Development of a Comprehensive Web Map Platform for Viewing and Use of Statewide Almond Mapping Results

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Background & Purpose

The Almond Board of California (ABC) uses information on constantly changing acreage and location of crops to make critical decisions on environmental, market, research, and production issues. Both growers and the ABC need to understand the impacts of land use, crop location, crop change, acreage, tree age and best management practices on environmental attributes and impacts such as water quality, air quality, disease, and/or pest vectors. Conversely, environmental factors, such as climate change and sensitive habitats, increasingly influence how much and where these crops are grown. For these purposes, as well as many others, spatial mapping layers need to be developed, and it is important for this spatial information to be accessible by designated end users to aid in effective decision-making and other applications.

In response to this need for information by the ABC, a spatial mapping effort was initiated to develop a statewide, orchard by orchard map for 2010, 2012, 2014 and soon 2016. This effort also included building a platform in which the data can be viewed and interpreted by growers, handlers, processors, researchers and other end users. The main requirements of the web map were that it would be:

1) User-friendly and accessible over the internet on any desktop or mobile device

2) Developed in a functional manner to quickly and efficiently answer questions and spatially relational queries generated from within and outside the ABC

Project Goals & Objectives

- Design, build, maintain, and update a web map application to be used by the ABC staff and designated affiliates/entities

- Provide a web map to ABC as a private and secure web-based system viewable with any computer or mobile device

- Provide the capacity to integrate multiple datasets into this web map including:

  - 2010, 2012, 2014, and ultimately 2016 base mapping products
  - Individual orchard planting year
  - Irrigation district boundaries
  - Various regulatory boundaries
  - Political boundaries
  - County boundaries
  - Groundwater recharge potential
  - Soil type
  - Evapotranspiration (ET) zones

Methodology

Land IQ's mapping approach draws on multiple lines of evidence including agronomic knowledge, robust on-the-ground verification, publicly available imagery and other third-party resources.
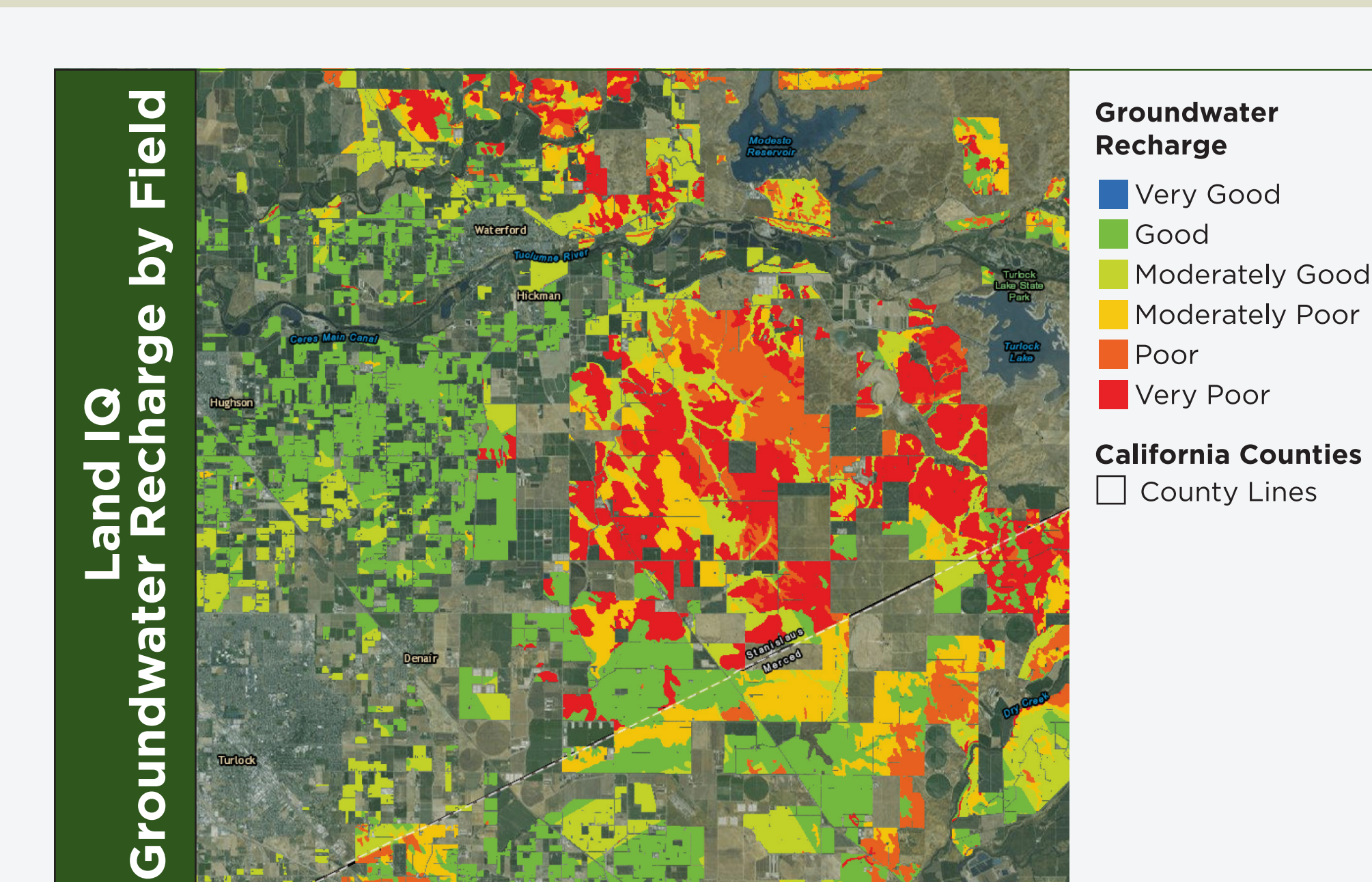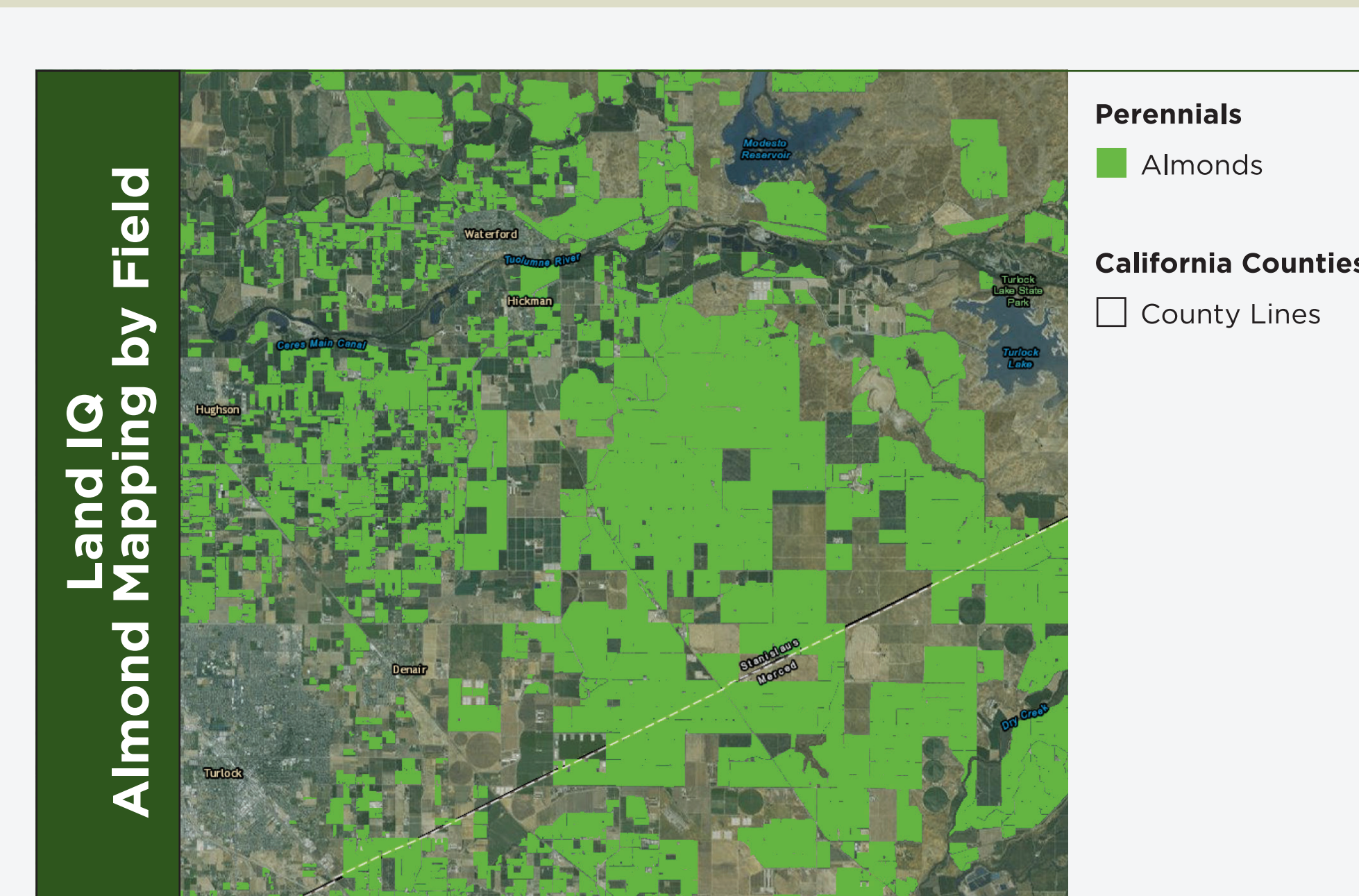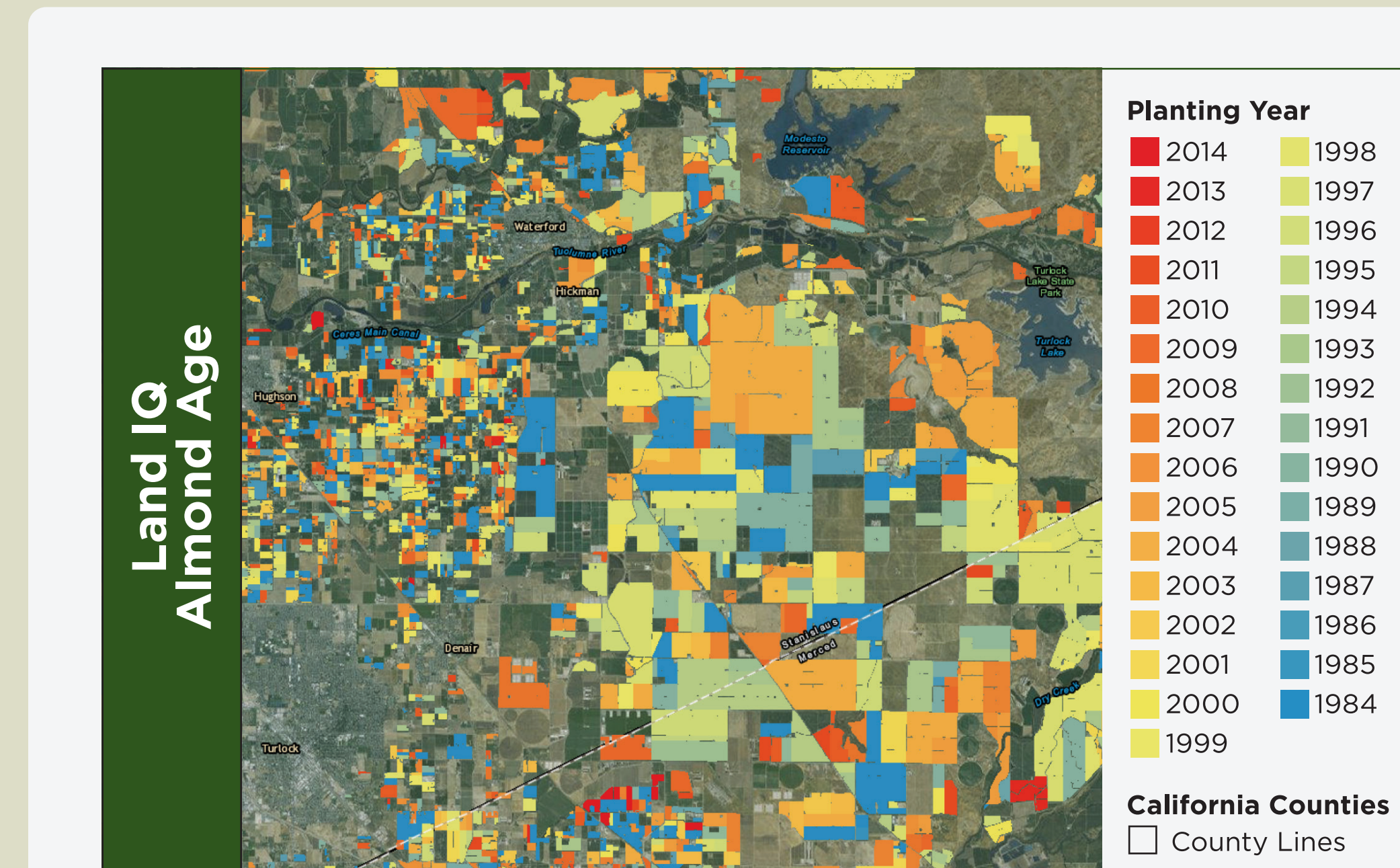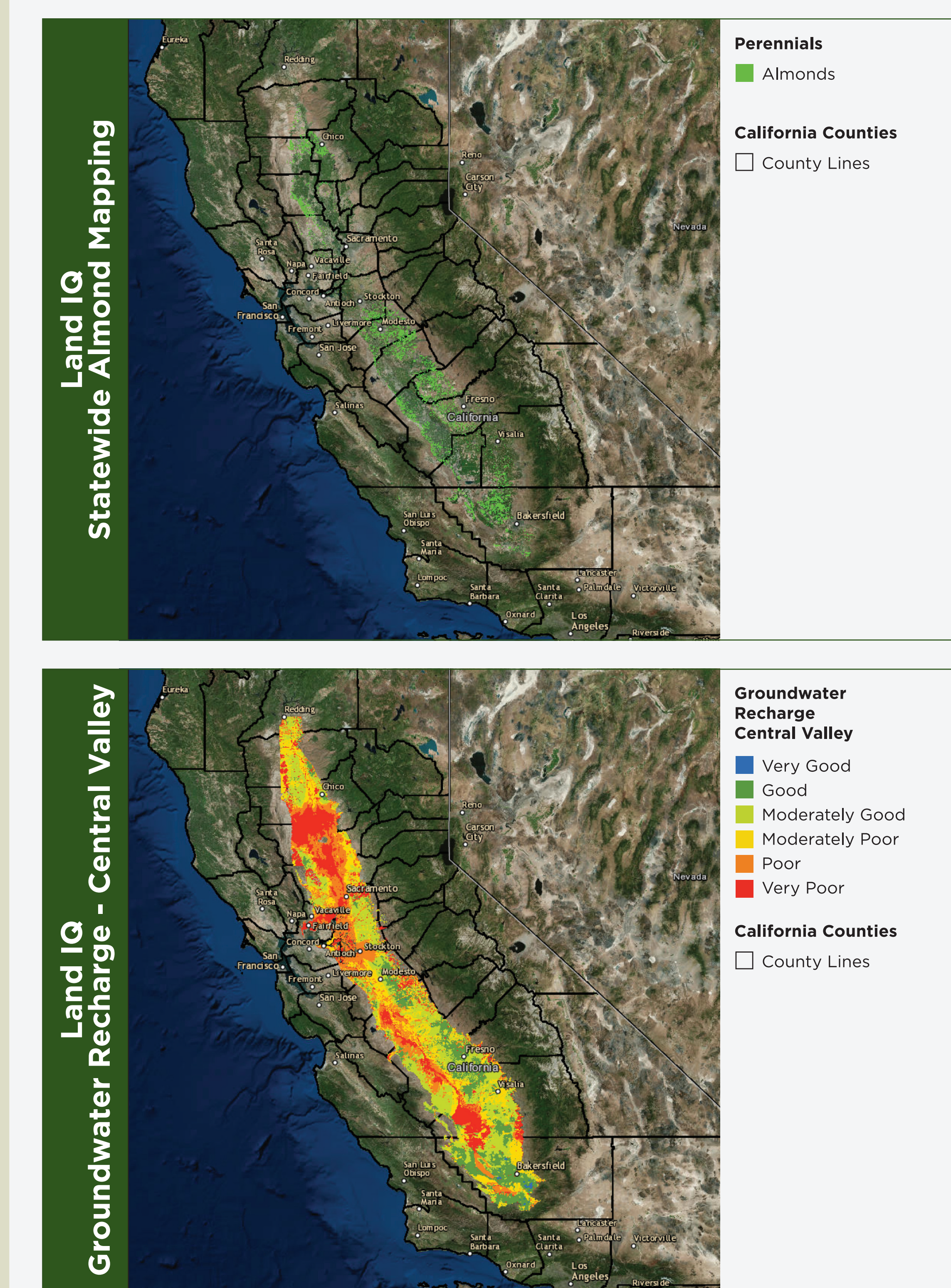
Crop Acreage

- **Imagery Acquisition:** Land IQ leverages publicly-available spatial imagery from both public and private sector sources, including the USDA's National Agricultural Imagery Program (NAIP), Landsat, and other commercially available image resources, which are then extensively validated by on-the-ground visual verification of orchard type.

- **Field Delineations:** Orchard boundaries that encompass only the irrigated portion of every orchard greater than 2 acres were delineated.

- **Ground Truthing/On-the-Ground Verification:** Almond orchards along 4,000 linear miles were surveyed with GPS instruments to train and validate remote sensing analytical results.

- **Analysis:** Finally, a unique and highly accurate remotely sensed analysis, that has been developed over a half decade of research and development efforts, is employed to locate orchards with greater than 96% accuracy.

Orchard Age

By looking back at more than 30 years of satellite imagery, the age of each orchard was determined.

Prior Crop

Crops grown previously on each orchard are known by determining the crop prior to the planting date.

Groundwater Recharge Suitability

Land IQ's analysis of the groundwater recharge suitability of California almond acreage is based on data from the UC Davis Soil Agricultural Groundwater Banking Index (SAGBI), California Department of Water Resources (DWR) groundwater levels, United States Geological Survey (USGS) Central Valley Hydrologic Model (CVHM) well logs, California Department of Water Resources (DWR) irrigation district coverage and information on hydrology and points of diversion. These data were integrated into a Central Valley-wide recharge suitability index, which was layered with the almond orchard mapping. The result is a map of every orchard with its own groundwater recharge suitability.

Results

The web map application has been developed in a timely and cost-effective. The ABC has finalized a data management protocol in which to use and share this information in a comprehensive, efficient, protected, updateable, and seamless manner. The results of this effort include an on-line web mapping viewer and analysis tool that simplifies access and use of spatial information and incorporates the statewide almond mapping along with other background mapping layers. The web map serves as a central, efficient means of communicating results of spatial mapping and analysis efforts based on the objectives of data communication, maintaining data integrity and data security.

These data will be used by the National Agricultural Statistical Service (NASS) to fine-tune the official almond acreage surveys and other forecasts and reports, and serve as a complimentary almond industry resource. With Almond Board of California, NASS and Land IQ have begun conversations of how to work together in the future to ensure improved accuracy across industry reports and forecasts.

Findings from this effort have allowed the almond industry to drive industry innovation, further scientific research, and educate stakeholders about almond-related opportunities, providing the fundamental information that is critical for accurately and objectively answering questions that could not have been answered before. Some of the specific findings include the following:

Crop Acreage

2010	2012	2014
934,954	**1,004,170**	**1,106,454**
Total Almond Acres	Total Almond Acres	Total Almond Acres

Prior Crop

Over the last 10-15 years, almonds have replaced both perennial and annual crops.

96% almond acreage planted in the last 10-15 years that lies within the Central Valley's historic irrigated area, most often replacing other irrigated crops

4% of the total acreage increase over the last 10 to 15 years has occurred within previously non-irrigated areas.

Groundwater Recharge

60% California almond orchards grown on soil suitable for groundwater recharge

Orchard Age

Acres / Planting Year

Orchards planted prior to 1985 not included