Google Earth Engine App for Residential Water Use and Preservation

G.E.A.R.U.P.

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Rebecca Moore, Google, Inc. – Manager, Earth Engine / *Visionary*

Landsat Science Team Meeting – July 2015

A Tool For Smarter Lawn Irrigation

https://residentialwateruse.appspot.com/

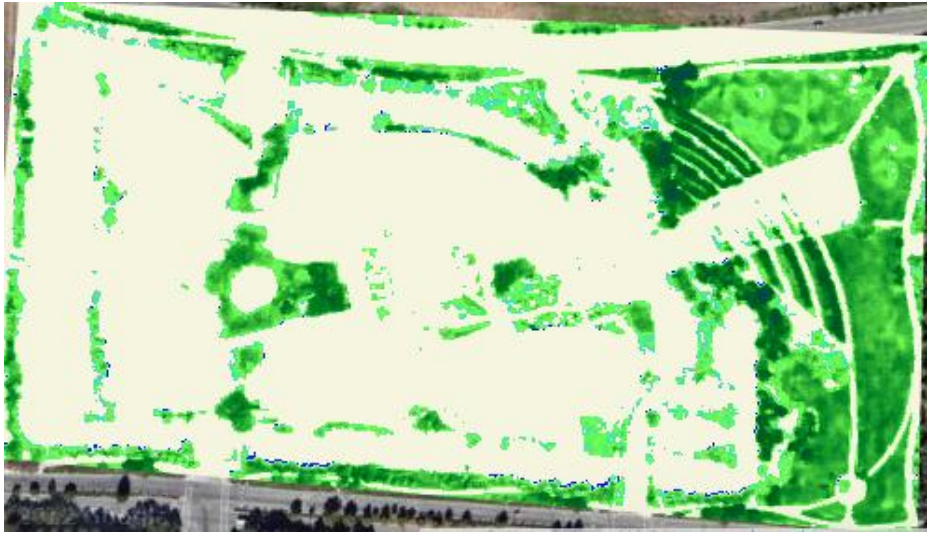
- Help homeowners manage water applications for their lawn
- Designed for the whole CONUS

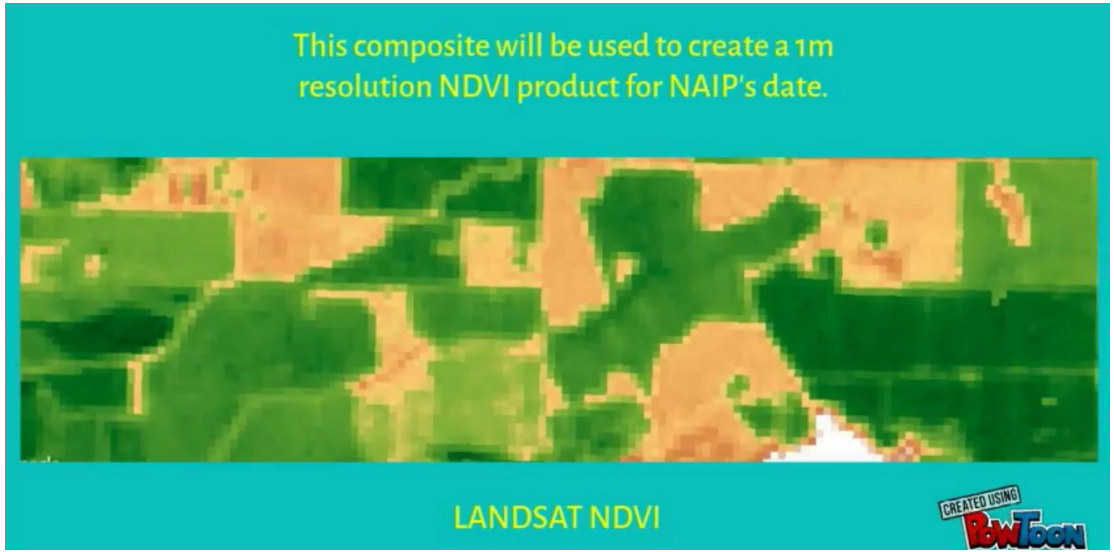
- Link to Beta version of App is at: https://residentialwateruse.appspot.com
- Link to You tube video that shows calibration of NAIP with LANDSAT: https://www.youtube.com/watch?v=9aV8vduSTu0

Googleplex -- NAIP Imagery Converted into Evapotranspiration Map

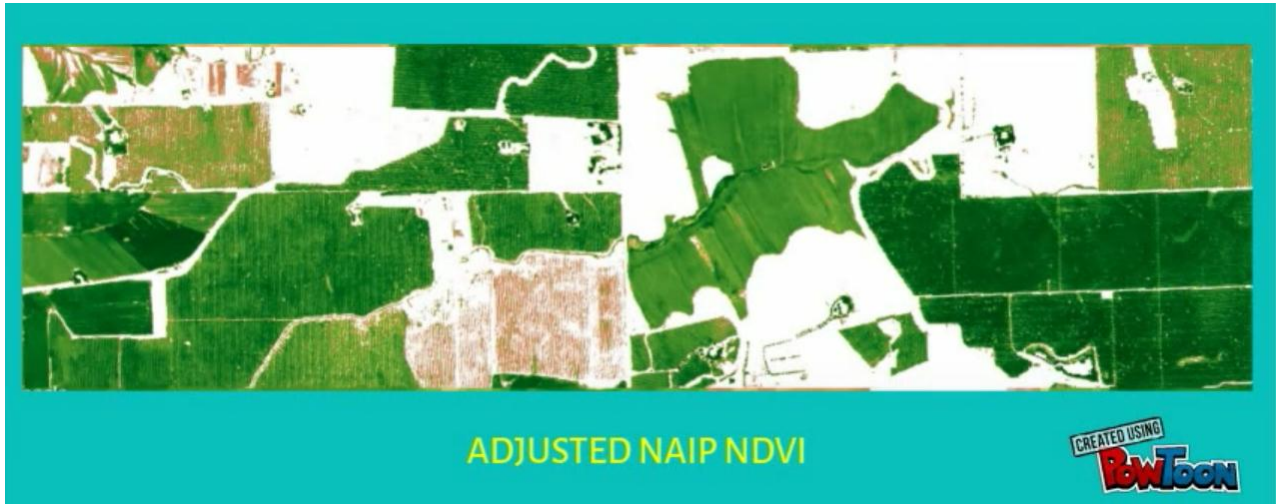
NAIP

Water Consumption





Landsat NDVI vs. NAIP NDVI following calibration



How we calculate ET for lawn

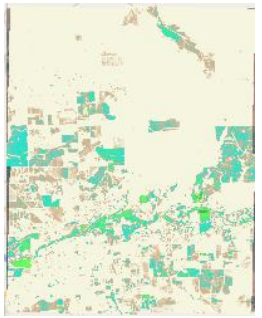
ET = KL x Reference ET

INPUT **OUTPUT**

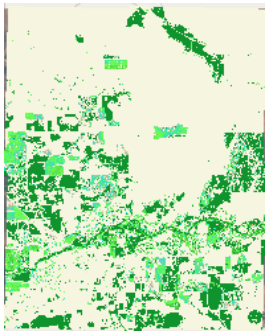
NAIP = National Agriculture Imagery Program (1 m near-infrared)
NAIP imagery is available as Digital Number (DN), only.
We convert NAIP to reflectance using Landsat.

Vegetation NAIP Landsat → KL

Reference ET represent "near maximum ET expected given the weather conditions"

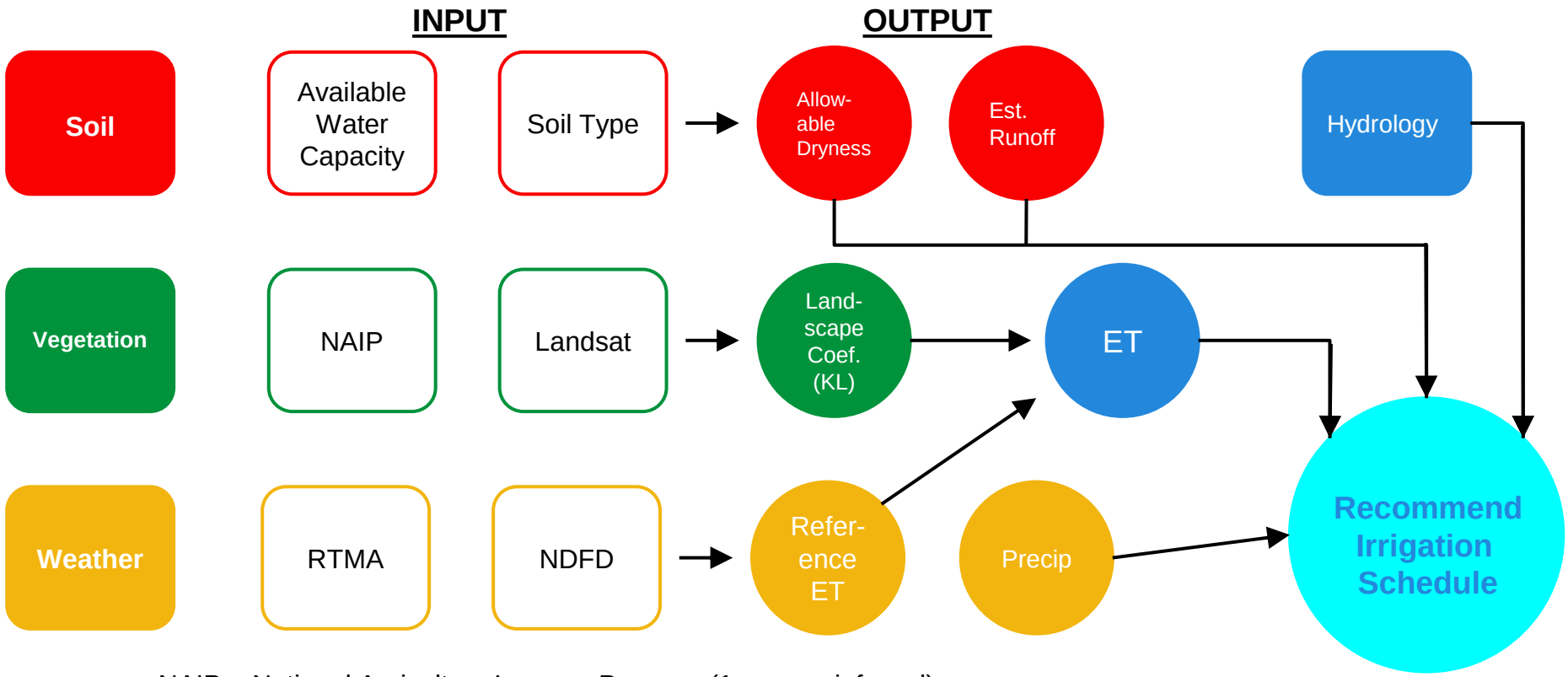


Landscape Coefficient (Kl) Before Calibration with Landsat



Landscape Coefficient (Kl) After Calibration with Landsat

Data flow for GEARUP App

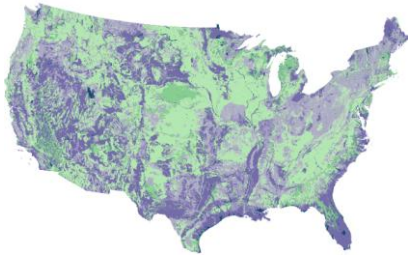


NAIP = National Agriculture Imagery Program (1 m near-infrared)
RTMA = Real-Time Mesocale Analysis Weather; NDFD = National Digital Forecast Database

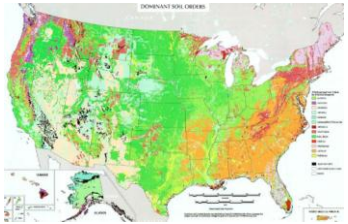
Soil data from STATSGO

INPUT **OUTPUT**

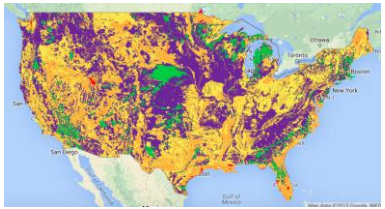
Soil | Available Water Capacity | Soil Type → Allow-able Dryness | Est. Runoff



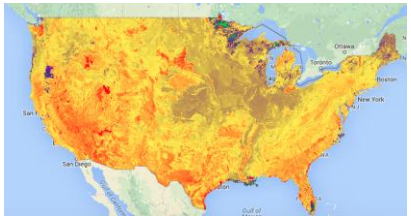
Available Water Capacity



Soil Type



Management Allowable Depletion
(Allowable Dryness)



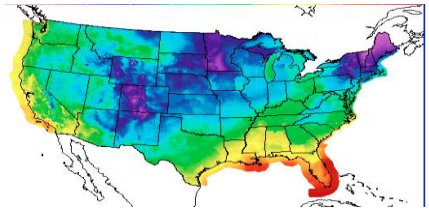
Curve Number
(for Estimating Precipitation Runoff)

Mechanics for the weather forecast

INPUT

OUTPUT

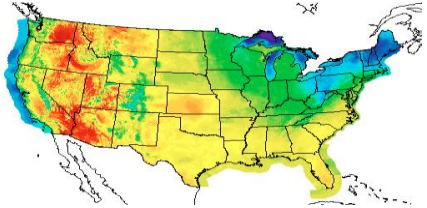
Previous Week



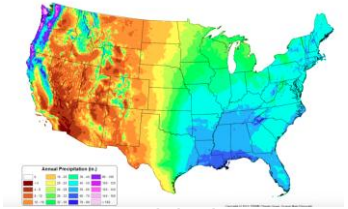
Real-time Mesoscale Analysis

Reference Evapotranspiration

Next Week



National Digital Forecast Database



Precipitation

Weather → RTMA → NDFD → Ref ET → Precip

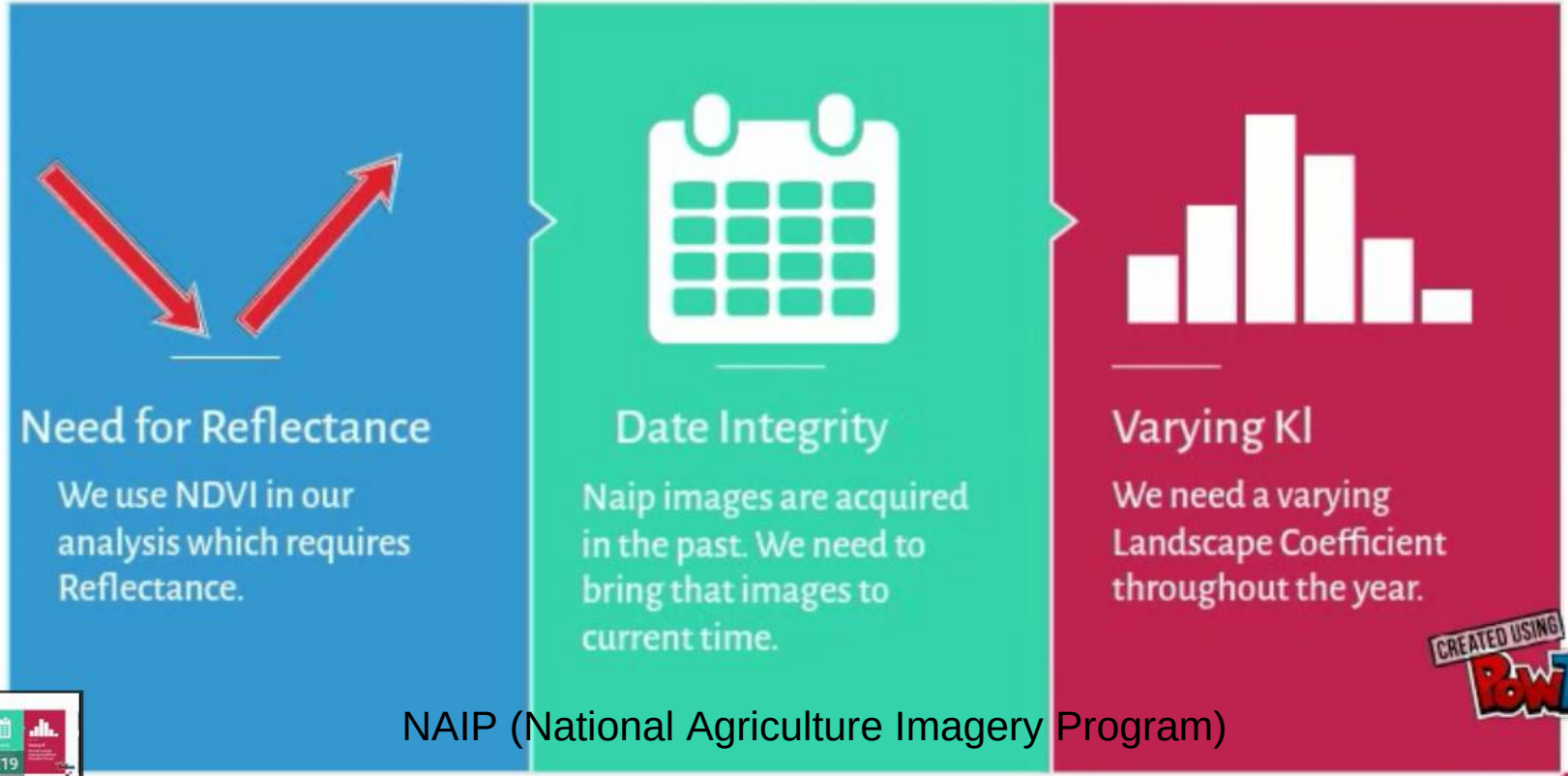
Why Do We Need NAIP?

NAIP (National Agriculture Imagery Program)

It has HIGH spatial resolution
It has RGB, and NIR bands

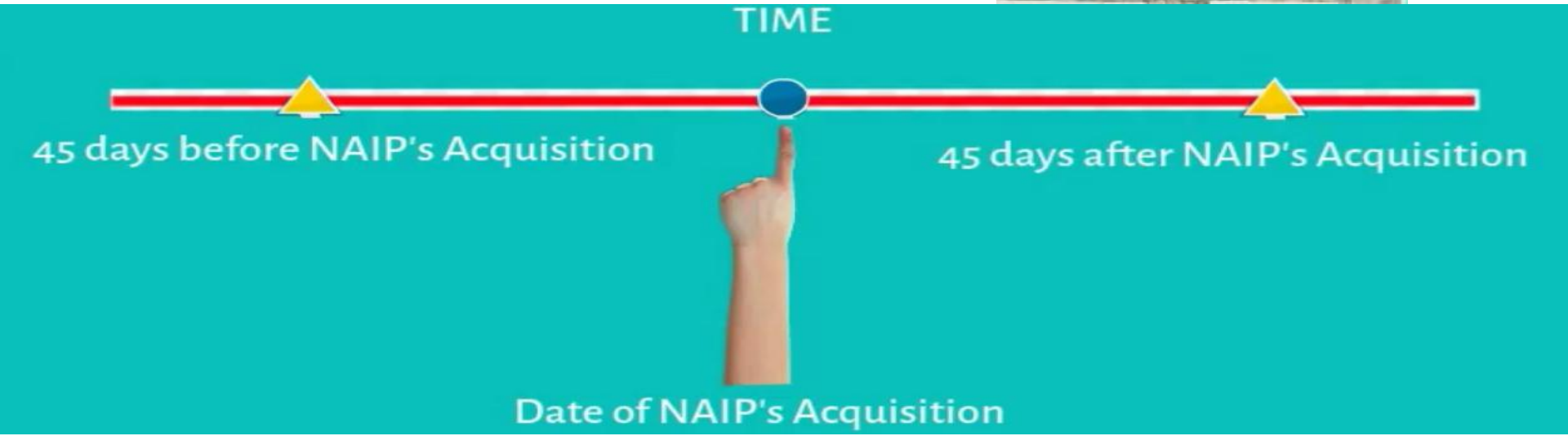
Purpose of the Adjustment

NAIP images report only digital numbers (DN) and bands are not intercalibrated



NAIP (National Agriculture Imagery Program)

Find the most recent NAIP image that has near infrared band



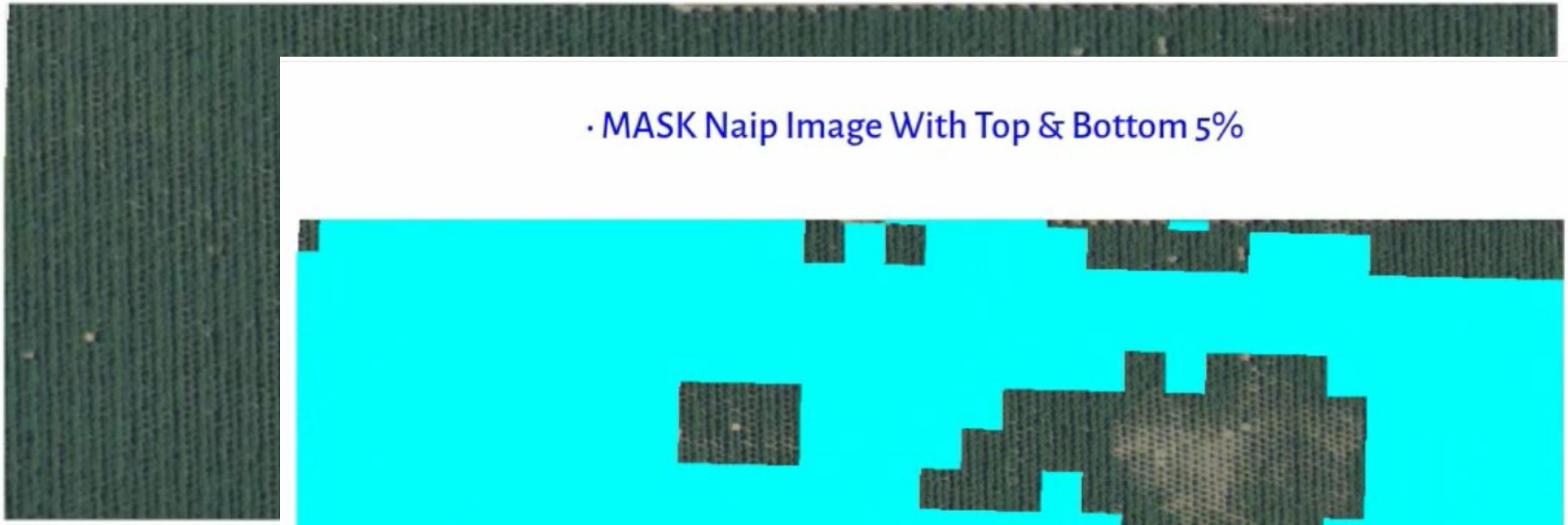
TIME

Create a Cloud Free Landsat Composite For This "INTERVAL"

NAIP vs Landsat Calibration Steps

1) Calculate NDVI with Landsat
2) Get the top and bottom 10 percent of the NDVI from Landsat
3) Mask NAIP with that top and bottom 10 percent from Landsat
4) For the masked NAIP, do the texture analysis for 30 m kernel that is aligned with Landsat pixels
5) Get the Top 20 most homogeneous pixels from the masked NAIP
6) That gives top 2 percent of the Landsat pixels and bottom 2 percent of the entire Landsat NDVI

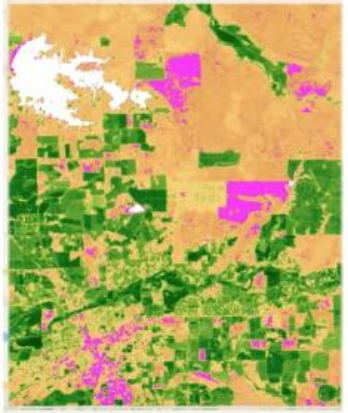
· MASK Naip Image With Top & Bottom 5%



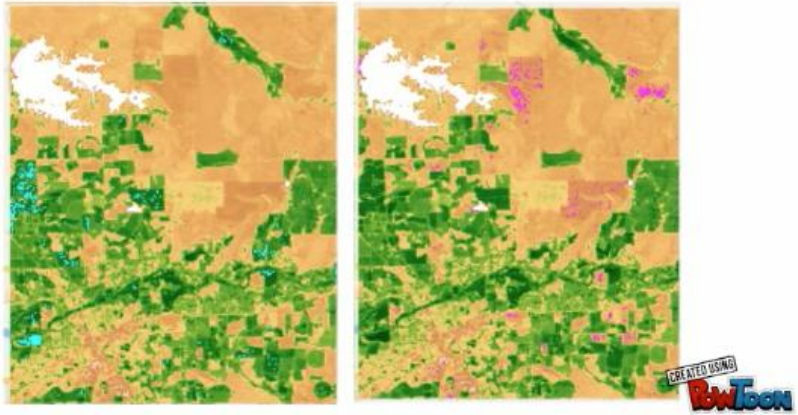
· MASK Naip Image With Top & Bottom 5%

· Take Top 5% of the NDVI Image (NAIP's Date Landsat Composite)

· Take Bottom 5% of the NDVI Image (NAIP's Date Landsat Composite)



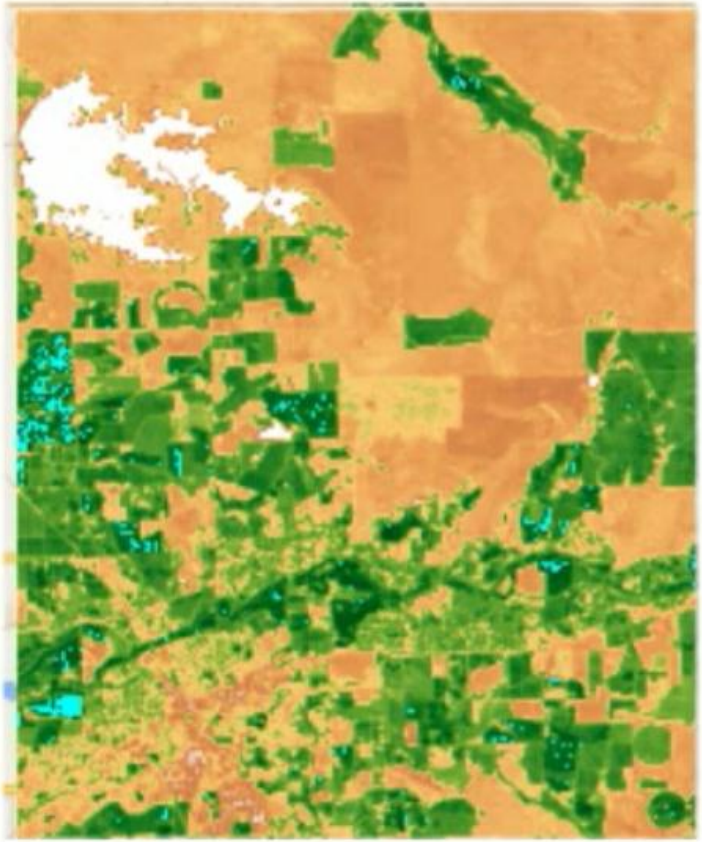
· Within the Masked NAIP Image, perform a GLCM Texture Analysis

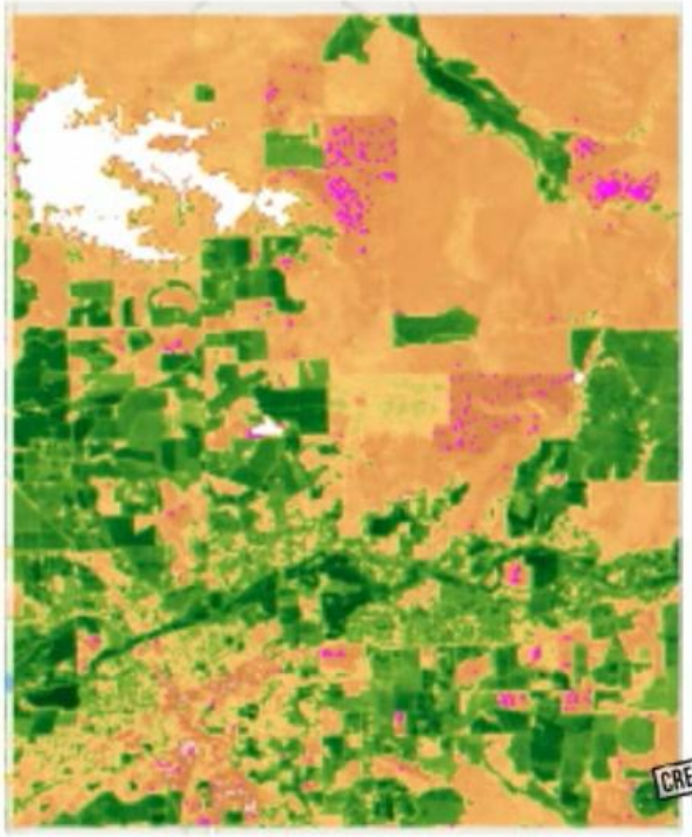


· To Get the Most Homogeneous 80% of the Masked Pixels

GLCM is Grey Level Co-occurrence Matrix

· Within the Masked NAIP Image, perform a GLCM Texture Analysis





GLCM is Grey Level Co-occurrence Matrix

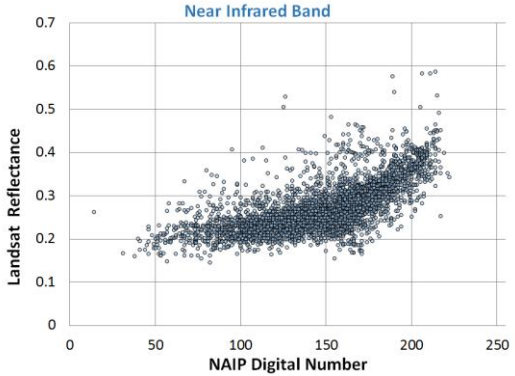
· To Get the Most Homogeneous 80% of the Masked Pixels

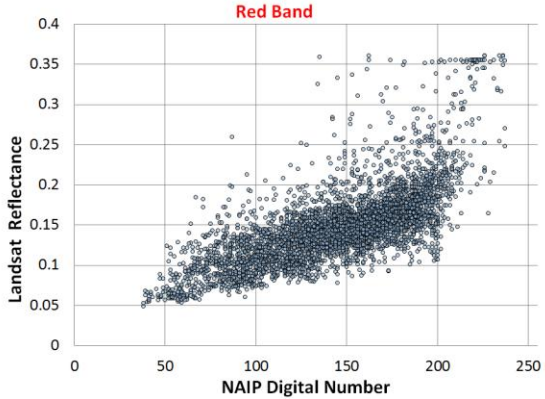
NAIP DN to NAIP Reflectance

NAIP

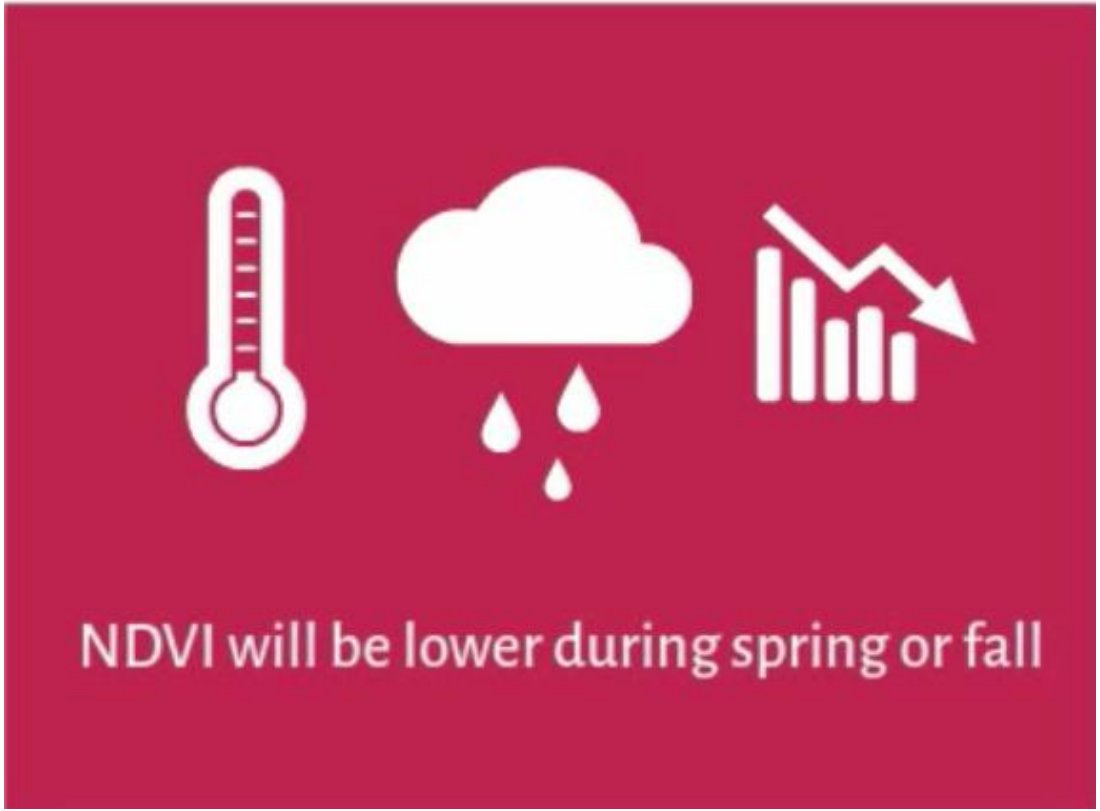
Landsat

Reflectance in NIR and Red vs. DN





Is that calibration sufficient?



TIME

Create Another Cloud Free Landsat Composite For This "INTERVAL"

NAIP

Landsat
Composite for
NAIP's Date

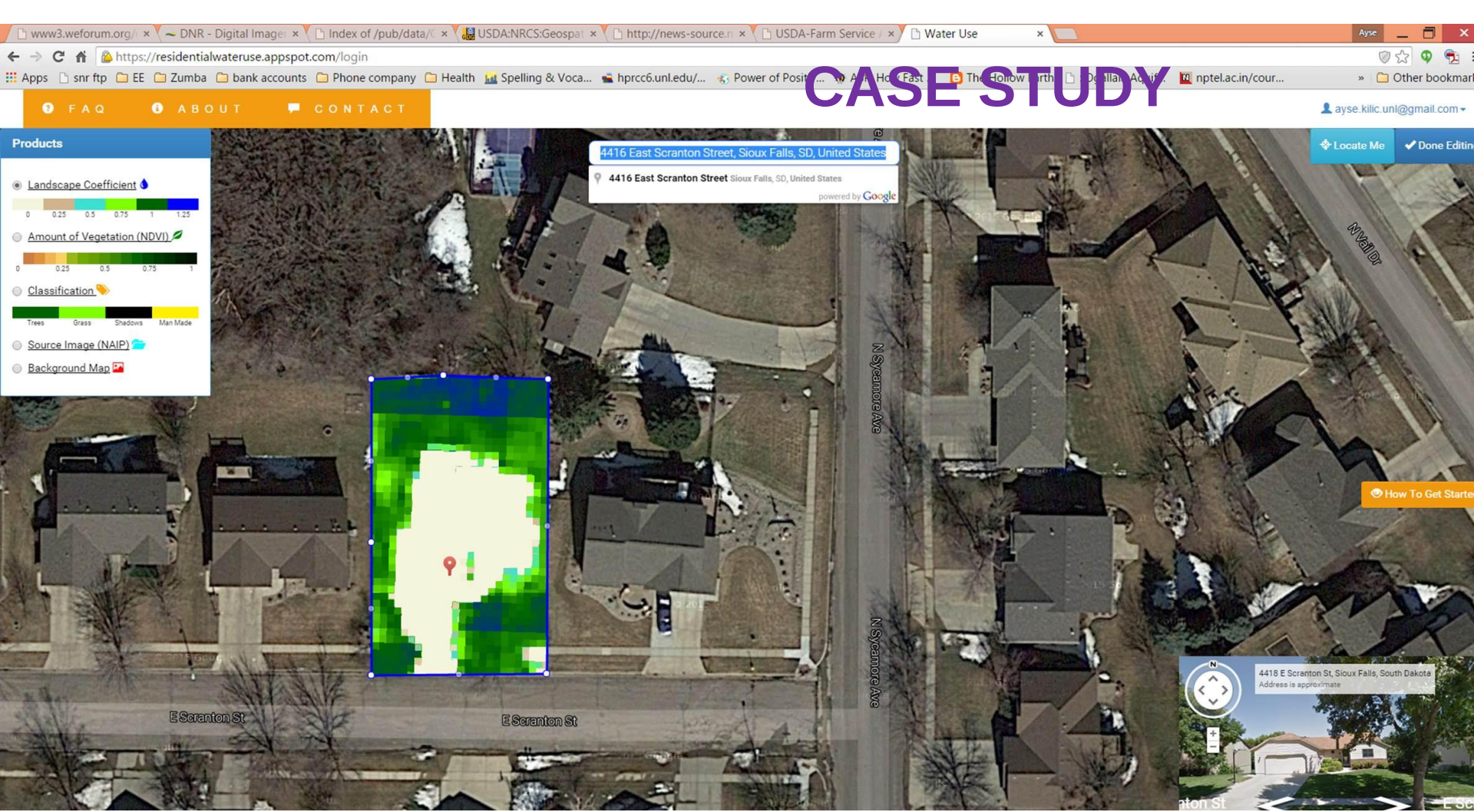
Landsat
Composite for
Last Year To

NAIP

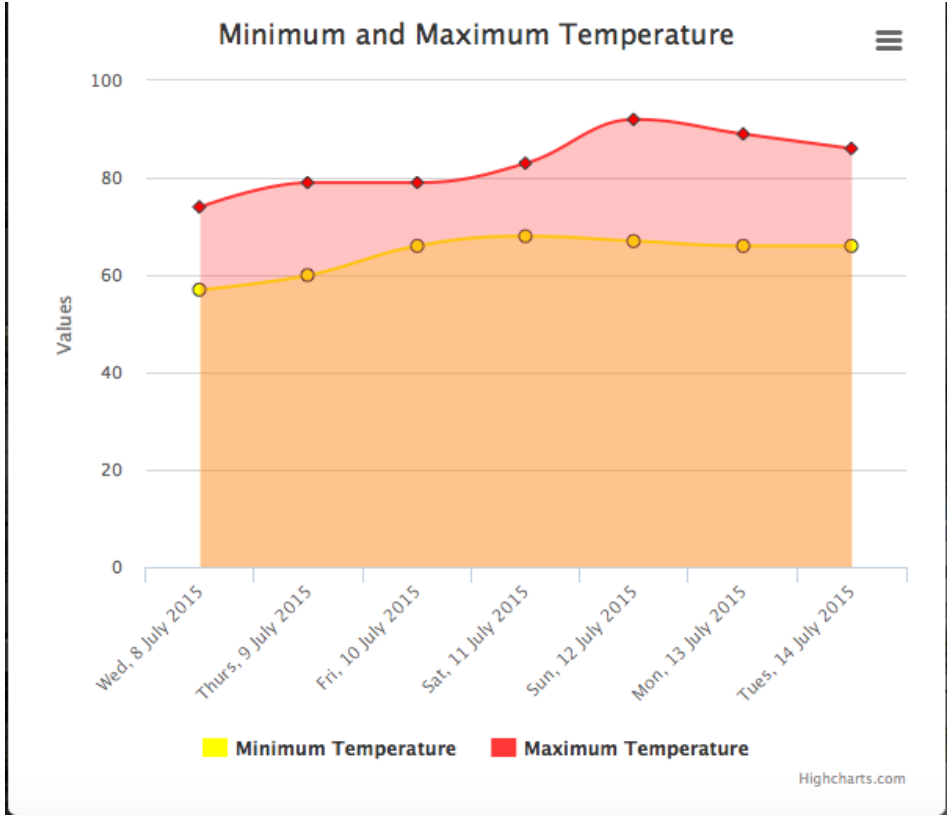
Landsat
Composite for
NAIP's Date
NDVI

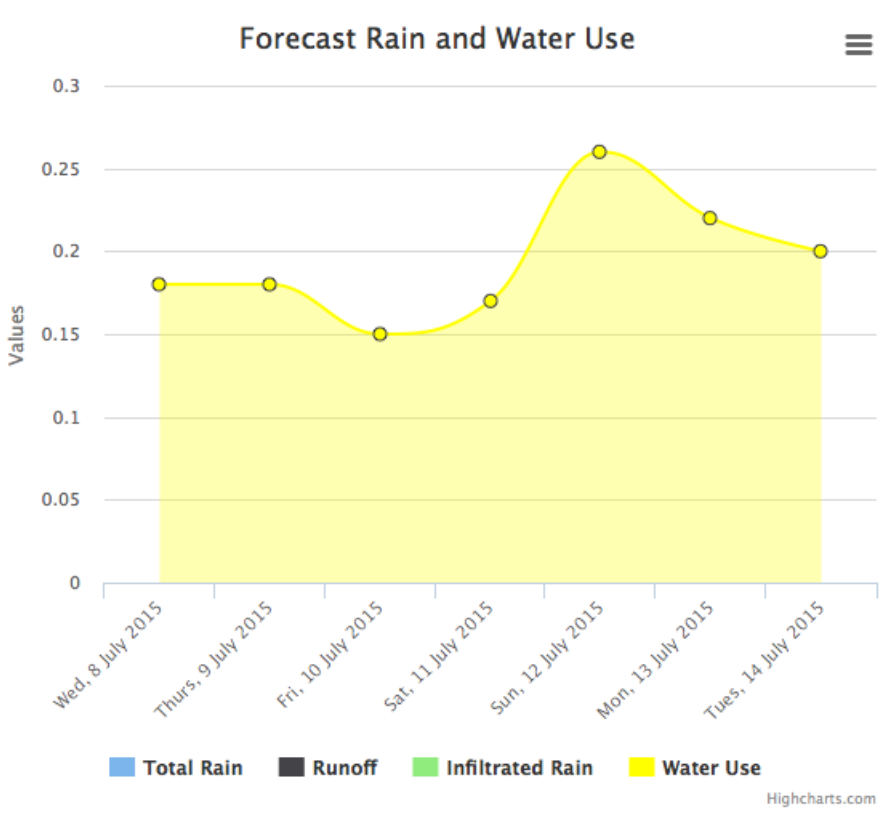
Landsat
Composite for
Last Year N

CASE STUDY


Water Use
https://residentialwateruse.appspot.com/login
FAQ
ABOUT
CONTACT
ayse.kilic.unl@gmail.com
Products
Landscape Coefficient
0 0.25 0.5 0.75 1 1.25
Amount of Vegetation (NDVI)
0 0.25 0.5 0.75 1
Classification
Trees Grass Shadows Man Made
Source Image (NAIP)
Background Map
4416 East Scranton Street, Sioux Falls, SD, United States
4416 East Scranton Street Sioux Falls, SD, United States
powered by Google
Locate Me
Done Editin
How To Get Starte
N Vail Dr
N Sycamore Ave
N Sycamore Ave
E Scranton St
E Scranton St
4418 E Scranton St, Sioux Falls, South Dakota
Address is approximate

GEARUP pulls down 7-day weather and rainfall forecasts from the National Digital Forecast Data Set of National Weather Service and Calculates Reference Evapotranspiration





One output from GEARUP is an estimate of Volume of Water Used based on Area