Agricultural Land Conservation:
An Important Part of California's Climate Strategy

A White Paper by
American Farmland Trust

April 2016

A Research Report of the
HELEN K. CAHILL CENTER FOR
FARMLAND CONSERVATION POLICY INNOVATION

American Farmland Trust
SAVING THE LAND THAT SUSTAINS US

About the Helen K. Cahill Center for Farmland Conservation Policy Innovation

The Helen K. Cahill Center for Farmland Conservation Policy Innovation is the research and educational arm of American Farmland Trust in California. Its namesake, Helen Kennedy "Peggy" Cahill (1916-2013), was a proud fourth generation descendant of California pioneers who in 1849 founded the City of Stockton. A teacher, outdoors enthusiast and philanthropist, Peggy had an abiding interest in the conservation of farmland, especially in the San Joaquin Valley. In her memory, her family has endowed the Cahill Center as a living legacy for future generations who will depend on the land that feeds and sustains us.

Agricultural Land Conservation: An Important Part of California's Climate Strategy

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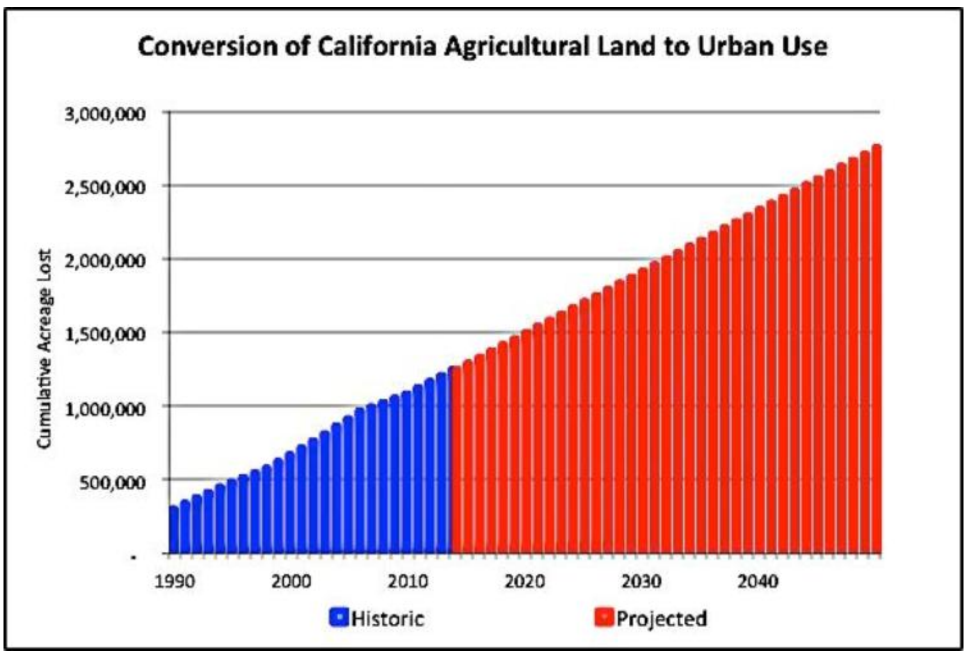
A Growing Consensus for Addressing Climate by Conserving Agricultural Land

There is a growing consensus that minimizing the future urbanization of agricultural lands and providing long-term protection for these lands are important, if not essential, to achieving California's greenhouse gas reduction goals[2].

Since the mid-1980's, an average of nearly 42,000 acres of the state's agricultural land has been converted to urban uses annually, a cumulative total of more than one million acres. If this trend continues, California will lose another 1.4 million acres of agricultural land by 2050.[3]

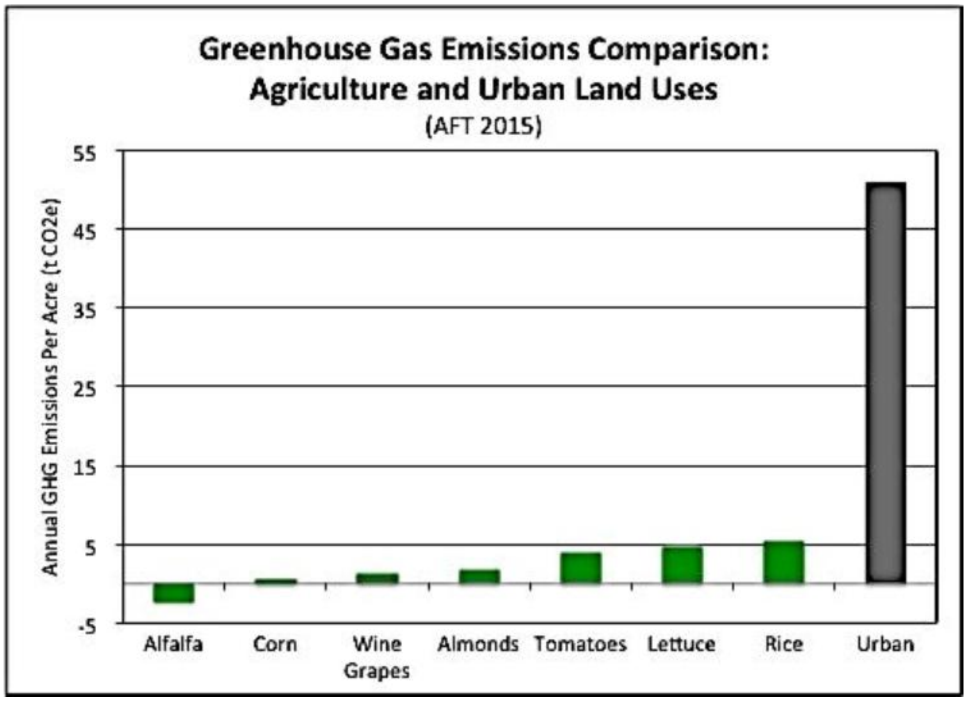


[1] AFT gratefully acknowledges the assistance of Louise Jackson, Stephen Wheeler, Joe DiStefano and Jeanne Merrill in reviewing this paper. The conclusions are solely those of AFT and not necessarily those of the reviewers.

[2] Governor Brown's Executive Order B-30-15 calls for a reduction in greenhouse gas emissions of 40% below 1990 levels by 2030. This goal has also been incorporated into SB 32 (Pavley) now under consideration by the state legislature.

[3] Calculated using data from the Farmland Mapping & Monitoring Program, Division of Land Resource Protection, Department of Conservation, California Natural Resources Agency.

The groundbreaking research done by Professor Louise Jackson and her colleagues at U.C. Davis (2012) was the first to establish a connection between urbanization of farmland and the increase in greenhouse gas emissions. Their work found that in Yolo County greenhouse gas emissions from urban uses were roughly 70 times greater on a per acre basis than those from agricultural operations.[4] A later study (2015) done for American Farmland Trust reached a similar conclusion after looking at emissions from the state's leading crops and cities throughout California.[5]



The *First Update to the Climate Change Scoping Plan* (2014) cited Jackson in concluding: "Recent research has shown that greenhouse gas emissions from urban areas are much greater than those from agricultural lands on a per-acre basis. As California's population increases, pressures to convert agricultural croplands and rangelands to urban and suburban development also increase. Conservation of these lands will be important in meeting our long-term climate goals."[6]

Other public and private sector reports have also underscored the importance of conserving farmland. For example, the climate mitigation strategy recently outlined by the state Department of Conservation (2015) in *Safeguarding California*[7] summed up the

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[4] Louise Jackson, Van R. Haden, et al., *Adaptation Strategies for Agricultural Sustainability in Yolo County, California: A White Paper from the California Energy Commission's Climate Change Center*, U.C. Davis, July 2012.
[5] Steve Shaffer and Edward Thompson, Jr., *A New Comparison of Greenhouse Gas Emissions from California Agricultural and Urban Land Uses*, American Farmland Trust, February 2015.
[6] California Air Resources Board, *First Update to the Climate Change Scoping Plan*, May 2014, at 59.
[7] *Safeguarding California: Implementation Action Plans*, Agricultural Sector Plan, California Natural Resources Agency, March 2016, at 24. This report also includes a vivid and comprehensive description of the risks that climate change poses to California agriculture.

synergistic effect that farmland conservation could have in mitigation climate change: "Reducing the rate of farmland conversion will buffer against climate risks by supporting smart growth, reducing unsustainable sprawl, and promoting sustainable food systems and ecosystems. Farmland conservation is a critical component of ensuring food security. Since California Farmland is so unique, it will be imperative for California to have sufficient farmland in the right locations to allow for food production and flexibility as impacts of climate change become more severe."

A recent analysis of statewide land use patterns and future options by Calthorpe Analytics and Energy Innovations found that "implementation of smart land use policy, in combination with technological advances in the energy sector, will be critical for the state to achieve its ambitious 2030 de-carbonization target. The [more efficient] land use patterns studied here could lead to even larger carbon emissions reductions than estimated because they will also preserve more land in California for carbon sequestration." [8]

Perhaps most significantly, a study published by the Duke Nicholas School for Environmental Policy Solutions (2014) compared the greenhouse reduction potential of various agricultural practices documented in the scientific literature, concluding that: "Because average greenhouse gas emissions from urban land uses are orders of magnitude higher than those from California croplands (approximately 70 times higher per unit area), **farmland preservation, more than any of the other management activities, will likely have the single greatest impact in stabilizing and reducing future emissions** across multiple land use categories."[9]

Estimating Potential Greenhouse Gas Avoidance from Farmland Conservation

To estimate the potential of farmland conservation to contribute to the avoidance and/or reduction of greenhouse gas emissions, we made some calculations based on existing sources of data and what we believe to be conservative assumptions.

We used data on greenhouse gas emissions from the Jackson study (Appendix, Table 2) to calculate that emissions from urban land uses average 60.7 tons per acre per year greater than those from crop production, and 61.2 tons per acre per year greater than those from rangeland. However, the conversion of cropland or rangeland to urban use does not necessarily increase greenhouse gas emissions by these amounts; nor does preventing such conversion result in comparable emissions savings. This is because preventing the conversion of agricultural land to urban use does not – and should not – prevent the economic activity that would have occurred on that land. It must go somewhere and, given the traditional pattern of city-centered development in California,

[8] Chris Busch, Erika Lew and Joe DiStefano, Calthorpe Analytics and Energy Innovation Policy & Technology, LLC, *Moving California Forward: How Smart Growth Can Help California Reach Its 2030 Climate Target While Creating Economic and Environmental Co-Benefits, Summary for Policymakers*, Sep. 2015, at 1.

[9] Steven W. Culman, Van R. Haden, Toby Maxwell, Hannah Waterhouse and William Horwath. *Greenhouse Gas Mitigation Opportunities in California Agriculture: Review of California Cropland Emissions and Mitigation Potential*. Duke University, 2014, at 35.

and the fact that most cities in agricultural areas are surrounded by farmland, it is likely to occur on urban edge farmland but at higher densities, thus resulting in the conversion of less agricultural land.

Because greenhouse gas emissions from urban land uses are known to vary with the density of development, the concentration of economic activity will influence what percentage of the difference between urban emissions and those from cropland and rangeland will actually be avoided. To estimate this percentage, we used data provided by Calthorpe Analytics on average population densities and per acre greenhouse gas emissions from various types of urban land uses in California: high-density urban, compact urban-suburban and standard suburban development. (Appendix, Table 3) We compared the emissions from development spread out over agricultural land at standard suburban densities to emissions from a scenario in which a comparable population was accommodated in a mix of 10% high-density urban-suburban and 90% compact urban-suburban patterns. Based on these assumptions, we calculated that the more compact scenario would reduce greenhouse gas from the same population by about 55 percent. This percentage was then applied to the greenhouse gas differential figures from the Jackson study to conclude that saving an acre of cropland would avoid an average of 33.24 t CO_2e per acre per year, while saving an acre of rangeland would save 33.51 t CO_2e per acre per year.

We then used these averages to compare the greenhouse gas implications of two statewide farmland conversion scenarios. The first was an extension of the status quo trend (Appendix, Table 4) out to the year 2050. The second was based on the goals of reducing statewide farmland conversion by 50% compared with the current trend by the year 2030 and further reducing it by 75% by the year 2050. (Appendix, Table 1) In the second scenario, we assumed that 74% of the agricultural land saved would be cropland and 26% would be rangeland, reflecting the historic statewide conversion trend. We further assumed that the conversion rate would steadily and consistently decline from year to year until the goals were reached. To calculate the cumulative greenhouse gas emissions avoided, we assumed that the annual emissions avoided by preventing the conversion of agricultural land would continue to accrue each year from the date that the land was saved from conversion (and further assuming, of course, that it would not be developed). Hence, farmland conversion avoided in 2015 would accrue greenhouse gas benefits for 35 years, out to the year 2050. The year-to-year calculations are shown in Table 1 of the Appendix, while a summary is provided in the table below.

Comparison of Agricultural Land Conversion Scenarios 2015-2050

Scenario	Acres Developed	Cumulative Greenhouse Gas Emissions (t CO_2e)
Current Trend	1,459,500	575,480,086
50%-75% Reduction Goal	766,238	260,288,381
Savings by Meeting Goal	693,263	315,191,705

The greenhouse gas savings that would be achieved by meeting the foregoing farmland conversion avoidance goals would be comparable to eliminating about 767 billion vehicle miles travelled or taking 1.9 million cars off the road every year between now and 2050.[10] (Appendix, Table 5)

Strategies to Achieve Avoided Farmland Conversion Goal

American Farmland Trust respectfully suggests that the foregoing analysis be the starting point for establishing a definitive statewide goal of reducing the annual rate of agricultural land conversion as a means of avoiding an unnecessary and avoidable increase in greenhouse gas emissions. This is consistent with the recommendation of the First Update of the Climate Scoping Plan: [The state should] "establish agriculture sector greenhouse gas emission reduction planning targets for the mid-term time frame and 2050."

The Governor's November 2015 Environmental Goals and Policy Report[11] also endorsed this step: "We need to set development goals that are compatible with the State's long-term climate change goals established by the State's five pillars for the future. These development goals are to:

- Reduce land consumed for development 50 percent relative to today's trend by 2050
- Reduce vehicle miles traveled per capita at least 15 percent by 2020 and 25% by 2040
- Prioritize the conservation of high quality agricultural land, including rangelands."

This paper suggests that the goal for reducing the rate conversion of agricultural land to urban use should be more ambitious than what the EGPR suggests, including a 50% reduction by 2030 and a 75% reduction by 2050. While this would save nearly 700,000 acres, it would still result in the conversion of more than three-quarters of a million acres of California agricultural land by mid-century. The impact of such a loss on California agriculture, not to mention on our climate, will be substantial. For comparison, the fallowing of about 500,000 acres of farmland due to drought in 2015 resulted in a $2.7 billion loss to agriculture and the state's economy – in just one year.[12] This underscores the need for an ambitious and targeted goal for avoiding the urbanization of farmland that will take into effect the impacts of climate change, including the prospect that additional farmland will be no longer be suitable for agricultural use. The relative productivity, vulnerability and resiliency of agricultural land should be considered in translating a statewide goal into regional and perhaps even local goals in the most important agricultural areas of the state.

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[10] *Greenhouse Gas Emissions from a Typical Passenger Vehicle*, U.S. Environmental Protection Agency, Office of Transportation and Air Quality, May 2014.

[11] Office of Planning & Research, A Strategy for California @ 50 Million: Supporting California's Climate Change Goals, November 2015, at 2.

[12] R.A. Howlett, et al., *Economic Analysis of the 2105 Drought for California Agriculture*, U.C. Davis, August 2015.

Achieving regional and local goals to reduce the rate of farmland conversion in California will require a determined, concerted and creative effort by state agencies and local governments as well as the open-minded cooperation of developers and landowners. Despite all the statutes and ordinances now on the books and the tens of millions of dollars that have been spent on land use planning, tax incentives and easement acquisition, the annual statewide rate of farmland conversion in has not appreciably declined since records were first kept more than three decades ago.

On the other hand, there seems to be growing interest in increasing urban and suburban densities, which would result in the consumption of less land – mostly agricultural land – for each new person, job and dollar of economic activity. Some of the reasons behind this are the rising cost of land, a shift in demographics and the housing market, and a growing recognition that low-density urban sprawl has many unnecessary public costs – among them, of course, excessive greenhouse gas emissions – that local governments and taxpayers are increasingly hard-pressed to afford. Harnessing this trend by promote more urban infill and compact, affordable suburban housing is a promising strategy for conserving farmland. But it must be accompanied by an equally robust, affirmative effort to prevent unnecessary development of agricultural land and, ideally, to provide permanent protection of the best land at the greatest risk.[13]

A number of local communities in California have effectively reduced or practically eliminated farmland conversion – and have done so while enjoying continued economic growth. Counties like Marin, Monterey, Napa, Sonoma, Ventura and Yolo – which together accounted for nearly 20% of the state's agricultural output in 2012 – are among the nation's leaders in farmland conservation. Most of them combine effective infill and urban growth management policies with robust agricultural easement acquisition efforts to prevent sprawl, offer long-term protection to agricultural land and spread the cost among landowners and the general public.[14] These communities demonstrate not only that it is possible to conserve a significant amount of farmland in California, but also how to do it.

There is much that the state could do using existing authorities and policies to encourage more local communities to embrace the kind of strategies that have proved effective at conserving farmland. It could begin by implementing a recommendation of the First Update of the Climate Change Scoping Plan, namely:

> "Local and regional land use planning actions and policies need to more fully integrate and emphasize land conservation and avoided conversion of croplands, forests, rangelands, and wetlands. The California Natural Resources Agency, the California Environmental Protection Agency, CDFA, and ARB will convene an inter-

[13] See, Wheeler, S.M., M. Tomuta, V.R. Haden, and L.E. Jackson, *The Impacts of Alternative Patterns of Urbanization on Greenhouse Gas Emissions in an Agricultural County,* Journal of Urbanism: International Research on Placemaking and Urban Sustainability, *2013.*
[14] For details about how these programs work see, Edward Thompson, Jr., *Hybrid Farmland Protection Programs: A New Paradigm for Growth Management*, 23 William & Mary Environmental Law and Policy Review 831 (1999).

agency 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."[15]

The state could and should also take a close look at existing state policies and programs that are designed to reduce the conversion of farmland to urban use and propose improvements in implementation or the statutory authorities themselves that would make them more effective. The following are examples of changes in state policies and programs that should be considered:

Williamson Act – Increase tax incentives for enrollment of urban edge agricultural lands at risk of conversion. Link eligibility for those tax incentives to effective local land conservation policies as well as to landowner contracts.

Cortese-Knox-Hertzberg Act – Require a stronger showing of genuine need for LAFCO approval of expansion of spheres of influence and city limits. Require farmland mitigation as a condition of annexation. Extend these policies to development in unincorporated areas that could influence orderly urban growth.

California Environmental Quality Act – Require mitigation of all farmland conversion by avoiding the highest quality farmland, minimizing its conversion through higher densities and offsetting any unavoidable losses through easement acquisition.

AB 857 – Harness state investments in local infrastructure to the state planning priorities enumerated in this law: infill, efficient development, conservation of farmland and open space. Give priority to communities that have plans that will achieve farmland conservation-related greenhouse gas reduction goals.

SB 375 – Incorporate a land conservation element with explicit goals for reducing farmland conversion into Sustainable Communities Strategies.

California Farmland Conservancy Program – Increase funding, possibly combine with SALCP.

Sustainable Agricultural Land Conservation Program – Increase funding to at least $100 million per year. Allow more flexibility to fund acquisition of easements in areas formally designated as agricultural conservation areas to avoid their development.

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[15] *Id.,* at 61.

Conclusion

As many leading authorities have suggested, the Natural and Working Lands pillar of California's climate strategy should include an aggressive effort to reduce the conversion of agricultural land to urban uses. This effort should be guided by an ambitious but achievable goal of reducing the annual rate of farmland conversion at least 50 percent by 2030 and at least 75 percent by 2050. This would result in substantial greenhouse gas savings over time as well as maintain the land base on which carbon sequestration and additional emissions reductions can be achieved through improved agricultural management practices. In pursuit of this goal, state policies and investments should be harnessed to encourage local communities in the state's most important agricultural areas to follow the lead of those who have already achieved great success in reducing farmland conversion.

Please direct comments and questions to:

Edward Thompson, Jr.
California Director
American Farmland Trust
ethompson@farmland.org

American Farmland Trust is a national, nonprofit conservation organization established in 1980 to conserve agricultural lands, promote environmentally beneficial agricultural practices and help keep farmers and ranchers on the land. AFT works collaboratively with government and private partners to design creative solutions to agricultural resource conservation challenges and champions public policies that will effectively implement those solutions. For more information, please see: www.farmland.org.

Appendix to Agricultural Land Conservation as An Important Part of California's Climate Strategy

TABLE 1

Calculation of Statewide Greenhouse Gas Emissions Avoided by Reducing Agricultural Land Conversion by 50% by 2030 and 75% by 2050

Year	Projected Acres Converted Current Trend	Goal for Acres Converted in Year X *	Acres Avoided Conversion in Year X	Cumulative Acres Avoided Conversion			Statewide GHG Avoided in Year X (t CO2e)		
				Total	Cropland #	Rangeland #	From Cropland	From Rangeland	Total
2015	41,700	41,700	0						
2016	41,700	40,310	1,390	1,390	1,029	361	34,191	12,110	46,301
2017	41,700	38,920	2,780	4,170	3,086	1,084	102,572	36,330	138,902
2018	41,700	37,530	4,170	8,340	6,172	2,168	205,144	72,660	277,804
2019	41,700	36,140	5,560	13,900	10,286	3,614	341,907	121,099	463,007
2020	41,700	34,750	6,950	20,850	15,429	5,421	512,861	181,649	694,510
2021	41,700	33,360	8,340	29,190	21,601	7,589	718,005	254,309	972,314
2022	41,700	31,970	9,730	38,920	28,801	10,119	957,340	339,078	1,296,418
2023	41,700	30,580	11,120	50,040	37,030	13,010	1,230,866	435,958	1,666,824
2024	41,700	29,190	12,510	62,550	46,287	16,263	1,538,582	544,947	2,083,529
2025	41,700	27,800	13,900	76,450	56,573	19,877	1,880,489	666,047	2,546,536
2026	41,700	26,410	15,290	91,740	67,888	23,852	2,256,587	799,256	3,055,843
2027	41,700	25,020	16,680	108,420	80,231	28,189	2,666,875	944,576	3,611,451
2028	41,700	23,630	18,070	126,490	93,603	32,887	3,111,355	1,102,005	4,213,360
2029	41,700	22,240	19,460	145,950	108,003	37,947	3,590,025	1,271,544	4,861,569
2030	41,700	20,850	20,850	166,800	123,432	43,368	4,102,885	1,453,193	5,556,079
2031	41,700	20,329	21,371	188,171	139,247	48,925	4,628,568	1,639,384	6,267,951
2032	41,700	19,808	21,893	210,064	155,447	54,617	5,167,071	1,830,115	6,997,186
2033	41,700	19,286	22,414	232,478	172,033	60,444	5,718,396	2,025,388	7,743,784
2034	41,700	18,765	22,935	255,413	189,005	66,407	6,282,543	2,225,202	8,507,745
2035	41,700	18,244	23,456	278,869	206,363	72,506	6,859,511	2,429,557	9,289,069
2036	41,700	17,723	23,978	302,846	224,106	78,740	7,449,301	2,638,454	10,087,755
2037	41,700	17,201	24,499	327,345	242,235	85,110	8,051,913	2,851,892	10,903,804
2038	41,700	16,680	25,020	352,365	260,750	91,615	8,667,345	3,069,871	11,737,216
2039	41,700	16,159	25,541	377,906	279,651	98,256	9,295,600	3,292,391	12,587,990
2040	41,700	15,638	26,063	403,969	298,937	105,032	9,936,675	3,519,452	13,456,128
2041	41,700	15,116	26,584	430,553	318,609	111,944	10,590,573	3,751,055	14,341,628
2042	41,700	14,595	27,105	457,658	338,667	118,991	11,257,292	3,987,199	15,244,490
2043	41,700	14,074	27,626	485,284	359,110	126,174	11,936,832	4,227,884	16,164,716
2044	41,700	13,553	28,148	513,431	379,939	133,492	12,629,194	4,473,110	17,102,304
2045	41,700	13,031	28,669	542,100	401,154	140,946	13,334,377	4,722,878	18,057,255
2046	41,700	12,510	29,190	571,290	422,755	148,535	14,052,382	4,977,187	19,029,569
2047	41,700	11,989	29,711	601,001	444,741	156,260	14,783,209	5,236,037	20,019,245
2048	41,700	11,468	30,233	631,234	467,113	164,121	15,526,857	5,499,428	21,026,285
2049	41,700	10,946	30,754	661,988	489,871	172,117	16,283,326	5,767,360	22,050,687
2050	41,700	10,425	31,275	693,263	513,014	180,248	17,052,617	6,039,834	23,092,451
Cum Total	1,459,500	766,238	693,263	9,462,425	7,002,195	2,460,231	232,753,268	82,438,437	315,191,705

* Assumes annual rate of conversion reduced by 50% by 2030 and by 75% by 2050. Baseline is 41,700 annual average 1984-2010. See Table 4.

Assumes historic average ratio (74/26) of cropland to rangeland conversion 1984-2010 (FMMP)

Assumes a net savings of 55% of the difference between agricultural and urban emissions as a result of concentrating population on fewer acres.
Urban and agricultural emisssions from Jackson (2012) See Table 2. Percentage determined by using RapidFire model of Calthrope Analytics based on a land use mix of 10% urban infill and 90% compact urban-suburban as an alternative to development at the average statewide urban-suburban density. See Table 3.

TABLE 2

Average Per Acre GHG Emissions (Jackson)

Land Use	t CO2e/ac/yr
Cropland	0.81
Rangeland	0.32
Urban	61.5
Difference between Urban and Cropland	60.7
Difference between Urban and Rangeland	61.2

Emissions Saved by Avoiding Conversion *

of Cropland to Urban Use	33.24
of Rangeland to Urban Use	33.51

* Assumes that economic activity will occur on less land, reducing GHG emissions by 55% rather than eliminating all emissions from that activity. See Table 3.

TABLE 3

GHG Savings Achieved by Concentrating Population in a Mixed Urban & Urban-Suburban Configuration versus Standard Suburban

Attribute		Place Type			
		Urban	Compact Urban-Suburban	Mixed Urban & Urban-Suburban *	Standard Suburban
Population density **	(people per gross acre)	66.7	14.9	20.1	6.6
Acres needed to accommodate the same number of people at the density of each place type		1.0	2.3	2.1	10.1
GHG for place type #	t CO2e/ac/yr	278.1	78.5		41.1
GHG for same population		278.1	176.8		413.3
Population allocation ##		10%	90%		100%
GHG for population allocation		27.8	159.1	186.9	413.3
GHG from place type mix as percentage of Standard				45%	
GHG Savings from place type mix as percentage of Standard				55%	

* Mix of place types based on population allocation in row 9..

** Statewide averages 2012. (Calthorpe Analytics)

Statewide average emissions from passenger VMT, residential and commercial energy use in 2012. (Calthorpe)

Assumed percentage of population accommodated by each place type in Mixed Urban & Urban-Suburban Place Type

TABLE 4

Historic Converison of California Agricultural Land

Year	Cumulative Acres
1984-1990	305,875
1990-1994	454,095
1994-1998	579,839
1998-2002	763,847
2002-2006	967,682
2006-2010	1,084,734
Annual average	41,721

Source: Farmland Mapping & Monitoring Program,
Division of Land Resource Protection, Department
of Conservation, California Natural Resources Agency

TABLE 5

Comparison of Current Statewide Farmland Conversion Trend with Goal of Reducing Rate of Cconversion 50% by 2030

Scenario	Acres Developed 2015-2050	Cumulative Statewide GHG Emissions t CO2e
Current Trend	1,459,500	575,480,086
Goal of 50%-75% Reduction in Conve	766,238	260,288,381
Savings from Avoided Conversion Go	693,263	315,191,705

Equivalent VMT for avoided conversion *	766,889,792,502
Equivalent Cars/Year **	1,922,030

* Based on 0.000411 t CO2e per mile (EPA)
** Based on 11,400 miles per auto per year (EPA)