Major Water Conservation Initiative: New Approach Developed for First California Statewide Irrigated Landscape Analysis

WaterSmart Innovations Conference

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quantum SPATIAL AN NV5 COMPANY

EAGLE AERIAL SOLUTIONS

Overview of Presentation

- Background to Program
- Technical Approach
- Output Datasets
- Using the Data
- Questions/Discussion

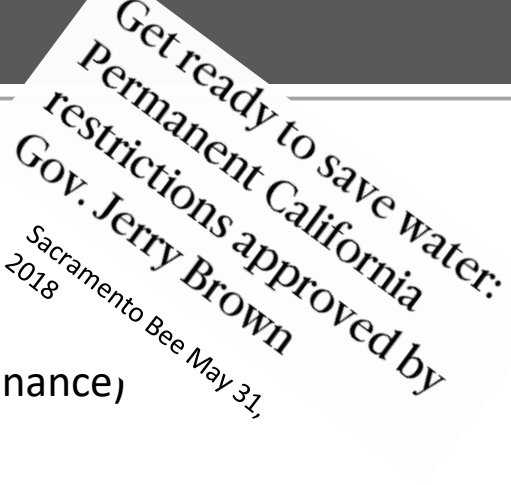
Background

California Statewide Urban Irrigated Landscape Program

Water Budget Targets

- Need an equitable way of assessing urban water use
- Recognize the efficiency of water use
- Water Use Objective customized to each district
  - Population
  - Landscape area
  - Potential Evapotranspiration
    - ET_0
  - Adjust with local variances where important

Conservation Programs


Get ready to save water: Permanent California restrictions approved by Gov. Jerry Brown

Sacramento Bee May 31, 2018

- SBX 7-7 20% by 2020 Method 2:
  - 55 gallons per capita per day Indoor Residential
  - Outdoor Water Use (Model Water Efficient Landscape Ordinance) (MWELO)
    - Landscape area x ET_0 x factor
  - 10% reduction in Commercial, Institutional and Industrial (CII) Water Use
- Executive Order B-37-16
  - Calls for 5 state agencies to develop recommendations for long term water conservation framework
  - Specifically calls for water budget target approach
  - Framework report released April 2017.
- SB 606/AB 1668
  - 4 Sections
  - Section: Water Use Objectives

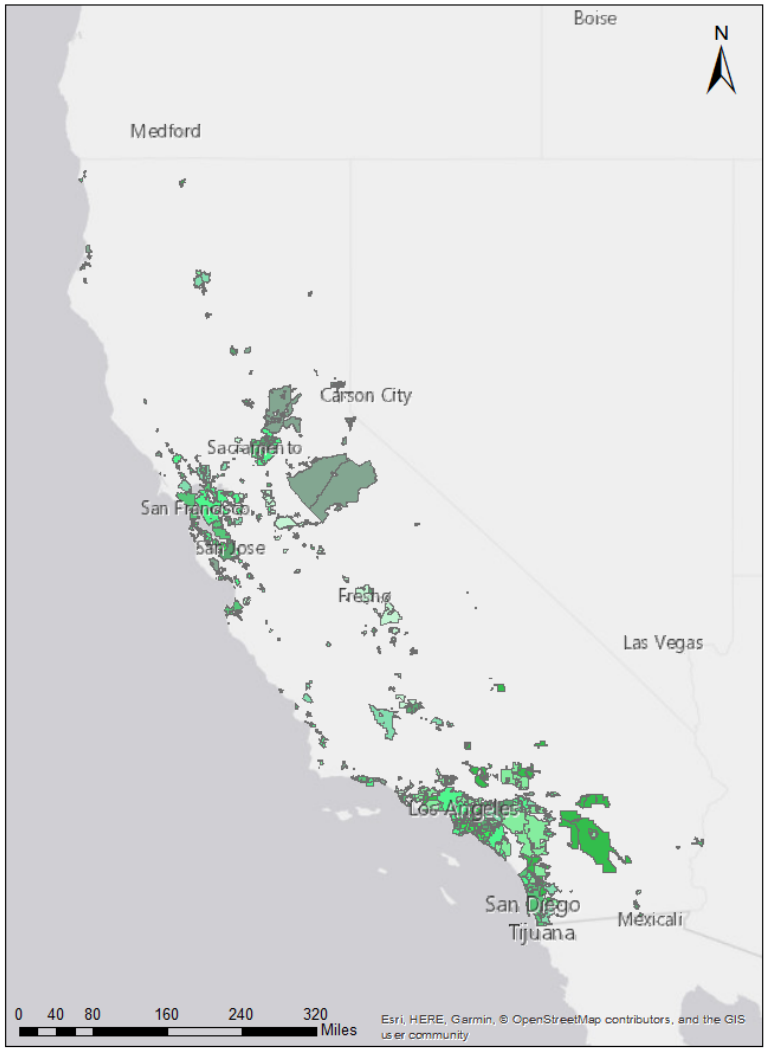
Water Use Objectives:

Indoor Residential Budget
{55 gal/person day}
+
Outdoor Irrigation Budget
{Landscape area x ET_0 x factor}
+
Distribution System Water Loss Budget
=
Annual Water Use Objective

- Compliance based on overall objective - do not have to comply with individual budgets
- Compliance based on service area average - not individual parcel

Need to Understand Landscape Area

- Phase 1: Method investigation
- Phase 2a: Analysis of 2 districts
- Phase 2b: Assessing 17 districts
- Phase 3: Assess remaining water districts
- Total number of districts = 400
- ~16,000 square miles of urban landscape



Estimating Irrigated Landscape Area

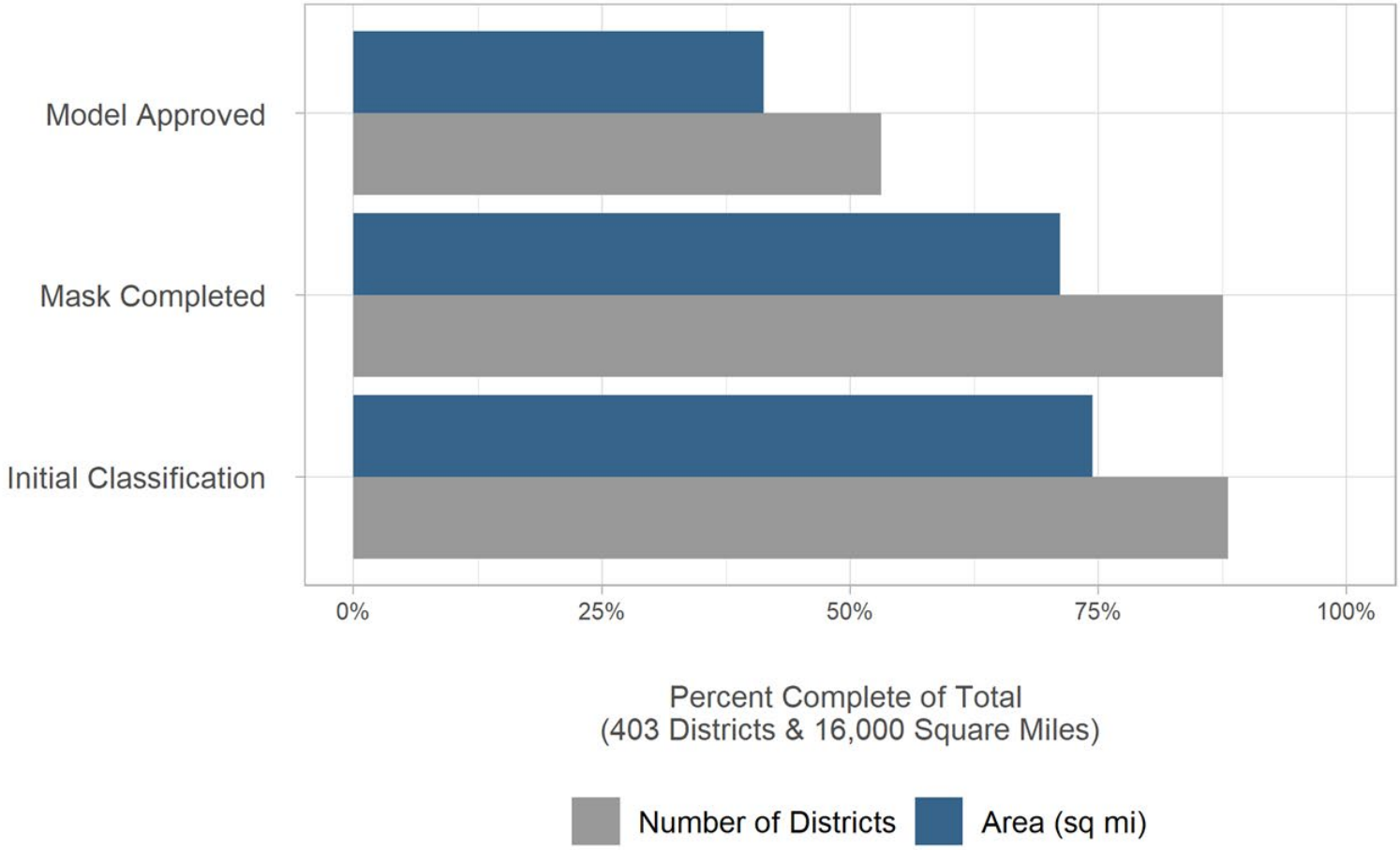
California Statewide Urban Irrigated Landscape Program

Classification Key

- Irrigated
  - Lawns
  - Shrubs and trees
  - Ground cover in irrigated areas (mulch/soil)
- Irrigable not Irrigated
  - Dry lawns
  - Dry landscaping that has evidence of irrigation

- Not Irrigable
  - Structures, roads, sidewalks, impervious
  - Undeveloped land
  - Open Water
- Special Cases
  - Horse Corals
  - Artificial Turf

Overall Progress to Completion



Acquire Digital Imagery and Ancillary Data

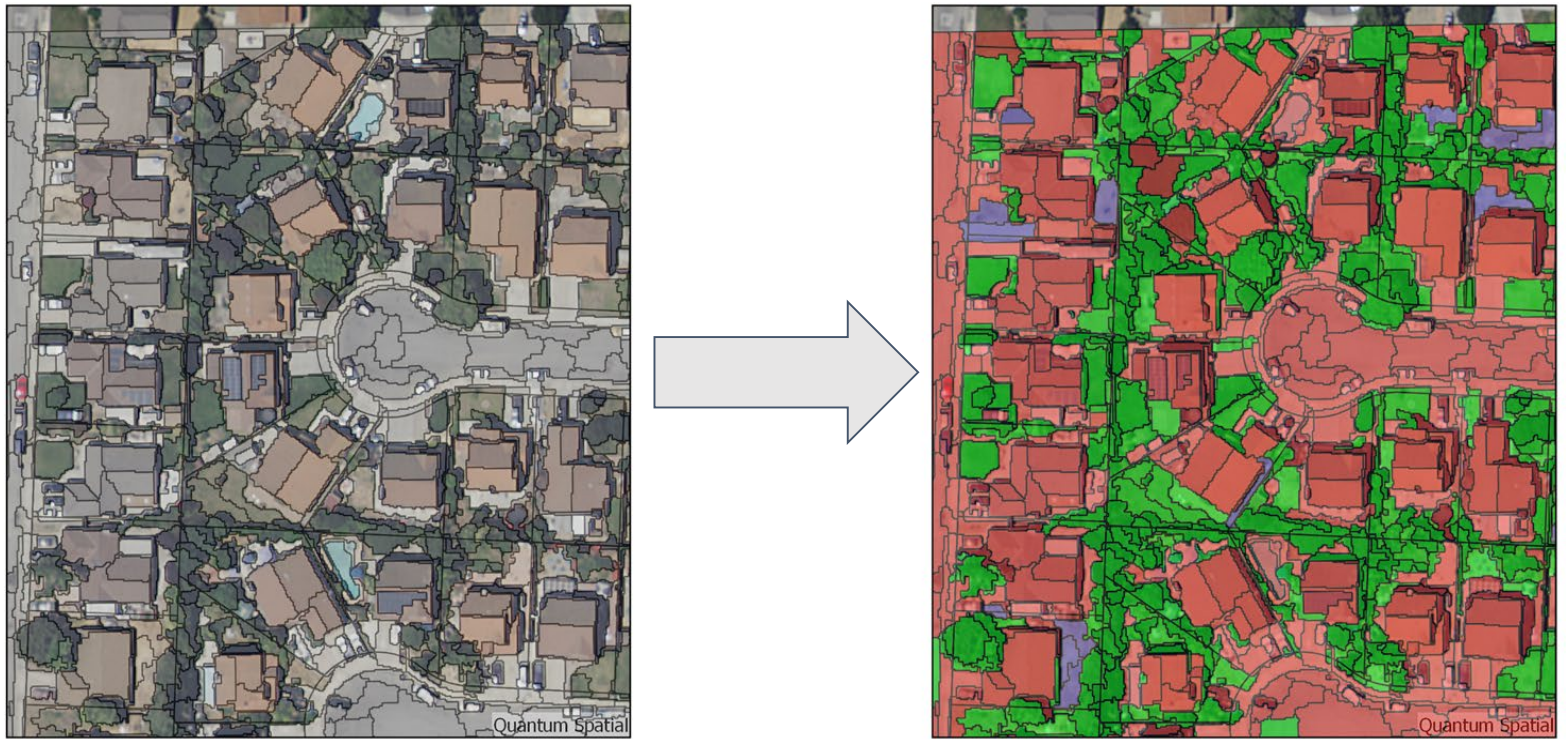
- Define Water District AOI: Now have 400 defined AOIs
- Aerial Imagery: 1 ft, 4 band, collected mid summer 2018
- Parcel Data: Consolidated County data for whole state with land use descriptions
  - Single Family Residential (SFR)
  - Multi-family Residential (MFR)
- Licensed data

Landscape Area Estimates Modeling Process

Imagery Segmentation: Using 4-band imagery, self-similar regions of pixels are grouped together to create features (super-pixel objects).

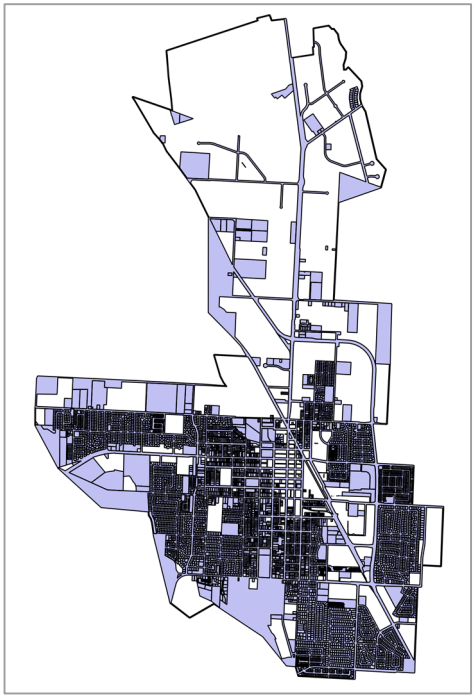
Landscape Area Estimates Modeling Process

Initial Land Cover Classification: Features are assessed and classified using advanced machine learning techniques.



Landscape Area Estimates Modeling Process

Network Creation: Parcels are networked based on similarity of cover classes and parcel attributes.



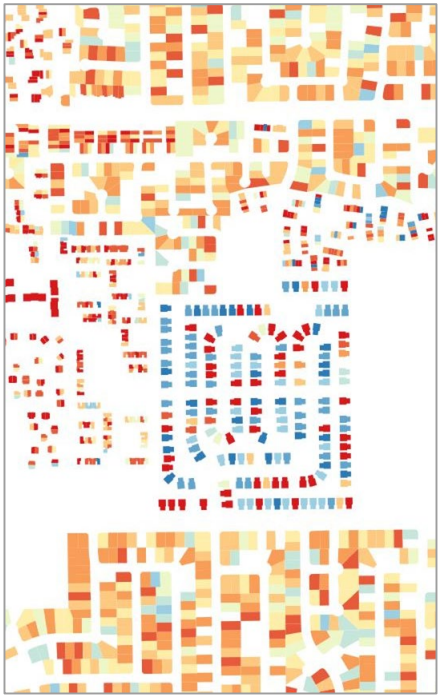
Land Cover Classes

Geometries

Zip Codes

Parcel Number

Land Use Code

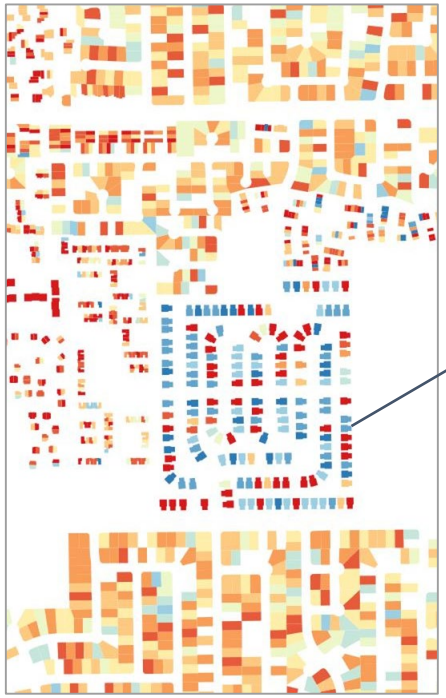


Landscape Area Estimates Modeling Process

Derived Land Masks: Undeveloped lands, agriculture, and horse corrals are manually captured by human photo interpreters in order to ensure correct classification in the LAE project.

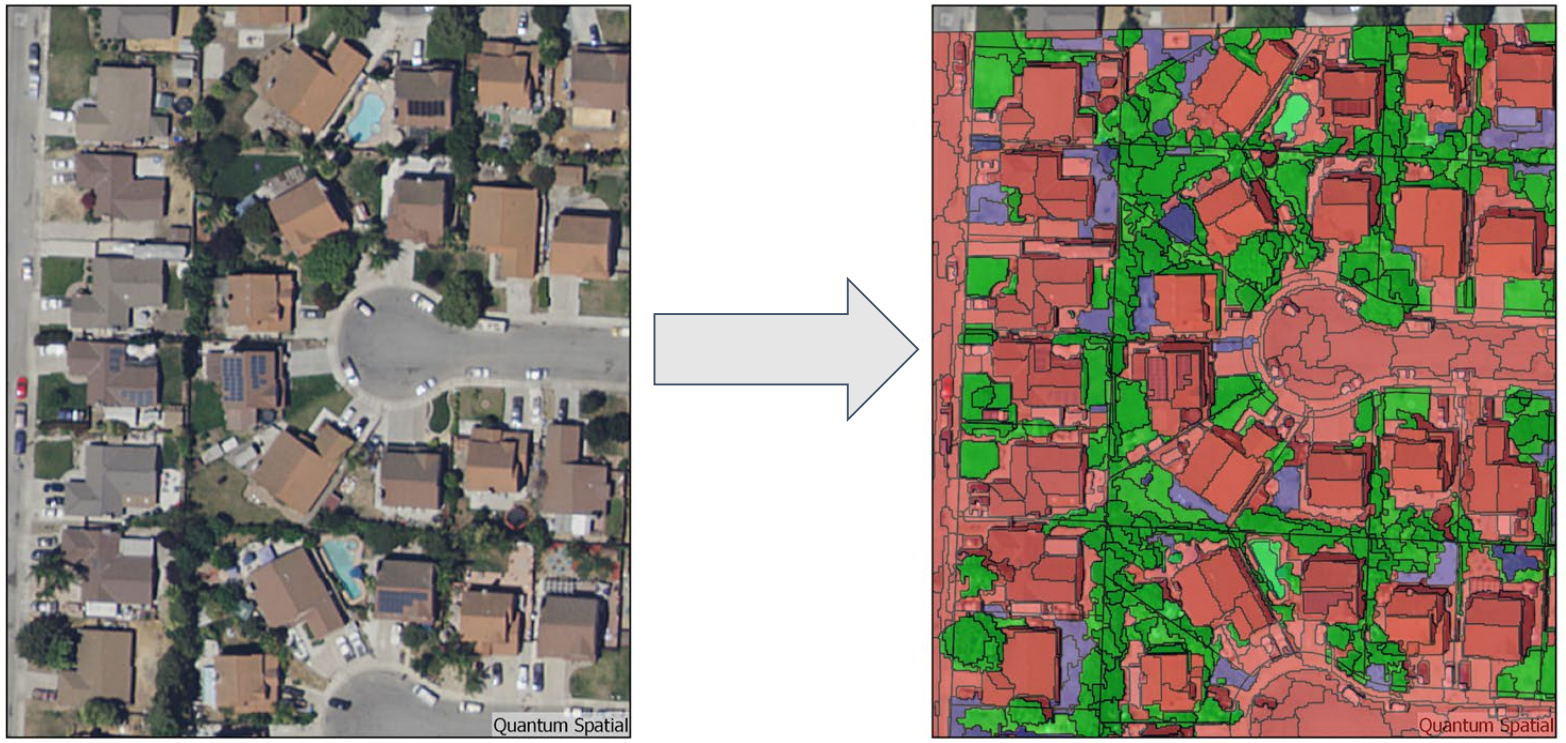
Landscape Area Estimates Modeling Process

Training Data: The most highly connected parcels in the network are selected as reference data, and manually digitized to establish relationship between land cover and land use.



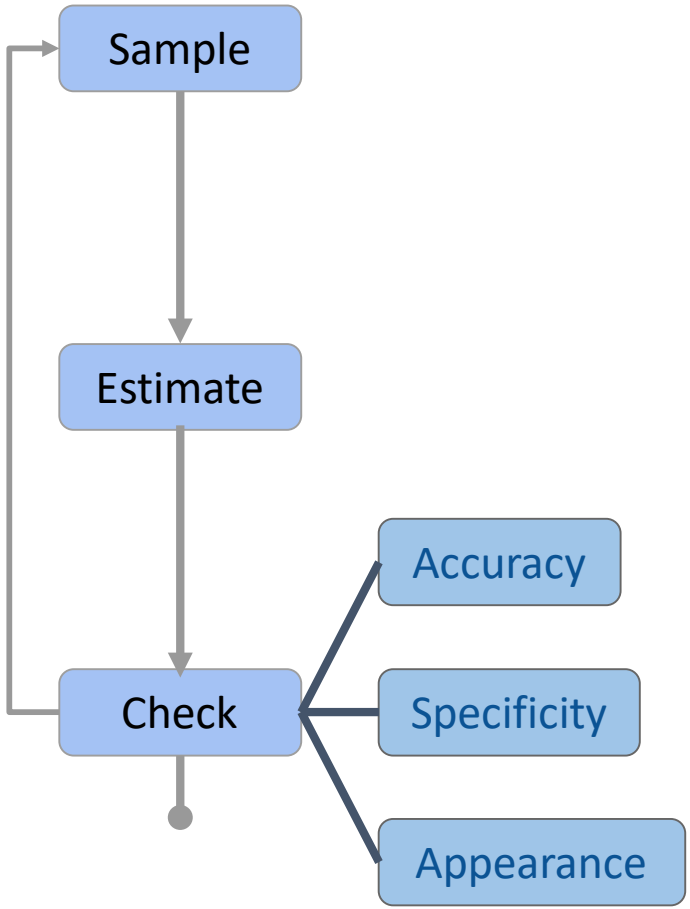
Landscape Area Estimates Modeling Process

Final Land Cover Classification: A unique model is tuned to the specific parameters of the district using training data, and features are assessed and classified using advanced machine learning techniques.



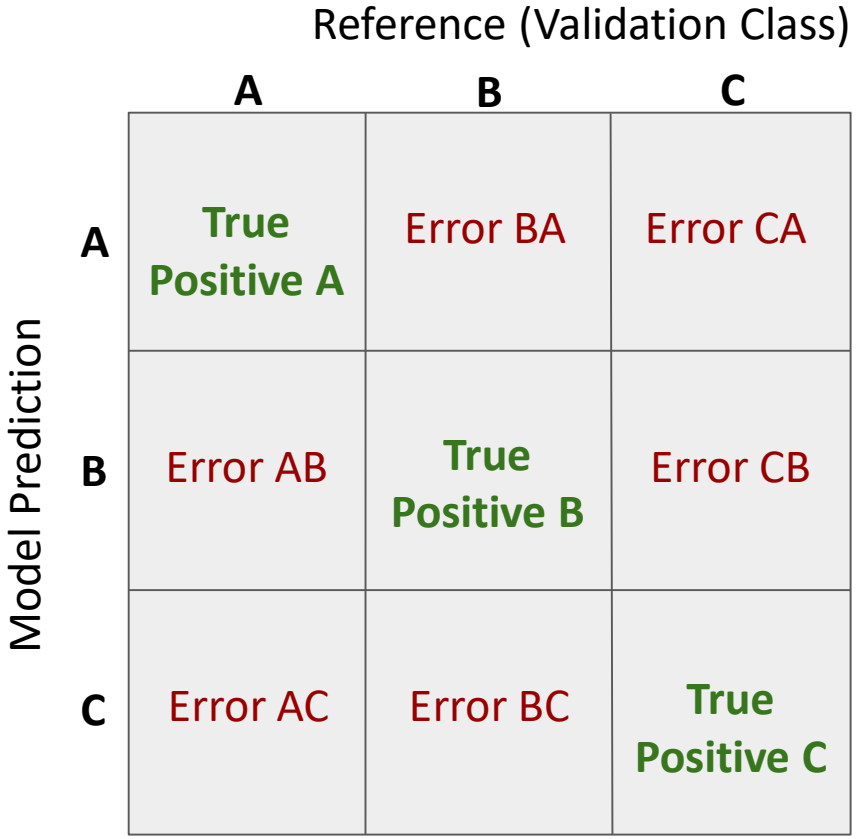
Assessing the Accuracy of the Model Classification

- A unique model for each district is used to classify super-pixel objects.
- Accuracy assessment is performed on every district.
- Model results are compared to a manually digitized validation classification for each super-pixel object and assessed using a confusion matrix.



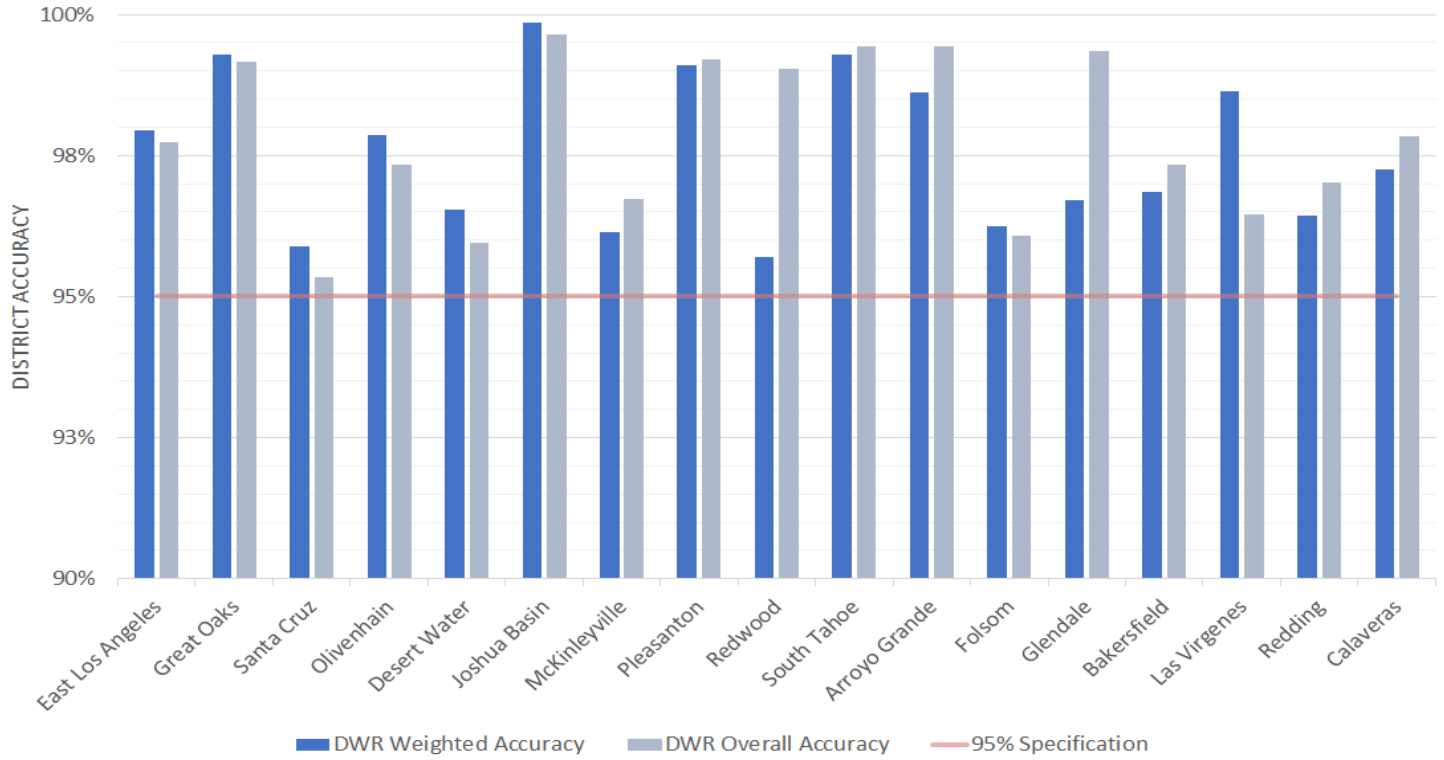
Confusion Matrices

Confusion matrices are a powerful way to visualize the performance of a classification model.



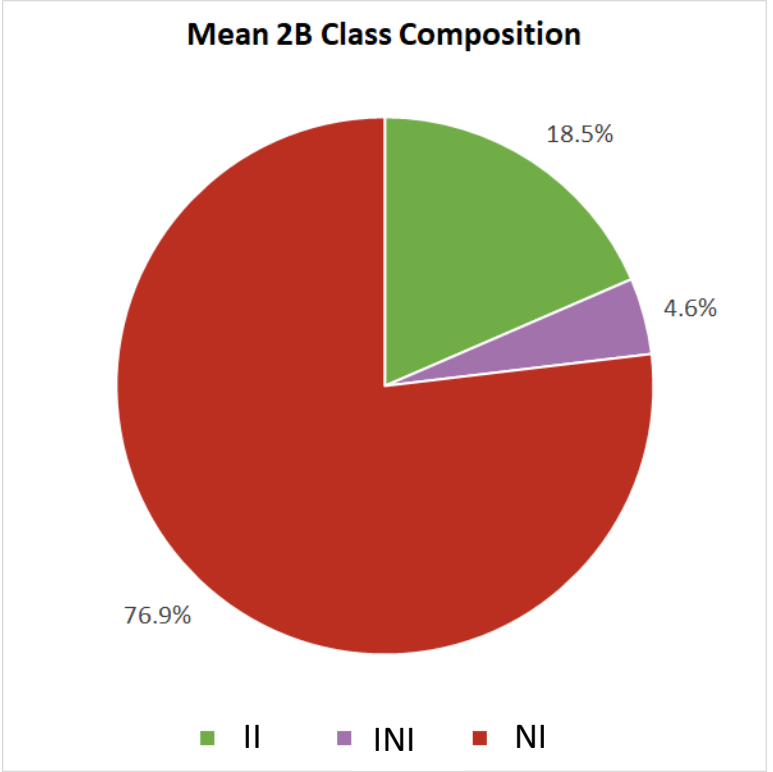
Accuracies

- Goal: 95% agreement with independent assessment over the district
- System designed to avoid bias, so final area can be used as guidance for allowance with confidence
- Results from 17 Phase 2B Districts



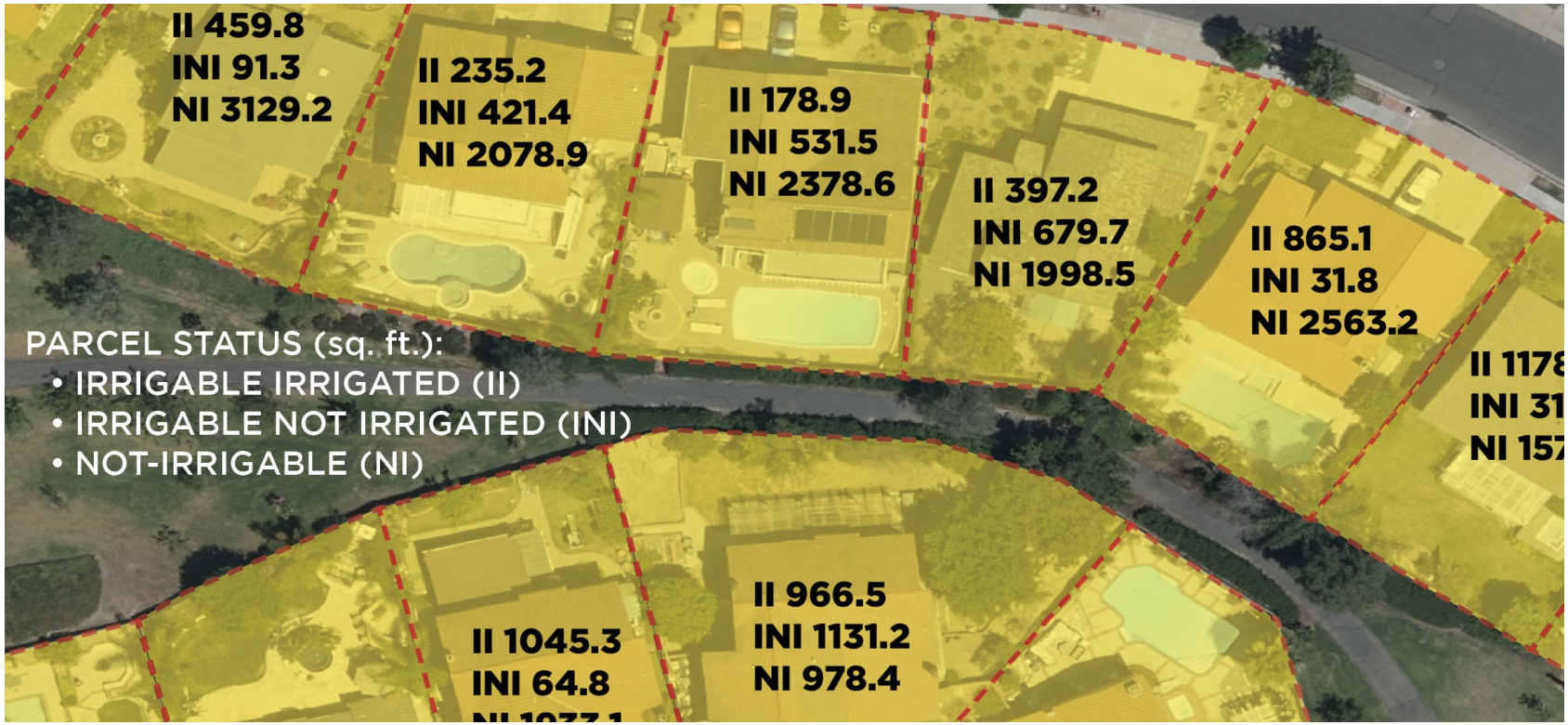
Distribution of Irrigation Status Class

Water District	II	INI	NI
District 1	24.31	5.81	69.88
District 2	2.12	4.06	93.82
District 3	23.22	9.13	67.65
District 4	19.24	9.06	71.69
District 5	19.38	4.39	76.23
District 6	27.7	5.64	66.66
District 7	25.73	3.26	71.01
District 8	25.95	3.61	70.44
District 9	0.5	0.1	99.4
District 10	6.93	0.34	92.73
District 11	13.29	1.08	85.63
District 12	23.04	7.34	69.62
District 13	28.77	1.92	69.31
District 14	21.36	5.97	72.67
District 15	25.33	8.3	66.36
District 16	23.66	8.74	67.6
District 17	3.92	0.05	96.03



	II	INI	NI
Mean	18.50	4.64	76.87
SD	9.15	3.11	11.26

Estimates at a Parcel Basis



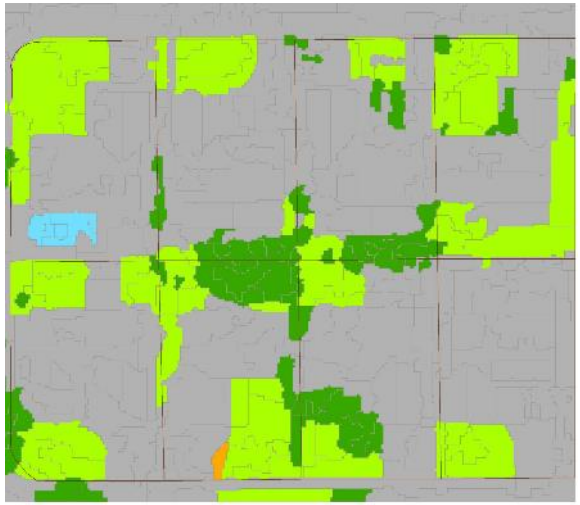
Deliverables as part of the Program

- Aggregated irrigated and irrigable landscape area estimates for single family and multi-family parcels – csv and shapefile output of irrigated area, irrigable not irrigated and non-irrigable area
- A subset of validation parcels – fully classified parcels used by QSI to ensure model accuracy meets contract specifications
- Parcel level estimates
- Summary reports for each water district outlining methods and metadata

Output Datasets and How they Can be Used

California Statewide Urban Irrigated Landscape Program

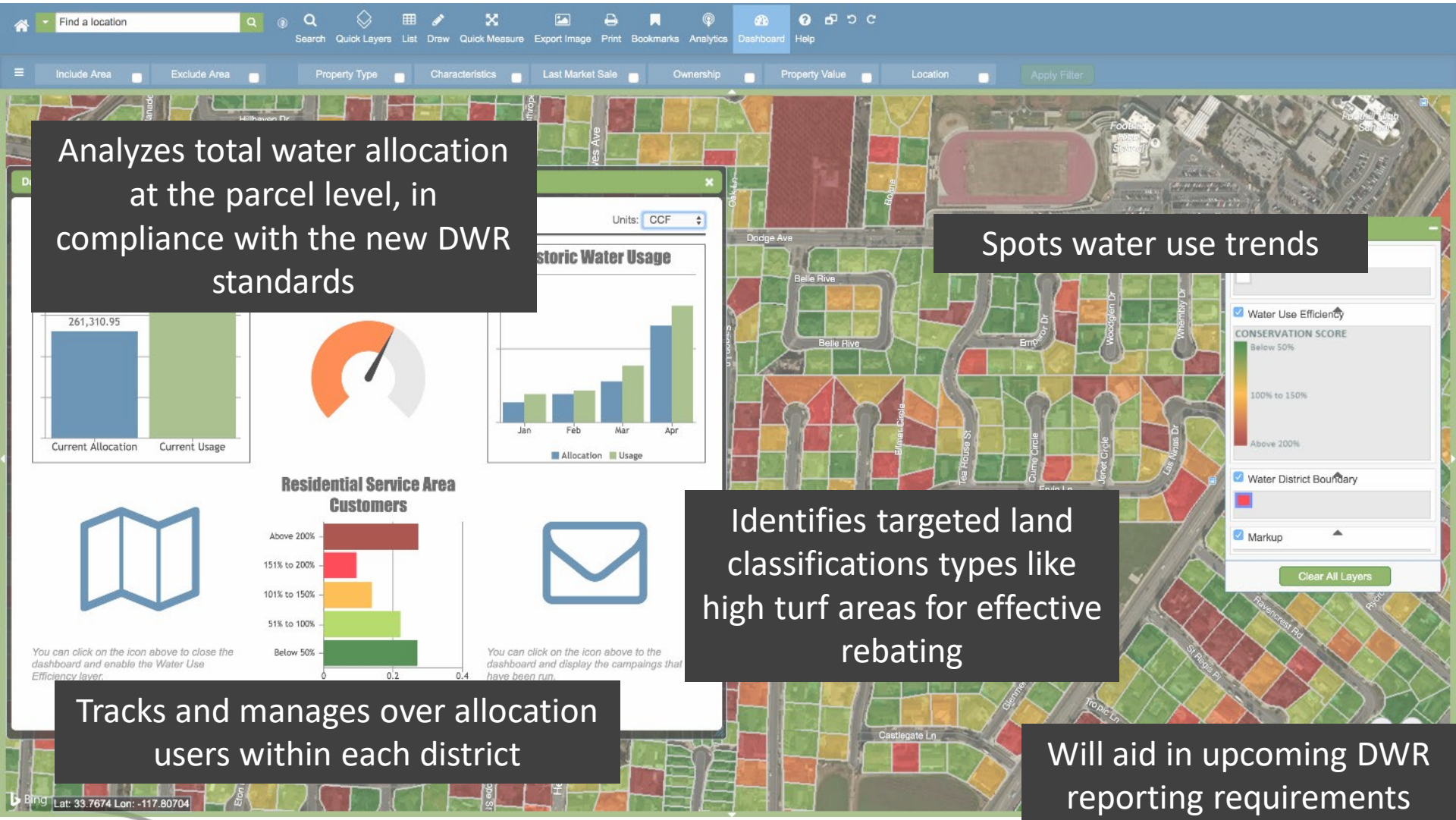
Uses of the Data



APN	class	area	percentage
7126411	grass	503.00	13.80
7126411	impervious	2604.02	71.46
7126411	trees/bushes	537.01	14.74
7126409	impervious	3384.00	78.33
7126409	grass	843.00	19.50
7126409	trees/bushes	93.00	2.17

Actual Water Use Data

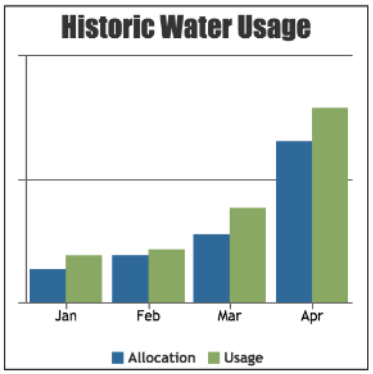
WATERVIEW


Find a location
Search
Quick Layers
List
Draw
Quick Measure
Export Image
Print
Bookmarks
Analytics
Dashboard
Help
Include Area
Exclude Area
Property Type
Characteristics
Last Market Sale
Ownership
Property Value
Location
Apply Filter
Analyzes total water allocation at the parcel level, in compliance with the new DWR standards
Units: CCF
261,310.95
Current Allocation
Current Usage
Jan
Feb
Mar
Apr
Allocation
Usage
Residential Service Area Customers
Above 200%
151% to 200%
101% to 150%
51% to 100%
Below 50%
You can click on the icon above to close the dashboard and enable the Water Use Efficiency layer.
You can click on the icon above to the dashboard and display the campaings that have been run.
Spots water use trends
Water Use Efficiency
CONSERVATION SCORE
Below 50%
100% to 150%
Above 200%
Water District Boundary
Markup
Clear All Layers
Identifies targeted land classifications types like high turf areas for effective rebating
Tracks and manages over allocation users within each district
Will aid in upcoming DWR reporting requirements
Dodge Ave
Belle Rive
Castlegate Ln
Bing
Lat: 33.7674 Lon: -117.80704

Consistent Over-Users

Identify customers that are over applying water month after month

Ability to see over-water users in your district



ED VALUE	DATE TRANSFER	VALUE TRANSFER	BUILDING SQUARE FEET	LOT ACREAGE	LOT SQUARE FEET	NUMBER OF UNITS	YEAR BUILT
	Fri Mar 31 2017 00:00:00 GMT-0600 (Mountain Daylight Time)	850000	3020	0.19	8200		1977
	Wed May 17 2000 00:00:00 GMT-0600 (Mountain Daylight Time)	436000	2236	0.15	6650		1977
	Fri Oct 01 1999 00:00:00 GMT-0600 (Mountain Daylight Time)	345000	2125	0.12	5400		1977
	Mon Jul 08 2002 00:00:00 GMT-0600 (Mountain Daylight Time)	490000	2642	0.12	5300		1977
	Mon Jun 30 2014 00:00:00 GMT-0600 (Mountain Daylight Time)	865000	2642	0.14	6000		1977

WATERVIEW

Additional Comments/Questions?

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