**NASA DEVELOP National Program**

****Langley Research Center

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**Colorado Water Resources**

*Utilizing NASA Earth Observations to Identify Water Quality Sampling Sites*

*in Denver, Colorado*

**Project Team:**

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**Advisors & Mentors:**

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**Partner Organizations**

Denver Water (POC: Diego Portillo, Linda Rosales, and Sheila Pelczarski)

**Applied Sciences National Applications Addressed:**

Water Resources

**Study Area:** This project is focused in the state of Colorado of the United States, specifically the city of Denver and its water system, including the South Platte River, Blue River, William Fork River, and the Fraser River.

**Study Period:** From 1996-2013

**Earth Observations & Parameters**

Landsat 7 – ETM+ - Land use/Land cover

Landsat 8 – OLI/TIRS – Land use/Land cover

**80 – 100 Word Objectives Overview**

This study utilized land cover data from Denver, Colorado, and surrounding areas to identify existing infrastructure and possible pollution sources in the Denver Water collection system, which contains the South Platte, Blue, William Fork and Fraser Rivers. A map identifying the optimal areas in which to place water quality sampling sites was also created to enable the reduction of the number of sampling sites, reducing operating costs.

**Abstract**

The state of Colorado is rich in its water resources due to its location in the southwestern and mountainous region of the United States. The Colorado watershed mainly originates from snow runoff that eventually feeds rivers, streams, reservoirs, and lakes. The city of Denver, Colorado and surrounding suburbs receives water provided by watersheds that feed into the Denver Water system, which supply high-quality water to more than 1 million people (Denver Water, 2014). After major events such as wildfires on Buffalo Creek, Black Forest, and Waldo Canyon, as well as the Front Range and Eastern Colorado floods, the re-evaluation of the water sampling sites and identification of possible source contaminants in the water is essential. The existing infrastructure of the system and potential pollution sources were contributing factors for the onset of this project. NASA Earth observation data from Landsat 7 ETM+ and Landsat 8 OLI/TIRS were used to provide land cover classifications. The data were extracted using the National Land-Cover Dataset, which is comprised of images taken from the Landsat Satellite. Partnered with Denver Water, the collection system was analyzed to determine future locations for water quality sampling sites. These decisions were mapped onto both a Water Sampling Suitability map, which identified optimal locations for water quality sampling sites, and a Land Cover Classification Map, which identified the current infrastructure and potential contaminant sources. Identifying these location sites will improve the efficiency of watershed monitoring for Denver Water. This in turn will allow for high-quality water to be distributed to the population of the Denver Water System.

**Community Concerns**

* Denver Water is responsible for supplying quality water to over 1.3 million people in the city of Denver, Colorado and surrounding suburbs and source contaminants within the watersheds system are a major concern.
* Recent flooding, forest fires, and changes in the pine beetle population in the area are possible sources of contamination in the water supply.

**Current Management Practices & Policies**

Denver Water currently employs field surveys to test the water quality in the Denver Water System. This is time-consuming and costly, as no permanent infrastructure exists at the sampling sites. There are no written policies regarding water sampling sites, but the end-user would prefer to avoid sampling on private property.

**Decision Support Tools**

* Land Cover Classification Map for the identification of current infrastructure and potential contaminate sources
* Water Sampling Site Suitability Map for the identification of optimal locations for water quality sampling sites

**Benefit to End-User:**

* Identifying source contaminants and producing site-suitability maps for water quality sampling sites can improve the efficiency of watershed monitoring for Denver Water.
* Support Denver Water’s mission to provide high-quality water using a resilient and reliable system.

**Ancillary Datasets Utilized**

* USGS National Land Cover Dataset (NLCD) – Land Cover
* USDA Cropland Data Layer - Land Cover
* USGS National Hydrography Dataset (NHD) – Watershed Shapefile
* Denver Water – locations of current sampling sites

**Software Utilized**

ERDAS IMAGINE - land classification of Landsat imagery and atmospheric correction

ArcGIS - Raster Manipulation/Analysis, Image Enhancement and Map Creation of Landsat ETM+, Landsat OLI/TIRS