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# Mitigation vs. Adaptation: Transportation and Land-use Planning to Combat Climate Change

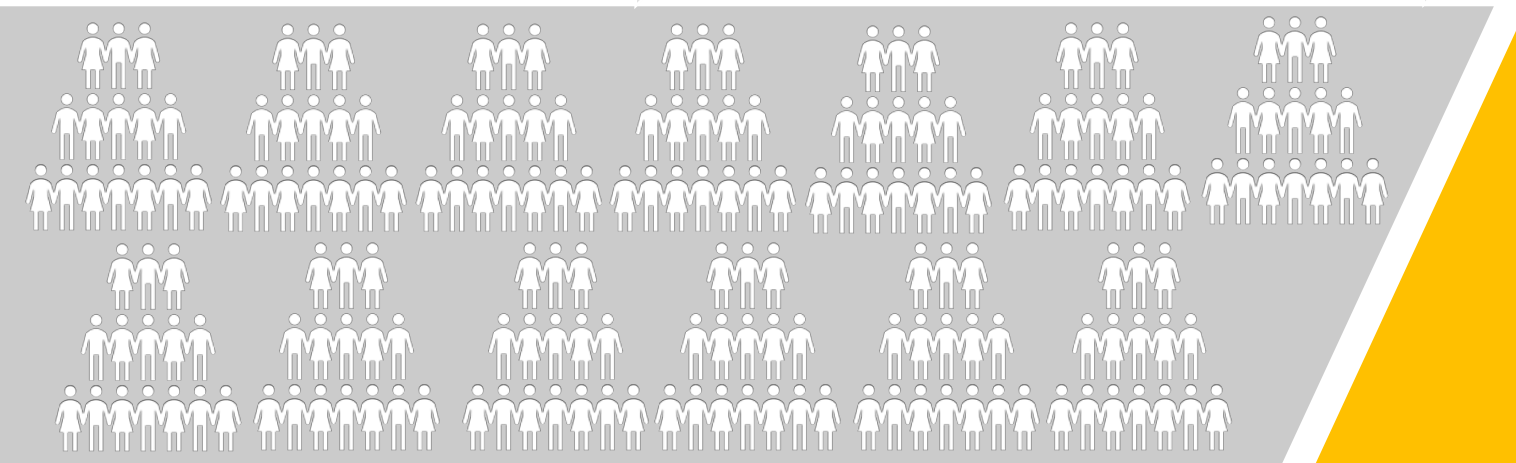
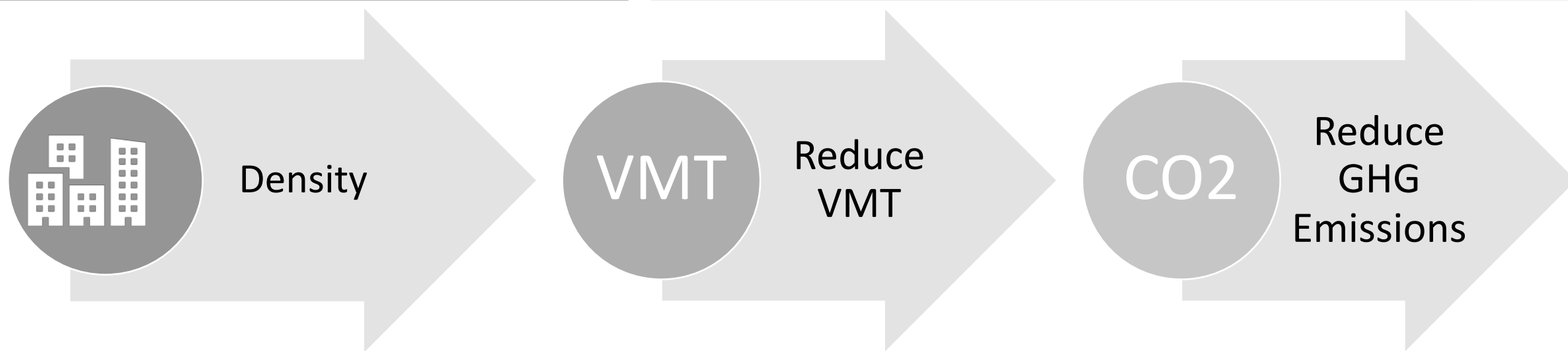
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June 04, 2020

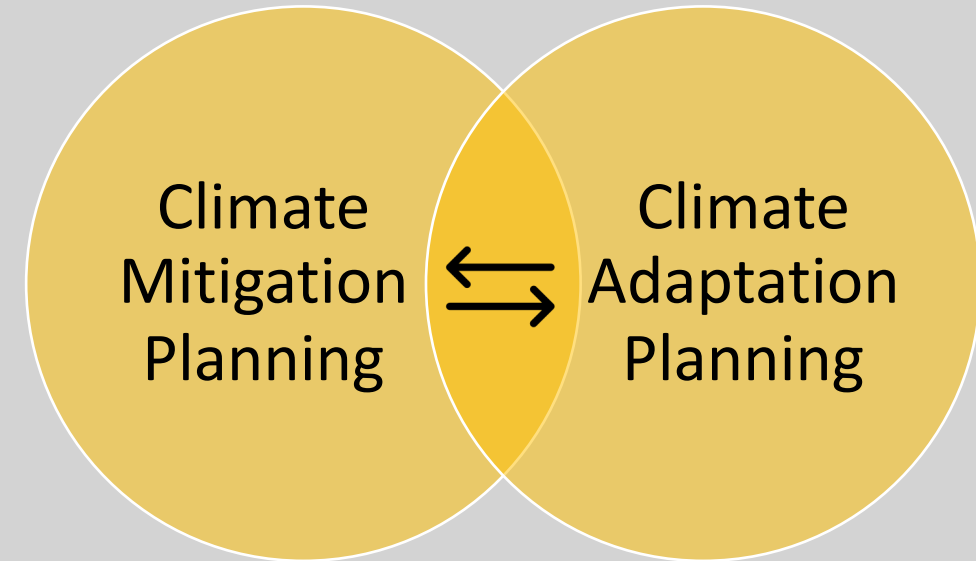


# The Problem



# An Introduction to “Integrated Actions”

- A central challenge for climate planning efforts has been identifying TLU strategies that simultaneously reduce GHGs (“mitigation”) and adapt communities so that they will be less affected by the adverse impacts of climate change (“adaptation”).
- Sets of policies that collectively address both mitigation and adaptation are known as “integrated actions.”

















## RESILIENCE THROUGH LOCAL FOOD

### LCFE1: Promote Low Carbon, Low Waste Lifestyles

Promote more sustainable food and drink options through campaigns, outreach events and community resources. Include all five pillars of the City's Sustainable Food Commitment: 1) reduce meat and dairy, 2) avoid processed foods, 3) eat organic, 4) eat local, and 5) reduce waste. Develop incentives and rewards programs to support the local food system and low carbon foods. Promote sustainable pet food through outreach and education.

Carbon Reduction Potential	Cost to City	Community Benefits	Lead	Partners	Status or Timeframe
	\$\$		OSE	FMD, EDD, OWB	Ongoing
	\$		OSE, PLD, CCS	CRD, HSD, OWB, Business, Nonprofits	Mid Term
	\$\$		OSE	FMD, OWB, Nonprofits	Mid to Long Term
	\$		FMD	HSD, OWB, Nonprofits	Mid to Long Term
	\$\$		PLD	OSE	Near Term
	\$		PLD	CPD	Near to Mid Term
	\$\$		OSE	Nonprofits	Near to Mid Term

## CARBON SEQUESTRATION & HEALTHY ECOSYSTEMS

### LCFE5: Climate Resilient Forest & Landscape Management

The updated Urban Forest Master Plan already addresses the effects of climate change and other potential threats to the urban forest. Assess pruning practices to preserve biomass and increase carbon sequestration potential. Encourage proper tree watering, fertilizer, maintenance and protection during construction. Establish a baseline of the energy used to build and maintain the City's urban forest and landscapes and develop a plan to reduce carbon emissions through maintenance and mulching.

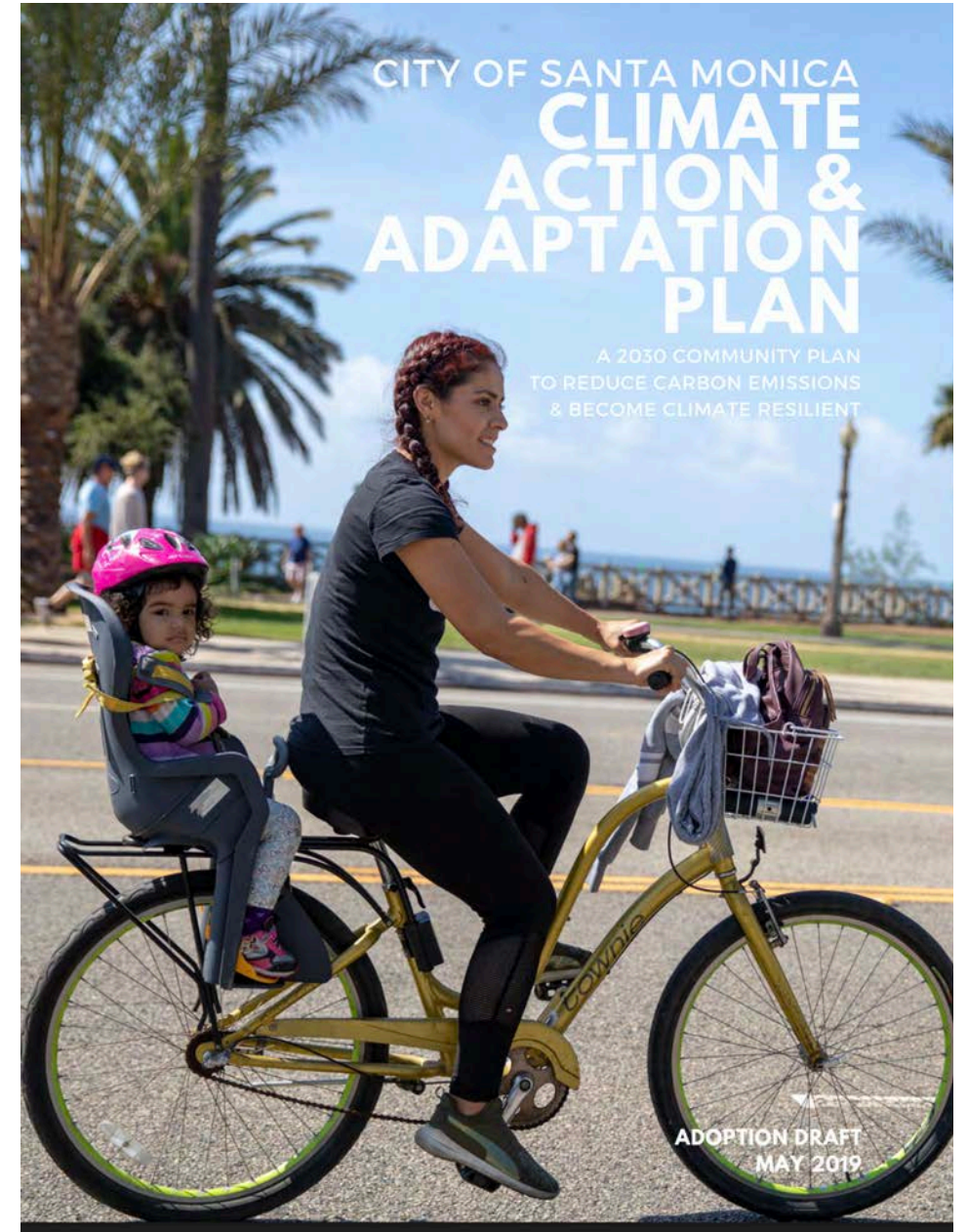
### LCFE6: Private Tree Preservation

Explore policies, incentives and funding mechanisms to encourage preservation of private trees, including revisiting the hedge ordinance.

### LCFE7: Local Carbon Sequestration

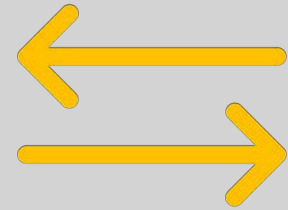
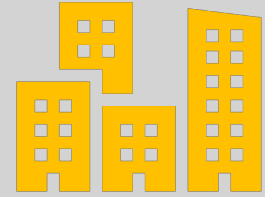
Explore opportunities to sequester carbon on all City properties, including Woodlawn Cemetery and Airport Park expansion, and local habitat systems, like sea kelp.

 Carbon Reduction Potential	Cost to City \$ Low \$\$ Medium \$\$\$ High	 Supports Paris Agreement	 Potential for Cost Savings, Local Investment and Jobs	 Potential to Address Equity	 Government Leadership
		 Advances Smart City Concepts	 Enhances Environmental Quality	 Enhances Community Resilience	 Improves Public Health & Safety



# Research Questions

1. In what ways do California cities incorporate integrated actions into their plans?
2. What are potential drivers of conflict between mitigation and adaptation in municipal plans?
3. What actions can the State of California take to help cities more effectively incorporate integrated actions?





# Research Methods

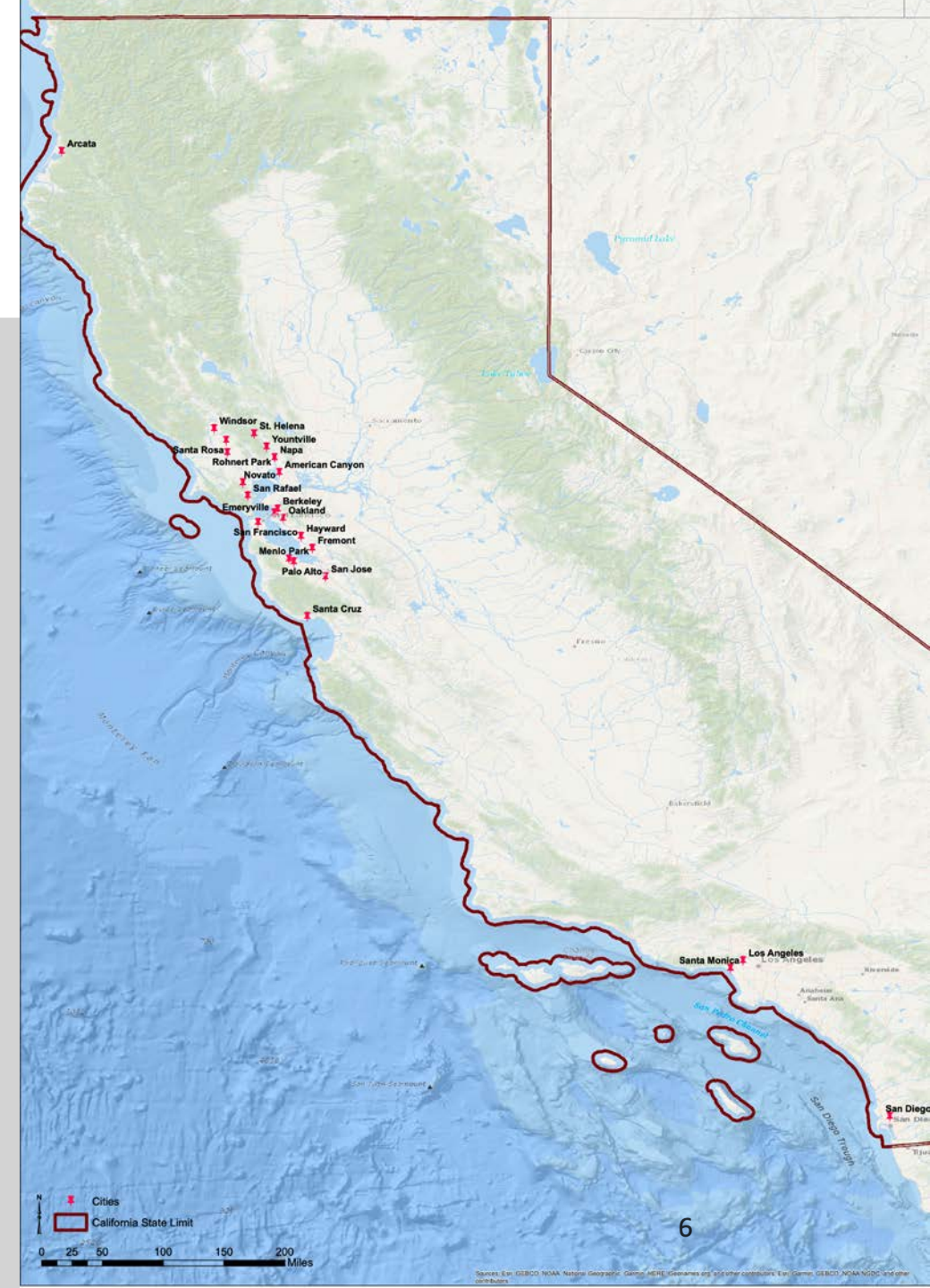


- Assessing climate planning efforts in 23 California cities known to have been leaders in climate planning for at least a decade.

- CAPs
- Climate adaptation plans
- Hazard mitigation plans
- Community resilience plans
- Sea level rise road maps and action plans
- General plans



- Interviewing 25 planners and other professionals at the city, regional, and state levels to better understand the challenges and opportunities involved in integrated actions for the TLU sector.



## Content Addressed in Climate Action Plans, by Municipality

		Transp. Infrastructure/Built Environment										Land-Use Policies										TDM						
City	Date	Bicycle	Pedestrian	Complete streets	Mass transit	Electric vehicles	Car-sharing	Low-carbon fuels	Autonomous vehicles	Climate-friendly infrastructure	Other	TOD	Infill development	ADU program	Housing development near activity centers	Housing affordability / jobs–housing balance	Preserve open space & environment	Urban growth boundaries	Parking requirements	Urban forest	Port policies	Other	TDM for employers	Programs to lessen driving	Education and outreach	Other	Regional collaboration	Total
American Canyon	2012									✓																		1
Arcata	2006	✓	✓		✓							✓	✓		✓					✓			✓	✓	✓		✓	13
Berkeley	2009	✓	✓	✓	✓		✓					✓			✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	17
Emeryville	2016	✓	✓		✓	✓		✓		✓		✓			✓		✓		✓	✓			✓	✓	✓	✓	✓	17
Fremont	2012	✓	✓		✓	✓		✓				✓			✓								✓	✓	✓	✓	✓	13
Hayward	2009	✓	✓	✓	✓					✓		✓			✓	✓			✓				✓	✓		✓	✓	15
Los Angeles	2007; 2019 <sup>a</sup>	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓		✓	✓	21
Menlo Park	2009; 2015 <sup>a</sup>	✓	✓		✓	✓	✓			✓		✓			✓									✓				12
Napa	2012	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓			✓			✓	✓	✓		✓	19
Novato	2009	✓	✓	✓	✓	✓		✓		✓		✓	✓		✓	✓			✓	✓			✓	✓	✓			16
Oakland	2012; 2018 <sup>a</sup>	✓	✓	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓			✓	✓	✓		✓	✓	✓	✓	21
Palo Alto	2016	✓				✓	✓			✓		✓	✓		✓	✓				✓				✓	✓	✓	✓	13
Rohnert Park	2007									✓														✓				2
Saint Helena	2009																											1
San Diego	2015	✓	✓	✓						✓		✓			✓	✓				✓				✓				10
San Francisco	2004	✓	✓		✓	✓	✓					✓			✓		✓			✓	✓			✓	✓	✓	✓	16
San José	2018	✓	✓		✓	✓		✓		✓	✓	✓	✓		✓					✓			✓	✓	✓	✓	✓	17
San Rafael	2009; 2019 <sup>a</sup>	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓		✓					✓			✓	✓	✓	✓	18
Santa Cruz	2012	✓	✓	✓							✓	✓	✓	✓	✓									✓		✓	✓	14
Santa Monica	2013; 2019 <sup>a</sup>	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓			✓		✓				✓		✓				16
Santa Rosa	2012	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓		✓		✓				✓		✓	✓	19
Windsor	2012									✓									✓					✓				2
Yountville	2016	✓	✓	✓	✓	✓	✓				✓				✓	✓		✓		✓			✓	✓	✓	✓	✓	13
		19	18	10	16	14	10	10	0	15	6	16	11	3	15	11	6	2	12	10	3	15	22	18	14	11	15	

## Summary of Risks Identified in Adaptation Plans

City	Earthquake	Flooding and/or Tidal inundation	Mudslides/landslides	Drought	Urban-wildland interface fires	Liquefaction	Tsunami	Dam/levy failure	Sea level rise	Hazardous materials release	Extreme/adverse weather	Heat waves/ Extreme heat	Urban conflagration/Fire	Terrorism/Biological threats	Civil unrest/Economic inequality	Erosion/Overtopping	Saltwater intrusion
Arcata	✓	✓					✓		✓							✓	✓
Berkeley	✓		✓	✓	✓	✓	✓		✓	✓		✓		✓			
Emeryville	✓	✓								✓			✓	✓	✓		
Fremont	✓	✓	✓	✓		✓	✓		✓			✓	✓				
Hayward	✓		✓	✓	✓	✓	✓		✓	✓							
Los Angeles	✓	✓	✓	✓	✓		✓	✓	✓		✓						
Novato	✓	✓	✓		✓												
Oakland	✓	✓		✓	✓	✓			✓						✓		
Palo Alto	✓	✓	✓	✓	✓			✓			✓						
Rohnert Park	✓	✓	✓	✓	✓	✓		✓		✓							
San Francisco	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓			
San Rafael		✓		✓				✓	✓		✓	✓	✓				
Santa Cruz	✓	✓	✓	✓		✓	✓	✓								✓	
Santa Monica	✓	✓	✓		✓		✓				✓						
Santa Rosa	✓	✓	✓	✓	✓	✓		✓		✓							
Windsor	✓	✓	✓	✓	✓	✓		✓			✓	✓					
<b>TOTAL</b>	<b>15</b>	<b>14</b>	<b>12</b>	<b>12</b>	<b>10</b>	<b>9</b>	<b>8</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>

Notes: Seven of the selected cities did not have adaptation plans to review. The table includes hazard mitigation plans and resiliency plans that incorporated adaptation strategies.





# Content Addressed in General Plans by City

		Transp. Infrastructure/Built Environment										Land-Use Policies											TDM						
City	Date	Bicycle	Pedestrian	Complete streets	Mass transit	Electric vehicles	Car-sharing	Low-carbon fuels	Autonomous vehicles	Climate-friendly infrastructure	Other	TOD	Infill development	ADU program	Housing development near activity centers	Housing affordability / jobs–housing balance	Preserve open space & environment	Urban growth boundaries	Parking requirements	Urban forest	Port policies	Other	TDM for employers	Programs to lesson driving, Education and outreach	Other	Regional collaboration	Total		
American Canyon	2012	✓	✓							✓	✓		✓	✓	✓	✓	✓	✓	✓	✓								12	
Arcata	2006	✓	✓		✓						✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓		15	
Berkeley	2009	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓		19	
Emeryville	2016	✓	✓	✓	✓					✓	✓		✓		✓	✓			✓		✓			✓		✓		13	
Fremont	2012	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		23	
Hayward	2009	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		21	
Los Angeles	2007; 2019 <sup>a</sup>	✓	✓	✓	✓			✓		✓	✓	✓			✓	✓	✓		✓				✓			✓		16	
Menlo Park	2009; 2015 <sup>a</sup>	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				✓	✓		✓		17	
Napa	2012	✓	✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		19	
Novato	2009	✓	✓		✓		✓				✓	✓	✓	✓	✓	✓	✓	✓			✓			✓		✓		16	
Oakland	2012; 2018 <sup>a</sup>	✓	✓		✓						✓	✓	✓	✓	✓	✓	✓		✓		✓		✓			✓		16	
Palo Alto	2016	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		22	
Rohnert Park	2007	✓	✓		✓					✓	✓		✓		✓	✓	✓	✓					✓		✓			14	
Saint Helena	2009	✓	✓		✓								✓		✓	✓	✓	✓	✓	✓					✓			12	
San Diego	2015	✓	✓		✓		✓				✓	✓	✓		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓		17	
San Francisco	2004	✓	✓		✓	✓	✓	✓			✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		19	
San José	2018	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		21	
San Rafael	2009; 2019 <sup>a</sup>	✓	✓		✓	✓	✓	✓			✓	✓			✓		✓	✓	✓	✓			✓			✓		17	
Santa Cruz	2012	✓	✓		✓					✓	✓	✓	✓		✓	✓	✓	✓					✓	✓	✓	✓		17	
Santa Monica	2013; 2019 <sup>a</sup>	✓	✓	✓	✓		✓				✓	✓	✓		✓	✓	✓		✓	✓			✓	✓	✓	✓		17	
Santa Rosa	2012	✓	✓		✓					✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		18	
Windsor	2012	✓	✓	✓	✓				✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		20	
Yountville	2016	✓	✓		✓								✓	✓	✓	✓	✓	✓	✓	✓				✓		✓		14	
		22	22	9	22	6	8	7	3	10	23	17	17	11	23	22	22	15	20	14	11	22		16	11	18	2	22	

# Major Findings

## Common Strategies for Integrated Actions

- Encouraging high-density, transit-oriented development in urban cores, while simultaneously incorporating measures for a robust urban forest and/or open-space program;
- Encouraging high-density, transit-oriented development in urban cores, while simultaneously incorporating measures to ensure passive, sustainable building design;
- Improving and expanding active transportation infrastructure, while simultaneously incorporating measures to plant trees in medians and preserve open space for cooling and/or stormwater management; and
- Improving and expanding alternative transportation infrastructure, while simultaneously incorporating measures to add shelters at transit hubs to protect users from weather events (e.g., increased rain or heat).



# Major Findings

## Potentials Conflicts between Mitigation and Adaptation

- Encouraging higher-density development, without taking measures to mitigate potentially exacerbated urban heat island effects;
- Encouraging higher-density development, without taking commensurate measures for flood protection;
- Changing land-use patterns that might limit mobility for vulnerable populations, without clearly establishing plans for evacuation in the case of disaster;
- Promoting expansion of electric vehicle charging infrastructure, without accounting for stress to energy grids in the case of extreme weather events; and
- Promoting the expansion of electric vehicle charging infrastructure, without fully examining potential equity issues related to limited grid infrastructure and access to EVs.






# Implications for State Policy Makers


- Stress the importance of “**integrated actions**” to tackle transportation emissions while simultaneously enhancing California’s resilience to adverse climate change impacts.
- Help determine and enact appropriate climate action at various levels of government.
- Boldly and directly address transportation in state-level regulations to meet both climate mitigation and adaptation goals and take the burden off of municipalities.
- Build a stronger collaboration between the state, city, and regional planning officials and a feedback mechanism for identifying and closing policy, technical, and communications gaps.



# More Opportunities for Integrated Actions

- Expanding and improving alternative transportation infrastructure and facilities, while simultaneously improving capacity to withstand flooding conditions.
- Expanding and improving alternative transportation infrastructure and facilities, while simultaneously planting vegetation to offset heat effects and provide cooling effects for alternative transit users.
- Encouraging high-density, transit-oriented development, while simultaneously improving proximal transportation infrastructure to withstand disaster events and/or allow for evacuations.
- Promoting the adoption of EV technology and EV infrastructure across the community, while also promoting green energy use and opportunities for using EVs as battery storage to bolster the energy grid.
- Pairing water and wastewater infrastructure improvements with transportation and land-use planning.
- Encouraging density near transit without significantly modifying land surfaces to avoid exacerbating urban heat island effects.

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Mitigation vs. Adaptation:  
Transportation and Land-use Planning to  
Combat Climate Change

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