

The background features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green. These shapes are positioned on the left and right sides of the slide, framing the central text area.

# Urban Irrigation Demand Analysis

City of Roseville, 2009

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# Agenda

- ▶ Project Scope
- ▶ Data Acquisition
- ▶ Steps
- ▶ Calculating the Savings
- ▶ Questions

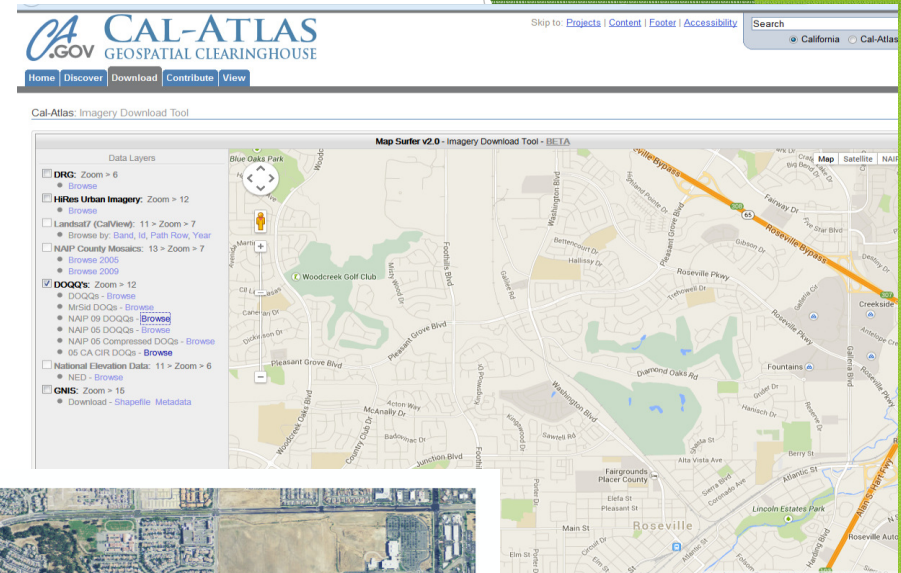
# Project Scope

- ▶ Identify the water demand for urban irrigation of landscaped lawns
  - ▶ Including commercial and residential
- ▶ Useful for drought management
- ▶ Water conservation policy making



# Data Acquisition

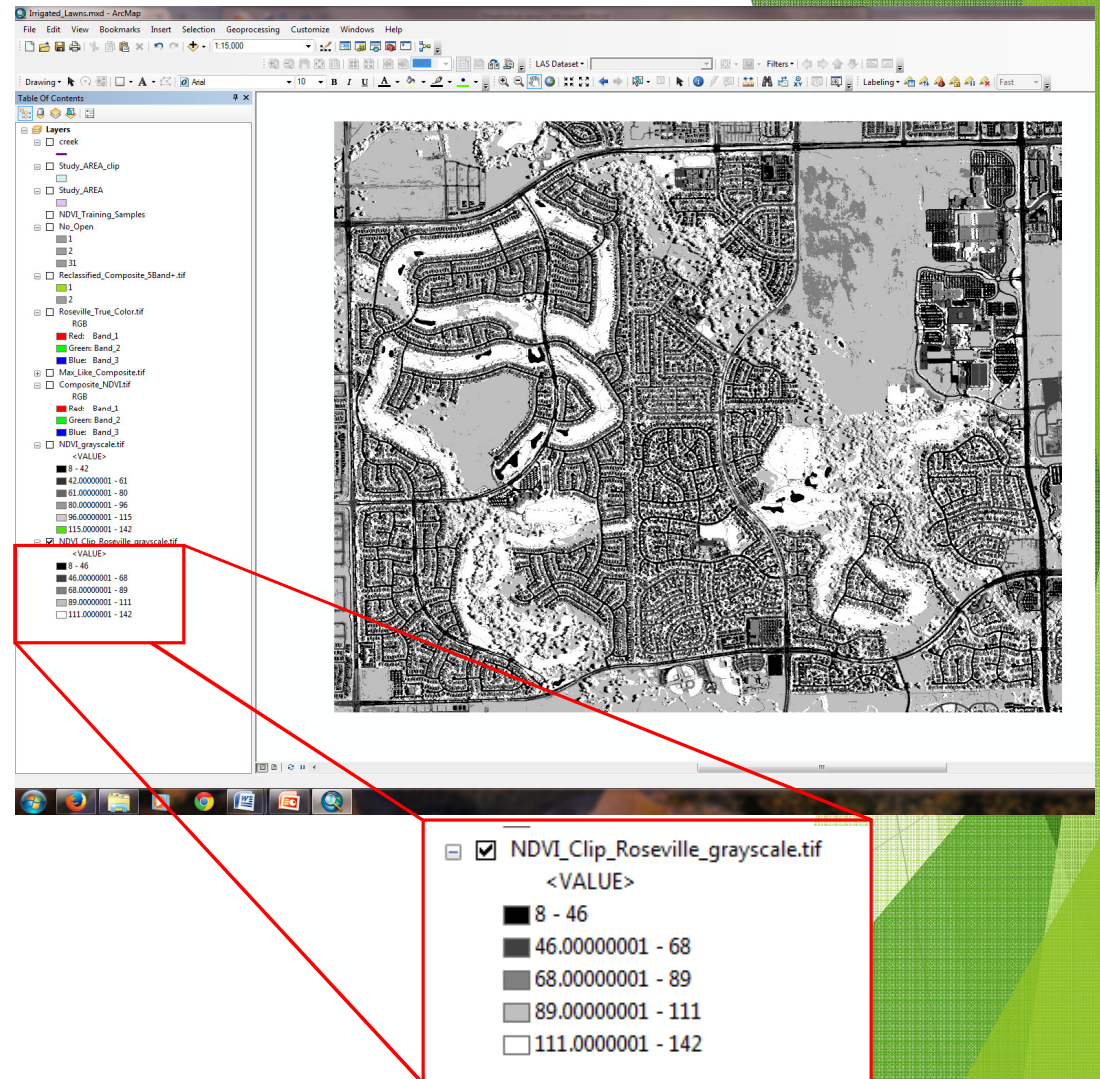
- ▶ Cal - Atlas :National Agriculture Imagery Program (NAIP)
  - ▶ High resolution aerial imagery
  - ▶ 2009, taken in Summer
  - ▶ 4 band image: R, G, B, NIR
- ▶ City of Roseville
  - ▶ Shapefiles
    - ▶ Open Space Layer
    - ▶ Residential Parcel Layer





# Step 1

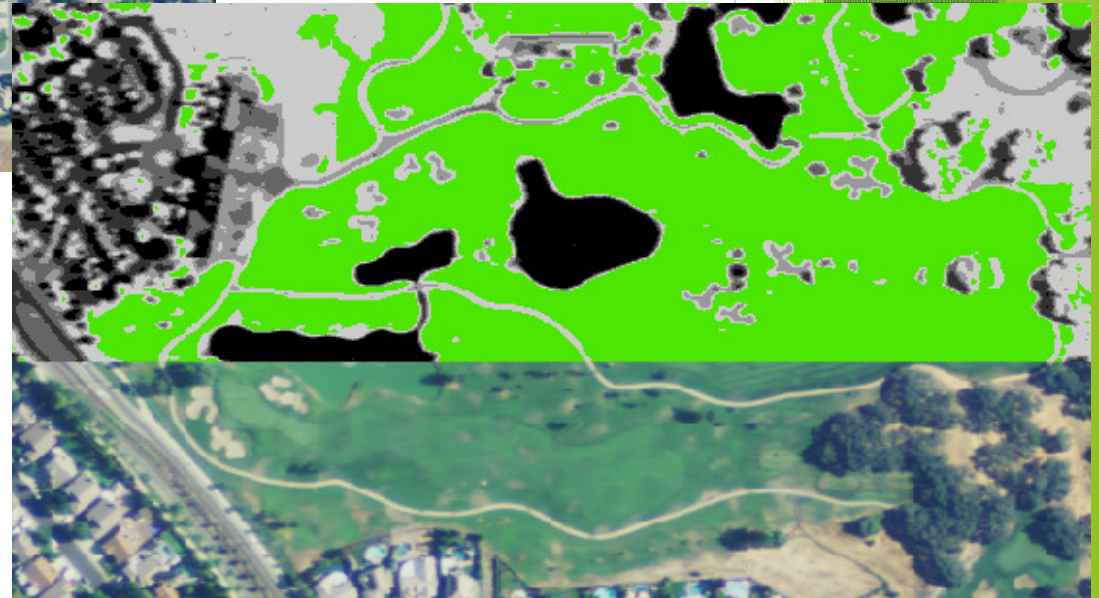
- ▶ 1. Image subset was created using a rectangular graphic
- ▶ 2. Ran NDVI
  - ▶ Notice the high reflective areas are identified as healthy green lawns.
  - ▶ Artificial turf and colored man made lakes reflect low





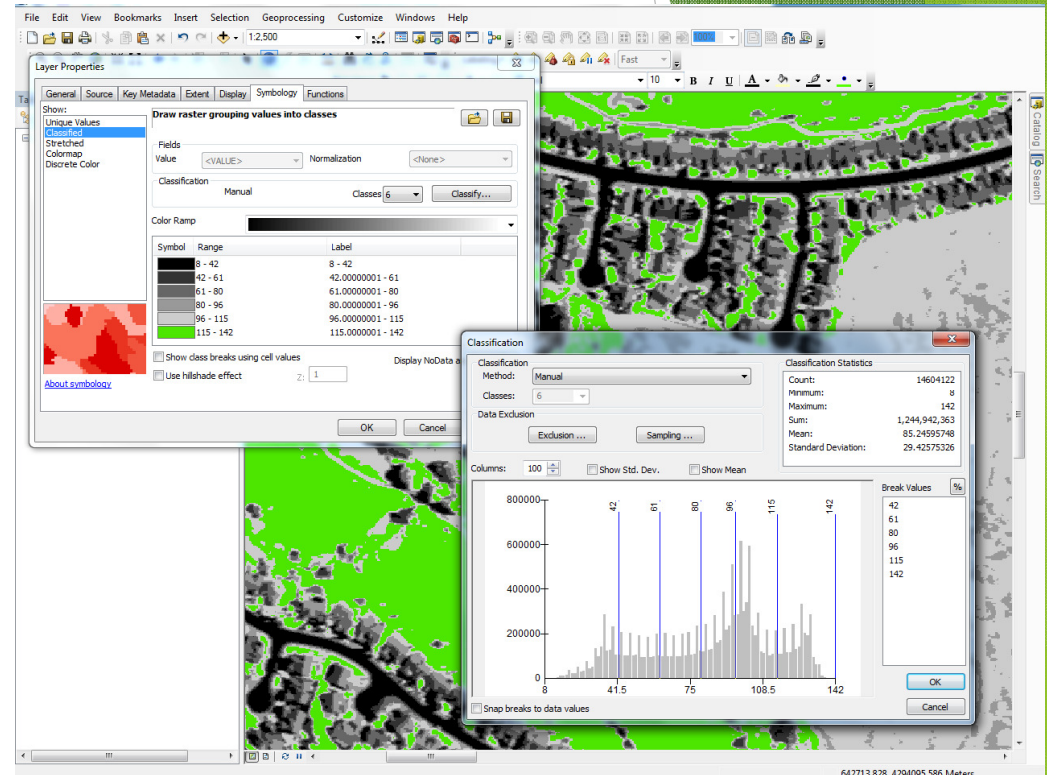




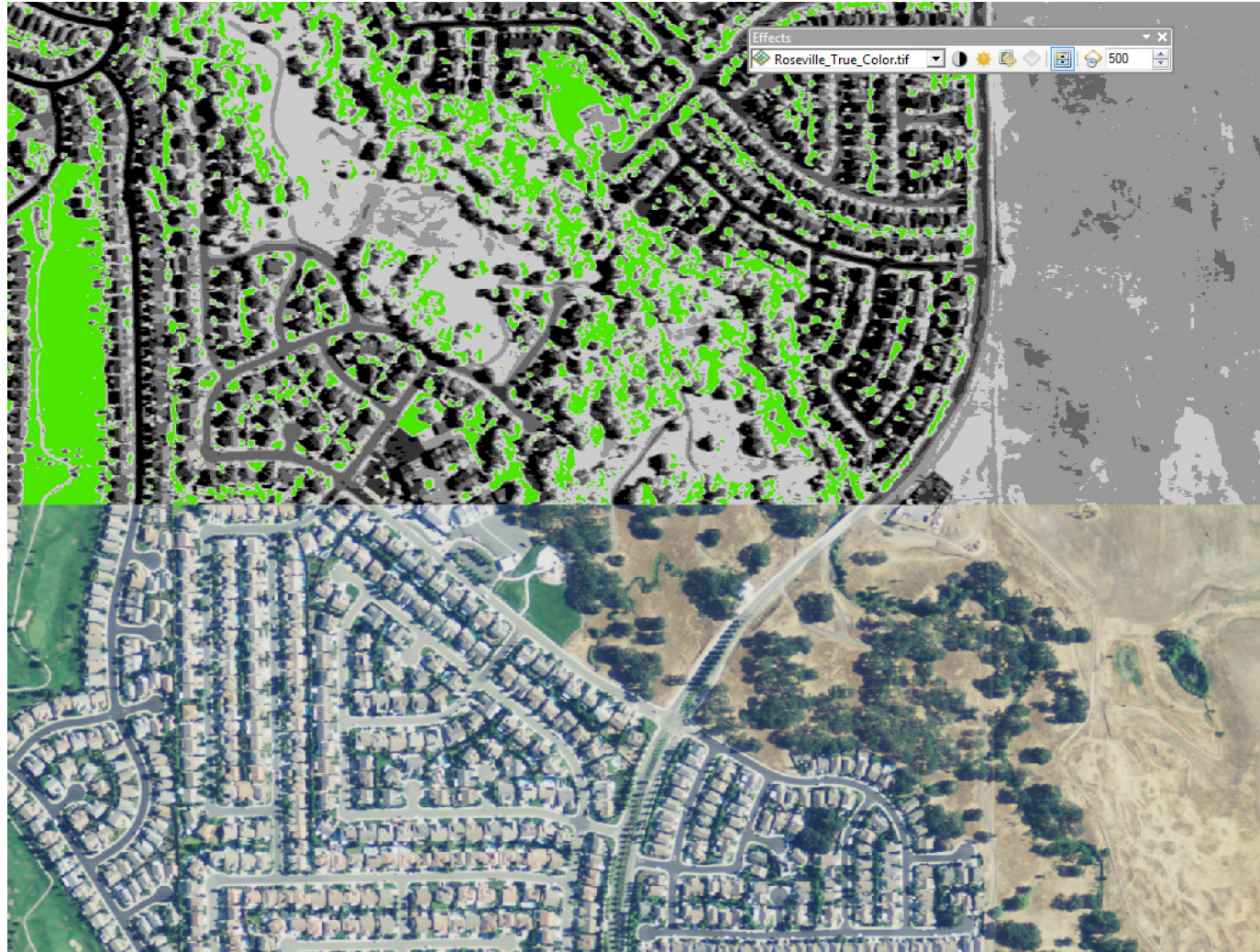


# Step 1 Symbolology

- ▶ A minimum pixel value of 115 was assigned to the last class to pick out the healthy green lawns
- ▶ Green was assigned to stand out from the rest of the pixels.
- ▶ Oak trees were still being picked up



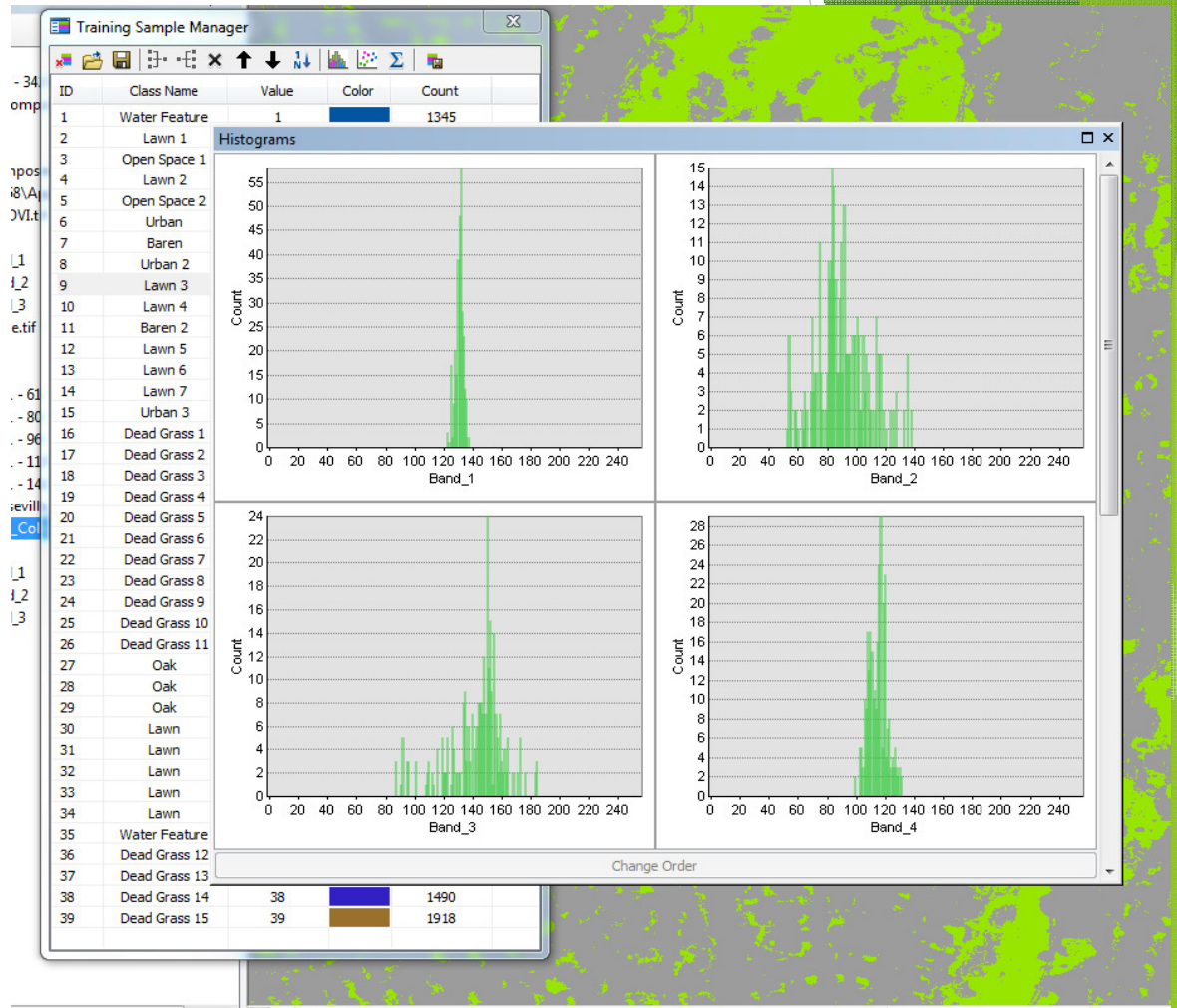






# Step 2

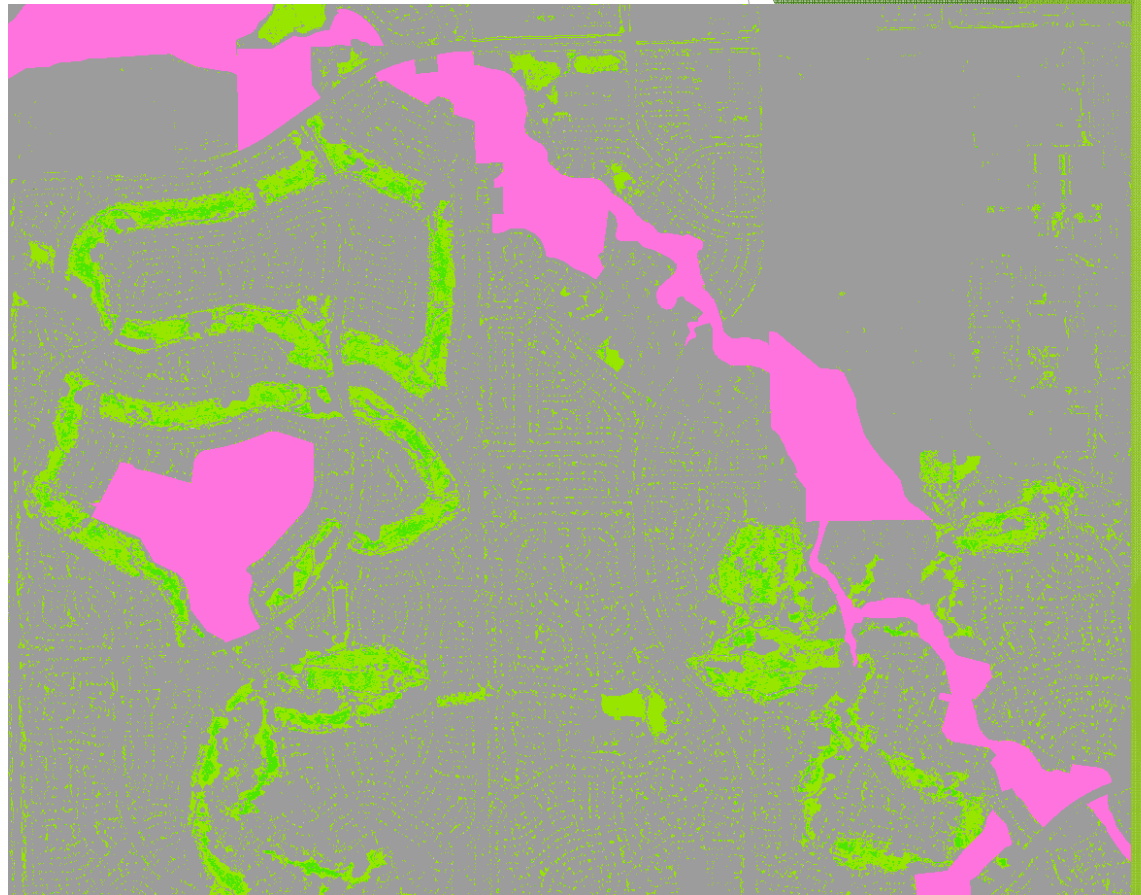
- Supervised Classification
  - 39 spectral signatures
    - Urban
    - Dead Grass
    - Lawn
    - Oak
    - Water Feature





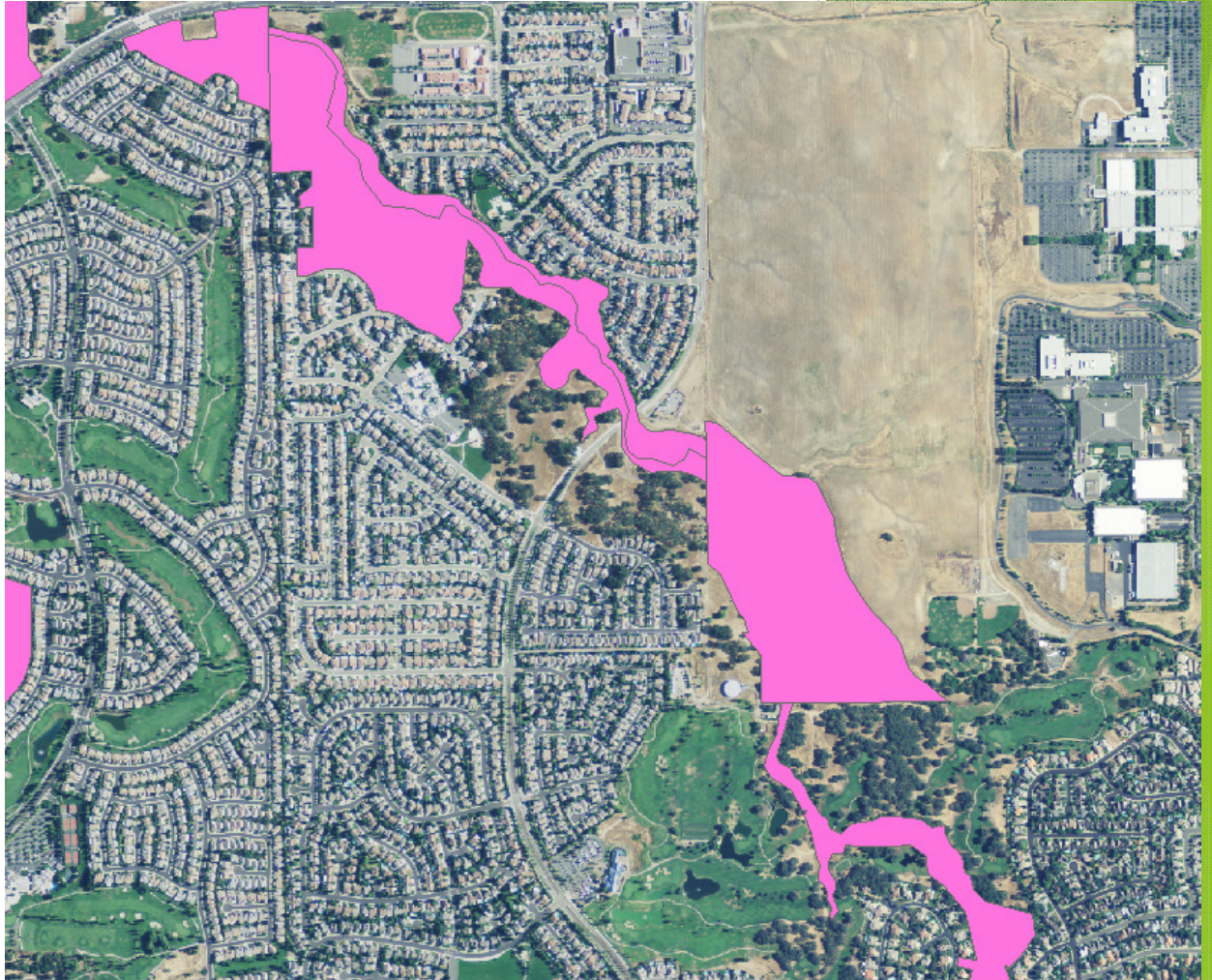
## Step 3

- ▶ Maximum Likelihood using Spectral Signatures
- ▶ Reclassified to 2 classes: lawns and everything else



## Step 3

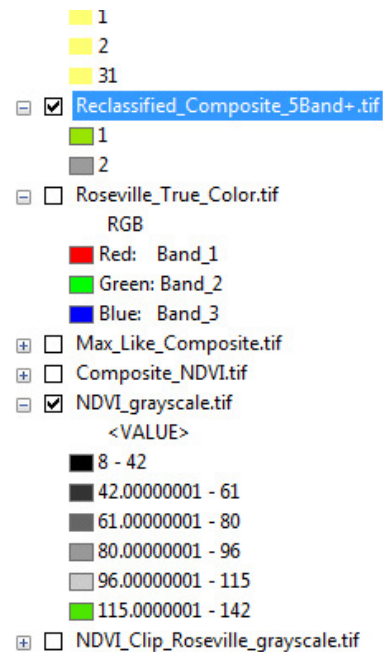
- ▶ Majority of oaks were still included in the output
- ▶ Open space layer was added
  - ▶ Still not 100% accurate
  - ▶ Extract by Mask to exclude the pixels in the open space area





# Results

- ▶ 1,534,757 square meters
- ▶ Or 16,519,986 square feet of irrigated lawns

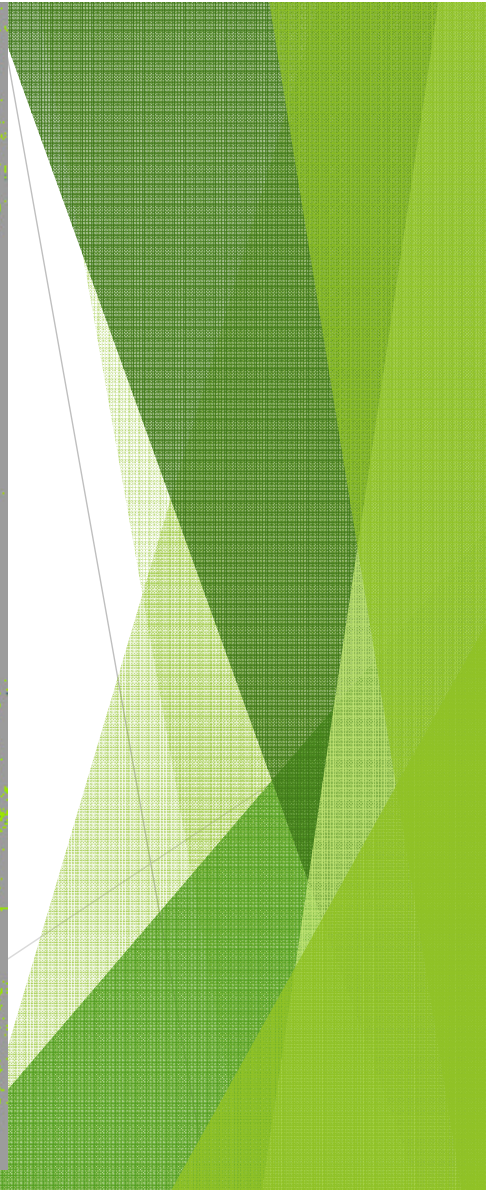
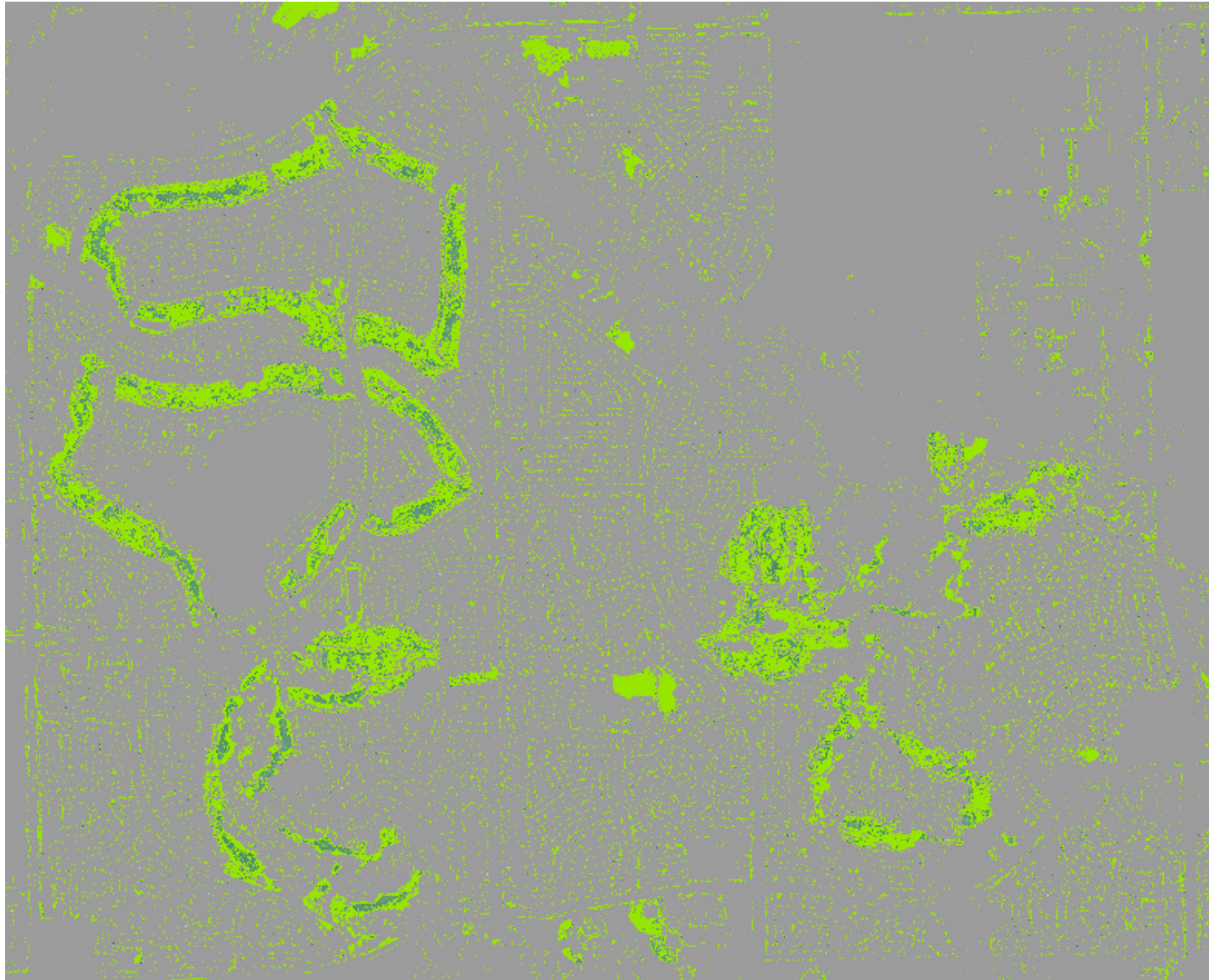


Table

OID	Value	Count
0	1	1534757
1	2	1284683
2	31	222532

(1 out of 3 Selected)

Reclassified\_Composite\_5Band+.tif





# Calculating the Savings

- ▶ Maximum Applied Water Allowance Calculation:
  - ▶ About 8,000 residential households
  - ▶ 16,519,986 ft<sup>2</sup> of irrigated lawns
  - ▶ 52.2"/year water evaporates from an area
  - ▶ Calculate the water savings by reducing the irrigated lawn area by 25%:
  - ▶ **SAVINGS = 93.5 million gallons per year**
  - ▶ Or water for 986 households for one year

## LANDSCAPE WATER USE CALCULATION EXAMPLES

### MAXIMUM APPLIED WATER ALLOWANCE

The Maximum Applied Water Allowance shall be calculated using the following equation:

$$MAWA = (ET_o) (0.62) [(0.7 \times LA) + (0.3 \times SLA)]$$

The example calculations below are hypothetical to demonstrate proper use of the equations and do not represent an existing and/or planned landscape project. For actual irrigation scheduling, automatic irrigation controllers are required and shall use current reference evapotranspiration data, such as from the California Irrigation Management Information System (CIMIS), other equivalent data, or soil moisture sensor data.

- (1) Example MAWA calculation: a hypothetical landscape project in Roseville, CA with an irrigated landscape area of 50,000 square feet without any Special Landscape Area (SLA = 0, no edible plants, recreational areas, or use of recycled water). To calculate MAWA, the annual reference evapotranspiration value for Roseville is 52.2 inches as listed in the Reference Evapotranspiration Table in Section 19.67.050.B.2.b.

$$\begin{aligned} MAWA &= (ET_o) (0.62) [(0.7 \times LA) + (0.3 \times SLA)] \\ MAWA &= \text{Maximum Applied Water Allowance (gallons per year)} \\ ET_o &= \text{Reference Evapotranspiration (inches per year)} \\ 0.62 &= \text{Conversion Factor (to gallons)} \\ 0.7 &= \text{ET Adjustment Factor (ETAF)} \\ LA &= \text{Landscape Area including SLA (square feet)} \\ 0.3 &= \text{Additional Water Allowance for SLA} \\ SLA &= \text{Special Landscape Area (square feet)} \end{aligned}$$

$$\begin{aligned} MAWA &= (52.2 \text{ inches}) (0.62) [(0.7 \times 50,000 \text{ square feet}) + (0.3 \times 0)] \\ MAWA &= 1,132,740 \text{ gallons per year} \end{aligned}$$

- (2) In this next hypothetical example, the landscape project in Roseville, CA has the same ET<sub>o</sub> value of 52.2 inches and a total landscape area of 50,000 square feet. Within the 50,000 square foot project, there is now a 2,000 square foot area planted with edible plants. This 2,000 square foot area is considered to be a Special Landscape Area.

$$\begin{aligned} MAWA &= (ET_o) (0.62) [(0.7 \times LA) + (0.3 \times SLA)] \\ MAWA &= (52.2 \text{ inches}) (0.62) [(0.7 \times 50,000 \text{ square feet}) + (0.3 \times 2,000 \text{ square feet})] \\ &= 32.36 \times [35,000 + 600] \text{ gallons per year} \\ &= 32.36 \times 35,600 \text{ gallons per year} \\ MAWA &= 1,152,016 \text{ gallons per year} \end{aligned}$$

The background features abstract green geometric shapes, including triangles and polygons, some with a fine grid pattern, set against a white background.

# Questions?

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