

The Impact of Agricultural Practices on the Environment, Social Equity and Economics

A Comparison of Open Field, Container Nursery and Greenhouse Farming



Ventura County Ag Futures Alliance
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Ag Futures Alliance

The first Ag Futures Alliance (AFA) was started in 2000 in Ventura County, California when leaders in the agricultural community engaged critics of farming in a process of sharing views, building trust, and identifying common ground. In the years since the founding of the AFA movement, new alliances have been formed in Ventura, Santa Barbara, and Yolo Counties. AFA seeks to create a framework for actions to assure that agriculture can remain a vibrant and vital element of the county landscape, culture, and economy in perpetuity.

Ventura AFA is successful because it has developed meaningful communication, built trust, and discovered win-win solutions through mutual respect and appreciation for all stakeholders and participants.

Ventura AFA has formed a number of committees to bring forth facts, clarify topics and propose policy positions in a number of areas. The Land Use Committee was one of the original break-out committees.

The AFA Land Use Committee

The AFA Land Use Committee is one of several sub-groups within AFA that focuses on a specific area of concern. The Land Use Committee focuses on land use planning and government regulation of private property that affects agricultural land.

2009 Committee Members

Brett Chandler, Rita Graham, Gus Gunderson, Marty Melvin, Monique Myers, Doug Nelson, Jeanette Lombardo, E. J. Remson, Larry Rose, and Edgar Terry

Speakers and Additional Contributors to this Report

- Susan Johnson, Ventura County Chief Deputy Agricultural Commissioner
- Scott Beylik, Agroponics – Beylik Family Farms
- Dexter McDonald, Ventura County Senior Biologist/Agricultural Inspector

Executive Summary

The value of its crops makes Ventura County the 10th largest agricultural producing county in the country, and its climate and soils make it one of the most agriculturally productive areas in the world. In addition to providing food for local, regional, state and national food systems, the county is also a major exporter of food to international markets. Ventura County has been a leader in commercial agricultural practices and innovation for more than a century. This excellence in practice has been complemented by land use policies and practices that are committed to preserving open space; the promotion of agricultural land preservation and sustainability; and a commitment to managed growth.

Ventura County is located adjacent to Los Angeles County, one of the largest metropolitan areas in the world. As Ventura County growers strive to meet global market demands, the County also faces pressure to develop land in ways that may threaten the sustainability of agriculture. Rising land costs, land speculation, and competition for agricultural land from growers relocating from other parts of southern California, in particular, are driving growers to shift toward higher-value crops and increasingly intensive cultivation practices in order to maintain the competitiveness and profitability of their businesses. Citrus groves have declined while row crops, berry field hoop houses, container nurseries and greenhouses have been expanding. Each of these types of agriculture has different implications for the environment, the community, farm workers, and farm economics – and each has different implications and requirements for land use policy and planning.



This paper explores the implications and tradeoffs of different types of agriculture relative to the AFA goal of sustaining agriculture in Ventura County. Specifically, it examines three types of agriculture which represent the range of current practices in Ventura County: 1) open field agriculture (citrus and avocado groves); 2) row crops and strawberries; and 3) container nurseries and greenhouses. The paper describes each category and discusses its impact on the three core elements of agricultural sustainability:

- Environmental sustainability (such as soils, water supplies, drainage quality, air quality, and wildlife resources);
- Social equity (such as farm worker employment, housing and health); and
- Economic viability (costs, profitability, and incentives to continue in farming)

The goals of this issue paper are to:

- Increase understanding of how different categories of agriculture operate;

- Encourage a discussion of the impacts each category of agriculture has on the environmental, social equity and economic concerns that make up the concept of sustainability; and
- Provide a framework for developing policy, planning and community engagement in Ventura County, and beyond.

We hope that this paper will be a useful tool for policymakers, residents, and farmers alike as we work together to adapt our land use policies and priorities in the face of looming economic, social and environmental challenges.

Overview of Crop Production and Pesticide Use in Ventura County

Chief Deputy Agricultural Commissioner Susan Johnson provided a general history of crop production and pest control uses in Ventura County. The first open field crops were dry land grains (barley, wheat and corn). Later, the first row crops were planted - lima beans and sugar beets. Lima beans were economically attractive because they could be dried, and like grains could be easily transported in the era before refrigerated rail cars.

Walnuts, apricots and citrus were common early orchard crops for local markets. Walnuts grew well in the dryer, rockier areas of Simi Valley. Moorpark had significant apricot acreage beginning in the 1930s. Most of the Simi Valley and Moorpark walnut and apricot orchards were eventually replaced by urbanization.

Citrus has remained in Ventura County, but crop types have changed. Valencia oranges were grown for fresh markets in Ventura County from the 1950s through early 1980s and there were experiments with navel oranges as well. Today, most California oranges are grown in the Central Valley foothill areas of Kern, Tulare and Fresno counties. Conversely, experiments with lemons in the Central Valley indicated that they are not frost tolerant; therefore, increasingly the California lemon crop has moved south into Ventura County.



Modern commercial avocado production started in California the 1950s in Orange County and L.A. County. After these crops were displaced by urbanization in those counties, production moved north to Ventura County. Avocados are a tropical fruit that were not well known or popular in the United States until the 1950s. More recently, avocados have emerged as one of the most profitable crops grown in Ventura County due to our unique and mostly frost-free climate.

Susan Johnson also spoke on the subject of pesticide use in the world and locally. She discussed how pesticide use has evolved over time.

Sulfur was one of the earliest known insecticides and fungicides. Arsenic was also documented to have been used for rodent control from the time of the Roman Empire. These are naturally occurring poisons and as broad spectrum poisons they are also lethal to humans. Arsenic was sprayed on trees as late as the beginning of the 20th century. Although harmful to humans, it does not leave residue in the soil.

Also in the twentieth century, in the 1930s through 1950s, cyanide gas was used to fumigate citrus trees for the problem of red scale. Like most fumigants, cyanide gas turns into naturally occurring compounds, such as Nitrogen, Oxygen and Carbon

Dioxide. While cyanide gas left no residue in the air or soil, there was significant acute danger to applicators and bystanders, and the agricultural industry looked for better insecticides and treatments.

With regard to other commonly used fumigants, Chloropicrin was a product of World War I-era research. It is commonly known as tear gas and was developed for use on enemy troops and for civilian riot control. As with many chemicals, following a war, a peacetime use was made in the service of food production. Chloropicrin was found to be useful as a soil fumigant. In fact, it is the oldest soil fumigant. Chloropicrin was also used to control stored product pests in grain, rice and fruit. Chloropicrin use is increasing in Ventura county as limitations on the use of Methyl Bromide and 1,3 D increase.

Methyl bromide also became available as a soil fumigant after World War II and is still in use in agriculture. Other World War II-era chemicals were employed for agriculture but are no longer used. Similar materials that are still in common use today include Metam Sodium, Metam Potassium products, Basamid, 1,3 Dichloropropene Dichloropropane (Telone), and Aluminum Phosphide. Edgar Terry noted that Telone is a by-product of the automobile industry and is reported to be in short supply currently as the number of vehicles produced has declined.

Other fumigants such as Carbon Disulfide and Ethylene Dibromide were used in agriculture in the 1950s through early 1980s, but were discontinued due to unacceptable human risk. The only product containing Carbon Disulfide that is still in use today is Enzone, which is occasionally used in citrus.

There were very few effective foliar pesticides available until the end of World War II. Three chemical groups of pesticides were developed just before and during the war, and later turned to peaceful uses. They were the Organochlorines, the Organophosphates and the N. Methyl-Carbamates.

The Organochlorine group, the most well known of which are DDT and its derivatives, Chlordane, Endrin, Dieldrin, Aldrin, and Heptachlor were heavily used in all agricultural areas throughout the 1950s and most of the 1960s. These compounds were fat-soluble, had very long half-lives (up to 30 years in some cases), were moderately toxic to mammals, and were very effective on a wide range of pests. They were registered for a long list of uses including agriculture, animal agriculture, and residential and industrial structural pest control.

DDT provided the first control of louse-borne typhus during WWII and was the most effective chemical ever used for controlling mosquitoes that spread malaria in the undeveloped world. However, as a result of their long half lives, and the fact that they tend to bond to soil particles and move with sediment, they continue to be found in trace amounts in both local soil and surface water. Almost all of these materials were banned by the mid-1970s in the U.S. due to effects on wildlife. The exception was

Chlordane, which continued to be used for termite control in structures until the early 1980s.

The Organophosphates and the N. Methyl Carbamates, which include over 100 different pesticides, replaced the Organochlorinates as the primary pesticides used in agriculture and in many other areas by the mid-1970s. They continued to be the pest control chemicals of choice for the next 10-15 years. These materials are water soluble and effective on a wide range of pests. Both Organosphosphates and N. Methyl Carbamates were registered on a wide range of crops. The half-life of these materials varies from less than a week to over 90 days. Some members of these two groups are highly toxic to humans, fish and birds. They were responsible for many worker exposures from the mid-1970s to the late 1980s. Although they did not result in the long residues associated with the Organochlorines, they were much more toxic to handlers and agricultural workers and were very hard to beneficial insects.

Many of the Organophosphate and N. Methyl Carbamate pesticides are no longer registered for use. However, two members of the Organophosphate group, Chlorpyrifos and Diazinon, have been detected through monitoring in local waterways, and Chlorphyrifos, commonly known as Lorsban, is still widely used in citrus in Ventura County in the fall to control scales and ants.

The synthetic pyrethroids (examples, Ambush, Pounce, Asana and Mustang) came into common use in the late 1980s and early 1990s. These chemicals are synthetically produced versions of pyrethrum, a natural insecticide found in chrysanthemum flowers. This is a large and diverse group of materials mostly used to control insects and mites. As their common names indicate, they provide a quick “knock down” of pests. They have a shorter residue than their predecessors, usually one to four days. But they can be very toxic to handlers and agricultural workers and may be very toxic to birds and fish. The materials vary in their effect on beneficial insects, but are generally less harmful to beneficials than the Organophosphates and Carbamates because pyrethroids break down faster.

Programs started by the U.S. Environmental Protection Agency and California Department of Pesticide Regulation have accelerated the registration and use of “reduced risk” pesticides. Reduced risk pesticides have increased the presence and use of materials with lower risk to humans and domestic animals. They do not persist long in the environmental and they are very specific in controlling target pests and have minimal effect on beneficial species. Common groups include the insect growth regulators, synthetic antibiotics, and other biologically based materials. Imidachloprid (Marathon, Admire, Advantage, and Precor) is a common active ingredient used to control pests in agricultural and landscape situations, termites in structures and fleas on cats and dogs. It is an example of a reduced risk material that is effective on a wide range of pests, has low mammalian toxicity, and leaves little to no residue in water or soil.

I. Open Field Agriculture

A. Orchard Crops – Citrus and Avocados

Environmental Concerns

Soils

The open field tree crops, citrus and avocados, are far less nutritionally demanding compared to row crops grown in Ventura County, meaning that they do not exhaust the soils quickly and do not require frequent fertilizers and soil amendments. In addition, citrus and avocados can be grown on lesser-quality hillside soils and do not require flat farmland. In fact, a hillside-grading ordinance was developed to allow citrus and avocado growers to alter hillsides for such production. Some growers had not used good management practices, which resulted in erosion and loss of agricultural soils. Now the ordinance assures best practices to avoid soil erosion. Pesticides used in citrus and avocado production today have a short half-life, and do not enter or remain long in the soils. Narrow range spray oils are commonly used but are considered a safer alternative to harsher pesticides. Avocados may be aerially sprayed approximately once per year. Citrus is typically ground rig sprayed.



Water Supplies

Progress in irrigation techniques has led to increased efficiency of water use in all types of agriculture, including open field tree crops. Citrus and avocados growers used to furrow, or flood irrigate their fields. Most growers then transitioned to regular sprinklers, and now most use efficient micro-sprinkler drip systems. Micro-sprinklers came into use in the mid-1990s as water became more costly and technology was upgraded to increase efficiency. However, some areas are still furrow-irrigated. Micro-sprinkler systems have allowed the hillsides of Ventura County to be planted with citrus and avocados and have increased the availability of flat irrigated farmland for other crops.

Drainage Quality

The high cost of water combined with efficient irrigation reduces the amount of drainage from most tree crop operations. Orchard crops contribute little to flooding or contaminated drainage. Furrow or flood irrigation produced more runoff than the use of micro-sprinklers in more common use today. It is also more common now to grow a ground cover crop or grass filter strips between tree crop rows rather than bare ground. This decreases runoff from irrigation. Orchard crop methods leave the ground exposed to rainfall, which may mimic the natural hydrologic watershed process whereby some rainwater is absorbed into the ground and some slowly runs off the land.

Where orchards are furrow-irrigated, there is a higher potential to introduce pollutants into the surface waters through irrigation and storm water runoff. Pre-emergent herbicides were commonly used to clear the furrows of weeds. Pre-emergent means that the herbicide kills the weeds before they have a chance to germinate or emerge. Cleared furrows allowed more irrigation water to pool or run off and caused problems with contamination in the surface and ground water. Some pre-emergent herbicides are still in use where they are allowed to clear the rows. They are closely regulated in areas where local soil types are vulnerable to ground water contamination.

In summary, where micro-sprinklers and cover crops and grass filter strips are used, the amount of irrigation runoff is reduced and water contamination is better controlled. In addition, all agriculture in Ventura County must comply with the Regional Water Quality Control Board non-point-source pollution regulations, which set standards for irrigation and storm water drainage quality.

Air Quality

Citrus and avocados do not significantly contribute to adverse air quality effects. The ground is not disked and typical drip irrigation also reduces particulate dust. Fumigation is not used; therefore, volatile organic compounds (VOCs) are not present. The narrow range spray oils that are commonly used are practically non-toxic and are a safer alternative to harsher pesticides; however, they do contain moderate levels of VOCs and may be subject to regulation in the future. Paradoxically, if regulations force a reduction in the use of spray oils, the replacement products available today would increase the short-term toxic load in favor of a reduction in the release of VOCs.

Citrus and avocado trees are harvested by hand, which is also air quality-friendly. In the Central Valley, tree crops such as nuts are harvested by shaking the trees. This process throws tremendous amounts of debris into the air. It is then scraped up by machines and creates significant amounts of particulate pollution. The defoliation of the Central Valley cotton crop also contributes to its poor air quality. A spray is applied to dry the cotton leaves. A picker machine is used. Then the crop is plowed down in a very dusty process. Ventura County tree crops and other local agriculture do not typically use such dusty, particulate-producing methods.

Wildlife

Citrus and avocados are considered relatively wildlife-friendly and may provide a refuge for beneficial insects and contribute to wildlife corridors. During the period of pre-emergent herbicide use in the 1980s, the resulting bare dirt was less friendly to beneficial insects and other wildlife. As stated above, the runoff of irrigation water from modern tree crop practices is more favorable to wildlife because the amount is low and consistent with natural watershed conditions.



Tree crops are not commonly fenced except when located along a major highway. All kinds of birds, migratory and non-migratory, move through orchards. Citrus is a habitat for raptors and scavenger birds, such as turkey vultures, which feed on squirrels, rats, meadow mice, and gophers that may come into the areas between tree rows, attracted by the cover crop or grass strips that may be planted. Cover crops attract beneficial insects, wasps and flies. Cover crops provide a harborage for beneficials. Larger wildlife, such as rats, moles and gophers are attracted, which in turn attract owls, kites, and coyotes.

Tangerine tree crops may be wrapped in plastic for a period of time to deter bees from cross-pollinating the trees with other fruit species. The period of time when tangerines are wrapped in plastic allows less wildlife movement within the orchards.

Avocados provide an especially dense, wildlife-friendly tree canopy. Duff, or leaf litter, is allowed to accumulate to control weeds and this shade and ground cover is beneficial to small wildlife. In addition, avocado and citrus prunings may be chopped or mulched in place. Avocados may provide an excellent wildlife corridor for animals that prefer a denser canopy, ground coverage, and a lot of shade. Once the avocados have matured, the canopy causes rainfall to disperse as larger droplets are converted to a finer spray upon contact with the canopy. This finer quality of rainfall is also beneficial to animals.

Open field tree crops such as citrus and avocados have the potential to keep existing environmental systems intact.

However, while tree crops offer some wildlife compatibility, farmers are greatly concerned with the issue of food sanitation. Industry publications strongly recommend a 10-foot fallow area around fields wherein no animal tracks should appear. If this becomes a standard, then more fencing will appear and wildlife corridors will be disrupted.

Social Equity Concerns

Farm Worker Employment

Citrus and avocado production offer steadier employment than row crop agriculture. However, the number of permanent employees on a citrus or avocado ranch may be few. Citrus and avocados require minimal number of full time employees compared to container nursery or greenhouse operations. During harvest and pruning, more workers are needed temporarily and are likely to be hired from labor contractors.

Compared to row crops and other open field farming, tree crop agriculture tends to be family-owned and the employees are more local and permanent. Operators tend to be owners. The labor force is considered skilled. With local family farm ownership and more permanent employment, upward economic and social mobility is more generally available for these farm workers and their families.

Housing and Services

The housing and service demand by citrus and avocado workers is more permanent. For the permanent workers, stability of employment offers the opportunity to have a family. Therefore, the demand for schools, healthcare and regular transportation is pronounced.

Worker Health

Exposure of tree crop laborers to agricultural chemicals is considered to be lower than other types of farming with less of a threat of acute exposure.

Open Space and Visual Resources

Open field tree crop production is a business and not part of the open space. Its presence is highly favored by communities as part of the visual resource. Citrus crops are particularly desirable for their beauty. Avocados are also well tolerated or welcome as part of the green visual resource.

Economic Concerns

Costs and Economies

Important cost factors for whether tree crop production can continue in Ventura County include the ability and cost to exclude the invasive pest Asian Citrus Psyllid in citrus and Ambrosia beetle in avocados, excess competition among an over-supply of small growers, and uncertain water and regulatory costs. San Diego and Riverside counties have greatly reduced their citrus production compared to past decades as a result of uneconomic water costs and availability. In Ventura County, the tree crop types have changed in response to returns on investment.

Citrus crops such as Valencia and navel oranges that were originally grown for the fresh produce market are in decline. Lemons have increased. Ventura County lemons serve a national and international market. Boxes are trucked or flown to markets around the nation and the world. Up to 80 percent of U.S. lemons are produced in Ventura County. Up to 85 percent of these are transported and sold out of the county, including approximately 65 percent that are sold internationally. Tree crop operations make the majority of their profit on exported produce. Specialty citrus such as pixie tangerines do not have the harvested acres of lemons, but the product is popular both locally and for wholesale. Mandarins and Clementine tangerines are also grown in Ventura County.

Incentives to Continue Farming

Ventura County has the Save Open Space and Agricultural Resources (S.O.A.R.) Ordinance, which provides a major barrier to the conversion of agricultural lands to urban uses; therefore, the lack of land use alternatives is a forced incentive to continue farming so long as costs do not exceed income. However, crop types may change as one tree crop may return less on a grower's investment than another other type due to conditions beyond the farmer's control.

Changes have occurred in the types of tree crops, from Valencias and navals to lemons and avocados. International competition often depresses prices paid to Ventura County producers. Increasingly, tree crops are being replaced by row crop production. In addition, the cost for agricultural water in this county is expected to rise considerably. Should tree crop and other open field agriculture become uneconomic, owners of land devoted to these crops types may switch to container nursery operations or greenhouse production, or some of the few non-farming uses that are permissible within agricultural zoning. Higher costs combined with lower prices for products have resulted in some local growers having more operations outside California than in-state.

B. Strawberries

Environmental Concerns

Soils

Constant strawberry production can deplete the soils of normal nutrients. Most strawberry fields are not alternated with other crops. Therefore the soil does not “rest” and requires application of nutrients. Land and production costs in Ventura are high; therefore the market dictates that the highest value crop, strawberries, is planted over and over. This tends to deplete those soils. The soils that grow strawberries are frequently fumigated. However, strawberry growing does not introduce permanently harmful substances into the soil because today’s fumigants and materials have short half-lives and quickly become inert.



Water Supplies

Today, most Ventura County strawberry farms use drip irrigation following initial overhead sprinkling to develop the young plants. Prior to the use of these water-saving devices, strawberry fields used inefficient flood irrigation or less efficient sprinklers.

Drainage Quality

Strawberries are one of the few crops in Ventura County that produce measurable runoff from irrigation methods. Nearly all of this occurs during the plant establishment phase. The runoff is likely to contain fertilizer residue and other constituents, sometimes in concentrations that exceed water quality standards.

In addition, strawberries may introduce nitrate fertilizer directly into groundwater, or via storm water runoff in streams and the ocean where it can stimulate the growth of micro-organisms and negatively effect ecosystem health. As the price of these petroleum-based products has increased, farmers have reduced the amount of nitrates. The rise in price of petroleum-based products has caused farmers to be very efficient with their use.

All agriculture in Ventura County must comply with the Regional Water Quality Control Board non-point-source pollution regulations, which set standards for irrigation and storm water drainage quality.

Air Quality

Ventura County is a non-attainment area for volatile organic compounds (VOCs) under the federal Clean Air Act. VOCs contribute to ozone air pollution. Strawberries are the primary crop that contributes to the VOC load through fumigation of the soil. Ozone formation is worst during the peak period of strawberry production, May through

October. Federal mitigation measures include a limit on the use of the most common fumigants. Over time, this may cause a reduction in the amount of acres planted to strawberries in Ventura County.

Wildlife

Open field strawberry production is not attractive to diverse wildlife. Fumigation and spraying of strawberries assures that insects are not present. Therefore, small rodents do not follow the insects and larger wildlife does not follow the rodents. Birds are attracted to the strawberries, but are actively repelled. Strawberry fields typically are not fenced; therefore, they may serve as wildlife corridors. However, the low profile of plastic tarps around the strawberry plants and weed-free rows provide uncomfortable exposure to any wildlife using the area as a movement corridor.

Social Equity Concerns

Farm Worker Employment

Strawberry farms offer few permanent farm labor jobs. Only four to five farm workers may be permanent and full-time. All others are hired as needed, usually from farm labor contractors. Strawberry growing offers workers approximately six months of intense, high-income work, mostly during December through June. Some of this is piece-rate remuneration, which can be high income for skilled workers. Many workers are migrants who follow the strawberry harvest from county to county.

Few landowners in Ventura County farm their own strawberry fields. Most are tenant operated. Therefore, the relationships with workers are more strictly controlled by economic interests on all sides and are less social. This is not necessarily adverse. The demand for workers who can and will work the strawberry crops has resulted in some large production companies offering benefits as well as money. There may be less overall upward economic and social mobility for migrant farm workers and their families, as they are not permanently settled in a community.

As with all other types of agriculture, contract labor makes the direct cost of labor more predictable and rational for farmers; however, it does not transfer all risk from the grower to the labor contractor.

Housing and Services

Strawberry labor has a small need for permanent, family housing and services and a great need for migrant, seasonal housing especially for single males. Growers complain that zoning and other restrictions may not allow the construction of migrant labor force camps. Growers indicate that the industry is more supportive of providing farm labor housing when they are more easily able to provide it on-site.

Worker Health

Strawberry laborers are believed to be exposed to multiple and different types of farm chemicals. Strawberries require frequent chemical applications; therefore, the

possibilities for acute and long-term exposure are greater than for other types of agricultural work. State law regulating pesticide use is strict, clear and monitored and carries penalties for improper use by growers, chemical applicators, or their employees.

Open Space and Visual Resources

Strawberry production is a business and not part of the open space. As a visual resource, public opinion is split as to whether strawberry production offers a welcome or tolerable visual resource. This is because vehicles, pipes, portable bathrooms, and other equipment are on open display in these fields and are not naturally screened by the crop, as with tree crop production. The plastic sheeting on strawberries is also highly visible for a portion of the crop cycle.

Economic Concerns

Costs and Economies

Strawberries do not grow well in other locations in the United States, but the climate in Ventura County is nearly ideal for them. Only the warmer climate in Orange County is considered more ideal for strawberry production; however, less farmland is available there. The climate assures relatively high production in Ventura County. Most strawberries are grown for national or foreign markets and are trucked or flown out of the area. Ventura County's proximity to Los Angeles Airport is a favorable cost factor.

The cost of water may be an increasingly negative factor. Water costs are anticipated to rise considerably in the future. In addition, air quality regulations (Volatile Organic Compound thresholds) are a negative cost factor as regulation may result in at least one less strawberry harvest per year in Ventura County, which will decrease overall returns. Over time, a decrease in income may cause large tenant growers to move to other areas and local landowners to lease or sell to nursery or greenhouse operations or non-farming uses that are permissible within agricultural zoning.

Land rents for strawberry properties are considered high. So long as the national and global market continues to demand the availability of strawberries year around, rents are likely to remain high.

Incentives to Continue Farming

Ventura County has the S.O.A.R. Ordinance, which provides a major barrier to conversion of agricultural lands to urban uses; therefore, the lack of land use alternatives is a forced incentive to continue farming so long as costs do not exceed income. Currently, strawberries are a crop where income exceeds costs, although better margins may exist elsewhere.

Strawberry fields in Ventura County tend to be locally owned but tenant farmed. Owners of the land may be second and third generation owners who no longer actively farm or they may be active farmers who are not strawberry specialists. The vast majority of strawberry growers in Ventura County are tenants, large and small. The

dominance of tenant growers who are well-capitalized national and global berry producers pressures the land market towards the highest rent values. Small tenant operators are under tremendous economic pressure, as they cannot dictate either the rental price for the land or the price they receive for the product. The strawberry business in Ventura County is considered highly replaceable due to the dominance of global producers who rent the land. These producers can move their operations quickly in response to lower costs elsewhere.

The incentives to continue strawberry farming in Ventura County are dominated by concerns related to the cost to obtain land (rental) and the income for the harvested product. Small local strawberry growers are subject to losing their leases to the large global producers. This structure has driven up the barriers to entry for new farmers.

C. Other Row Crops

Environmental Concerns

Soils

Ventura County is a major supplier of open field row crops such as celery, onions and cabbages. The county is a local supplier of other specialty crops. The impact of these crops on soil quality depends greatly on how they are grown. If the roots and leaves are plowed under, they may provide good natural fumigants and return nutrients into the soils. Some of these crops are frequently sprayed with specific types of pesticides needed for insects or conditions common to the crop. However, harmful substances are not introduced permanently into the soil because today's fumigants and materials have short half-lives and quickly become inert.

Colored peppers, open field tomatoes and flowers may require fumigation of the soils approximately once every year or so. However, as stated above, today's fumigants have short half-lives and do not permanently introduce chemicals into the soil.

Water Supplies

Most row crops use efficient drip irrigation rather than flood irrigation. Some row crop farmers use sprinklers.



Drainage Quality

Few crops in Ventura County produce a measurable amount of drainage from irrigation runoff. The high cost of water combined with efficient irrigation reduces the amount of runoff.

The quality of storm water runoff is dependent on the chemicals used and the method of irrigation. As stated in the Overview, pyrethroid compounds have been found during water quality monitoring in Ventura County. This is probably as result of growers shifting to the newer chemicals as older ones become less available. The modern pesticide chlorpyrifos, also known as Lorsban, can persist in water long enough to wash into local waterways, where monitoring has detected it at several sites. Some nitrate fertilizers are likely to be in row crop drainage water; however, water-saving drip irrigation lessens the amount of water that runs off the site or leaches into the under ground water supply. In addition, all agriculture in Ventura County must comply with the Regional Water Quality Control Board non-point-source pollution regulations, which set standards for irrigation and storm water drainage quality.

Air Quality

Ventura County is a non-attainment area for volatile organic compounds (VOCs) under the federal Clean Air Act. VOCs contribute to ozone air pollution. While colored bell peppers, row crop tomatoes and flower crops occasionally require fumigation of the

soils prior to planting, most other row crop soils do not require fumigation. Fumigation of crops contributes to the VOC load in the air; however, the peak period for the formation of ozone pollution from VOCs is the period March through June, which is not generally the period in which fumigation would take place for these row crops. Strawberries are the primary crop that contributes to the VOC load through fumigation of the soil. Plowing and disking of non-strawberry row crops contributes some particulate dust pollution.

Wildlife

Impacts related to wildlife are similar to those for strawberries discussed above. While most other row crop soils are not typically fumigated, as they are for strawberries, they are heavily sprayed with other chemicals to reduce insects, which reduce the food chain for larger wildlife. Typically, crops are not fenced and can provide a wildlife movement corridor. A major concern for open field row crops is wildlife waste intruding into the irrigation water. Increasingly, farmers are taking steps to keep wildlife out of these growing areas for purposes of food sanitation. Open field cover crops in Ventura County attract some types of wildlife.

Social Equity Concerns

Farm Worker Employment

Other open field row crops that are farmed in Ventura County such as onions, lettuce, celery, and peppers have highly variable labor demands. Some produce is machine-harvested and some is hand-harvested. Many temporary workers are needed for hand-harvest. Most of this labor has piece-rate remuneration and is mobile and seasonal. Increasingly, farm workers have become specialists at one or more crop types, which reduce their longevity in a single area and require migration out of the county.

Housing and Services

The housing and service demand by typical row crop workers is for temporary lodgings. Many workers are single males. Their lodgings may be temporary roommate situations with other workers or with family or friends in the areas they work. Most workers carpool to the fields in which they work. Many dozens of field workers' cars are parked along the roads during a hand-harvest.

Worker Health

Chemical exposure is variable by crop type. State law regulating pesticide use is strict, clear and monitored and carries penalties for improper use by growers, chemical applicators, or their employees.

Open Space and Visual Resources

Vegetable row crop production is a business and not part of the open space. Public opinion is split as to whether the production of open field row crops such as lettuces, onions, celery, and peppers, and shaded crops such as raspberries offers a tolerable or

welcome visual resource because vehicles, pipes, portable bathrooms, and other equipment are on open display in these areas compared to citrus and avocado production areas where the trees typically provide a continuous green screen. Hoop-house shade structures for raspberries and blueberries are also highly visible in some locations. These structures protect the berry crop from sanitation problems such as bird waste and dust, as well as from excess sun and hot winds. One large visible area is along US 101 near Central Avenue between Oxnard and Camarillo. Although covered, these crops are considered part of open field agriculture rather than part of nursery stock or greenhouse agriculture.

Economic Concerns

Costs and Economies

Open field non-strawberry row crops in Ventura County serve the large fresh market demands of Los Angeles as well as the nation. The proximity to the Los Angeles market provides efficiencies in transportation costs. Ventura County's mild climate allows three produce crops per year, which allows an excess supply that can serve a national market.

The primary disadvantage to growing row crops in Ventura County, other than strawberries, raspberries, blueberries, and other cane berries, is that most common row crops do not provide a large enough return on investment to pay the high lease prices for local agricultural land. Therefore, common row crops have been declining in recent years while acreage in berries is dramatically increasing. Large lettuce and broccoli operations that used to farm in Ventura County have moved operations to Huron, California and Yuma, Arizona where the cost of production is less.

Ventura is still an important local production area for oriental vegetables, cilantro and other herbs, watercress, and leafy greens. Farmers in Ventura County are always on the look-out for a niche market, as the unique climate and soils can serve these specialty markets.

With the diversity of crop types, labor is considered specialized and often organized through labor contractors. Contract labor makes the direct cost of labor more predictable and rational for farmers; however, it does not transfer risk from the farmer to the labor contractor.

Incentives to Continue Farming

Non-strawberry row crop areas in Ventura County are a mix of farmer owned and operated land and leased land. Some owners may be second and third generation owners who no longer actively farm. Ventura County has the S.O.A.R. ordinance, which provides a major barrier to conversion of agricultural lands to urban uses; therefore, the lack of land use alternatives is a forced incentive to continue farming so long as costs do not exceed income. As stated above, the income for some row crops is not high enough to cover costs plus the required return on investment. Therefore, they are being replaced by specialty crops that are higher in value. If income does not continue

to exceed costs, a change of use on these lands to concentrated value-added agricultural uses such as nurseries or greenhouses or non-farming uses that are permissible within agricultural zoning may start to occur. Otherwise, local leaseholders may be forced to reduce rents to attract tenant growers. Tenant farmers can leave the county to farm elsewhere.

II. Container Nursery Agriculture

Overview of Container Nursery Growing in Ventura County

Dexter McDonald of the Agricultural Commissioner's Office provided information to the committee. He said typical nurseries in Ventura County are laid out with plants growing in containers. However, many nurseries have some field-grown stock that is awaiting transplant to containers and further development of the root system in the container. This is referred to as "bare-root" stock. Containers typically are made of wood or plastic and can be large for trees or small for retail garden plants.

Environmental Concerns

Soils

Ventura County is a major supplier of container nursery products. The impact of this type of agriculture on the soils is mixed. Nurseries may remove high quality agricultural soils from open field production. The underlying soils may become more compacted due to structures and intensity of container nursery uses. In some cases land is graded to facilitate container nurseries. Grading may prohibit returning the ground to open field agriculture. However, container nurseries can use land that would not otherwise be suitable for in-ground farming. It is the climate, access to agricultural water, and zoning that creates a desirable location for a container nursery, not the underlying soils first and foremost.

Agricultural chemicals are less likely to go into the natural soils underlying a container nursery because pesticide spraying in container nurseries, when used, is typically hand-applied, which reduces the amount of pesticides. Some stock, such as flowers, may be hand-sprayed with Roundup®. In addition, hand-weeding is used on in-ground stock that is awaiting transplant to containers, which reduces the use of spray herbicides.

Water Supplies

Many container nurseries use efficient hand-watering methods. Larger nurseries typically use drip irrigation, which is also efficient. Bedding plants may use sprinklers.

Drainage Quality

The high cost of water combined with efficient irrigation reduces the amount of drainage from irrigation of nursery operations. Many container nurseries catch and retain their drainage. All agriculture in Ventura County must comply with the Regional Water Quality Control Board non-point-source pollution regulations, which set standards for irrigation and storm water drainage quality. Full capture is one method of compliance; however for most operations it is too expensive and not practical.

Nurseries generally target-spray chemicals onto plants. This reduces the amount of materials flowing into drainage areas. Plants are typically hand watered or watered by drip lines, which is highly efficient with little runoff. Plants in container nurseries are

hand cared for and monitored. In open field agriculture, only strawberries are watched as closely by employees. These methods tend to reduce the amount of chemicals in runoff water and the amount of water use overall. In open field farming, typically there is nothing to contain the chemicals and the amount of water used can be large. Open fields often need large amounts of water to leach out salts more often than container nurseries because field crops are planted very close together and this intensity builds up salts. As an example, celery is planted in extreme density, whereas container plants are often grown many inches or even feet apart from each other.

Air Quality

Container nurseries do not require soil fumigation; therefore, they do not contribute to volatile organic compound (VOC) ozone formation. Watering reduces particulate dust and other practices and methods do not create a great amount of particulates. Farmers consider nursery agriculture to be an under-recognized carbon sink because nursery plants reduce carbon dioxide in the overall environment.

Wildlife

Agricultural inspectors report seeing birds of prey, rodents, snakes, rabbits, raccoon and possum scat, coyotes, foxes, mountain lion, and even a bear on or adjacent to container nursery properties. The largest animals were seen at nurseries in the far northeast of the county. Animals and birds are attracted by the small amounts of pooled water on the site from watering and weeds around the perimeter of some nurseries. (Although a weedy nursery with irrigation runoff is not considered well-tended; it is good for wildlife habitat and movement. The small creatures, particularly rabbits, attract birds and animals of prey. The presence of these animals indicates that container nurseries do not impede wildlife movement. The inspector who observed the bear said it was sleeping in the shade of a row of citrus containers, had probably eaten from a nearby avocado orchard, and was likely in transit to another area. Container nurseries that have on-site structures such as offices and paved surfaces can cause an incremental increase to urban storm water runoff that contributes to downstream habitat loss.

Social Equity Concerns

Farm Worker Employment

Container nurseries offer steady, year-round employment for farm workers. Nursery owners tend to be local and relationships with workers may be social as well as strictly economic. At peak season, employment tends to be augmented with loading crews hired from labor contractors.

Housing and Services

Housing demand tends to be permanent and family-oriented rather than seasonal and oriented towards single males. With permanent employment, there may be more upward economic and social mobility for farm workers and their families.

Worker Health

Chemical exposure to container nursery farm workers is different for bedding or color crops and large tree crops. Bedding crops use a lot of nitrogen and there is a moderate amount of chemical pest control. Exposure from the misuse of chemicals can be acute or long-term. Large tree crops within container nurseries are mostly native species that do not require any chemical nutrition or pest control. State law regulating pesticide use is strict, clear and monitored and carries penalties for improper use by growers, chemical applicators, or their employees.

Open Space and Visual Resources

Container nursery production is a business and not part of the open space. Well-kept container nurseries are considered attractive and are usually welcome or tolerated in and around communities. Disorderly container nurseries not tolerated and are frequently reported to county code enforcement if there are violations of planning codes.

Some local nurseries have expressed concern that the arrival of the Asian Citrus Psyllid insect will require nurseries to extensively cover their citrus to protect from pest infestation. This may shift public tolerance of nurseries as part of the visual resource.

Ventura County has the S.O.A.R. Ordinance, which provides a major barrier to conversion of agricultural lands including container nursery areas to urban uses; therefore, the lack of land use alternatives provides a forced incentive to continue farming so long as costs do not exceed income.

Economic Concerns

Costs and Economies

There is a local market in Ventura County for container nursery products grown here. In addition, Los Angeles is a large market that is nearby. Ventura County container nursery products are also trucked or flown to national and international markets. The proximity to Los Angeles for both sales and air transportation is considered a positive cost factor.

Most nursery species grow well in Ventura County due to the temperate climate. Ventura County nursery stock is a high value crop and higher gross revenues here may offset higher costs. Higher gross revenues may derive from the ease of growing and the proximity to the Los Angeles wholesale and retail markets. The current availability and price of water is also considered a positive cost factor; however, water cost is anticipated to rise.

Planning and permitting costs for container nurseries are considered unacceptably high by owners and operators in the area. Operators report that building and safety requirements are not easy to understand and contribute to high operating costs. If nurseries must cover their citrus to protect from the Asian Citrus Psyllid insect, there may be additional planning and building and safety regulatory costs as well as the costs

for installation materials. As with other crop types, nursery operators desire more allowable uses within zoning and the ability to locate agriculture-related structures such as for distribution and supply on convenient and compatible sites.

Incentives to Continue Farming

Container nursery products can be grown on land that is less suitable for in-ground agriculture. This provides a broad incentive to continue container nursery farming, as the larger climate is more important than specific soil qualities and more locations are usable for container nurseries.

The Ventura County S.O.A.R. Ordinance provides a major barrier to conversion of agricultural lands to urban uses. Therefore, lesser-quality agricultural lands will continue to be available and may attract more participants and competition in the container nursery industry. Disincentives to continue container nursery farming include the continuing need for expensive labor.

III. Greenhouse Agriculture

Overview of Greenhouse Growing in Ventura County

Scott Beylik of Agroponics spoke to the committee on the subject of small greenhouse farming. Beylik uses hydroponics, which grows vegetables in a special medium rather than in the dirt. The structure for hydroponics growing is a type of greenhouse.

Ventura County has seen a recent increase in the number of large greenhouse agricultural operations. The county now has a mix of greenhouse operations from small, thin plastic-clad structures to large, glass houses that are completely climate-controlled



Susan Johnson noted separately that while Ventura has, until recently, had mostly open field agriculture, in colder climates in the U.S. and internationally, growers operate winter gardens within conservatories. These are artificially heated glass houses. In cold climates, seeds are started in cold frames. These are little wooden boxes with glass tops and are probably still common in England where it may still be frost as late as May. In colder climates, tomatoes are covered with “hot caps”, little hats that shelter seedling tomatoes from frost.

Dexter McDonald also stated separately that cut flower greenhouses vary greatly in their methods from tomato and produce growing greenhouses. He also said that greenhouses in Ventura County vary in their cleanliness, which affects whether insects, parasites and fungus enter in large quantities and must be eradicated using pesticides and herbicides.

Environmental Concerns

Soils

As with container nurseries, the impacts of greenhouse agriculture on agricultural soils are mixed. Greenhouses may remove high quality agricultural soils from open field production. The weight and concentrated use of most greenhouses will compact the underlying agricultural soils. In some cases, land is graded to facilitate greenhouses. Grading may prohibit returning the ground to open field agriculture. However, because greenhouses do not use the underlying soils for planting, they are capable of being constructed upon land that is less suitable for in-ground farming, leaving better quality soils for open field farming.

Typically, underlying soils are not depleted of their nutrients because most greenhouses do not plant in the underlying soils. Leaching of chemicals into the soils is usually less in these greenhouses where special growing medium is used rather than the underlying soils. Plants in greenhouses are concentrated into a smaller area than

typical open field crops and workers can make reduced, targeted treatments of any necessary chemicals. In addition, most chemicals have short half-lives and do not remain in the soils. Greenhouse growers are one of the largest users of beneficial insects for pest control. Most greenhouse growers locate greenhouses, not for the quality of the underlying soils, but where the climate is temperate and there is access to agricultural water, transportation and markets as well as appropriate zoning.

Some greenhouses do plant directly into underlying soils. The depletion of natural soils in these greenhouses would be dependent on crop type and rotation. Leaching of chemicals into the soils typically would be less than for open field crops due to the concentration of crops in a small area where workers can make reduced, targeted treatments with any necessary chemicals. In greenhouses that use underlying soils, occasional fumigation of the soils may be required. When fumigation is used, the chemical application is planned according to state law and monitored. The fumigant is vented upward. These rare fumigant applications use chemicals with a short half-life that do not remain in the soil.

Greenhouses that plant directly into underlying soils may have no impervious or paved surfaces within the structure. These locations could easily be returned to open field agriculture.

Some greenhouses have some paved surfaces within the structure for use as walkways for workers. Typically, these greenhouses do not plant in the underlying soils but use special growing media. There is probably some ability to return these areas to open field agriculture.

Other greenhouses, particularly those that grow cut flowers, may have floors that are completely paved. The growing medium is spread onto the concrete. When plants are removed, the growing medium can be replaced to reduce fungus and the need to fumigate. The ability to return these areas to open field agriculture would be more difficult due to the cost of demolition of the solid floors.

A greenhouse whose crop and methods require that workers and entrants cover their shoes, clothes and hair prior to entry, is air-tight, and keeps insects out of entries through the use of forced air, may be able to operate with no pesticides and few other chemicals that could have some impact to the underlying soils.

For other greenhouses that are less capable of being sealed, or where the crop type is more susceptible to insects such as with cut flowers, pesticide use may be required.

In summary, the use of chemical nutrients, herbicides, pesticides and fungicides in a greenhouse is highly variable by the type of crop grown and the methods of operation. Different plants have different needs and greenhouses are equipped with different capabilities.

Water Supplies

Greenhouse stock is highly concentrated and therefore needs an abundant water supply. A greenhouse may use ten times the water as an open field of equivalent size; however, the greenhouse is likely to produce well over ten times the product. Water is re-circulated in many greenhouse operations. Less water is used than in open fields for the same amount of produce. Information provided for this report is that few greenhouses have private wells. Most greenhouses are believed to be on land with water supplied and metered by irrigation districts. This assures that the large amount of water used in the small area of a greenhouse is properly accounted. Despite the large amount of water used in the small area of a greenhouse, the harvest is high-quantity and high-quality, assuring overall efficiency in the use of water.

Drainage Quality

The high cost of water combined with efficient watering methods reduces the amount of drainage created by irrigation. The amount and velocity of storm water drainage from large greenhouses is a concern. The nature of greenhouse operations (e.g. large roofed areas, roads, etc.) may result in more rapid rainwater runoff. Greenhouses cover land that is permeable and replace it with impermeable surface area. As a result, less water is absorbed into the ground and more water flows off the land into streams and the ocean as storm water runoff. Both the quantity and quality of storm water is a problem for aquatic ecosystems.

Drainage water from around and within greenhouses is unlikely to be contaminated with farm chemicals in current use. Many greenhouses do not use any pesticides, or use them infrequently. As stated above, agricultural chemicals in use today quickly become inert in the soils. In addition, all agriculture in Ventura County must comply with the Regional Water Quality Control Board non-point-source pollution regulations, which set standards for irrigation and storm water quality.

Small greenhouse operators may collect rainwater for use on nearby open fields. However, the large quantity of rainwater runoff from large greenhouses and/or greenhouse complexes can be problematic.

Air Quality

Greenhouses use fewer chemicals than other types of crops production and when chemicals are used, they are typically well contained within the structure. Greenhouses are one of the biggest users of non-chemical, beneficial insects for the purpose of pest control. Occasionally, fumigation may be required for a special situation. The fumigant is released upward into the air. It is a planned and monitored event and is not considered harmful to humans. However, the volatile organic compounds (VOCs) from fumigants contribute to ozone formation, an adverse air quality impact.

Wildlife

Greenhouse structures do not offer any advantages to wildlife and may disrupt wildlife corridors, if such corridors previously existed in the area. However, greenhouses produce large amounts of food on small amounts of land and their overall use may allow more land for use by wildlife. Greenhouse structures and paved areas of the operations can cause an incremental increase to urban storm water runoff that contributes to downstream habitat loss.

Social Equity Concerns

Farm Worker Employment

Farm workers in greenhouse agriculture are typically permanent and have year-round employment. As much as 80 percent of greenhouse employment is thought to be permanent, versus approximately only 40 percent for other types of farming. This stability also results in higher income as tenure is built up on the job.

Housing and Services

Housing demand for greenhouse farm labor is permanent and employees can create families and be a part of the permanent community. There is less demand for seasonal or migrant housing.

Worker Health

Chemical exposure of greenhouse labor is believed to be less than other types of agriculture. Greenhouse crops typically use fewer chemicals than other types of crops.

Open Space and Visual Resources

Greenhouse crop production is a business and not part of the open space. With respect to visual resources, greenhouses are not as well tolerated or welcomed by the public as open field or container nursery production because of the large size, industrial appearance, and glare from lighted greenhouses.

Economic Concerns

Costs and Economies

Major tomato growers, global in scope, have come to the Oxnard area for its fine climate and proximity to the large Los Angeles market and transportation hub. These are considered positive cost factors for greenhouse production in Ventura County. In addition, water availability and cost is considered a positive cost factor; however, water cost is anticipated to increase. Currently, for some national and global greenhouse operators, the over-use of ground water and resulting fines from regulatory agencies can be less costly than the purchase of water in other regions. Increasingly, highly treated recycled water will be used. Monterey County growers currently use such water and it is considered very safe. However, the cost of highly treated water is likely to be higher than extracted ground water.

Since greenhouse operations do not depend on the quality of the soils they occupy they could be located on virtually any reasonably flat ground. They typically locate on agricultural land because it is less costly than land allowing other uses, has agricultural support services in the area, and does not have interface issues with any nearby non-agricultural development. These are factored into the consumer's final cost of vegetables and fruits.

Labor costs are predictable for greenhouse agriculture, because the labor force is generally permanent. Initial development costs are considered high. Even small greenhouses are subject to the same rigorous building standards as structures that are entirely non-agricultural. Farmers report that the process to obtain permits is onerous and lengthy.

Incentives to Continue Farming

Like, nursery stock, greenhouse products can be grown on land that is less suitable for in-ground agriculture. This provides a broad incentive to continue greenhouse farming, as the climate is more important than specific soil qualities, and more locations are potentially usable for greenhouse operations.

In addition, the Ventura County S.O.A.R. Ordinance provides a major barrier to conversion of agricultural lands to urban uses. Therefore, lesser-quality agricultural lands will continue to be available and may attract more participants and competition in the greenhouse business. Disincentives to continued greenhouse farming include the continuing need for expensive labor.

In summary, while investment in a greenhouse is considered very costly, high productivity provides an acceptable return on the investment. Increasingly, both small local farmers and regional, national and global farm companies will turn to greenhouse agricultural methods to achieve a predictable crop yield at a predictable cost and to meet the demands of consumers looking for a product that has an unblemished appearance and comes with the perception that it is more sanitary. Thus, the economics of farming will create an incentive to continue farming using the greenhouse method for those who have the initial start-up capital.