Appendix III

How We Will Grow: Baseline Projections of California's Urban Footprint through 2100

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1. Introduction

By 2020, most forecasters agree, California will be home to between 43 and 46 million residents — up from 35 million today. Beyond 2020 the size of California's population is less certain. Depending on the composition of the population, and future fertility and migration rates, California's 2050 population could be as little as 50 million or as much as 70 million. One hundred years from now, if present trends continue, California could conceivably have as many as 90 million residents.

Where these future residents will live and work is unclear. For most of the 20th century, two-thirds of Californians have lived south of the Tehachapi Mountains and west of the San Jacinto Mountains — in that part of the state commonly referred to as southern California. Yet most of coastal southern California is already highly urbanized, and relatively little vacant land is available for new development. More recently, slow-growth policies in northern California and declining developable land supplies in southern California are squeezing ever more of the state's population growth into the San Joaquin Valley.

How future Californians will occupy the landscape is also unclear. During the last 50 years, the state's population has grown increasingly urban. Today, nearly 95% of Californians live in metropolitan areas, mostly at densities of less than 10 individuals per acre. Recent growth patterns have strongly favored locations near freeways, most of which were built in the 1950s and 1960s. With few new freeways on the planning horizon, how will California's future growth organize itself in space? By national standards, California's large urban areas are already reasonably dense, and economic theory suggests that densities should increase further as California's urban regions continue to grow. In practice, densities have been rising in some urban counties, but falling in others.

These are important issues as California plans its future. Will California have enough land of the appropriate types and in the right locations to accommodate its projected population growth? Will future population growth consume ever greater amounts of irreplaceable resource lands and habitat? Will jobs continue decentralizing, pushing out the boundaries of metropolitan areas? Will development densities be sufficient to support mass transit, or will future Californians be stuck in perpetual gridlock? Will urban, resort, and recreational growth in the Sierra Nevada and Trinity Mountain regions lead to the overfragmentation of precious natural habitat? How much water will California's future industries, farms, and residents need, and where will that water be stored? Where should future highway, transit, and high-speed rail facilities and rights-of-way be located? Most of all, how much will all this growth cost, both economically and in terms of changes in California's quality of life?

Clearly, the more precise our current understanding of how and where California is likely to grow, the sooner more inexpensively appropriate lands can be acquired for purposes of conservation, recreation, and future facility siting. Similarly, the more clearly future urbanization patterns can be anticipated, the greater our collective ability to undertake sound city, metropolitan, rural, and bioregional planning.

Consider two scenarios for 2100. In the first, California's population would grow to 80 million people and would occupy the landscape at an average density of eight individuals per acre, the current statewide urban average. Under this scenario, and assuming that 10% of California's future population growth would occur through infill — that is, on existing urban land — California's expanding urban population would consume an additional 5.06 million acres of currently undeveloped land. As an alternative, assume the share of infill development were increased to 30%, and that new residents were accommodated at a density of about 12 individuals per acre — which is the current average density of the city of Los Angeles. Under this second scenario, California's urban population would consume an additional 2.6 million acres of currently undeveloped land. Both scenarios accommodate the same amount of population growth and generate large increments of additional urban development — indeed, some might say that the second scenario allows far too much growth and development — but the second scenario is far kinder to California's unique natural landscape.

This report presents the results of a series of baseline population and urban growth projections for California's 38 urban counties through 2100. Presented in both figure and table form, these projections are based on extrapolations of current population trends and recent urban development trends. The next section, titled Approach, outlines the methods and data used to develop the various projections. The following section, Baseline Scenario, reviews the projections themselves. A final section, entitled Baseline Impacts, quantitatively assesses the impacts of the baseline projections on wetland, farmland, and habitat loss.

2. Approach

Developing short-term forecasts in a state as diverse and fluid as California is a difficult proposition. Developing long-term forecasts, whether for 20, 50, or 100 years, is harder still. Developing long-term forecasts that are spatially explicit — that project which lands are likely to be developed and which are not — is closer to art than science.

At a conceptual level, our forecasting method is actually quite simple (Figure 1). We begin by calibrating a spatial-statistical model of historical development patterns spanning 1988 to 1998 (Figure 1, Step A). The calibrated model parameters are then used with contemporary spatial data to generate a development probability surface describing the likelihood that particular undeveloped sites will subsequently be developed (Figure 1, Step B; Figure 2). This is the *where*

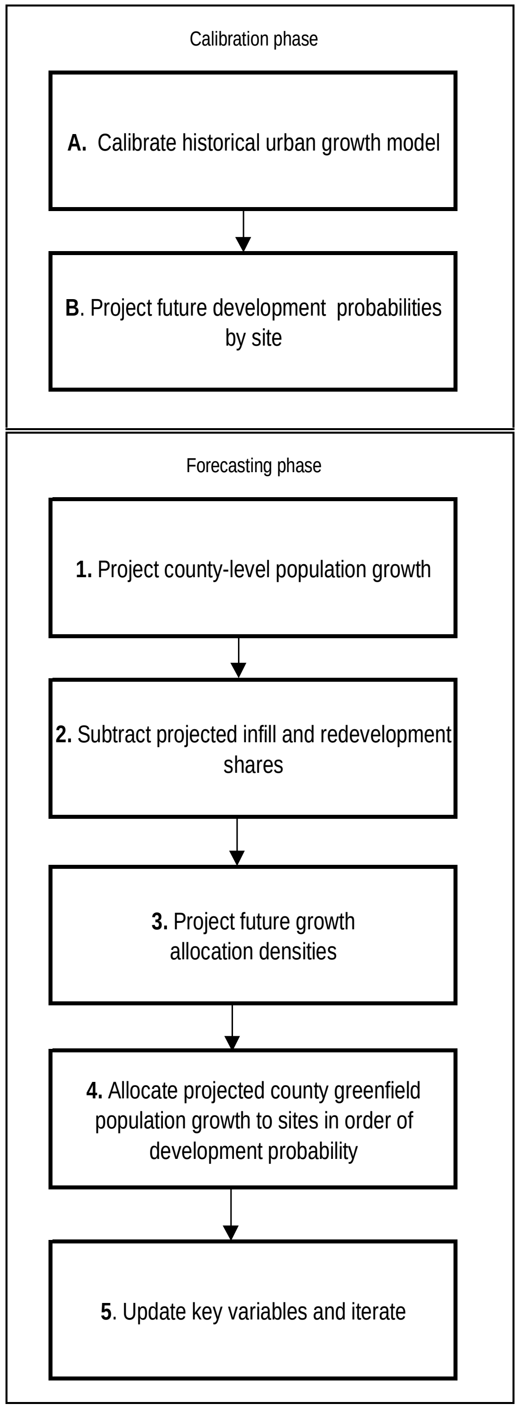

Figure 1. Urban growth forecasting process

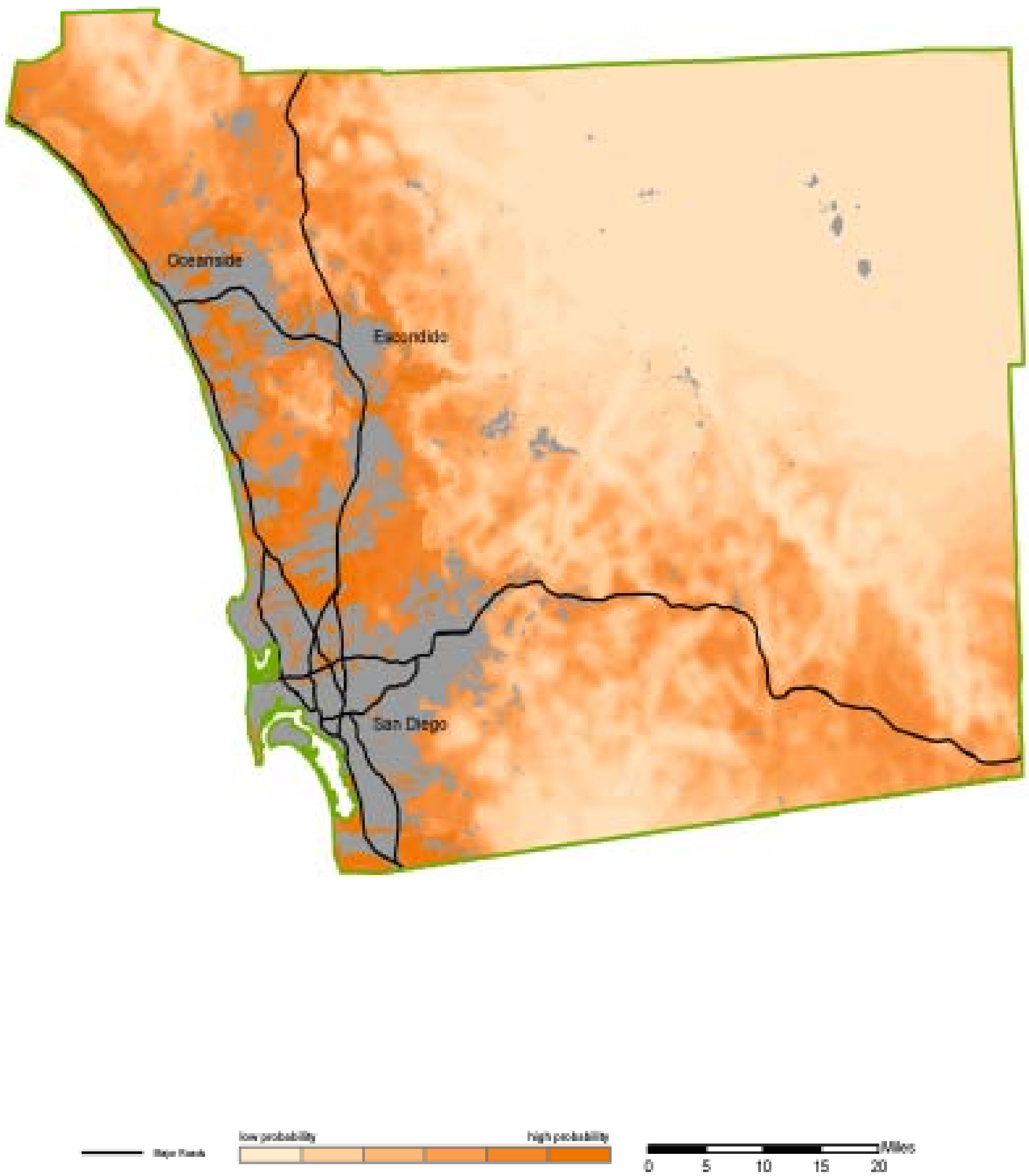

Figure 2. Projected development probabilities for San Diego County

part of the equation. *When* development happens is a function of state and county population growth pressures (Figure 1, Step 1), the share of population accommodated through infill development (Figure 1, Step 2), and the density at which development occurs (Figure 1, Step 3). Projected population growth, net of infill, is then allocated to allowable development sites in order of their projected development probability (from Step B) at a designated development density (Figure 1, Step 4). Once a future allocation has been completed (e.g., for the 2000-2020 period), infill rates, densities, and development probabilities are updated to reflect any intervening changes. The model is then run again (Steps 1 through 5) for subsequent periods.

Alternative futures or scenarios can be tested any number of ways. Different growth increments can be postulated. Allocation densities can be adjusted up or down for regions, counties, or individual jurisdictions. More or less land can be excluded from development a priori by specifying additional or fewer exclusion conditions. By changing a few input settings, for example, it is possible to compare a “business-as-usual” scenario that extends recent development trends to an “environmental protection” scenario in which development densities are increased and development is prohibited on farmlands, wetlands, hillsides, and sensitive habitats to an “infrastructure investment” alternative in which new highways and transit systems are constructed. Subsequent reports will consider several such scenarios.

2.1 Growth Model Calibration

Before a statistical model can be used to generate future projections, it must be calibrated. With nonspatial models, this usually involves fitting a line or curve to historical data. With spatial data, equations and parameters that are sensitive to locational and nonlocational influences are developed and estimated. In this case, the model being calibrated relates changes in the development status of particular sites between 1988 and 1998 — measured as a matrix of 1 ha grid cells — and their various physical, locational, and administrative characteristics. As with all statistical models, the estimated parameters describe the relationship between a set of independent or explanatory variables and a single dependent variable:

$$\text{Prob [undeveloped site}_i > \text{developed]} = f(X1_i, X2_i, \ldots Xn_i) \qquad (1)$$

The dependent variable in this case is the change in development status between 1988 and 1998 of all potentially developable sites, measured as a matrix of 1 ha grid cells. Sites that were undeveloped in 1988 and remained that way through 1998 are assigned a value of “0.” Sites that were developed between 1988 and 1998 are assigned a value of “1.” The California Farmland Mapping and Monitoring Program (CFMMP), a division of the California Department of Conservation, supplied the land use change information. Through a combination of remote sensing and local ground-truthing, the CFFMP conducts detailed biannual land cover inventories for 38 California counties of urban development in 1988 and 1998. CFMMP data are generally accurate down to the 1 ha level.

The *X*s, or independent variables, are those attributes thought most likely to affect each site's conversion from nonurban to urban use. Independent variables can include physical site characteristics, locational and economic characteristics, the characteristics of nearby sites, and policy and administrative characteristics such as the presence of a local growth control and management measure. Once measured, geographic information systems (GIS) are used to spatially match the dependent and independent variables.

Because the dependent variable is categorical rather than continuous, the model is estimated using logistical regression, also known as "logit," rather than linear regression. Model parameters are estimated using a maximum-likelihood procedure in which the error terms are presumed to follow a Weibull distribution. In this case, because the dependent variable takes on just two categorical values (e.g., indicating either a change in land use or no change in land use), the type of logit model presented above is known as a binomial logit model. The use of logit models to analyze discrete choices at a single point in time is firmly grounded in microeconomic theory (McFadden, 1974). Although statistically feasible, using logit models to analyze discrete land use changes, particularly changes identified from maps, introduces additional theoretical complications. If the estimated model parameters are to be reliable — that is, free from bias — we must make two assumptions about the process of land use change itself. The first is that all participants in the land development process must act independently of each other. This includes landowners, developers, builders, brokers, homebuyers, renters, and businesses. This assumption is intended to rule out the possibility of oligopolistic or strategic behavior. A second assumption concerns the lack of presence of any identifiable participants (known as agents). Discrete choice analysis has traditionally been used to model the behavior of identifiable agents such as voters, travelers, and consumers. In the case of land use change, the agents of interest are land buyers and sellers. Modeling approaches like this are known as reduced-form models because they include information on transaction outcomes but not on the agents involved in the transaction. In simple economics terms, there are no utility-maximizing buyers or profit-maximizing sellers present in the model to start or complete a transaction. This is a problem only to the extent that the characteristics of specific buyers and sellers might affect their actions. To deal with this problem, we invoke the idea of competition. Specifically, we argue that if land markets are competitive (e.g., there are no barriers to entry), the characteristics and noneconomic motivations of particular agents should not affect transaction outcomes. Whether developers are well or poorly capitalized, whether they specialize in residential development or retail development, whether their experience is local or national — in a competitive market, these factors should be of less importance than the strength of the demand for urban development and the availability of appropriate sites.

The use of small grid cells as surrogates for development sites exacerbates a problem known as "spatial autocorrelation." Spatial autocorrelation refers to the fact that adjacent or nearby objects tend to influence each other. Some types of spatial autocorrelation are legitimate, as in the case of the rancher who observes his next-door neighbor selling to a developer and is influenced to do the same. Other types of spatial autocorrelation are artifacts, generated by the choice of the spatial unit of analysis. If, as in the current case, 1 ha grid cells are used to record land use change events, any land use changes larger than 1 ha will be recorded as multiple adjacent events. The resulting overcounting of land use change will tend to bias the results of any statistical models calibrated on the basis of those changes. As yet, there is no commonly available modeling package that corrects for spatial autocorrelation. As noted below, we attempt to do so through the explicit inclusion of neighborhood-level independent variables.

Four types of measures were included as independent variables:

1. **Demand variables**, which measure the demand for sites as a function of their accessibility to job opportunities and job growth, as well as local income levels. Two demand variables are included in each model: JOB_ACCESS90, which measures the number of jobs within 90 minutes of a given grid cell, assuming travel times of 50 mph on freeways and limited access roads and 25 mph on local roads; and INC_RATIO90, which is the ratio of community median household income to county median household income. All else being equal, we would expect sites with superior job accessibility to be more likely to be developed, and sites in upper income communities to be less likely to be developed.

2. **Own-site variables**, which measure the physical and land use characteristics of each grid cell as determinants of its development potential. Four own-site variables are modeled: FRWY_DISTSQ, a measure of the squared distance from each site to the nearest freeway; PRIME_FARM, a dummy variable that indicates whether the CFMMP classifies the site as prime farmland; SLOPE, the average percentage slope of each site; and FLOOD, a dummy variable indicating whether the site falls within 100-year flood zone designated by the Federal Emergency Management Agency (FEMA). Based on cost and market considerations, we would expect sites near freeways to be more likely to be developed, and sites classified as prime farmland or in flood zones to be less likely to be developed. Similarly, based on the higher cost of building on steep slopes, we would expect the probability of a site being developed to be inversely proportional to its slope.[1]

1. In areas where views are rewarded in the marketplace with price and rent premiums, the probability of development may actually rise with slope.

3. **Adjacency and neighborhood variables**, which summarize the environmental and land use characteristics of adjacent and neighboring grid cells. Four neighborhood variables are modeled: SLOPE_1KM, the average slope of the cells within 1 km of each subject site; SLOPE_2-3KM, the average slope of sites within the 2 to 3 km ring around each subject site; FLOOD_1KM, the share of sites within 1 km of the subject site that are located in the FEMA 100-year flood zone; and FLOOD_2-3KM, the share of sites within the 2 to 3 km ring around each subject site. Including these variables in the model offers two benefits: (1) the characteristics of adjacent and neighboring sites are allowed to affect the development of subject sites (e.g., a flat site surrounded by steep slopes is presumed to be less likely to be developed); and (2) parameter bias resulting from potential spatial autocorrelation is reduced.

4. **Regulatory and administrative variables**, which are intended to capture the development-encouraging or constraining effects of different land use policies and regulations. With respect to land use policy, the dummy variable IN_CITY denotes whether or not a site is located within an incorporated city. Most California jurisdictions provide more services and a higher level of services within incorporated cities. Many California cities and counties work collaboratively to encourage city-centered development and to discourage growth in unincorporated areas. We would thus expect sites located within incorporated cities to be more likely to be developed than unincorporated county lands. A second set of dummy variables, one for each county, is included to reflect intercounty differences in land use regulation.

The calibration sample consists of all 1 ha sites in a county that were undeveloped as of 1988; that were not publicly owned (and therefore could be developed); that had a slope of less than 15%; and that were within 15 km (9 mi) of a major highway or existing urban development.

To better account for systematic regional variations, we tested separate models for southern California, northern California, the Sacramento region, and the southern San Joaquin Valley. The northern California study area includes the nine counties of the Bay Area (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma), as well as five neighboring counties (Monterey, San Benito, San Joaquin, Santa Cruz, and Stanislaus) that now fall within commuting range of the Bay Area. The southern California study area includes Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura counties. The Sacramento region includes Sacramento County as well as Yolo, Sutter, Yuba, El Dorado, and Placer counties. The San Joaquin Valley includes Kern, Fresno, Madera, Merced, Kings, and Tulare counties.

The results of the four regional models are presented in Table 1. Overall, the four models fit the data extremely well, explaining more than 95% of urban land use between 1988 and 1998 in their respective regions.

Table 1. Logistic regression model of 1988-1998 site-level land use changes in southern California, the Bay area, the Sacramento region, and the southern San Joaquin Valley

Dependent variable: Probability of site-level land use change, 1988-1998		**Southern California region**		**Northern California region**		**Sacramento region**		**Southern San Joaquin Valley**	
Independent variables		**Standardized coefficient**	**Probability level**	**Standardized coefficient**	**Probability level**	**Standardized coefficient**	**Probability level**	**Standardized coefficient**	**Probability level**
All regions									
Dummy variable [within incorporated city]	IN_CITY	0.185	0.00	0.179	0.00	0.017	0.00	0.146	0.00
Distance to freeway (km) — squared	FRWY_DISTSQ	-0.297	0.00	-0.305	0.00	-0.231	0.00	-0.0018	0.80
Regional job accessibility as of 1990	JOB_ACCESS	0.180	0.00	0.073	0.00	0.102	0.00	0.2070	0.00
Ratio of 1990 city-to-region median household income	INC_RATIO90	-0.032	0.00	0.005	0.00	-0.007	0.01	Not entered	
Dummy variable [CFMMP-designated prime farmland]	PRIME	-0.007	0.02	-0.045	0.00	-0.131	0.00	-0.0018	0.68
Dummy variable [FEMA flood zone]	FLOOD	Not entered		-0.023	0.01	-0.151	0.00	-0.038	0.00
Flood zone 1x Nbr. percent	FLOOD_1X	Not entered		-0.060	0.00	0.102	0.00	-0.024	0.02
Flood zone 2-3x Nbr. percent	FLOOD_2X	Not entered		-0.097	0.00	Not entered		Not entered	
Site slope	SLOPE	-0.031	0.00	-0.033	0.00	0.038	0.00	0.0127	0.38
Average slope of 1x adjacent sites	ADJ_SLOPE	-0.192	0.00	-0.291	0.00	-0.187	0.00	-0.455	0.00

Table 1. Logistic regression model of 1988-1998 site-level land use changes in southern California, the Bay area, the Sacramento region, and the southern San Joaquin Valley (cont.)

Dependent variable: Probability of site-level land use change, 1988-1998		**Southern California region**		**Northern California region**		**Sacramento region**		**Southern San Joaquin Valley**	
Independent variables		**Standardized coefficient**	**Probability level**	**Standardized coefficient**	**Probability level**	**Standardized coefficient**	**Probability level**	**Standardized coefficient**	**Probability level**
Avg. slope of 1x-2x adjacent sites	NEIGH_SLOPE	0.031	0.00	-0.111	0.00	0.168	0.00	0.209	0.00
	P9098d0	0.438	0.00	Not entered		0.487	0.00	0.357	0.00
	P9098d2	-0.032	0.00	Not entered		0.082	0.00	-0.056	0.00
	P9010	Not entered		Not entered		0.101	0.00	Not entered	
	P90D0M10	Not entered		Not entered		0.265	0.00	Not entered	
	P90D2	Not entered		Not entered		-0.032	0.00	Not entered	
Southern California county dummy variables									
Imperial County		0.037	0.00						
Orange County		0.018	0.00						
Riverside County		0.057	0.00						
Santa Barbara		0.127	0.00						
San Bernardino County		-0.010	0.09						
San Diego		0.076	0.00						
Ventura		0.064	0.00						
Northern California county dummy variables									
Contra Costa County				0.042	0.00				
Marin County				0.077	0.00				
Monterey County				0.099	0.00				
Napa County				0.144	0.00				
San Benito County				0.098	0.00				
San Mateo County				0.025	0.00				

Table 1. Logistic regression model of 1988-1998 site-level land use changes in southern California, the Bay area, the Sacramento region, and the southern San Joaquin Valley (cont.)

Dependent variable: Probability of site-level land use change, 1988-1998	**Southern California region**		**Northern California region**		**Sacramento region**		**Southern San Joaquin Valley**	
Independent variables	**Standardized coefficient**	**Probability level**	**Standardized coefficient**	**Probability level**	**Standardized coefficient**	**Probability level**	**Standardized coefficient**	**Probability level**
Northern California county dummy variables (cont.)								
Santa Clara County			0.047	0.00				
Santa Cruz County			0.126	0.00				
Solano County			-0.067	0.00				
Sonoma County			0.127	0.00				
Stanislaus County			0.119	0.00				
Sacramento Region county dummy variables								
El Dorado County					0.022	0.07		
Nevada County					0.111	0.00		
Placer County					0.011	0.14		
Sutter County					0.001	0.97		
Yolo County					-0.150	0.00		
Yuba County					-0.040	0.02		
South San Joaquin county dummy variables								
Merced County							0.029	0.00
Madera County							-0.011	0.06
Kings County							0.085	0.00
Tulare County							0.075	0.00
Kern County							-0.028	0.00
Intercept	-4.695	0.00	-5.349	0.00	-5.655	0.00	-6.463	0.00
Percent correct predictions							95.8%	
Number of observations							3,510,148	

We report both the standardized parameter estimate and the odds ratio for each independent variable. Except where noted, all the parameter estimates are statistically significant, and most are of the expected signs. The importance of particular factors varies by region.

Among southern California counties, the factors that most increased the likelihood of site development during the 1990s were freeway proximity (FRWY_DISTSQ), job accessibility (JOB_ACCESS), being located in a city (IN_CITY), and being located in Santa Barbara or San Diego counties. Steeply sloped sites were less likely to be developed than flatter sites, and prime farmlands were somewhat less likely to be developed. Reflecting NIMBY ("not in my backyard") pressures, sites in upper income communities were significantly less likely to be developed than sites in middle or lower income communities. All else being equal, sites in San Bernardino County were less likely to be developed than sites elsewhere in southern California.

Among northern California counties, the factors that most increased the likelihood of site development during the 1990s were freeway proximity (FRWY_DISTSQ); being located in a city (IN_CITY); and being located in Napa, Sonoma, Santa Cruz, Monterey, and Stanislaus counties. Compared to southern California, steeply sloped sites and prime farmlands in northern California were far less likely to be developed than flatter and less fertile locations. Sites in Solano County were less likely to be developed than sites elsewhere in the Bay Area, as were sites in and around flood zones. Accessibility to jobs, although a positive influence on development, was far less significant in northern California than southern California. Surprisingly, sites in wealthy communities in northern California were actually more likely to be developed than sites in poorer communities — the opposite situation than in southern California.

Among Sacramento area counties, the factors that most affected the likelihood of site development during the 1990s were freeway proximity (FRWY_DISTSQ), whether the site was located in a flood zone (FLOOD), and whether the site was on prime farmland (PRIME). Sites near freeways were much more likely to have been developed; flood zone and prime farmland sites were much less likely to have been developed. Job accessibility (JOB_ACCESS) was also an important influence. Sites located in incorporated cities were only marginally more likely to be developed than unincorporated sites — a finding in contrast to the southern and northern California regions, where development strongly favored incorporated sites. The effect of community income on development activity, although negative, was also slight. Compared to sites in Sacramento County, sites in Nevada County were much more likely to be have been developed between 1988 and 1998. Sites in Yolo County were much less likely to have been developed. Sites in El Dorado and Placer counties were marginally more likely to have been developed and sites in Yuba County were marginally less likely to have been developed.

Among counties in the southern San Joaquin Valley — including Fresno, Kern, Kings, Madera, Merced, and Tulare — the two factors that most affected the likelihood of site development during the 1990s were regional job accessibility (JOB_ACCESS) and whether the site was located in an incorporated city. Sites with good accessibility to jobs were much more likely to have been developed, as were sites in incorporated cities. As in the Sacramento region, hillside sites were slightly more likely to have been developed than valley sites. Still, freeway accessibility had a much smaller effect on site developability in the southern San Joaquin Valley than elsewhere in the state. On the negative side, flood zone sites and sites located on prime farmland were less likely to have been developed than other, less environmentally sensitive sites, although the differences were not large. Compared to similar sites in Fresno County, sites in Kings and Tulare counties were somewhat more likely to be have been developed between 1988 and 1998. Sites in Madera and Kern counties were less likely to have been developed. Sites in Merced County were marginally more likely to have been developed than sites in Fresno County.

Once estimated, the various model parameters can be used to generate development probability scores for all remaining undeveloped sites. Figure 2 presents a map of these scores for San Diego County. Using these scores for forecasting assumes that the particular factors that influenced development in the recent past will continue to do so in the future, and in the same combination. To the extent that the future brings no large technological or land use policy changes, or significant shifts in household and business location preferences, the assumption that future land development trends will follow those of the past may be quite reasonable. On the other hand, to the extent that land use preferences, policies, and technologies *all change*, the usefulness of models calibrated using historical data is obviously reduced.

2.2 Patterns of Job Growth

Depending on the region, job accessibility is either the second, third, or fourth most important determinant of urban growth patterns in California (see Table 1). Having long-term, accurate, and spatially disaggregate job projections is thus a prerequisite to developing accurate growth scenarios, although this is easier said than done. The phrase “long-term, accurate, and spatially disaggregate job projections” is an oxymoron, because economies are, by their very nature, interdependent and unpredictable. Most available employment projections are therefore short term, and subject to constant revision. In terms of space, most job projections are undertaken at the metropolitan statistical area (MSA) or county level — for reasons of data availability as much as for modeling capability.

Our approach to forecasting jobs and job accessibility is a little different. Rather than generating separate sectoral and county-level job forecasts and then aggregating them into a single regional total — as is common practice — we start with the presumption that there is a more or less regular relationship between the size of a region’s population and its employment base.[2] By

2. This approach requires defining regions in terms of commute sheds, the residential areas from which job centers draw daily workers.

accepting this assumption, we can use believable regional population projections as a starting point for developing serviceable regional employment projections.

For our purposes, the major challenge is not projecting the total number of new jobs. Instead, it is to figure out where in each region those new jobs are most likely to locate. Fortunately, the long-term spatial trend is quite clear. Broadly speaking, we expect jobs in California to continue their historical pattern of intrametropolitan decentralization. Before 1950, most basic jobs in the U.S. economy were located in urban cores.[3] Since 1950, job growth has increasingly favored suburban communities over urban cores. Since 1980, almost all net basic job growth has occurred outside traditional central cities.[4] First the Los Angeles region and more recently the San Francisco Bay Area have been national leaders in the trend toward increased job decentralization.

To project future job decentralization, we start by comparing the 1990 and 2000 spatial distribution of jobs in each California metropolitan region. We obtained employment estimates were obtained from multiple sources, most notably the Southern California Association of Governments (SCAG), the Association of Bay Area Governments (ABAG), the Sacramento Area Council of Governments (SACOG), and the San Diego Association of Governments (SANDAG). Job estimates for the southern San Joaquin Valley region were obtained from each county Council of Government (COG). Next, we mapped 1990 and 2000 job totals by city and Census Designated Place (CDP). Next, 10 km wide rings were generated outward from each regional center, and used to count the number of job centers and total number of jobs in each ring. Next, a spatial shift-share model was applied to decompose 1990-2000 city and CDP job changes into three components:

1. **A regional growth component (RGC)**, calculated as the percent change in regional jobs between 1990 and 2000:

$$\text{(2000 regional jobs/1990 regional jobs)} \qquad (2)$$

   The larger the regional growth component, the more vital the entire regional economy.

2. **A ring change component (RCC)**, calculated as the difference between the 1990-2000 percent change in jobs in each ring and RGC:

$$\text{(2000 ring jobs}_i\text{/1990 ring jobs}_i\text{) - (2000 regional jobs/1990 regional jobs)} \qquad (3)$$

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3. Most regional economic studies divide employment into (1) basic jobs, which generate income to a region or metropolitan area through the sales of goods and services to customers outside the region; and (2) nonbasic, or service jobs, which provide goods and services to the resident population and businesses with the region.

4. By net job growth we mean the excess of job gains (through attraction and expansion) over losses.

Rings with RCC values greater than zero added jobs at a faster rate than the region as a whole. Rings with RCC values less than zero added jobs at a slower rate than the region as a whole.

3. A local change component (LCC), calculated as the difference between the 1990-2000 percent change in jobs in each city or CDP, and the 1990-2000 percent change in jobs in its respective ring:

$$(2000 \text{ local jobs}_j/1990 \text{ local jobs}_j) - (2000 \text{ ring jobs}_i/1990 \text{ ring jobs}_i) \qquad (4)$$

Localities with LCC values greater than zero added jobs at a faster rate than their rings. Localities with LCC values less than zero added jobs at a slower rate than their rings.

The outer rings in each metropolitan area added jobs at a faster rate during the 1990s than the inner rings (the innermost southern California ring actually lost jobs between 1990 and 2000, the only such ring to do so). Among the four regions we profiled, the rate of inner-ring job growth was highest in northern California and the rate of outer-ring job growth was greatest in southern California.

Using their own procedures, ABAG, SACOG, SANDAG, and SCAG have each developed their own job projections for the 2000-2020 period. To put these forecasts into context, we applied the same ring-identification procedures and spatial shift-share model calculations developed above to each set of projections. Generally speaking, all four COGs expect the pace of job decentralization to accelerate during the next 20 years. In no case are any rings expected to lose employment.

2.3 Forecasting Procedures

As we noted previously forecasting and scenario-building involves five distinct steps:

1. **Project county-level population growth through 2100**. County population projections for 2020 and 2040 were obtained from the California Department of Finance (DOF), Population Research Unit.[5] We used these projections to estimate annualized population growth rates (by county) spanning the periods 2000-2040 and 2020-2040. Projected forward, these growth rates were used in turn to forecast county population totals for 2050 and 2100.

5. DOF uses a modified cohort-component model, disaggregated by race and 1-year age cohort to project population.

2. **Subtract projected infill and redevelopment shares**. A significant share of projected population growth will occur within the existing urban footprint in the form of infill or redevelopment. Infill shares tend to rise over time as remaining greenfield areas are used up and as developers reconsider infill lands that were previously passed over. A cross-sectional regression model was developed relating current county infill shares to remaining greenfield land supplies. We then used this model to project future infill and greenfield population shares for 2020, 2050, and 2100.

3. **Project future allocation densities.** The amount of greenfield land consumed by future population growth will depend both on the magnitude of growth and on its gross density. Marginal gross densities — the gross densities of new development — were estimated for each county by dividing the change in the population between 1988 and 1998 by the change in urbanized land area for the same period. Theory suggests that densities should rise as available greenfield lands are used up, because developers seek to use remaining lands more intensely. We developed a cross-sectional regression model to relate 1988-1998 marginal densities to remaining greenfield land supplies, then used this model to project future allocation densities by county for 2020, 2050, and 2100.

4. **Allocate projected greenfield population growth to undeveloped sites in each region in order of development probability**. Starting with the hectare-scale development probability scores derived above, a series of exclusion conditions are developed identifying sites that are to be precluded from development. Projected population growth (from Step 2) for the period 2000-2020 is then allocated to sites at projected densities (from Step 3) in order of development probability (from high to low) subject to any exclusion conditions.

5. **Update key variables to reflect projected employment growth and allocated population growth.**

Steps 4 and 5 are iterated for the periods from 2020 to 2050 and from 2050 to 2100. Because of the analytical power of GIS, different forecasting steps can be undertaken at different spatial scales and then reconciled. Population growth, greenfield shares, and allocation densities, for example, are all identified and projected (Steps 1, 2, and 3) at the county level. Development probability scores, on the other hand, are estimated for individual 1 ha sites, accounting for differences among counties and regions. Employment projections, an input into the allocation procedure (Step 4) are developed for individual job centers. Distance to city boundaries, another input into the allocation procedure, is estimated and updated for incorporated cities.

The following sections explain and discuss each of these procedures in greater detail.

2.4 Population Projections — Huge Growth Ahead

Forecasters project large population growth in one of two ways, either by extrapolating a single long-term population growth trend, or by decomposing that trend into its two component parts — natural increase and net migration — and then projecting those. The DOF, which is required by state law to develop 40 year county-level population projections, takes the latter approach.

Natural increase is the difference between births and deaths, and generally follows fertility rate trends. Following accepted demographic practice, the DOF identifies natural increase and fertility rate trends by age cohort, race, and ethnicity. Fertility rates vary as well by immigration status and length of residency, although not always in predictable ways. Net migration measures the difference between in- and out-migration, and for the most part follows job growth trends — rising when the economy is booming and falling when it is in recession. Like fertility rates, net-migration rates vary by population age. Higher for young adults, they typically decline with age. County (and to a lesser extent, state) migration rates also vary with the relative cost of living, as new migrants are often shunted into counties with more affordable housing. Some of these complications wash out at the state level, but serve to make county-level forecasting all the more complicated.

Attachment A reports the DOF's Series E-6 county-level population projections for 2000, 2020, and 2040. These projections — which were developed using the cohort component method described above — were then used to calculate composite annual growth rates by county for from 2000 to 2040. These rates, shown in Column 5 of Table B.1, vary from a high of 3.0% per year for Imperial County to a low of -0.4% per year for San Francisco County. Annualized 2020-2040 growth rates (Table B.1, Column 6) are somewhat lower, and range from a high of 2.65%, also for Imperial County, to a low of -0.5% for San Francisco County.

High growth rates are rarely sustainable over the long term. Similarly, the growth rates of low-growth counties located in high-growth states tend to pick up over time. To better reflect this county-state convergence, we averaged each county's 2000-2040 and 2020-2040 growth rates with those of the state as a whole. These combined growth rates are reported in Columns 7 and 8 in Table B.1.

Table B.2 projects each county's population forward to 2050 and 2100, based first on the lower 2020-2040 combined rate, and second on the higher 2000-2040 combined rate. Based on this method, California's largest county, Los Angeles, will grow from 10 million people in 2000 to 15.5 million by 2050. The populations of Riverside, San Bernardino, and San Diego counties will each exceed 5.0 million by 2050. The population of Orange County will grow from 2.8 million in 2000 to more than 4.5 million in 2050. Elsewhere, the 2050 population of the largest county in northern California, Santa Clara, will be just under 3.0 million. With a 2050 population of 2.4 million, Sacramento County will be the most populous in the Central Valley. Added up, the total 2050 population of California's 58 counties will exceed 66 million!

Projecting further forward to 2100 presents additional challenges. Given the immense size of California's population, even the lower 2020-2040 growth rates are likely to be unsustainable over time. To better reflect the natural tendency for growth rates to decline as the population increases, we reduced both the lower 2020-2040 composite growth rate, and the higher 2000-2040 composite growth rate by 50% before applying them to the 2050-2100 period. County population projections for 2100 using these reduced growth rates are presented in the final two columns of Table A.2 in Attachment A. Table 2 presents the final set of population projections for 2020, 2050, and 2100 in tabular form, organized by region, subregion, and county; Figure 3 presents the same information graphically.

Despite the imposed slowdown in growth rates, California's largest counties will continue to grow. California's largest county, Los Angeles, will grow from 15.5 million people in 2050 to 20.4 million by 2100. The populations of Riverside, San Bernardino, and San Diego counties will each exceed approach or exceed 5.0 million by 2050 and 7.5 million by 2100. The population of Orange County will grow from 4.5 million in 2000 to nearly 5.0 million by 2050 and nearly 6.0 million by 2100. Elsewhere, the 2100 population of the largest county in northern California, Santa Clara, will be about 3.8 million. With a 2100 population of 3.3 million, Sacramento County will still be the most populous in the Central Valley. Added up, the total 2100 population of California's 58 counties could very well exceed 92 million!

The huge size of these projections — particularly among southern California counties — clearly indicates the dangers implicit in the long-term use of average annual growth rates. Even so, as large as these projections may seem, they are not unbelievable. California's population in 1900 was just over 1.0 million. One hundred years later, the state's population stood at nearly 35 million.

2.5 Infill Shares and Growth Densities — Both Will Increase

Two opposing forces shape the location and density of new urban development in California. Development has traditionally been attracted to California's coastal areas both for reasons of economics — that's where the ports are — and amenities — the climate along the coast is more moderate. Accordingly, housing and land prices in California have long formed a downward-sloping gradient eastward from the coastal centers of Los Angeles, San Francisco, and San Diego.

Table 2. Population projections by county, subregion, and region: 2000-2020, 2020-2050, and 2050-2100

			Population estimates and forecasts				Population change		
Major region	**County**	**Sub-region**	**2000 (source: DOF)**	**2020F (source: DOF)**	**2050F (see Table B-2 for calculations)**	**2100F (see Table B-2 for calculations)**	**2000-2020**	**2020-2050**	**2050-2100**
Southern California	Los Angeles	Central	**9,838,861**	**11,575,693**	**15,497,560**	**20,400,280**	**1,736,832**	**3,921,867**	**4,902,719**
	Imperial	South	154,549	298,700	612,914	1,000,884	144,151	314,214	387,969
	Orange	South	2,833,190	3,431,869	4,535,936	5,932,517	598,679	1,104,067	1,396,581
	San Diego	South	2,943,001	3,917,001	5,831,574	8,097,302	974,000	1,914,573	2,265,728
	Subregional total		**5,930,740**	**7,647,570**	**10,980,424**	**15,030,702**	**1,716,830**	**3,332,854**	**4,050,278**
	Riverside	Inland Empire	1,570,885	2,773,431	5,335,081	8,431,480	1,202,546	2,561,650	3,096,399
	San Bernardino	Inland Empire	1,727,452	2,747,213	4,983,011	7,644,175	1,019,761	2,235,798	2,661,164
	Subregional total		**3,298,337**	**5,520,644**	**10,318,093**	**16,075,656**	**2,222,307**	**4,797,449**	**5,757,563**
	Santa Barbara	North	412,071	552,846	905,294	1,318,823	140,775	352,448	413,529
	Ventura	North	753,820	981,565	1,456,134	2,018,255	227,745	474,569	562,120
	Subregional total		**1,165,891**	**1,534,411**	**2,361,429**	**3,337,078**	**368,520**	**827,018**	**975,649**
	Regional total		**20,233,829**	**26,278,318**	**39,157,506**	**54,843,715**	**6,044,489**	**12,879,188**	**15,686,210**
Northern California	Alameda	Central	1,470,155	1,793,139	2,287,126	2,938,378	322,984	493,987	651,251
	Contra Costa	Central	931,946	1,104,725	1,394,436	1,782,151	172,779	289,711	387,714
	San Francisco	Central	792,049	750,904	710,034	785,565	-41,145	-40,870	75,531
	San Mateo	Central	747,061	855,506	1,044,065	1,312,014	108,445	188,559	267,949
	Santa Clara	Central	1,763,252	2,196,750	2,884,875	3,760,965	433,498	688,125	876,089
	Subregional total		**5,704,463**	**6,701,024**	**8,320,538**	**10,579,072**	**996,561**	**1,619,514**	**2,258,535**
	Marin	North	248,397	268,630	325,152	406,920	20,233	56,522	81,768
	Napa	North	127,084	157,878	214,934	285,317	30,794	57,056	70,383
	Solano	North	399,841	552,105	789,742	1,074,736	152,264	237,637	284,993
	Sonoma	North	459,258	614,173	845,837	1,129,343	154,915	231,664	283,506
	Subregional total		**1,234,580**	**1,592,786**	**2,175,666**	**2,896,317**	**358,206**	**582,880**	**720,650**
	Monterey	South	401,886	575,102	1,006,978	1,517,431	173,216	431,876	510,453
	San Benito	South	51,853	82,276	133,208	192,948	30,423	50,932	59,740

Table 2. Population projections by county, subregion, and region: 2000-2020, 2020-2050, and 2050-2100 (cont.)

			Population estimates and forecasts				Population change		
Major region	**County**	**Sub-region**	**2000 (source: DOF)**	**2020F (source: DOF)**	**2050F (see Table B-2 for calculations)**	**2100F (see Table B-2 for calculations)**	**2000-2020**	**2020-2050**	**2050-2100**
Northern California (cont.)	San Luis Obispo	South	254,81	392,329	617,709	882,227	137,511	225,380	264,518
	Santa Cruz	South	260,248	367,196	572,017	812,597	106,948	204,821	240,580
	Sub-regional total		**968,805**	**1,416,903**	**2,329,912**	**3,405,203**	**448,098**	**913,009**	**1,075,291**
	Regional total		**7,907,848**	**9,710,713**	**12,826,116**	**16,880,592**	**1,802,865**	**3,115,403**	**4,054,476**
San Joaquin Valley	Merced	North	215,256	319,785	537,166	792,667	104,529	217,381	255,501
	San Joaquin	North	579,172	884,375	1,454,089	2,122,660	305,203	569,714	668,571
	Stanislaus	North	459,025	708,950	1,160,376	1,690,026	249,925	451,426	529,650
	Sub-regional total		**1,253,453**	**1,913,110**	**3,151,631**	**4,605,353**	**659,657**	**1,238,521**	**1,453,722**
	Fresno	South	811,179	1,114,403	1,753,356	2,503,297	303,224	638,953	749,941
	Kern	South	677,372	1,073,748	1,919,849	2,923,829	396,376	846,101	1,003,980
	Kings	South	126,672	186,611	309,815	454,484	59,939	123,204	144,668
	Madera	South	126,394	224,567	411,713	635,019	98,173	187,146	223,305
	Tulare	South	379,944	569,896	982,425	1,468,811	189,952	412,529	486,386
	Sub-regional total		**2,121,561**	**3,169,225**	**5,377,159**	**7,985,439**	**1,047,664**	**2,207,934**	**2,608,280**
	Regional total		**3,375,014**	**5,082,335**	**8,528,790**	**12,590,792**	**1,707,321**	**3,446,455**	**4,062,002**
Sacramento	**Sacramento**	Central	**1,212,527**	**1,651,765**	**2,409,784**	**3,312,096**	**439,238**	**758,019**	**902,312**
	El Dorado	Foothills	163,197	256,119	381,668	530,209	92,922	125,549	148,541
	Nevada	Foothills	97,020	136,405	185,998	247,103	39,385	49,593	61,105
	Placer	Foothills	243,646	391,245	598,462	842,385	147,599	207,217	243,923
	Sub-regional total		**503,863**	**783,769**	**1,166,127**	**1,619,697**	**279,906**	**382,358**	**453,570**
	Sutter	North	82,040	116,408	173,672	241,405	34,368	57,264	67,732
	Yuba	North	63,983	84,610	124,998	172,890	20,627	40,388	47,892
	Sub-regional total		**146,023**	**201,018**	**298,670**	**414,295**	**54,995**	**97,652**	**115,625**
	Yolo	West	**164,010**	**225,321**	**341,228**	**477,893**	**61,311**	**115,907**	**136,665**
	Regional total		**2,026,423**	**2,861,873**	**4,215,809**	**5,823,981**	**835,450**	**1,353,936**	**1,608,172**

Table 2. Population projections by county, subregion, and region: 2000-2020, 2020-2050, and 2050-2100 (cont.)

			Population estimates and forecasts				Population change		
Major region	County	Sub-region	2000 (source: DOF)	2020F (source: DOF)	2050F (see Table B-2 for calculations)	2100F (see Table B-2 for calculations)	2000-2020	2020-2050	2050-2100
Nonmetropolitan counties	Alpine		1,239	1,701	2,261	2,965	462	560	704
	Amador		34,853	40,129	46,935	57,739	5,276	6,806	10,804
	Butte		207,158	307,296	483,980	691,341	100,138	176,684	207,361
	Calaveras		42,041	62,688	91,124	125,014	20,647	28,436	33,891
	Colusa		20,973	41,398	82,055	131,662	20,425	40,657	49,607
	Del Norte		31,155	41,898	56,955	75,549	10,743	15,057	18,594
	Glenn		29,298	49,113	88,790	135,982	19,815	39,677	47,191
	Humboldt		128,419	141,092	158,279	190,693	12,673	17,187	32,414
	Inyo		18,437	20,694	27,538	36,140	2,257	6,844	8,602
	Lake		60,072	93,058	148,122	212,717	32,986	55,064	64,595
	Lassen		35,959	49,322	69,607	94,087	13,363	20,285	24,480
	Mariposa		16,762	23,390	32,101	42,785	6,628	8,711	10,685
	Mendocino		90,442	118,804	169,149	229,650	28,362	50,345	60,501
	Modoc		10,481	12,396	16,629	21,911	1,915	4,233	5,282
	Mono		10,891	14,166	19,434	25,897	3,275	5,268	6,463
	Plumas		20,852	23,077	26,612	32,507	2,225	3,535	5,895
	Shasta		175,777	240,975	329,849	439,059	65,198	88,874	109,209
	Sierra		3,457	3,575	3,678	4,245	118	103	566
	Siskiyou		45,194	53,676	68,588	88,199	8,482	14,912	19,611
	Tehama		56,666	83,996	131,321	186,892	27,330	47,325	55,571
	Trinity		13,490	15,594	18,300	22,549	2,104	2,706	4,250
	Tuolumne		56,125	77,350	106,662	142,505	21,225	29,312	35,842
	Regional total		**1,109,741**	**1,515,388**	**2,177,969**	**2,990,087**	**405,647**	**662,581**	**812,118**
California			**34,653,395**	**45,448,627**	**66,763,758**	**92,081,030**	**10,795,232**	**21,315,131**	**25,317,272**

Table 2. Population projections by county, sub-region, and region: 2000-2020, 2020-2050, and 2050-2100 (cont.)

			Percent population change			County share of regional change (%)		
Major region	**County**	**Sub-region**	**2000-2020**	**2020-2050**	**2050-2100**	**2000-2020**	**2020-2050**	**2050-2100**
Southern California	**Los Angeles**	Central	**17.7**	**33.9**	**31.6**	**28.7**	**30.5**	**31.3**
	Imperial	South	93.3	105.2	63.3	2.4	2.4	2.5
	Orange	South	21.1	32.2	30.8	9.9	8.6	8.9
	San Diego	South	33.1	48.9	38.9	16.1	14.9	14.4
	Sub-regional total		**28.9**	**43.6**	**36.9**	28.4	25.9	25.8
	Riverside	Inland Empire	76.6	92.4	58.0	19.9	19.9	19.7
	San Bernardino	Inland Empire	59.0	81.4	53.4	16.9	17.4	17.0
	Sub-regional total		**67.4**	**86.9**	**55.8**	**36.8**	**37.2**	**36.7**
	Santa Barbara	North	34.2	63.8	45.7	2.3	2.7	2.6
	Ventura	North	30.2	48.3	38.6	3.8	3.7	3.6
	Sub-regional total		**31.6**	**53.9**	**41.3**	**6.1**	**6.4**	**6.2**
	Regional total		**29.9**	**49.0**	**40.1**	**100.0**	**100.0**	**100.0**
Northern California	Alameda	Central	22.0	27.5	28.5	17.9	15.9	16.1
	Contra Costa	Central	18.5	26.2	27.8	9.6	9.3	9.6
	San Francisco	Central	-5.2	-5.4	10.6	-2.3	-1.3	1.9
	San Mateo	Central	14.5	22.0	25.7	6.0	6.1	6.6
	Santa Clara	Central	24.6	31.3	30.4	24.0	22.1	21.6
	Sub-regional total		**17.5**	**24.2**	**27.1**	**55.3**	**52.0**	**55.7**
	Marin	North	8.1	21.0	25.1	1.1	1.8	2.0
	Napa	North	24.2	36.1	32.7	1.7	1.8	1.7
	Solano	North	38.1	43.0	36.1	8.4	7.6	7.0
	Sonoma	North	33.7	37.7	33.5	8.6	7.4	7.0
	Sub-regional total		**29.0**	**36.6**	**33.1**	**19.9**	**18.7**	**17.8**
	Monterey	South	43.1	75.1	50.7	9.6	13.9	12.6
	San Benito	South	58.7	61.9	44.8	1.7	1.6	1.5
	San Luis Obispo	South	54.0	57.4	42.8	7.6	7.2	6.5

Table 2. Population projections by county, sub-region, and region: 2000-2020, 2020-2050, and 2050-2100 (cont.).

			Percent population change			County share of regional change (%)		
Major region	**County**	**Sub-region**	**2000-2020**	**2020-2050**	**2050-2100**	**2000-2020**	**2020-2050**	**2050-2100**
Northern California (cont.)	Santa Cruz	South	41.1	55.8	42.1	5.9	6.6	5.9
	Sub-regional total		**46.3**	**64.4**	**46.2**	**24.9**	**29.3**	**26.5**
	Regional total		**22.8**	**32.1**	**31.6**	**100.0**	**100.0**	**100.0**
San Joaquin Valley	Merced	North	48.6	68.0	47.6	6.1	6.3	6.3
	San Joaquin	North	52.7	64.4	46.0	17.9	16.5	16.5
	Stanislaus	North	54.4	63.7	45.6	14.6	13.1	13.0
	Sub-regional total		**52.6**	**64.7**	**46.1**	**38.6**	**35.9**	**35.8**
	Fresno	South	37.4	57.3	42.8	17.8	18.5	18.5
	Kern	South	58.5	78.8	52.3	23.2	24.5	24.7
	Kings	South	47.3	66.0	46.7	3.5	3.6	3.6
	Madera	South	77.7	83.3	54.2	5.8	5.4	5.5
	Tulare	South	50.0	72.4	49.5	11.1	12.0	12.0
	Sub-regional total		**49.4**	**69.7**	**48.5**	**61.4**	**64.1**	**64.2**
	Regional total		**50.6**	**67.8**	**47.6**	**100.0**	**100.0**	**100.0**
Sacramento	**Sacramento**	Central	**36.2**	**45.9**	**37.4**	**52.6**	**56.0**	**56.1**
	El Dorado	Foothills	56.9	49.0	38.9	11.1	9.3	9.2
	Nevada	Foothills	40.6	36.4	32.9	4.7	3.7	3.8
	Placer	Foothills	60.6	53.0	40.8	17.7	15.3	15.2
	Sub-regional total		**55.6**	**48.8**	**38.9**	**33.5**	**28.2**	**28.2**
	Sutter	North	41.9	49.2	39.0	4.1	4.2	4.2
	Yuba	North	32.2	47.7	38.3	2.5	3.0	3.0
	Sub-regional total		**37.7**	**48.6**	**38.7**	**6.6**	**7.2**	**7.2**
	Yolo	West	**37.4**	**51.4**	**40.1**	**7.3**	**8.6**	**8.5**
	Regional total		**41.2**	**47.3**	**38.1**	**100.0**	**100.0**	**100.0**

Table 2. Population projections by county, sub-region, and region: 2000-2020, 2020-2050, and 2050-2100 (cont.).

			Percent population change			County share of regional change (%)		
Major region	**County**	**Sub-region**	**2000-2020**	**2020-2050**	**2050-2100**	**2000-2020**	**2020-2050**	**2050-2100**
Nonmetropolitan counties	Alpine		37.3	32.9	31.2	0.1	0.1	0.1
	Amador		15.1	17.0	23.0	1.3	1.0	1.3
	Butte		48.3	57.5	42.8	24.7	26.7	25.5
	Calaveras		49.1	45.4	37.2	5.1	4.3	4.2
	Colusa		97.4	98.2	60.5	5.0	6.1	6.1
	Del Norte		34.5	35.9	32.6	2.6	2.3	2.3
	Glenn		67.6	80.8	53.1	4.9	6.0	5.8
	Humboldt		9.9	12.2	20.5	3.1	2.6	4.0
	Inyo		12.2	33.1	31.2	0.6	1.0	1.1
	Lake		54.9	59.2	43.6	8.1	8.3	8.0
	Lassen		37.2	41.1	35.2	3.3	3.1	3.0
	Mariposa		39.5	37.2	33.3	1.6	1.3	1.3
	Mendocino		31.4	42.4	35.8	7.0	7.6	7.4
	Modoc		18.3	34.1	31.8	0.5	0.6	0.7
	Mono		30.1	37.2	33.3	0.8	0.8	0.8
	Plumas		10.7	15.3	22.2	0.5	0.5	0.7
	Shasta		37.1	36.9	33.1	16.1	13.4	13.4
	Sierra		3.4	2.9	15.4	0.0	0.0	0.1
	Siskiyou		18.8	27.8	28.6	2.1	2.3	2.4
	Tehama		48.2	56.3	42.3	6.7	7.1	6.8
	Trinity		15.6	17.3	23.2	0.5	0.4	0.5
	Tuolumne		37.8	37.9	33.6	5.2	4.4	4.4
	Regional total		**36.6**	**43.7**	**37.3**	**100.0**	**100.0**	**100.0**
California			**31.2**	**46.9**	**37.9**	**100.0**	**100.0**	**100.0**

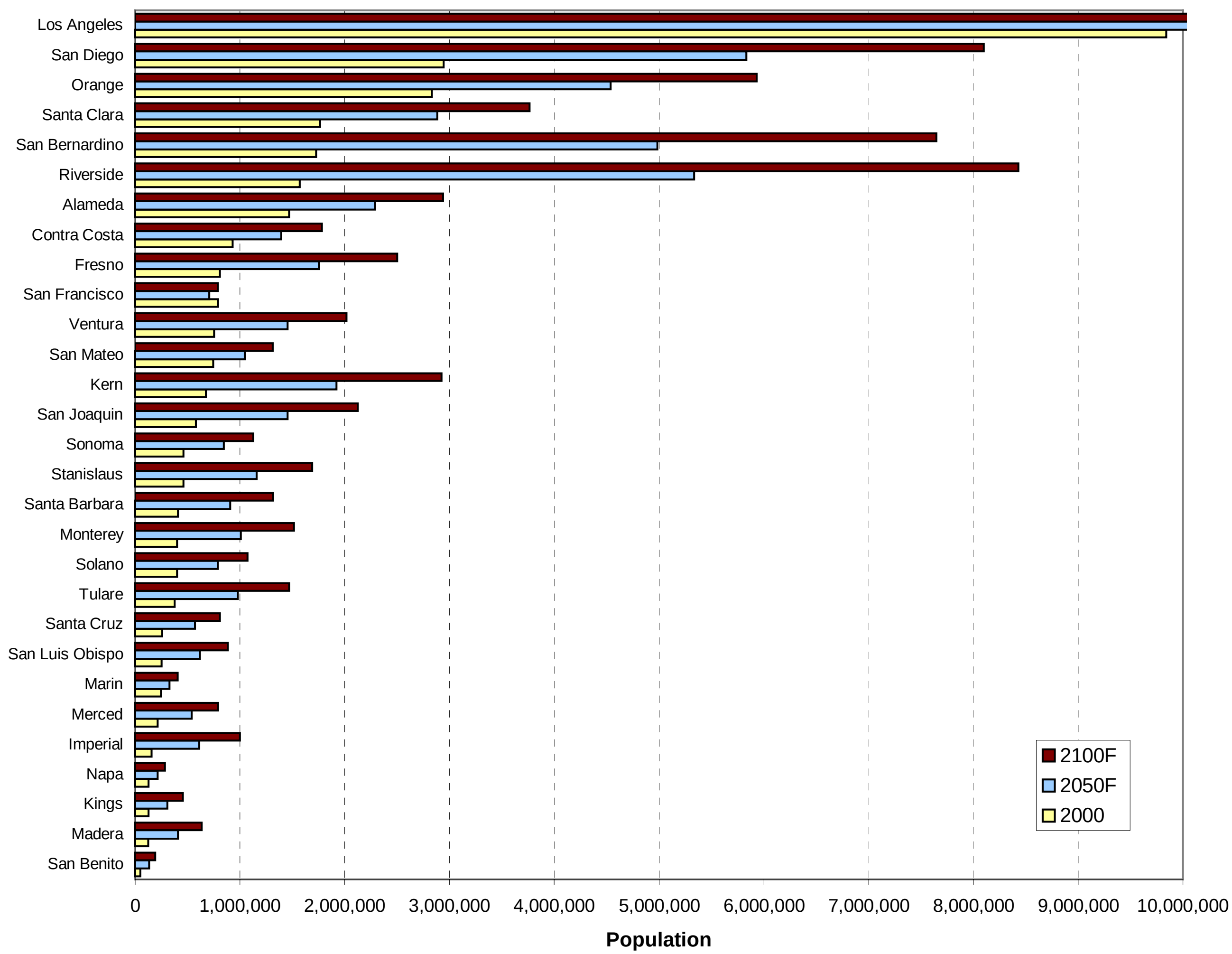

Figure 3. Projected population growth among metropolitan California counties, 2000-2020, 2020-2050, 2050-2100

As coastal locations have grown increasingly built out, developers have moved farther inland. In addition to being less expensive, inland locations have traditionally been less subject to land use and environmental regulation than their coastal counterparts, making development cheaper and easier.

California was built by developers, and developers are nothing if not opportunistic. Even as they continue their inexorable inland push, California's developers also continually look over their shoulders to consider potential infill and redevelopment opportunities. Thus, at the same time that California's coastal metropolitan areas are growing eastward, they are also infilling and redeveloping. And to the extent that infill development tends to occur at higher-than-existing densities, overall urban densities also rise.

This is the theory — in practice, local land use controls and opposition from neighborhood groups often function to make infill and redevelopment proportionately more difficult than greenfield development, breaking the link between growth at the urban fringe, increased infill activity, and rising urban densities. The result is less urban redevelopment and more urban sprawl.

Figures 4 and 5 graphically present these relationships for 38 predominantly urban counties. Figure 4 compares the share of each county's land area that was urbanized in 1972 with the population density of subsequent new development. As predicted, marginal densities — measured as the change in population divided by change in urban land area — rise with the share of each county's land in urban use. Based on the fitted trend line, for every percent share of each county's land area in urban use in 1972, marginal development densities during the 1972-1996 period rose by 26 individuals per acre.

Figure 5 compares the share of each county's land area that was urbanized as of 1972 with the share of new development occurring within the existing urban footprint in the form of infill. As expected, county infill shares rise (and greenfield shares fall) with the share of each county's land in urban use. Based on the fitted trend line, for every percent share of each county's land area in urban use in 1972, the share of subsequent urban development occurring as infill — that is, within the initial 1980 urban footprint — rose by 200%.

Neither the density trend line in Figure 4 nor the infill trend line in Figure 5 fits the observed data all that well, a fact confirmed by the middling goodness-of-fit statistics of the estimated regression lines (see Table 3). Some counties, such as Los Angeles, Orange, Santa Clara, San Mateo, and Stanislaus developed at higher densities and with more infill than average for their respective regions. Others, most notably Alameda, Contra Costa, and Sacramento, developed at lower densities or with less infill than expected.

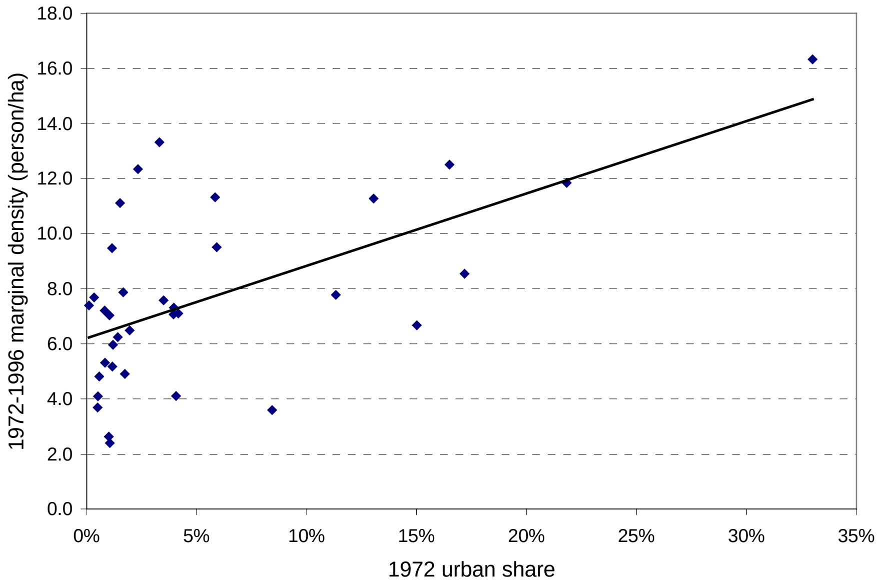

Figure 4. Comparison of 1972 urbanization levels and 1972-1996 development densities for selected California counties

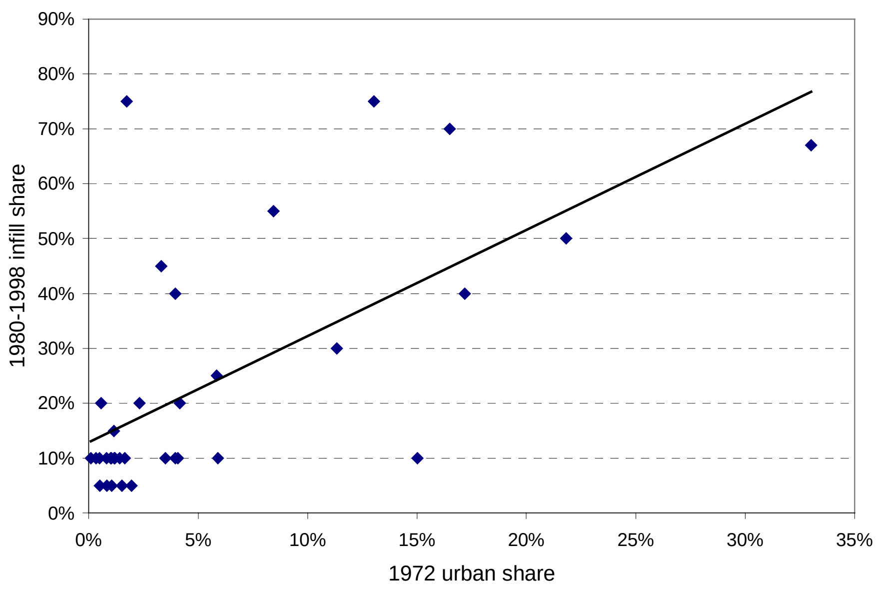

Figure 5. Comparison of 1972 urbanization shares and 1972-1996 infill rates for selected California counties

Table 3. Regression results comparing county 1972 urban land shares with 1972-1996 infill rates and development densities

	Dependent variable: 1972-1996 development densities		Dependent variable: 1972-1996 infill rates	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
1972 urban land share	26.29	4.27	1.94	4.88
Intercept	6.21	11.04	0.13	3.55
Adjusted r-squared	0.34		0.40	
Number of observations	35		235	

Used with care, these two regression lines can be used to project future development densities and infill shares. In both cases, this involves incorporating additional information:

1. We project incremental densities by selecting the maximum of the recent incremental density for each county (denoted by the subscript *i* below) and the regression-based incremental density. This adjustment has the effect of preventing projected incremental densities from falling. Projected incremental densities are listed as Columns 7 through 10 in Table B.1 in Attachment B.

$$\text{Projected incremental density}_i = \text{MAX [recent incremental density}_i\text{, regression-based incremental density}_i\text{]} \quad (5)$$

2. County-level infill growth shares are projected as the average of the current infill share and the maximum of the current infill share and the regression-estimated infill share. This adjustment has the effect of preventing infill shares from either rising too quickly or falling. Projected incremental densities are listed as Columns 11 through 14 in Table B.1 in Attachment B.

3. Projected greenfield population growth — the amount of population growth not projected to take the form of infill development — is calculated by multiplying projected population growth for each county by 1.0 minus the projected infill share for that county. The result of this calculation is then multiplied by the projected incremental density to yield an estimate of the amount of additional projected greenfield development. Table C.2 presents the results of this sequence of calculations. Projected greenfield population growth$_i$ = Population projection$_i$ * [1 - projected infill share$_i$]

$$\text{Projected greenfield development in acres}_i = \text{Projected greenfield population growth}_i * \text{[Projected incremental density}_i\text{] / 2.47} \quad (6)$$

2.6 Updating the Inputs

Projected population growth is allocated to sites during three periods: 1997-2020, 2020-2050, and 2050-2100. Several parameters and data layers are updated prior to each successive allocation round. These include:

1. **Job accessibility:** A job accessibility measure is calculated for each site based on its proximity via the highway network to all jobs, as located at discrete job centers. As noted in Table 1, this measure is used in the logit model equation used to estimate future site-level development probabilities. Subsequent to each growth allocation, a new set of job accessibility measures is computed for each site based on projected job growth by city or place and any changes in relative highway accessibility. For the baseline scenario (see Section 3), no changes in relative highway accessibility are assumed. Thus changes in site-level job accessibility reflect only changes in the distribution and number of jobs. In subsequent scenarios, we expect to alter job accessibility by also adding new highway or rail links.

2. **City boundaries:** Because development in California generally favors locations within cities — with some important differences among regions — it is essential to update city boundaries subsequent to each growth allocation, and to then estimate development probabilities accordingly. This does not present a problem for newly developed sites within existing city boundaries, but for sites outside existing boundaries, those boundaries must be stretched to accommodate the additional growth, which is done manually. In the most common case, increments of new development adjacent to or nearby existing cities are effectively "incorporated." In rarer cases, small free-standing increments of new development are treated as unincorporated urban places. In rarer cases still, large free-standing increments of new development are incorporated as new cities.

3. **Physical features:** The physical features of sites, such as their slope, location in a flood zone, or status as prime farmland, do not change between allocation rounds.

4. **Urban share:** Subsequent to each allocation round, the share of land area in each county in urban use is updated. The updated urban share is then used to estimate updated incremental development densities and infill shares for the next allocation round. Table B.1 in Attachment B reports this sequence of densities and infill shares for each county.

2.7 Key Assumptions and Caveats

Numerous assumptions are embedded in this procedure and its components. Perhaps the most questionable is whether it is within the realm of human capability to accurately extrapolate current population and employment growth trends and urban settlement patterns far into the future — in this case, through 2100 — and particularly in a state as changeable as California. If history teaches us anything, it is that the future is *always different* than we anticipate, no matter how sophisticated our reasoning or projection techniques. For this reason, the projections developed here and in later efforts are best viewed not as forecasts, per se, but as scenarios — that is, as a set of illustrative futures designed to indicate how particular growth trends and development dynamics might play out on California's diverse landscapes. Beyond this general caveat, five specific assumptions drive this analysis:

1. **The same factors that shaped land development patterns in the recent past will continue to do so in the future, and in the same ways**. As we discussed previously, this procedure allocates future development to individual sites based on their projected development probability. These probabilities are estimated using the results of a statistical model calibrated for the period 1988-1998. The exact role of particular factors varies by region, but several influences are consistently important. These include proximity to freeways, access to jobs, site slope, and site incorporation status. Other factors such as farmland and wetland status vary more widely in their importance. To the extent that these factors are less important in the future, or are important in different ways — or, as is even more likely, that other factors become important — the model results will vary widely than what is presented here.

2. **Jobs will continue decentralizing within California's four major urban regions — southern California, the greater San Francisco Bay area, the Sacramento region, and the southern San Joaquin Valley**. Taking advantage of improved freeway access, less expensive land, and lower development costs, job growth during the last 50 years has favored suburban locations over core cities. To the extent that this trend continues — given the increasing importance of telecommunications in shaping economic geography, and in the absence of countervailing policies, there is no reason to believe that it should not — decentralizing job growth will continue to pull population outward, leading to more decentralized growth patterns.

3. **California's population will continue to grow, and at more or less the same rate and in the same spatial pattern as projected by the California DOF.** For consistency's sake, we rely on county population projections developed by the DOF through 2040. (The DOF population projections are calculated by extrapolating current fertility and migration trends.) Thereafter, we extrapolate and trend downward the annualized county

growth rates embedded in the DOF population projections, This approach yields a statewide population of 68 million in 2050 and 92 million in 2100.

As large as these numbers are, they are hardly inconceivable. Since 1940, because of its robust economy, benign weather, and location on the Pacific Rim, California has been adding population at a steady rate of about 5 million individuals every decade. Should this trend continue, California's 2100 population would exceed 85 million. On the flip side, if California's economy falters, or if the state's high cost of living starts to choke off further job growth, the state's population could easily plateau around 50 million, and although it seems unthinkable today, perhaps even trend downward.

4. **Average infill rates and population densities will increase with additional development**. It is an axiom of economics that scarce resources are used more intensely than plentiful ones. Following this logic, as available supplies of developable land are used up, developers seek ways to use remaining land more intensely, either by increasing densities or through redevelopment. Thus, both development densities and infill activity should increase with population growth. Counteracting this tendency is the desire of many residents to preserve a rural or suburban lifestyle. In many parts of California, then, infill activities and development densities are below the levels suggested by theory. For the purposes of constructing a baseline scenario, we assume that future infill activity and development densities will follow the upward trend lines reported in Figures 4 and 5. To the extent that these trend lines are not followed, additional greenfield sites will be needed to accommodate projected population growth.

5. **With respect to the baseline scenario (see next section), no new freeways, or intra- and inter-regional rapid transit systems will be developed. Freeway road travel speeds will remain at current levels**. This is perhaps the least realistic assumption of all. It is abundantly clear that California's growing population will need additional transportation infrastructure, but it is unclear what the infrastructure should be, where it should go, and how it should be planned and financed. Lacking these specifics, and for the purposes of constructing a baseline scenario, we assumed no change in transportation technology or facilities beyond what is currently available. The effect of this assumption is to direct additional growth to locations already served by transportation infrastructure rather than to new or different areas. Additional scenarios beyond the baseline will be developed to evaluate the likely effects of specific planned or proposed transportation investments.

3. The Baseline Scenario

3.1 Building the Baseline Scenario

The function of the baseline scenario is to serve as a minimum-change alternative against which future scenarios that posit more extensive policy, regulatory, or investment interventions can be compared. More succinctly, the baseline scenario assumes continued growth along the lines of past trends and patterns without significant policy change. Among the list of possible policy interventions *not envisioned* in the baseline scenario are additional infrastructure projects, environmental restrictions on land development, and conservation and land preservation initiatives, as well as locally initiated changes in development densities and infill activities.

The baseline scenario as developed does not incorporate local planning concerns and issues as articulated in local general plans, zoning and subdivision ordinances, and other local planning documents. In this sense, the baseline scenario is neither explicitly "pro-market" nor "pro-planning." In counties where recent development patterns have principally been a function of market factors, that reality is projected to continue. And in counties where recent development patterns have been more constrained by formal or ad hoc policies, that reality is projected to continue as well.

Scenario building involves four steps. First, we calculate a future development probability for each undeveloped site (see Figure 2), using the land use change model results presented in Table 1 and job projections. For purposes of calculating future job and highway accessibility, no additions to the current highway system were assumed.

Second, we specify a population growth increment to be allocated and an appropriate allocation density. For the baseline scenario, county population totals and allocation densities were drawn from Attachment B.

Third, we specify a list of absolute exclusion conditions denoting which sites may *not be developed* regardless of their development probability or the level of projected population growth. Four types of sites were excluded from development under the baseline scenario: (1) sites that are publicly owned, (2) sites that are currently under water, (3) sites that are identified as wetlands, and (4) sites with an average slope in excess of 20%. Sites on which development *is allowed* under the baseline scenario include flood zone sites, farmlands of all types, sites in riparian areas, and sites presumed to be habitat to one or more threatened or endangered species. The fact that development is allowed on this latter set of sites does not mean that it is encouraged; instead, under the baseline scenario, no policies or plans exclude development.

Finally, we allocate prospective population growth to nonexcluded sites in order of their development probability.

3.2 Baseline Scenario Results

Statewide baseline scenario results for 1998, 2020, 2050, and 2100 are presented in tabular form by region and county in Table 4 and in map form in Figures 6 through 18. Throughout the state, projected urban development will occur on flat sites, follow freeways, and be located in and adjacent to existing cities and urban places (Figures 6 through 9). Beyond these commonalities, growth patterns will differ significantly by region and county. Starting in the south and moving north:

Southern California: San Diego, Orange, and Imperial counties (Figure 10): Urban development in the San Diego-Orange-Imperial County subregion will increase from about 245,000 ha in 1998; to 301,000 ha in 2020; to 385,000 ha in 2050; and to 479,000 ha in 2100. Urban growth in the San Diego-Orange-Imperial subregion will account for about one-quarter of all new urban development in southern California.

More than two-thirds of the region's projected urban growth will occur in San Diego County. Historically, most urban development in San Diego County has been located within 10 miles of the Pacific coast. As these areas were built out in the 1980s and 1990s, growth leapfrogged north into southwestern Riverside County, and to a lesser extent, up the eastern foothills.

These trends will continue into the foreseeable future. If current trends continue, the I-15/Temecula area in southwestern Riverside County will be substantially built out by about 2020, and development will have begun backfilling northern San Diego County. By 2050, Camp Pendleton, which separates San Diego and Orange counties, will be completely encircled by urban development. By 2100, if current trends continue, northern San Diego County and southwestern Riverside County will be completely urbanized, and intense urban growth will have moved east along Interstate I-10 into central San Diego County.

Most of Orange County's projected population growth will take the form of high-density infill. Thus, even though Orange County will account for a significant share of southern California's population growth by 2100, it will account for a far lesser share of the region's projected urban expansion — on the order of only 2% to 4%, depending on the period. By 2050, almost all undeveloped lands in Orange County west and north of the foothills will have been developed.

Table 4. Summary of urban land area growth projections by county, subregion, and region: 1998-2020, 2020-2050, and 2050-2100

			Urbanized land area (ha)				Change in urbanized land area (ha)		
Major region	**County**	**Sub-region**	**1998**	**2020F**	**2050F**	**2100F**	**1998-2020**	**2020-2050**	**2050-2100**
Southern California	**Los Angeles**	Central	**307,205**	**318,174**	**342,037**	**360,808**	**10,969**	**23,863**	**18,771**
	Imperial	South	9,682	19,834	38,365	59,615	10,152	18,531	21,250
	Orange	South	109,364	116,424	122,459	129,443	7,060	6,035	6,984
	San Diego	South	125,883	164,271	224,118	290,171	38,388	59,847	66,053
	Sub-regional total		**244,929**	**300,529**	**384,942**	**479,229**	**55,600**	**84,413**	**94,287**
	Riverside	Inland Empire	97,760	162,938	270,893	389,620	65,178	107,955	118,727
	San Bernardino	Inland Empire	110,329	171,155	281,363	411,287	60,826	110,208	129,924
	Sub-regional total		**208,089**	**334,093**	**552,256**	**800,907**	**126,004**	**218,163**	**248,651**
	Santa Barbara	North	24,061	28,142	45,317	63,227	4,081	17,175	17,910
	Ventura	North	39,135	50,043	67,330	85,631	10,908	17,287	18,301
	Sub-regional total		**63,196**	**78,185**	**112,647**	**148,858**	**14,989**	**34,462**	**36,211**
	Regional total		**823,419**	**1,030,981**	**1,391,882**	**1,789,802**	**207,562**	**360,901**	**397,920**
Northern California	Alameda	Central	56,562	63,453	70,471	79,053	6,891	7,018	8,582
	Contra Costa	Central	55,547	60,250	65,067	70,751	4,703	4,817	5,684
	San Francisco	Central	9,386	9,386	9,386	9,386	0	0	0
	San Mateo	Central	28,473	29,769	31,682	34,300	1,296	1,913	2,618
	Santa Clara	Central	72,717	77,510	83,628	91,392	4,793	6,118	7,764
	Sub-regional total		**222,685**	**240,368**	**260,234**	**284,882**	**17,683**	**19,866**	**24,648**
	Marin	North	16,073	16,590	17,718	19,373	517	1,128	1,655
	Napa	North	8,313	9,861	11,924	14,411	1,548	2,063	2,487
	Solano	North	21,470	27,815	35,417	44,275	6,345	7,602	8,858
	Sonoma	North	26,762	34,494	43,614	54,514	7,732	9,120	10,900
	Sub-regional total		**72,618**	**88,760**	**108,673**	**132,573**	**16,142**	**19,913**	**23,900**
	Monterey	South	20,224	28,922	50,837	74,896	8,698	21,915	24,059
	San Benito	South	2,709	4,344	7,240	10,457	1,635	2,896	3,217
	San Luis Obispo	South	14,989	20,920	32,512	45,581	5,931	11,592	13,069

Table 4. Summary of urban land area growth projections by county, sub-region, and region: 1998-2020, 2020-2050, and 2050-2100 (cont.)

			Urbanized land area (ha)				Change in urbanized land area (ha)		
Major region	**County**	**Sub-region**	**1998**	**2020F**	**2050F**	**2100F**	**1998-2020**	**2020-2050**	**2050-2100**
Northern California (cont.)	Santa Cruz	South	11,539	14,713	21,142	21,145	3,174	6,429	3
	Sub-regional total		**49,461**	**68,899**	**111,731**	**152,079**	**19,438**	**42,832**	**40,348**
	Regional total		**344,764**	**398,027**	**480,638**	**569,534**	**53,263**	**82,611**	**88,896**
San Joaquin Valley	Merced	North	12,358	18,528	29,353	41,382	6,170	10,825	12,029
	San Joaquin	North	29,023	43,284	63,652	85,114	14,261	20,368	21,462
	Stanislaus	North	20,430	25,142	38,362	54,256	4,712	13,220	15,894
	Sub-regional total		**61,811**	**86,954**	**131,367**	**180,752**	**25,143**	**44,413**	**49,385**
	Fresno	South	37,765	48,893	81,243	119,323	11,128	32,350	38,080
	Kern	South	40,840	65,117	111,187	159,400	24,277	46,070	48,213
	Kings	South	11,501	15,094	20,830	27,189	3,593	5,736	6,359
	Madera	South	9,025	15,348	24,970	35,827	6,323	9,622	10,857
	Tulare	South	19,701	30,181	52,627	76,216	10,480	22,446	23,589
	Sub-regional total		**118,832**	**174,633**	**290,857**	**417,955**	**55,801**	**116,224**	**127,098**
	Regional total		**180,643**	**261,587**	**422,224**	**598,707**	**80,944**	**160,637**	**176,483**
Sacramento	**Sacramento**	**Central**	**61,009**	**71,950**	**85,317**	**100,003**	**10,941**	**13,367**	**14,686**
	El Dorado	Foothills	10,436	13,920	17,829	22,611	3,484	3,909	4,782
	Nevada	Foothills	5,924	7,935	9,905	12,367	2,011	1,970	2,462
	Placer	Foothills	15,284	23,776	33,099	44,089	8,492	9,323	10,990
	Sub-regional total		**31,644**	**45,631**	**60,833**	**79,067**	**13,987**	**15,202**	**18,234**
	Sutter	North	4,311	6,385	9,202	12,333	2,074	2,817	3,131
	Yuba	North	4,531	5,821	7,834	10,290	1,290	2,013	2,456
	Sub-regional total		**8,842**	**12,206**	**17,036**	**22,623**	**3,364**	**4,830**	**5,587**
	Yolo	**West**	**10,368**	**12,923**	**16,752**	**21,422**	**2,555**	**3,829**	**4,670**
	Regional total		**111,863**	**142,710**	**179,938**	**223,115**	**30,847**	**37,228**	**43,177**

Table 4. Summary of urban land area growth projections by county, sub-region, and region: 1998-2020, 2020-2050, and 2050-2100 (cont.)

			Percent change in urbanized land area (ha)			County share of regional change (%)		
Major region	**County**	**Sub-region**	**1998-2020**	**2020-2050**	**2050-2100**	**1998-2020**	**2020-2050**	**2050-2100**
Southern California	**Los Angeles**	Central	**3.6**	**7.5**	**5.5**	**5.3**	**6.6**	**4.7**
	Imperial	South	104.9	93.4	55.4	4.9	5.1	5.3
	Orange	South	6.5	5.2	5.7	3.4	1.7	1.8
	San Diego	South	30.5	36.4	29.5	18.5	16.6	16.6
	Sub-regional total		**22.7**	**28.1**	**24.5**	26.8	23.4	23.7
	Riverside	Inland Empire	66.7	66.3	43.8	31.4	29.9	29.8
	San Bernardino	Inland Empire	55.1	64.4	46.2	29.3	30.5	32.7
	Sub-regional total		**60.6**	**65.3**	**45.0**	**60.7**	**60.4**	**62.5**
	Santa Barbara	North	17.0	61.0	39.5	2.0	4.8	4.5
	Ventura	North	27.9	34.5	27.2	5.3	4.8	4.6
	Sub-regional total		**23.7**	**44.1**	**32.1**	**7.2**	**9.5**	**9.1**
	Regional total		**25.2**	**35.0**	**28.6**	**100.0**	**100.0**	**100.0**
Northern California	Alameda	Central	12.2	11.1	12.2	12.9	8.5	9.7
	Contra Costa	Central	8.5	8.0	8.7	8.8	5.8	6.4
	San Francisco	Central	0.0	0.0	0.0	0.0	0.0	0.0
	San Mateo	Central	4.6	6.4	8.3	2.4	2.3	2.9
	Santa Clara	Central	6.6	7.9	9.3	9.0	7.4	8.7
	Sub-regional total		**7.9**	**8.3**	**9.5**	**33.2**	**24.0**	**27.7**
	Marin	North	3.2	6.8	9.3	1.0	1.4	1.9
	Napa	North	18.6	20.9	20.9	2.9	2.5	2.8
	Solano	North	29.6	27.3	25.0	11.9	9.2	10.0
	Sonoma	North	28.9	26.4	25.0	14.5	11.0	12.3
	Sub-regional total		**22.2**	**22.4**	**22.0**	**30.3**	**24.1**	**26.9**
	Monterey	South	43.0	75.8	47.3	16.3	26.5	27.1
	San Benito	South	60.4	66.7	44.4	3.1	3.5	3.6
	San Luis Obispo	South	39.6	55.4	40.2	11.1	14.0	14.7

Table 4. Summary of urban land area growth projections by county, sub-region, and region: 1998-2020, 2020-2050, and 2050-2100 (cont.)

			Percent change in urbanized land area (ha)			County share of regional change (%)		
Major region	**County**	**Sub-region**	**1998-2020**	**2020-2050**	**2050-2100**	**1998-2020**	**2020-2050**	**2050-2100**
Northern California (cont.)	Santa Cruz	South	27.5	43.7	0.0	6.0	7.8	0.0
	Sub-regional total		**39.3**	**62.2**	**36.1**	**36.5**	**51.8**	**45.4**
	Regional total		**15.4**	**20.8**	**18.5**	**0.0**	**0.0**	**0.0**
San Joaquin Valley	Merced	North	49.9	58.4	41.0	7.6	6.7	6.8
	San Joaquin	North	49.1	47.1	33.7	17.6	12.7	12.2
	Stanislaus	North	23.1	52.6	41.4	5.8	8.2	9.0
	Sub-regional total		**40.7**	**51.1**	**37.6**	**31.1**	**27.6**	**28.0**
	Fresno	South	29.5	66.2	46.9	13.7	20.1	21.6
	Kern	South	59.4	70.7	43.4	30.0	28.7	27.3
	Kings	South	31.2	38.0	30.5	4.4	3.6	3.6
	Madera	South	70.1	62.7	43.5	7.8	6.0	6.2
	Tulare	South	53.2	74.4	44.8	12.9	14.0	13.4
	Sub-regional total		**47.0**	**66.6**	**43.7**	**68.9**	**72.4**	**72.0**
	Regional total		**44.8**	**61.4**	**41.8**	**100.0**	**100.0**	**100.0**
Sacramento	**Sacramento**	**Central**	**17.9**	**18.6**	**17.2**	**35.5**	**35.9**	**34.0**
	El Dorado	Foothills	33.4	28.1	26.8	11.3	10.5	11.1
	Nevada	Foothills	33.9	24.8	24.9	6.5	5.3	5.7
	Placer	Foothills	55.6	39.2	33.2	27.5	25.0	25.5
	Sub-regional total		**44.2**	**33.3**	**30.0**	**45.3**	**40.8**	**42.2**
	Sutter	North	48.1	44.1	34.0	6.7	7.6	7.3
	Yuba	North	28.5	34.6	31.4	4.2	5.4	5.7
Sacramento	**Sub-regional total**		**38.0%**	**39.6%**	**32.8%**	**10.9%**	**13.0%**	**12.9%**
	Yolo	**West**	**24.6%**	**29.6%**	**27.9%**	**8.3%**	**10.3%**	**10.8%**
	Regional total		**27.6%**	**26.1%**	**24.0%**	**100.0%**	**100.0%**	**100.0%**

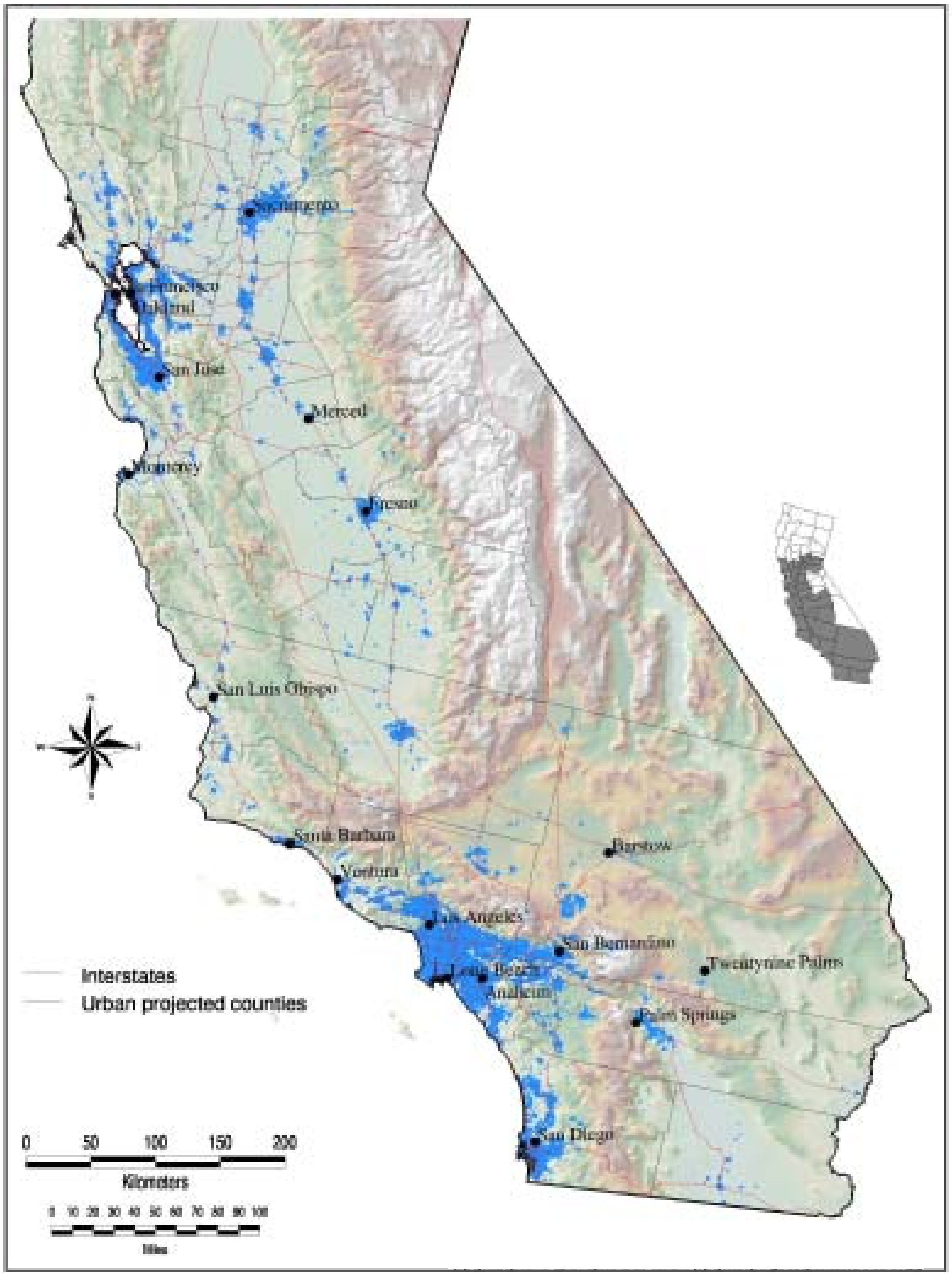

Figure 6. California's urban footprint, 1998 (population: 33 million)

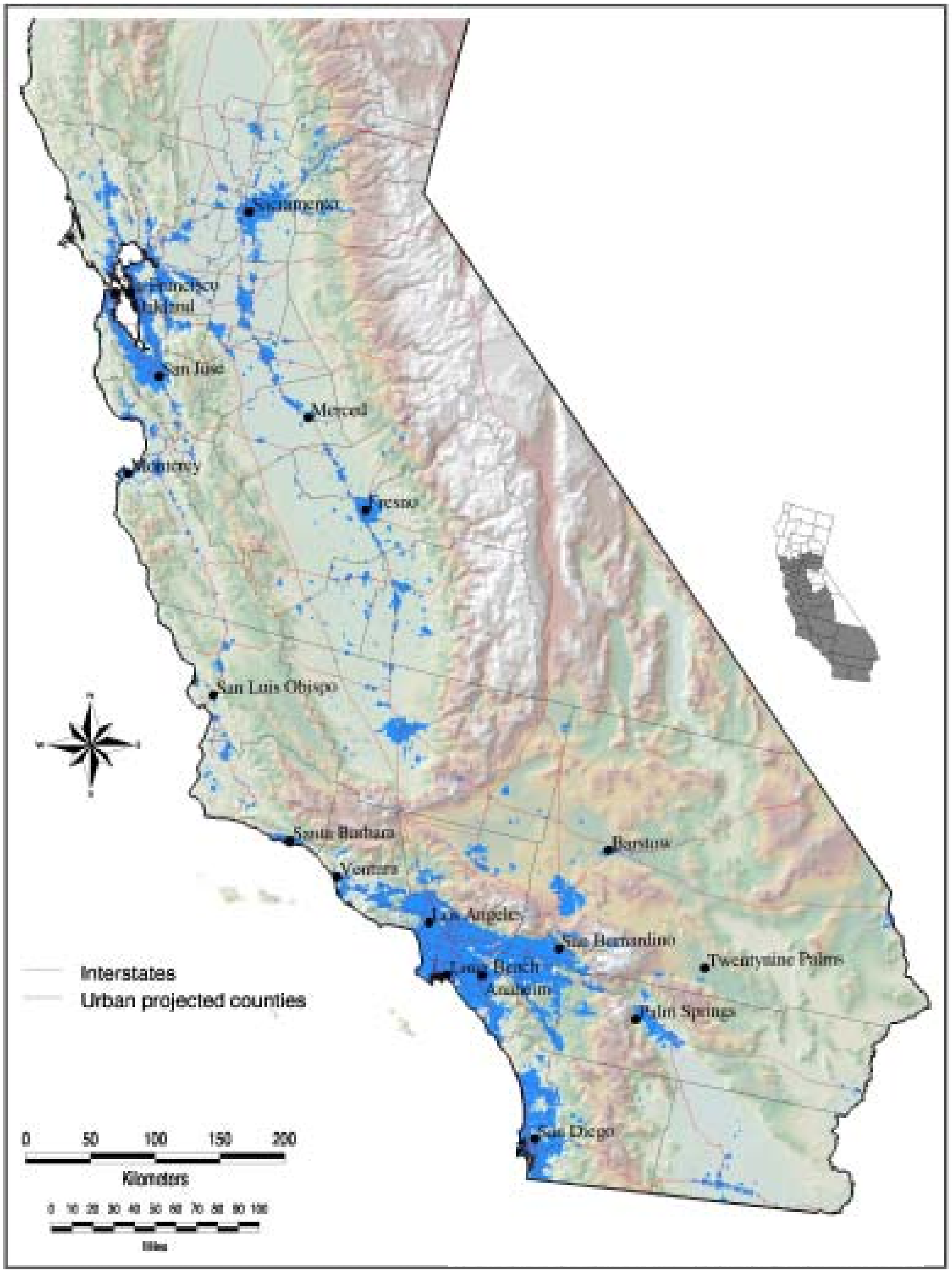

Figure 7. California's urban footprint, 2020F (population: 45.5 million)

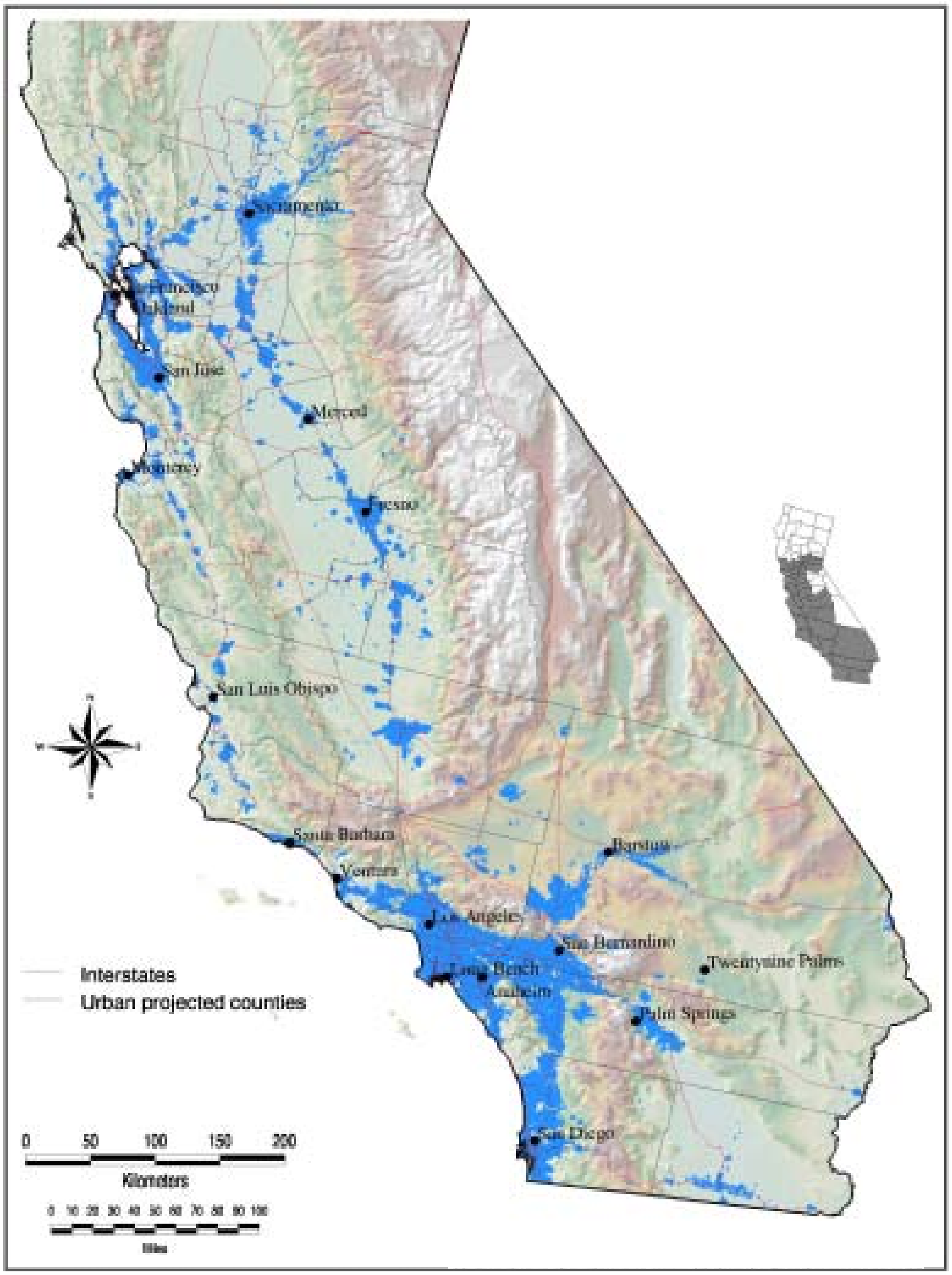

Figure 8. California's urban footprint, 2050F (population: 67 million)

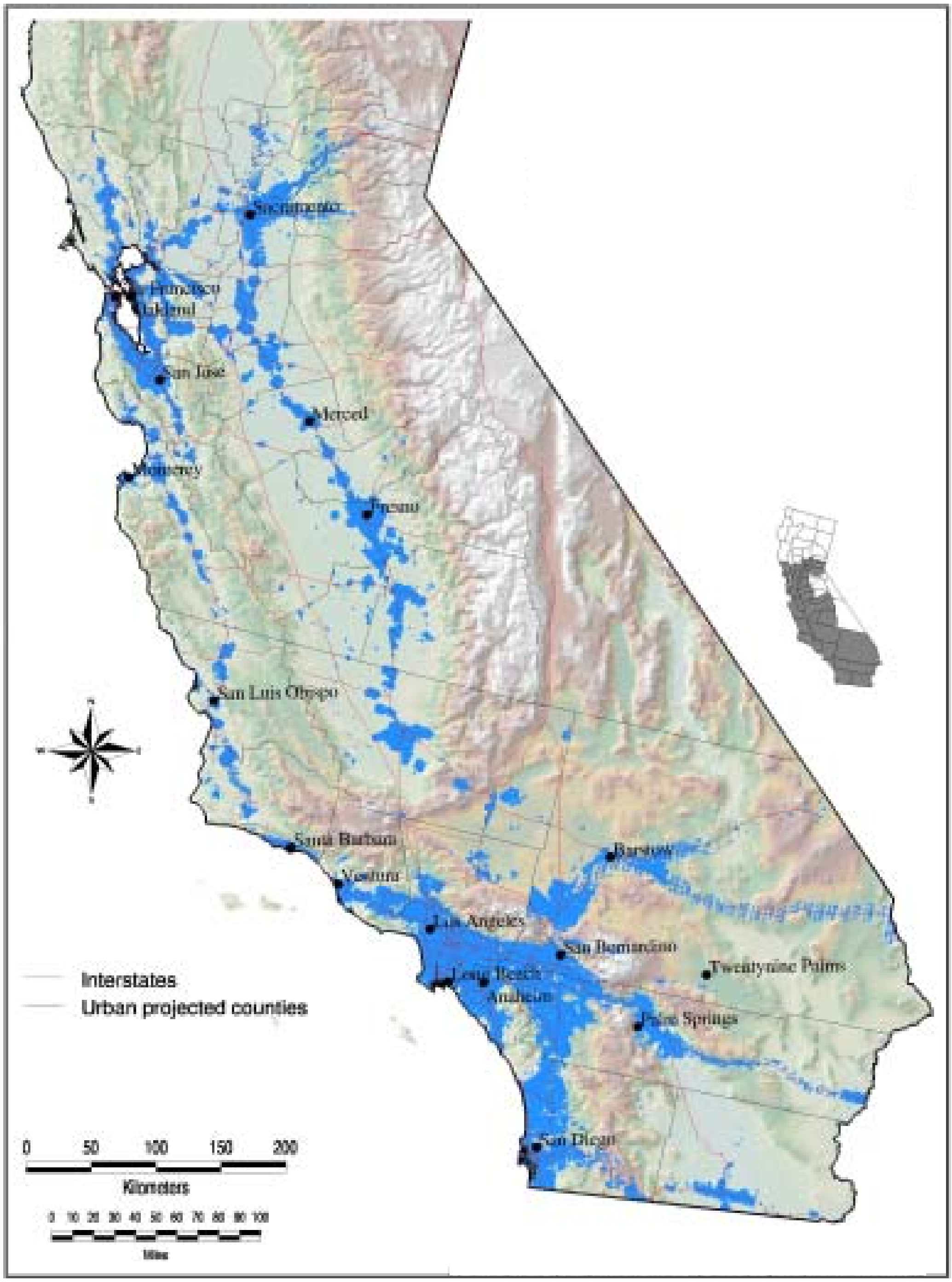

Figure 9. California's urban footprint, 2100F (population: 92 million)

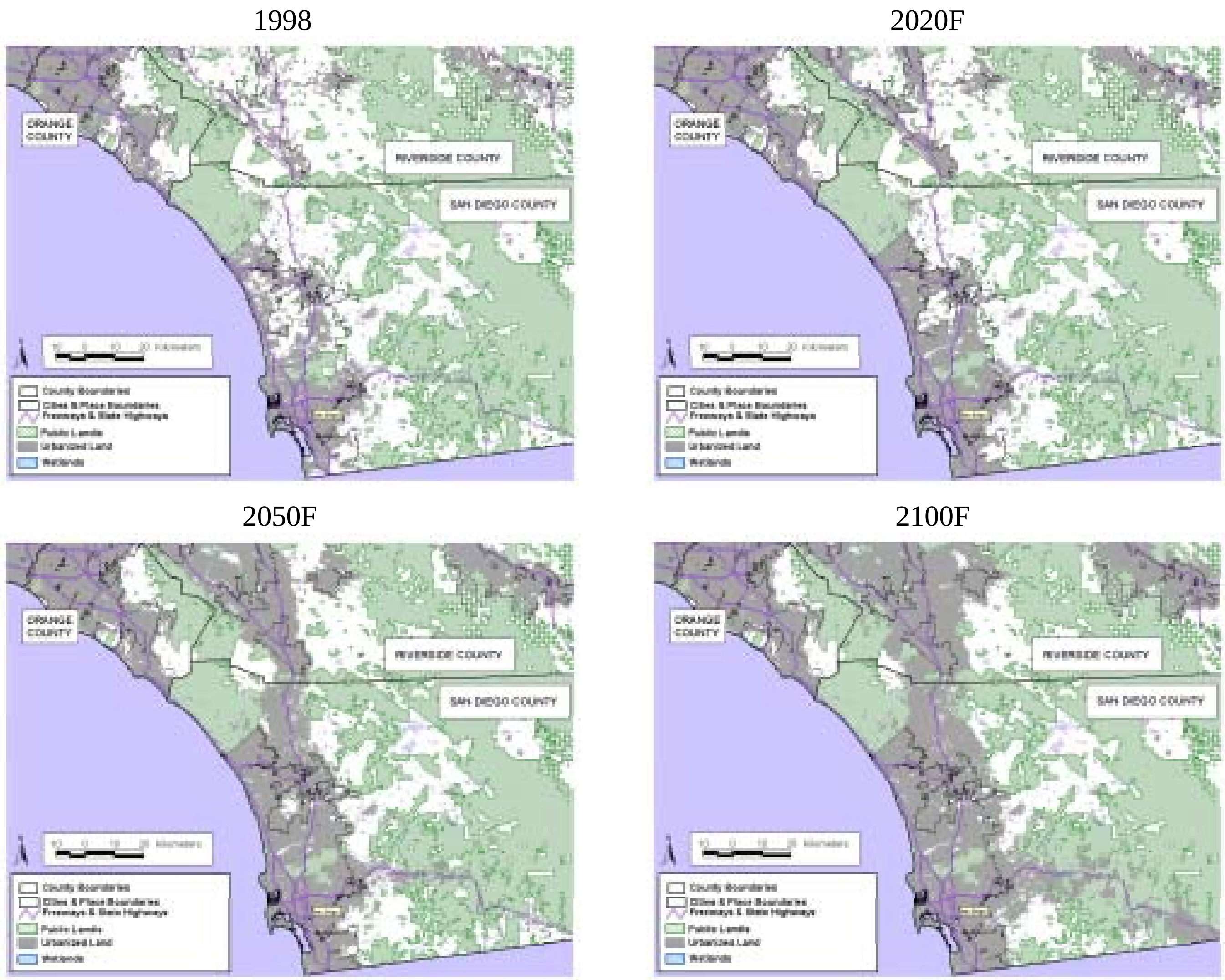

Figure 10. Urban growth projections for the San Diego/Orange County area, 1998-2100

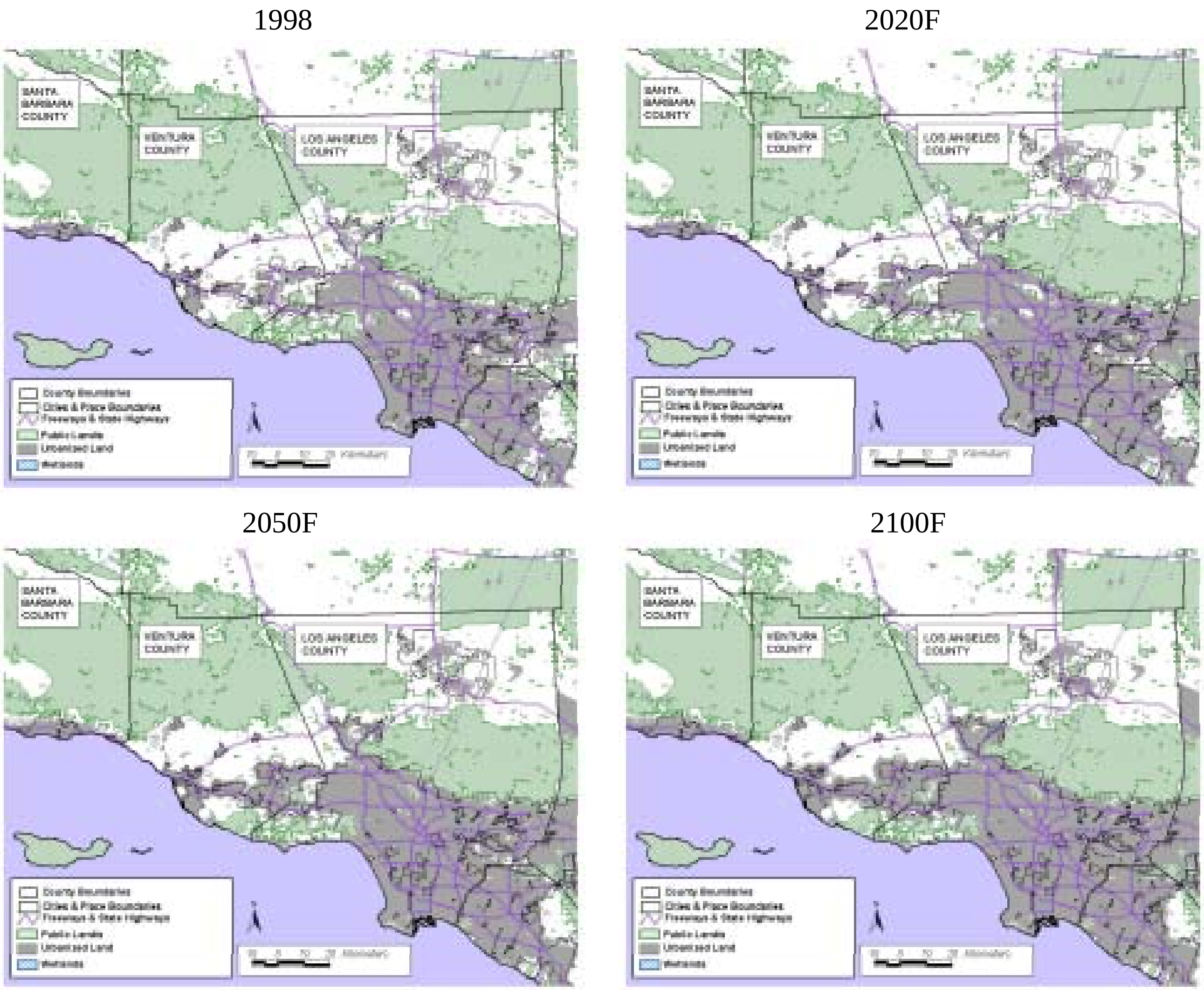

Figure 11. Urban growth projections for the Los Angeles/Ventura County, 1998-2100

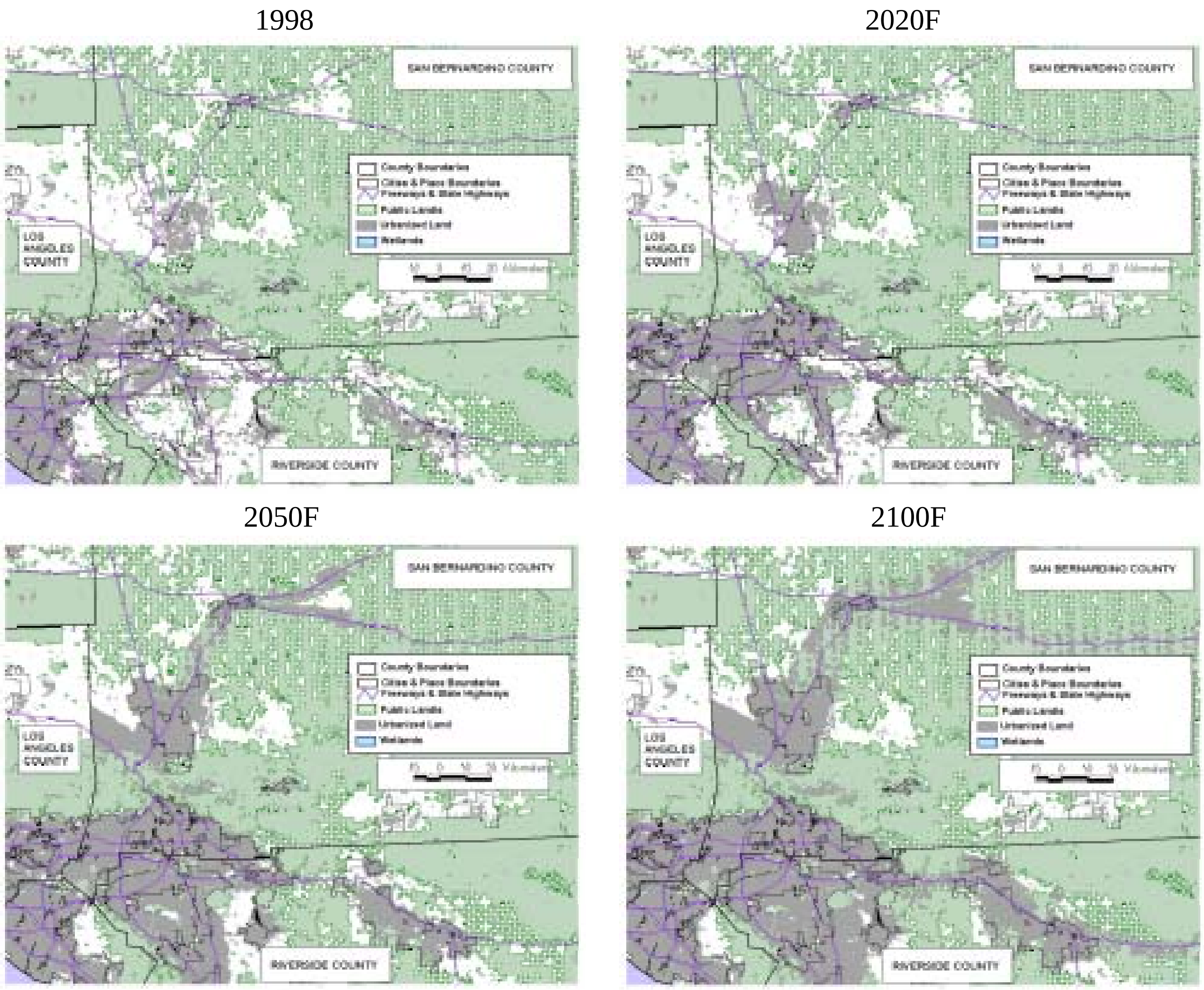

Figure 12. Urban growth projections for the Inland Empire region, 1998-2100

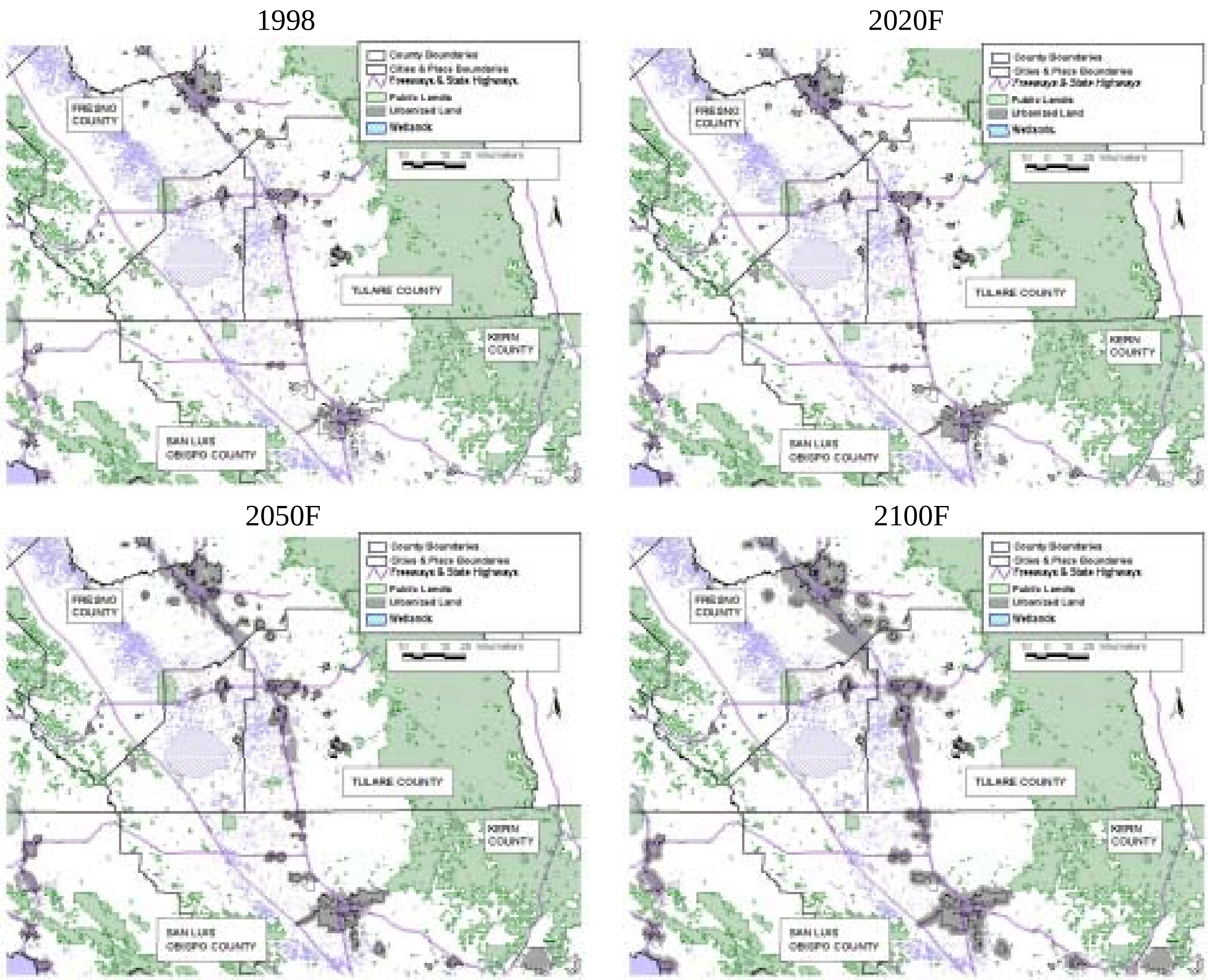

Figure 13. Urban growth projections for the South San Joaquin Valley, 1998-2100

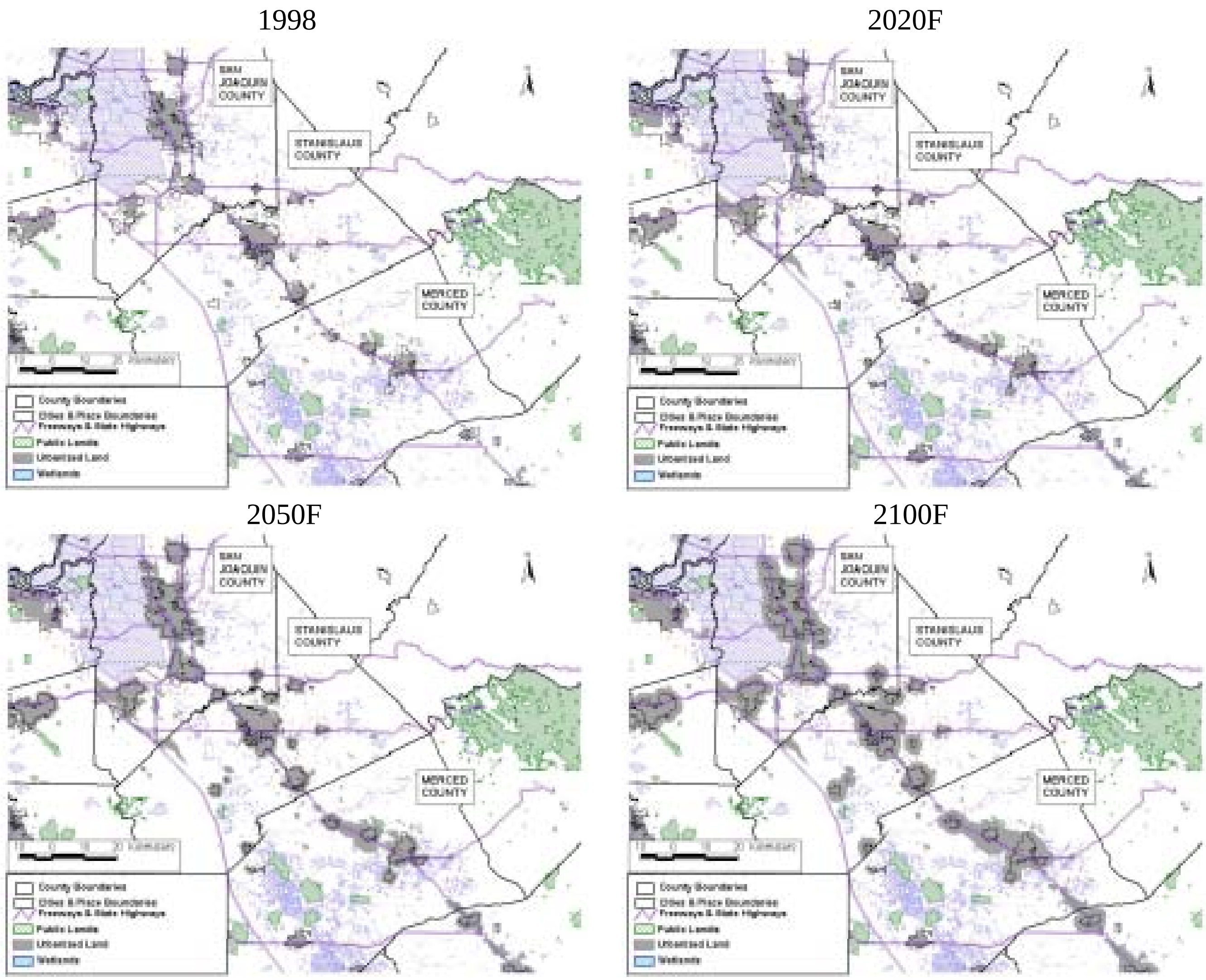

Figure 14. Urban growth projections for the North San Joaquin Valley, 1998-2100

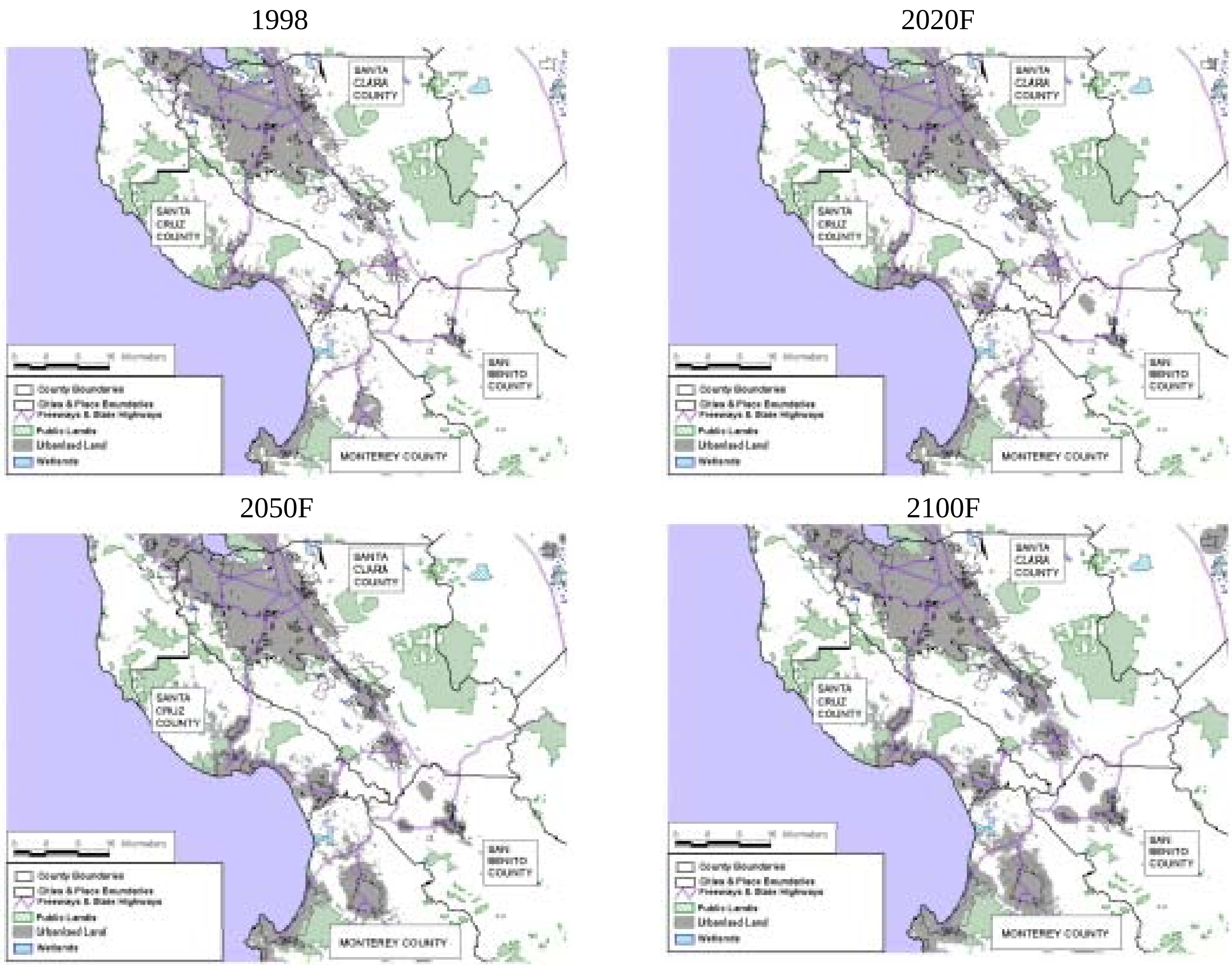

Figure 15. Urban growth projections for the Santa Clara County/Monterey Bay area, 1998-2100

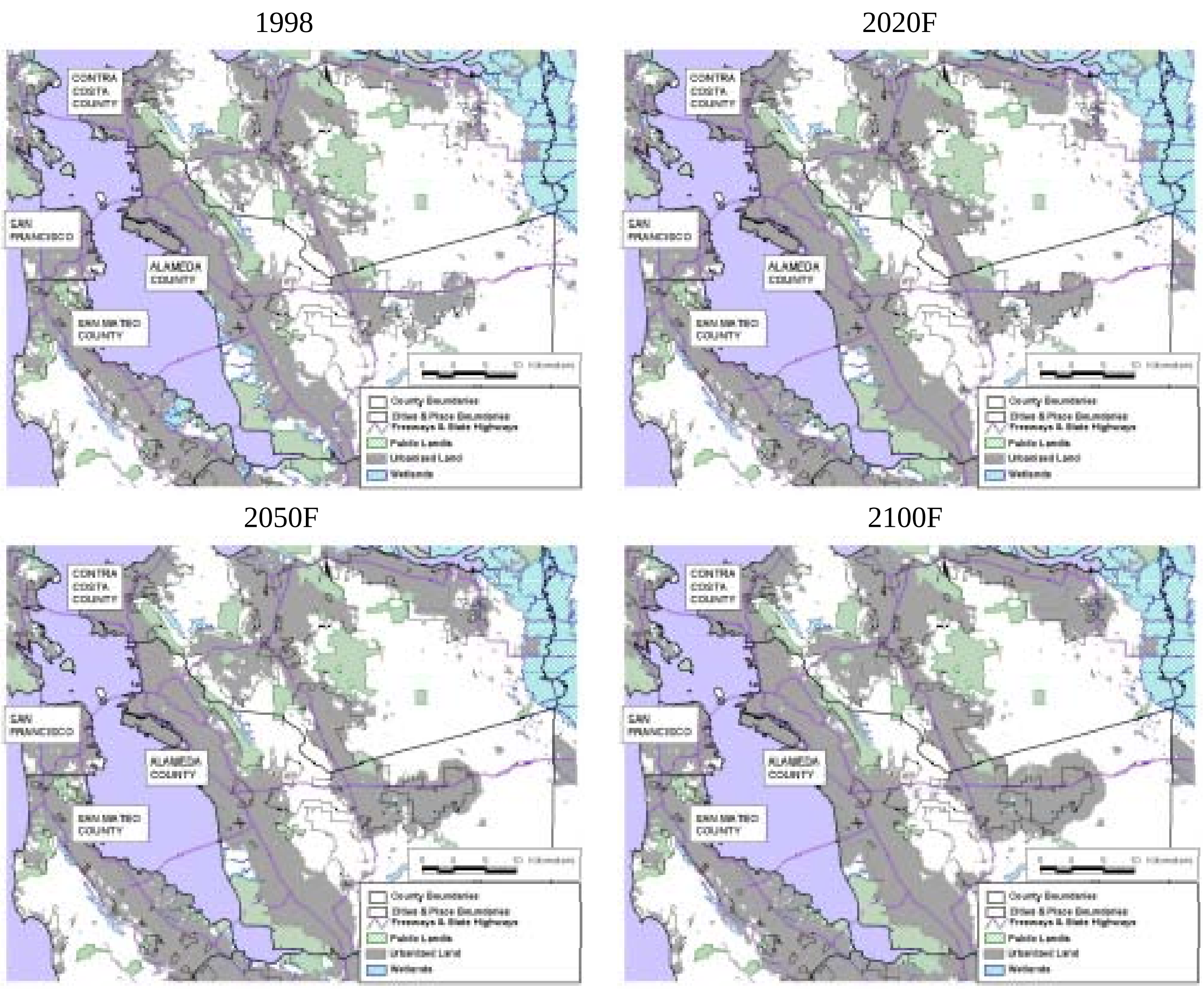

Figure 16. Urban growth projections for the Central San Francisco Bay area, 1998-2100

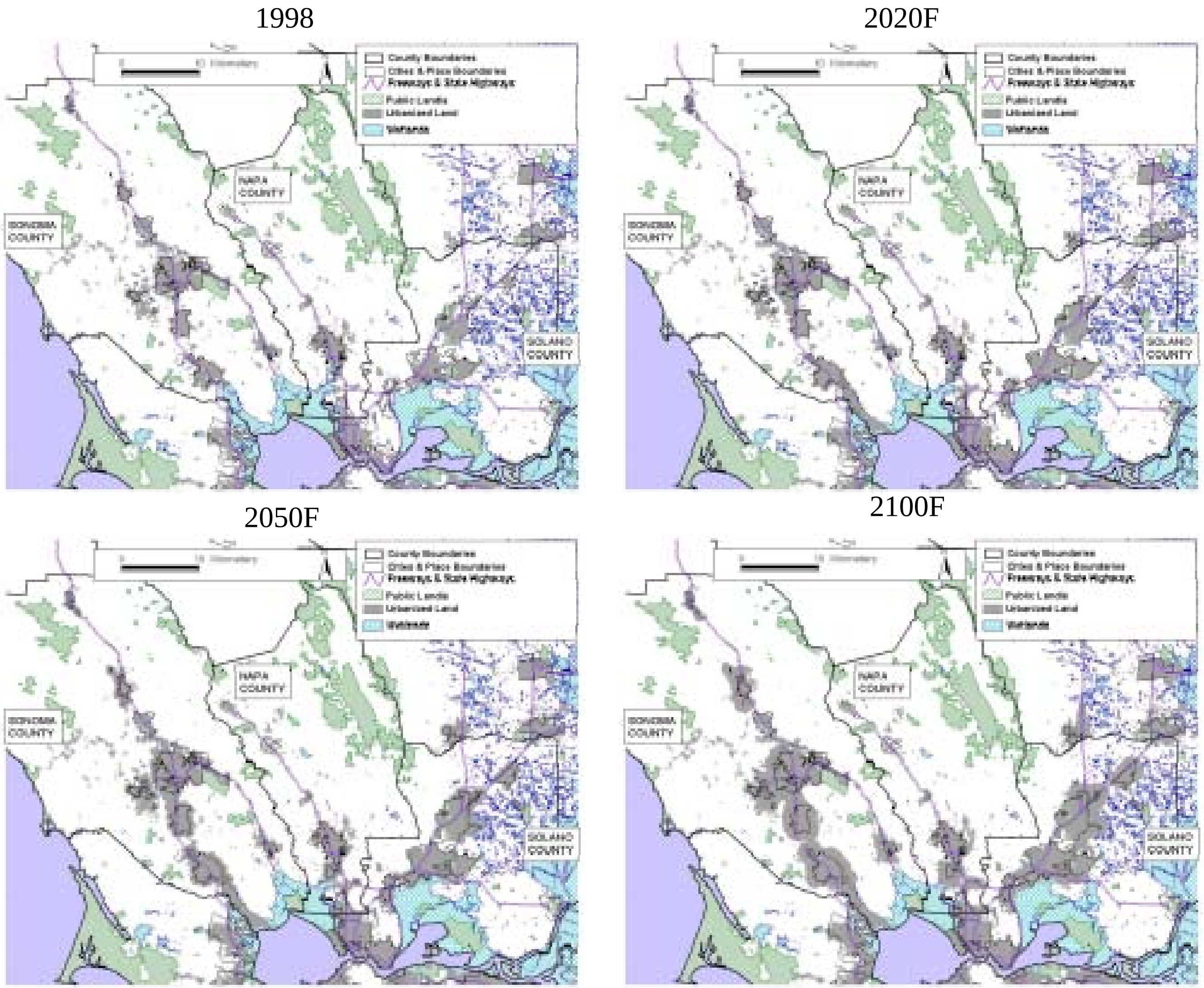

Figure 17. Urban growth projections for the North San Francisco Bay area, 1998-2100

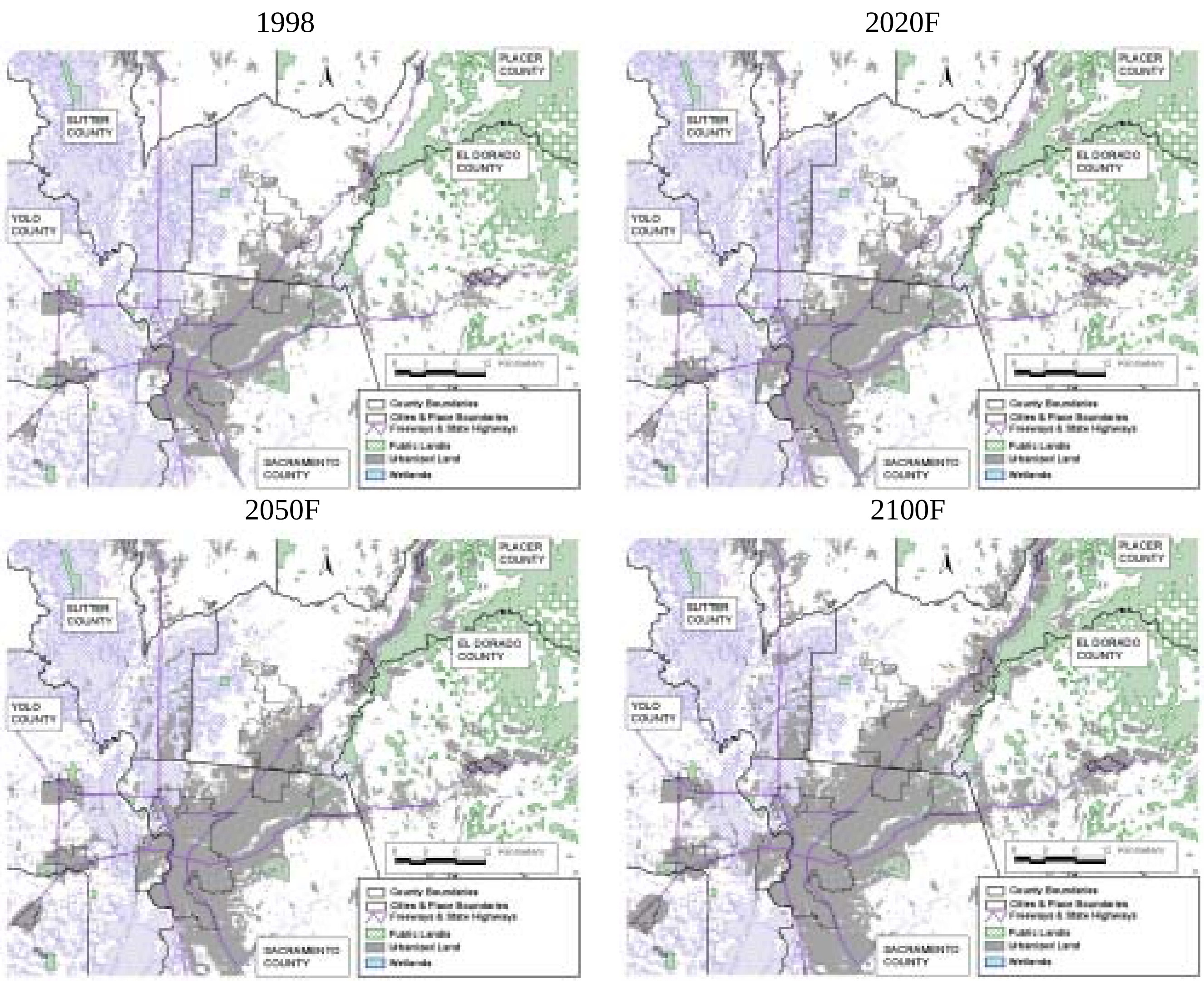

Figure 18. Urban growth projections for the Greater Sacramento region, 1998-2100

The situation is the opposite for Imperial County, which will account for only 2% of the region's population growth between 1998 and 2100, but about 5% of the increase in its urban land area. All of Imperial County's projected urban growth between 1998 and 2100 will occur along Interstate I-8, most of it within 10 miles of El Centro.

Southern California: Los Angeles County (Figure 11): Except for a few areas in the San Fernando Valley, Los Angeles County is almost entirely built out southwest of the San Gabriel mountains. As a result, most of Los Angeles County's projected population growth during the 21st century will take the form of infill and redevelopment. Currently, Los Angeles County's urban and suburban footprint occupies about 307,000 ha of land; by 2100, it will have grown to 361,000 ha. We can see that even though Los Angeles County will account for 31% of southern California's population growth during the 21st century, its share of the region's urbanized land area growth will be just under 6%. Spatially, Los Angeles County will continue its inexorable push northward and eastward, filling out all of eastern Los Angeles County by 2020, and most of the Santa Clarita Valley by 2050.

Southern California: Ventura and Santa Barbara counties (Figure 11): Urban development in Ventura and Santa Barbara counties will increase from about 63,000 ha in 1998; to 78,000 ha in 2020; to 113,000 ha in 2050; and to just under 150,000 ha in 2100. Depending on the time period, growth in the Ventura and Santa Barbara subregion will account for 7% to 10% of new urban development in southern California during the 21st century.

Being closer to Los Angeles, Ventura County will grow more and sooner. Ventura County's urban footprint will expand by 11,000 ha between 1998 and 2020; by 17,000 ha between 2020 and 2050; and by 18,000 ha between 2050 and 2100 (these correspond to percentage increases of 28%, 35%, and 27%, respectively). Spatially, Ventura County will continue growing in a northwestern direction. The Highway 101 corridor from Calabassas to Ventura, and the Highway 118 corridor from Simi Valley to Moorpark will both be built out by 2020. By 2050, development along the Highway 101 and 118 corridors will have merged, creating a continuous 20-mile westward extension of the San Fernando Valley.

Santa Barbara County should be able to continue resisting southern California's extreme growth pressures for about another 20 years, increasing its urban footprint by only 4,000 ha. After 2020, develop activity should pick up: between 2020 and 2100, Santa Barbara's urban footprint should increase by more than 200%. With growth in southeastern Santa Barbara County limited by the Santa Ynez mountains, most new development will occur along the Highway 101 corridor from Buellton north to Santa Maria. Indeed, by 2100, the entire Highway 101 corridor from downtown Los Angeles north to Santa Maria will be essentially built out.

Southern California: The Inland Empire (Figure 12): With coastal areas running out of buildable land, the real development action in southern California during the 21st century will be in Riverside and San Bernardino counties — known as the Inland Empire. Urban development in the Inland Empire will increase from 208,000 ha in 1998 to just over 800,000 ha in 2100, an increase of nearly 400%. Sixty percent of new urban development in southern California during this century will occur in the Inland Empire.

San Bernardino and Riverside counties will grow at about the same rate. Riverside County's urban footprint will increase in size from about 100,000 ha in 1998 to just under 400,000 ha by 2100. San Bernardino County's urban footprint will grow from 110,000 ha in 1998 to 411,000 ha by 2100.

The two counties' growth patterns will also be similar: development will proceed from west to east, along Interstates I-10 and I-215 in Riverside County, and along Interstates I-10, I-15, and I-40 in San Bernardino County. By 2020, almost all remaining developable lands within a 10-mile radius of Ontario Airport — the current growth center of the Inland Empire — will be built out, whether in San Bernardino or Riverside counties. Development will continue apace in the Victorville-Apple Valley-Hesperia area of San Bernardino County, and the Perris-Hemet-Moreno Valley area of Riverside County. By 2050, both areas will have emerged as major metropolitan centers, and the Inland Empire will be entirely built out west of the line connecting Hemet in Riverside County and Yucaipa in San Bernardino County. North of Cajon Pass, intense suburban development will reach the Barstow area and points east along Interstates I-5 and I-40 by 2030. By 2050, the Coachella Valley (stretching from Palm Springs to Indio) will be built out south of Interstate I-10; by 2100, the north side of the Coachella Valley will have been developed.

The southern San Joaquin Valley: Kern, Kings, Fresno, Madera and Tulare counties (Figure 13): Urban development in the southern end of the San Joaquin Valley will grow from 118,000 ha in 1998 to 418,000 ha in 2100 — an increase of nearly 250%. Nearly three-quarters of new urban development in the entire San Joaquin Valley (stretching from Kern County in the south to San Joaquin County in the north) will be in the southern subregion. As it has since the turn of the 20th century, new development in the southern San Joaquin Valley will be concentrated along the Highway 99 corridor — with or without the construction of a high-speed rail system. For the most part, development will occur from the north to the south, connecting Fresno and Visalia by 2030, and extending south to Tulare and Corcoran by 2050. By 2100, the entire corridor will be urbanized, and active farmlands will have been pushed to the east and west. New development will also follow Highway 99 south of Bakersfield toward Los Angeles.

Almost one-third of the region's urban growth will occur in Kern County. Between 1998 and 2100, Kern County's urban footprint will expand from 65,000 ha to nearly 160,000 ha. Currently, almost all urban development in Kern County is concentrated in and around

Bakersfield. With the city's urban footprint likely to grow three-fold by 2100, Bakersfield will continue to dominate Kern County's urban landscape. Even so, new and smaller urban nodes will also develop around the cities of Shafter and Delano by 2020, Wasco and Tehachapi by 2050, and Arvin and Mojave by 2100.

Fresno County will be the other major locus of future urban growth in the southern San Joaquin Valley. Between 1998 and 2100, Fresno County's urban footprint will expand three-fold, from 38,000 ha to 119,000 ha. Almost all new urban development in Fresno County will occur at the outskirts of the city of Fresno or along Highway 99.

Tulare County, which lies along Highway 99 between Kern and Fresno counties, will also grow significantly more urban during the 21st century. If current trends continue, Tulare's urban footprint will grow in size from 20,000 ha in 1998 to 76,000 ha in 2100. Although growth will initially cluster around Visalia and Tulare, by 2100, the entire Highway 99 corridor in Tulare County will be urbanized. Madera and Kings counties will also see significant, albeit somewhat lesser amounts of additional urban growth throughout the 21st century.

The northern San Joaquin Valley: Kern, Kings, Fresno, Madera, and Tulare counties (Figure 14): The northern San Joaquin Valley extends from Lodi and Stockton in San Joaquin County in the north; south along Highway 99 to Modesto, Ceres, and Turlock in Stanislaus County; and then further south to Livingston and Merced in Merced County. New development in the northern San Joaquin Valley subregion will be principally fed by unaccommodated eastward overflow growth from the Bay Area. Altogether, urban development in the northern San Joaquin Valley will grow from 62,000 ha in 1998 to 180,000 ha in 2100 — an increase of nearly 200%. As in the southern part of the San Joaquin Valley, new development in the north will be concentrated along the Highway 99 corridor. By 2100, the entire Highway 99 corridor will be developed to a width of 10-20 miles in San Joaquin County, down to 5-10 miles in Merced County.

About half of the northern subregion's urban growth will occur in San Joaquin County. Between 1998 and 2100, San Joaquin County's urban footprint will expand from 29,000 to 85,000 ha. By 2020, the Interstate I-205 corridor connecting Tracy and Manteca will be mostly built out. By 2050, urban development will extend continuously along the Highway 99/I-5 corridor from Lodi in the north to Ripon in the south. By 2100, San Joaquin County's urban footprint will rival Santa Clara's in size.

Stanislaus County will also grow substantially, adding 55,000 ha of new urban development by 2100. Most of Stanislaus County's new development will occur in and around the cities of Modesto and Turlock. Further south, Merced County's urban footprint will expand from 12,000 ha in 1998 to more than 40,000 hectares by 2100. Growth in Merced County will generally proceed north to south: starting in Livingston, then moving south to Atwater, and later to Merced. One wildcard in the future development of Merced County is the new University of California-Merced (UC-Merced) campus, the presence of which was not included in the baseline model runs. If, as is intended, UC-Merced serves as an engine of economic development, urban growth in Merced County could well exceed these estimates.

Northern California: The Monterey Bay area and San Luis Obispo County (Figure 15): We have included the Monterey Bay Area and San Luis Obispo County as a subregion of northern California, which is usually not done — at least not yet. More and more, however, as the Silicon Valley continues to grow southward, its economic sphere of influence will envelop Monterey, San Benito, Santa Cruz, and even the northern section of San Luis Obispo County.

Urban development in these four counties will increase continuously from 49,000 ha in 1998 to more than 150,000 ha by 2100. Depending on the time period, urban growth in this subregion will account for between one-third and one-half of new urban development in northern California during the 21st century. Unlike the central Bay Area, where significant population growth will occur as infill, most population growth in the Monterey Bay Area and points south will occur as greenfield development.

Monterey County, being more directly connected to Santa Clara County along Highway 101, will grow more and sooner than its three subregional neighbors. From its current size of 20,000 ha, Monterey County's urban footprint will expand to 51,000 ha by 2050 and 75,000 ha by 2100. Within Monterey County, the wave of urban development will move north to south, enveloping Prunedale and Salinas by 2020 and Gonzales and Soledad by 2050, and reaching as far south as King City by 2100. Indeed, by 2050, the central spine of the Salinas River Valley — which includes some of the most fertile farmland in the world — will be essentially built out.

Further to the south, San Luis Obispo County's urban footprint will also expand significantly, from 15,000 ha in 1998 to nearly 46,000 ha by 2100. Growth will occur radially around the cities that line the Highway 1010 corridor. These include Paso Robles, Atascadero, San Luis Obispo, and Pismo Beach.

Because they lack flat, accessible, and easily serviced raw land, Santa Cruz and San Benito counties will grow more moderately — at least in comparison to Monterey and San Luis Obispo counties. If current trends continue, Santa Cruz County's urban footprint will expand from 12,000 ha in 1998 to more than 20,000 hectares in 2100. Most of this growth will occur in the Watsonville area. To the east, San Benito County's urban footprint will grow from about 3,000 ha in 1998 to 10,000 ha in 2100.

Northern California: The central San Francisco Bay area (Figure 16): Urban development in the central San Francisco Bay Area — encompassing Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara counties — currently occupies a 220,000 ha footprint. With so little undeveloped land left adjacent to the San Francisco Bay, most new development in this subregion will occur east of Oakland and the East Bay Hills and south of San Jose. If current trends continue, the central Bay Area's urban footprint will grow in size to 240,000 ha by 2020, 260,000 ha by 2050, and 284,000 ha by 2100. This is a relatively modest level of growth compared to California's other urban areas, and reflects the fact that most of the subregion's population growth will take the form of infill and redevelopment. Although it is currently home to more than 5 million residents and more than 75% of the northern California region's population, throughout the next century the central Bay Area will account for less than 30% of the region's projected urban growth.

Already mostly urbanized, Santa Clara County has little flat and accessible land available for future development. Most of the land that is available is in the central and southern part of the county. As a result, Santa Clara County's urban footprint will grow from its current size of 73,000 ha to 91,000 ha by 2100. Almost all of this increase will occur within the Highway 101 corridor south of San Jose.

As is the case today, many of those who work in Santa Clara County will live in an adjacent county. Neighboring Alameda County's urban footprint, for example, will expand from its current size of 57,000 ha to 79,053 ha by 2100. Most of this increase will occur in and around three cities: Dublin, Pleasanton, and Livermore. Further north, Contra Costa County will also experience significant development pressure as its urban footprint grows from its current size of 56,000 ha to 71,000 ha in 2100. Contra Costa's new urban growth will be divided between the Interstate I-680 corridor that connects Martinez and Pleasanton, and the Highway 4 corridor that connects Concord and Brentwood. Development will also be continuously climbing the foothills of Mount Diablo, as well as the western side of the East Bay Hills. Should a major highway be built on the eastern side of Mount Diablo — something we have not included in our projections — the mountain would soon be completely encircled by urban growth.

On the San Mateo Peninsula, San Francisco is already entirely built out and will accommodate all its projected population growth through infill and redevelopment. San Mateo County will also grow mainly through infill and redevelopment; between 1998 and 2100, its urban footprint will expand by less than 6,000 ha. Most of this growth will occur adjacent to the San Francisco Bay or south of Pacifica along Highway 1.

Northern California: The north San Francisco Bay Area (Figure 17): The north San Francisco Bay Area includes Marin, Sonoma, Napa, and Solano counties. Currently, urban development in this region is organized into a series of separate suburban valleys along Highway 101 in Marin and Sonoma counties, Highways 29 and 12 in Napa County, and Interstate I-80 in Solano County. As of 1998, the North Bay subregion included 16% of the northern California region's population and at 73,000 ha, about 21% of its urbanized area. By

2100, if present trends continue, the urbanized area of the North Bay subregion will have increased to 133,000 ha.

Most of this increase will take place in Sonoma and Solano counties. Sonoma County's urban footprint will likely grow from its current size of 27,000 ha to nearly 55,000 ha by 2100. Almost all of this increase will occur within 5 miles of Highway 101. Indeed, by 2050, the Highway 101 corridor will be continuously developed from the Sonoma-Marin county line north through the city of Healdsburg.

A similar corridor-centric form will characterize urban growth patterns in suburban Solano County — indeed, almost all Solano County's growth will occur within 10 km of Interstate I-80. Altogether, Solano County's urban footprint will grow from its current size of 22,000 ha to more than 44,000 ha by 2100.

Compared to Sonoma and Solano counties, Marin and Napa counties will hardly grow at all. Marin County's urban footprint will expand from its current size of just over 16,000 ha to 19,000 ha by 2100. Most all of Marin's projected new development will occur along the Highway 1010 corridor in and around Novato. Lacking good freeway access, Napa County will also experience only moderate growth, adding about 6,000 ha of new urban development by 2100.

The Sacramento region: Sacramento County (Figure 18): The Sacramento region extends from Yolo County in the west to Lake Tahoe in the east, and from Sutter and Yuba counties in the north, to Isleton (Sacramento County) in the south. By 2100, if current trends continue, the region's urban footprint will have more than doubled from its current size of 112,000 ha to nearly 225,000 ha.

At 61,000 ha, Sacramento County alone accounts for just more than half the region's total urban footprint. Located at the confluence of the Sacramento and American rivers, Sacramento County still has ample flat land on which to grow — mostly to the south and east — and by 2100, its urban footprint will likely exceed 100,000 ha. Highway 50, which currently forms the southern boundary of development in eastern Sacramento County, will be likely be breached by 2025, as urban growth continues pushing east. New growth will also extend north along Interstate I-5 and California Highway 70. All told, Sacramento County will account for about one-third of the Sacramento region's growth during the 21st century.

The Sacramento region: Foothill subregion (Figure 18): The foothill subregion consists of the western sides of El Dorado, Placer, and Nevada counties. Urban growth in these counties generally takes two or three forms. On the west side, adjacent to Sacramento County, urban development takes a mostly suburban form, consisting of large, moderate-density single-family subdivisions; retail strip and big box centers; and the occasional free-standing office building.

Ten miles to the east, along Interstate I-80 and Highway 50, in and around the hills of Auburn and Placerville, growth consists of smaller residential developments of larger lot sizes, sprinkled at the edges of existing cities and towns. Farther off the beaten track, abutting local roads, new development typically takes the form of clusters of large houses on large lots, some with fenced-in grazing acreage and farmlands. Known as “ranchettes,” these developments occupy significant land areas but accommodate relatively few residents. The projections detailed in Table 4 and Figure 18 significantly undercount the number and area of ranchette developments.

Currently, the urban footprint of the foothill subregion, excluding ranchettes, exurban, and vacation development totals about 32,000 ha. By 2050, urbanization in the foothill subregion will have nearly doubled; by 2100, it will approach 80,000 ha. Most of the subregion’s growth will occur in Placer County along Interstate I-80. Indeed, by 2100, the I-80 corridor will be completely built out to a width of 5 km from Roseville, past Auburn, to Meadow Vista. Lesser (although still sizable) amounts of development are projected for El Dorado and Nevada counties. Growth in El Dorado County will be focused along Highway 50, in and around the Placerville area. In Nevada County, new urban development will favor the Grass Valley-Nevada City area. All together, the three-county foothills subregion will account for about 40% of the growth of the Sacramento region during the 21st century.

The Sacramento region: Yolo County (Figure 18): Located at the western end of the Sacramento region, Yolo is separated from Sacramento County and the rest of the region by the Sacramento River. Urban growth in Yolo County has long followed a city-centric pattern — the result of the county’s long-standing commitment to conserving farmlands and discouraging sprawl. As of 1998, Yolo County’s urban footprint occupied just over 10,000 ha of land. By 2100, this total is projected to double to just over 21,000 ha. Unless actions to limit growth are taken, which the city of Davis does periodically, just about all of this increase will occur in and around the three cities that line Interstate I-80: Dixon, Davis, and West Sacramento. Woodland and Winters, Yolo’s two other significant cities, will grow less dramatically Altogether, Yolo County will account for about 10% of the Sacramento region’s urban growth in the 21st century.

The Sacramento region: Sutter and Yuba counties (Figure 18): Yuba and Sutter counties are the least populous, least urbanized counties in the Sacramento region. At just under 9,000 ha, urban development in Yuba and Sutter counties currently account for only 8% of the region’s total. If current trends continue, Yuba and Sutter’s urban footprint will swell to 17,000 ha by 2050, and to 23,000 ha by 2100. These are big increases by the standards of Yuba and Sutter counties. They are less large when compared to the region a whole: altogether, Yuba and Sutter counties will account for about 12% of the region’s urban growth during the 21st century. Spatially, most of this subregion’s growth will occur in southeastern Sutter County, near the Sacramento County border.

4. Baseline Impact Assessment

The conversion of undeveloped land to urban uses generates three types of effects on the landscape: (1) it reduces the amount of undeveloped land still available; (2) it alters the patch size, shape, and fragmentation level of the remaining undeveloped landscape; and (3) it alters both the amount and quality of the resource and environmental services provided by undeveloped lands. This section assesses the effects of (1) under the baseline scenario for the periods 1997-2020, 2020-2050, and 2050-2100. These effects can be measured using many of the same digital data layers used to derive the baseline scenario. Considering the effects of urban growth on the supply and quality of resource and ecological services is beyond the scope of this effort.

It is important to note up front that measuring landscape change is not the same thing as valuing landscape change. Valuing landscape change requires incorporating human preferences regarding relative scarcity, accessibility, existence value, and a whole host of other attributes. Valuation can be undertaken through an analysis of market and non-market transactions, or through the use of survey research methods. Neither method is employed here.

4.1 Hillsides and Steeply Sloped Land

Statewide, projected urban growth presents a relatively small threat to steep hillsides. Among the 45 counties for which we developed detailed urban growth projections, we project that an additional 8,200 ha of steeply sloped land — that is, land with a slope in excess of 15% — will be developed by 2020 (see Table 5). By 2050 and 2100, we project that urban growth will have consumed an additional 38,000 and 55,000 ha of steeply sloped land, respectively. These growth increments account for only 0.1%, 0.4%, and 0.6% of the current hillside land area of these counties.

The counties projected to suffer the largest absolute hillside losses by 2050 and 2100 are all in southern California: San Diego County (-14,600 ha, or 4% of the county's remaining steep hillsides); Riverside County (-13,900 ha, or 3%); Los Angeles County (-8,800 ha, or 3%); and San Bernardino County (-6,300 ha, or 1%). Placer and El Dorado are the only counties outside the southern California region that are projected to suffer significant hillside losses because of urbanization. Because it is extremely flat, Sacramento County is likely to suffer minimal absolute hillside losses, but significant relative losses.

Note that these projections assume a continuation of current development trends and patterns. If these patterns shift in ways that make hillside development easier from a regulatory perspective, less costly from a development perspective, or more attractive from a market perspective, it is quite conceivable that amounts of hillside loss could be much greater, particularly in counties

Table 5. Anticipated loss in steeply sloped land area resulting from projected urbanization, selected counties, 1998-2100

County (sorted in order of absolute loss, 1998-2100)	Sites with slope >15% (ha). Source: USGS 100m DEM	Projected loss, 1998-2020		Projected loss, 1998-2050		Projected loss, 1998-2100	
		ha	%	ha	%	ha	%
San Diego	329,233	1,566	0	8,142	2	14,563	4
Riverside	410,745	968	0	9,402	2	13,916	3
Los Angeles	312,987	380	0	6,164	2	8,838	3
San Bernardino	792,543	1,049	0	5,462	1	6,287	1
Ventura	215,297	787	0	2,347	1	3,423	2
Kern	478,067	168	0	582	0	1,506	0
Orange	34,877	86	0	402	1	1,276	4
Santa Barbara	298,600	51	0	435	0	948	0
Placer	152,427	1,378	1	1,984	1	915	1
El Dorado	172,730	647	0	1,119	1	905	1
Monterey	272,641	15	0	327	0	554	0
Alameda	49,589	29	0	82	0	553	1
Nevada	92,597	450	0	655	1	506	1
Santa Cruz	45,919	113	0	523	1	410	1
Santa Clara	128,831	26	0	97	0	233	0
Contra Costa	35,107	69	0	79	0	191	1
Napa	82,046	20	0	71	0	142	0
Sonoma	152,606	140	0	184	0	127	0
San Mateo	39,393	0	0	0	0	44	0
Marin	45,870	5	0	13	0	42	0
San Luis Obispo	179,069	25	0	47	0	41	0
San Benito	130,608	0	0	10	0	17	0
Sacramento	101	5	5	12	12	11	11
Tulare	552,543	0	0	0	0	0	0
Fresno	511,120	0	0	0	0	0	0
Mariposa	166,912	0	0	0	0	0	0
Madera	154,653	0	0	0	0	0	0
Stanislaus	55,929	0	0	0	0	0	0
Merced	33,315	0	0	0	0	0	0
Yolo	30,106	17	0	17	0	0	0
Yuba	28,218	0	0	0	0	0	0
Solano	15,485	185	1	185	1	0	0
San Joaquin	10,020	0	0	0	0	0	0
Kings	9,378	2	0	2	0	0	0
Sutter	3,808	0	0	0	0	0	0

like San Diego, Ventura, Orange, Santa Barbara, Santa Clara, and Marin. All these counties are running out of accessible flat land near urban centers.

4.2 Wetlands

Mainly for planning and regulatory reasons, wetland development is growing increasingly difficult throughout California. Counties with large amounts of wetlands that are in agricultural use are looking for ways to keep them that way, and counties with few remaining wetland areas are vigorously trying to protect and enhance them.

Statewide, projected urban growth presents a small but significant threat to wetlands, particularly those identified as part of the National Wetland Inventory (NWI).[6] Among the 28 California counties with significant remaining wetlands that are threatened by urban growth, we project that an additional 12,000 ha of wetlands will be developed by 2020 (see Table 6). By 2050 and 2100, respectively, we project that urban growth will have likely consumed an additional 26,000 and 42,000 ha of wetlands. In percentage terms, these growth increments account for only 1%, 2%, and 3%, respectively, of the current wetlands inventory.

The counties projected to suffer the largest absolute hillside losses by 2050 and 2100 are mostly in the northern San Joaquin Valley, the southern Sacramento River Valley, or adjacent to the San Francisco Bay. They include San Joaquin County (-8,600 ha, or 11% of the county's remaining wetlands); Sutter County (-4,300 ha, or 7%); Sonoma County (-3,200 ha, or 26%); Solano County (-2,500 ha, or 5%); and Alameda County (-2,300 ha, or 33%). A number of additional counties are facing moderate absolute wetland losses but large percentage losses: Marin County (-1,700 ha, or 24%); San Mateo County (-1,300 ha, or 42%); San Diego County (-1,200 ha, or 15%); and Santa Clara (-700 ha, or 15%). At the other extreme, Sacramento, Merced, and Yolo counties are all facing moderate absolute wetland losses but small relative losses.

Issues of wetland conservation and protection go well beyond consideration of absolute and percentage losses. Wetlands are typically prime habitat for a wide variety of plant and animal species, many of which are on the national threatened and endangered list. Wetlands also play an important role in ensuring the health of adjacent habitat areas and in controlling floods. Because wetlands are not interchangeable, questions of how and where projected urbanization is likely to affect wetland quality may dominate questions of absolute loss.

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6. The NWI does not include vernal pools.

Table 6. Anticipated losses in wetlands resulting from projected urbanization, selected counties, 1998-2100

County (sorted in order of absolute loss, 1998-2100)	1998 wetlands (ha). Source: NWI	Projected loss, 1998-2020		Projected loss, 1998-2050		Projected loss, 1998-2100	
		ha	%	ha	%	ha	%
San Joaquin	81,294	947	1	4,686	6	8,618	11
Sutter	62,612	832	1	2,904	5	4,341	7
Sonoma	12,288	2,976	24	3,084	25	3,239	26
Solano	54,483	412	1	991	2	2,464	5
Alameda	7,046	1,689	24	1,937	27	2,325	33
Sacramento	40,678	492	1	952	2	1,934	5
Merced	41,971	127	0	1,096	3	1,927	5
Yolo	43,066	137	0	515	1	1,845	4
Marin	7,294	130	2	690	9	1,722	24
Yuba	19,816	283	1	865	4	1,568	8
Tulare	12,087	364	3	930	8	1,552	13
Contra Costa	23,597	250	1	901	4	1,391	6
San Mateo	3,158	1,071	34	1,243	39	1,329	42
Kern	21,787	284	1	819	4	1,223	6
San Diego	8,291	341	4	862	10	1,221	15
Napa	10,371	202	2	590	6	1,004	10
Fresno	51,494	330	1	522	1	846	2
Santa Clara	4,403	343	8	418	9	675	15
Placer	33,594	130	0	232	1	604	2
San Luis Obispo	7,151	148	2	363	5	537	8
Los Angeles	5,994	148	2	221	4	265	4
Kings	61,924	51	0	126	0	248	0
Stanislaus	7,266	19	0	102	1	237	3
Riverside	31,566	2	0	63	0	201	1
Madera	3,424	38	1	167	5	190	6
San Bernardino	9,159	152	2	175	2	175	2
Nevada	6,525	21	0	41	1	65	1
Orange	415	5	1	5	1	5	1

4.3 Riparian Areas

Riparian zones are the land areas around rivers, streams, lakes, and permanent wetlands. They are typically but not exclusively characterized by woody, fast-growing vegetation, as well as by water-oriented bird, animal, and insect species. Inventories of riparian areas have thus far been developed for the San Francisco Bay and San Joaquin Valley but not for the rest of the state. To augment these more limited data sources, we generated a statewide, 100 m riparian zone data layer by buffering all inland rivers, streams, and lakes listed in the 2000 Census TIGER file (U.S. Census Bureau, 2001; Digital TIGER line files). Although it is comprehensive and consistent, this method tends to overestimate the total amount of riparian area and underestimate the area of specific riparian zones.

The counties projected to suffer the largest absolute riparian losses by 2050 and 2100 are mostly in southern and coastal California (see Table 7). They include San Bernardino County (-52,200 ha, or 6% of the county's remaining riparian zone land area); Riverside County (-51,000 ha or 13%); San Diego County (-22,000 ha, or 11%); Imperial County (-14,000 ha, or 6%); and Kern County (-14,000 ha, or 3%). A number of additional counties are facing moderate to small absolute riparian zone losses but large percentage losses by 2100: Stanislaus County (-5,000 ha, or 12%); San Joaquin County (-4,900 ha or 12%); Sacramento County (4,600 hectares, or 12%), Alameda County (3,800 hectares, or 13%), Orange County (-2,700 ha, or 11%); Santa Cruz County (-2,400 ha, or 10%); San Diego County (-1,200 ha, or 15%); and Santa Clara (-700 ha, or 15%).

Similar to wetlands, riparian zone quality varies widely. Some offer rich habitats for a diverse variety of plant and animal species. Others are ecologically narrower. Most of the state's remaining riparian lands south of Sacramento and west of the Sierras border urban development, active farmlands, or grazing lands, and as a result, have suffered severe degradation. In many areas, then, riparian zone restoration is as important as riparian zone protection.

4.4 Prime Farmlands

Every two years, the CFMMP collects detailed spatial data on the status of different types of farmland in 47 California counties, including all urban counties except San Francisco. The CFMMP defines prime farmland as land used for the production of irrigated crops at some time during the previous 4 years. To be classified as prime, the land must also meet the highest soil moisture, pH, erodability and permeability, and soil-rooting depth criteria. At the time of this work, 1998 was the most recent year for which complete data were available.

Table 7. Anticipated losses in 100 m riparian zone land area resulting from projected urbanization, selected counties, 1998-2100

County (sorted in order of absolute loss, 1998-2100)	Lands in 100 m riparian zone (ha)	Projected loss, 1998-2020		Projected loss, 1998-2050		Projected loss, 1998-2100	
		ha	%	ha	%	ha	%
San Bernardino	941,274	10,458	1	30,267	3	52,184	6
Riverside	381,053	10,465	3	29,892	8	50,636	13
San Diego	187,349	4,786	3	11,825	6	21,522	11
Imperial	235,071	2,893	1	7,633	3	13,745	6
Kern	459,260	3,085	1	7,792	2	13,659	3
Santa Barbara	195,223	1,014	1	5,296	3	9,778	5
San Luis Obispo	219,250	1,692	1	5,164	2	8,671	4
Monterey	232,381	758	0	3,597	2	7,212	3
Sonoma	88,819	2,643	3	4,381	5	6,394	7
Ventura	113,836	1,240	1	3,229	3	5,555	5
Stanislaus	43,679	574	1	2,894	7	5,419	12
Placer	83,925	2,215	3	3,816	5	5,164	6
Merced	130,553	824	1	2,654	2	5,148	4
Tulare	210,905	1,098	1	3,208	2	5,147	2
San Joaquin	41,079	1,147	3	3,159	8	4,932	12
Los Angeles	76,804	1,844	2	3,526	5	4,902	6
Sacramento	38,510	1,326	3	2,887	7	4,657	12
Alameda	28,968	1,170	4	2,305	8	3,796	13
Santa Clara	49,442	895	2	1,667	3	3,199	6
Fresno	261,193	905	0	1,956	1	3,113	1
El Dorado	119,694	866	1	1,805	2	2,872	2
Solano	41,947	874	2	1,553	4	2,735	7
Orange	24,168	1,271	5	2,044	8	2,686	11
Santa Cruz	23,796	763	3	2,373	10	2,373	10
Contra Costa	25,963	470	2	1,285	5	2,130	8
Madera	106,266	399	0	1,390	1	1,989	2
Nevada	67,846	638	1	1,106	2	1,759	3
San Mateo	27,694	522	2	925	3	1,579	6
Kings	31,182	179	1	427	1	1,526	5
Yolo	31,720	527	2	1,082	3	1,484	5
Napa	23,480	250	1	846	4	1,282	5
San Benito	109,581	86	0	603	1	1,002	1
Marin	28,980	97	0	499	2	935	3
Yuba	44,443	142	0	448	1	811	2
Sutter	25,941	144	1	250	1	659	3
Mariposa	90,671	0	0	0	0	0	0

Projected urban growth presents a significant threat to the state's remaining supplies of prime farmland, especially in the San Joaquin, Monterey, and Imperial valleys. Among the 35 California counties in which prime farmlands are threatened by urban growth, we project that 52,000 ha of prime farmland will have been converted to urban uses by 2020 (see Table 8). By 2050 and 2100, respectively, we project that urban growth will have likely consumed an additional 165,000 and 297,000 ha of riparian land area. In percentage terms, these growth increments account for 3%, 9%, and 17%, respectively, of the current inventory of prime farmlands.

Most at risk from urban growth are prime farmlands in the San Joaquin and Monterey valleys. Assuming that present trends continue, Fresno County will lose 51,600 ha of prime farmland by 2100, a drop of 35%. Nearby Kern County will lose 42,100 ha of prime farmland to projected urban growth, a 19% decline. San Joaquin, Monterey, and Riverside counties will each lose more than 20,000 ha. Five counties will lose more than half of the precious little prime farmland they still have: San Bernardino (78%), San Diego (58%), Orange (57%), Alameda (51%), and Santa Clara (50%). For counties in southern California, these losses will be immediate — that is, they will have largely occurred by 2020. Among Bay Area and coastal counties, the losses will be seen over a longer period. Among San Joaquin Valley counties, prime farmland losses will be continuous throughout the century.

The situation might not be quite as bleak as these numbers would make it seem. If current trends continue, even as large amounts of prime farmland are lost to urban growth, farmers will likely be "developing" new prime farmlands in other locations, mostly by extending irrigation to grazing and secondary farmlands. Although not of the soil quality of the prime farmlands being lost, assuming sufficient water is available at the right price, these new farmlands should easily sustain California's agricultural economy. Potential opportunities for new prime farmland development are most plentiful in the San Joaquin and Monterey valleys (where urbanization will pose less of a threat to grazing lands), but are extremely limited in southern California and the Bay Area. As a result, for purposes of protecting prime farmland from incursion by urban growth throughout the state, policy makers and farmland preservationists should perhaps concentrate their efforts in Riverside, Imperial, San Bernardino, Ventura San Diego, Alameda, and Contra Costa counties, among others.

4.5 State and Locally Important Farmlands

"Farmlands of state importance" are those similar to prime farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture. "Farmland of local importance" is determined by each county's board of supervisors and a local advisory committee. For purposes of tracking farmland loss resulting from projected urbanization, we have grouped state and locally important (S&LI) farmland.

Table 8. Anticipated losses in prime farmland resulting from projected urbanization, selected counties, 1998-2100

County (sorted in order of absolute loss, 1998-2100)	1998 prime farmlands (ha). Source: CFMMP	Projected loss, 1998-2020		Projected loss, 1998-2050		Projected loss, 1998-2100	
		ha	%	ha	%	ha	%
Fresno	148,584	3,818	3	25,589	17	51,552	35
Kern	217,093	7,930	4	24,375	11	42,081	19
San Joaquin	173,331	5,678	3	16,416	9	29,088	17
Monterey	69,068	3,025	4	14,593	21	26,559	38
Riverside	64,517	9,533	15	16,579	26	24,710	38
Stanislaus	67,478	1,077	2	9,055	13	18,842	28
Imperial	80,722	53	0	1,781	2	12,844	16
Merced	116,887	3,519	3	8,351	7	12,562	11
San Bernardino	12,110	5,769	48	7,016	58	9,467	78
Ventura	20,935	1,103	5	4,617	22	8,661	41
Solano	60,730	673	1	3,926	6	8,079	13
Santa Barbara	29,128	486	2	4,056	14	7,879	27
Kings	57,624	1,853	3	4,561	8	7,402	13
Madera	41,350	1,011	2	3,502	8	7,035	17
Santa Clara	12,951	1,257	10	4,095	32	6,482	50
San Benito	13,874	281	2	1,954	14	3,271	24
Sonoma	14,450	95	1	1,438	10	2,848	20
Yolo	107,582	104	0	1,304	1	2,837	3
Orange	4,524	946	21	2,139	47	2,593	57
San Diego	4,323	1,466	34	2,257	52	2,526	58
Contra Costa	16,036	386	2	1,473	9	2,213	14
Santa Cruz	6,960	427	6	2,172	31	2,172	31
San Luis Obispo	16,159	255	2	1,011	6	2,080	13
Alameda	3,081	573	19	1,334	43	1,573	51
Tulare	34,365	347	1	578	2	788	2
Los Angeles	9,949	212	2	435	4	636	6
Napa	12,117	34	0	161	1	283	2
Sacramento	49,317	1	0	1	0	9	0
Yuba	18,465	0	0	0	0	0	0
Placer	3,964	0	0	0	0	0	0
San Mateo	1,082	0	0	0	0	0	0
El Dorado	490	0	0	0	0	0	0
Nevada	153	0	0	0	0	0	0
Marin	71	0	0	0	0	0	0
Mariposa	12	0	0	0	0	0	0

Projected urban growth presents a significant threat to the state's remaining supplies of S&LI farmlands, especially in Riverside, Imperial, San Diego, Sacramento, and San Joaquin counties. Among the 36 California counties in which S&LI farmlands are threatened by urban growth, we project that an additional 74,000 ha of S&LI farmland will have been converted to urban uses by 2020 (see Table 9). By 2050 and 2100, respectively, we project that urban growth will have likely consumed an additional 173,000 and 268,000 ha of S&LI farmland. In percentage terms, these growth increments account for only 4%, 9%, and 14%, respectively, of the current inventory of S&LI farmlands.

Most at risk from urban growth are S&LI farmlands in the Inland Empire and in the central Sacramento-San Joaquin Valley. Assuming that present trends continue, Riverside County will lose 66,000 ha of S&LI farmland by 2100, a drop of 54%. Nearby Imperial County will lose 25,000 ha to projected urban growth, an 18% decline. San Diego and Sacramento counties each lose more than 20,000 ha, and San Joaquin will lose nearly that much. In addition to Riverside, five counties will lose more than half of their S&LI farmlands by 2100: Alameda (72%), San Bernardino (62%), Monterey (51%), San Diego (51%), and Sacramento (50%). Even though Bay Area and coastal counties will suffer significant relative losses, except for Monterey and Sonoma counties, their absolute losses will not be that great. In terms of timing, most losses will be continuous throughout the forecast period. Whether or not these losses will be offset through the irrigation and conversion of grazing land will depend on many factors: water availability, commodity prices, labor costs, and changing environmental regulations.

4.6 Unique Farmlands

The CFMMP identifies "unique farmland" as land with soils of lower quality that are used for the production of the state's leading agricultural crops. Unique farmlands are typically irrigated, but may also include nonirrigated orchards or vineyards as found in some climatic zones in California. Despite their lower soil quality, many of California's highest value crops are grown on unique farmlands. Unique farmlands must have been cropped at some time during the 4 years preceding the mapping date.

Projected urban growth presents a significant threat to the state's remaining supplies of unique farmlands, especially in San Diego and Riverside counties. Among the 36 California counties in which unique farmlands are threatened by urban growth, we project that an additional 13,000 ha of unique farmland will have been converted to urban uses by 2020 (see Table 10). By 2050 and 2100, respectively, we project that urban growth will have likely consumed an additional 47,000 and 77,000 ha of unique farmlands. In percentage terms, these growth increments account for only 2%, 5%, and 8%, respectively, of the current inventory of unique farmlands in the counties studied.

Table 9. Anticipated losses in S&LI farmland resulting from projected urbanization, selected counties, 1998-2100

County (sorted in order of absolute loss, 1998-2100)	1998 S&LI farmlands (ha). Source: CFMMP	Projected loss, 1998-2020		Projected loss, 1998-2050		Projected loss, 1998-2100	
		ha	%	ha	%	ha	%
Riverside	121,657	20,223	17	44,162	36	65,965	54
Imperial	143,556	8,029	6	17,620	12	25,137	18
San Diego	47,992	6,867	14	16,576	35	24,461	51
Sacramento	40,908	6,673	16	14,439	35	20,374	50
San Joaquin	60,776	5,398	9	12,192	20	18,731	31
Sonoma	44,341	4,360	10	8,697	20	13,080	29
Fresno	70,398	1,904	3	6,047	9	11,496	16
Merced	84,233	1,668	2	4,860	6	10,044	12
Madera	46,932	2,227	5	5,531	12	8,877	19
Monterey	15,685	2,273	14	4,992	32	8,010	51
Ventura	19,743	1,175	6	4,317	22	7,972	40
Sutter	45,981	1,407	3	4,094	9	6,288	14
Kings	176,253	596	0	3,127	2	6,058	3
San Luis Obispo	78,154	944	1	3,250	4	6,032	8
San Bernardino	6,949	2,175	31	3,565	51	4,327	62
Kern	45,500	1,222	3	2,846	6	3,945	9
Contra Costa	24,318	770	3	2,218	9	3,697	15
Stanislaus	26,332	278	1	1,540	6	2,942	11
Napa	11,660	919	8	1,838	16	2,746	24
Yolo	32,110	1,096	3	2,252	7	2,708	8
Santa Barbara	13,328	333	2	1,742	13	2,669	20
El Dorado	33,216	1,067	3	1,891	6	2,632	8
Placer	48,438	57	0	639	1	2,125	4
San Benito	19,922	894	4	1,155	6	1,974	10
Santa Clara	5,525	578	10	1,353	24	1,969	36
Marin	27,203	25	0	341	1	1,092	4
Yuba	4,470	172	4	360	8	692	15
Solano	4,513	29	1	281	6	629	14
Santa Cruz	1,573	233	15	451	29	451	29
Alameda	548	43	8	228	42	393	72
Nevada	8,633	100	1	222	3	350	4
Tulare	40,242	213	1	290	1	345	1
Orange	347	94	27	128	37	149	43
Los Angeles	12,783	0	0	0	0	0	0
San Mateo	1,686	0	0	0	0	0	0
Mariposa	40	0	0	0	0	0	0

Table 10. Anticipated losses in unique farmlands resulting from projected urbanization, selected counties, 1998-2100

County (sorted in order of absolute loss, 1998-2100)	1998 unique farmlands (ha). Source: CFMMP	Projected loss, 1998-2020		Projected loss, 1998-2050		Projected loss, 1998-2100	
		ha	%	ha	%	ha	%
San Diego	27,258	2,816	10	15,038	55	19,545	72
Riverside	16,903	2,402	14	6,082	36	9,951	59
Fresno	38,599	910	2	3,617	9	7,833	20
Madera	65,134	1,508	2	3,446	5	6,229	10
Santa Barbara	11,864	490	4	2,530	21	4,766	40
Merced	39,084	338	1	2,189	6	3,821	10
San Joaquin	21,401	159	1	1,476	7	2,793	13
Monterey	6,118	597	10	1,509	25	2,735	45
Yolo	22,264	272	1	1,057	5	2,679	12
Ventura	9,120	180	2	1,045	11	2,346	26
Yuba	14,957	434	3	1,318	9	2,200	15
San Luis Obispo	12,149	127	1	814	7	1,754	14
Orange	2,539	608	24	1,049	41	1,579	62
San Bernardino	1,559	585	38	1,209	78	1,345	86
Solano	5,658	150	3	561	10	1,278	23
Sacramento	5,435	225	4	522	10	1,139	21
Stanislaus	19,803	181	1	527	3	1,137	6
Sonoma	10,163	16	0	343	3	786	8
El Dorado	1,871	280	15	535	29	560	30
Kern	21,846	26	0	254	1	421	2
Santa Cruz	1,773	81	5	410	23	410	23
Placer	9,155	26	0	104	1	406	4
Alameda	640	251	39	340	53	399	62
Sutter	8,954	119	1	122	1	257	3
Napa	6,396	90	1	130	2	226	4
Kings	9,904	56	1	176	2	208	2
Los Angeles	380	74	19	83	22	145	38
Contra Costa	2,677	28	1	83	3	101	4
Santa Clara	562	4	1	21	4	95	17
Nevada	118	19	16	40	34	40	34
Tuolumne	2,951	3	0	30	1	36	1
San Mateo	1,215	0	0	0	0	0	0
Amador	1,137	0	0	0	0	0	0
San Benito	364	0	0	0	0	0	0
Mariposa	60	0	0	0	0	0	0
Marin	9	0	0	0	0	0	0

Most at risk from urban growth are unique farmlands in and around the Inland Empire and in the central San Joaquin Valley. Assuming that present trends continue, San Diego County will lose 20,000 ha of unique farmlands by 2100, or three-quarters of its current stock. Nearby Riverside will lose 10,000 ha to projected urban growth, a 59% decline. In the central San Joaquin Valley, Fresno and Madera counties will each lose more than 5,000 hectares. Nearby Merced County will lose 3,800 ha.

Three counties in addition to San Diego and Riverside will lose more than half of their unique farmlands to urban development by 2100: San Bernardino (86%), Alameda (62%), and Orange (62%). All of California's costal counties south of San Francisco and most of its Central Valley counties are facing significant losses of unique farmlands as a result of projected urban growth. Presumably, as with prime farmlands and S&LI farmlands, it may be possible to offset some of these losses through irrigation of otherwise fertile lands currently being used for grazing. The specific potential for such conversion is unknown.

4.7 Grazing Lands

The CFMMP identifies "grazing lands" as those on which the existing vegetation is suited to the grazing of livestock. This category is used only in California and was developed in cooperation with the California Cattlemen's Association, University of California Cooperative Extension, and other groups interested in the extent of grazing activities.

Projected urban growth presents a significant threat to grazing lands in Riverside, Placer, San Diego, and San Bernardino counties; a moderate threat in Orange, Ventura, Alameda, Solano, Sacramento, Los Angeles, Santa Cruz, and Santa Barbara counties; and a minor threat elsewhere in the state. Among the 35 California counties in which grazing lands are threatened by urban growth, we project that an additional 77,600 ha of grazing land will have been converted to urban uses by 2020 (see Table 11). By 2050 and 2100, respectively, we project that urban growth will have likely consumed an additional 216,300 and 329,600 ha of grazing lands. In percentage terms, these growth increments account for only 1%, 2%, and 3%, respectively, of the current inventory of grazing land in the counties studied.

Most at risk from urban growth are grazing lands in and around the Inland Empire. Assuming that present trends continue, San Bernardino County will lose 132,400 ha of grazing land by 2100, or about one-third its current supply. Nearby Riverside and San Diego counties will lose 28,400 and 23,500 ha, respectively — declines of 52% and 41%. Six other counties will lose more than 10,000 ha of grazing land to projected urban growth by 2100: Kern (22,600), Santa Barbara (16,400), San Luis Obispo (11,900), Ventura (11,600), Alameda (11,400), and Monterey (10,300).

Table 11. Loss in grazing land area resulting from projected urbanization, selected counties, 1998-2100

County (sorted in order of absolute loss, 1998-2100)	1998 grazing lands (ha). Source: CFMMP	Projected loss, 1998-2020		Projected loss, 1998-2050		Projected loss, 1998-2100	
		ha	%	ha	%	ha	%
San Bernardino	385,995	32,905	9	99,198	26	132,403	34
Riverside	54,523	5,289	10	22,194	41	28,367	52
San Diego	57,737	7,456	13	14,165	25	23,468	41
Kern	714,443	6,955	1	13,204	2	22,527	3
Santa Barbara	238,539	1,439	1	8,393	4	16,434	7
San Luis Obispo	267,659	2,386	1	6,930	3	11,886	4
Ventura	84,145	3,015	4	6,634	8	11,550	14
Alameda	100,358	1,480	1	5,474	5	11,372	11
Monterey	435,161	1,286	0	5,221	1	10,289	2
Solano	80,640	3,811	5	5,839	7	8,128	10
Los Angeles	88,217	1,110	1	5,170	6	7,803	9
Sacramento	66,897	1,780	3	3,737	6	6,831	10
Placer	12,893	344	3	3,339	26	6,205	48
Contra Costa	70,182	1,850	3	2,889	4	5,313	8
Sonoma	177,400	551	0	1,724	1	4,610	3
El Dorado	75,004	897	1	2,108	3	3,676	5
Santa Clara	158,147	702	0	1,245	1	3,503	2
Orange	15,587	259	2	1,074	7	2,288	15
San Benito	240,099	408	0	1,217	1	2,047	1
Napa	75,038	165	0	754	1	1,615	2
Madera	161,602	689	0	1,029	1	1,549	1
Yuba	58,006	252	0	707	1	1,342	2
Merced	234,748	332	0	821	0	1,295	1
Nevada	52,491	13	0	354	1	1,085	2
Sutter	20,153	433	2	487	2	855	4
San Joaquin	61,666	623	1	642	1	792	1
Kings	98,776	354	0	405	0	657	1
Yolo	57,992	147	0	338	1	622	1
Santa Cruz	6,747	369	5	564	8	564	8
Tulare	184,355	297	0	425	0	492	0
Fresno	129,534	1	0	4	0	6	0
Mariposa	165,152	0	0	0	0	0	0
Stanislaus	47,126	0	0	0	0	0	0
Marin	37,177	0	0	0	0	0	0
San Mateo	18,461	0	0	0	0	0	0

The real threat to grazing lands may be well bigger than these numbers suggest. As urbanization consumes prime and unique quality farmlands in the San Joaquin, Monterey, and Imperial valleys, agricultural businesses may well attempt to convert grazing lands to cultivated use, mostly by extending irrigation. The realization of this potential “domino effect” will depend on many factors, including land, water, and agricultural product prices, and the costs of extending key infrastructure.

The trend toward ranchette and resort and vacation home development also threatens California’s grazing lands. Ranchettes and rural subdivisions are typically developed at densities well below the threshold that the CFMMP uses to identify urban and suburban development. As a result, it goes largely uncounted during the CFMMP’s biannual farmland inventories. In the absence of hard data, anecdotal evidence suggests that such activity is on the rise and that it is occurring mainly on grazing and ranchland. To the extent that California’s urban areas continue to spin off ranchettes and rural subdivisions, the potential threat of population growth to grazing land may be the greatest of all. As a result, although the geography of cultivated farmland in California in 2100 could very well be similar to that of today, the geography of California’s grazing lands will almost certainly be different.

References

CFMMP (Tables 8-11)

CA DOF (Tables 2, B.1, B.2)

McFadden, 1974

NWI (Table 6)

U.S. Census Bureau, 2001

USGS (Table 5)

Appendix III — Attachment A

Projected Population Growth

Table A.1. Projected population growth and growth rates, by county, 2000-2040

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
County	2000 population (source: DOF)	2020F population (source: DOF)	2040F population (source: DOF)	Annual population growth rate, 2000-2040 (%)	Annual population growth rate, 2020-2040 (%)	Average of state and county growth rates, 2000-2040 (%)	Average of state and county growth rates, 2020-2040 (%)
Alameda	1,470,155	1,793,139	2,069,530	0.86	0.72	1.09	1.00
Alpine	1,239	1,701	2,029	1.24	0.89	1.28	1.09
Amador	34,853	40,129	43,210	0.54	0.37	0.93	0.83
Butte	207,158	307,296	419,856	1.78	1.57	1.55	1.43
Calaveras	42,041	62,688	80,329	1.63	1.25	1.48	1.27
Colusa	20,973	41,398	67,975	2.98	2.51	2.16	1.90
Contra Costa	931,946	1,104,725	1,264,400	0.77	0.68	1.05	0.98
Del Norte	31,155	41,898	50,885	1.23	0.98	1.28	1.13
El Dorado	163,197	256,119	334,786	1.81	1.35	1.57	1.32
Fresno	811,179	1,114,403	1,521,360	1.58	1.57	1.46	1.43
Glenn	29,298	49,113	74,926	2.38	2.13	1.85	1.71
Humboldt	128,419	141,092	146,933	0.34	0.20	0.83	0.75
Imperial	154,549	298,700	504,220	3.00	2.65	2.16	1.97
Inyo	18,437	20,694	24,708	0.73	0.89	1.03	1.09
Kern	677,372	1,073,748	1,623,671	2.21	2.09	1.77	1.69
Kings	126,672	186,611	265,944	1.87	1.79	1.60	1.54
Lake	60,072	93,058	128,225	1.91	1.62	1.62	1.45
Lassen	35,959	49,322	61,725	1.36	1.13	1.34	1.21
Los Angeles	9,838,861	11,575,693	13,888,161	0.87	0.91	1.10	1.10
Madera	126,394	224,567	346,451	2.55	2.19	1.94	1.74
Marin	248,397	268,630	297,307	0.45	0.51	0.89	0.90
Mariposa	16,762	23,390	28,625	1.35	1.01	1.34	1.15
Mendocino	90,442	118,804	149,731	1.27	1.16	1.30	1.23
Merced	215,256	319,785	460,020	1.92	1.83	1.62	1.56
Modoc	10,481	12,396	14,896	0.88	0.92	1.11	1.11
Mono	10,891	14,166	17,331	1.17	1.01	1.25	1.15
Monterey	401,886	575,102	855,213	1.91	2.00	1.62	1.65
Napa	127,084	157,878	191,971	1.04	0.98	1.18	1.14
Nevada	97,020	136,405	166,073	1.35	0.99	1.34	1.14
Orange	2,833,190	3,431,869	4,075,328	0.91	0.86	1.12	1.08
Placer	243,646	391,245	522,214	1.92	1.45	1.63	1.37

Table A.1. Projected population growth and growth rates, by county, 2000-2040 (cont.)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
County	**2000 population (source: DOF)**	**2020F population (source: DOF)**	**2040F population (source: DOF)**	**Annual population growth rate, 2000-2040 (%)**	**Annual population growth rate, 2020-2040 (%)**	**Average of state and county growth rates, 2000-2040 (%)**	**Average of state and county growth rates, 2020-2040 (%)**
Plumas	20,852	23,077	24,569	0.41	0.31	0.87	0.80
Riverside	1,570,885	2,773,431	4,446,277	2.64	2.39	1.98	1.84
Sacramento	1,212,527	1,651,765	2,122,769	1.41	1.26	1.37	1.28
San Benito	51,853	82,276	114,922	2.01	1.68	1.67	1.49
San Bernardino	1,727,452	2,747,213	4,202,152	2.25	2.15	1.79	1.72
San Diego	2,943,001	3,917,001	5,116,228	1.39	1.34	1.36	1.32
San Francisco	792,049	750,904	681,924	-0.37	-0.48	0.48	0.40
San Joaquin	579,172	884,375	1,250,610	1.94	1.75	1.64	1.52
San Luis Obispo	254,818	392,329	535,901	1.88	1.57	1.60	1.43
San Mateo	747,061	855,506	953,089	0.61	0.54	0.97	0.92
Santa Barbara	412,071	552,846	779,247	1.61	1.73	1.47	1.51
Santa Clara	1,763,252	2,196,750	2,595,253	0.97	0.84	1.15	1.06
Santa Cruz	260,248	367,196	497,319	1.63	1.53	1.48	1.41
Shasta	175,777	240,975	294,289	1.30	1.00	1.31	1.15
Sierra	3,457	3,575	3,474	0.01	-0.14	0.67	0.57
Siskiyou	45,194	53,676	62,040	0.80	0.73	1.06	1.01
Solano	399,841	552,105	698,430	1.40	1.18	1.37	1.24
Sonoma	459,258	614,173	753,729	1.25	1.03	1.29	1.16
Stanislaus	459,025	708,950	998,906	1.96	1.73	1.65	1.51
Sutter	82,040	116,408	152,304	1.56	1.35	1.44	1.32
Tehama	56,666	83,996	114,090	1.76	1.54	1.55	1.42
Trinity	13,490	15,594	16,836	0.56	0.38	0.94	0.84
Tulare	379,944	569,896	836,973	1.99	1.94	1.66	1.62
Tuolumne	56,125	77,350	95,023	1.33	1.03	1.33	1.16
Ventura	753,820	981,565	1,278,426	1.33	1.33	1.33	1.31
Yolo	164,010	225,321	298,350	1.51	1.41	1.42	1.35
Yuba	63,983	84,610	109,834	1.36	1.31	1.34	1.30
California	**34,653,395**	**45,448,627**	**58,731,006**	**1.33**	**1.29**	**1.33**	**1.29**

Table A.2. Projected population growth by county, 2000-2100

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
County	2000 population (source: DOF)	2020F population (source: DOF)	2040F population (source: DOF)	2050F population based on 2000-2040 state and county avg. growth rate	2050F population based on 2020-2040 state and county avg. growth rate	2100F population based on 2000-2040 state and county avg. growth rate/2	2100F population based on 2020-2040 state and county avg. growth rate/2
Los Angeles	9,838,861	11,575,693	13,888,161	15,488,480	15,497,560	20,358,311	20,400,280
Imperial	154,549	298,700	504,220	624,597	612,914	1,069,779	1,000,884
Orange	2,833,190	3,431,869	4,075,328	4,555,623	4,535,936	6,023,483	5,932,517
San Diego	2,943,001	3,917,001	5,116,228	5,856,124	5,831,574	8,217,815	8,097,302
Riverside	1,570,885	2,773,431	4,446,277	5,410,127	5,335,081	8,856,860	8,431,480
San Bernardino	1,727,452	2,747,213	4,202,152	5,016,658	4,983,011	7,827,504	7,644,175
Santa Barbara	412,071	552,846	779,247	901,379	905,294	1,298,862	1,318,823
Ventura	753,820	981,565	1,278,426	1,458,787	1,456,134	2,031,211	2,018,255
Alameda	1,470,155	1,793,139	2,069,530	2,307,210	2,287,126	3,030,028	2,938,378
Contra Costa	931,946	1,104,725	1,264,400	1,403,147	1,394,436	1,821,563	1,782,151
San Francisco	792,049	750,904	681,924	715,163	710,034	805,635	785,565
San Mateo	747,061	855,506	953,089	1,049,599	1,044,065	1,336,596	1,312,014
Santa Clara	1,763,252	2,196,750	2,595,253	2,909,443	2,884,875	3,874,714	3,760,965
Marin	248,397	268,630	297,307	324,821	325,152	405,465	406,920
Napa	127,084	157,878	191,971	215,910	214,934	289,896	285,317
Solano	399,841	552,105	698,430	799,913	789,742	1,124,197	1,074,736
Sonoma	459,258	614,173	753,729	856,546	845,837	1,180,410	1,129,343
Monterey	401,886	575,102	855,213	1,003,988	1,006,978	1,501,628	1,517,431
San Benito	51,853	82,276	114,922	135,604	133,208	205,440	192,948
San Luis Obispo	254,818	392,329	535,901	628,199	617,709	936,084	882,227
Santa Cruz	260,248	367,196	497,319	576,018	572,017	832,769	812,597
Merced	215,256	319,785	460,020	540,335	537,166	809,247	792,667
San Joaquin	579,172	884,375	1,250,610	1,470,860	1,454,089	2,210,085	2,122,660
Stanislaus	459,025	708,950	998,906	1,175,972	1,160,376	1,771,336	1,690,026
Fresno	811,179	1,114,403	1,521,360	1,757,985	1,753,356	2,526,621	2,503,297
Kern	677,372	1,073,748	1,623,671	1,934,808	1,919,849	3,004,843	2,923,829
Kings	126,672	186,611	265,944	311,681	309,815	464,186	454,484

Table A.2. Projected population growth by county, 2000-2100

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
County	**2000 population (source: DOF)**	**2020F population (source: DOF)**	**2040F population (source: DOF)**	**2050F population based on 2000-2040 state and county avg. growth rate**	**2050F population based on 2020-2040 state and county avg. growth rate**	**2100F population based on 2000-2040 state and county avg. growth rate/2**	**2100F population based on 2020-2040 state and county avg. growth rate/2**
Madera	126,394	224,567	346,451	419,856	411,713	680,373	635,019
Tulare	379,944	569,896	836,973	986,845	982,425	1,492,208	1,468,811
Sacramento	1,212,527	1,651,765	2,122,769	2,431,894	2,409,784	3,420,199	3,312,096
El Dorado	163,197	256,119	334,786	391,225	381,668	578,408	530,209
Nevada	97,020	136,405	166,073	189,723	185,998	264,942	247,103
Placer	243,646	391,245	522,214	613,612	598,462	919,840	842,385
Sutter	82,040	116,408	152,304	175,768	173,672	251,808	241,405
Yuba	63,983	84,610	109,834	125,519	124,998	175,441	172,890
Alpine	1,239	1,701	2,029	2,305	2,261	3,175	2,965
Amador	34,853	40,129	43,210	47,416	46,935	59,843	57,739
Butte	207,158	307,296	419,856	489,893	483,980	721,522	691,341
Calaveras	42,041	62,688	80,329	93,039	91,124	134,506	125,014
Colusa	20,973	41,398	67,975	84,133	82,055	143,797	131,662
Del Norte	31,155	41,898	50,885	57,791	56,955	79,522	75,549
Glenn	29,298	49,113	74,926	90,013	88,790	142,691	135,982
Humboldt	128,419	141,092	146,933	159,633	158,279	196,480	190,693
Inyo	18,437	20,694	24,708	27,377	27,538	35,404	36,140
Lake	60,072	93,058	128,225	150,589	148,122	225,448	212,717
Lassen	35,959	49,322	61,725	70,540	69,607	98,593	94,087
Mariposa	16,762	23,390	28,625	32,692	32,101	45,619	42,785
Mendocino	90,442	118,804	149,731	170,341	169,149	235,392	229,650
Modoc	10,481	12,396	14,896	16,627	16,629	21,901	21,911
Mono	10,891	14,166	17,331	19,619	19,434	26,777	25,897
Plumas	20,852	23,077	24,569	26,790	26,612	33,278	32,507
Shasta	175,777	240,975	294,289	335,267	329,849	464,937	439,059
Sierra	3,457	3,575	3,474	3,714	3,678	4,390	4,245
Siskiyou	45,194	53,676	62,040	68,949	68,588	89,839	88,199
Tehama	56,666	83,996	114,090	133,011	131,321	195,492	186,892
Trinity	13,490	15,594	16,836	18,490	18,300	23,385	22,549
Tuolumne	56,125	77,350	95,023	108,406	106,662	150,864	142,505
Yolo	164,010	225,321	298,350	343,439	341,228	488,874	477,893
California	**34,653,395**	**45,448,627**	**58,731,006**	**67,011,271**	**66,763,758**	**93,286,986**	**92,081,030**

Appendix III — Attachment B

Urban Land Shares, Incremental Densities, Infill Shares, Greenfield Population, and Urban Acreage

Table B.1. Baseline and projected urban land shares, incremental densities, and infill shares, by county, 1972-2100

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14
	Urban share of county land area (%)					Incremental density (persons/acre)				Infill share 1980-1998 (%)			
County	1972	1996	2020F	2050F	2100F	1972-1996	1997-2020F	2020-2050F	2050-2100F	1980-1998	1997-2020	2020-2050	2050-2100
Alameda	17.2	22.5	23.6	24.8	26.2	8.5	12.1	12.9	12.9	40.0	48.2	55.1	58.0
Alpine	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Amador	0.5	1.8	1.9	2.0	2.1	3.7	6.7	6.7	6.7	10.0	13.2	14.9	15.8
Butte	na	na	1.0	2.0	2.0	na	6.2	6.5	6.6	na	6.4	10.6	13.7
Calaveras	na	na	1.0	2.0	2.0	na	6.2	6.5	6.6	na	6.4	10.6	13.7
Colusa	na	na	1.0	2.0	2.0	na	6.2	6.5	6.6	na	6.4	10.6	13.7
Contra Costa	15.0	22.3	23.1	23.9	24.8	6.7	12.1	12.8	12.8	10.0	33.1	47.4	53.3
Del Norte	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
El Dorado	0.6	2.2	2.6	3.1	3.7	4.8	6.8	6.9	7.0	20.0	20.0	20.0	20.0
Fresno	1.5	2.3	2.5	3.0	3.6	11.1	11.1	11.1	11.1	5.0	11.1	14.5	16.6
Glenn	na	na	1.0	2.0	2.0	na	6.2	6.5	6.6	na	6.4	10.6	13.7
Humboldt	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Imperial	na	na	1.0	2.0	2.0	na	6.2	6.5	6.6	na	6.4	10.6	13.7
Inyo	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Kern	0.8	1.8	2.3	3.1	4.0	5.3	6.7	6.8	6.9	5.0	10.7	14.0	16.4
Kings	1.0	3.0	3.3	4.0	4.7	2.6	7.0	7.1	7.2	10.0	14.3	17.0	18.8
Lake	na	na	1.0	2.0	2.0	na	6.2	6.5	6.6	na	6.4	10.6	13.7
Lassen	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Los Angeles	32.2	39.1	39.7	40.8	41.7	16.3	16.5	16.5	16.7	67.0	77.8	77.8	84.8
Madera	0.5	1.6	2.0	2.7	3.5	4.1	6.6	6.8	6.8	5.0	10.5	13.8	16.0

Table B.1. Baseline and projected urban land shares, incremental densities, and infill shares, by county, 1972-2100 (cont.)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14
	Urban share of county land area (%)					Incremental density (persons/acre)				Infill share 1980-1998 (%)			
County	1972	1996	2020F	2050F	2100F	1972-1996	1997-2020F	2020-2050F	2050-2100F	1980-1998	1997-2020	2020-2050	2050-2100
Marin	8.4	10.6	10.7	11.0	11.5	3.6	9.0	9.1	9.1	55.0	55.0	55.0	55.0
Mariposa	0.1	0.2	0.3	0.3	0.4	7.4	7.4	7.4	7.4	10.0	11.7	12.5	13.0
Mendocino	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Merced	1.2	2.3	2.8	3.6	4.6	6.0	6.8	7.0	7.1	10.0	13.7	16.1	18.0
Modoc	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Mono	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Monterey	1.7	2.3	2.7	3.5	4.5	7.9	7.9	7.9	7.9	10.0	13.6	15.9	17.8
Napa	4.1	7.1	7.7	8.4	9.3	4.1	8.1	8.3	8.4	10.0	18.3	23.4	26.3
Nevada	1.0	2.3	2.6	3.0	3.5	7.0	7.0	7.0	7.0	10.0	13.6	15.8	17.3
Orange	21.8	34.0	34.9	35.7	36.6	11.8	15.1	16.7	16.7	50.0	64.4	77.3	79.7
Placer	1.2	3.5	4.4	5.3	6.3	5.2	7.1	7.4	7.5	10.0	14.8	18.3	20.7
Plumas	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Riverside	2.0	4.7	6.0	8.2	10.6	6.5	7.5	7.9	8.1	5.0	13.5	19.3	24.0
Sacramento	11.3	19.0	20.4	22.1	24.0	7.8	11.2	12.1	12.1	30.0	39.8	48.1	51.9
San Benito	0.3	0.7	0.9	1.1	1.4	7.7	7.7	7.7	7.7	10.0	12.1	13.3	14.2
San Bernardino	1.0	1.8	2.2	3.1	4.1	2.4	6.7	6.9	6.9	5.0	10.7	14.2	16.5
San Diego	5.9	10.2	11.5	13.4	15.5	9.5	9.5	9.5	9.6	10.0	21.3	28.7	33.8
San Francisco	82.3	85.0	76.6	77.1	75.5	na	28.6	28.6	28.6	na	88.8	125.0	143.6
San Joaquin	4.0	7.1	8.6	10.6	12.9	7.3	8.1	8.6	8.8	10.0	18.3	24.3	28.9

Table B.1. Baseline and projected urban land shares, incremental densities, and infill shares, by county, 1972-2100 (cont.)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14
	Urban share of county land area (%)					Incremental density (persons/acre)				Infill share 1980-1998 (%)			
County	**1972**	**1996**	**2020F**	**2050F**	**2100F**	**1972-1996**	**1997-2020F**	**2020-2050F**	**2050-2100F**	**1980-1998**	**1997-2020**	**2020-2050**	**2050-2100**
San Luis Obispo	1.2	1.7	2.0	2.4	2.8	9.5	9.5	9.5	9.5	15.0	15.6	16.2	16.8
San Mateo	22.8	26.8	27.3	28.0	28.9	12.5	13.3	13.3	13.4	70.0	70.0	70.0	70.0
Santa Barbara	2.3	2.9	3.1	3.7	4.3	12.3	12.3	12.3	12.3	20.0	20.0	20.0	20.0
Santa Clara	13.0	17.5	18.0	18.6	19.4	11.3	11.3	11.3	11.3	75.0	75.0	75.0	75.0
Santa Cruz	5.8	8.8	9.8	11.5	13.3	11.3	11.3	11.3	11.3	25.0	27.5	30.0	32.6
Shasta	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Sierra	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Siskiyou	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Solano	4.2	8.6	9.7	11.0	12.5	7.1	8.5	8.9	9.0	20.0	24.8	28.8	31.5
Sonoma	3.5	5.9	6.7	7.5	8.5	7.6	7.8	8.0	8.1	10.0	17.2	21.7	24.5
Stanislaus	3.3	4.8	5.3	6.0	6.9	13.3	13.3	13.3	13.3	45.0	45.0	45.0	45.0
Sutter	1.4	2.7	3.2	3.8	4.6	6.2	6.9	7.1	7.1	10.0	14.0	16.6	18.4
Tehama	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Trinity	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Tulare	0.8	1.5	1.8	2.4	3.2	7.2	7.2	7.2	7.2	10.0	12.9	14.6	16.1
Tuolumne	na	na	1.0	1.0	1.0	na	6.2	6.5	6.5	na	6.4	10.6	12.7
Ventura	4.0	7.4	8.2	9.6	11.1	na	8.1	8.7	8.7	na	13.6	22.4	26.9
Yolo	0.2	0.3	0.4	0.4	0.5	7.1	7.1	7.2	7.2	40.0	40.0	40.0	40.0
Yuba	na	2.0	2.0	2.0	2.0	4.9	6.7	6.7	6.7	10.0	13.4	15.1	15.9
California	**3.4**	**5.1**	**5.7**	**6.7**	**7.7**								

Table B.2. Projected greenfield population and urban acreage by county, 1997-2100

	Population projections (from Table 2 and Table B.2)				Projected greenfield population growth			Projected greenfield development (acres)		
County	**2000**	**2020F**	**2050F**	**2100F**	**1997-2020F**	**2020-2050F**	**2050-2100F**	**1997-2020F**	**2020-2050F**	**2050-2100F**
Alameda	1,470,155	2,069,530	2,287,126	2,938,378	204,218	222,009	273,841	6,818	6,991	8,623
Alpine	1,239	2,029	2,261	2,965	464	500	615	30	31	38
Amador	34,853	43,210	46,935	57,739	5,814	5,789	9,092	352	349	547
Butte	207,158	419,856	483,980	691,341	101,810	157,918	178,989	6,641	9,882	10,978
Calaveras	42,041	80,329	91,124	125,014	23,199	25,415	29,253	1,513	1,590	1,794
Colusa	20,973	67,975	82,055	131,662	21,404	36,339	42,819	1,396	2,274	2,626
Contra Costa	931,946	1,264,400	1,394,436	1,782,151	139,568	152,354	181,154	4,678	4,803	5,711
Del Norte	31,155	50,885	56,955	75,549	12,638	13,458	16,230	824	842	1,016
El Dorado	163,197	334,786	381,668	530,209	86,986	100,439	118,833	5,196	5,871	6,896
Fresno	811,179	1,521,360	1,753,356	2,503,297	298,374	546,416	625,224	10,875	19,916	22,788
Glenn	29,298	74,926	88,790	135,982	20,794	35,463	40,734	1,356	2,219	2,498
Humboldt	128,419	146,933	158,279	190,693	14,056	15,362	28,292	917	961	1,770
Imperial	154,549	504,220	612,914	1,000,884	145,986	280,841	334,884	9,522	17,574	20,539
Inyo	18,437	24,708	27,538	36,140	2,276	6,117	7,508	148	383	470
Kern	677,372	1,623,671	1,919,849	2,923,829	392,438	727,326	839,010	23,773	43,179	49,106
Kings	126,672	265,944	309,815	454,484	59,014	102,202	117,471	3,420	5,790	6,608
Lake	60,072	128,225	148,122	212,717	35,577	49,216	55,757	2,321	3,080	3,420
Lassen	35,959	61,725	69,607	94,087	14,535	18,131	21,367	948	1,135	1,337
Los Angeles	9,838,861	13,888,161	15,497,560	20,400,280	454,519	869,151	743,699	11,156	21,332	18,020
Madera	126,394	346,451	411,713	635,019	99,451	161,373	187,657	6,074	9,644	11,092
Marin	248,397	297,307	325,152	406,920	11,398	25,435	36,796	513	1,131	1,636
Mariposa	16,762	28,625	32,101	42,785	6,550	7,620	9,296	359	417	509

Table B.2. Projected greenfield population and urban acreage by county, 1997-2100 (cont.)

County	Population projections (from Table 2 and Table B.2)				Projected greenfield population growth			Projected greenfield development (acres)		
	2000	2020F	2050F	2100F	1997-2020F	2020-2050F	2050-2100F	1997-2020F	2020-2050F	2050-2100F
Mendocino	90,442	149,731	169,149	229,650	30,734	44,998	52,809	2,005	2,816	3,305
Merced	215,256	460,020	537,166	792,667	101,681	182,461	209,554	6,035	10,612	12,015
Modoc	10,481	14,896	16,629	21,911	2,100	3,783	4,611	137	237	289
Mono	10,891	17,331	19,434	25,897	3,353	4,708	5,642	219	295	353
Monterey	401,886	855,213	1,006,978	1,517,431	170,378	363,391	419,643	8,768	18,700	21,595
Napa	127,084	191,971	214,934	285,317	30,041	43,686	51,883	1,505	2,123	2,509
Nevada	97,020	166,073	185,998	247,103	41,489	41,737	50,546	2,389	2,403	2,910
Orange	2,833,190	4,075,328	4,535,936	5,932,517	258,926	250,263	284,056	6,922	6,061	6,880
Placer	243,646	522,214	598,462	842,385	149,669	169,256	193,373	8,499	9,236	10,426
Plumas	20,852	24,569	26,612	32,507	2,484	3,160	5,145	162	198	322
Riverside	1,570,885	4,446,277	5,335,081	8,431,480	1,167,292	2,067,287	2,352,480	63,425	106,433	117,394
Sacramento	1,212,527	2,122,769	2,409,784	3,312,096	303,777	393,104	433,825	10,980	13,130	14,490
San Benito	51,853	114,922	133,208	192,948	31,755	44,143	51,260	1,673	2,325	2,700
San Bernardino	1,727,452	4,202,152	4,983,011	7,644,175	1,009,410	1,919,091	2,221,226	61,228	113,283	129,546
San Diego	2,943,001	5,116,228	5,831,574	8,097,302	907,963	1,365,013	1,500,807	38,686	58,160	63,193
San Francisco	792,049	681,924	710,034	785,565	-2,987	10,216	-32,912	-42	145	-467
San Joaquin	579,172	1,250,610	1,454,089	2,122,660	279,451	431,534	475,607	14,004	20,421	21,933
San Luis Obispo	254,818	535,901	617,709	882,227	133,080	188,964	220,102	5,688	8,077	9,408
San Mateo	747,061	953,089	1,044,065	1,312,014	43,135	56,568	80,385	1,317	1,727	2,426
Santa Barbara	412,071	779,247	905,294	1,318,823	121,646	281,959	330,783	3,993	9,255	10,858
Santa Clara	1,763,252	2,595,253	2,884,875	3,760,965	131,335	172,031	219,022	4,719	6,182	7,870
Santa Cruz	260,248	497,319	572,017	812,597	86,958	143,326	162,231	3,111	5,127	5,803

Table B.2. Projected greenfield population and urban acreage by county, 1997-2100 (cont.)

County	Population projections (from Table 2 and Table B.2)				Projected greenfield population growth			Projected greenfield development (acres)		
	2000	2020F	2050F	2100F	1997-2020F	2020-2050F	2050-2100F	1997-2020F	2020-2050F	2050-2100F
Shasta	175,777	294,289	329,849	439,059	72,720	79,435	95,324	4,743	4,971	5,965
Sierra	3,457	3,474	3,678	4,245	153	92	494	10	6	31
Siskiyou	45,194	62,040	68,588	88,199	8,867	13,328	17,117	578	834	1,071
Solano	399,841	698,430	789,742	1,074,736	130,404	169,198	195,239	6,226	7,688	8,778
Sonoma	459,258	753,729	845,837	1,129,343	150,247	181,489	213,936	7,832	9,177	10,701
Stanislaus	459,025	998,906	1,160,376	1,690,026	155,999	248,284	291,307	4,743	7,548	8,856
Sutter	82,040	152,304	173,672	241,405	34,718	47,781	55,242	2,036	2,742	3,134
Tehama	56,666	114,090	131,321	186,892	27,483	42,299	48,505	1,793	2,647	3,035
Trinity	13,490	16,836	18,300	22,549	2,198	2,418	3,709	143	151	232
Tulare	379,944	836,973	982,425	1,468,811	184,307	352,140	407,974	10,359	19,791	22,929
Tuolumne	56,125	95,023	106,662	142,505	23,577	26,199	31,285	1,538	1,639	1,958
Ventura	753,820	1,278,426	1,456,134	2,018,255	219,810	368,311	410,834	10,928	17,147	19,093
Yolo	164,010	298,350	341,228	477,893	42,254	69,544	81,999	2,419	3,937	4,642
Yuba	63,983	109,834	124,998	172,890	21,319	34,306	40,277	1,282	2,063	2,422
California	**34,653,395**	**58,731,006**	**66,763,758**	**92,081,030**	**8,228,794**	**13,374,379**	**15,083,844**	**398,883**	**636,679**	**716,627**