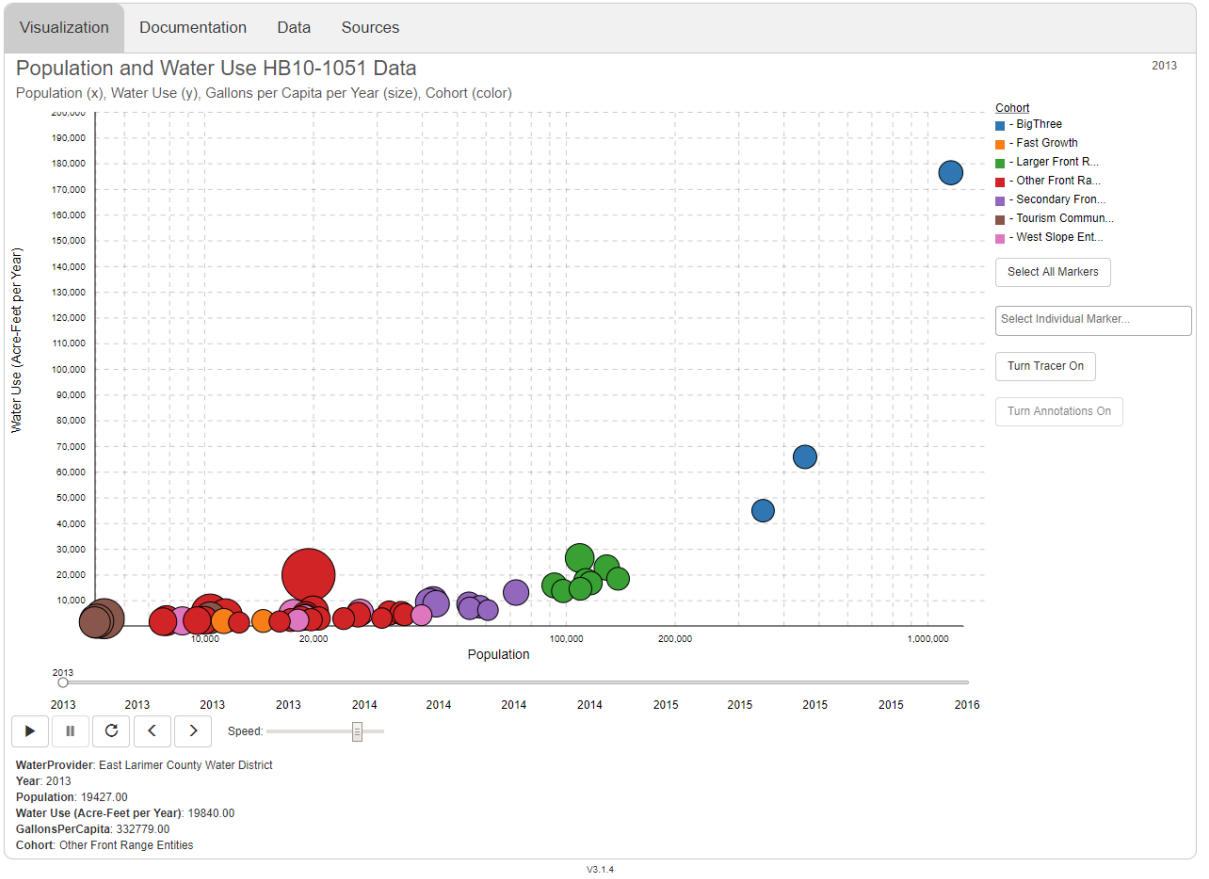
6. Results

Additional cohorts were created, representing tourist communities like Aspen (in brown), West Slope water providers (in pink), water providers with fast growth (in orange) and all other Front Range entities (in red).

This graphic plots population and water use and shows how the water providers reasonably fit into cohorts.

This type of visualization can be made “live” and cycle through years of data. With additional years of data, this visualization can clearly show trends in water use statewide.



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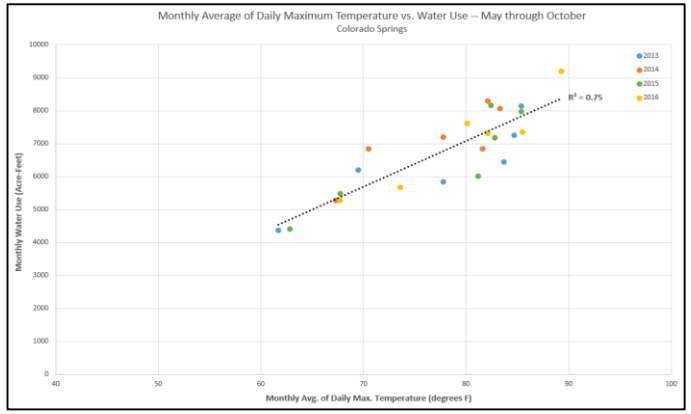
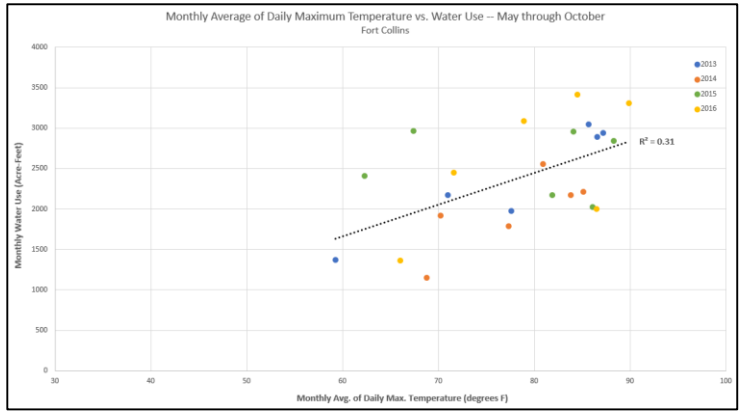
6. Results

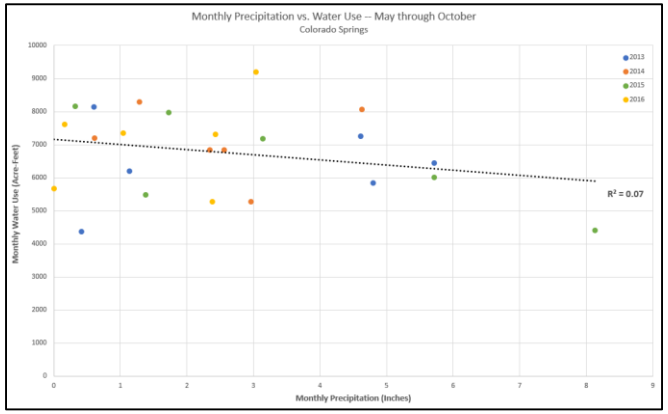
The effect of warm summer temperatures on water use was investigated. Monthly water use was graphed against the monthly average of daily maximum temperatures for Colorado Springs and Fort Collins.

While there was a strong correlation between water use and temperature in Colorado Springs, there was not a strong correlation in Fort Collins.

OWF also evaluated the effect of precipitation on water use in Colorado Springs and Fort Collins and did not find a correlation between water use and precipitation, indicating that additional innovation is necessary to adjust landscape irrigation in response to precipitation events and soil moisture.







Conclusions

Grouping water providers into cohorts allows for insights into trends in water use and population growth and may indicate opportunities to improve efficiencies of mid-sized systems, in particular fast-growing Front Range communities where innovation in new development is easier to implement than upgrading old systems. Analyses such as this performed by OWF can be leveraged to add additional insights. These insights, when evaluated in the context of regional and state level can improve water use efficiency.

Further knowledge can be gained from water use data by combining it with other open data such as temperature and precipitation data.

Statewide organizations, such as the CWCB, and nonprofits are in positions to use such analytics to drive funding and programs. Water providers may use the information for benchmarking and trend analysis.

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