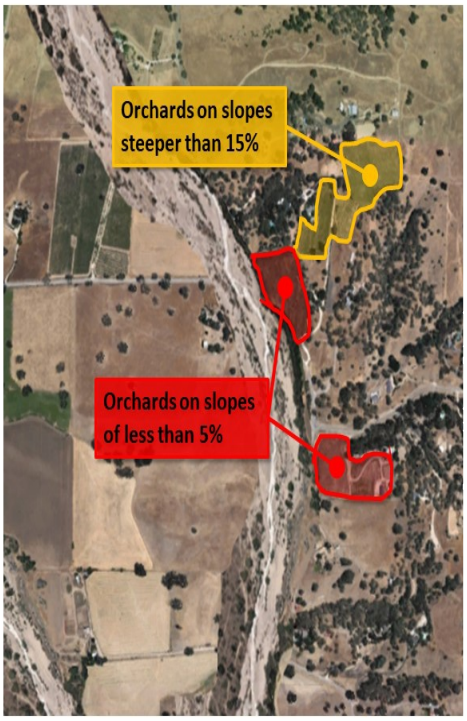
California Envirothon
2019 Current Issue Scenario
"Agriculture and the Environment: Knowledge and Technology to Feed the World"

The Setting: Farmers, Maria and Philip Alcante, own and operate Olivares Farm on the Central Coast of California. The Alcante family has been producing olives, livestock, and other agricultural products on the property for four generations. They trace their family lineage to the original Chumash people of the region. Maria and Philip are teaching the fifth generation, their daughter Ruby, to manage the family business within the next few years. The Alcante family's formula for success includes keeping a long-range outlook and being steadfastly committed to conservation and stewardship. While they have made many improvements on the farm to conserve water, improve soil health, and achieve other sustainability goals, Maria and Philip are ready to make additional investments to ensure Ruby's success. Today, the heart of Olivares Farm is a medium-density, conventionally farmed olive orchard which produces bottled olive oil. The farm consists of 90 acres of rolling hillside land approximately 1,000 feet above sea level. An olive orchard is established on 30 acres while 50 acres remain oak woodland and riparian buffer. Ten acres are used for a farmhouse, oil mill, barns, roads, and the irrigation system. The orchard is composed of 8,070 trees which were planted on a 9 X 18 foot spacing in 2005. Three Italian olive varieties are grown. Prior to 2005, the Alcantes dry-farmed crops on a small scale and raised livestock. When they established the new orchard they installed a drip irrigation system to irrigate the olive trees using groundwater pumped on the property.

Knowing the Alcantes are committed to farming the area for generations to come, their neighbors have offered to sell them a 100-acre parcel adjacent to the Olivares Farm for a very reasonable price. This property has two older agricultural wells and is currently used to graze cattle. Most of this neighboring property has slopes of less than 5%, so the Alcantes see an exciting opportunity to expand their orchards on easier terrain.

About half of the olive orchard is on slopes steeper than 15%, while the other half is planted along Buho Creek at a slope of less than 5%. Calcareous soils dominate on the hills, while



loam and clay are overlain with sand along the Buho Creek Valley. The property receives 15 inches of rain annually, and the creek becomes a series of disconnected pools along a wide dry bed during the summer months. With sufficiently heavy rains, the normally tiny creek quickly transforms into a fast flowing river. About 8 acres remain a wetland through the winter. A recent biological study of the county's aquatic habitats by university researchers identified this seasonal wetland area as containing high quality vernal pool habitat. One of the study's conclusions was that any reduction in vernal pool habitat quantity in the county could adversely affect vernal pool invertebrate populations. Tree species such as western sycamore (*Platanus racemosa*) and Fremont's cottonwood (*Populus fremontii*) are found along the creek, while blue oak (*Quercus douglasii*) and valley oak (*Quercus lobata*) dominate the hillside woodland. The riparian woodland provides important wildlife habitat and ecosystem function despite its small footprint on the property. In addition to the native tree species, non-native annual grasses dominate the uncultivated areas, a legacy of the early ranching days.

The Alcantes' weed management system consists of temporary cover cropping and herbicide application. In the past, they performed several cultivator passes each year between the tree rows. They stopped this practice after observing increased erosion on the hilly terrain and a buildup of pests that appeared to correlate with the amount of dust being deposited on the trees. Thus, they switched to a different management system consisting of broadcast seeding a cover crop between the tree rows every year with the first autumn rains and killing the cover with herbicide in the early spring. They also apply herbicide within the tree rows at this time, and do spot treatments throughout the year as needed. They have used different herbicides over the years, but primarily rely on a glyphosate product. No pesticides have been applied in the past several seasons, but the family recently observed trees in the cooler, humid areas near Buho Creek having leaves sooty and black in appearance. They want to better understand what is causing this problem and what they should do about it.

The Alcantes target an annual irrigation rate of 30 inches/acre, but the amount of water applied can vary depending on rainfall and other factors. Irrigation scheduling has been done primarily through the use of manual tensiometers, which reflect soil moisture by measuring how hard a root needs to "pull" to get water. Tensiometer measurements are typically made in 2-3 areas of the orchard nearest the barns in order to determine irrigation needs for the whole property. The trees are irrigated during the growing season, typically between April and October, and nitrogen (N) fertilizer is applied to the trees through the drip irrigation system. In years with heavy bloom and heavy crop set, trees receive 100 lbs. of actual N per acre, while in years with light bloom and low crop

load trees receive 40 lbs. of actual N per acre. No other fertilizers have been applied in the past decade and they can't recall the last time they performed soil tests on the farm.

The Scenario

The Alcantes have called on your assistance as technical experts at the Obispeno Resource Conservation District (ORCD). The family has two fundamental requests:

1. Olivares Farm Plan - They want to develop a farm management plan to guide their management and technological investment decisions over the next several years. Their goal is to achieve organic certification. They are particularly interested in how to improve soil health and water use efficiency.
2. Mechanized Farm Plan - They want to develop a plan for establishing and producing oil olives in a higher density orchard on the neighboring 100-acre property. They want this orchard to be set up for mechanical harvest.

Olivares Farm Plan

While the Alcantes have ceased using mechanical tillage in order to improve their soil health, they recognize that their reliance on conventional herbicides isn't an option as they work towards organic certification. Your plan should provide a sustainable weed management program that builds soil organic matter, minimizes the risk of erosion, and is cost-effective. You will need to help them identify the weed species they are likely to observe on their farm today and how the weed populations might change under a new organic management system. You should also consider the species composition of any cover crop in order to improve on-farm habitat for beneficial insects while reducing the potential for pests. The family has a history of livestock management, so your plan should provide a discussion of how animals could be integrated into the operation to manage the cover crop and weeds. Consider what types of cover crop mixes would work best for livestock integration.

At the request of the family, the plan's scope should include findings of the quality of the orchard soil and whether any soil health issues are present, including compaction layers, nutrient loss of imbalance, presence of soil-borne pathogens, and loss of organic matter. Your plan should use the soil quality findings to produce a fertility program that is inclusive of amendments, keeping in mind that the family wishes to organically certify their farm. In addition to soil fertility, consider how plant and tissue analysis could be used to analyze mineral deficiencies and toxicities in the olive trees. Lastly, you need to help the Alcantes identify and organically manage the pest issue that is causing the leaves of some of their olive trees to become sooty and black in appearance.

The farm relies on a groundwater basin, now designated as "high priority" under California's Sustainable Groundwater Management Act. The Alcantes recognize that the recent expansion of irrigated agriculture in the Buho Creek Valley watershed will likely result in future limits on groundwater pumping, particularly in drought years. They need technical assistance test and improve the efficiency of their groundwater pumps. They

are interested in improving their water use efficiency and exploring technological options for better tracking plant stress and scheduling irrigation. In particular, consideration of what kinds of smart water management solutions could be implemented, such as irrigation controllers using either weather-based (Evapotranspiration or ET) or on-site soil moisture sensors, and mobile and cloud-based software platforms for improved on-site or remote control of the irrigation system. In the context of global warming, the family wants to be prepared for changing climate conditions and weather extremes, They understand that as farmers, they are wholly dependent on water forecasting. They want to begin using as a tool satellite and weather forecasting to improve the precision in farming. What can you recommend for all these ideas?

The local Groundwater Sustainability Agency (GSA) is interested in exploring opportunities for groundwater recharge on farms in the area. The GSA may soon offer financial incentives to farmers who participate in a recharge program. Your plan should address opportunities for groundwater recharge on the farm especially in capturing floodwaters from Buho Creek and other stormwater flows. Given the soil types on the farm, which sites are more feasible or conducive to capturing and retaining flows to allow water to percolate to the groundwater basin and thus create recharge?

As part of the family's commitment to sustainability, Ruby has learned about new ways of using satellite data for groundwater management. She is interested in the interferometric synthetic aperture radar (In-SAR) for monitoring groundwater levels. Scientists are collaborating with farmers to have them leave a field clear for expanding InSAR data collection. What can you tell the family about how to join this effort?

They have also heard about drones being used for irrigation and nutrition management of olives in Portugal. Research how this might be a solution for them.

The Alcantes love their land and are committed to preserving and enhancing the native ecosystems on their farm. Your proposed plan should identify practices to enhance on-farm wildlife habitat and help improve water quality in the creek. Explain which state and federal programs regulate activities around these waterways. The plan must allow them to achieve regulatory compliance with applicable regulations.

A monitoring program is needed to confirm the effectiveness of the best management practices the Alcante family will implement. They want you to recommend approaches or assistance for this purpose. For example, is there a coordinated watershed wide water quality monitoring program they can join or initiate? Are there groups who can provide technical or financials assistance?

The Olivares Farm must remain an economically viable operation. The Alcantes would like your ideas on how to reduce costs, enhance profitability, and utilize financial assistance programs. For instance, they heard a presentation at a recent Farm Bureau meeting about the Obispeno Land Trust's conservation easement program. They want to know if this sort of program could work for them. They have never participated in a financial assistance program and want to know if such programs could help them make

the on-farm improvements you recommend. These could include utility programs to help with pump efficiency retrofits, the California Department of Food and Agriculture's State Water Efficiency and Enhancement Program for improving irrigation system efficiency, or the USDA-Natural Resources Conservation Service's Environmental Quality Improvement Program or other Farm Bill programs, for cost-sharing on soil and habitat conservation practices.

Mechanized Farm Plan

The plan must include all of the elements needed to establish a higher density, hedgerow type olive orchard. Your plan should provide recommendations on variety selection, pre-planting soil preparation, orchard design, establishing an irrigation system, and annual management and tree maintenance. You will need to explain what types of farming equipment will be needed for mechanized management.

There are some grand heritage oaks on their property they wish to preserve. They want you to prepare a plan for how the family can develop this new orchard while protecting some of the existing oak woodlands.

While the Alcantes are transitioning Olivares Farm to organic management, they are unsure if they will be able to manage this new orchard organically. You will need to provide options for both conventional and organic management of this new orchard. You must make a case for which type of management system you think is best for a mechanically harvested high-density orchard. If it is feasible for the Alcantes to manage this new orchard organically, they will process and market them in the same manner as their Olivares Farm olives. However, if it makes the most sense for them to manage this new orchard conventionally, you need to provide a marketing plan for conventionally grown olives.