CALIFORNIA DEPARTMENT OF
FOOD & AGRICULTURE

BENEFITS OF FARMLAND CONSERVATION IN CALIFORNIA

2015

California's farmland provides multiple benefits including food security and economic strength. Farmland also has a critical role in California's climate change mitigation and adaptation strategies.

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BENEFITS OF FARMLAND CONSERVATION IN CALIFORNIA

INTRODUCTION

California's farmland is a critical resource that provides over 400 diverse commodities (CDFA, 2013). All fifty-eight of California's counties contribute to the state's agricultural production (CDFA CASS, 2012). California's farmland includes rangeland, pastureland, and cropland for growing perennial, annual, nursery, and field crops. Some crops grown in California are not grown anywhere else in the nation and are exported throughout the world. Ensuring the protection of agricultural lands and its water supply are essential to food security and supports numerous other social and environmental benefits provided by California agriculture. This report provides a general overview of the importance of conserving California's agricultural lands.

VULNERABILITY OF FARMLAND

Farmland in California is vulnerable to pressures from climate change and shifting land use patterns, including urban and suburban sprawl. Alarmingly, some of the highest quality farmland continues to be converted to urban development, resulting in permanent loss of agricultural productivity from that land. Between 1990 and 2004, 538,000 acres of farmland were converted to urban use in California (American Farmland Trust, 2007). California is the most economically important agricultural state in the union, but, ironically, also ranks in the top three states for high rates of conversion of farmland (American Farmland Trust, 2014).The rate of farmland conversion is expected to increase tremendously as California's population is projected to exceed fifty million people by 2040. If changes in current development patterns, and farmland policies and programs do not occur, 2.5 million acres more of agricultural land are anticipated to be lost by 2040 (Gomes, 2002).

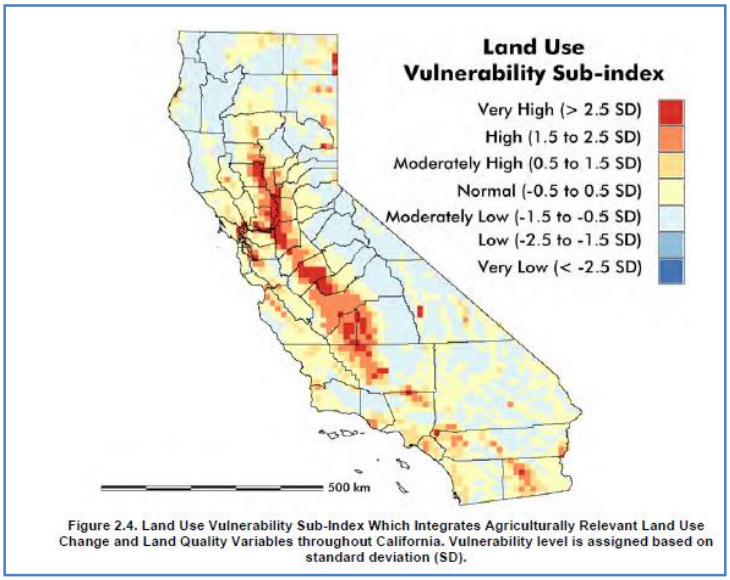

FIGURE 1: LAND USE VULNERABILITY SUB-INDEX SHOWING REGIONS OF CALIFORNIA AT RISK OF URBANIZATION

Researchers at the University of California, Davis assessed the vulnerability of the agriculture sector to four sub-indices; climate, land use, crop, and socioeconomic. They combined these sub-indices into a total Agricultural Vulnerability Index which identified areas of California where agriculture is most at risk of being lost. Figure 1 shows the agricultural vulnerability sub-index for land use. Much of the

Central Valley, Salinas Valley and other agricultural regions have "high" or "very high" vulnerability due to land use changes (Jackson et al, 2012).

HISTORICAL PERSPECTIVE

As California's population has grown, cities also grew and sometimes merged. New urban development extended into agricultural production areas. The Santa Clara Valley, once known as "The Valley of the Heart's Desire" for its orchards of apricots and prunes, among other crops, is one example where once productive and treasured agricultural land has been converted to urban development (National Park Service, n.d.) (American Farmland Trust, 2007). In the past few years there has been renewed effort by the American Farmland Trust and partners to conserve the remaining agricultural land left in the Santa Clara Valley for future productivity.

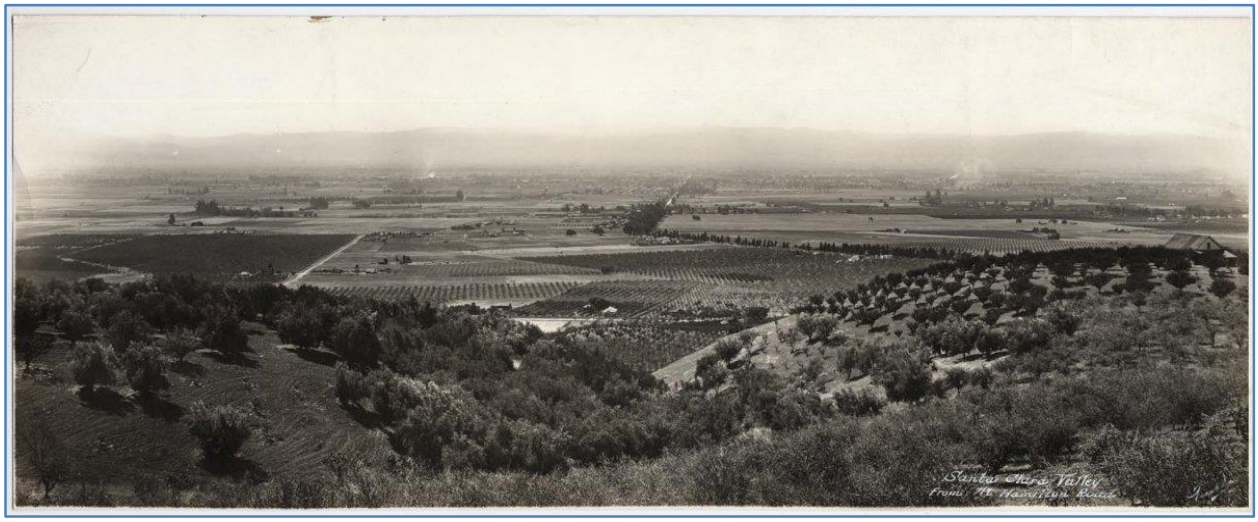

FIGURE 2: THE SANTA CLARA VALLEY CIRCA 1914 FROM THE TOP OF MOUNT HAMILTON (STONE, 2014).

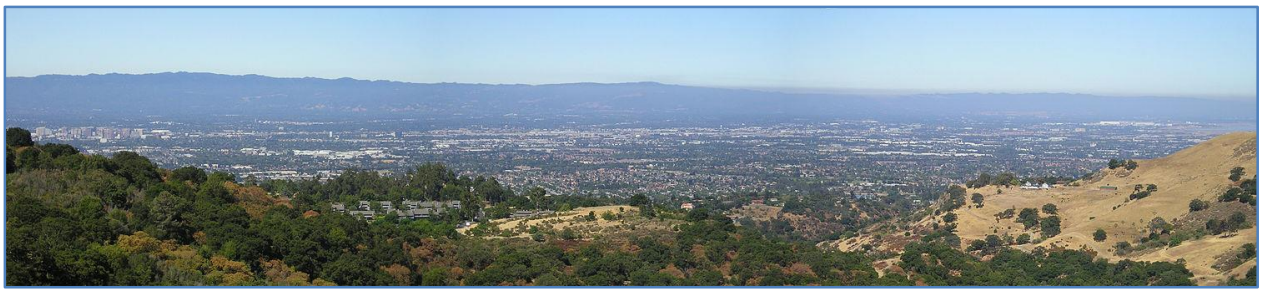

FIGURE 3: SIMILAR VIEW OF THE SANTA CLARA VALLEY IN 2004 (WIKIMEDIA COMMONS, 2004).

The California Department of Food and Agriculture (CDFA) documented a loss of 2.2 million acres of farmed land from 2002 to 2012; most of that loss occurred from 2002 to 2007 which were years of increasing real estate values and urban growth throughout the state. (CDFA, 2013). A 2007 report by the American Farmland Trust titled *Paving Paradise*: *A New Perspective on California Farmland Conversion,* provides a comprehensive summary of the magnitude of farmland loss that has already occurred and is expected in the future. The authors analyzed available data on total farmland conversion by county (Table 1). They also looked at the *quality* of farmland that was converted and the *urban efficiency*, measured in this report as the number of people per urban acre,

of the resulting urban development. The results of the study show a significant loss of farmland from California's most productive agricultural counties (American Farmland Trust, 2007).

American Farmland Trust documented these alarming statistics in a 2009 publication, *California Agricultural Land Loss & Conservation: The Basic Facts:*

Table 1. High quality farmland converted to urban land use from 1990-2004, top 10 counties (Adapted from American Farmland Trust, 2007)

County	Acres	Total Land Area (%)	Rate of Loss (Ac/Yr)
San Joaquin*	14,888	1.6	1,063
Riverside	14,551	0.3	1,039
Fresno*	12,524	0.3	895
Kern*	12,025	0.2	859
Stanislaus*	10,189	1.1	728
Tulare*	8,758	0.2	626
San Bernardino	7,379	0.1	527
Orange	6,533	1.1	467
Santa Clara	6,233	0.8	445
Kings*	5,170	0.6	369

AN ASTERISK DENOTES A TOP 10 AGRICULTURAL PRODUCING COUNTY

- "3.4 million acres of land in California's agricultural counties are now urbanized. (Another 2 million acres are in areas that are so urbanized that there is no more agricultural production)."
- "Development is now consuming an average of 40,000 acres of agricultural land per year."
- Since 1990, 538,000 acres have been developed; of this, 28% or 152,000 acres of land, were prime, unique or statewide important farmland (farmland categories are discussed below).
- "In the San Joaquin Valley, which accounts for over half of California's total agricultural output, more than 60% of all land developed was prime, unique or of statewide importance."
- "If current development trends continue, 1.3 million acres of California's agricultural land, including 670,000 acres of prime, unique and statewide important farmland, will be developed by 2050. For irrigated cropland alone, this would entail an annual loss of an estimated $2 billion in agricultural production in current dollars" (American Farmland Trust, 2009).

Farmland Categories

In 1981 the U.S. Department of Agriculture (USDA) published the *National Agricultural Land Study*. This report raised concerns regarding the increased conversion of farmland to urban development. The report indicated that between 1960 and 1970 the rate of conversion increased by three times (Alterman, 1997; Brent, 2013). A 1981 Congressional report, *Compact Cities: Energy-Saving Strategies for the Eighties* echoed a similar concern and proved to be the impetus for Congress to implement a series of land use programs and policies to combat urban sprawl and reduce farmland loss. One such action included the passage of the Farmland Protection Policy Act (Agriculture and Food Act 1981, Subtitle 1 of Title XV, Section 1539-1549). The intent of the Farmland Protection Policy Act was to minimize the "…irreversible conversion of farmland to non-agricultural uses…" by requiring federal agencies to consider how federal projects would impact farmland. The Farmland Protection Policy Act does not mandate the preservation of farmland and does not provide authority to the federal government to regulate private or state-held land rights. The Act does however, require the USDA, Natural Resource Conservation Service (NRCS) to categorize farmland through a rating system known as the Land Evaluation and Site Assessment (LESA). The categories

established by NRCS include (1) prime farmland, (2) unique farmland, (3) farmland of state or local importance, and (4) grazing land. These categories can include forest land, pastureland, cropland, or other land uses, except urban land and waterways (USDA NRCS, 2014). California has adopted these farmland category definitions for its use in statewide farmland conservation initiatives as well as the Farmland Mapping and Monitoring Program (FMMP).

The California Department of Conservation generates maps of California's farmland types through the FMMP. The latest statewide map from 2010 is included as Appendix A. Similar maps are available on a county scale and are available at: http://www.conservation.ca.gov/dlrp/fmmp/products/Pages/DownloadGISdata.aspx.

Prime Farmland

Prime farmland is defined by the USDA as *"land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses."* Prime farmland must have a climate that accommodates a growing season, adequate water either from precipitation or irrigation, and soils that sustain high yields when properly managed. It does not include land that is threatened by flooding. Prime farmland can be of any land use type including forest, pasture, or crop land. Prime farmland cannot include built-up areas including urban residential, commercial, industrial, public works facilities or transportation areas (USDA NRCS, n.d.). Prime farmland is a priority for conservation efforts because it is so crucial to agricultural productivity, and ultimately, future food security.

Without purposeful efforts to conserve particularly the most productive farmland, the agriculture sector in California will permanently lose potential; reducing economic vitality and resiliency. Making a strategic statewide effort to conserve farmland can contribute to a vibrant future for California, where residents will enjoy the multiple benefits provided by agriculture.

BENEFITS OF FARMLAND CONSERVATION

ECOSYSTEM SERVICES

California's farmland provides many benefits to humans and the environment. These benefits are collectively known as "ecosystem services in agriculture." The California Department of Food and Agriculture's Environmental Farming Act Science Advisory Panel[1] defined ecosystem services in agriculture as:

> "The multiple benefits we gain from farming and ranching including crop and livestock production. In addition to valuable open space and wildlife habitat, the management decisions and conservation practices of farmers and ranchers also enhance environmental quality, provide recreational opportunities and offer social benefits" (CDFA, 2014).

CDFA's Ecosystem Services Database

CDFA developed an Ecosystem Services Database to promote farm management practices with multiple benefits and to recognize farms that employ those practices. The database provides the following ecosystem services: wildlife habitat; nutrient cycling; food; fiber; fuel; recreation and cultural; soil structure, formation and fertility; biodiversity conservation; water cycling; atmospheric gas and climate regulation; water quality; pest control; and pollination services. To explore the database, visit:

http://apps.cdfa.ca.gov/EcosystemServices/

The following sections highlight some of the ecosystem services of farmland in California and emphasize the need for farmland conservation.

SOCIETAL BENEFITS OF FARMLAND

AGRICULTURAL PRODUCTIVITY

California's various microclimates, long periods of sunlight, the ability to move water for many beneficial purposes including crop production, and fertile soils make it an exceptional place to produce food. In 2012 the agriculture sector brought in $44.7 billion, making California the leading agricultural state in the United States. The top thirteen counties in California earned more than $1 billion each in agricultural revenue; Fresno County alone earned $6.6 billion (CDFA, 2013).

FIGURE 4: BREAKDOWN OF CALIFORNIA'S AGRICULTURAL REVENUE, 2012 (CDFA, 2013).

California's agricultural regions, with nicknames such as Salinas Valley's, the "salad bowl of the world," are unique due to the specialty crops produced throughout the State. Specialty crops are defined by the USDA as "fruits and

[1]The Cannella Environmental Farming Act of 1995 (California Food and Agricultural Code, Sections 560-568) established a Scientific Advisory Panel on environmental farming at the California Department of Food and Agriculture.

vegetables, tree nuts, dried fruits, horticulture, and nursery crops (including floriculture)." Some specialty crops, including almonds, artichokes, figs, raisin grapes, dates, kiwifruit, clingstone peaches, olives, dried plums, pomegranates, sweet rice, and walnuts, are produced nowhere else in the nation. Many specialty crops have a continuous growing season in California including broccoli, artichokes, carrots, cabbage, lettuce, spinach, mushrooms, avocadoes, and potatoes (CDFA, 2013). This means that Californians have access to a fresh, highly nutritious, safe and locally-produced year-round food supply.

Milk was California's most valued agricultural commodity in 2012 and is produced in thirty-three of California's fifty-eight counties. Similar to California's specialty crops, the livestock products raised in California are also surprisingly diverse and include dairy cattle, beef cattle, pigs, sheep, poultry for meat and eggs, and bees for honey (CDFA, 2013). Livestock production is closely associated with the land. Livestock use the land for grazing and farmers use the land for animal feed production (e.g., corn, hay, silage).

Economic Contributions

California's specialty crops and livestock industries are especially labor-intensive. Many fruit and vegetable crops are maintained (e.g., pruned, thinned, weeded) and harvested by hand. Estimates from a 2004 study indicate that at that time there were 1.1 million seasonally employed individuals working on farms in California; the equivalent of 400,000 full time jobs. (Khan et al, 2004).The USDA Census of Agriculture indicated that California farms spent $5.9 billion on hired labor, $3.4 billion on contracted labor and $1.3 billion on custom labor or custom hauling[2] in 2012. In several California counties hired labor expenses alone (excluding contracted or custom work) represent 25% or more of production costs. Figure 5 shows the average expenses for hired farm labor throughout the nation. Note the higher expense in regions of

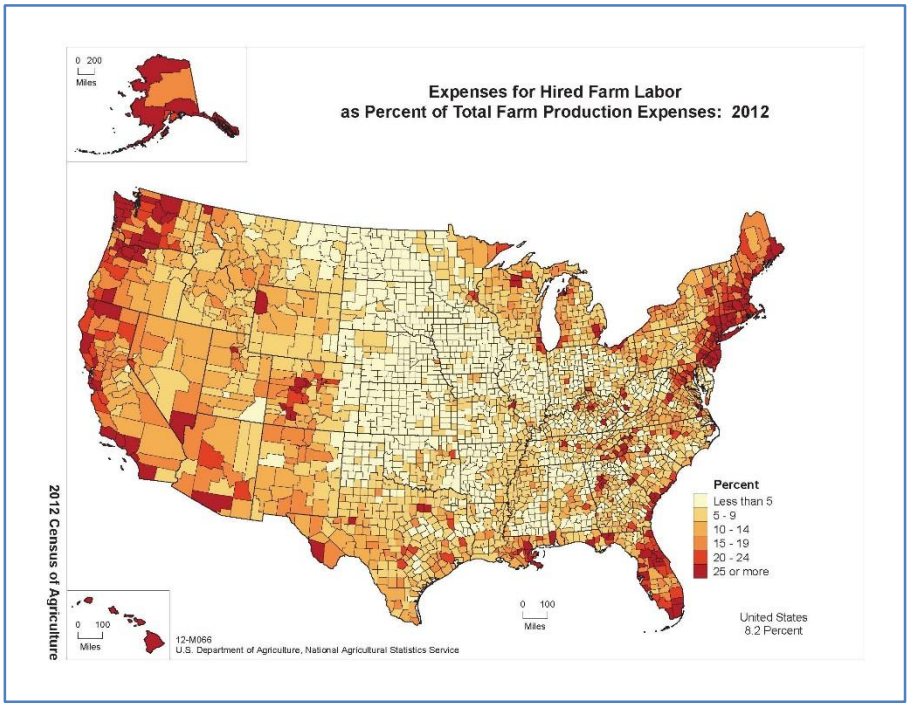

FIGURE 5: PERCENT OF FARM PRODUCTION COSTS EXPENDED ON HIRED LABOR (NASS, 2012).

[2] Custom labor and custom hauling generally refer to businesses for hire that own and operate harvesting or faming equipment that the farm owner does not own.

specialty crop production (NASS, 2012).

On-farm employment is not the only measure of agriculture's contribution to the state's economy. Agriculture reverberates into many of California's other business sectors. The 2007 U.S. Census Bureau, Economic Census indicated that there were 4,564 businesses that process agricultural products (e.g., food and beverages) in California (Paggi, 2011). California's agriculturally-based businesses utilize employees with numerous skill sets including farm managers, information technology specialists, scientists, office support staff, quality control specialists and production analysts, among others. When one considers the related employment opportunities in food processing, agricultural support services and transportation, the employment figures for the agricultural industry as a whole in California become significantly greater than farm employment alone.

Researchers at California State University, Fresno, in 2011 estimated the multiplier effect, or the greater economic impact, of agriculture in California. They found that for every $1 that agriculture contributes directly to the economy, another $1.56 is added to the state's economy. They also estimated the multiplier effect on employment numbers and found that food production and processing components of California agriculture had a total impact of approximately 1.35 million *annual* jobs in California (Paggi, 2011). The Agricultural Issues Center at University of California has also looked at similar measures of agricultural impacts on the state's economy. A 2012 report titled *The Measure of California Agriculture*, indicated that 6.7% of jobs statewide are generated by farms and farm processing. In the Central Valley the figure is much higher at 22% (U.C. Agricultural Issues Center, 2012). Agriculture is the economic foundation for many of California's communities, particularly rural communities where other employment opportunities are limited.

Food Security

Earth's population is expected to grow to nine billion by the year 2050 (Zabel et al, 2014). Agricultural production demand, including the need for meat, dairy, fruit, vegetable crops and biofuel crops is expected to increase by 70-110% (Zabel et al, 2014; Tilman et al, 2011). Among the scientific community there is concern that global crop yields are not increasing at the rate required and food supplies might fall short of future needs. The average rate of increase in yields for maize, rice, wheat and soy ranges from 0.9-1.6% per year. In order to meet caloric demands for the future population, a yield increase of 2.5% per year is needed (Ray et al, 2013).

As mentioned previously in this report, California's agriculture is rare in that specialty crops are grown throughout the state and supply the nation with a healthy, fresh and varied diet rich in fruits, vegetables, and nuts. Many studies on food supply focus on staple crops such as corn and rice, but do not consider specialty crops and the very important role that they have in human nutrition. In consideration of the constricted global regions in which specialty crops are grown, more research on future demand of these commodities is needed to properly assess California's contribution to the worldwide food supply.

A 2014 study examined agriculturally-suitable land around the globe and made predictions regarding shifts in production due to climate change and farmland characteristics. The researchers found that over the next century, many northern latitudes will become more suitable for food production, for example Canada, China, and Russia, and tropical regions will become less suitable (Zabel et al, 2014). The implications of these findings for food security are significant. Farmland conservation is critical especially in relation to climate change; there is a need to conserve land that *will* be suitable for agricultural production in the future. Figure 6 shows in green the regions of the world that will be suitable for agricultural production at the end of the century (Zabel et al, 2014). According to this data, California can remain an important food production area as long as water resources are available.

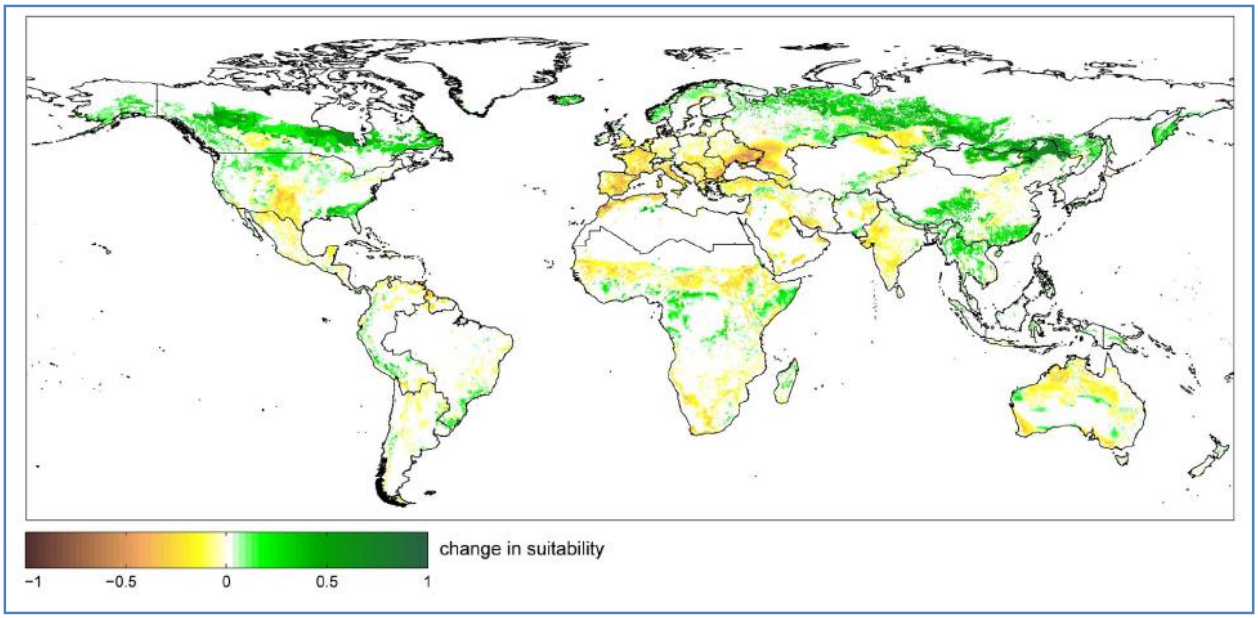

FIGURE 6: CHANGE IN SUITABILITY OF LAND FOR AGRICULTURAL PRODUCTION FROM 1981-2010 AND 2071-2100. GREEN AREAS INDICATE INCREASED SUITABILITY AND YELLOW TO BROWN INDICATE DECREASED SUITABILITY (ZABEL ET AL, 2014).

It should be noted that land used for growing crops, or arable land, in the United States has been on a declining trend since 1995. In 1995 20% of the total land mass in the United States was defined as arable land, but in 2010 that figure had fallen to 17% (World Bank, 2015). The decline in arable land in the United States is likely attributed to land use changes (urbanization), but it is important to recognize the loss since climate change may cause shifting in cropping systems and change the suitability of regions for farming.

CLIMATE BENEFITS

URBAN GREENHOUSE GAS (GHG) EMISSIONS

Farmland conservation is complementary to infill and open space goals of regional planning. As farmland is strategically conserved at the periphery of a city, infill development patterns are encouraged, which provides for higher density development and documented lower greenhouse

gas emissions from urban areas. Urban efficiency can be assessed through various measurements (e.g., vehicle miles traveled per person per day or the number of people per urban acre).

In a case study of the Toronto area, researchers looked at three urban development variables; transportation, construction materials and building operations, to make determinations on the impacts of urban density to greenhouse gas emissions. They found that the key to reducing urban greenhouse gas emissions was the transportation aspect; specifically by reducing the vehicle miles traveled per person per day. Public transportation methods such as buses, subway, and streetcars only accounted for 2-5% of total transportation emissions as opposed to personal vehicle emissions in both high density and low density situations. In consideration of all three variables, low density suburban areas are 2.0-2.5 times more greenhouse gas intensive per capita than high density urban areas. Figure 7 summarizes the per capita greenhouse gas emissions from the Toronto case study; in low density areas GHG emissions averaged 8.6 tonnes CO_2 equivalent per year while in high density areas the average GHG emissions were 3.3 tonnes CO_2 equivalent per year (Norman et al, 2006).

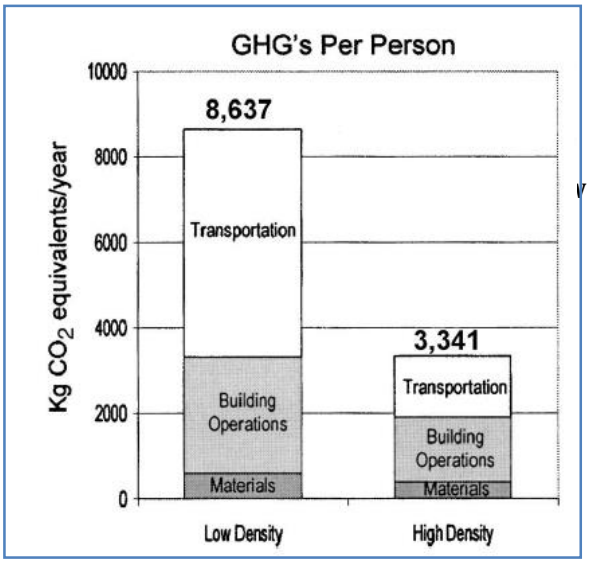

FIGURE 7: GHG EMISSIONS PER CAPITA IN LOW POPULTION DENSITY AND HIGH POPULATION DENSITY URBAN DEVELOPMENTS (NORMAN ET AL, 2006).

Multiple studies indicate that smart urban growth strategies have a crucial role in mitigating greenhouse gas emissions. Relatedly, urban areas result in heat islands which exacerbate the impacts of climate change within the urban area and the surrounding areas. Heat islands result when built areas absorb energy from the sun and prevent evaporation from the soil (Deng et al, 2013). Putting limits on urban growth can reduce the overall impact of heat islands and support agricultural productivity on urban edges (Jackson et al, 2012a).

Farmland Greenhouse Gas (GHG) Emissions

Research in California has shown that agricultural lands emit seventy times less greenhouse gases than urban areas of the same size (Jackson et al, 2012a; Haden et al, 2013). The American Farmland Trust recently published a study comparing the average greenhouse gas emissions from California's farmland to the average emissions of California's urban areas and had similar conclusions. The authors analyzed seven of California's most commonly-grown crops and found that, on average, California's irrigated farmland emits 0.89 tonnes of CO_2 equivalent per acre per year in comparison to an average 51 tonnes of CO_2 equivalent per year per acre for California's urban areas. The take away message from this study is clear; California's productive irrigated farmland emits greenhouse gases on a level that is an order of magnitude less than urban areas (Shaffer and Thompson, 2015). One should also consider that one quarter of California's land is used for agriculture however,

agriculture only accounted for six percent of California's greenhouse gas inventory in 2012 (Haden et al, 2013).

There are numerous opportunities for agricultural operators to incorporate climate-friendly management practices into their farming operations and further minimize greenhouse gas emissions. These management practices include reducing the amount of nitrous oxide emitted from nitrogen fertilizers, improving efficiencies of farm equipment and irrigation systems to reduce fuel use and carbon dioxide emissions and utilizing by-products (such as livestock manure) for bio-energy production (Haden et al, 2013; California Climate and Agriculture Network, 2013). These practices have environmental and economic co-benefits and in California there are current initiatives that incentivize the adoption of these practices (e.g., California Department of Food and Agriculture (CDFA) State Water Efficiency and Enhancement Program, CDFA Dairy Digester Research and Development Program, USDA NRCS Environmental Quality Incentive Program).

Efforts to quantify the climate benefits of various agronomic practices are ongoing. Utilizing available research, USDA NRCS and Colorado State University recently launched a new tool, Comet-Planner, to evaluate the emissions reductions from several agronomic practices (USDA NRCS Conservation Practice Standards). According to Comet-Planner the switch from conventional tillage practices to no-tillage management on 100 acres in Merced County, California has the potential climate benefits (carbon sequestration and reduced emissions) of 35 tonnes of CO_2 equivalent per year. This is just one simplified example, but it serves to demonstrate the possibility to evaluate various farming decisions for climate benefits (Colorado State University, 2015).

Carbon Sequestration on Farmland

Rangeland

Carbon sequestration is the removal of carbon dioxide from the atmosphere and the long-term storage of that carbon in reservoirs such as soil or vegetation. Many researchers agree that carbon sequestration on rangeland is a feasible greenhouse gas mitigation opportunity (DeLonge et al, 2013; McDermot and Elavarthi, 2014; Ryals and Silver, 2013). The application of organic matter amendments to rangeland is considered to have three co-benefits; (1) waste remediation, (2) greenhouse gas mitigation, and (3) increased plant primary productivity (Ryals and Silver, 2013). Studies show that organic amendments to rangeland soils can improve the water holding capacity of the soil, increase soil stability, sequester carbon, and balance soil pH among other agronomic benefits (McDermot and Elavarthi, 2014).

In one study where green by-product amendments were applied, researchers found that with just one application, the carbon stored in the soil increased by 25 - 70% (Ryals and Silver, 2013). In another study, applications of composted manure were revealed to have especially high greenhouse gas mitigation potential. The benefits were realized not just through increased carbon sequestration and gains in net primary productivity of the grazing land, but also through the avoided emissions of alternative manure management practices and the avoided emissions of growing, processing and transporting supplemental cattle feed. That study estimated that emissions of 28 million tonnes of CO_2equivalent could be avoided by applying composted manure to 5% of California's rangelands (DeLonge et al, 2013).

Cropland

The ability of cropland to sequester carbon from the atmosphere is dependent on the soil type, crop and the management practices used to grow those crops (e.g., conservation tillage or no tillage). Some of the management practices that have been promoted to increase soil organic carbon (SOC) include conservation tillage, use of cover crops, intercropping, utilizing windbreaks, enhanced crop rotation, increased perennial cropping, and the application of green manure or other organic matter amendments (Rosenzweig and Hillel, 2000) (West and Post, 2002).

The carbon sequestration potential of California agriculture is much different than elsewhere in the world due to the sheer number of specialty crops grown. California crop-specific estimates of carbon sequestration potentials are needed to guide decision-making regarding the best opportunities for carbon sequestration in California (Suddick et al, 2013). Carbon sequestration is dependent on crop type and existing soil organic carbon pools. Perennial crops such as fruit and nut trees remove carbon dioxide from the atmosphere over the lifespan of the planting; the ultimate disposal of the biomass (wood) is a critical step in determining the emissions or sequestration of the crop. For example, if the biomass of a removed orchard is used for bioenergy production, the stored carbon is destroyed (White, 2014).

COMPELLING EVIDENCE TO SUPPORT FARMLAND CONSERVATION FOR CLIMATE BENEFITS

- Fifty percent of land surface warming since 1950 has been due to urbanization (Deng et al, 2013).
- Excluding Los Angeles County, which has a much higher urban density than the rest of the state, California has an average statewide urban density efficiency measure of 7 people per urban acre (American Farmland Trust, 2007).
- Agricultural lands emit seventy times less greenhouse gases than urban areas of the same size (Haden et al, 2013; Jackson et al, 2012a).
- A 2013 study indicates that twenty-eight million tonnes of CO_2 equivalent GHG emissions could be avoided by applying composted manure to 5% of California's rangelands (DeLonge et al, 2013). Continuing research on this is needed, but this study demonstrates one practice (applying composted manure to rangelands) that may have multiple benefits including significant carbon sequestration.

Farmland Conservation Initiatives in California

In 2012 Secretary Karen Ross of the California Department of Food and Agriculture convened the Climate Change Consortium for specialty crops, a group of agricultural representatives and researchers from specialty crop industries in California. The Consortium was tasked with recommending strategies for agricultural adaptation to climate change and produced a 2013 report titled, *Climate Change Consortium For Specialty Crops: Impacts and Strategies for Resilience*. The Consortium recognized farmland conservation as playing a role in creating resilience to climate change. As California's farmers adopt alternative crops, new technologies and management practices to adapt to climate change, there must be adequate farmland and water supply to allow for transitions such as crop shifting (CDFA, 2013b).

Farmland conservation has been recognized in California state statute (box at right) as being beneficial to the economic and environmental well-being of the state. There are several ongoing state and federal initiatives that support farmland conservation in California. The Williamson Act, discussed below, is a program that has a long history in California. Other initiatives are emerging as new tools. Local initiatives and efforts of farmland conservation organizations are not included below, but they are crucial to future success.

Williamson Act

The California Land Conservation Act of 1965 (known as the Williamson Act) allows landowners to enter into restrictive land use agreements with local governments. The restriction on the landowner's property is in the form of a contract that limits the use of the land to agricultural production, compatible uses, or open space. In return the landowner benefits by having the value of property based on the value of its agricultural production and not its fair market

Statutory Support

The California Public Resources Code Division 10.1, Chapter 1 Article 10201

The Legislature hereby finds and declares all of the following:

(a) The agricultural lands of the state contribute substantially to the state, national, and world food supply and are a vital part of the state's economy.

(b) The growing population and expanding economy of the state have had a profound impact on the ability of the public and private sectors to conserve land for the production of food and fiber, especially agricultural land around urban areas.

(c) Agricultural lands near urban areas that are maintained in productive agricultural use are a significant part of California's agricultural heritage. These lands contribute to the economic betterment of local areas and the entire state and are an important source of food, fiber, and other agricultural products. Conserving these lands is necessary due to increasing development pressures and the effects of urbanization on farmlands close to cities.

(d) The long-term conservation of agricultural land is necessary to safeguard an adequate supply of agricultural land and to balance the increasing development pressures around urban areas.

(e) A program to encourage and make possible the long-term conservation of agricultural lands is a necessary part of the state's agricultural land protection policies and programs, and it is appropriate to expend money for that purpose. A program of this nature will only be effective when used in concert with local planning and zoning strategies to conserve agricultural land.

(f) Funding is necessary to better address the needs of conserving agricultural land near urban areas.

value which always includes some speculative value. Williamson Act contracts are termed "evergreen contracts" and have initial terms of 10 or 20 years. The contracts are considered to be evergreen because they self-renew each; i.e., another year is added as the previous year expires. Farmland can be removed from the program in two ways; either through non-renewal at the end of the contract term (9-19 years) to expire or, in some circumstances, the contract can be canceled immediately but with significant financial penalties (California Department of Conservation, 2014).

In 1971 additional legislation titled The Open Space Subvention Act allowed local governments to receive compensation for lost property tax revenues associated with Williamson Act. Funding for those the payments was terminated in 2009 (California Department of Conservation, 2014). Consequently the lack of funds reduces the incentive for local jurisdictions to participate in Williamson Act contracts and new enrollments have declined statewide. In fact, the total land under Williamson Act contracts has been declining since 2005 (California Department of Conservation, 2013).

Appendix B shows the land under Williamson Act contracts in California. While these contracts may not necessarily be permanent, participating landowners have protected 13.5 to 16 million acres, including two-thirds of our prime farmland, for nearly half of a century.

Assembly Bill 857 of 2002

Assembly Bill 857, passed in 2002, set planning priorities for the State of California. The statute identified the conservation of farms and working landscapes as a priority, along with infill and efficient development. AB 857 mandates that the State's planning activities support these goals in the Five-Year Infrastructure Plan by the Department of Finance and the Environmental Goals and Policy Report published by the Governor's Office of Planning and Research. AB 857 aims to ensure that

Assembly Bill 857 of 2002

Government Code Section 65041.1

(a) To promote infill development and equity by rehabilitating, maintaining, and improving existing infrastructure that supports infill development and appropriate reuse and redevelopment of previously developed, underutilized land that is presently served by transit, streets, water, sewer, and other essential services, particularly in underserved areas, and to preserving cultural and historic resources.

(b) To protect environmental and agricultural resources by protecting, preserving, and enhancing the state's most valuable natural resources, including working landscapes such as farm, range, and forest lands, natural lands such as wetlands, watersheds, wildlife habitats, and other wild lands, recreation lands such as parks, trails, greenbelts, and other open space, and landscapes with locally unique features and areas identified by the state as deserving special protection.

(c) To encourage efficient development patterns by ensuring that any infrastructure associated with development that is not infill supports new development that uses land efficiently, is built adjacent to existing developed areas to the extent consistent with the priorities specified pursuant to subdivision (b), is in an area appropriately planned for growth, is served by adequate transportation and other essential utilities and services, and minimizes ongoing costs to taxpayers.

state capital funding remains in line with the named planning priorities (Jouganatos, 2013). This policy provides strong statutory support for farmland conservation efforts statewide. (See the box on page 15 for the text of AB 857).

Global Warming Solutions Act (AB 32) Scoping Plan update 2014

Assembly Bill 32, The Global Warming Solutions Act of 2006, mandated that California reduce greenhouse gas emissions to 1990 levels by the year 2020. This aggressive goal exemplifies California's leadership in environmental issues and has pushed state agencies to determine and prioritize actions that can help achieve both short-term and long-term emission reduction goals.

The California Air Resources Board (CARB) recognized the role of farmland in mitigating greenhouse gas emissions in the 2014 Scoping Plan Update. CARB is required to update the plan every five years in accordance with AB 32. The 2014 plan update contains recommendations that are designed to reduce greenhouse gas emissions beyond 2020, into 2030 and 2050. One recommendation for agriculture is the implementation of an interagency workgroup to "engage local and regional land use planning agencies in establishing a coordinated local land use program to develop recommendations and targets for incorporating farmland conservation in local and regional land use planning" (California Air Resources Board, 2014).

Strategic Growth Council Activities

The Strategic Growth Council (SGC) is a cabinet-level committee that was formed in 2008 with the passage of Senate Bill 732 (Chapter 729, Statutes of 2008). The SGC has the purpose of coordinating state agency activities that support the following goals:

- Improve air and water quality
- Protect natural resources and agriculture lands
- Increase the availability of affordable housing
- Promote public health
- Improve transportation
- Encourage greater infill and compact development
- Revitalize community and urban centers
- Assist state and local entities in the planning of sustainable communities and meeting AB 32 goals.

The Secretary of the California Department of Food and Agriculture serves as a member of the SGC along with secretaries and directors from several other state agencies.

The Strategic Growth Council oversees the Affordable Housing and Sustainable Communities Program (AHSC). Part of AHSC is the Sustainable Agriculture Land Conservation Program (SALC), which was allocated $5 million in the 2014-2015 fiscal year from the Greenhouse Gas Reduction Fund (GGRF).The SALC program includes $1 million for a new grant program that will disperse funds to cities and counties in collaboration with other partners for farmland conservation planning. A second component of the program includes $4 million for the purchase of agricultural conservation easements. In future years, the program will also include a third component, payments to landowners for utilizing management practices that reduce greenhouse gas emissions.

The Strategic Growth Council adopted the guidelines for the SALC at its January 20, 2015 meeting. (California Strategic Growth Council, 2014).

Federal Agricultural Conservation Easement Program (ACEP)

In the 2014 Farm Bill, California was designated $22.3 million dollars for the 2014 fiscal year for conservation easements on wetlands and agricultural land, including cropland and grassland. The USDA Natural Resources Conservation Agency (NRCS) administers the Agricultural Conservation Easement Program (ACEP) and makes financial assistance available toward the purchase of agricultural easements. State and local governments, Indian tribes, and non-profit organizations are eligible to apply for the funding. NRCS will provide awardees up to 50% of the purchase price of the easement or up to 75% if the land is determined to be Grassland of Special Environmental Significance (USDA NRCS, 2014).

CONSERVATION EFFORTS ELSEWHERE

Various tools have been utilized for the purpose of farmland conservation in the United States; some simplified descriptions are listed below in Table 2.

Table 2. Summary of several farmland conservation tools (Nelson, 2002)**.**

Agricultural Zoning	Differential Assessment Programs	Purchase of Development Rights	Transfer of Development Rights
Agricultural land is zoned for agricultural use; other land uses are restricted or prohibited. The benefit of this approach is that farmland can be protected in large tracts. One drawback is that the protection is not necessarily permanent as zoning can be changed to accommodate development pressures.	Contracts are established between the government and landowner. The landowner agrees to maintain agriculture as the land use in return for property tax reductions. This is a voluntary action and contracts can expire or be cancelled.	The landowner sells the development rights, defined as the right to build on the property, to a government or private organization. The landowner maintains all other rights of the property including the right to sell the property. The property is permanently protected from development.	The development rights, defined as the right to build on the property, are sold and designated to another property. An organizing program designates areas of land which may sell their development rights, the sending areas, and areas that may receive the development rights, the receiving areas. This type of program strategically guides development and protects land that is priority for conservation.

Farmland conservation strategies vary throughout the United States. A few state programs are highlighted below to illustrate how approaches in policy and funding are different.

PENNSYLVANIA

Pennsylvania's farmland conservation program, the Pennsylvania Agricultural Conservation Easement Purchase Program, is partially funded through a cigarette tax, amounting to $20.5 million per year. The funds are distributed to counties who then purchase easements from farmers. The program is very popular, with more farmers wishing to participate than funds allow. In order to participate, farms must be in an "Agricultural Security Area," which are designated by county advisory committees. Farms are then are prioritized for participation based on soil quality, size, farm stewardship practices, and the likelihood of conversion to development. According to the program's 2013 annual report, a total of 484,270 acres have been placed under permanent conservation easements since the program's establishment in 1989 (Pennsylvania Department of Agriculture, 2014; Pennsylvania Department of Agriculture, 2015).

Oregon

The goal of Oregon's farmland protection policy is the "preservation of a maximum amount of the limited supply of agricultural land." Oregon utilizes a zoning approach for conserving farmland, requiring counties to incorporate farmland protection into regional plans. All counties in Oregon evaluate and designate the quality of land for farming. The highest quality farmland is zoned as "Exclusive Farm Use". What makes Oregon's agricultural zoning program different from other zoning ordinances throughout the country is that a state level volunteer citizen commission, The Land Conservation and Development Commission (LCDC), oversees zoning activities, sets minimum parcel sizes for farmland, and defines appropriate uses for exclusive agricultural use designations. Where most states use voluntary programs to incentivize landowners to maintain agriculture or open space on their property, in Oregon zoning ultimately determines which parcels are allowed for conversion and the LCDC determines the amount of land that is able to be released for development (Alterman, 1997; Oregon Department of Land Conservation and Development, 2015). Of Oregon's approximately 61 million acres of land, 16.1 million acres (26%) are designated as "Exclusive Farm Use" (Oregon Department of Land Conservation and Development, 2015).

Connecticut

The State of Connecticut is unique in that it has a published *goal* of protecting 130,000 acres of land from development, with 85,000 of those acres being cropland. The Connecticut Department of Agriculture administers the Connecticut Farmland Preservation Program and purchases easements for farms that volunteer for the program. Since 1978 over 37,000 acres of farmland have been preserved through the program (Connecticut Department of Agriculture, 2014).

International Efforts

European Union

Farmers within the European Union often are provided economic support through the Common Agriculture Policy (CAP). This policy provides income to farmers who manage their land to support biodiversity and other environmental benefits which are outlined in CAP. It is likely that this policy does remove some economic pressure from farmers in a way that supports farmland preservation (Cotteleer et al, 2007). Each nation within the European Union has unique strategies for farmland conservation. In Britain the focus of farmland preservation is not for the purpose of agricultural productivity but instead for the intrinsic value of open space and for the environmental benefits that are provided by farmland. In fact, farmland preservation is a secondary goal of urban planning or "urban restraint," which is enforced through the use of large greenbelts. In contrast to Britain, the Netherlands is both a densely populated *and* an agriculturally-intensive nation and has a successful history of farmland conservation through the use of strategic regional planning that also emphasizes urban restraint and the preservation of open space (Alterman, 1997).

Canada

Canada has a much smaller population density than the United States and a slower rate of farmland conversion to urban development. There is also less agriculturally suitable land available, but the agricultural sector contributes significantly to the Canadian economy. Canada is a large exporter of food products globally. For these reasons farmland conservation has been a priority in Canada. In

Ontario Canada, prime farmland is protected under the 1996 Provincial Policy Statement. Regional and local governments cannot develop prime farmland unless no other options to accommodate for growth are demonstrated. In Quebec, a provincial commission designates urban zones and agricultural zones; agricultural zones may not be developed. The commission considers the growth needs of municipalities over 20 years when zoning decisions are made (Alterman, 1997).

CHINA

China passed the Basic Farmland Protection Regulation in 1994 after a drastic loss of farmland in the country. From 1979 to 1995 China lost 14.5 million hectares (35.8 million acres) of farmland during a time of explosive economic growth and industrialization; food security became a concern as imports of grain expanded. The Farmland Protection Regulation required counties to create two types of farmland protection areas in their jurisdictions; (1) the highest quality farmland, which was prohibited from development and (2) moderately productive farmland, which could be developed after significant planning. Additionally, if infrastructure projects unavoidably took farmland from production, then new farmland must be put into production elsewhere. This is called "dynamic balance." The New Land Administration Law of 1999 strengthened the dynamic balance policy. Some have noted that a fault of this policy is that farmland that is taken out of production is not always replaced with farmland of equal quality and productivity (Lichtenberg and Ding, 2008; Li, 2014).

CONCLUDING REMARKS

Farmland on urban edges is most at risk of conversion. Farmers on the urban edge often find themselves in conflict with urban or suburban neighbors. Common concerns for the agricultural operators include vandalism, trespassing, and increased regulation on farming activities. For urban neighbors issues may include dust, odor, late night operations, and chemical use (Sokolow 2003). Land speculation and development prices also create a situation in which there is a disincentive for farmers to continue farming. As farmers experience this pressure they may begin to invest less in their farming operation since they no longer envision farming for the long-term. This has been described as the "impermanence syndrome;" the idea that the insecurity of farmland may itself result in reduced agricultural productivity from existing farms (Sokolow, 2003; Lynch, 2008; Swan, 2012). Regional planning efforts can help to alleviate some of the problem of the impermanence syndrome in several strategic steps; (1) identification of prime farmland most at risk of development; (2) defining urban boundaries with consideration toward preserving prime farmland; (3) reducing fragmentation of prime farmland; and (4) focus on increased urban efficiency and infill.

California is a vital food production region, not only nationally, but globally. As the effects of climate change become more pronounced and the world's population grows, food security will become increasingly important.

In recent years, Americans have become more conscious of the quality and sources of their food supply. Public concern has increased about wellness and the importance of the nutrition provided by fresh fruits, vegetables, and proteins such as nuts, dairy, eggs, and lean meats. The California Department of Food and Agriculture has supported initiatives and movements such as local farmers markets, farm-to-school lunch programs and established CDFA's Office of Farm to Fork. These types of initiatives indirectly provide support for farmland conservation as they raise public awareness of locally produced agriculture.

Agricultural organizations have advocated for farmland conservation policies and action plans for decades. California Agricultural Vision (Ag Vision), conceived by the California Department of Food and Agriculture and the State Board of Food and Agriculture, addressed farmland conservation and related issues in the report *California Agricultural Vision: Strategies for Sustainability* in 2010. Several of the strategies laid out in Ag Vision are related directly to farmland conservation, in particular Strategy 6, "Adopt a Policy of Conserving Agricultural Land and Water Resources". One objective included in Strategy 6 is the adoption of "a clear state policy that leads to the establishment of measureable goals for conserving California's agricultural and land and water resources, and an effective statewide strategy for achieving those goals" (American Farmland Trust, 2010). For the agricultural industry in California, farmland conservation is linked to other environmental and economic issues such as water security, farming practices that benefit the environment, and the development of renewable energy on farms. All of the aspirations in Ag Vision are inextricably tied to the sustainability of farmland in California.

Non-governmental organizations, interested in the issue of climate change have also documented the beneficial impacts of productive agricultural land in reducing in greenhouse gases. Below are

some of the policy initiatives advocated by these groups that would help achieve the food security and environmental goals outlined in this paper:

- Update California's General Plan Guidelines to include agricultural land conservation tools and model ordinances, including farmland mitigation policies (California Climate and Agriculture Network, 2015).
- Explore alternatives to address Williamson Act funding inadequacies.
- Increase funding for the Sustainable Agricultural Land Conservation Program (SALCP), funded by cap and trade revenue. (Twenty-two organizations spoke in support of the SALCP when the program's guidelines were adopted by the Strategic Growth Council in January 2015).

With the issues of nutrition and climate change at the forefront of public awareness as well as the inevitable challenge of global food security, California is exploring the opportunities for protecting valuable farmland and maximizing ecosystem services.

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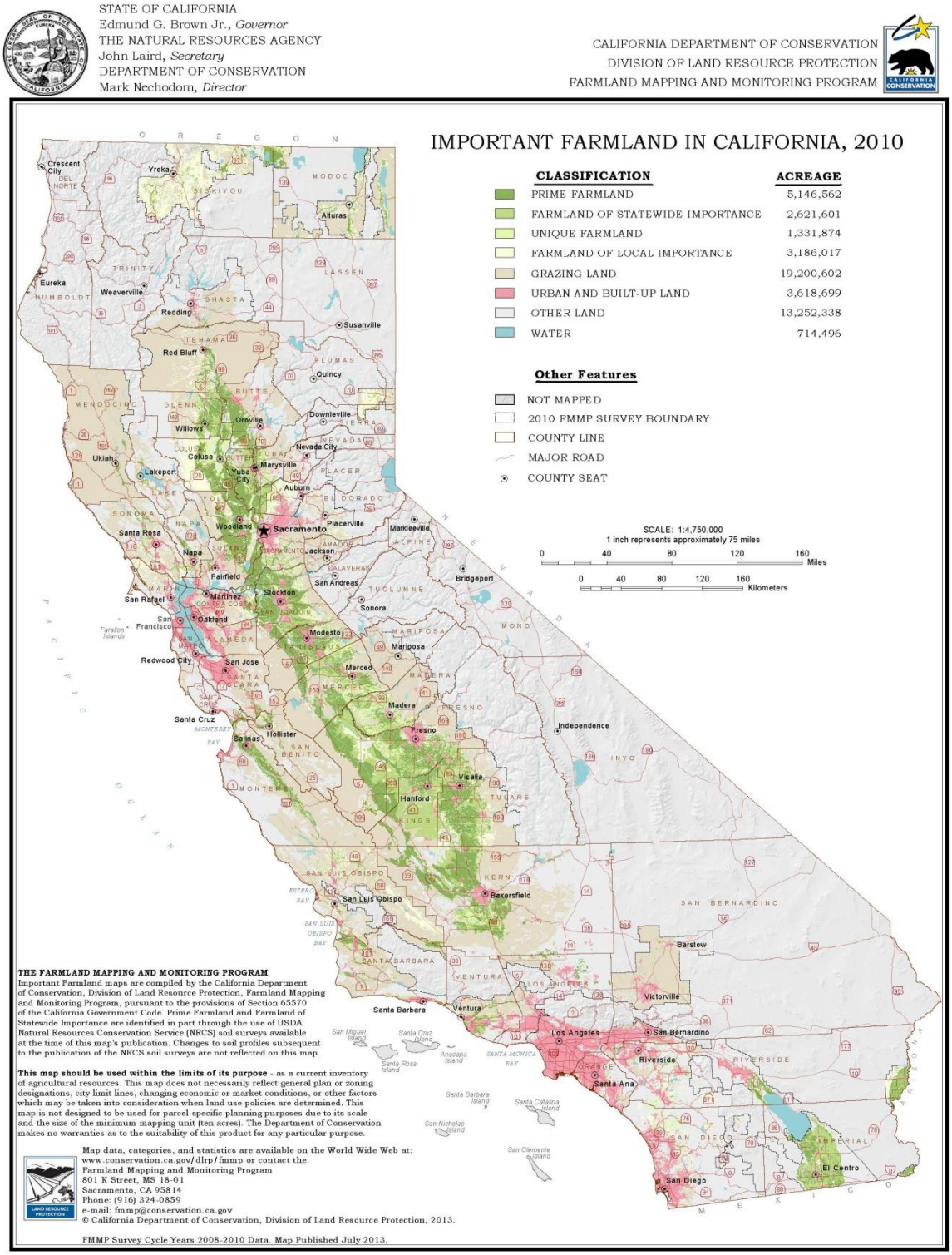
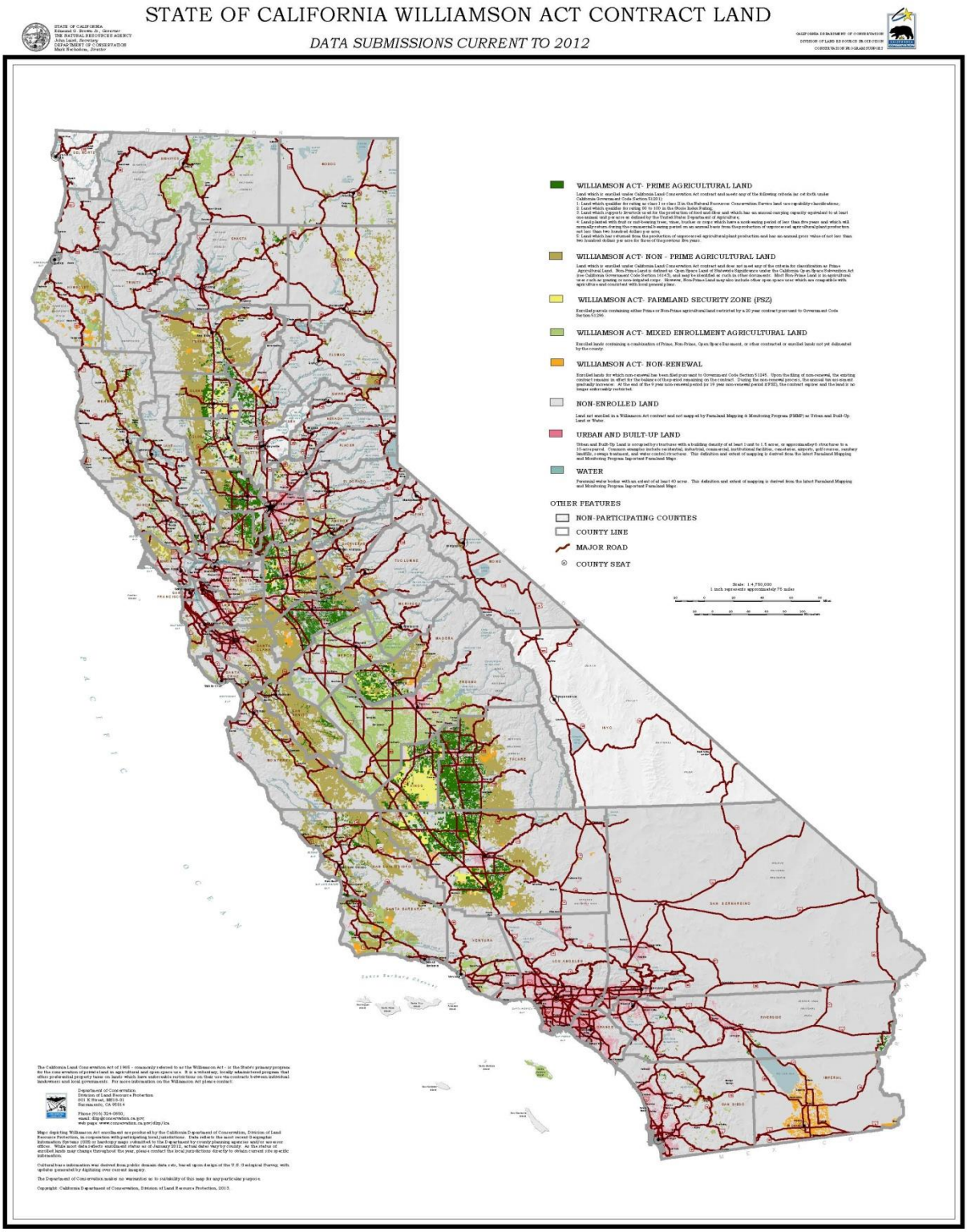
APPENDIX A: IMPORTANT FARMLAND MAP, 2010



APPENDIX B: LAND UNDER WILLIAMSON ACT CONTRACTS, 2012