Interpreting Agricultural Land Attributes Via Remote Sensing:

Validated, Ground Truthed Approaches

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LAND IQ

CRWUA
COLORADO RIVER WATER USERS ASSOCIATION

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Land IQ Technical Disciplines

Land-Based Sciences: Land and Water Resources

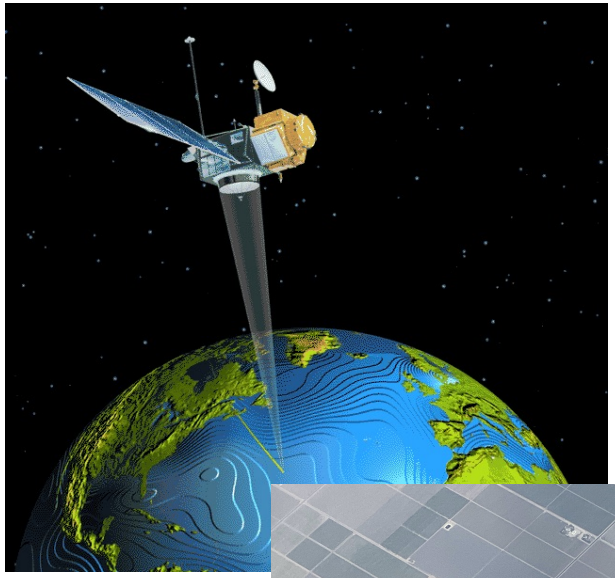
- Agronomic assessments
- Plant/Soil/Water dynamics
- Water quality and supply evaluations
- Salinity and nutrient management
- Agricultural reuse
- Soil reclamation and irrigation/drainage

Spatial Sciences: Remote Sensing and GIS

- Consumptive use estimation and crop identification
- Large landscape evaluations
- Irrigation and drainage
- Production agriculture

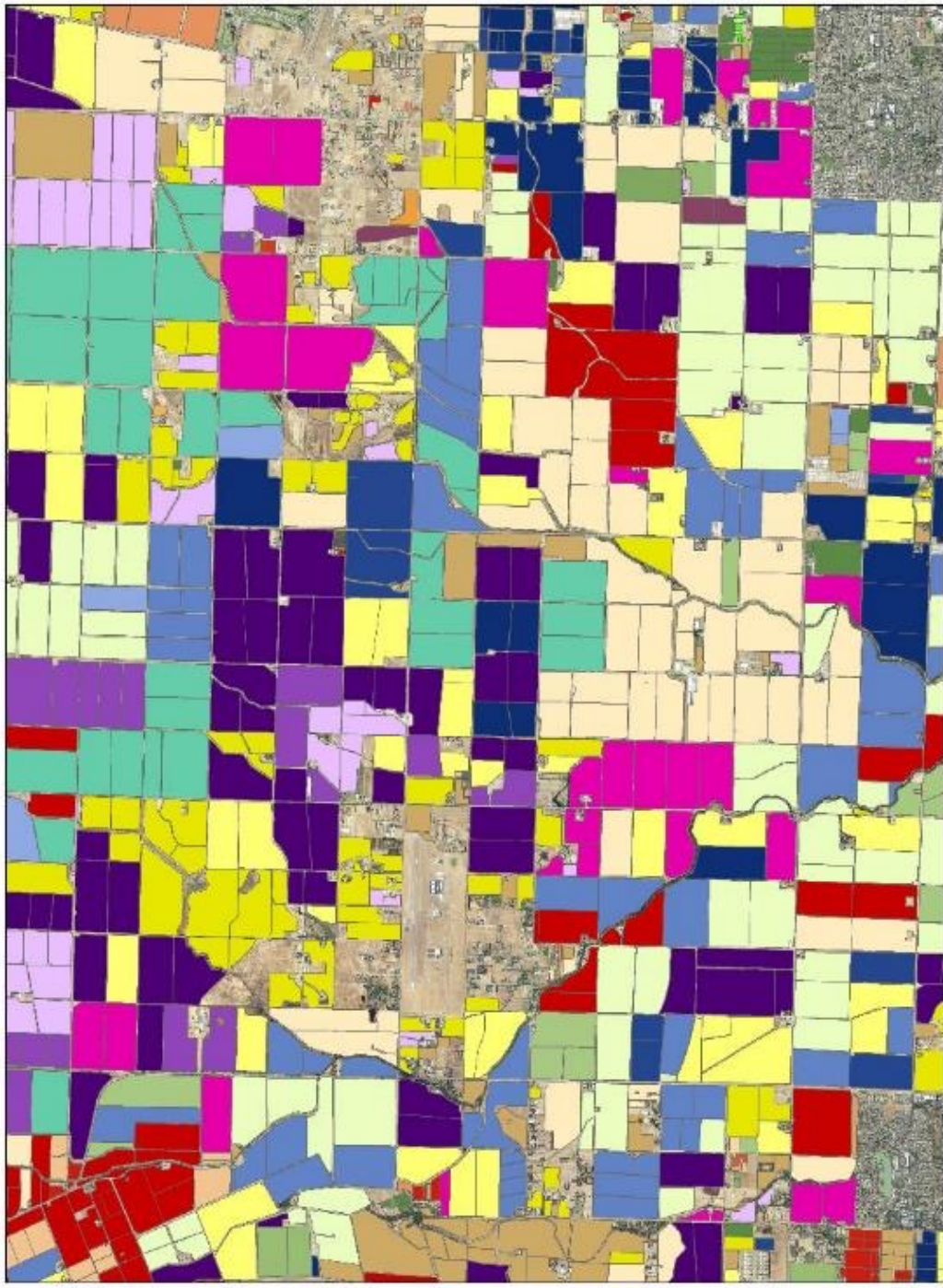
Development

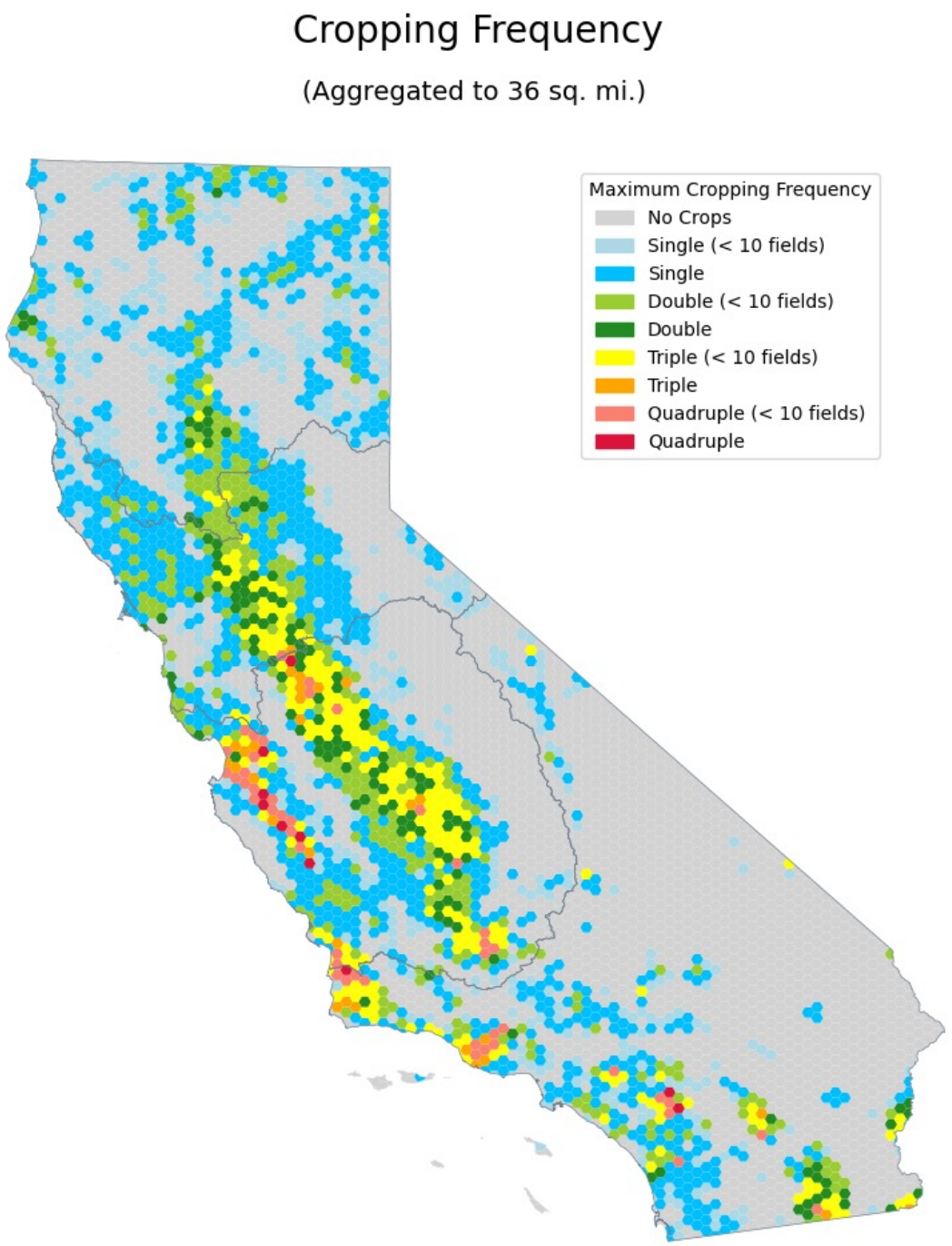
- Data management tools



The Ask:

- Looking for new approaches in agricultural water management to be shared with the CRWUA audience.
- Those can be new and innovative tools that can be used to monitor and measure land change and water use in a more comprehensive, timely, and accurate manner.





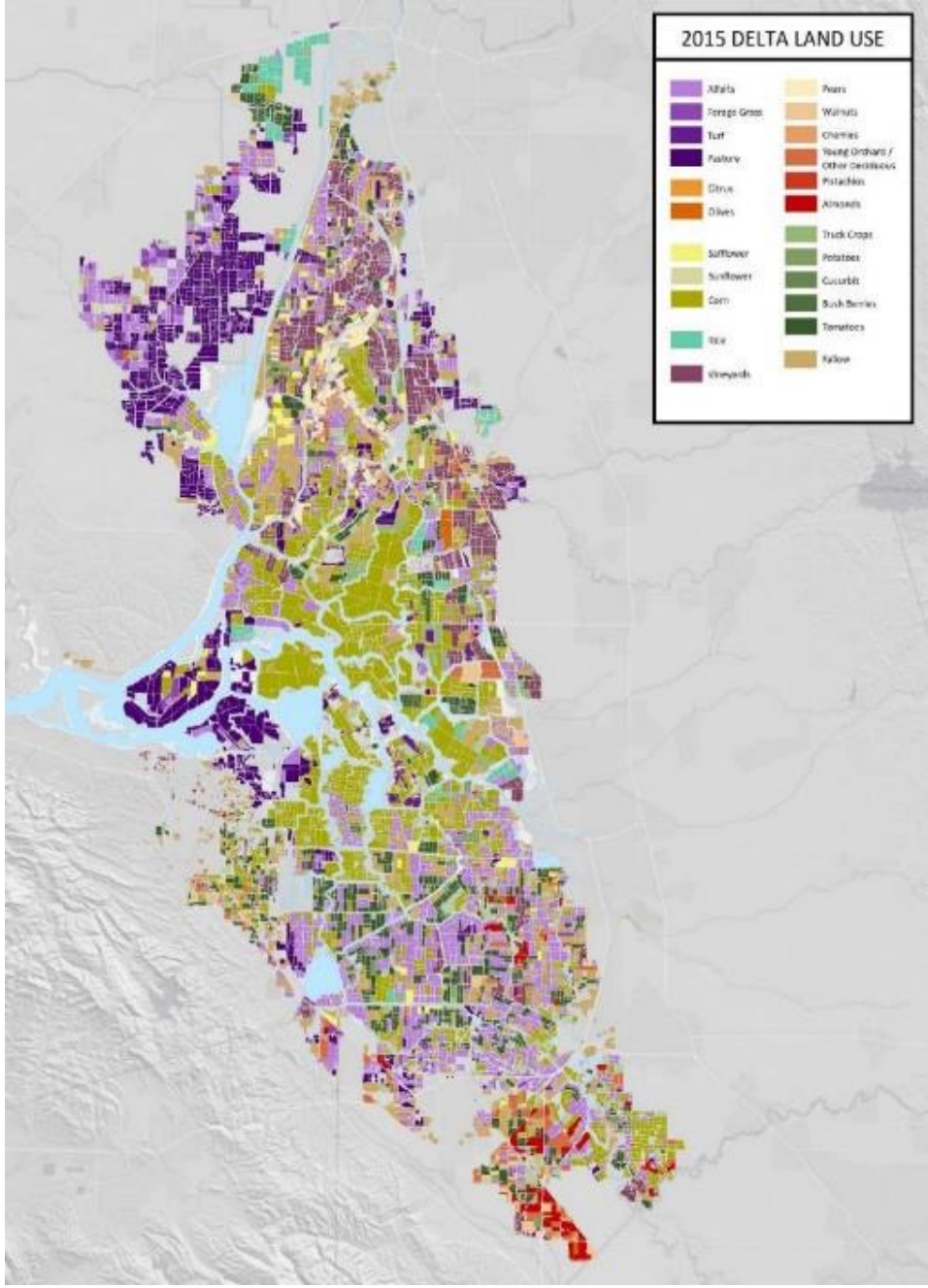
Two Examples:

Both based on data-driven, ground truthing approaches for the purpose of calibrating and validating remotely sensed approaches:

1. Field-by-field crop type mapping
2. Field-by-field crop water consumptive use

Agricultural Land Use Mapping

- Advanced methods developed over last 12 years
- Implemented on large projects spanning CA, AZ, NM, TX, OK, LA, GA, FL, MO, MS, AL, AR, KS, NC, SC, regions of Mexico and Australia
- Leverages a spatial & spectral crop library
- Results in accurate crop maps, statistics, and crop change



Who Uses Land Cover Mapping … and … What Are The Uses

Uses

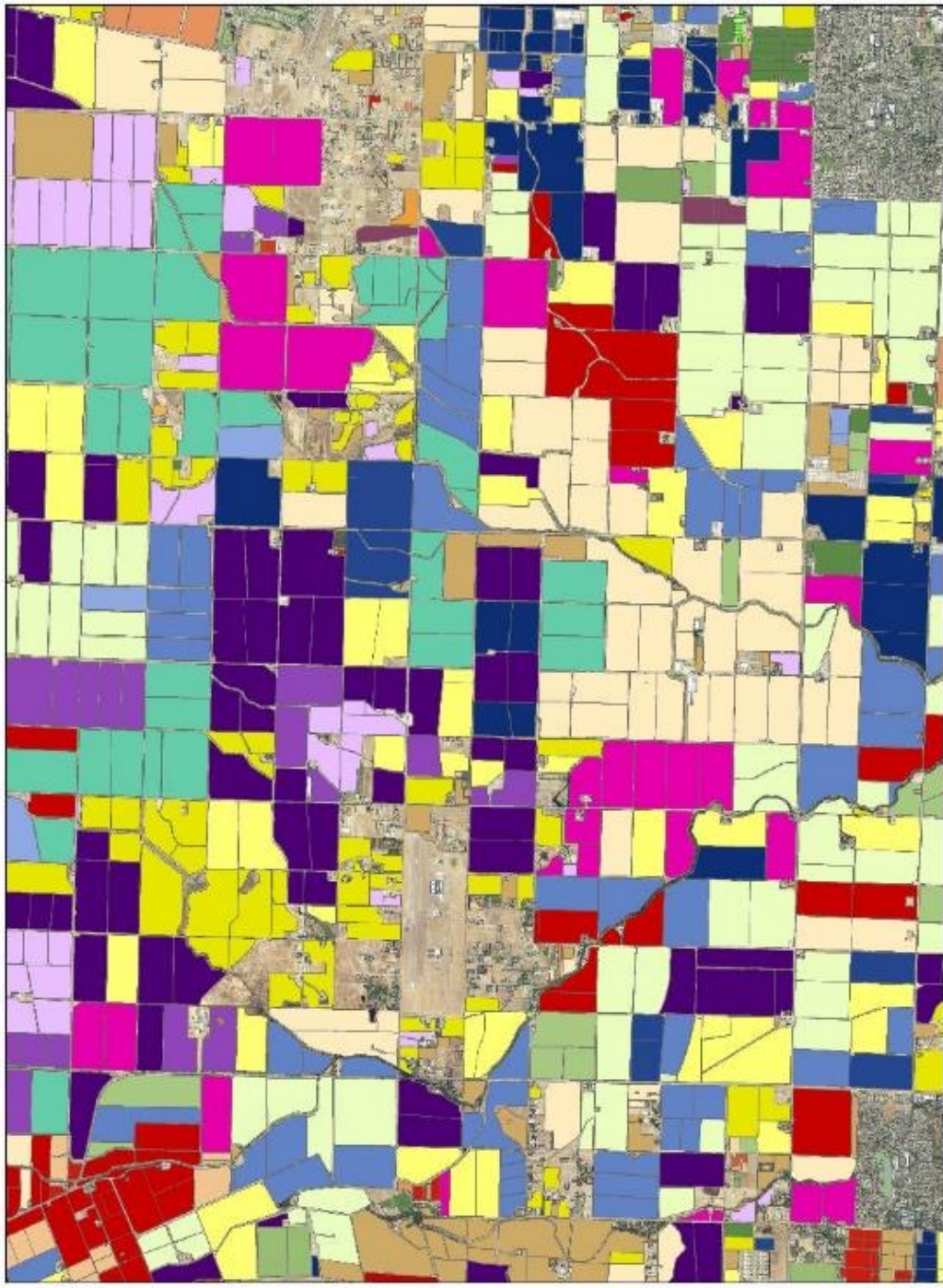
California Water Plan
Carbon Modeling
Central Valley Salinity Coalition Implementation
Climate Impact Forecasting
Commodity Marketing Programs
Crop Consumptive Use Estimations
Crop Forecasting
Crop Rotation Management
Economic Modeling
Energy Resource Management and Modeling
Fallowing Impacts
Flood and Drought Impacts
Groundwater Recharge Programs
Groundwater Resource Management and Modeling
Historical Land Use Change
Irrigated Lands Regulatory Program Implementation and Compliance
Land Use Forecasting
Multi-Benefit Land Repurposing Programs
Nutrient Management Compliance and Planning
Pollinator Habitat Management
Proximity Analyses
Regional Planning
Salinity Management and Modeling
Species Habitat and Management
Surface Water Resource Management and Modeling
Sustainable Groundwater Management Act Implementation and Compliance
Water Balance Projections
Water Conservation
Water Quality Management and Modeling
Water Resource Engineering
Water Resources Planning
Water Rights Analyses
Water Supply Risk Analysis
Yield Analysis and Forecasting

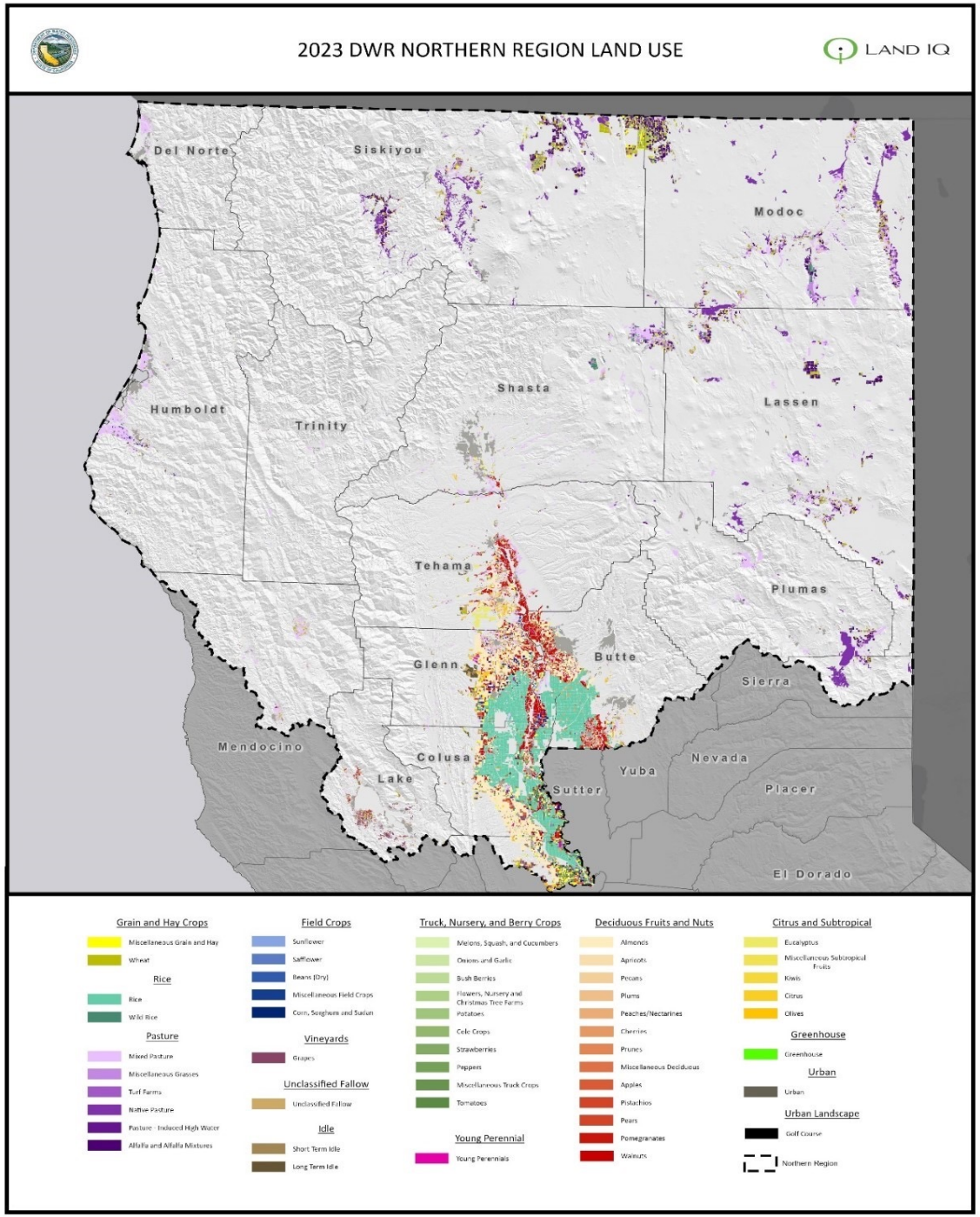
Users

Administrative Committee on Pistachios
Agricultural Consultants
Almond Board of California
American Pecan Council
Banking Industry
California Air Resources Board
California Avocado Commission
California Blueberry Commission
California Department of Food & Agriculture
California Department of Conservation
California Department of Fish and Wildlife
California Department of Pesticide Regulation
California Department of Water Resources
California Energy Commission
California Fresh Fruit Association
California Prune Board
California Raisin Administrative Committee
California Regional Water Resources Control Boards
California Rice Industry
California State Water Resources Control Board
California Walnut Board
California Wild Rice Advisory Board
Central Valley Salinity Coalition
County Governments
Ditch Companies
Economic Consultants
Environmental Consultants
Environmental Defense Fund
Farming Companies
Flood Control Agencies
Groundwater Sustainability Agencies
Insurance Companies
Investment Firms
Irrigated Lands Regulatory Program Coalitions
Irrigation Districts
Nature Conservancy
Northern California Water Association
Public Policy Institute of California
Real Estate Industry
Reclamation Districts
Resource Conservation Districts
Science and Engineering Firms
Sustainable Conservation
United States Bureau of Reclamation
United States Department of Agriculture - APHIS
United States Department of Agriculture - ARS
United States Department of Agriculture - NASS
United States Department of the Interior
United States Environmental Protection Agency
University of California Cooperative Extension
University Researchers
Water Companies
Water Law Firms
Water Storage Districts

STATEWIDE LAND USE MAPPING

- Driven by: Regulations (SGMA), Commodity Groups, Water Managers/Planners, Government Agencies, Water Modelers, Etc. Etc.
- Approximately 460,000 individual fields
- 9.55 million acres
- Minimum field size of approximately 1.0 acre
- Nearly 60 crop legend categories, which represent 98% of all irrigated lands
- Continuous mapping including multicropping
- Completed a decade of statewide mapping: 2014, 2016, 2018, 2019, 2020, 2021, 2022, and 2023





NORTHERN REGION

Rank	Crop	Acres
1	Almonds	210,943
2	Walnuts	158,821
3	Mixed Pasture	148,963
4	Alfalfa and Alfalfa Mixtures	128,717
5	Rice	128,137
6	Miscellaneous Grain and Hay	98,000
7	Miscellaneous Grasses	78,384
8	Mixed Pasture - Fallow	59,902
9	Wheat	34,955
10	Tomatoes	31,283
	Total	1,995,678
	Total Agriculture	1,795,389
	Total Fallow	351,793
	Total Urban	200,289

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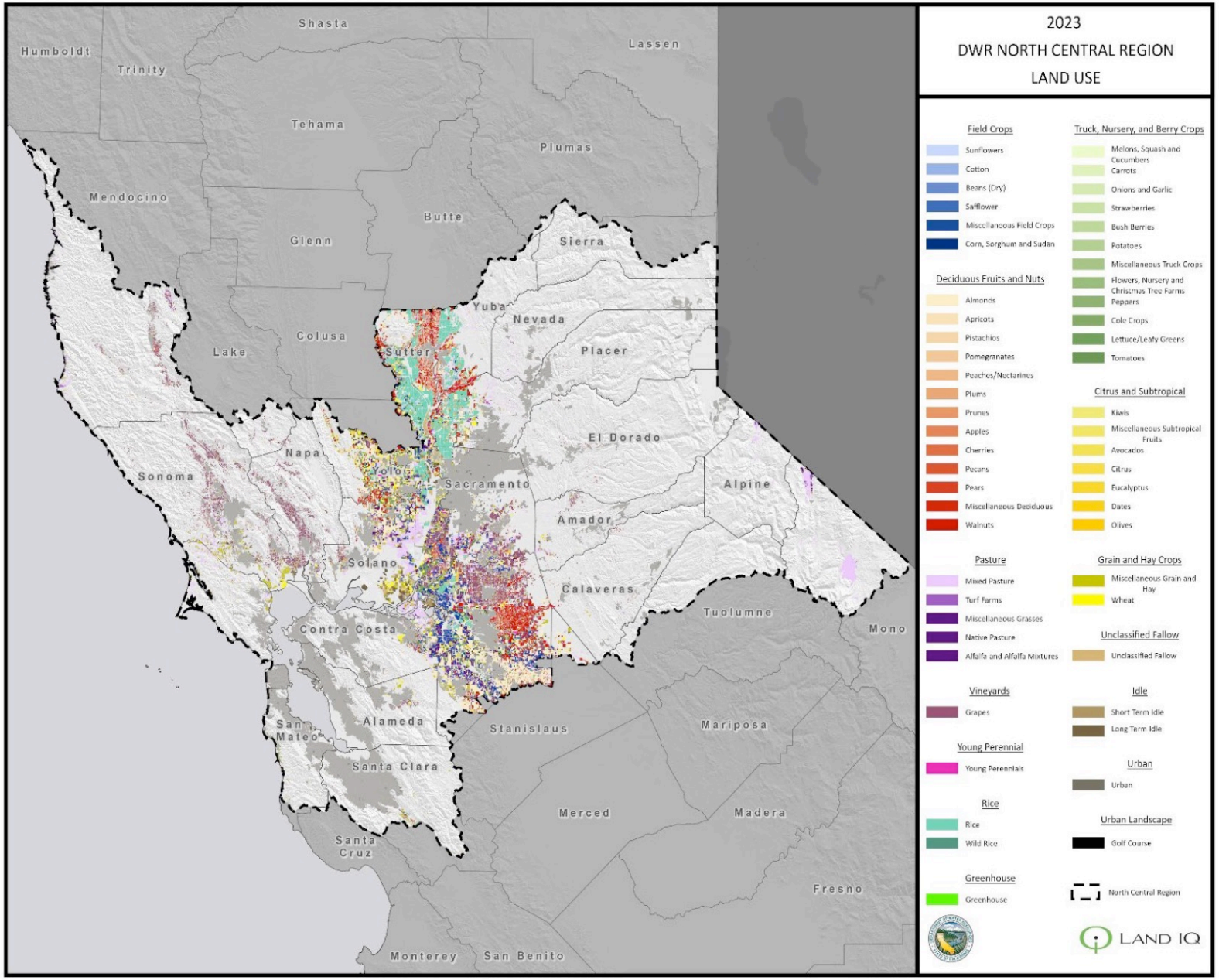
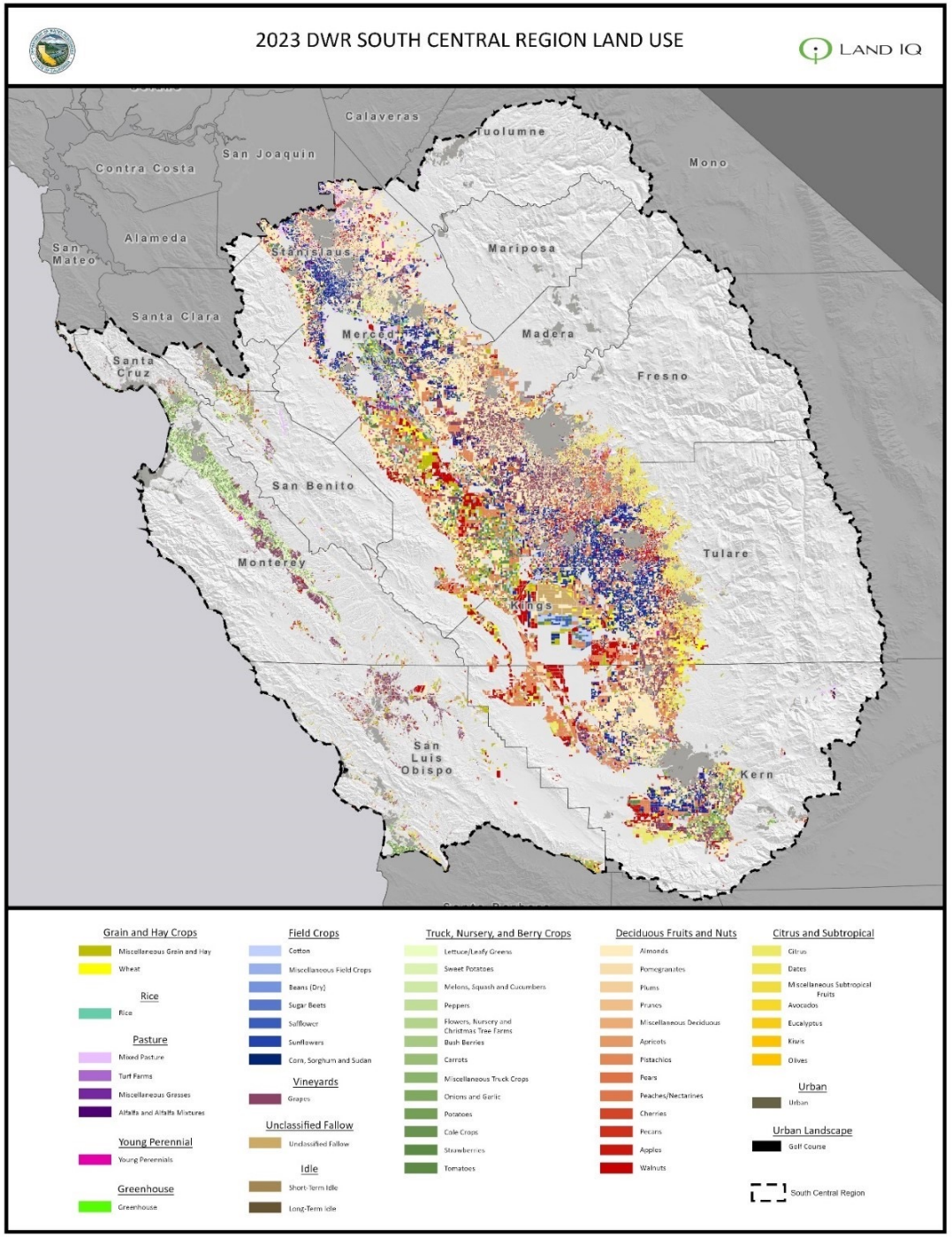


NORTH CENTRAL REGION

Rank	Crop	Acres
1	Grapes	278,141
2	Almonds	192,702
3	Walnuts	170,044
4	Miscellaneous Grain and Hay	161,684
5	Mixed Pasture	135,837
6	Rice	119,422
7	Corn, Sorghum and Sudan	115,323
8	Alfalfa and Alfalfa Mixtures	97,834
9	Wheat	79,267
10	Tomatoes	66,969
	Total	3,306,946
	Total Agriculture	1,939,039
	Total Fallow	237,275
	Total Urban	1,367,907



South Central Region

Rank	Crop	Acres
1	Almonds	1,178,168
2	Pistachios	530,013
3	Grapes	436,937
4	Corn, Sorghum and Sudan	429,096
5	Wheat	335,773
6	Citrus	251,843
7	Miscellaneous Grain and Hay	235,720
8	Lettuce/Leafy Greens	193,698
9	Alfalfa and Alfalfa Mixtures	186,767
10	Tomatoes	136,129
	Total	6,497,818
	Total Agriculture	5,794,354
	Total Fallow	863,462
	Total Urban	703,464

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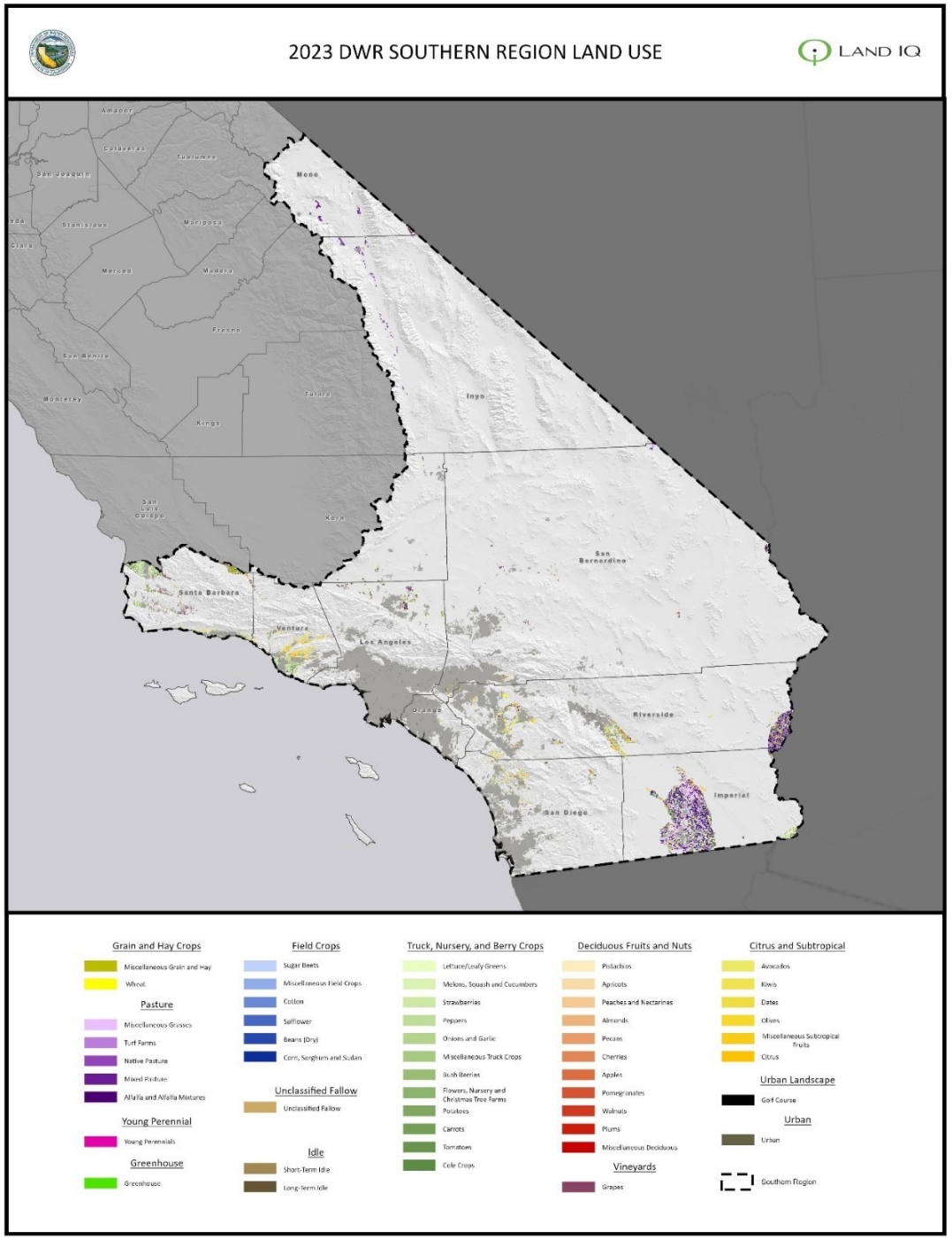

Southern Region

Rank	Crop	Acres
1	Alfalfa and Alfalfa Mixtures	208,280
2	Miscellaneous Grasses	103,270
3	Corn, Sorghum and Sudan	69,139
4	Lettuce/Leafy Greens	67,520
5	Cole Crops	63,371
6	Miscellaneous Truck Crops	62,356
7	Citrus	58,591
8	Wheat	53,661
9	Avocados	48,738
10	Golf Course	48,111
	Total	3,849,291
	Total Agriculture	1,202,522
	Total Fallow	205,657
	Total Urban	2,598,658

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Ground Truthing & Accuracy

- Standardized approach for independent validation of calibrated remotely sensed approaches
- Over 23,000 miles of ground truthing in 2023
- Captured approximately 90,000 data points
- Use a set aside portion of ground truthing results as an independent validation dataset
- What did we see on the ground versus what did the models predict
- Overall accuracy of 97.6% based on independent ground-truth validation dataset

- **2023 DWR Class had an overall accuracy of 98% based on independent ground-truth validation dataset for specific crop type.**
- **2023 Subclass (Land IQ) overall accuracy of 97% based on independent ground-truth validation dataset for grouped crop type.**

WY 2023 Overall Land Use Mapping Weighted Accuracy by Hydrologic Region

Crop Legend	Central Coast	Colorado River	North Coast	North Lahontan	Sacramento River
DWR Class	98%	98%	97%	98%	99%
Subclass (Land IQ)	94%	96%	95%	94%	98%
	San Francisco Bay	**San Joaquin River**	**South Coast**	**South Lahontan**	**Tulare Lake**
DWR Class	97%	99%	97%	99%	99%
Subclass (Land IQ)	97%	98%	95%	98%	99%

Reference \ Predicted	Citrus and Subtropical	Deciduous Fruits and Nuts	Field Crops	Grain and Hay crops	Pasture	Rice	Truck, Nursery, and Berry Crop	Unclassified	Vineyard	Young Perennial	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
Citrus and Subtropical	1,081	1	0	0	0	0	3	1	0	2	1,088	1%	99%	
Deciduous Fruits and Nuts	0	3,754	0	0	0	0	1	3	0	1	3,759	0%	100%	
Field Crops	0	0	1,110	3	11	0	24	5	0	0	1,153	4%	96%	
Grain and Hay crops	0	0	1	1,020	16	0	19	37	0	0	1,093	7%	93%	
Pasture	0	1	13	8	1,877	0	1	5	0	0	1,905	1%	99%	
Rice	0	0	0	0	0	152	0	0	0	0	152	0%	100%	
Truck, Nursery, and Berry Crops	0	0	8	4	2	0	2,294	7	0	0	2,315	1%	99%	
Unclassified	1	6	0	12	8	0	7	1,397	0	0	1,431	2%	98%	
Vineyard	1	1	0	0	0	0	0	1	999	0	1,002	0%	100%	
Young Perennial	1	2	0	0	0	0	0	24	0	105	132	20%	80%	
Predicted Total	1,084	3,765	1,132	1,047	1,914	152	2,349	1,480	999	108	14,030			
Commission Error	0%	0%	2%	3%	2%	0%	2%	6%	0%	3%				
Users Accuracy	100%	100%	98%	97%	98%	100%	98%	94%	100%	97%				
Kappa Coefficient														0.98

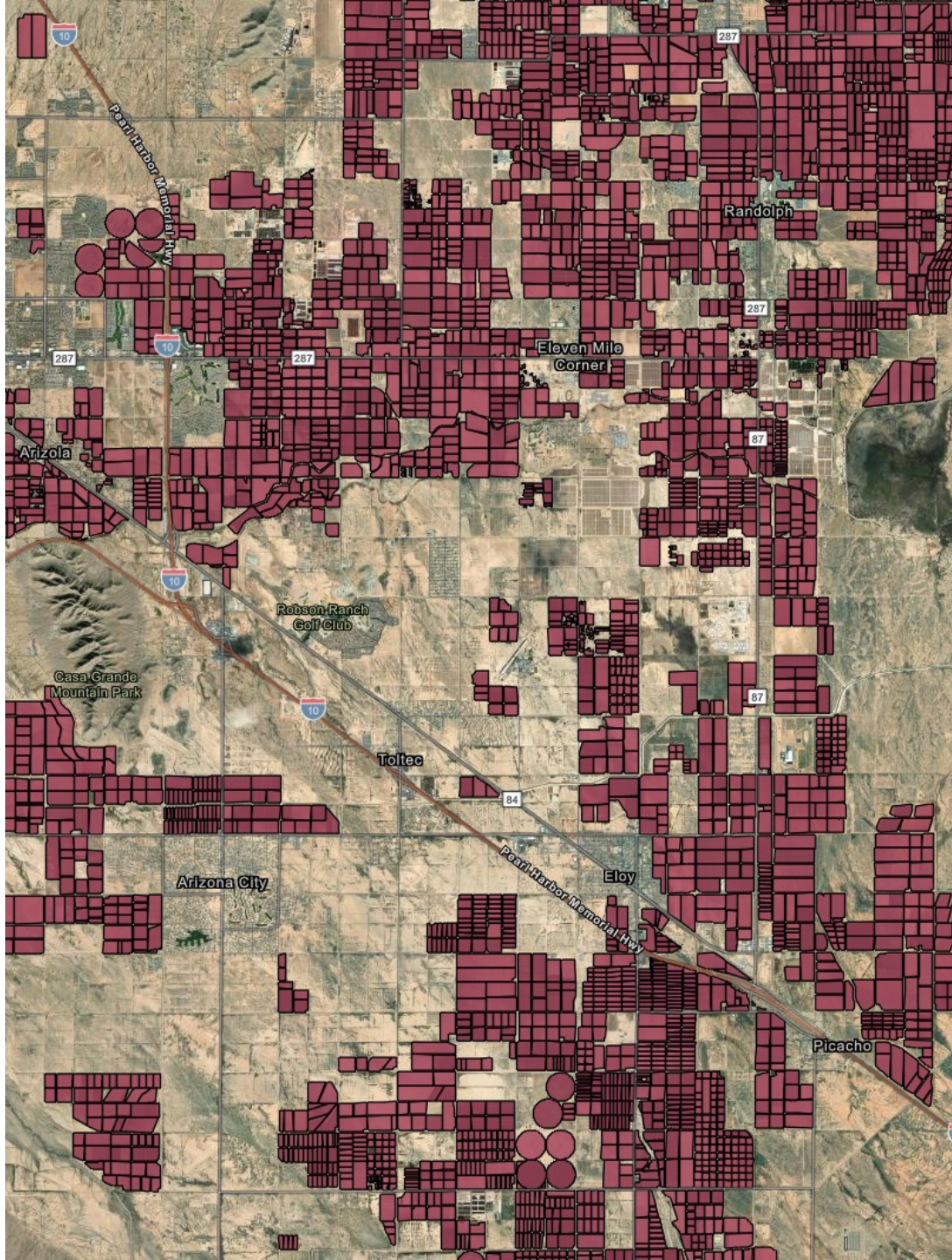
- **Publicly available for 2014, 2016, 2018, 2019, 2020, 2021, 2022, and 2023 (Provisional).**
- **2024 statewide mapping being completed now. Some commodity groups already completed in expedited mapping**

WY 2023 Statewide Land Use Mapping Accuracy and Precision by Crop

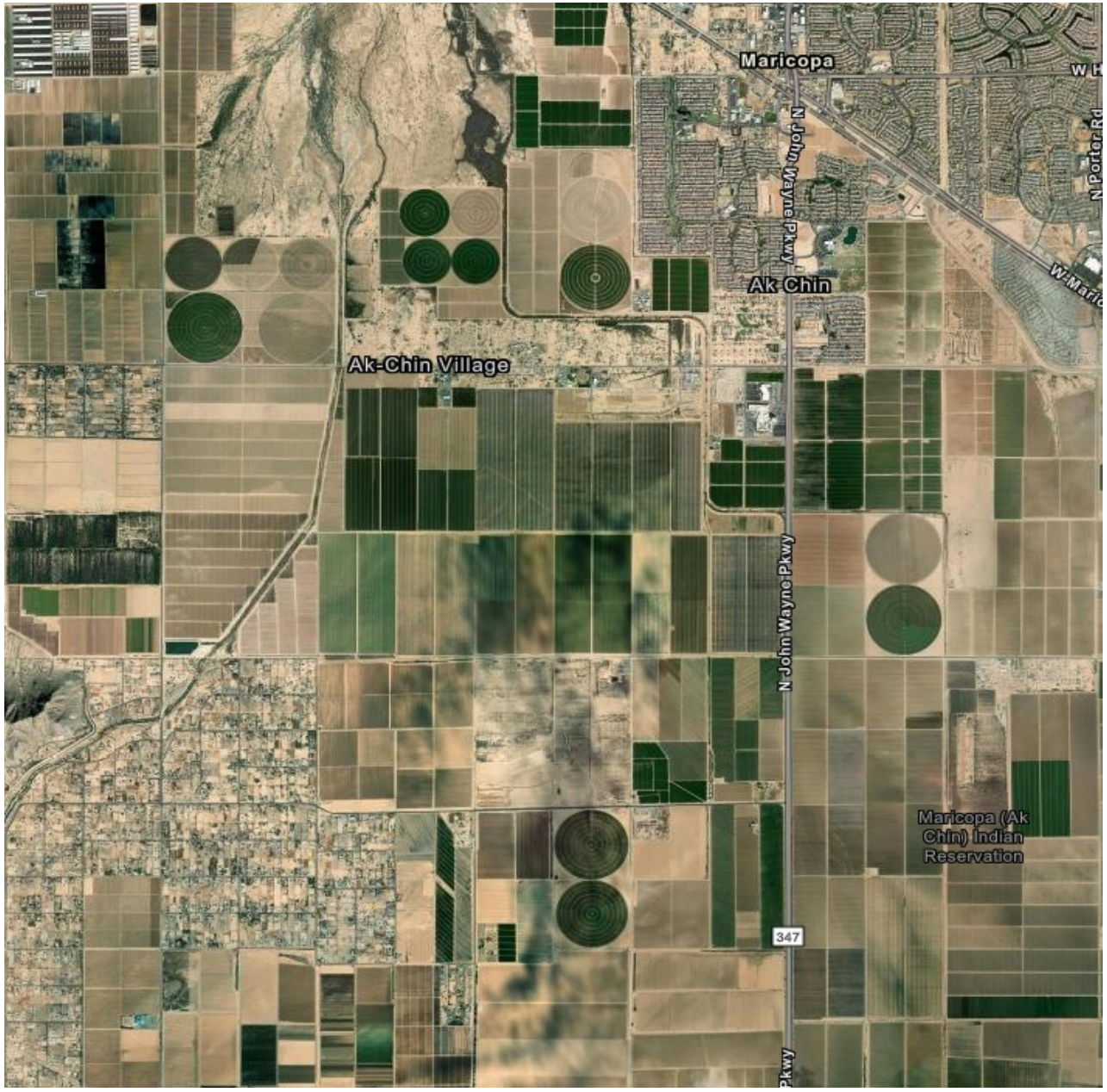
Crop Class	User's Accuracy (area correctly classified/total area classified)	Total validation area (counts)	95% Two-tailed Confidence Interval
Alfalfa and Alfalfa Mixtures	97%	1,336	1%
Almonds	100%	2,136	0%
Apples	100%	37	0%
Apricots	98%	47	4%
Avocados	98%	564	1%
Beans (Dry)	96%	34	8%
Bush Berries	98%	90	3%
Carrots	94%	48	7%
Cherries	99%	143	2%
Citrus	100%	646	0%
Cole Crops	96%	560	2%
Corn, Sorghum, and Sudan	96%	847	1%
Cotton	97%	108	3%
Dates	99%	111	2%
Flowers, Nursery, and Christmas Tree Farms	100%	53	0%
Grapes	97%	191	2%
Kiwis	100%	1,184	0%
Lettuce or Leafy Greens	100%	50	0%

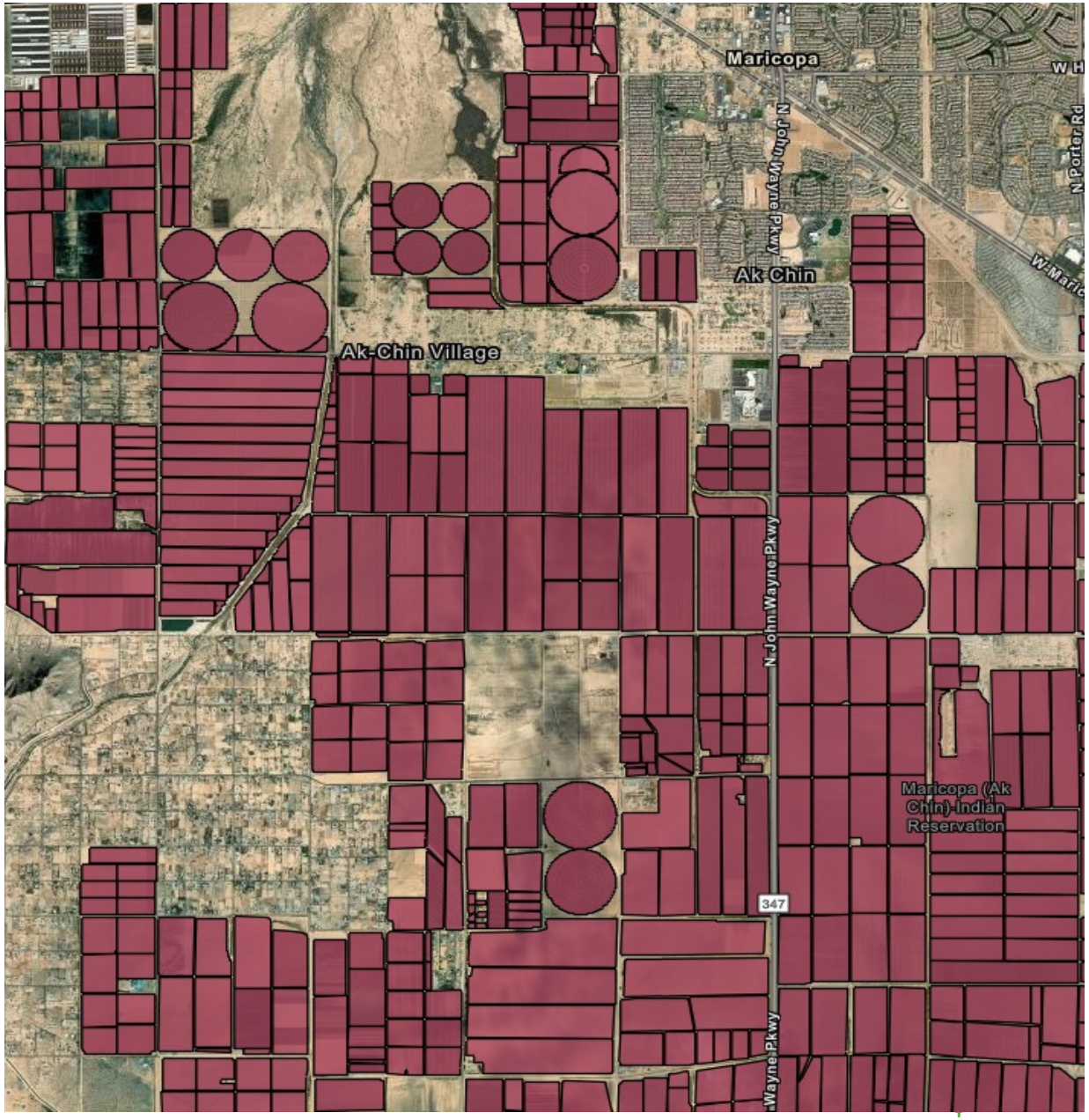
Mapping And ET Project Work Outside of California

- Arizona Projects:
  - Central Arizona Project – Fallowing program includes ET estimates and crop mapping
    - Yuma Mesa IDD
    - Welton Mohawk IDD
  - Mojave Valley IDD – includes ET estimates and crop mapping
  - Resolution Copper/New Magma IDD
  - Almond Mapping – Almond Board of California
  - Pistachio Mapping – American Pistachio Growers
  - Pecan Mapping – American Pecan Council

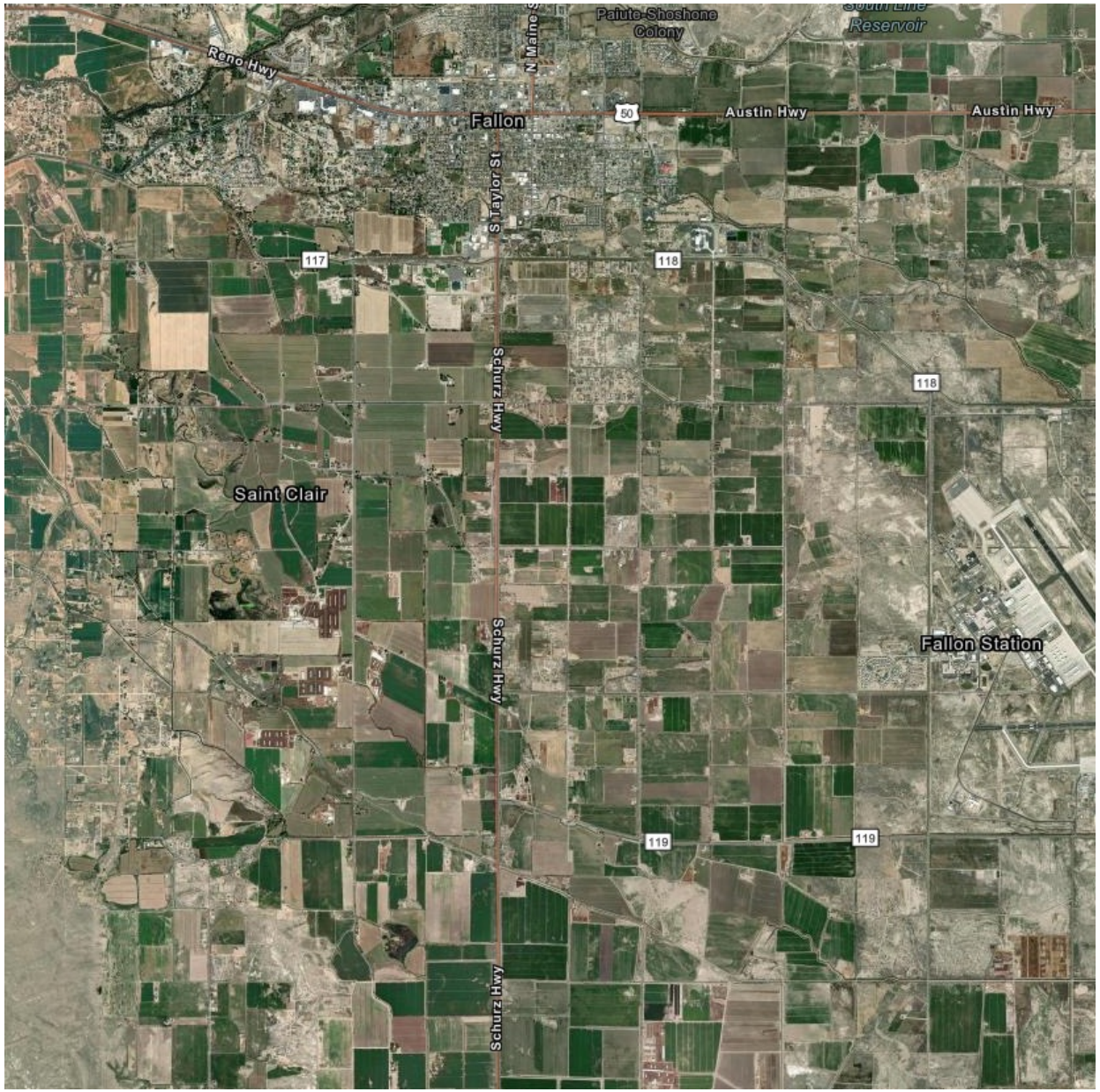


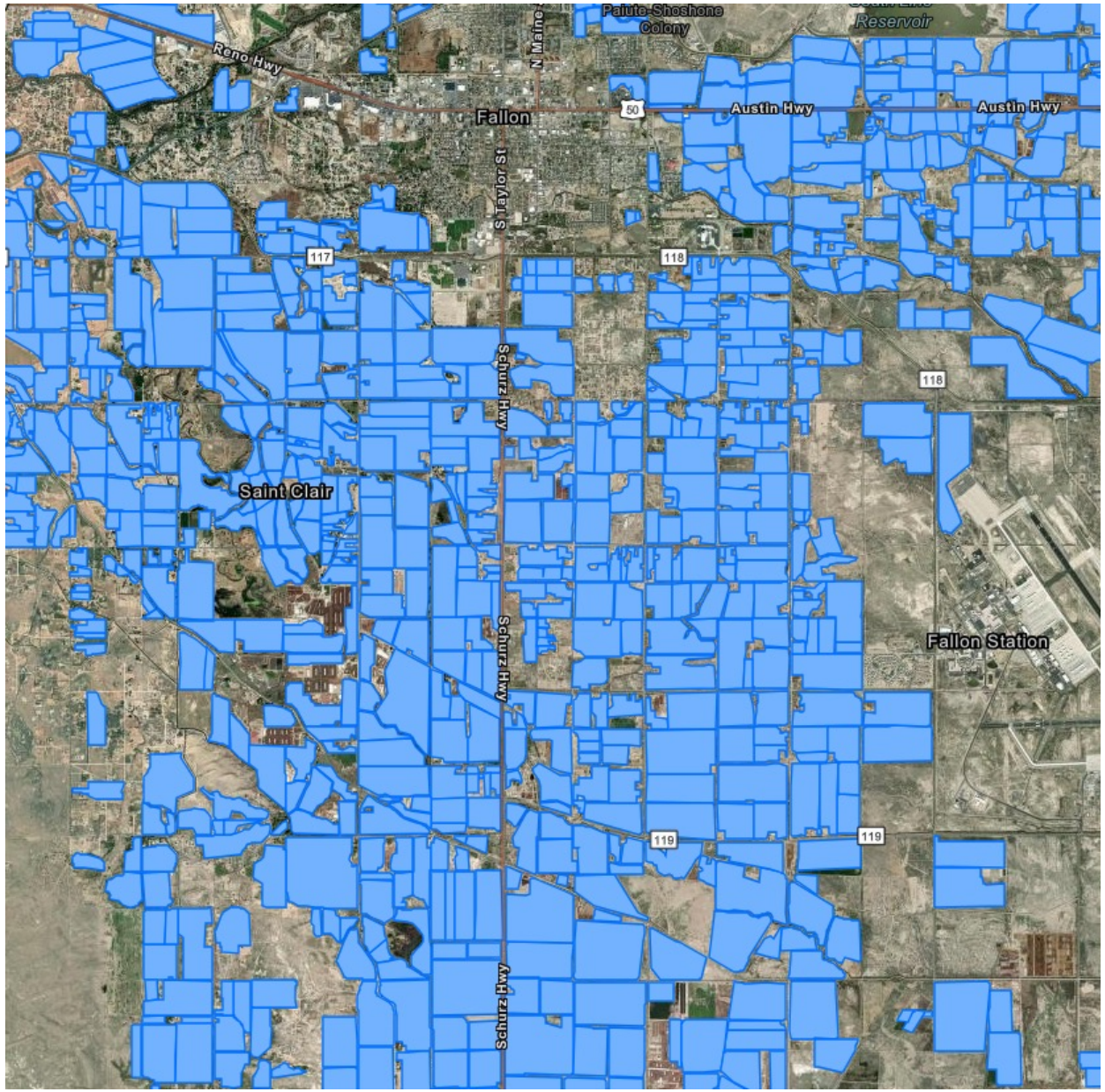
Arizona Statewide Crop-Specific Mapping – Field Level



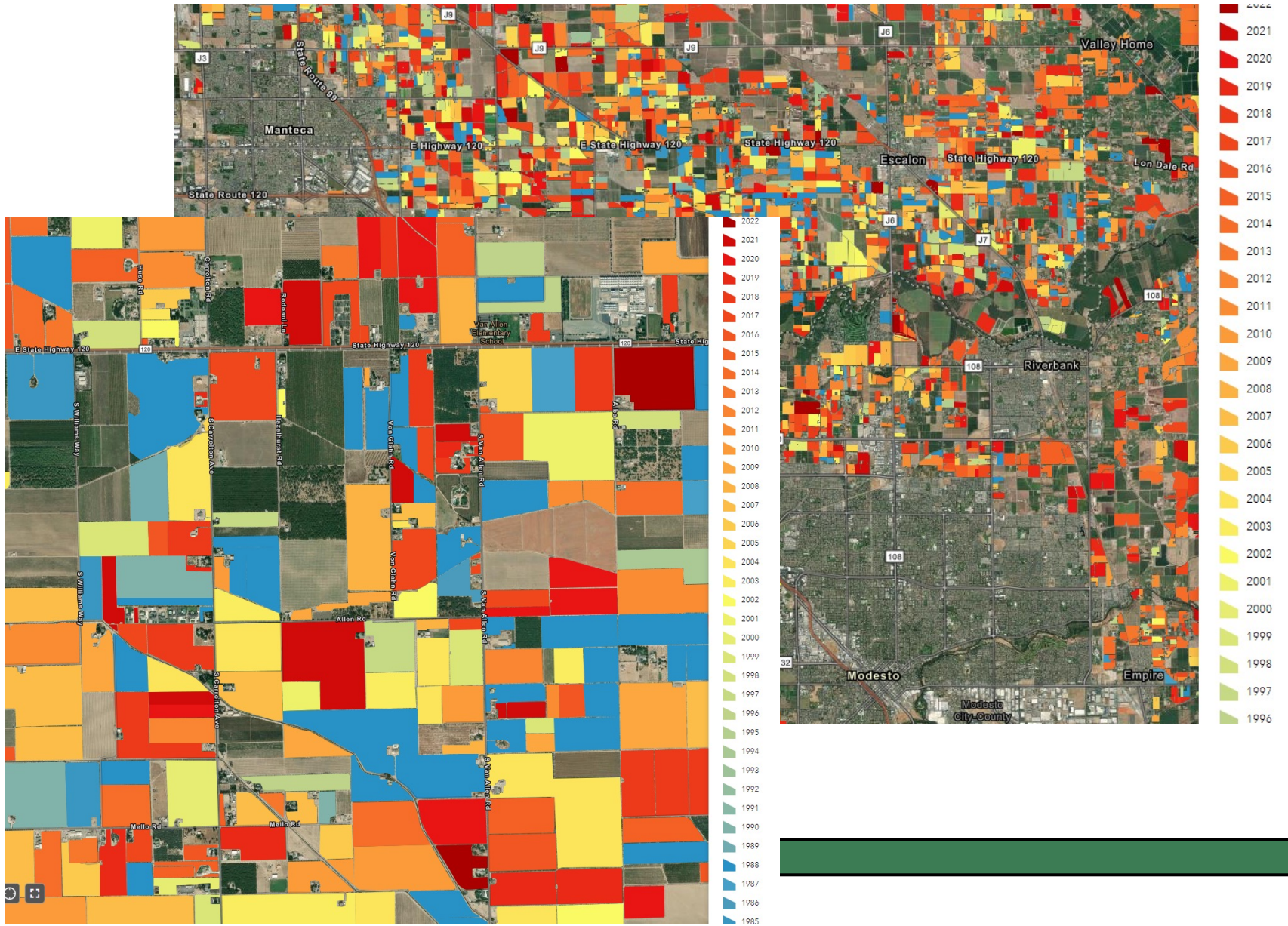


Nevada Statewide Crop-Specific Mapping – Field Level





New Applications: Permanent Crop Age



Separate approach to determine when field was last fallow.

Permanent crop age can help predict:

- Water Usage
- Crop removals and replanting
- Yield Estimations

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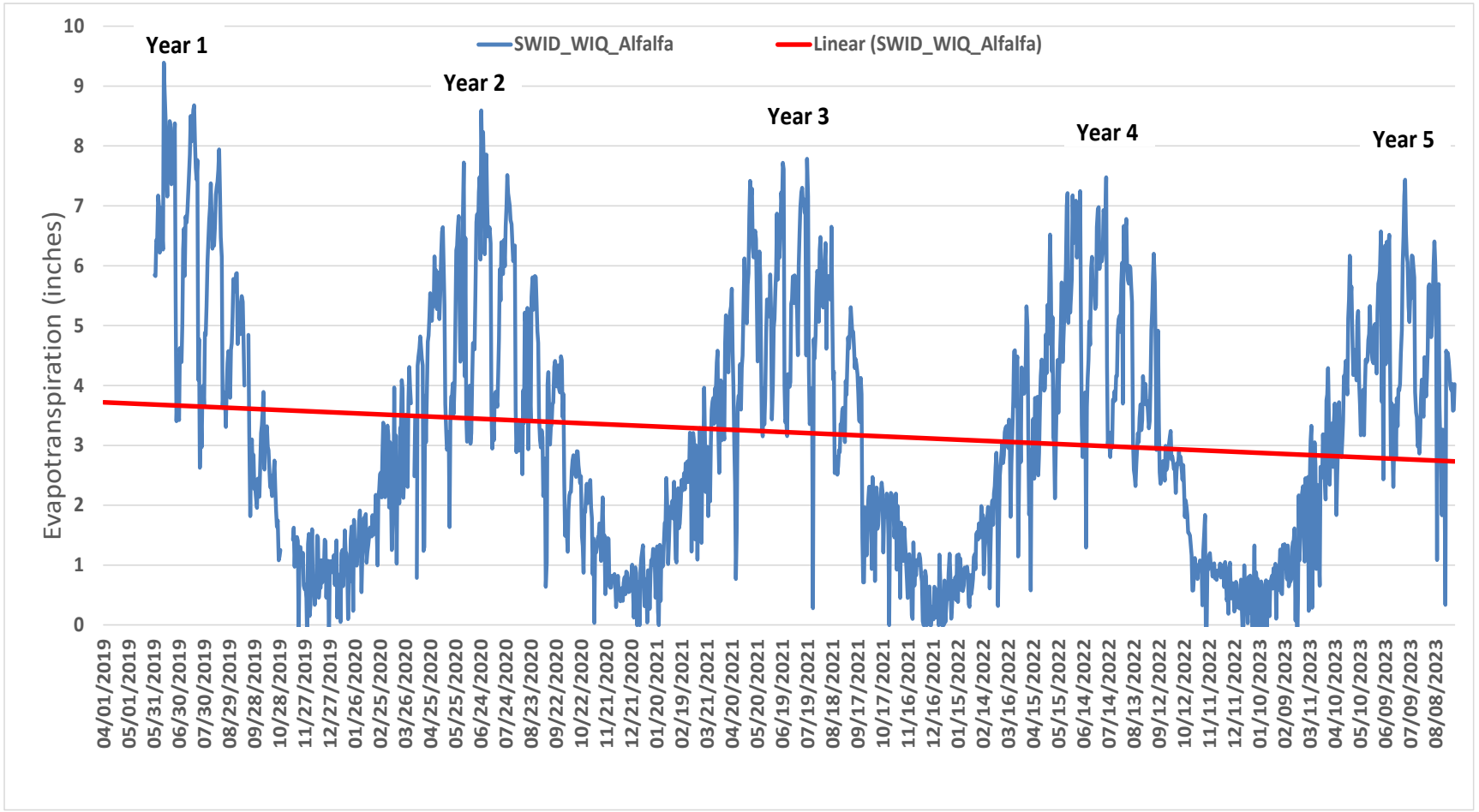
DELIVERABLE - FIELD BY FIELD ALFALFA AGE AND ET

- Distinct correlation to age of the alfalfa field and ET
- Consumptive use declines over time in alfalfa
- 34% reduction in this example
- Some fields more than others
- Alfalfa-specific age x ET results as an additional attribute with crop mapping



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New Value-Added Attributes Each Year

2014

- ★ X Crop Classes
- ★ Urban Footprint
- Special Conditions
- Irrigation Status
- 2nd Gen Multi-Cropping
- Peak Dates
- Percent Cover
- Main Crop & Date
- Inter-Annual Crops
- Permanent Crop Age
- Inter-Annual Dates
- Irrigated Golf Courses
- 1st Gen Multi-Cropping
- ★ Managed Wetlands

2016

- ★ X Crop Classes
- ★ Urban Footprint
- ★ Special Conditions
- ★ Irrigation Status
- 2nd Gen Multi-Cropping
- Peak Dates
- Percent Cover
- Main Crop & Date
- Inter-Annual Crops
- Permanent Crop Age
- Inter-Annual Dates
- Irrigated Golf Courses
- ★ 1st Gen Multi-Cropping
- Managed Wetlands

2018

- ★ X Crop Classes
- ★ Urban Footprint
- ★ Special Conditions
- ★ Irrigation Status
- ★ 2nd Gen Multi-Cropping
- ★ Peak Dates
- ★ Percent Cover
- Main Crop & Date
- Inter-Annual Crops
- Permanent Crop Age
- Inter-Annual Dates
- Irrigated Golf Courses
- 1st Gen Multi-Cropping
- Managed Wetlands

2019

- ★ X Crop Classes
- ★ Urban Footprint
- ★ Special Conditions
- ★ Irrigation Status
- ★ 2nd Gen Multi-Cropping
- ★ Peak Dates
- ★ Percent Cover
- ★ Main Crop & Date
- Inter-Annual Crops
- Permanent Crop Age
- Inter-Annual Dates
- Irrigated Golf Courses
- 1st Gen Multi-Cropping
- Managed Wetlands

2020

- ★ X Crop Classes
- ★ Urban Footprint
- ★ Special Conditions
- ★ Irrigation Status
- ★ 2nd Gen Multi-Cropping
- ★ Peak Dates
- ★ Percent Cover
- ★ Main Crop & Date
- ★ Inter-Annual Crops
- ★ Permanent Crop Age
- Inter-Annual Dates
- Irrigated Golf Courses
- 1st Gen Multi-Cropping
- Managed Wetlands

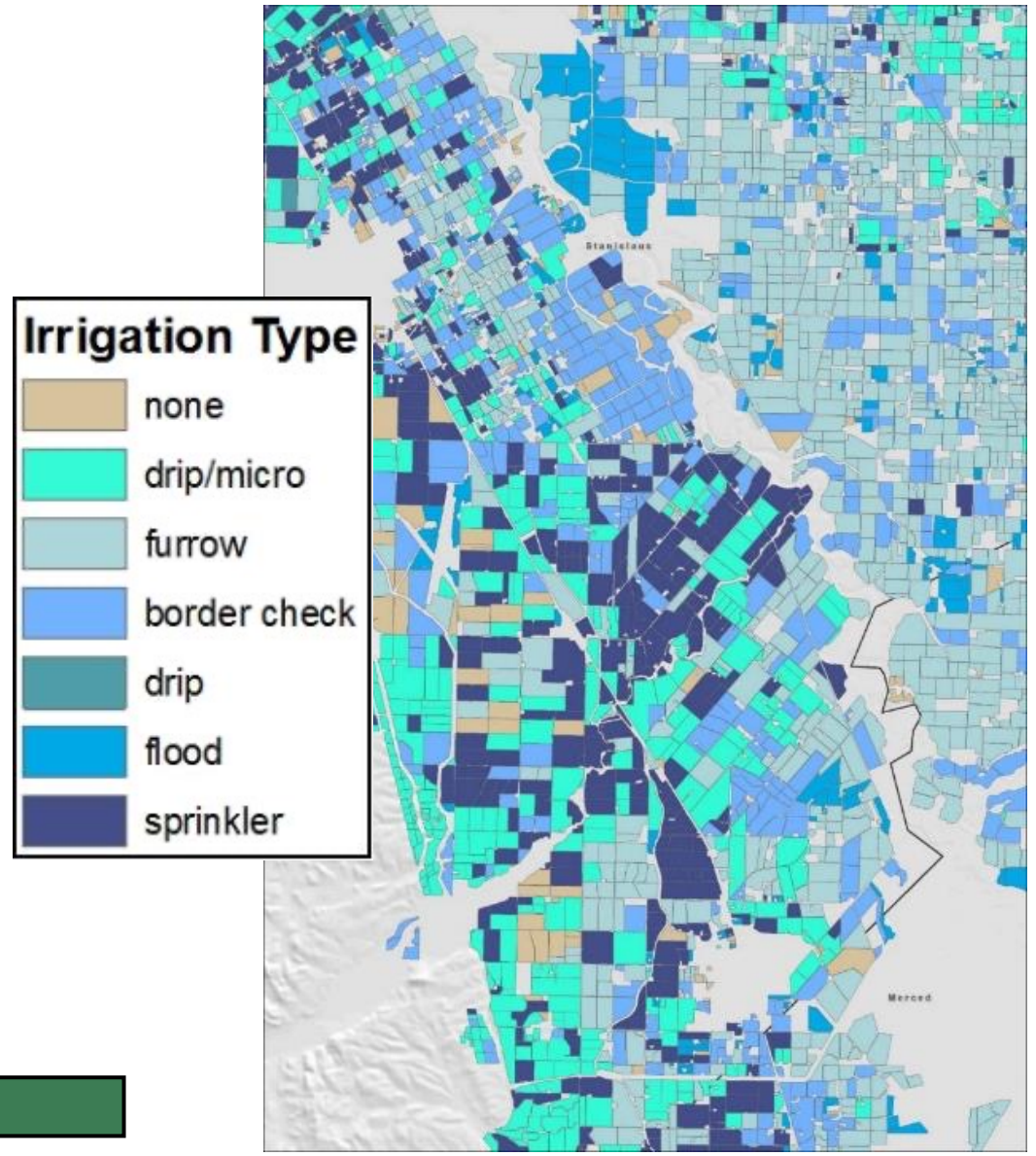
2021

- ★ X Crop Classes
- ★ Urban Footprint
- ★ Special Conditions
- ★ Irrigation Status
- ★ 2nd Gen Multi-Cropping
- ★ Peak Dates
- ★ Percent Cover
- ★ Main Crop & Date
- ★ Inter-Annual Crops
- ★ Permanent Crop Age
- ★ Inter-Annual Dates
- ★ Irrigated Golf Courses
- 1st Gen Multi-Cropping
- Managed Wetlands

New Applications: Irrigation Method Determination

Incorporation of various lines of evidence to create irrigation method distribution

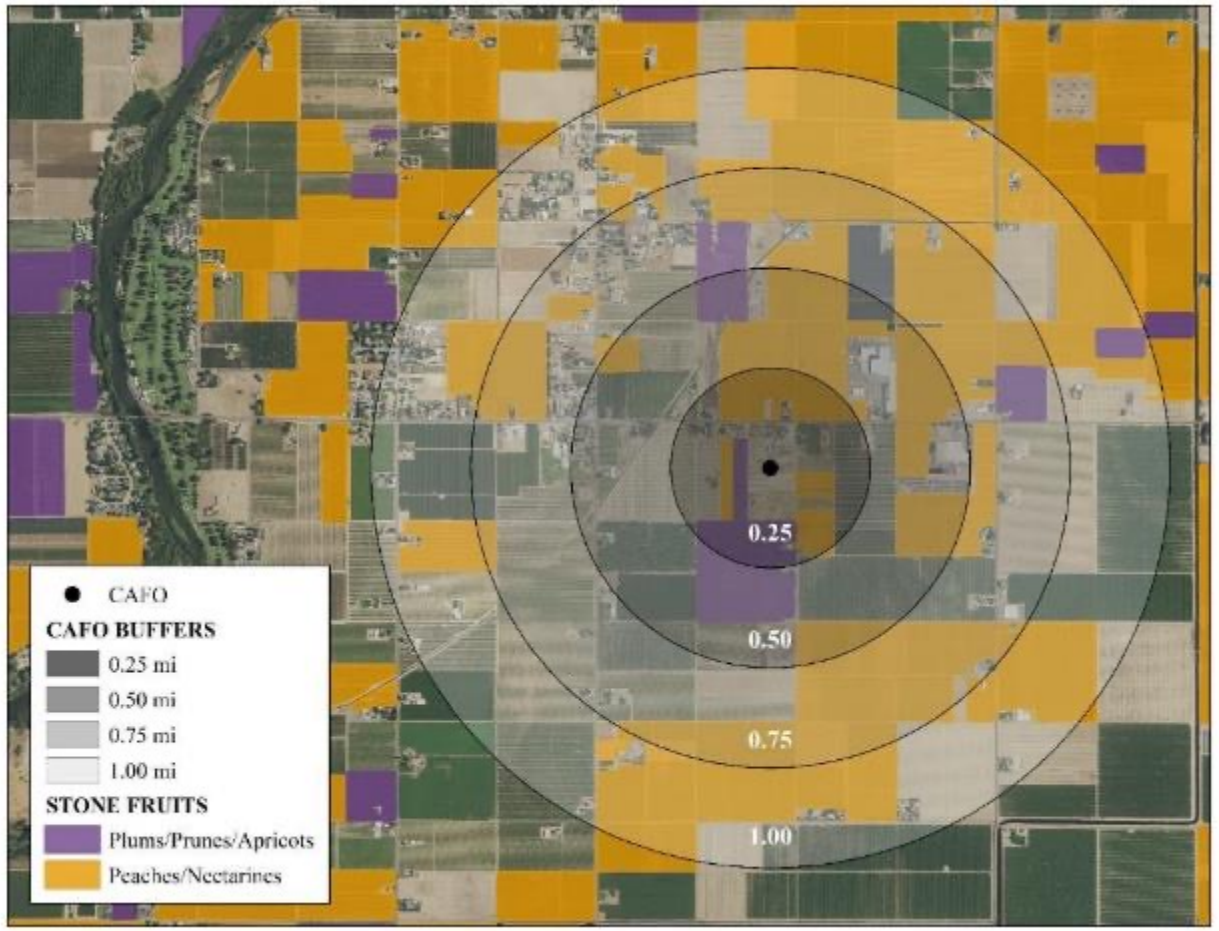
- Crop type
- Statewide ground truth results
- Irrigation district records
- Previous records
- Source water supply
- Agronomic knowledge
- Known regional differences
- Temporal differences (e.g. crop age)
- Topography



New Applications: Proximity Analyses

Proximity analyses can be conducted to determine impacts on water use and production systems from:

- Regulatory compliance
- Environmental impacts
- Adjacent agricultural operations



New Applications: Field-Scale Consumptive Use

Land IQ currently provides monthly, field by field consumptive use, land use, and precipitation results for:

- 35 GSAs or Districts
- Over 3.5 million acres
- 35-40 different crops
- Multiple water sources
- Field-by-field ET and Precipitation
- Supports various allocation methods and water management strategies
- Monthly reports with accuracies
- Delivery within 25-30 days
- Integration to on-line platform results

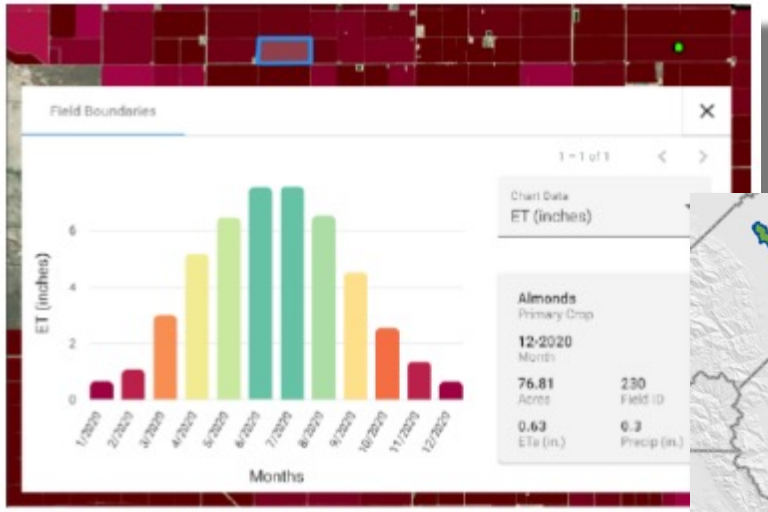
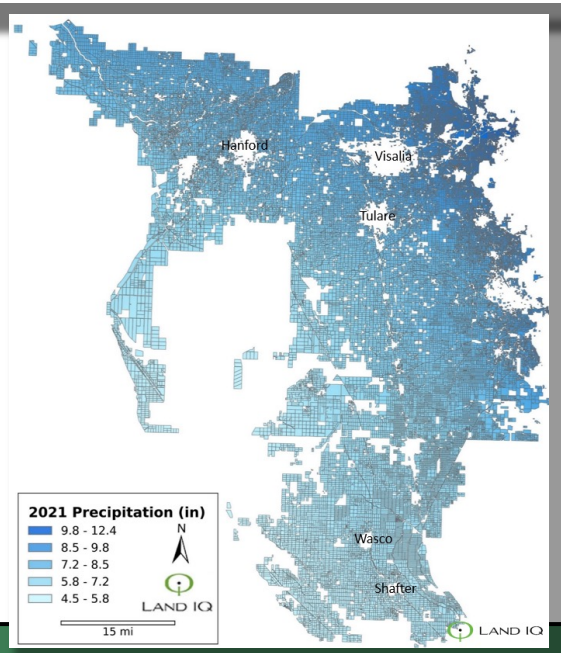
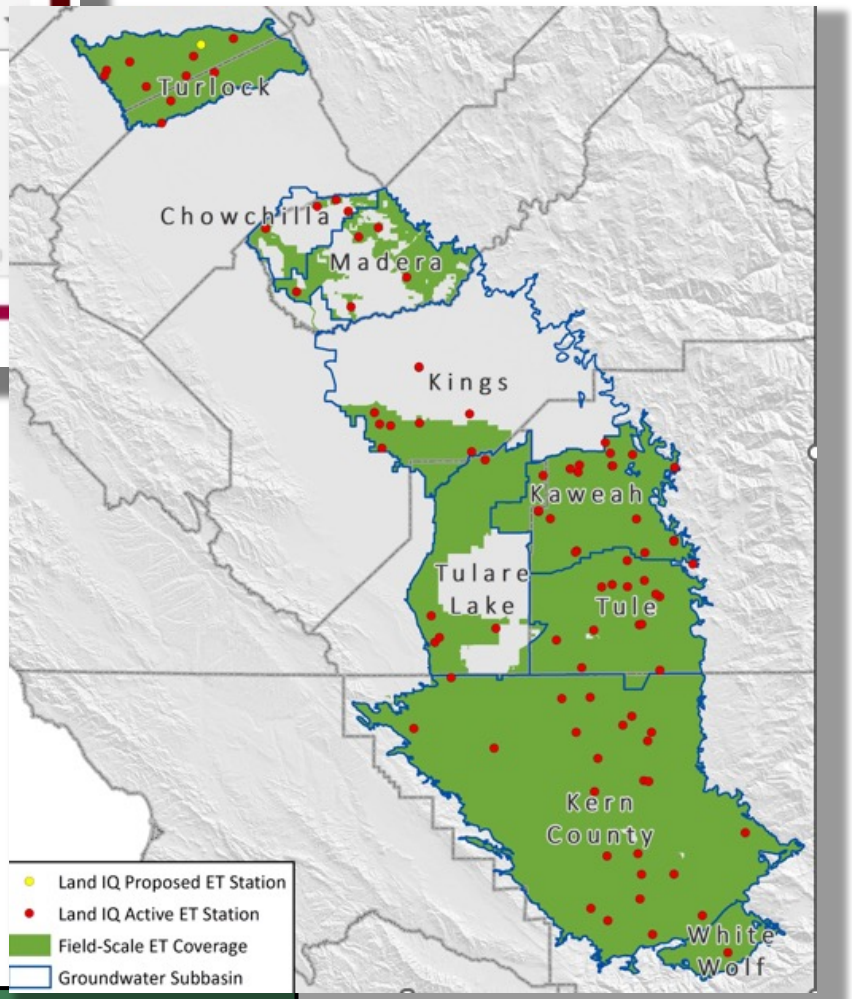
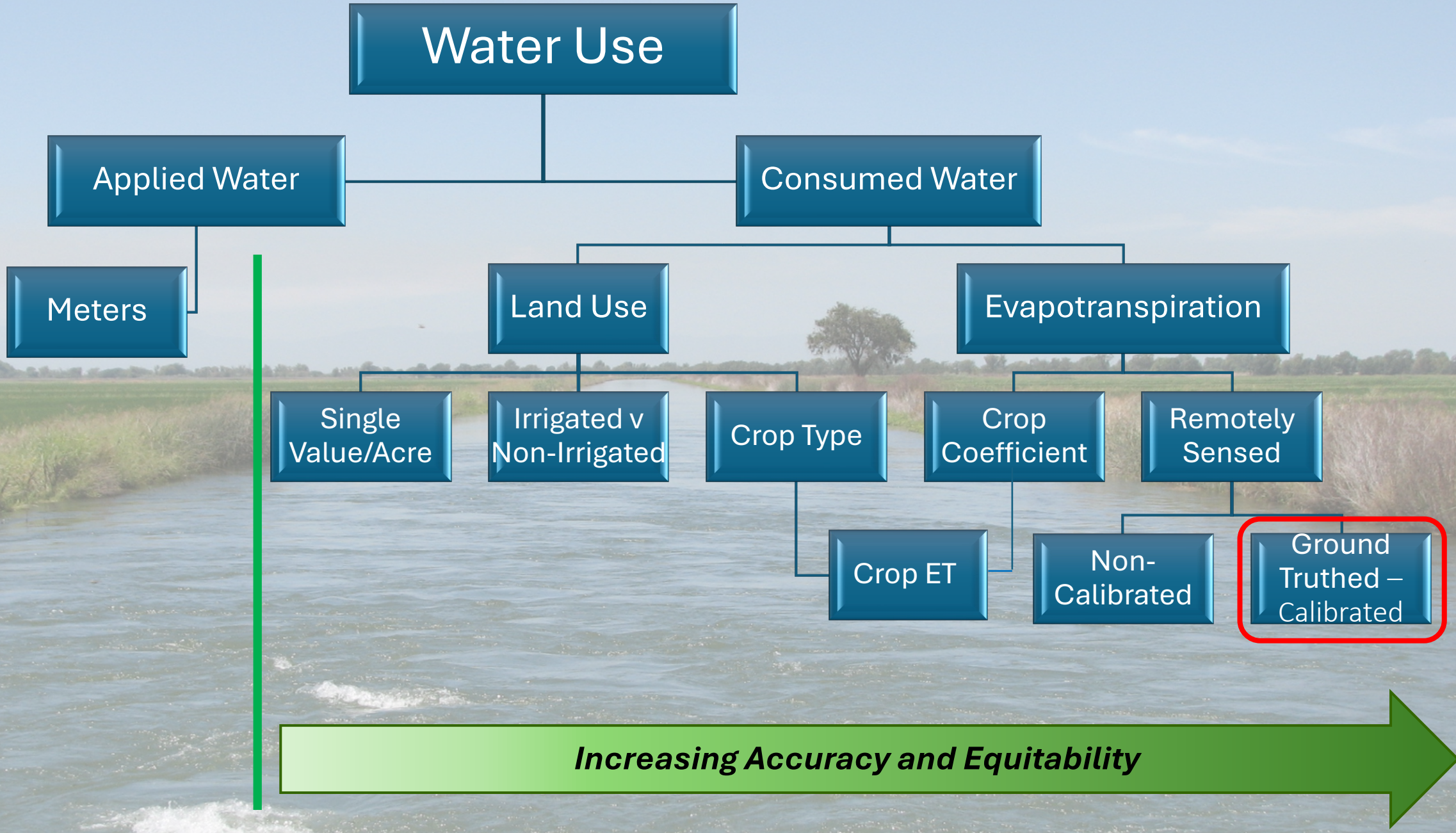


Figure 1. Example of field-by-field ET results for a 76.81-acre almond orchard in Kern County.





Water Use - A Decision Tree Approach

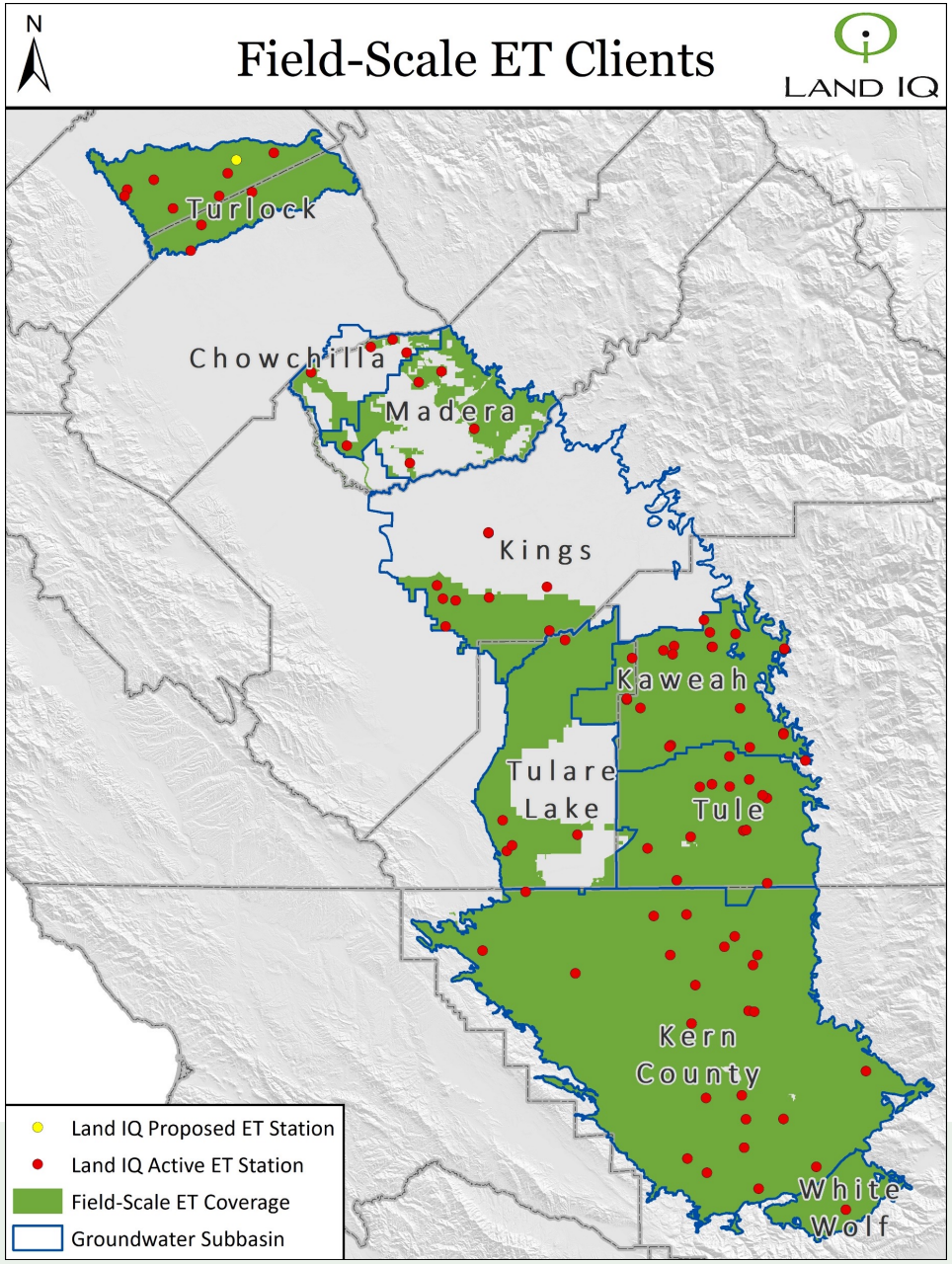


GROUND TRUTHING FOR ET CALIBRATION – WHY?

- Defensible
- Independent validation
- Calibration to actual conditions
- Avoiding interpolation during lengthy cloud and smoke cover
- Understanding specific field conditions and management
- Allows for crop-specific modeling
- Stations used are a combination of eddy covariance and surface renewal approaches developed through collaboration with DWR (Delta) and UC Davis researchers
- A “ground up” approach

GROUND TRUTHING FOR CALIBRATION – WHERE?

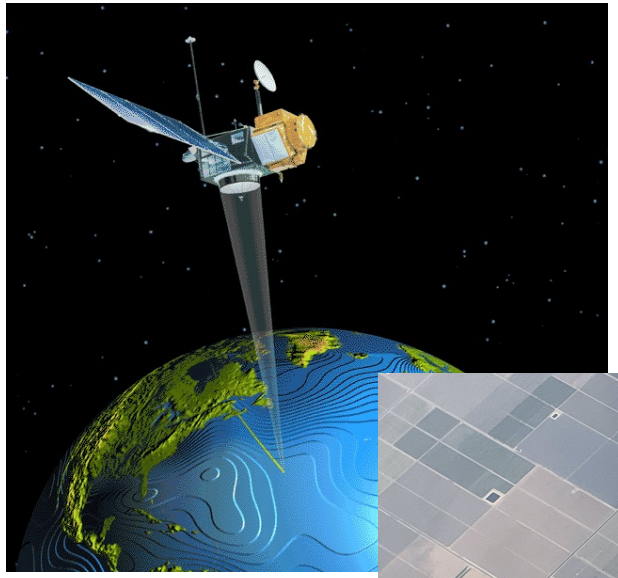
- Approximately 85 stations installed in the San Joaquin Valley
- Establishment of spatial precipitation with multiple rain gauges
- For the purpose of understanding crop specific and repeated measurements
- Collaboration with UC Davis, UC Cooperative Extension and USDA Agricultural Research Service
- Necessary for more accurate estimation of consumed water in any:
  - Water allocation programs
  - fee-based establishment
  - Demand management programs
  - Grower collaboration and outreach



Responding to the Ask

Q: What's New?

A: Ground Truthed Solutions



Previous Crop Mapping Approaches:

- Survey based – numeric only
- Intermittent and Infrequent (county by county)
- Non ground truthed (USDA CropScape Crop Data Layer),
- Generally less accurate, less timely, and less comprehensive (e.g. many times doesn't include multicropping)

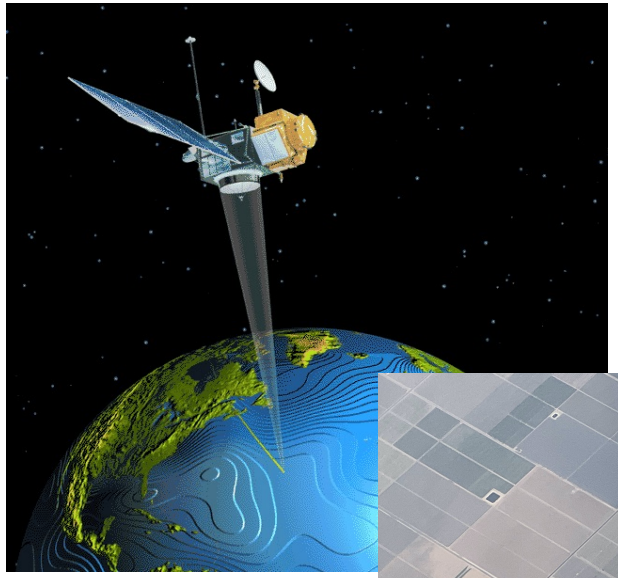
New Crop Mapping Approaches:

- Continuous
- Accurate
- Comprehensive

Responding to the Ask

Q: What's New?

A: Ground Truthed Solutions



Previous Crop Water Use Approaches:

- Crop Coefficient (ETc = ETo x Kc)
- Research-based methods
- Mass balance methods
- Micrometeorological (plant specific) methods

New Crop Water Use Approaches:

- Remotely sensed ET – data driven, ground calibrated
- At least provide relative differences in water use and are now providing accurate estimation of water use across an entire landscape on a field by field basis
- Coupled with crop mapping (knowing what is grown where and how much) is a powerful combination

Interpreting Agricultural Land Attributes Via Remote Sensing:

Validated, Ground Truthed Approaches

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COLORADO RIVER WATER USERS ASSOCIATION

December 5, 2024

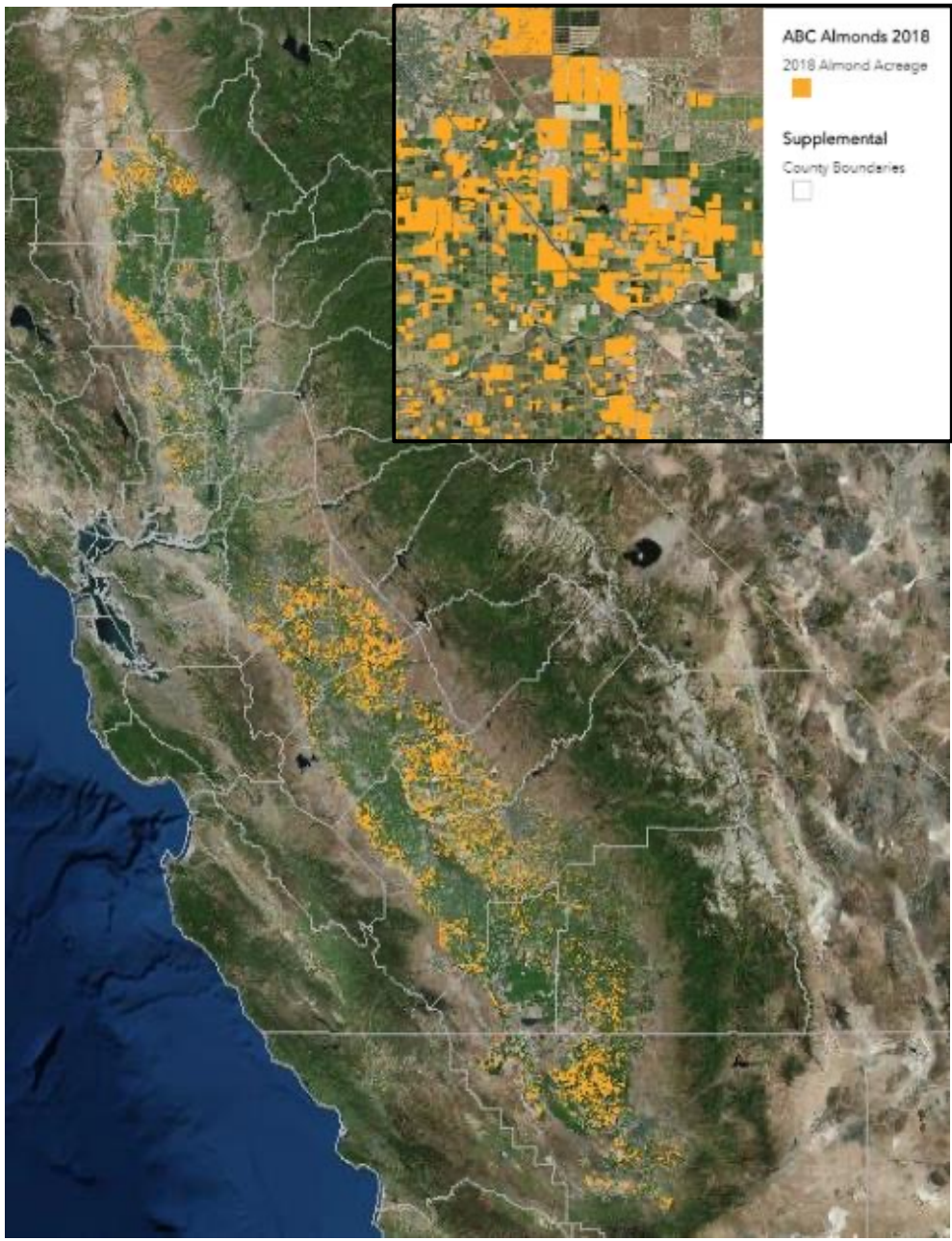
LAND IQ

Extra Slides Below

Development Timeline

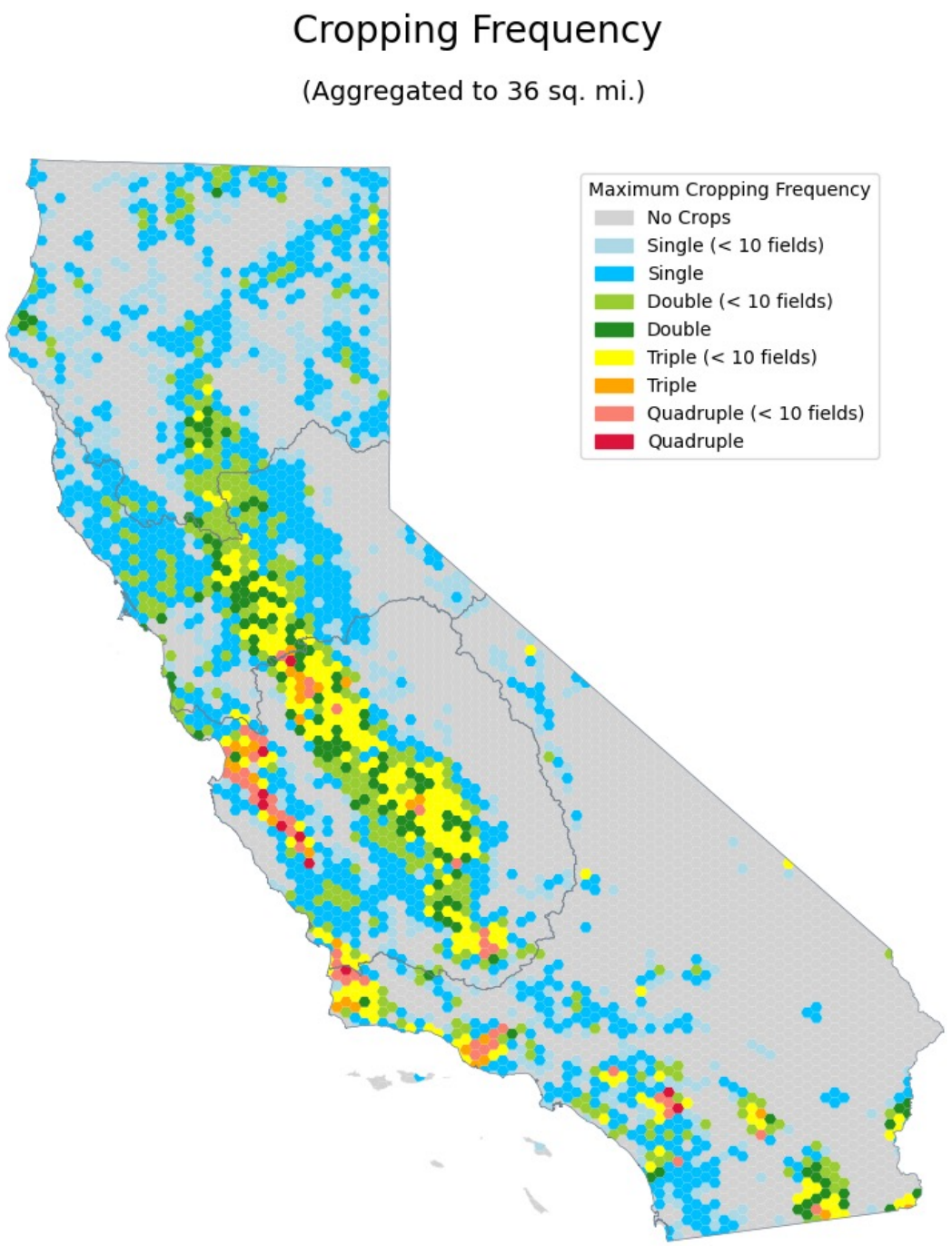
Over a Decade of Research, Development, and Mapping

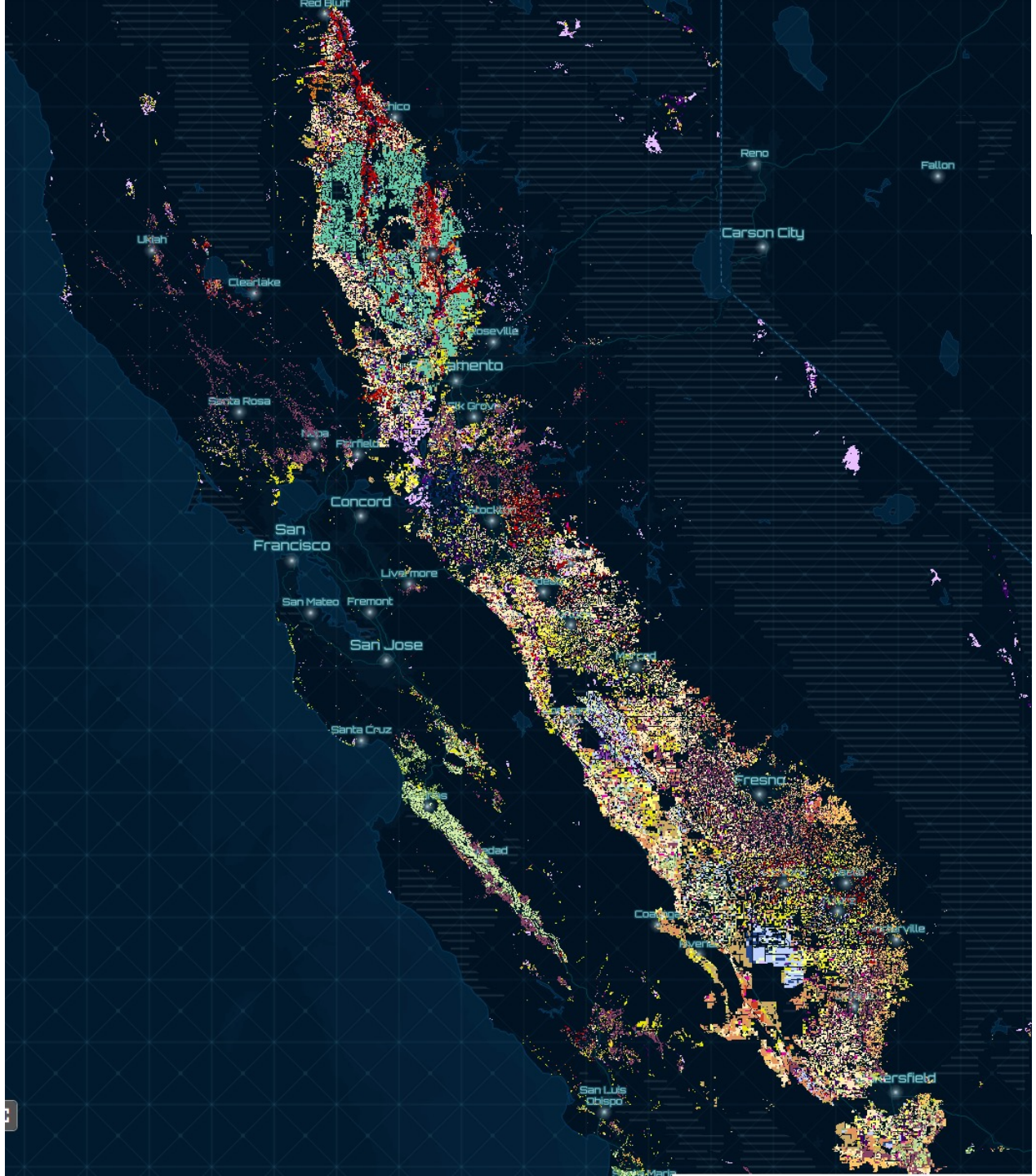
- Idea Developed in 2010 and before
- Were average yields slightly elevated in almonds?
- Initial Pilot Study - Madera County in 2011
- Secondary Pilot Study - Madera County in 2013
- Statewide tree crop mapping in 2014 including walnuts, pistachio and dried plums
- Retrospective almond mapping for 2010 and 2012
- Statewide land use mapping for DWR for 2014, 2016, 2018, 2019, 2020, 2021, 2022 and 2023 (in progress)
- Delta land use mapping for DWR and SWRCB in 2015, 2016 and 2017
- Various commodity groups (ABC, CWB, Rice, PRB, APC, ACP, CPB, CAC,)



Accuracy Assessment

- Standardized approach for remote sensing
- Use a set aside portion of ground truthing results as an independent validation dataset
- Evaluates omission and commission errors
- Accuracies calculated for all crops with adequate data (>5 records)





California Avocado Commission

California Almonds — Almond Board of California

California Walnuts

ADM

Australian Almonds

California Pistachios

California Blueberry Commission

Pinnacle Rice Cooperative

SunFoods

ACC — American Commodity Company, LLC

American Pecans

California Raisins

Administrative Committee for Pistachios

FRC — Farmers' Rice Cooperative

Department of Water Resources — State of California

California Wild Rice Advisory Board

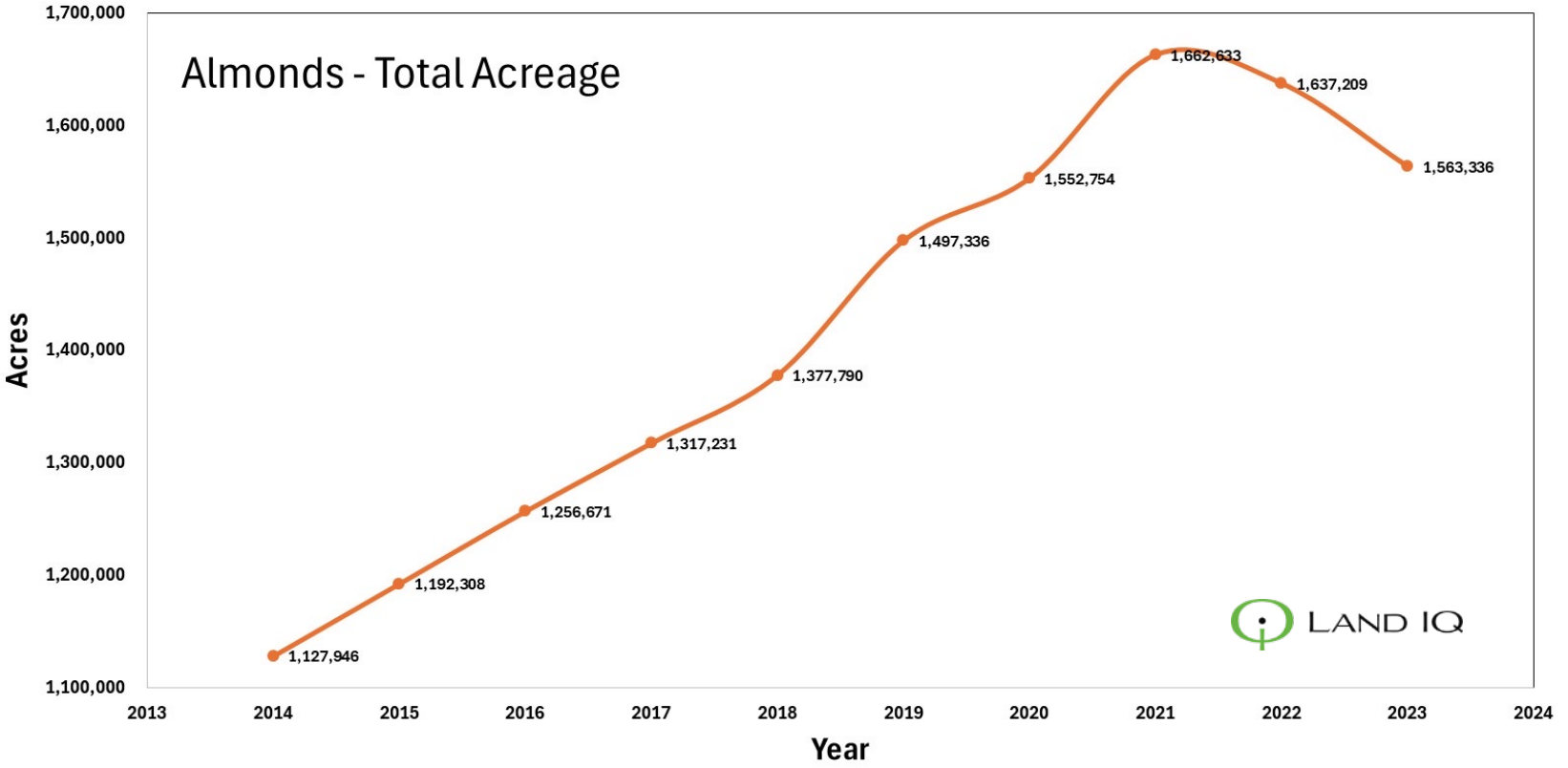
SunWest Foods

the Wonderful company

Pistachio Growers' Association

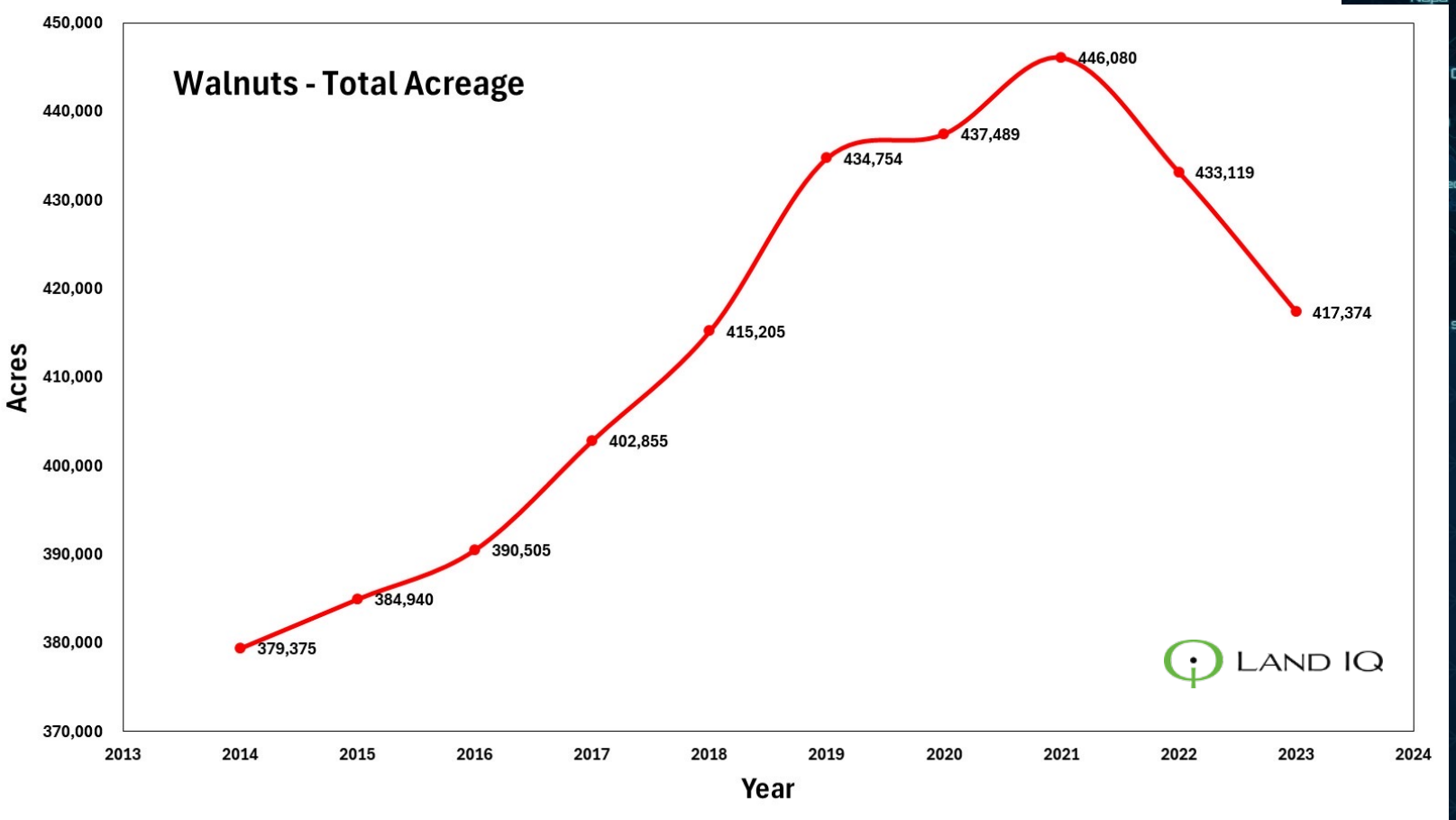
Almonds

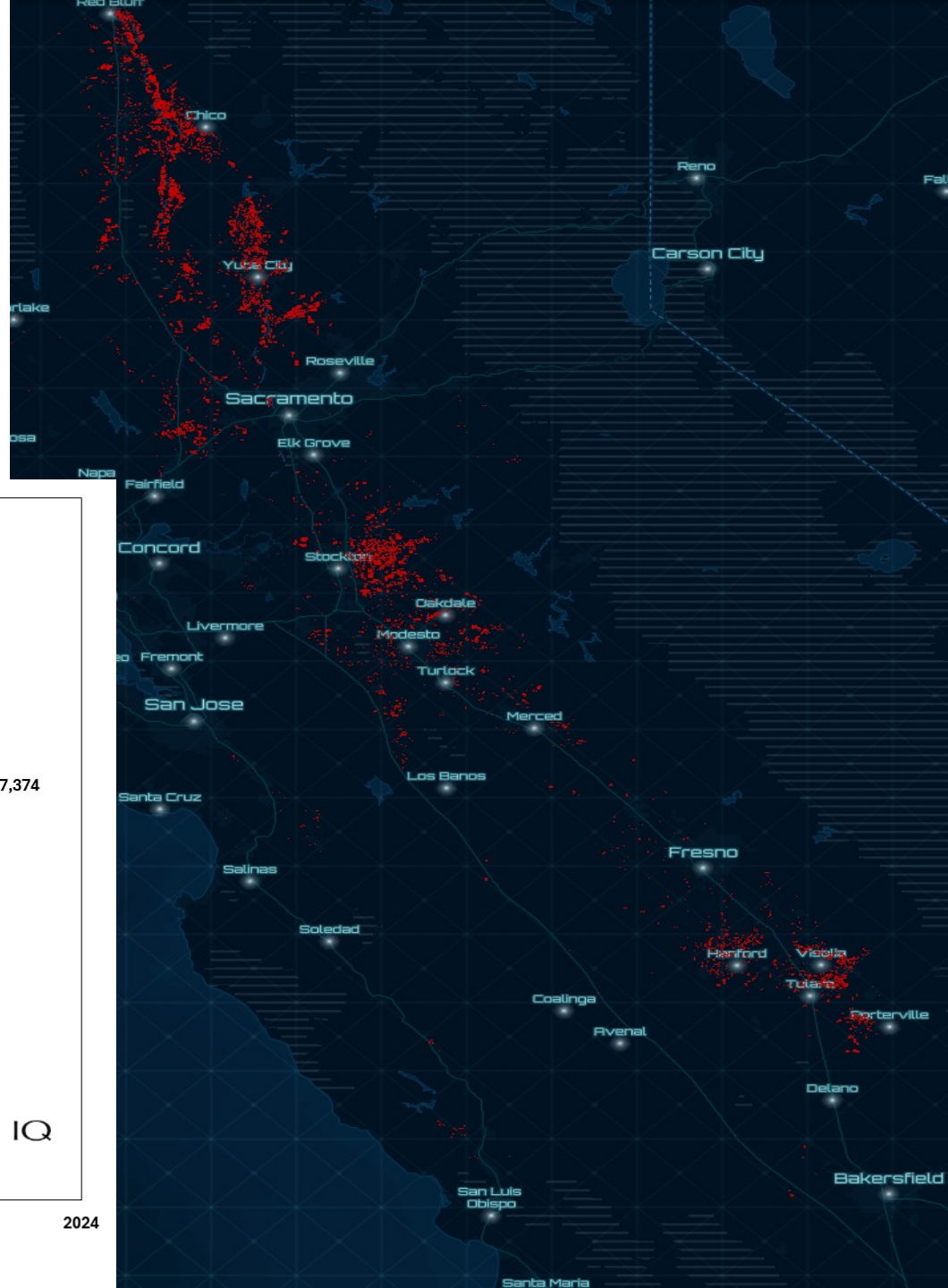
- Reduction in total acreage beginning in 2022
- Reduction in bearing acreage beginning in 2024
- Significantly impacted by SGMA
- More change likely to occur in San Joaquin Valley



Walnuts

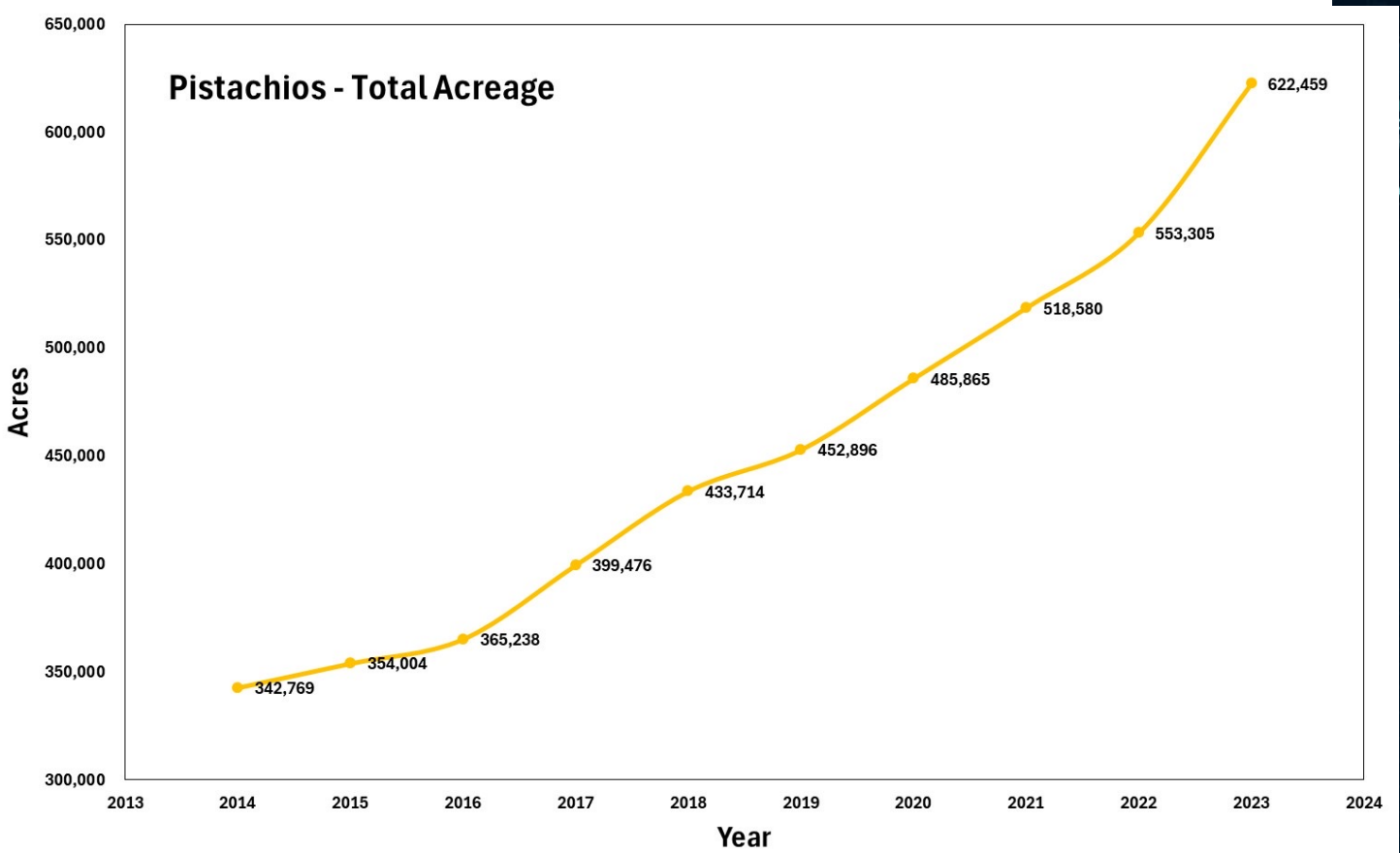
- Peak in total acreage beginning in 2022
- Reduction in total acreage in 2023 and again in 2024
- Significantly impacted by SGMA
- More change likely to occur in San Joaquin Valley

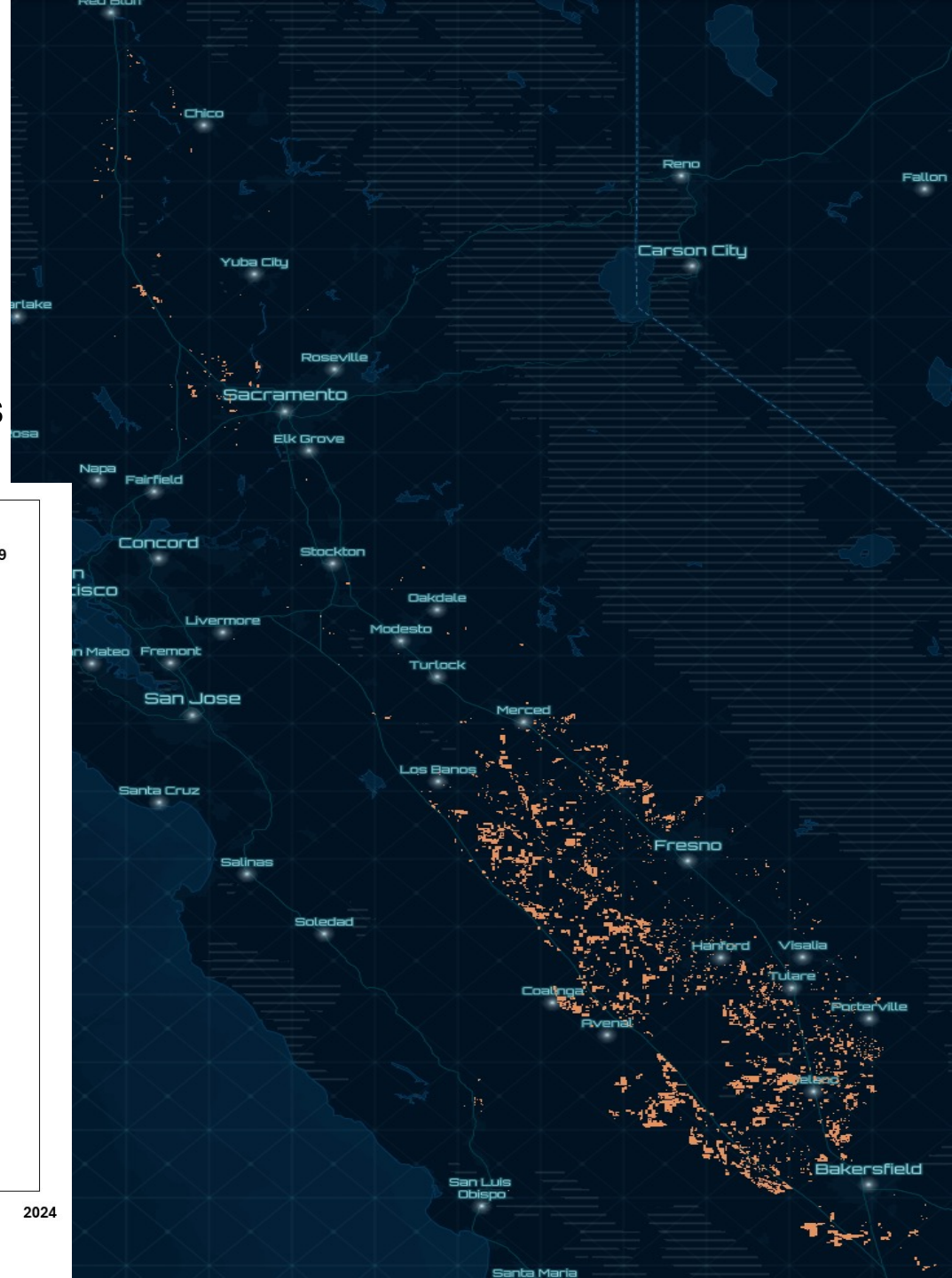




Pistachios

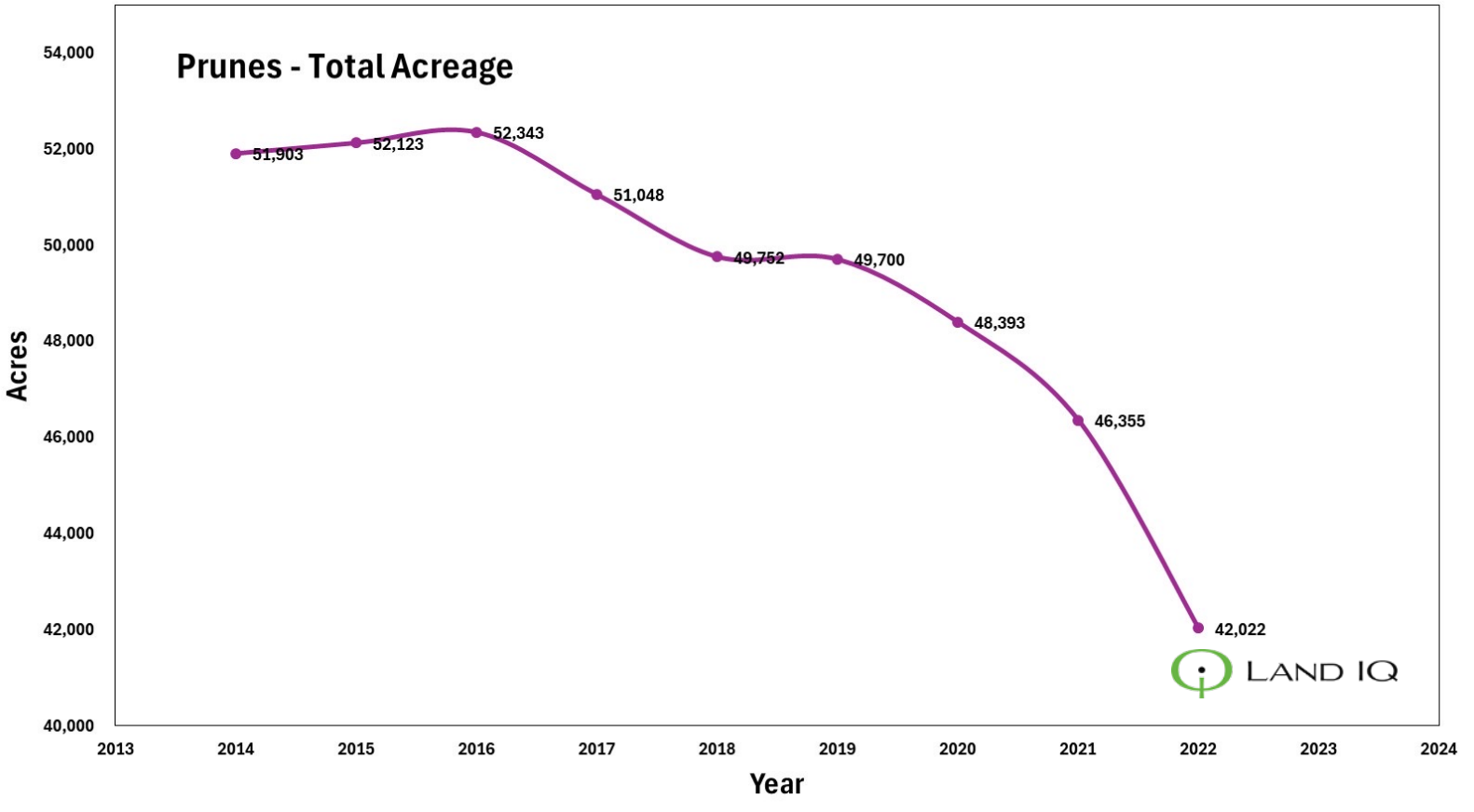
- Non-bearing – 25-35%
- 2023 recent mapping includes non-bearing estimate
- Conversion from almonds (recent) and annual crops
- Approximately 75% of water use of almonds and walnuts





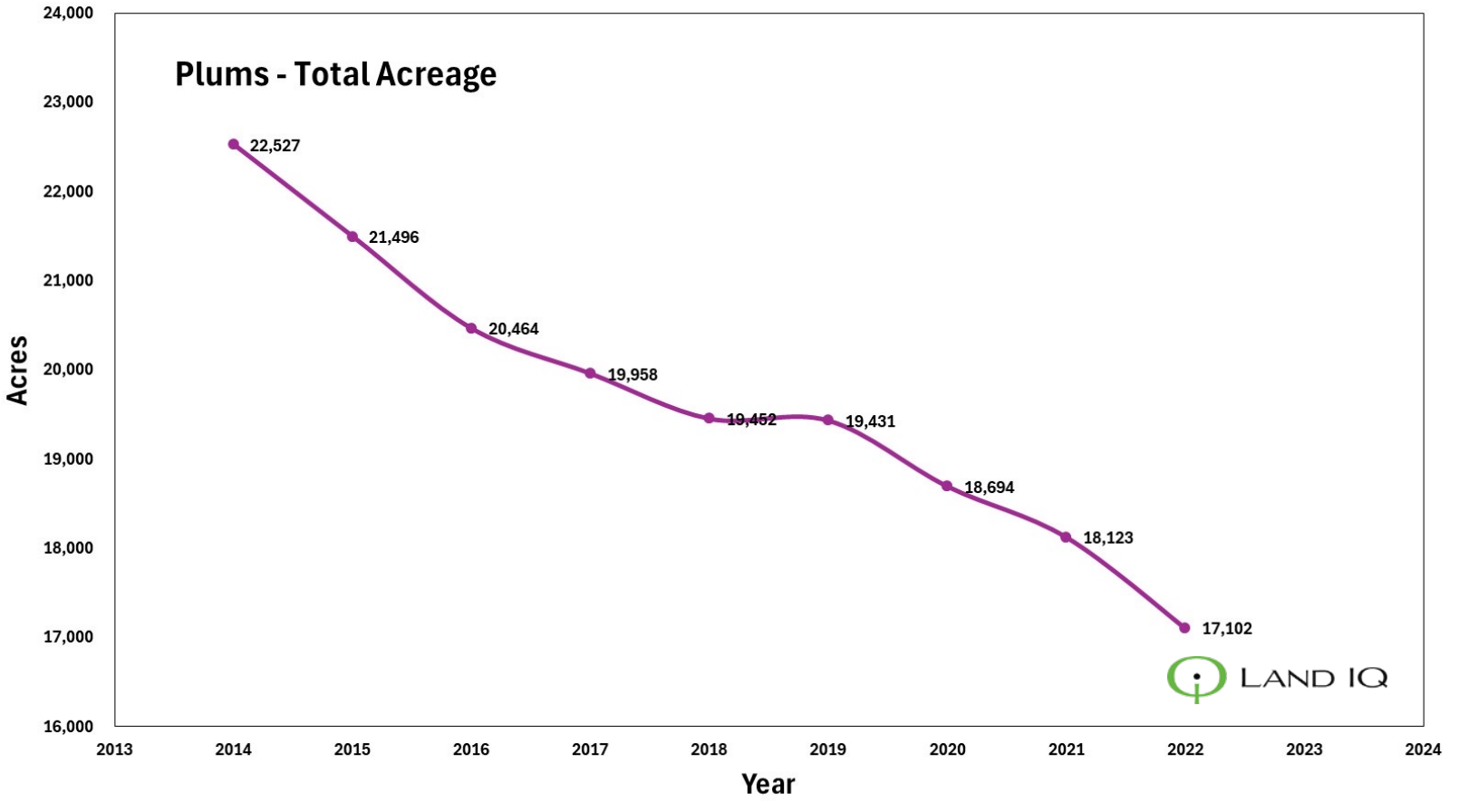
Prunes

- 2023 acreage not completed
- More acreage in the Sacramento Valley
- More change likely to occur in San Joaquin Valley
- Decent prices somewhat recently



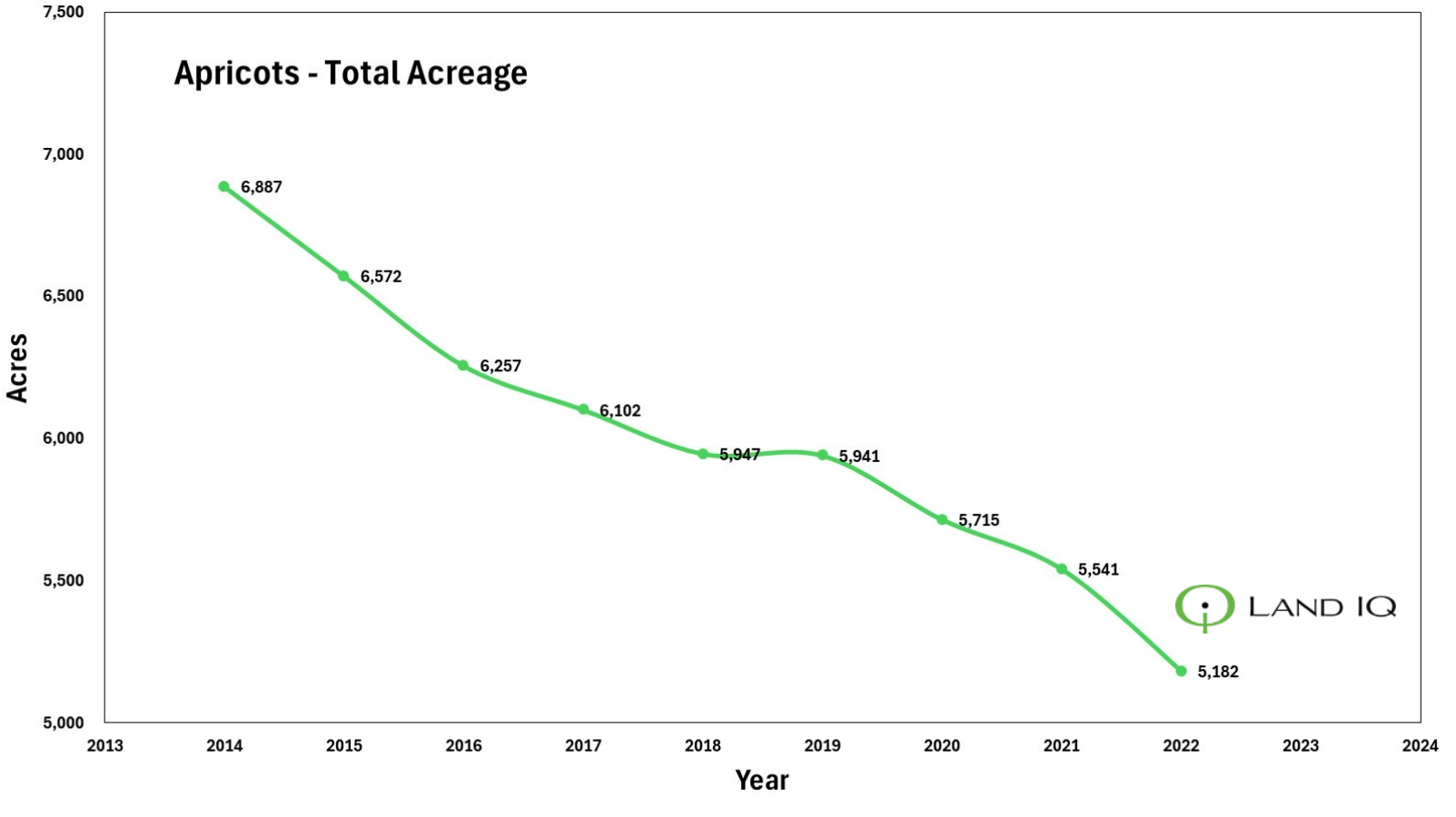
Plums

- 2023 acreage not completed
- More acreage in San Joaquin Valley
- Usually smaller blocks



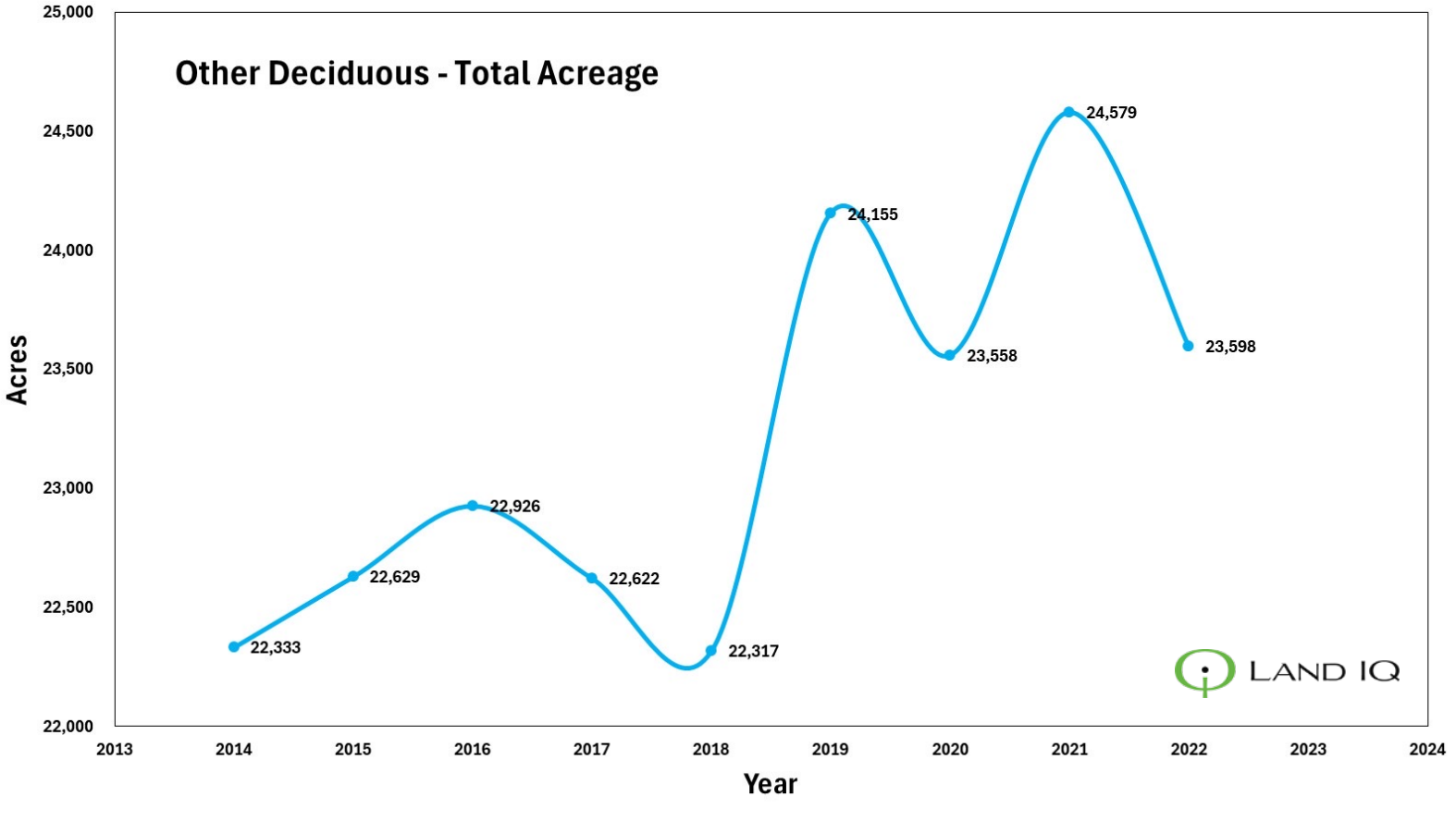
Apricots

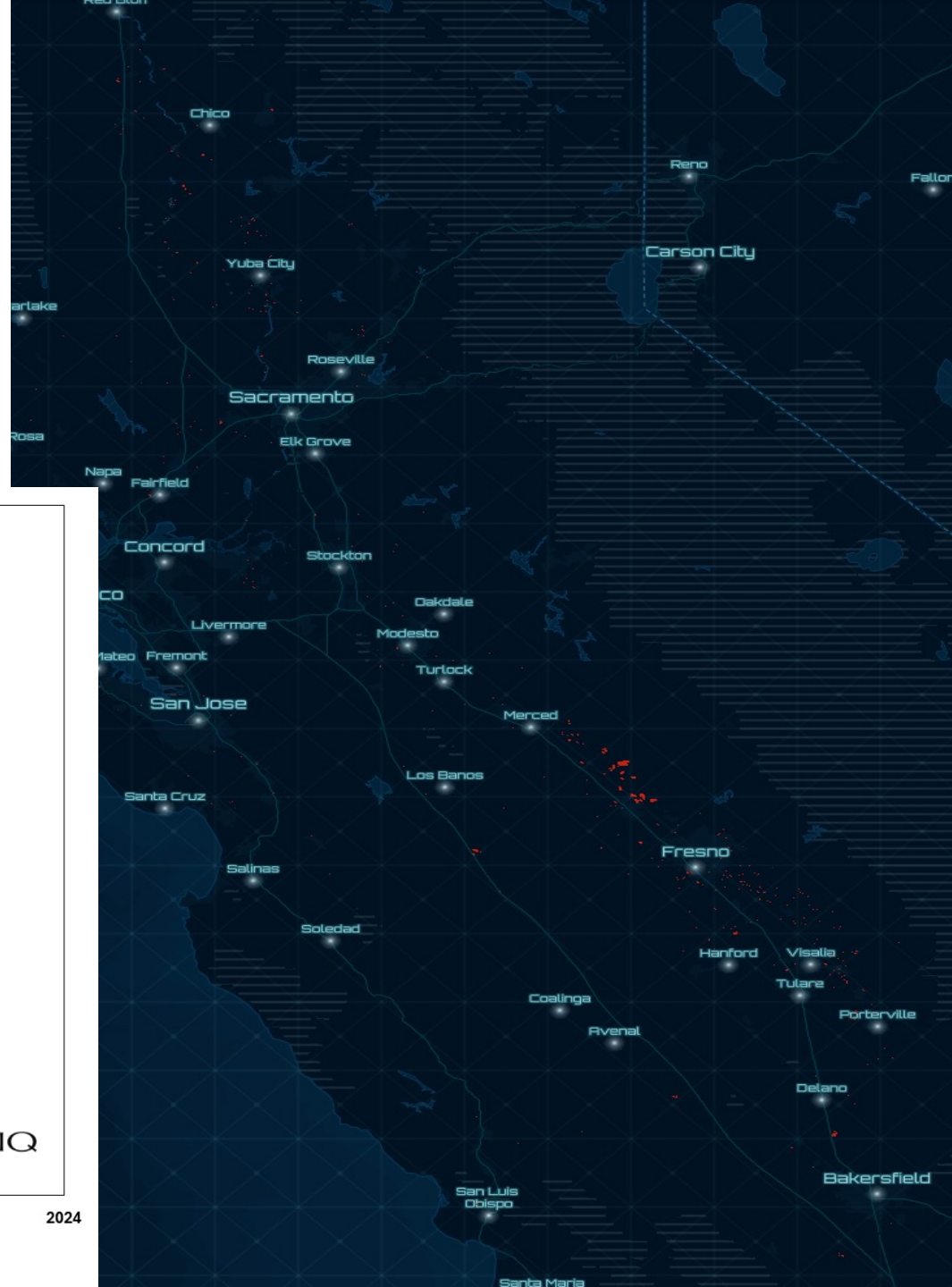
- Small acreage crop
- Primarily around the Patterson area
- Consistent decline over the past decade



Other Deciduous

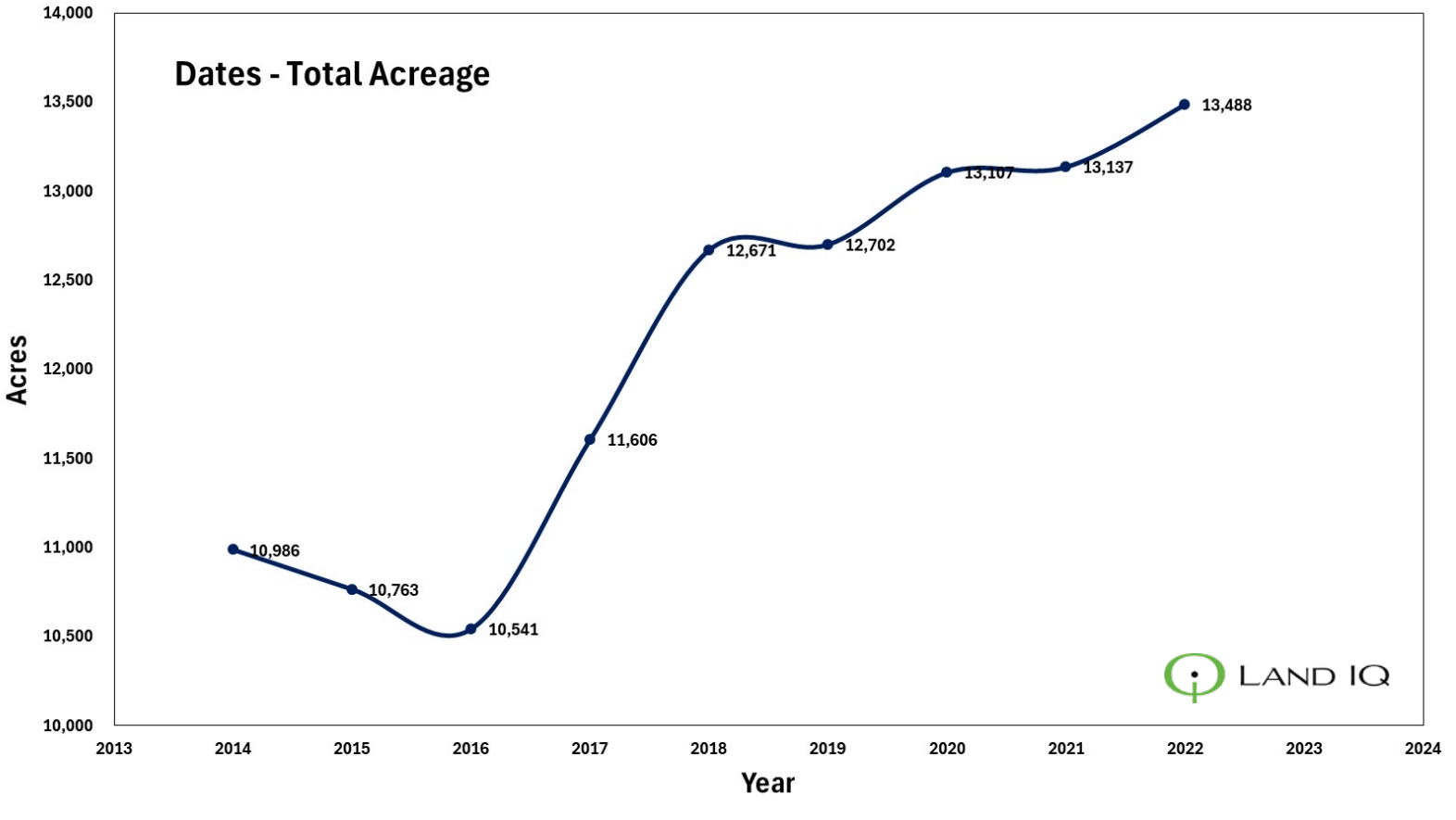
- A catchall for remaining deciduous tree crops
- Pecans – 6,069 acres in 2022
- Persimmons, Figs, Hazelnuts, Chestnuts, Jujube

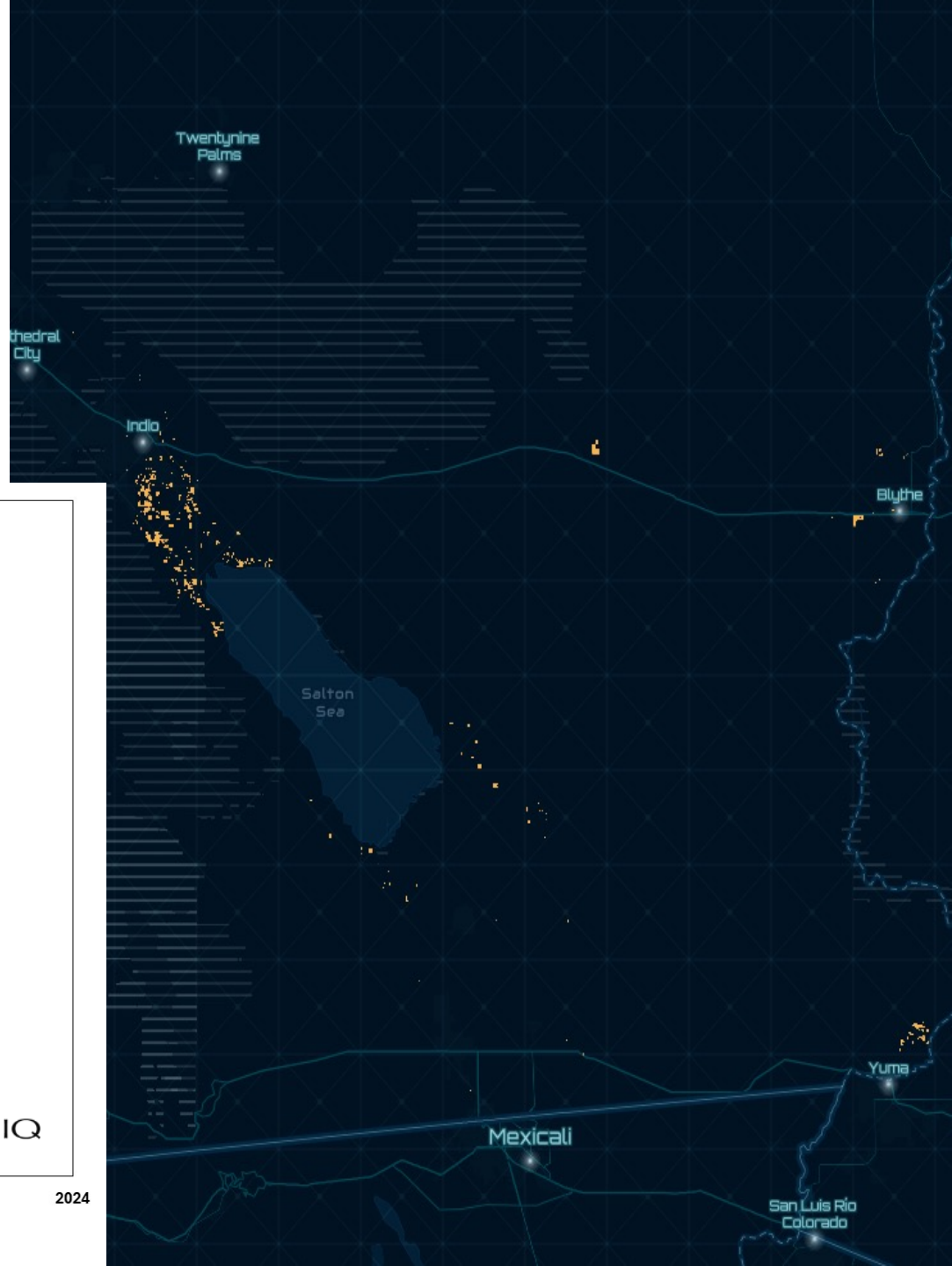




Dates

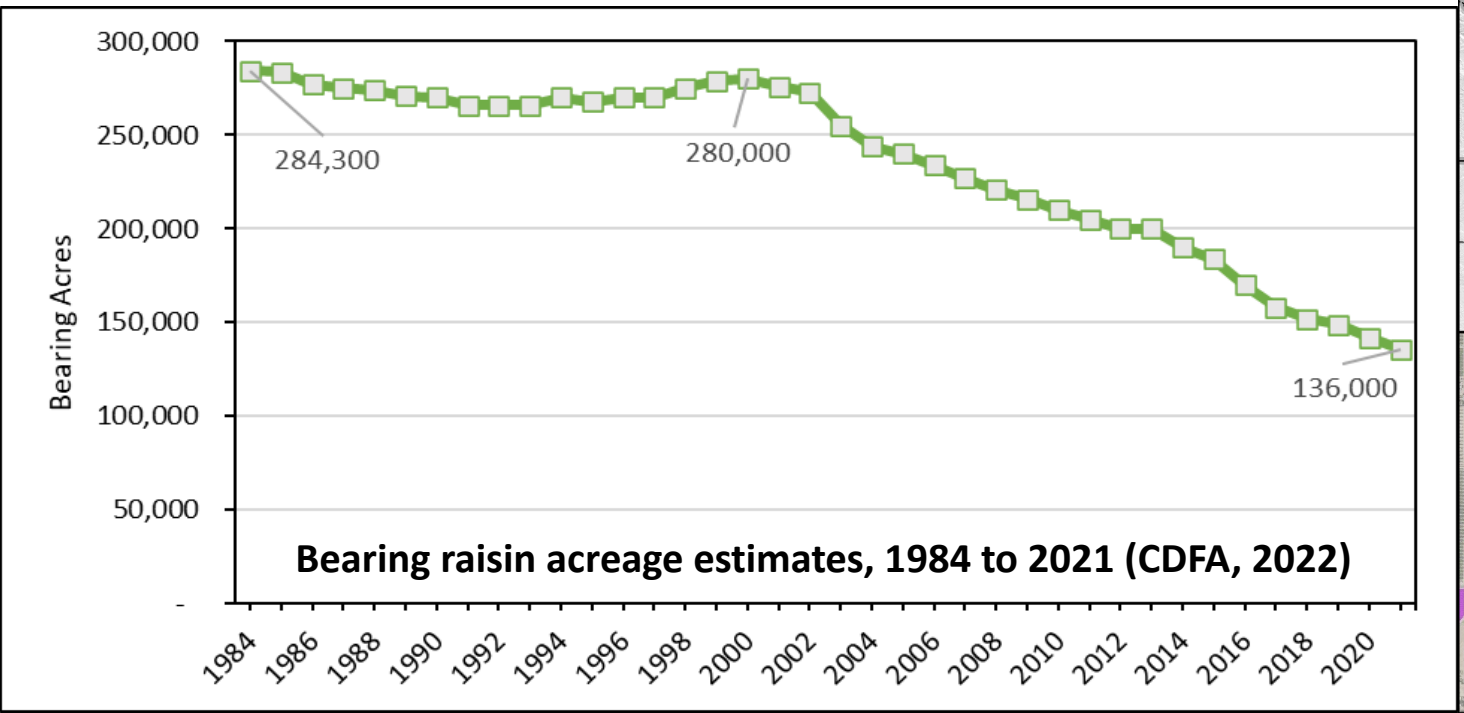
- Grown in the southeastern desert areas of CA
- Increased in popularity
- Still smaller acreage crop



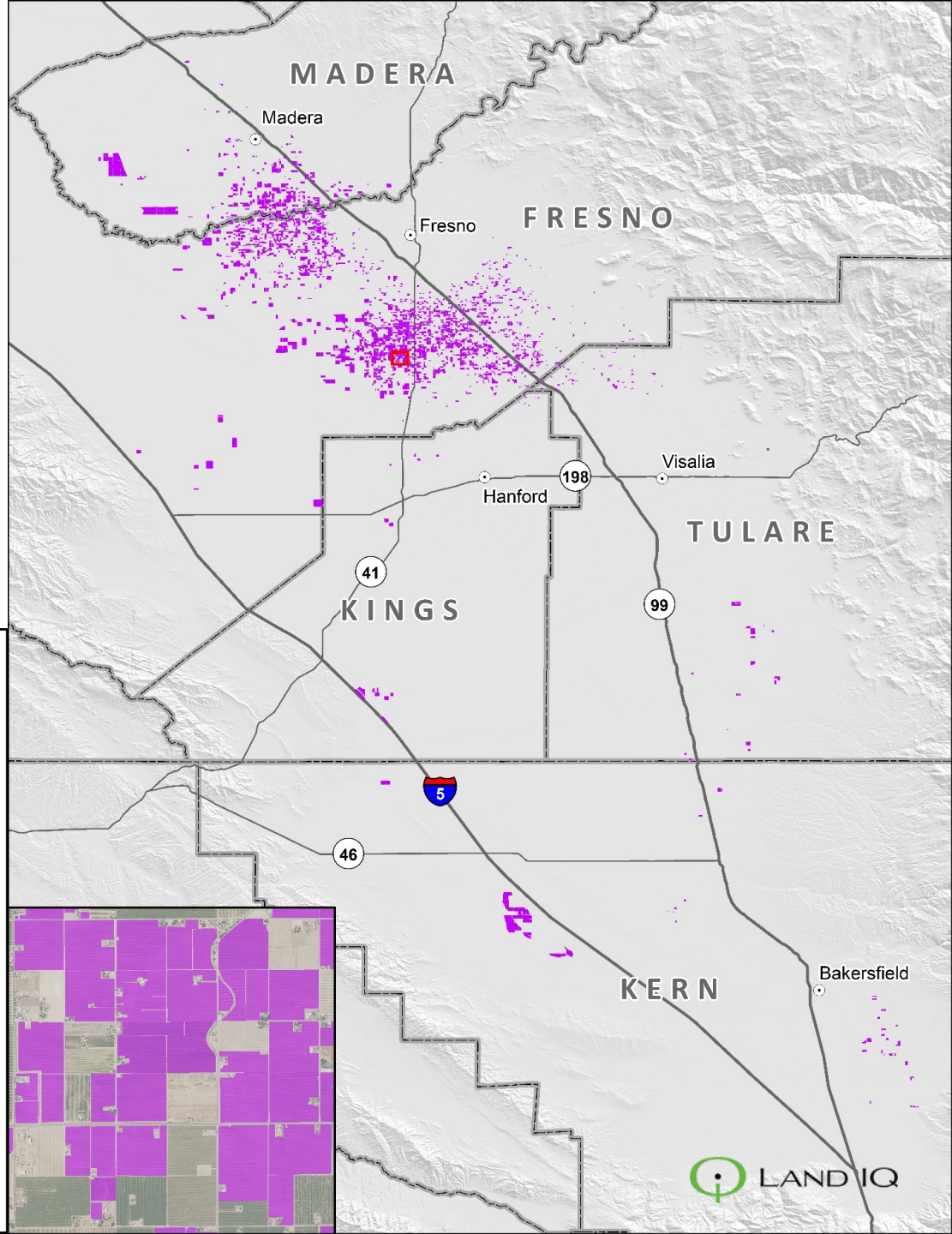


Raisins – Dried Grapes

- Growers were concerned the acreage was over-estimated, affecting markets
- 97,774 acres mapped and validated in 2022
- Differs from USDA (127,000) and CDFA (132,000) estimates



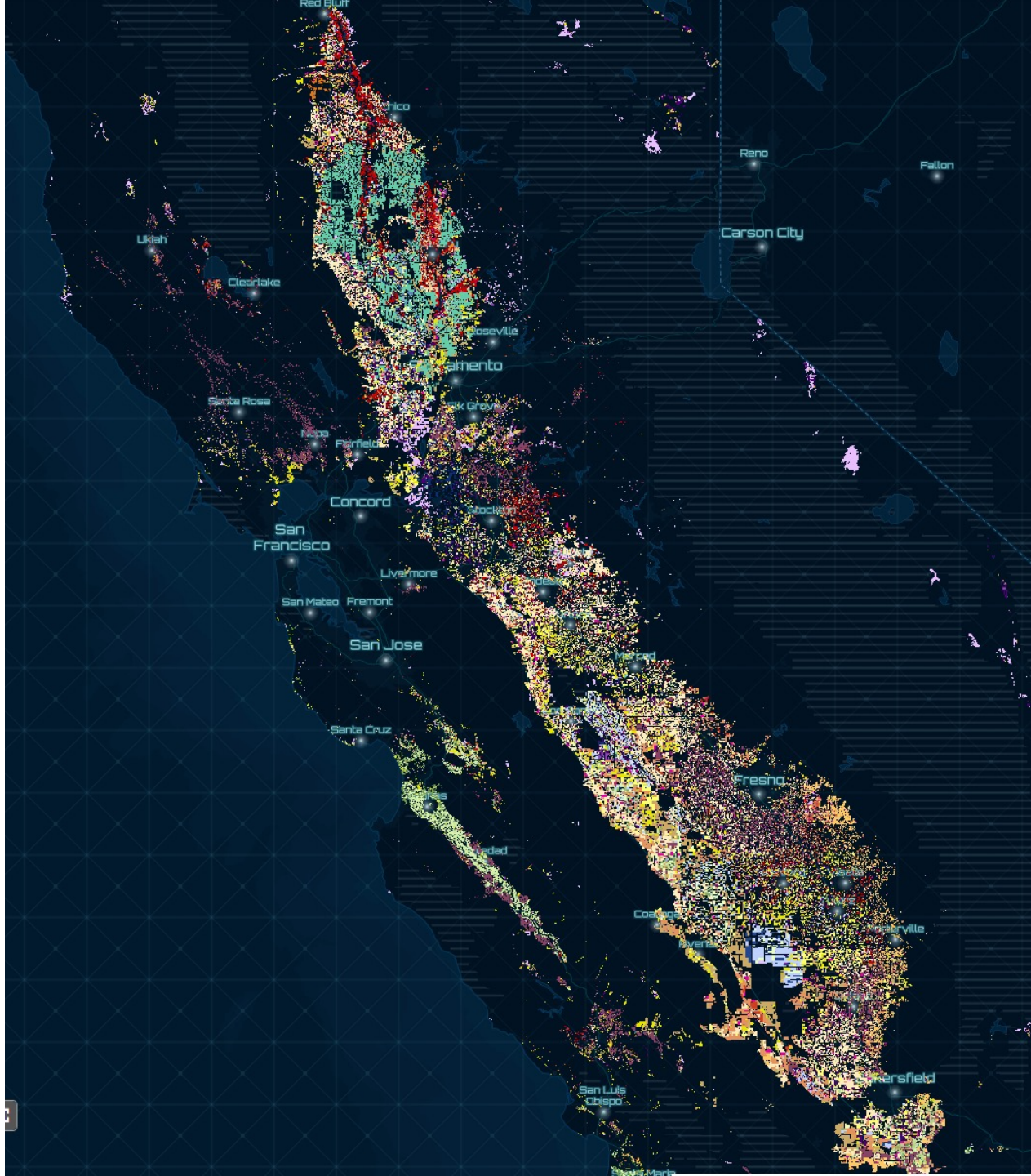
Bearing raisin acreage estimates, 1984 to 2021 (CDFA, 2022)



Other CA Crops/Land Use

- Grapes (all): 762,311
- Citrus: 311,389
- Peaches/Nectarines: 64,282
- Olives: 56,006
- Avocados: 52,204
- Cherries 39,848
- Pomegranates: 21,607
- Pears: 8,554
- Apples: 8,378

- All CA Agriculture: 9,661,716
- All CA Urban: 4,995,733



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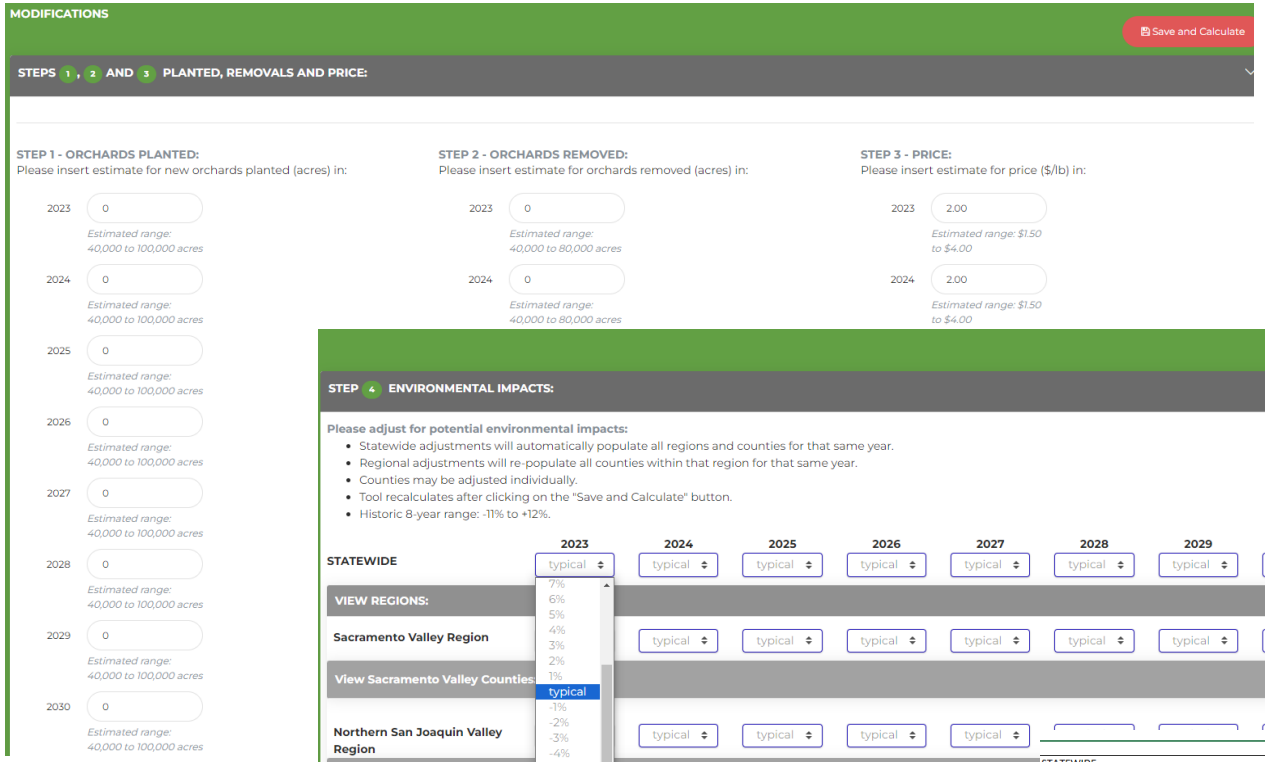
APPLICATIONS: YIELD FORECASTING



On-line calculator requires:

- Acreage
- Age
- Location
- Environmental variables
- User defined

Total Yield

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
STATEWIDE	3,036,300,369	3,227,480,208	3,353,989,419	3,410,178,055	3,425,664,066	3,425,730,735	3,422,487,221	3,414,232,955	3,407,046,436	3,400,126,789
Sacramento Valley Region	464,359,834	498,398,296	524,737,868	539,311,276	543,755,216	544,500,268	544,019,509	543,012,743	541,994,980	541,072,771
Butte	51,271,696	52,780,285	54,037,339	54,637,052	54,755,212	54,718,669	54,672,784	54,565,166	54,464,496	54,417,179
Colusa	123,344,921	129,976,968	134,303,874	136,250,635	136,777,580	136,884,511	136,705,472	136,254,169	135,922,163	135,602,896
Glenn	80,263,935	86,967,292	93,165,104	97,105,031	98,151,328	98,193,109	98,078,500	97,915,224	97,692,286	97,532,815
Tehama	30,810,063	33,299,163	35,370,230	36,314,932	36,479,989	36,472,019	36,450,368	36,398,561	36,374,162	36,327,832
Yolo	84,416,408	89,550,097	93,525,393	96,015,759	97,071,759	97,401,481	97,346,815	97,237,931	97,105,731	96,957,305
Other: Shasta, Lake, Yuba, Placer, Solano, Sacramento, Sutter (< 3%)	94,252,810	105,824,490	114,335,929	118,987,867	120,519,348	120,830,480	120,765,571	120,641,691	120,436,141	120,234,744
Northern San Joaquin Valley Region	1,210,348,836	1,281,261,987	1,320,848,937	1,336,132,726	1,339,082,329	1,337,815,194	1,335,280,046	1,328,582,393	1,323,146,818	1,317,929,407
Madera	308,520,240	319,820,026	325,415,417	327,147,164	327,444,311	327,226,252	326,655,683	325,722,650	324,773,168	323,443,608
Merced	299,460,963	318,417,844	328,300,028	331,802,616	332,486,629	332,296,464	331,812,886	330,728,210	329,620,512	328,594,555
San Joaquin	191,604,404	209,044,892	219,172,912	223,406,653	224,044,293	223,862,740	223,402,756	222,481,374	221,695,621	221,032,883
Stanislaus	405,034,046	426,030,344	438,342,073	443,244,677	444,294,490	443,522,192	442,501,174	438,742,612	436,149,971	433,950,814
Other: Alameda, Contra Costa, Calaveras (< 1%)	5,729,183	7,948,881	9,618,508	10,531,615	10,812,606	10,907,546	10,907,546	10,907,546	10,907,546	10,907,546
Southern San Joaquin Valley Region	1,361,591,699	1,447,819,926	1,508,402,613	1,534,734,053	1,542,826,521	1,543,415,272	1,543,187,667	1,542,637,820	1,541,904,639	1,541,124,611
Fresno	630,779,553	666,757,151	691,889,473	701,677,238	704,015,921	704,132,265	704,074,278	703,946,738	703,774,811	703,581,484
Kern	477,931,456	506,507,655	526,556,192	536,078,053	539,937,490	540,276,694	540,214,612	540,087,639	539,875,222	539,690,894
Kings	89,262,806	95,204,870	99,205,336	100,815,147	101,289,600	101,315,808	101,313,869	101,302,134	101,289,951	101,275,410
Tulare	157,626,620	173,358,986	184,760,349	190,172,351	191,592,247	191,699,241	191,593,777	191,310,178	190,973,524	190,585,692
Other: San Luis Obispo (< 1%)	5,991,264	5,991,264	5,991,264	5,991,264	5,991,264	5,991,264	5,991,131	5,991,131	5,991,131	5,991,131

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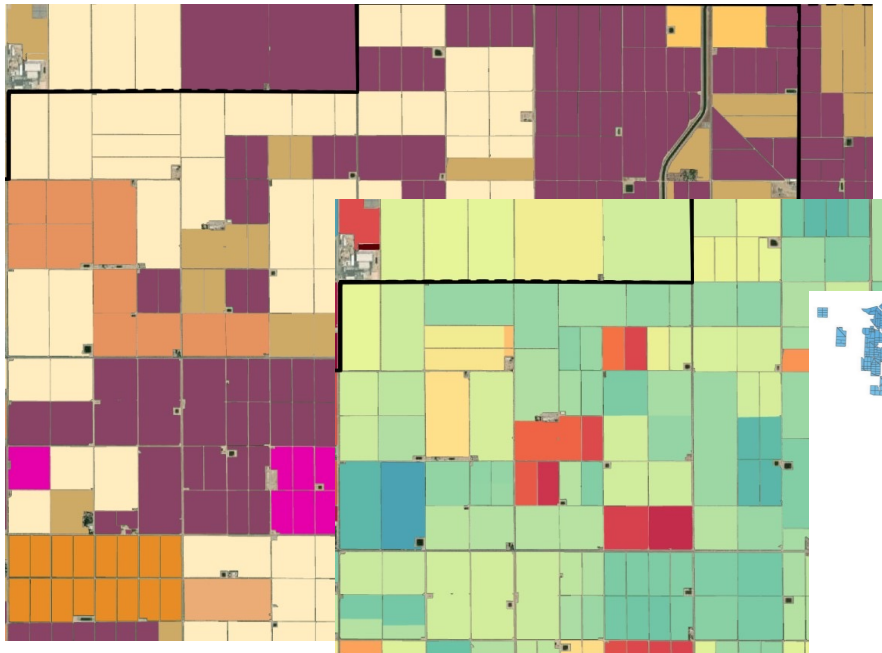
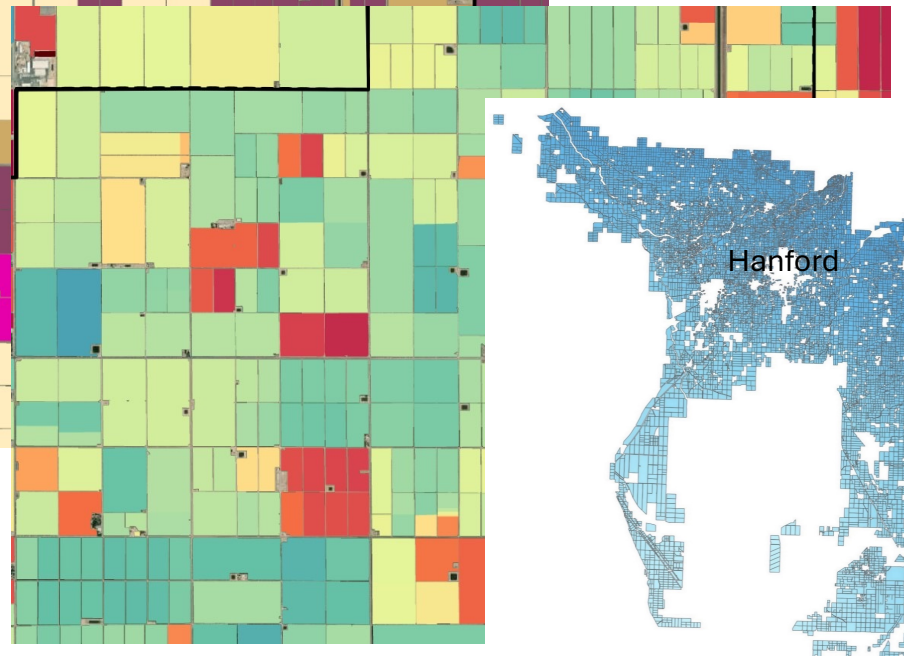
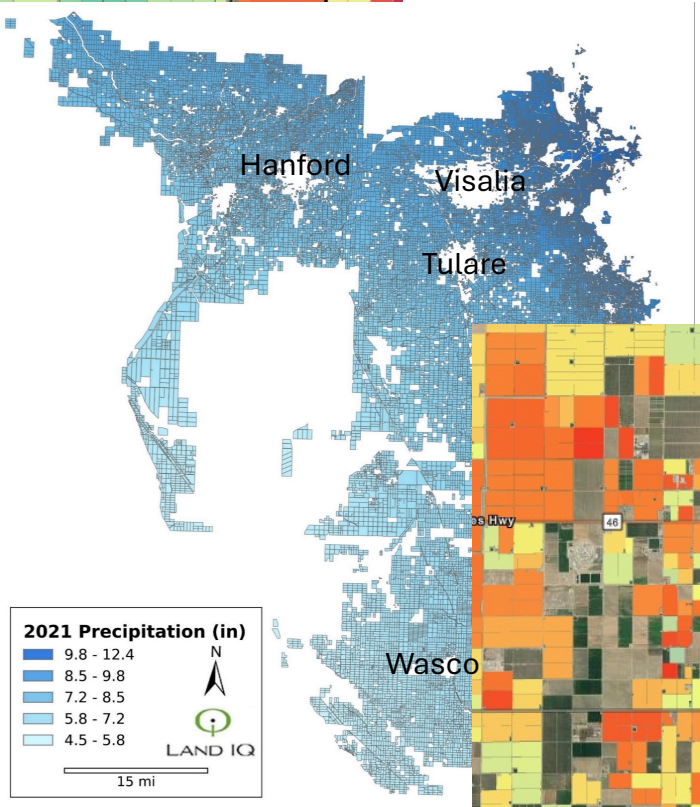
FIELD-BY-FIELD RESULTS



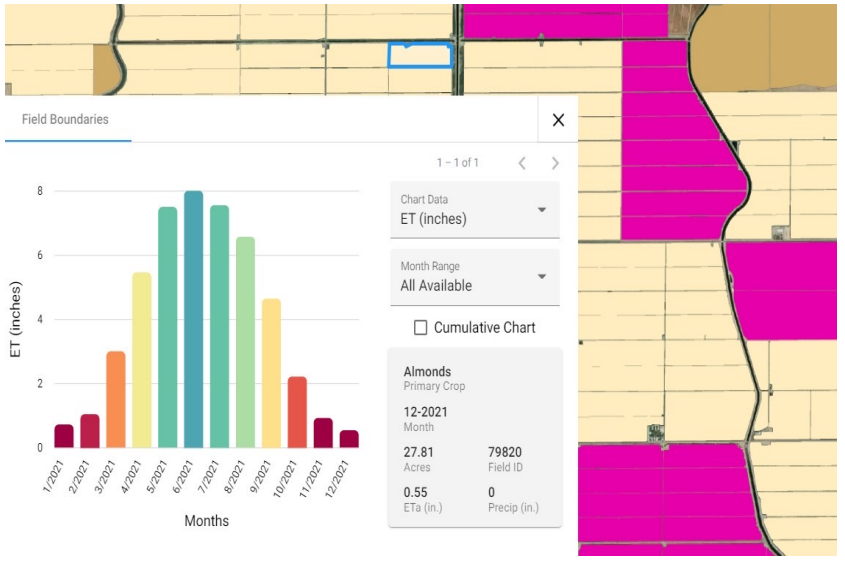
Crop Type



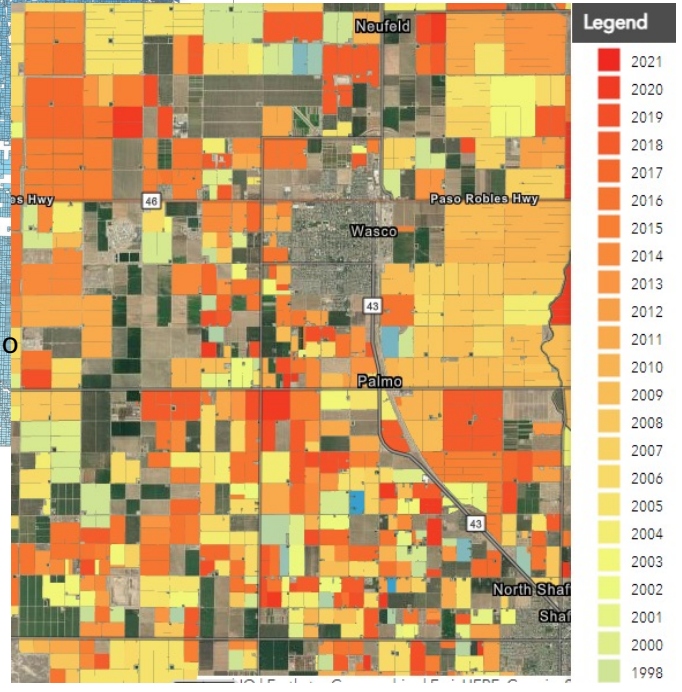
Monthly ET



Monthly Precipitation

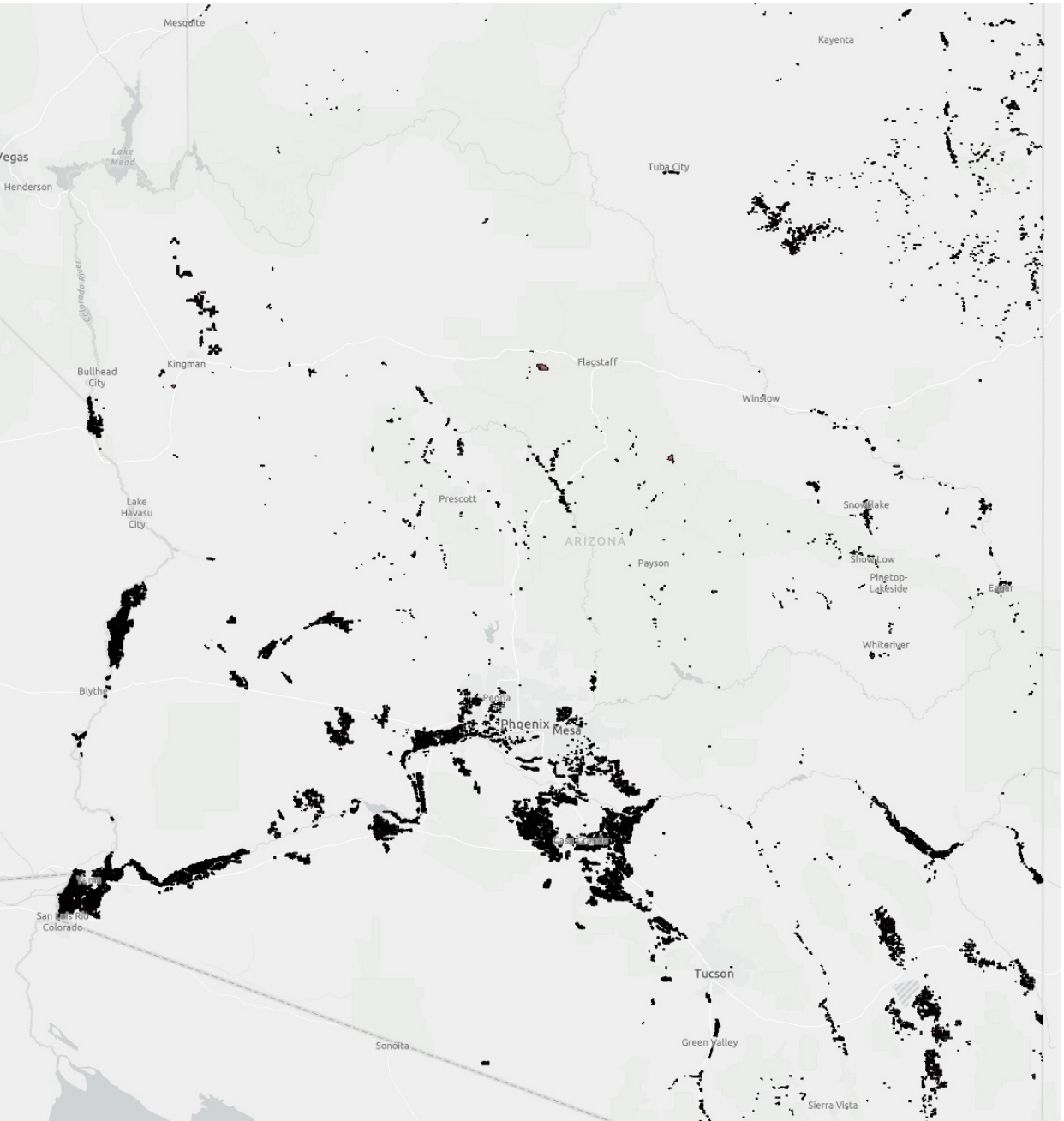


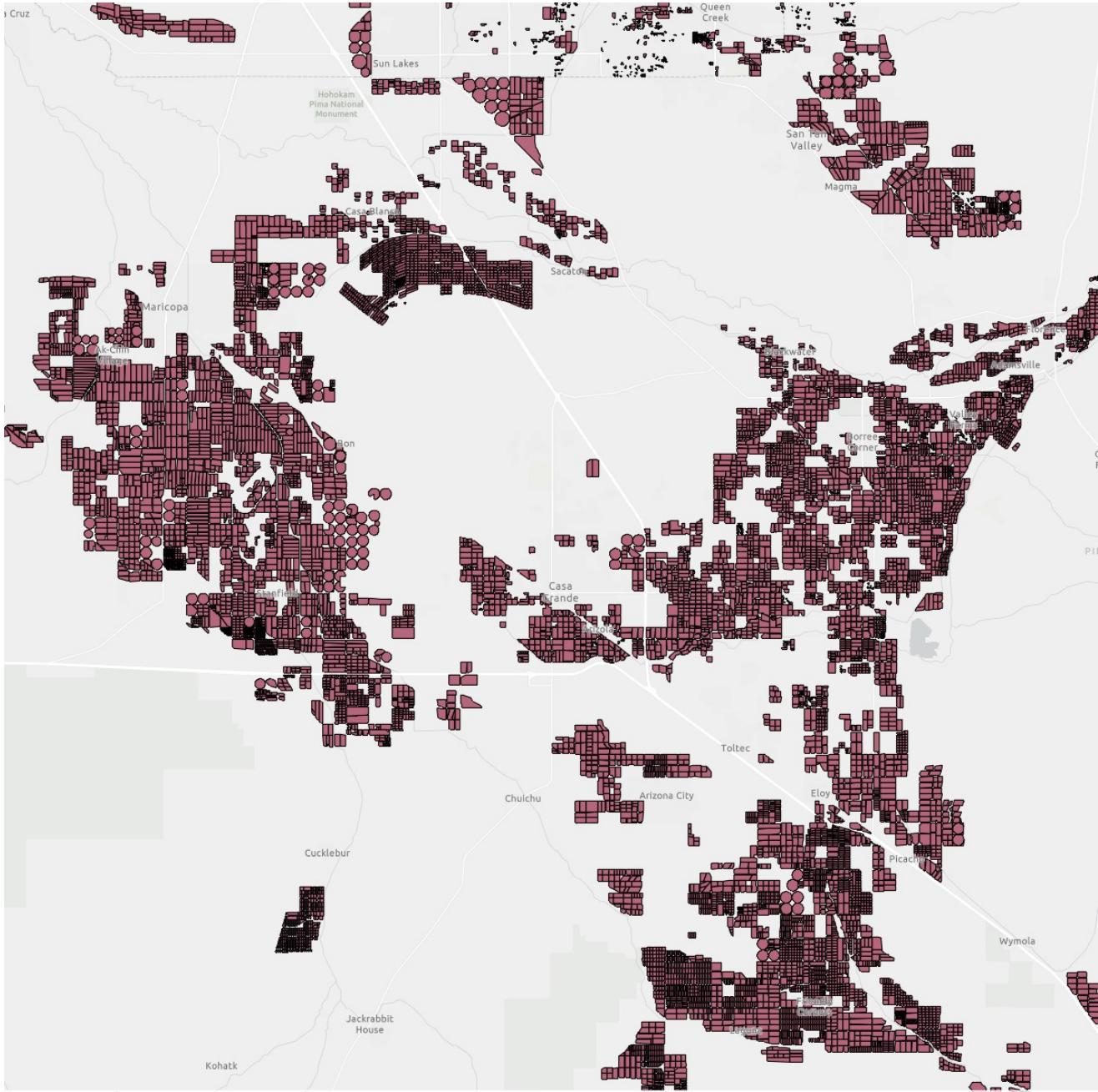
Online Viewer and Data Download Tool



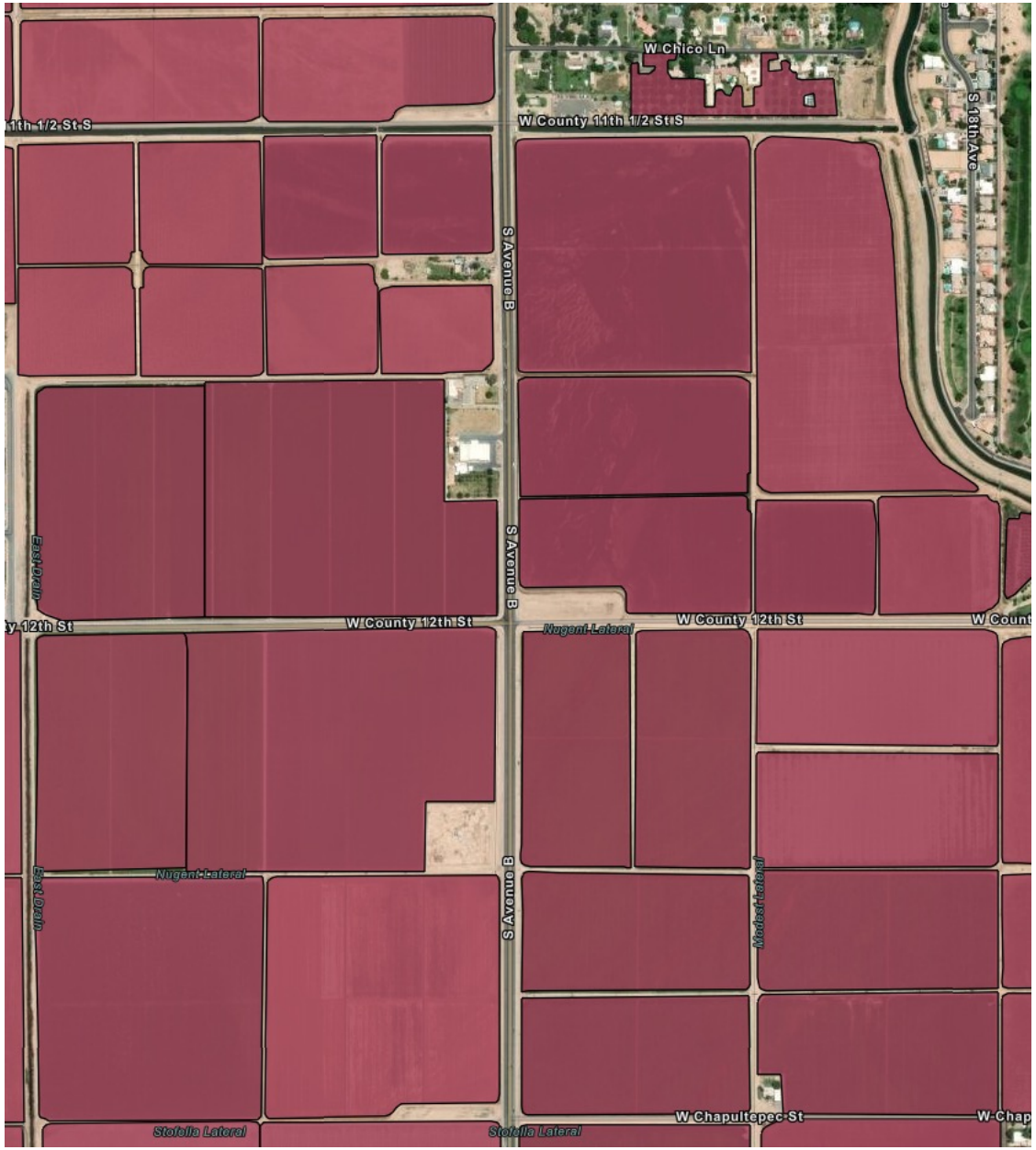
Age

Arizona Statewide Crop-Specific Mapping – Field Level





Arizona Statewide Crop-Specific Mapping – Field Level



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