# ECONOMIC EFFECTS OF CRITICAL HABITAT DESIGNATION FOR THE RED-LEGGED FROG IN 23 CALIFORNIA COUNTIES

Prepared For

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# I EXECUTIVE SUMMARY

## I.1 PURPOSE AND APPROACH

On September 24, 2002, the U.S. Fish & Wildlife Service (Service) proposed critical habitat for the California red-legged frog (RLF), *Rana aurora draytonii*, pursuant to the Endangered Species Act of 1973. For this economic analysis, a total of 737,793 proposed acres are examined, from Butte County in the north through Riverside County in the south. This report quantifies the economic impacts associated with the proposed designation of critical habitat. It does so by taking into account the cost of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries. The report combines information on current and projected land uses within critical habitat areas with a defined economic model to calculate these impacts. This report also disaggregates individual critical habitat units defined by the Service to identify the sub-regions where most economic impacts occur.

The economic analysis considers both the economic efficiency and distributional effects that may result from species and habitat protection. Economic efficiency effects generally reflect opportunity costs associated with the commitment of resources required to accomplish species and habitat conservation and lost economic surplus resulting from reduced levels of economic activity. Distributional effects reflect which sectors of the economy experience changes in costs or revenues as a consequence of critical habitat designation.

## I.2 REPORT ORGANIZATION

Following the Executive Summary is an outline of the analytical framework and approach used in the analysis and an overview of the socioeconomic conditions in the affected counties. The impacts to land development, public projects, and private activities are presented next, followed by an evaluation of the regional costs and impacts to small businesses.

## I.3 DESCRIPTION OF HABITAT AND AFFECTED COUNTIES

The primary constituent elements used to determine suitable habitat for the RLF fall into three categories: Standing bodies of fresh water (including natural and manmade (e.g., stock) ponds and other ephemeral or permanent water bodies); upland habitats adjacent to breeding ponds that contain small mammal burrows; and barrier-free upland dispersal habitat between occupied locations.

The Service proposes to designate approximately 737,793 acres across 23 counties. Table II-1: Summary of Critical Habitat Units by County and Region displays acres of critical habitat by county. A variety of economic activities are undertaken within the affected counties, from housing construction to farming. For profiles of the socioeconomic conditions in the affected counties, please see Section III.

## I.4 IMPACTS ON REAL ESTATE DEVELOPMENT

Critical habitat designation for the RLF is expected to have the largest impacts on real estate development. Critical habitat occurs in a number of rapidly growing areas. Onsite avoid and mitigation requirements affect the welfare of both producers and consumers. To describe alternative regulatory approaches, two scenarios are considered. In the base scenario, mitigation requirements increase the cost of development and avoidance requirements are assumed to reduce the construction of new housing. In this scenario, critical habitat is expected to impose losses of over $497 million relating to lost development opportunities. A second scenario, in which increased costs and the reduction in developable land are accommodated through densification, is also discussed.

Table I-1: Summary of Economic Effects of Critical Habitat Designation shows losses for each affected county under the two modeling scenarios. San Luis Obispo County is the most affecte in both cases. In the rationed housing scenario, impacts are in excess of $165 million for this county alone. The three most affected counties are the same in both scenarios: San Luis Obispo, Alameda and Contra Costa. These counties appear to experience impacts that are significantly larger than is the case in other counties – nearly twice as large as the next most impacted county. At least in the rationing scenario, Santa Barbara County may also impacts in excess of $41 million.

The impacts of critical habitat designation vary widely even within counties. That is, the impacts of designation are frequently localized. This finding is sensible from an economic point of view and is consistent with the teachings of urban economics. Housing prices vary over urban areas, typically declining as the location of the house becomes more remote. Critical habitat is not evenly distributed across the landscape, and large impacts may result if a particular area has a large fraction of developable land in critical habitat. Some areas have few alternate sites for development, or have highly rationed housing resulting in high prices. Any of these factors may cause the cost of critical habitat designation to increase.

The disaggregated spatial scale of the analysis permits identification of specific locations, or parts of individual critical habitat units, that result in the largest economic impacts. The maps contained at the end of this section are instructive in this regard. The maps identify the Census tracts within the counties where the impacts are predicted to occur. They appear in order of impact per county.

## I.5 PUBLIC SECTOR ACTIVITIES

The California Department of Transportation is planning to undertake several projects to build, upgrade, and maintain the state's transportation network in areas of red-legged frog critical habitat. After determining the number of affected critical habitat acres, the typical mitigation requirements were applied to determine the impacts on this type of activity. The total costs to transportation projects are estimated to be $687,000. This figure does not include the costs of project delays, as we lack information on benefits from these projects.

The report also considers potential impacts on the energy sector. This analysis examines planned power production facilities within the study area for proximity to proposed critical habitat. It finds the sites fall into one of two categories: either they are too far

from critical habitat to be affected, or are within or near habitat but have already completed the environmental mitigation process for red-legged frog habitat. In both cases, the incremental impacts of designation are zero; the regulation is not expected to impact energy production.

There are overlaps between critical habitat and land managed by the Service, the Department of the Defense, Bureau of Land Management, Bureau of Reclamation, the Forest Service, the Fish and Wildlife Service, and the Bureau of Indian Affairs. After consideration and discussion with Service staff, it was determined that the impacts from designation on these organizations will be minimal.

## I.6 Regional Economic Effects

Designation of critical habitat alters the level of economic activity. As a result, regulation has impacts that spread beyond the sectors directly affected. Indirect and induced impacts of the regulation are calculated using the standard IMPLAN model. Counties with the largest change in new residential home construction were included in this analysis. Critical habitat designation has little effect on the regional economy. New residential construction is reduced by approximately $7.7 million, which causes output in other industries to decrease by approximately $5.1 million. These combined reductions represent only 0.01 percent of the region's output. Included among the industries most affected are wholesale trade and architectural/engineering services.

## I.7 Small Business Impacts

Critical habitat is not expected to result in significant small business impacts since revenue losses are less than one percent of total small business revenues in affected areas. From permit data, it appears that large businesses greatly dominate greenfield development. It is estimated that no more than a single small business will be affected annually as a consequence of designation.

## I.8 Summary Of Measured Impacts

The economic impacts of critical habitat designation vary widely among the 23 affected counties, and even within counties. The counties most impacted by the critical habitat designation include San Luis Obispo ($166 million), Alameda ($91 million), Contra Costa ($88 million) and Santa Barbara ($41 million). Further, economic impacts are unevenly distributed within counties. Our analysis is conducted for each of the 99 affected census tracts, resulting in a high degree of spatial precision.

**Table I-1: Summary of Economic Effects of Critical Habitat Designation**

| County<br>(1) | Surplus Lost<br>(2) | Public Projects<br>(3) | Total<br>(2)+(3) | Surplus Lost (Densification)<br>(4) | Total<br>(3)+(4) |
|---|---|---|---|---|---|
| San Luis Obispo | $165,959,851 | | $165,959,851 | $86,599,887 | $86,599,887 |
| Alameda | $90,546,539 | | $90,546,539 | $90,293,420 | $90,293,420 |
| Contra Costa | $88,031,116 | | $88,031,116 | $72,184,432 | $72,184,432 |
| Santa Barbara | $41,067,801 | | $41,067,801 | $2,533,785 | $2,533,785 |
| San Mateo | $19,719,615 | | $19,719,615 | $19,814,214 | $19,814,214 |
| Ventura | $18,153,714 | $112,000 | $18,265,714 | $12,566,591 | $12,678,591 |
| Riverside | $13,885,294 | | $13,885,294 | $2,020,723 | $2,020,723 |
| Santa Clara | $13,599,103 | | $13,599,103 | $13,558,563 | $13,558,563 |
| Solano | $8,134,928 | | $8,134,928 | $5,118,543 | $5,118,543 |
| Monterey | $7,969,990 | | $7,969,990 | $3,030,792 | $3,030,792 |
| Santa Cruz | $7,549,927 | | $7,549,927 | $2,991,021 | $2,991,021 |
| Los Angeles | $5,897,583 | | $5,897,583 | $703,330 | $703,330 |
| San Benito | $3,996,567 | | $3,996,567 | $1,138,280 | $1,138,280 |
| Marin | $3,972,888 | | $3,972,888 | $4,816,709 | $4,816,709 |
| Nevada | $3,485,145 | | $3,485,145 | $2,668,715 | $2,668,715 |
| El Dorado | $3,053,845 | $404,000 | $3,457,845 | $2,642,386 | $3,046,386 |
| Calaveras | $1,936,668 | | $1,936,668 | $1,872,486 | $1,872,486 |
| Merced | $313,798 | $171,000 | $484,798 | $300,696 | $471,696 |
| Yuba | $262,126 | | $262,126 | $3,263 | $3,263 |
| Napa | $108,092 | | $108,092 | $226,099 | $226,099 |
| Kern | $2,796 | | $2,796 | $101,887 | $101,887 |
| Stanislaus | $448 | | $448 | $425 | $425 |
| Butte | $0 | | $0 | $0 | $0 |
| **Total** | **$497,647,833** | **$687,000** | **$498,334,833** | **$325,186,246** | **$325,873,246** |

Sources: Critical Habitat Boundary Files, U.S. Fish and Wildlife Service; California Department of Transportation, Office of State Planning.

# II RELEVANT BACKGROUND AND ANALYTICAL FRAMEWORK

## II.1 REPORT PURPOSE

On September 24, 2002, the U.S. Fish & Wildlife Service (Service) proposed critical habitat for the California red-legged frog (RLF), *Rana aurora draytonii*, pursuant to the Endangered Species Act of 1973. For this economic analysis, a total of 737,793 proposed acres are examined. The habitat units span 23 California counties, from Butte County in the north through Riverside County in the south. This report attempts to quantify the economic effects associated with the proposed designation of critical habitat. It does so by taking into account the cost of conservation-related measures that are likely to be associated with future economic activities that may adversely affect the habitat within the proposed boundaries. The report combines information on current and projected land uses within critical habitat areas with a defined economic model to calculate these impacts. This report also disaggregates individual critical habitat units defined by the Service to identify the sub-regions where most economic impacts occur.

This information is intended to assist the Secretary in determining whether the benefits of excluding particular areas from the designation outweigh the biological benefits of including them.[1] In addition, this information allows the Service to address the requirements of Executive Orders 12866 and 13211, and the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).[2] This report also complies with direction from the U.S. 10th Circuit Court of Appeals that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[3]

This section provides the framework for this analysis. First, it describes the general analytic approach to estimating economic effects, including both efficiency and distributional effects. Next, it discusses the scope of the analysis, including the link between existing and critical habitat-related protection efforts and economic impacts. Finally, it describes the information sources employed to conduct this analysis.

## II.2 APPROACH TO ESTIMATING ECONOMIC EFFECTS

This economic analysis considers both the economic efficiency and distributional effects that may result from species and habitat protection. Economic efficiency effects generally reflect "opportunity costs" associated with the commitment of resources required to accomplish species and habitat conservation. Efficiency losses also include reductions in surplus levels resulting from economic activities such as land development. Similarly, the costs incurred by a Federal action agency to consult with the Service under section 7 represent opportunity costs of habitat conservation.

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[1] 16 U.S.C. §1533(b)(2).

[2] Executive Order 12866, "Regulatory Planning and Review," September 30, 1993; Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001; 5 U.S.C. §§601 *et seq* ; and Pub Law No. 104-121.

[3] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

This analysis also addresses the distribution of impacts associated with the designation, including an assessment of any local or regional impacts of habitat conservation and the potential effects of conservation activities on small entities and the energy industry. This information may be used to determine whether the effects of the designation unduly burden a particular group or economic sector. For example, while habitat conservation activities may have a small impact relative to the national economy, individuals employed in a particular sector of the regional economy may experience a significant level of impact. The difference between economic efficiency effects and distributional effects, as well as their application in this analysis, are discussed in greater detail below.

## II.3 EFFICIENCY EFFECTS

At the guidance of the Office of Management and Budget (OMB) and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to discern the implications on a societal level of a regulatory action. For regulations specific to the conservation of the RLF, efficiency effects represent the opportunity cost of resources used, or benefits foregone, by society as a result of the regulations. Economists generally characterize opportunity costs in terms of changes in producer and consumer surplus in affected markets.[4]

In some instances, compliance costs may provide a reasonable approximation of the efficiency effects associated with a regulatory action. For example, a lead Federal agency may enter into a consultation with the Service to ensure that a particular activity will not adversely modify critical habitat. The end result of the consultation may be a small amount of additional mitigation for on-site impacts of the proposed activity. The cost of the additional mitigation would have been spent on alternative activities if the proposed project not been designated critical habitat. In the case that compliance activity is not expected to significantly affect markets – that is, not result in a shift in the quantity of a good or service provided at a given price, or in the quantity of a good or service demanded given a change in price – the measurement of compliance costs provides a reasonable estimate of the change in economic efficiency.

More generally, where habitat protection measures are expected to significantly impact a market, it may be necessary to estimate changes in producer and consumer surpluses. For example, a designation that precludes the development of large areas of land may shift the price and quantity of housing supplied in a region. In this case, changes in economic efficiency (i.e., social welfare) can be measured by considering changes in producer and consumer surplus in the real estate market.

## II.4 DISTRIBUTIONAL AND REGIONAL ECONOMIC EFFECTS

Measurements of changes in economic efficiency focus on the net impact of conservation activities, without consideration of how certain economic sectors or groups of people are affected. Thus, a discussion of efficiency effects alone may miss important distributional considerations. OMB

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[4] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see Gramlich, Edward M., *A Guide to Benefit-Cost Analysis (2nd Ed.)*, Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/ webpages/Guidelines.html.

encourages Federal agencies to consider distributional effects separately from efficiency effects.[5] This analysis considers several types of distributional effects, including impacts on small entities; impacts on energy supply, distribution, and use; and regional economic impacts. It is important to note that these are fundamentally different measures of economic impact than efficiency effects, and thus cannot be added to or compared with estimates of changes in economic efficiency.

Regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in the regional economy resulting from a regulatory action. Regional economic impacts are commonly measured using input / output models. These models investigate the effects of a change in one sector of the economy on economic output, income, or employment in other local industries. These economic data provide a quantitative estimate of the magnitude of shifts of jobs and revenues in the local economy.

Regional input / output models may overstate the long-term impacts of a regulatory change because they provide a static view of the regional economy. That is, they measure the initial impact of a regulatory change on an economy but do not consider long-term adjustments that the economy will make in response. For example, these models provide estimates of the number of jobs lost as a result of a regulatory change, but do not consider re-employment of these individuals over time or other adaptive responses by affected businesses. In addition, the flow of goods and services across the regional boundaries defined in the model may change as a result of the regulation, compensating for a potential decrease in economic activity within the region.

Despite these and other limitations, in certain circumstances regional economic impact analysis may provide useful information about the scale and scope of localized impacts. It is important to remember that measures of regional economic effects generally reflect shifts in resource use rather than efficiency losses. Thus, these types of distributional effects are reported separately from efficiency effects (i.e., not summed). In addition, measures of regional economic impact cannot be compared with estimates of efficiency effects, but should be considered as distinct measures of impact.

## II.5 Scope Of The Analysis

This analysis identifies those economic activities believed to most likely threaten the listed species and its habitat and, where possible, quantifies the economic impact to avoid, mitigate, or compensate for such threats within the boundaries of the proposed critical habitat. In instances where critical habitat is being proposed after a species is listed, some future impacts may be unavoidable, regardless of the final designation and exclusions under 4(b)(2). However, due to the difficulty in making a credible distinction between listing and critical habitat effects within critical habitat boundaries, this analysis considers all future conservation-related impacts to be coextensive with the designation.[6,7]

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[5] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[6] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (New Mexico Cattle Growers Assn v. U.S.F.W.S., 248 F.3d 1277 (10th Cir. 2001)).

[7] In 2004, the U.S. 9th Circuit invalidated the Service's regulation defining destruction or adverse modification of critical habitat (Gifford Pinchot Task Force v. United States Fish and Wildlife Service). The Service is currently

Coextensive effects may also include impacts associated with overlapping protective measures of other Federal, State, and local laws that aid habitat conservation in the areas proposed for designation. We note that in past instances, some of these measures have been precipitated by the listing of the species and impending designation of critical habitat. Because habitat conservation efforts affording protection to a listed species likely contribute to the efficacy of the critical habitat designation, the impacts of these actions are considered relevant for understanding the full effect of the proposed designation. Enforcement actions taken in response to violations of the Act, however, are not included.

### II.5.1 Sections of the Act Relevant To the Analysis

The analysis focuses on activities that are influenced by the Service through sections 4, 7, 9, and 10 of the Act. Section 4 of the Act focuses on the listing and recovery of endangered and threatened species, as well as critical habitat designation. According to section 4, the Secretary is required to list species as endangered or threatened "solely on the basis of the best available scientific and commercial data."[8]

The protections afforded to threatened and endangered species and their habitat are described in sections 7, 9, and 10 of the Act, and economic impacts resulting from these protections are the focus of this analysis:

- Section 7 of the Act requires Federal agencies to consult with the Service to ensure that any action they authorize, fund, or carry out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the species' designated critical habitat. The administrative costs of these consultations, along with the costs of project modifications resulting from these consultations, represent compliance costs associated with the listing of the species and the designation of critical habitat.[9]
- Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered wildlife, where "take" means to "harass, harm, pursue, or collect, or to attempt to engage in any such conduct."[10] The economic impacts associated with this section manifest themselves in sections 7 and 10.
- Under section 10(a)(1)(B) of the Act, an entity (i.e., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for an endangered animal species in order to meet the conditions for issuance of an incidental take permit in connection with the

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reviewing the decision to determine what effect it (and to a limited extent Center for Biological Diversity v. Bureau of Land Management (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

[8] 16 U.S.C. §1533.

[9] The Service notes, however, that a recent Ninth Circuit judicial opinion, Gifford Pinchot Task Force v. United States Fish and Wildlife Service, has invalidated the Service's regulation defining destruction or adverse modification of critical habitat. The Service is currently reviewing the decision to determine what effect it (and to a limited extent Center for Biological Diversity v. Bureau of Land Management (Case No. C-03-2509-SI, N.D. Cal.)) may have on the outcome of consultations pursuant to section 7 of the Act.

[10] 16 U.S.C. §1538 and 16 U.S.C. §1532.

development and management of a property.[11] The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately minimized and mitigated. The designation of critical habitat does not require completion of an HCP; however, the designation may influence conservation measures provided under HCPs. Federal agencies are not typically the sole stakeholder agency involved with development of an HCP. Federal agencies, however, can be the lead agency on a multi-jurisdictional HCP.

### II.5.2 Other Relevant Protection Efforts

The protection of listed species and habitat is not limited to the Act. Other Federal agencies, such as the Army Corps of Engineers, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction.[12]

CEQA is a California State statute that requires State and local agencies (known here as "lead agencies") to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. Projects carried out by Federal agencies are not subject to CEQA provisions. CEQA regulations require a lead agency to initially presume that a project will result in a potentially significant adverse environmental impact and to prepare an EIR if the project may produce certain types of impacts, including when:

> "[T]he project has the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory."[13]

State law instructs the lead agency (typically a county or city community development or planning department in the case of land development projects) to examine impacts from a very broad perspective, taking into account the value of animal and plant habitats to be modified by the project. The lead agency must determine which, if any, project impacts are potentially significant and, for any such impacts identified, whether feasible mitigation measures or feasible alternatives will reduce the impacts to a level less than significant. It is within the power of a lead agency to decide that negative impacts are acceptable in light of economic, social, or other benefits generated by the project.

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[11] U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," http://endangered.fws.gov/hcp/.

[12] For example, the Sikes Act Improvement Act (Sikes Act) of 1997 requires Department of Defense (DOD) military installations to develop Integrated Natural Resources Management Plans (INRMPs) that provide for the conservation, protection, and management of wildlife resources (16 U.S.C. §§ 670a - 670o). These plans must integrate natural resource management with the other activities, such as training exercises, taking place at the facility.

[13] California Natural Resources Code §15065(a)

### II.5.3 Additional Analytic Considerations

Previous economic impact analyses prepared to support critical habitat decisions have considered other types of economic impacts related to critical habitat designation, including time delay. This analysis considers these economic impacts and has determined that the proposed critical habitat for RLF will cause economic impacts of this nature. These impacts are described in detail in Section IV. This section includes a discussion of indirect benefits that may result from the designation of critical habitat.

### II.5.4 Benefits

Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.[14] OMB's Circular A-4 distinguishes two types of economic benefits: *direct benefits and ancillary benefits*. Ancillary benefits are defined as favorable impacts of a rulemaking that are typically unrelated, or secondary, to the statutory purpose of the rulemaking.[15]

In the context of CHD, the primary purpose of the rulemaking (i.e., the direct benefit) is the potential to enhance conservation of the species. The published economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of defensible, relevant studies or a lack of resources on the implementing agency's part to conduct new research.[16] *Rather than rely on economic measures, the Service believes that the direct benefits of the proposed rule are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.*

Critical habitat designation may also generate ancillary benefits. Critical habitat aids in the conservation of species specifically by protecting the primary constituent elements on which the species depends. To this end, critical habitat designation can result in maintenance of particular environmental conditions that may generate other social benefits aside from the preservation of the species. That is, management actions undertaken to conserve a species or habitat may have coincident, positive social welfare implications, such as increased recreational opportunities in a region. While they are not the primary purpose of critical habitat, these ancillary benefits may result in gains in employment, output, or income that may offset the direct, negative impacts to a region's economy resulting from actions to conserve a species or its habitat.

It is often difficult to evaluate the ancillary benefits of critical habitat designation. To the extent that the ancillary benefits of the rulemaking may be captured by the market through an identifiable shift in resource allocation, they are factored into the overall economic impact assessment in this report. For example, if decreased off-road vehicle use to improve species habitat leads to an increase in opportunities for wildlife viewing or hiking within the region, the local economy may

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[14] Executive Order 12866, *Regulatory Planning and Review*, September 30, 1993.

[15] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

[16] U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf.

experience an associated measurable, positive impact. Where data are available, this analysis attempts to capture the *net* economic impact (i.e., the increased regulatory burden less any discernable offsetting market gains), of species conservation efforts imposed on regulated entities and the regional economy.

## II.6 INFORMATION SOURCES

The primary sources of information for this report were communications with and data provided by the Service. In addition, the analysis relies on information from the following entities.

- University of California, Berkeley Department of City and Regional Planning;
- DataQuick Information Systems;
- U.S. Census 1990 and Census 2000;
- U.S. Department of Commerce, Bureau of Economic Analysis;
- U.S. Department of Labor, Bureau of Labor Statistics;
- California Department of Finance;
- California Department of Transportation;
- California Employment Development Department;
- Federal Highway Administration;
- California Department of Conservation Farmland Mapping and Monitoring Program;
- U.S. Bureau of Land Management;
- Federal Emergency Management Agency;
- U.S. Geological Survey;
- Marshall & Swift;
- IMPLAN;
- Dun & Bradstreet;
- Robert Morris Associates;
- Environmental Systems Research Institute (ESRI);
- Association of Bay Area Governments (ABAG);
- Association of Monterey Bay Area Governments (AMBAG);
- San Joaquin Council of Governments (SJCOG);
- Stanislaus Council of Governments (StanCOG);
- Kern Council of Governments (Kern COG);
- Southern California Association of Governments (SCAG).

## II.7 HABITAT DESCRIPTION

### II.7.1 Primary Constituent Elements

In identifying areas as critical habitat for the RLF, the Service considered those physical and biological habitat features that are essential to the conservation of the species. These essential features are referred to as the species' primary constituent elements (PCEs). Areas that do not contain any PCEs at the time of critical habitat designation are not considered critical habitat, whether or not they occur within a mapped critical habitat unit. The primary constituent elements for the California red-legged frog are as follows:

1. Aquatic Breeding Habitat. Standing bodies of fresh water (with salinities less than 7.0 ppt), including natural and man-made (e.g., stock) ponds, slow moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a sufficient length of time necessary for the subspecies to complete the aquatic portion of its life cycle.
2. Non-Breeding Aquatic Habitat. Fresh water habitats as described above which may or may not hold water long enough for the subspecies to hatch and complete its aquatic lifecycle but does provide for shelter, foraging, predator avoidance, and aquatic dispersal habitat. Other wetland habitat which would be considered to meet these elements would include, but are not limited to, plunge pools within intermittent creeks, seeps, quiet water refugia during high water flows, and springs of sufficient moisture to withstand the summer dry period.
3. Upland Habitat. Upland areas surrounding aquatic and wetland habitat that will provide the frog shelter, forage, and predator avoidance. The upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological and edaphic features that support and surround the wetland or aquatic habitat. These upland features contribute to the filling and drying of the wetland or aquatic habitat and are responsible for maintaining suitable periods of pool inundation for larval frogs and their food sources, and provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs.
4. Dispersal Habitat. Barrier free upland dispersal habitat that connects two (or more) areas of aquatic habitat, which may or may not be suitable for breeding. Dispersal habitat allows for frogs to migrate to other wetland features and potentially to other frog populations.

Because of limitations in GIS data, the Service did not exclude all developed areas, such as towns, housing developments, or other lands unlikely to contain the PCEs essential for the conservation of the red-legged frog. Existing features and structures within the boundaries of the mapped units, such as buildings, roads, most intensively farmed areas, etc., are unlikely to contain one or more of the PCEs, and are therefore not considered critical habitat. As a result, Federal actions in those areas would not trigger section 7 consultations unless the actions affect the species or PCEs in adjacent critical habitat.

## II.8 PROPOSED CRITICAL HABITAT AND AFFECTED COUNTIES

At total of 44 habitat units for the RLF are proposed for 23 counties in California. Habitat units located partially or wholly within each county are shown in Table II-1: Summary of Critical Habitat Units by County and Region and the total acres covered by at least one critical habitat unit is shown in comparison to the land area of the entire county.

California includes a diverse array of cities, counties, and regions. Counties can be divided into regions in various ways. The division of counties into the regions described below attempts to follow groupings used by Association of Government organizations.

### II.8.1 Units in the Sierra Nevada Foothills Region

This region is composed of Butte, Calaveras, El Dorado, Nevada, and Yuba counties. The five proposed habitat units cover 33,605 acres or 0.9 percent of the region's land area. El Dorado County accounts for the largest share (9,254 acres) of the habitat in the region.

### II.8.2 Units in the Central Valley Region

The six habitat units in this region span Kern, Merced, San Benito, and Stanislaus counties. The proposed habitat totals 58,513 acres, which represents 0.7 percent of the region's land area. The largest share, 43,827 acres, is held San Benito County.

### II.8.3 Units in the San Francisco Bay Region

Comprised of Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, and Solano counties, this region contains the most proposed habitat. The nine habitat units span 298,821 acres, which represents 8.1 percent of the land area in the region. Of the seven counties in the region, Alameda contains largest share (64,733 acres) of habitat.

### II.8.4 Units in the Central Coast Region

Monterey, San Luis Obispo, and Santa Cruz counties compose the Central Coast Region and contain 12 habitat units. A total of 163,746 acres are contained within these three counties, which represents 3.6 percent of the region's land area. San Luis Obispo contains the greatest number, 97,578, of habitat acres.

### II.8.5 Units in the Southern California Region

This region consists of Los Angeles, Riverside, Santa Barbara, and Ventura counties and contains 13 habitat units. The 183,108 acres of proposed habitat accounts for 1.8 percent of the region's land area. Santa Barbara County hosts the greatest share (147,235 acres) of habitat.

**Table II-1: Summary of Critical Habitat Units by County and Region**

| Region | County | Number of Proposed Habitat Units | Total Acres of Proposed Habitat | Percent of County Area | Totals Acres in County |
|---|---|---|---|---|---|
| **Sierra Nevada Foothills** | | | | | |
| | Butte | 1 | 5,294 | 0.5% | 1,073,165 |
| | Calaveras | 1 | 4,450 | 0.7% | 663,008 |
| | El Dorado | 1 | 9,254 | 0.8% | 1,145,527 |
| | Nevada | 1 | 8,285 | 1.3% | 623,183 |
| | Yuba | 1 | 6,322 | 1.5% | 412,097 |
| Subtotal | | 5 | 33,605 | 0.9% | 3,916,980 |
| **Central Valley** | | | | | |
| | Kern | ? | 3,079 | 0.1% | 5,223,345 |
| | Merced | 1 | 11,604 | 1.0% | 1,261,121 |
| | San Benito | 3 | 43,827 | 4.9% | 889,415 |
| | Stanislaus | 1 | 2 | 0.0% | 969,630 |
| Subtotal | | 5 | 58,513 | 0.7% | 8,343,511 |
| **San Francisco Bay** | | | | | |
| | Alameda | 1 | 64,733 | 12.4% | 524,750 |
| | Contra Costa | 1 | 58,379 | 11.3% | 514,952 |
| | Marin | 2 | 48,476 | 12.7% | 378,976 |
| | Napa | 1 | 2,525 | 0.5% | 505,822 |
| | San Mateo | 2 | 56,331 | 15.9% | 353,365 |
| | Santa Clara | 1 | 59,132 | 7.0% | 835,905 |
| | Solano | 1 | 9,245 | 1.6% | 582,146 |
| Subtotal | | 9 | 298,821 | 8.1% | 3,695,915 |
| **Central Coast** | | | | | |
| | Monterey | 2 | 46,102 | 2.2% | 2,120,220 |
| | San Luis Obispo | 8 | 97,592 | 4.6% | 2,124,831 |
| | Santa Cruz | 2 | 20,052 | 7.0% | 285,634 |
| Subtotal | | 12 | 163,746 | 3.6% | 4,530,686 |
| **Southern California** | | | | | |
| | Los Angeles | 1 | 7,872 | 0.3% | 2,615,385 |
| | Riverside | 1 | 10,417 | 0.2% | 4,672,363 |
| | Santa Barbara | 7 | 147,235 | 8.4% | 1,759,233 |
| | Ventura | 4 | 17,584 | 1.5% | 1,188,281 |
| Subtotal | | 13 | 183,108 | 1.8% | 10,235,263 |
| **Total** | | **44** | 737,793 | **2.4%** | **30,722,355** |

# III SOCIOECONOMIC PROFILE OF AFFECTED COUNTIES

To understand the economic impacts of critical habitat designation for the RLF, it is essential to have an accurate picture of current and projected economic activity. This section presents a summary of the current conditions and forecasts for the affected counties by examining population growth, employment sectors and patterns, and housing trends.

Assuming the present growth trends continue, the population in California will likely total 40 million in 2010 and 45.5 million in 2020.[17] The California Department of Finance estimates a statewide growth rate of 1.3 percent per year from 2010 to 2020 and a total change of 29 percent between 2000 and 2020. The population increase will strain the urban housing markets and an estimated 220,000 additional housing units will have to be constructed every year through 2020 in order to keep pace with the expanding population. For comparison, an average of 100,000 permits were issued for new home construction in the state each year between 1990 and 2000. Single-family home construction has been the trend; between 1987 and 2001, this type of development represented 80 percent of new home construction.[18]

The following sections review the growth patterns in the regions and counties that contain proposed critical habitats. Table III-1 presents the changes in population, jobs, and housing units that occurred between 1990 and 2000 and the change in the unemployment rates between 2000 and 2004. Table III-2: Changes in Population: 2000-2020 displays the predicted changes in population between 2000 and 2020, as estimated by the Demographic Research Unit of the California Department of Finance. In addition, economic activity is characterized by the current and future employment sectors. Table III-3: 2002 Business and Employment Pattern summarizes the business and employment patterns for the 25 counties with critical habitat units, and Table III-4: Jobs to Housing Ratios displays the jobs-to-housing ratios in the counties as of the 1990 Census and 2000 Census.

## III.1 UNITS IN THE SIERRA NEVADA FOOTHILLS

Butte, Calaveras, El Dorado, Nevada, and Yuba counties comprise the Sierra Nevada Foothills Region. Between 1990 and 2000, this region experienced a population change of 15.8 percent, driven by the growth in Calaveras and El Dorado counties. The region added 75,425 residents, 31,349 housing units, and 60,214 jobs over the ten-year period. The California Department of Finance estimates population changes between 27 and 46 percent between 2000 and 2020 for all counties in the region.

As of 2002, the following principal industries, in terms of annual payroll, existed in the region: retail trade; health care and social assistance; manufacturing; construction; and, information services.[19] In 2002, the largest industries, ranked by number of employees, included trade, government, leisure and hospitality; and, education and healthcare services. All five counties are

[17] California Department of Housing and Community Development, "Raising the Roof, California's Housing Development Projections and Constraints, 1997-2020," May 2000, http://www.hcd.ca.gov/hpd/hrc/rtr/index.html.

[18] California Department of Housing and Community Development, "Raising the Roof, California's Housing Development Projections and Constraints, 1997-2020," May 2000, http://www.hcd.ca.gov/hpd/hrc/rtr/index.html.

[19] U.S. Census Bureau, "2002 County Business Patterns," http://censtats.census.gov/cbpnaic/cbpnaic.shtml.

expected to add additional jobs in government, services, and retail trade, as well as see continued success in the tourism industry.[20]

At the time of the 2000 Census, the region had a 1.1 jobs-to-housing ratio, with a range of 0.7 (Calaveras) to 1.2 (Butte and Yuba). The median new home prices in 2004 were $263,934 (Butte), $354,584 (Calaveras), (El Dorado), (Nevada) and $197,948 (Yuba).[21]

## III.2 Units in the Central Valley Region

This region includes Kern, Merced, San Benito, and Stanislaus counties and experienced a 21.6 percent increase in population between 1990 and 2000. The region also added 65,940 housing units (16.4 percent increase) and 109,706 jobs. San Benito County posted the greatest increases in population (45.1 percent) and housing units (34.9 percent) over the ten-year period. Between 2000 and 2020, the region is expected to add 659,214 residents.

The following industries in the region ranked high in terms of annual payroll in 2002: manufacturing; retail trade; construction; and, health care and social assistance.[22] The agriculture, trade, government, and manufacturing industries employed the majority of the residents in the region in 2002. Growth in the region is predicted to continue, with additional jobs in services, manufacturing, and government.[23]

The median new home prices in 2004 were $234,901 (Kern), $305,565 (Merced), and $366,681 (Stanislaus).[24] As of the 2000 Census, the region held a 1.4 jobs-to-housing ratio, with a range of 1.2 (Merced) to 1.4 (Kern and Stanislaus).

## III.3 Units In The San Francisco Bay Region

Between 1990 and 2000, the San Francisco Bay Region, which includes Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, and Solano counties, experienced 13 percent and 7.8 percent increases in population and housing, respectively. An additional 635,480 jobs were added over the same time period. Between 2000 and 2020, the population is predicted to increase by 413,036 (28.5 percent) in Alameda, 372,577 (39 percent) in Contra Costa, 2,787 (1.1 percent) in Marin, 41,001 (32.8 percent) in Napa, 76,247 (10.7 percent) in San Mateo, 315,809 (18.7 percent) in Santa Clara, and 158,480 (39.9 percent) in Solano.[25] According the California Department of Finance, the population of the region comprised of the seven previously listed counties plus San Francisco and Sonoma counties, will add a "disproportionately-low 13.3 percent of California's future

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[20] California Department of Transportation, Office of Transportation Economics, "Long-Term Socioeconomic Forecasts by County 2003-2020," May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm.

[21] DataQuick Information Systems, Assessor Database, www.dataquick.com.

[22] U.S. Census Bureau,"2002 County Business Patterns," http://censtats.census.gov/cbpnaic/cbpnaic.shtml.

[23] California Department of Transportation, Office of Transportation Economics, "Long-Term Socio Economic Forecasts by County 2003-2020," May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm

[24] DataQuick Information Systems, Assessor Database, www.dataquick.com. Data were not available for San Benito in 2004.

[25] State of California, Department of Finance, "Population Projections by Race / Ethnicity for California and Its Counties 2000-2050," May 2004, http://www.dof.ca.gov/html/demograp/DRU_Publications/Projections/P1.htm.

population".[26] Alameda and Santa Clara counties will account for over half of this anticipated growth. The seven counties with critical habitat are predicted to grow by 1,379,937 residents between 2000 and 2020.

As of 2002, the following principal industries, in terms of annual payroll, existed in the region: manufacturing; health care and social assistance; finance and insurance; professional, scientific, and technical; construction; and information services.[27] The largest industries, ranked by number of employees in 2002, include trade, government, and professional services. The region is expected to add additional jobs in the services, financial, education, healthcare, hospitality, and retail sectors.[28]

The median new home prices in 2004 were $772,276 (Alameda), $582,770 (Contra Costa), (Marin), $785,059 (Napa), (San Mateo), (Santa Clara), and $492,613 (Solano).[29] As of the 2000 Census, the region held a 1.8 jobs-to-housing ratio, with a range of 1.2 (Solano) to 2.2 (Santa Clara). The jobs-housing balance is of particular concern for this area, given the current strain on the transportation networks and the expectations for future growth.[30]

## III.4 Units in the Central Coast Region

Between 1990 and 2000, the Central Coast Region, which includes Monterey, San Luis Obispo, and Santa Cruz counties, realized 12.6 and 9.7 percent increases in population and housing, respectively. An additional 78,253 jobs were added to the region. The populations of Monterey and San Luis Obispo are projected to increase by 22-25 percent between 2000 and 2020. A smaller growth rate of 11.4 percent is predicted for Santa Cruz County over the same time period.

As of 2002, the following principal industries, in terms of annual payroll, existed in the region: retail and wholesale trade; manufacturing; and, health care and social assistance.[31] The largest industries, ranked by number of employees in 2002, include trade, agriculture, government, and leisure and hospitality. Growth in the region is predicted to continue, with additional jobs in the services, government, education, healthcare, and tourism sectors.[32]

The median new home prices in 2004 were $450,843 (Monterey), $461,426 (San Luis Obispo), and (Santa Cruz).[33] As of the 2000 Census, the region held a 1.5 jobs-to-housing ratio, with a range of 1.4 (San Luis Obispo) to 1.7 (Monterey).

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[26] California Department of Housing and Community Development, "Raising the Roof, California's Housing Development Projections and Constraints, 1997-2020," May 2000, http://www.hcd.ca.gov/hpd/hrc/rtr/index.html.

[27] U.S. Census Bureau,"2002 County Business Patterns," http://censtats.census.gov/cbpnaic/cbpnaic.shtml.

[28] California Department of Transportation, Office of Transportation Economics, "Long-Term Socioeconomic Forecasts by County 2003-2020," May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm.

[29] DataQuick Information Systems, Assessor Database, www.dataquick.com

[30] "ABAG Regional Housing Need Determination, Chapter 2, 2001-2006," October 2002.

[31] U.S. Census Bureau, "2002 County Business Patterns," http://censtats.census.gov/cbpnaic/cbpnaic.shtml.

[32] California Department of Transportation, Office of Transportation Economics, "Long-Term Socioeconomic Forecasts by County 2003-2020," May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm

[33] DataQuick Information Systems, Assessor Database, www.dataquick.com.

## III.5 UNITS IN THE SOUTHERN CALIFORNIA REGION

The Southern California Region, which includes Los Angeles, Riverside, Santa Barbara and Ventura counties, grew by 11.7 percent, or 1,751,939 people, between 1990 and 2000. The region also added 920,980 jobs and 389,325 housing units. According to the California Department of Housing & Community Development, the Greater Los Angeles Metropolitan Area is projected to absorb half of California's 1997-2020 population increase, with the majority of the growth occurring in Los Angeles, Riverside and Orange counties. Smaller growth is predicted for Ventura County, which will add approximately 167,200 new residents between 2000 and 2020. Santa Barbara will grow at a slighter slower pace over the same time period, with an increase of 63,200 in population.

As of 2002, the following principal industries, in terms of annual payroll, existed in the region: manufacturing; health care and social assistance; retail trade; and professional, scientific, and technical services.[34] The largest industries, ranked by number of employees in 2002, include trade; government; professional and business services; and, manufacturing. According to the California Office of Transportation Economics, the employment forecasts for Los Angeles and Ventura counties are restricted by the lack of affordable housing.[35] A similar picture is painted for Santa Barbara County; however, growth is predicted in the education and services industries.[36] Riverside County maintains a stock of affordable housing, which will accommodate the influx of workers.[37]

The jobs-to-housing ratio for the region at the time of the 2000 Census was 1.6, with a range of 1.1 (Riverside) to 1.7 (Los Angeles and Santa Barbara). In 2004, the median new home prices were (Los Angeles), (Riverside), $491,863 (Santa Barbara), and $773,950 (Ventura).[38]

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[34] U.S. Census Bureau, "2002 County Business Patterns," http://censtats.census.gov/cbpnaic/cbpnaic.shtml.

[35] California Department of Transportation, Office of Transportation Economics, "Long-Term Socioeconomic Forecasts by County 2003-2020," May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm.

[36] California Department of Transportation, Office of Transportation Economics, "Long-Term Socioeconomic Forecasts by County 2003-2020," May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm.

[37] California Department of Transportation, Office of Transportation Economics, "Long-Term Socioeconomic Forecasts by County 2003-2020," May 2000, http://www.dot.ca.gov/hq/tpp/offices/ote/socio-economic.htm

[38] DataQuick Information Systems, Assessor Database, www.dataquick.com.

**Table III-1: Population, Housing, and Employment Characteristics**

| Region | County | Change in Population, 1990-2000 | Percent Change in Population, 1990-2000 | Change in Housing Units, 1990-2000 | Percent Change in Housing Units, 1990-2000 | Change in Number of Jobs, 1990-2000 | Change in Unemployment Rate, 2004-2000 |
|---|---|---|---|---|---|---|---|
| **Sierra Nevada Foothills** | | | | | | | |
| | Butte | 21,051 | 11.6 | 9,408 | 12.4 | 16,007 | 0.7 |
| | Calaveras | 8,556 | 26.7 | 3,793 | 19.8 | 3,702 | 0.6 |
| | El Dorado | 30,304 | 24.1 | 9,827 | 16.0 | 24,513 | 1.1 |
| | Nevada | 13,523 | 17.2 | 6,930 | 18.6 | 15,968 | 0.9 |
| | Yuba | 1,991 | 3.4 | 1,391 | 6.5 | 24 | 2.0 |
| | Region | 75,425 | 15.8 | 31,349 | 14.6 | 60,214 | |
| **Central Valley** | | | | | | | |
| | Kern | 118,168 | 21.7 | 32,928 | 16.6 | 59,663 | 1.1 |
| | Merced | 32,151 | 18.0 | 9,963 | 17.1 | 7,322 | -0.3 |
| | San Benito | 16,537 | 45.1 | 4,269 | 34.9 | 5,986 | 1.2 |
| | Stanislaus | 76,475 | 20.6 | 18,780 | 14.2 | 36,735 | 0.8 |
| | Region | 243,331 | 21.6 | 65,940 | 16.4 | 109,706 | |
| **San Francisco Bay** | | | | | | | |
| | Alameda | 164,559 | 12.9 | 36,074 | 7.2 | 140,605 | 2.9 |
| | Contra Costa | 145,084 | 18.1 | 38,407 | 12.1 | 77,486 | 2.3 |
| | Marin | 17,193 | 7.5 | 5,233 | 5.2 | 29,066 | 1.8 |
| | Napa | 13,514 | 12.2 | 4,355 | 9.9 | 24,109 | 1.4 |
| | San Mateo | 57,538 | 8.9 | 8,794 | 3.5 | 103,554 | 2.4 |
| | Santa Clara | 185,008 | 12.4 | 39,089 | 7.2 | 237,999 | 4.1 |
| | Solano | 54,121 | 15.9 | 14,980 | 12.5 | 22,661 | 1.5 |
| | Region | 637,017 | 13.0 | 146,932 | 7.8 | 635,480 | |
| **Central Coast** | | | | | | | |

| Region | County | Change in Population, 1990-2000 | Percent Change in Population, 1990-2000 | Change in Housing Units, 1990-2000 | Percent Change in Housing Units, 1990-2000 | Change in Number of Jobs, 1990-2000 | Change in Unemployment Rate, 2004-2000 |
|---|---|---|---|---|---|---|---|
| | Monterey | 46,102 | 13.0 | 10,484 | 8.6 | 20,196 | 0.3 |
| | San Luis Obispo | 29,519 | 13.6 | 12,075 | 13.4 | 34,465 | 0.4 |
| | Santa Cruz | 25,868 | 11.3 | 6,995 | 7.6 | 23,592 | 2.1 |
| | Region | 101,489 | 12.6 | 29,554 | 9.7 | 78,253 | |
| **Southern California** | | | | | | | |
| | Los Angeles | 656,174 | 7.4 | 107,566 | 3.4 | 145,310 | 1.2 |
| | Riverside | 374,974 | 32.0 | 100,827 | 20.8 | 206,545 | 0.3 |
| | Santa Barbara | 29,739 | 8.0 | 4,752 | 3.4 | 33,041 | 0.1 |
| | Ventura | 84,181 | 12.6 | 23,234 | 10.2 | 73,238 | 0.5 |
| | Region | 1,145,068 | 10.3 | 236,379 | 5.9 | 458,134 | |
| **California** | | **4,111,627** | **14** | **1,031,667** | **9.2** | **2,660,826** | **1.2** |

Sources:

(1) Fulton, W., Guide to California Planning, Second Edition, 1999

(2) "Census 2000 PHC-T-4. Ranking Tables for Counties: 1990 and 2000", released 2 April 2001, U.S. Census Bureau, Census 2000 Redistricting Data (P.L. 94-171) Summary File and 1990 Census, http://www.census.gov/population/www/cen2000/phc-t4.html

(3) U.S. Census 1990 Summary File 3, Table H1: Housing Units and U.S. Census 2000 Summary File 3, Table H1: Housing Units, http://factfinder.census.gov

(4) U.S. Bureau Economic Analysis, Regional Economic Information System, Table CA30, May 2004, http://www.bea.doc.gov/bea/regional/reis/

(5) U.S. Bureau of Labor Statistics, Unemployment Rates by County in 2000 and 2005, Not Seasonally Adjusted, http://data.bls.gov/map/servlet/map.servlet.MapToolServlet?survey=la

**Table III-2: Changes in Population: 2000-2020**

| County | Population Change | Percent Change |
|---|---|---|
| Alameda | 413,036 | 28.5 |
| Butte | 56,058 | 27.4 |
| Calaveras | 18,801 | 46.0 |
| Contra Costa | 372,577 | 39.0 |
| El Dorado | 62,719 | 39.6 |
| Kern | 285,418 | 42.9 |
| Los Angeles | 1,325,457 | 13.9 |
| Marin | 2,787 | 1.1 |
| Merced | 149,955 | 71.1 |
| Monterey | 101,723 | 25.2 |
| Napa | 41,001 | 32.8 |
| Nevada | 34,481 | 37.3 |
| Riverside | 1,121,746 | 72.2 |
| San Benito | 19,777 | 36.8 |
| San Luis Obispo | 56,947 | 22.9 |
| San Mateo | 76,247 | 10.7 |
| Santa Barbara | 63,241 | 15.8 |
| Santa Clara | 315,809 | 18.7 |
| Santa Cruz | 29,170 | 11.4 |
| Solano | 158,480 | 39.9 |
| Stanislaus | 204,064 | 45.4 |
| Ventura | 167,238 | 22.1 |
| Yuba | 24,263 | 40.1 |
| **California** | **9,808,543** | **28.8** |

Source:

(1) State of California, Department of Finance, Population Projections by Race/Ethnicity for California and Its Counties 2000–2050, Sacramento, California, May 2004, available for download http://www.dof.ca.gov/html/demograp/DRU_Publications/Projections/P1.htm

**Table III-3: 2002 Business and Employment Patterns**

| Region | County | Top Three Industries[39] | Number of Employees | Percent of Total Employees in County |
|---|---|---|---|---|
| **Sierra Nevada Foothills** | | | | |
| | Butte | Government | 16,800 | 22.5 |
| | | Trade, Transportation, and Utilities | 14,100 | 18.9 |
| | | Educational and Health Services | 11,400 | 15.2 |
| | Calaveras | Government | 2,580 | 29.2 |
| | | Trade, Transportation, and Utilities | 1,480 | 16.7 |
| | | Leisure and Hospitality | 1,150 | 13.0 |
| | El Dorado[40] | Government | 195,800 | 26.2 |
| | | Trade, Transportation, and Utilities | 120,700 | 16.2 |
| | | Professional and Business Services | 88,700 | 11.9 |
| | Nevada | Government | 5,800 | 19.7 |
| | | Trade, Transportation, and Utilities | 5,300 | 18.0 |
| | | Leisure and Hospitality | 3,900 | 13.2 |
| | Yuba[41] | Government | 10,100 | 23.6 |
| | | Trade, Transportation, and Utilities | 8,100 | 18.9 |
| | | Educational and Health Services | 4,900 | 11.4 |
| **Central Valley** | | | | |
| | Kern | Government | 55,200 | 22.6 |
| | | Agriculture | 40,200 | 16.4 |
| | | Trade, Transportation, and Utilities | 38,900 | 15.9 |
| | Merced | Government | 13,500 | 20.5 |

[39] Ranked by number of employees in 2002.

[40] Sacramento Metropolitan Statistical Area (includes Sacramento, El Dorado, and Placer counties.)

[41] Yuba City Metropolitan Statistical Area (includes Sutter and Yuba counties)

| Region | County | Top Three Industries[39] | Number of Employees | Percent of Total Employees in County |
|---|---|---|---|---|
| | | Trade, Transportation, and Utilities | 11,000 | 16.7 |
| | | Agriculture | 10,900 | 16.5 |
| | | Manufacturing | 10,900 | 16.5 |
| | San Benito | Government | 3,000 | 19.9 |
| | | Trade, Transportation, and Utilities | 2,610 | 17.3 |
| | | Agriculture | 2,420 | 16.0 |
| | Stanislaus | Trade, Transportation, and Utilities | 31,700 | 19.2 |
| | | Government | 25,300 | 15.3 |
| | | Manufacturing | 22,500 | 13.6 |
| **San Francisco Bay** | | | | |
| | Alameda / Contra Costa[42] | Trade, Transportation, and Utilities | 203,900 | 19.5 |
| | | Government | 185,500 | 17.7 |
| | | Professional and Business Services | 151,200 | 14.5 |
| | Marin / San Mateo[43] | Professional and Business Services | 190,000 | 19.2 |
| | | Trade, Transportation, and Utilities | 175,100 | 17.7 |
| | | Government | 132,700 | 13.4 |
| | Napa / Solano[44] | Government | 36,300 | 19.2 |
| | | Trade, Transportation, and Utilities | 33,100 | 17.5 |
| | | Educational and Health Services | 23,000 | 12.2 |
| | Santa Clara | Manufacturing | 203,600 | 22.3 |
| | | Professional and Business Services | 172,500 | 18.9 |
| | | Trade, Transportation, and Utilities | 134,600 | 14.7 |

[42] Oakland Metropolitan Statistical Area (includes Alameda and Contra Costa counties.)

[43] San Francisco Metropolitan Statistical Area (includes Marin and San Mateo counties.)

[44] Vallejo - Fairfield - Napa Metropolian Statistical Area (includes Napa and Solano counties.)

| Region | County | Top Three Industries[39] | Number of Employees | Percent of Total Employees in County |
|---|---|---|---|---|
| **Central Coast** | | | | |
| | Monterey | Agriculture | 35,400 | 21.2 |
| | | Government | 31,300 | 18.7 |
| | | Trade, Transportation, and Utilities | 25,600 | 15.3 |
| | San Luis Obispo | Government | 23,100 | 22.2 |
| | | Trade, Transportation, and Utilities | 19,000 | 18.3 |
| | | Leisure and Hospitality | 13,700 | 13.2 |
| | Santa Cruz | Government | 20,800 | 20.0 |
| | | Trade, Transportation, and Utilities | 18,400 | 17.7 |
| | | Leisure and Hospitality | 11,800 | 11.3 |
| **Southern California** | | | | |
| | Los Angeles | Trade, Transportation, and Utilities | 786,700 | 19.5 |
| | | Government | 605,900 | 15.0 |
| | | Professional and Business Services | 578,300 | 14.3 |
| | Riverside / San Bernardino[45] | Trade, Transportation, and Utilities | 224,300 | 20.8 |
| | | Government | 212,400 | 19.7 |
| | | Manufacturing | 114,700 | 10.6 |
| | Santa Barbara | Government | 35,600 | 19.8 |
| | | Leisure and Hospitality | 20,800 | 11.6 |
| | | Professional and Business Services | 20,500 | 11.4 |
| | Ventura | Trade, Transportation, and Utilities | 51,800 | 17.3 |
| | | Government | 45,400 | 15.2 |
| | | Manufacturing | 38,000 | 12.7 |

Sources:

[45] Riverside - San Bernardino Metropolitan Statistical Area.

(1) Counties divided into regions based on Association of Government organizations and the Guide to California Planning, Second Edition, 1999 by W. Fulton.

(2) California Employment Development Department, Labor Market Information Division, 2002 County Snapshots, http://www.calmis.ca.gov/htmlfile/subject/COsnaps.htm

**Table III-4: Jobs to Housing Ratios**

| Region | County | Jobs-to-Housing Ratio, 1990 | Jobs-to-Housing Ratio, 2000 |
|---|---|---|---|
| **Sierra Nevada Foothills** | | | |
| | Butte | 1.1 | 1.2 |
| | Calaveras | 0.6 | 0.7 |
| | El Dorado | 0.8 | 1.1 |
| | Nevada | 0.9 | 1.1 |
| | Yuba | 1.2 | 1.2 |
| | Region | 1.0 | 1.1 |
| **Central Valley** | | | |
| | Kern | 1.3 | 1.4 |
| | Merced | 1.3 | 1.2 |
| | San Benito | 1.3 | 1.3 |
| | Stanislaus | 1.3 | 1.4 |
| | Region | 1.3 | 1.4 |
| **San Francisco Bay** | | | |
| | Alameda | 1.5 | 1.7 |
| | Contra Costa | 1.3 | 1.3 |
| | Marin | 1.5 | 1.7 |
| | Napa | 1.4 | 1.7 |
| | San Mateo | 1.6 | 1.9 |
| | Santa Clara | 1.9 | 2.2 |
| | Solano | 1.2 | 1.2 |
| | Region | 1.6 | 1.8 |
| **Central Coast** | | | |
| | Monterey | 1.7 | 1.7 |
| | San Luis Obispo | 1.2 | 1.4 |
| | Santa Cruz | 1.4 | 1.5 |
| | Region | 1.4 | 1.5 |
| **Southern California** | | | |
| | Los Angeles | 1.7 | 1.7 |
| | Riverside | 0.9 | 1.1 |
| | Santa Barbara | 1.6 | 1.7 |
| | Ventura | 1.4 | 1.6 |
| | Region | 1.5 | 1.6 |
| **California** | | 1.5 | 1.6 |

Sources:

(1) Fulton, W., Guide to California Planning, Second Edition, 1999

(2) U.S. Census 1990 Summary File 3, Table H1: Housing Units, http://factfinder.census.gov

(3) U.S. Census 2000 Summary File 3, Table H1: Housing Units, http://factfinder.census.gov

(4) U.S. Bureau Economic Analysis, Regional Economic Information System, Table CA30, May 2004, http://www.bea.doc.gov/bea/regional/reis/

# IV ECONOMIC IMPACTS ON LAND DEVELOPMENT

A primary aim of this analysis is to estimate the economic impacts of designation on the markets for land, housing and commercial real estate. The methodology used to estimate these impacts is described below, followed by a discussion of the calculated results. The section concludes with an estimate of the total costs of critical habitat designation attributable to regulation of land development.

## IV.1 BACKGROUND

This portion of the analysis considers the effects of designation on the linked markets for land and improvements to land such as housing and commercial buildings. At the guidance of the OMB and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to understand how society, as a whole, will be affected by a regulatory action.[46] In the context of this regulatory action, these efficiency effects represent the overall welfare gained or lost by society as a result of critical habitat designation. Economists generally characterize welfare in terms of changes in producer and consumer surpluses in affected markets.[47]

### IV.1.1 Compliance with Section 7 of the Act

The measurement of direct compliance costs focuses on the implementation of Section 7 of the Act. This section requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. The costs of project modifications and mitigation requirements resulting from these consultations represent the direct compliance costs of designating critical habitat.

The estimate of total Section 7 impacts presented in this analysis does not differentiate between consultations that result from the listing of the species (i.e., the jeopardy standard) and consultations that result from the presence of critical habitat (i.e., the adverse modification standard). Consultations resulting from the listing of the species, or project modifications meant specifically to protect the species, as opposed to its habitat, may occur even in the absence of critical habitat. However, in 2001, the 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic

[46] Executive Order 12866, "Regulatory Planning and Review," September 30, 1993; Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," May 18, 2001; 5 U.S.C. §§ 601 *et seq*; and Pub Law No. 104–121; and 2 U.S.C. §§658–658g and 1501–1571.

[47] For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see Gramlich, Edward M., *A Guide to Benefit-Cost Analysis (2nd Ed.)*, Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, *Guidelines for Preparing Economic Analyses*, EPA 240-R-00-003, September 2000, available at http://yosemite.epa.gov/ee/epa/eed.nsf/ webpages/Guidelines.html.

impacts of critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes.[48]

### IV.1.2 Defining Co-Extensive Effects

This report complies with direction from the U.S. 10th Circuit Court of Appeals that "co-extensive" effects should be included in the economic analysis to inform decision-makers regarding which areas to designate as critical habitat.[49] Estimates of the regulatory impacts are derived from the Service's consultation history (see Section IV.2.4.) When assigning mitigation responsibilities, the Service frequently considers additional regulations beyond the ESA (such as the CWA and/or CEQA.) Hence, the impacts presented in this report include the regulatory burden of both ESA-related conservation and other pre-existing environmental legislation.

### IV.1.3 Time Frame

The analysis examines activities taking place both within and adjacent to the proposed designation. It estimates impacts based on activities that are "reasonably foreseeable," including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available to the public. Accordingly, the analysis bases estimates on activities that are likely to occur within a 20-year time frame, beginning on the day that the current proposed rule becomes available to the public.

Twenty years is an optimal time frame for this analysis for several reasons. First, the scale of the proposed critical habitat designation requires the use of regional and county level growth data. In the State of California, this data is readily available beyond the ten year horizon. A 20-year time frame is very common among a number of planning and development tools including: California State-mandated jurisdictional General Plans, population and employment projections by regional associations of governments, and project planning and the calculation of absorption rates and financial rates of return by real estate developers. If the proposed critical habitat designation had been restricted to a handful of local, single-county sites, this data would not have been useful and a shorter interval period, perhaps 10 years, would have been more appropriate.

In addition, speculative real estate transactions in high growth communities in the Central Valley frequently involve land not yet annexed into cities and land upon which development is not likely to occur for 15 to 20 years. Master planned communities consisting of hundreds, if not thousands, of acres of raw land increasingly require more than ten years to receive planning approvals from local, State and Federal agencies. Certain land development interests that precede the ownership by the eventual land developer, therefore, often financially control property more than a decade in advance of the first project application. Farming or ranching may continue, but critical habitat

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[48] *New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001).

[49] In 2001, the U.S. 10th Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed CHD, regardless of whether those impacts are attributable co-extensively to other causes (*New Mexico Cattle Growers Ass'n v. U.S.F.W.S.*, 248 F.3d 1277 (10th Cir. 2001)).

designation has the potential to affect development potential and associated speculative land value at a very early stage in the development process.

## IV.2 METHODOLOGY

The total economic impact of critical habitat designation depends on a variety of factors, including the size of the designation, the nature of pre-existing markets and regulation, and geographical features of the designated land itself. Because these factors vary by region, the methodology adopts the Census tract as its baseline unit of analysis. This modeling choice invests the results with a high degree of spatial precision.

Economic repercussions of the designation affect landowners, builders and housing consumers in different ways. Accordingly, the methodology analyzes both costs of designation and their incidence on producers and consumers.

The steps followed to determine the impacts of critical habitat designation on housing markets are:

- Describe current and projected economic and demographic characteristics in the proposed critical habitat areas;
- Determine the effects and significance of prior regulation of land development in affected areas;
- Determine the intersection of future development and critical habitat determination;
- Determine the incremental, project-level regulatory requirements resulting from critical habitat designation;
- Calculate the market effects of critical habitat and estimate economic costs for these areas.

Each step is discussed in greater detail below.

### IV.2.1 Socioeconomic Characteristics Critical Habitat Areas

Data on current and future socioeconomic characteristics for areas affected by critical habitat designation are necessary precursors to this analysis. To obtain present-day estimates, data were obtained from several sources, including population and household data the most recent United States Census, and data on new home characteristics from DataQuick, a housing market research firm. These are used to establish the economic baseline against which the market impacts of the critical habitat designation are measured.

The analysis also requires forecasted data to investigate impacts at the end of the 20-year time frame (see Section for further information on the time frame.) Population forecasts were derived from several sources, including federally-recognized metropolitan planning organizations and forecasting performed in prior studies for transportation planning purposes. County-level forecasts on gross urban density—including residential, commercial and public development—along with shares of greenfield and infill development were obtained from a study performed by urban planning researchers at the

University of California.[50,51] Combining density and population forecasts yields an estimate of the overall urban footprint within each Census tract.

Table IV-1: Socioeconomic Characteristics of Affected Tracts summarizes some of this baseline information. Each FIPS code corresponds to a distinct Census tract within a county. Median home prices are in 2005 dollars and are for newly constructed single-family residences. Average square footage is indicative of the size of these homes. The projected population increase indicates the Census tracts projected to experience the most rapid development. Since these are net population increases, they are used to specify the demand for new housing in each census tract. The last column shows the number of new dwellings needed to accommodate the projected population increase in each Census tract.

### IV.2.2 Prior Regulation in Affected Areas

Markets for land, housing and commercial real estate are highly regulated by governments at the local, State and Federal level. The welfare impacts of critical habitat designation are affected by the nature and extent of prior regulation, and by the response of governments at all levels to the designation of critical habitat.

Regulation can have several types of effects on land and housing markets. Zoning and other interventions in the land market can limit the stock of developable land and increase its price. Local regulations can also directly limit the construction of new housing. This latter type of intervention is important as it generates qualitatively different predictions about the effects of critical habitat than regulations that simply limit the amount of developable land.

As explained in Appendix A, when the pre-designation number of new housing units constructed is limited by prior regulation, there is a "shadow value" of housing that is not necessarily incorporated in the price of land. These rents are earned by providers of fixed factors to the homebuilding process. When critical habitat designations impose further restrictions on an already constrained homebuilding process, welfare impacts can be larger than if the number of housing units constructed is not directly controlled by regulation.

Recent research has uncovered methods to test for the existence of rationing in the market for new housing.[52] Such testing entails a comparison of the "extensive" and "intensive" margin values of land which are loosely defined as the value of land with a house on it and the willingness of homebuyers to pay for an additional unit of lot size. In the conventional case where regulation may limit the supply of land but not the number of

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[50] John D. Landis and Michael Reilly, "How We Will Grow: Baseline Projections of the Growth of California's Urban Footprint through the Year 2100" (August 1, 2003). Institute of Urban & Regional Development. IURD Working Paper Series. Paper WP-2003-04. http://repositories.cdlib.org/iurd/wps/WP-2003-04

[51] Greenfield development refers to development occurring on land that was not previously urbanized. Infill development refers to the redeveloping of already-urbanized land—for example, leveling an old home and building a new apartment complex over it.

[52] David Sunding and Aaron Swoboda, *Does Regulation Ration Housing?*, UC Berkeley Working Paper, 2004, and Ed Glaeser and Joseph Gyourko, *The Impacts of Building Restrictions on Housing Affordability*, Federal Reserve Board of New York Economic Policy Review, 2003.

housing units built, extensive and intensive margin values should be the same since density will adjust to equate the two. When housing is directly limited by regulation, the extensive margin value will exceed the intensive margin value. The rationale is that the extensive margin value incorporates the shadow value of housing while the intensive margin value is simply the value of additional lot size.

This test was implemented using the data on newly constructed homes in three of the five study regions. Appendix B contains a description of the data and the hedonic regression used to calculate intensive margin land values. Two regions were excluded due to an absence of data on lot sizes of newly constructed homes. Test results strongly indicate that the number of new homes built in the regions of California containing RLF critical habitat is indeed constrained by prior regulation. Thus, the market for new housing is rationed even before the imposition of incremental regulations related to critical habitat.

One implication of this finding is that the ultimate impacts of critical habitat may depend in an important way on how local governments respond to the designation. If housing restrictions are relaxed in response to the designation of critical habitat, then impacts will be lower than in the case where regulations are unaffected. For example, if cities accommodate critical habitat designation by allowing for higher density development, then economic losses may be lower than if housing is even further restricted by critical habitat.

Following this line of reasoning, two scenarios are presented in this analysis. First, the more conservative scenario is that critical habitat results in a reduction in the housing stock in Census tracts where avoidance requirements place some land off-limits to development. In this case, critical habitat will result in housing price increases to clear the market and potential gains to developers and landowners who benefit from the increased price. These potential producer gains must be counterbalanced against the requirement for mitigation expenditures resulting from development in critical habitat areas, and profits lost through the reduction in housing units constructed. An alternative scenario is that critical habitat designation is accommodated entirely through densification. Consumer losses in this case result from reductions in lot size since the number of housing units is unaffected. Producer losses will result mainly from mitigation expenditures. Comparing welfare losses between the two scenarios illustrates potential gains from policy coordination among levels of government.

### IV.2.3 Critical Habitat Likely To Be Developed

The method for calculating the quantity of new development per Census tract was described in the preceding section. It remains to allocate that development within the tract itself. To do so, GIS analysis was used to calculate overlap between proposed critical habitat and the development probabilities that form the basis of an urban growth model designed at the University of California, Berkeley. The California Urban and Biodiversity Analysis (CURBA) model, developed by City and Regional Planning professors, uses GIS technology to provide spatial predictions of the extent of urban growth in the year 2025.

The basis of the CURBA model is a set of econometrically estimated development probabilities that incorporate the preferences of consumers for distance and landscape features in their choice of location. These development probabilities are cardinal, as

opposed to the ordinal (1/0) predictions of location of development that are ultimately generated by CURBA. The probabilities also are a good indication of the degree to which consumers view alternative development sites as substitutes. By overlaying the proposed critical habitat unit areas over CURBA predictions, it is possible to measure the expected amount of development that is likely to take place within critical habitat. Furthermore, the precise nature of the CURBA model—predictions have resolution of one one-hundredths of a hectare—invests this analysis with a high degree of specificity, resulting in a more accurate impact assessment.

The CURBA model covers 21 of the 24 counties containing critical habitat. For the remaining 3, GIS is used to exclude land in critical habitats that has already been, or cannot be developed. Therefore, the impact estimates of critical habitat on land markets are limited to only those parcels which might actually support development.

To determine already developed land, GIS data is used from the California Fire and Resource Assessment Program (FRAP). The FRAP data delineates areas of land with a structural density of one unit per acre or higher. To determine land that is not developable, the analysis excludes those portions of critical habitat which meet one or more of the following criteria (unless otherwise noted, the features listed were obtained from GIS data provided by ESRI, the leading GIS provider):

- Land that is under water. These features include rivers, reservoirs, intermittent reservoirs, lakes, intermittent lakes, streams, and canals.
- Land that is on or within two meters of a major highway, minor highway, major road or railroad.
- Land that is on the property of an airport.
- Land owned by the government. This includes land holdings of the Service, Bureau of Land Management, Forest Service, National Park Service, or the Department of Defense.
- Land forming part of an American Indian reservation or tribal lands.
- Land that cannot be developed due to geography. This includes land within the 100-year floodplain as determined by the Federal Emergency Management Agency, and land that is sloped at more than a 20% grade.

### IV.2.4 Avoidance, Mitigation and Indirect Effects of Critical Habitat

Interviews with Service personnel, as well as a comprehensive examination of the Service's consultation history, were used to determine the level and types of mitigation required. For development occurring within in the jurisdictions of the Sacramento and Carlsbad field offices, it was assumed that the average private development project sited in proposed critical habitat will be subject to a 1.1:1 mitigation ratio for temporary impacts to each acre of habitat and 3:1 for permanent effects. For breeding habitat, it was assumed that projects will be subject to a 1:1 avoidance requirement and a 3:1 mitigation requirement on the remaining land. A review of the Service's consultation history for residential development projects revealed breeding habitat comprises, on average, about 5% of the overall RLF habitat, and that roughly 45% of impacts, by area, are of a temporary nature.

Projects within the jurisdiction of the Ventura field office are assumed to be affected by designation only if they lay within 90 meters of a stream reach. In those cases, the level of assigned mitigation will be 1.1:1, together with a 1:1 avoidance requirement.[53]

Projects may fulfill the requirement for compensation by purchasing conservation credits from a conservation bank, purchasing suitable habitat and managing that habitat in perpetuity, or dedicating land already owned by the project applicant and having suitable habitat.

Conservation bank prices are used to estimate the project modification costs associated with section 7 requirements. The analysis uses market data collected from several private conservation banks in the Bay Area and central California regions to determine off-site mitigation prices by county. These prices represent the blended average of the costs of mitigation for both upland and breeding habitat; they reflect simultaneously the higher cost of mitigating for breeding habitat versus upland and the greater prevalence of upland habitat, as well as differences in regional land prices. Mitigation credits are assumed to cost an average of $10,000 per acre.[54]

The Section 7 consultation process may result in time delays and other effects that have impacts that are incremental to direct compliance costs. If such effects would not have occurred in the absence of critical habitat (i.e., "but for" critical habitat), then they are considered by this analysis to be an impact of the designation.

These costs include project delays stemming from the consultation process or compliance with other regulations, or, in the case of land location within or adjacent to the designation, loss in property values due to regulatory uncertainty, and loss (or gain) in property values resulting from public perceptions regarding the effects of critical habitat.

Both public and private entities may experience incremental time delays for projects and other activities due to requirements associated with the Section 7 consultation process and / or compliance with other laws triggered by the designation. The need to conduct a Section 7 consultation will not necessarily delay a project, as often the consultation may be coordinated with the existing baseline regulatory approval process. However, depending on the schedule of the consultation, a project may experience additional delays, resulting in an unanticipated extension in the time needed to fully realize returns from the planned activity.

## IV.3 Calculation of Market Effects and Welfare Losses

Estimates of welfare impacts on the markets for land, housing and commercial development proceed directly from the spatial and socioeconomic data described above. This analysis adopts a supply and demand approach based on partial equilibrium to assess those impacts.

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[53] Assumption based on personal conversation with Bill McIver, biologist, Ventura branch, Fish and Wildlife Service.

[54] These estimates were derived from personal interviews with developers, conservation bank administrators and other affected entities.

Estimating the regulatory impact requires several steps within the context of this framework:

1. Identify the supply and demand functions and determine the market equilibrium "but for" the regulatory action.
2. Determine the effects of regulation on supply, demand and relevant constraints.
3. Estimate the resulting new market equilibrium and resultant changes in producer and consumer surplus.

New residents' demand for housing in each Census tract is specified as linear and of unit price elasticity as suggested by the academic literature.[55] The number of new housing units is taken from the population growth forecasts and new home prices are taken from DataQuick as described above.

The Section 7 consultation process may result in time delays and other effects that have impacts that are incremental to direct compliance costs. The analysis considers the cost of time delays associated with Section 7 consultation or other requirements triggered by the designation above and beyond project delays resulting from baseline regulatory processes. Delay costs are measured as the incremental carrying costs on the underlying option to purchase land for development. The delay period is six months and the value of the land held was calculated using a hedonic regression of home sales. The effect of this assumption is that delay increases development cost and reduces producer surplus, but does not affect consumer welfare. A more conservative analysis (i.e., more likely to result in larger impacts) might consider that designation of critical habitat would delay completion of the project beyond when it would have been completed without the designation of critical habitat. However, since the possible presence of the RLF is widely known to developers, it is reasonable to assume that they would initiate the development process sooner in anticipation of the extra regulation flowing from listing.

A sample calculation is provided to assist with understanding the model. Consider a hypothetical census tract with the following characteristics:

- 200 new homes are projected to be built at a cost of $500,000 each;
- The cost of building each of these homes is $300,000;

[55] The seminal analysis of Muth (1964) suggested that the price elasticity of demand for residential land could be expressed as $\varepsilon_L = -k_N\sigma + k_L\varepsilon_H$, where $\varepsilon_L$ and $\varepsilon_H$ are the own-price elasticities of residential land and housing, respectively, $\sigma$ is the elasticity of substitution between land and capital in the production of housing, and $k_L$ and $k_N$ are the shares of land and non-land factors in housing production. Thorsnes (1997) has estimated the value of $\sigma$ as roughly -1.0. Reid (1962) first demonstrated that the price elasticity of housing was near -1.0. While several studies have reported lower elasticities, Rosen (1979) reported a price elasticity of -1.0 using time series data. Representative cost shares for land and non-land factors of production are 0.3 and 0.7, respectively. Richard Muth, "The Derived Demand for a Factor of Production and the Industry Supply Curve," *Oxford Economic Papers* (July 1964): 221-234; Paul Thorsnes, "Consistent Estimates of the Elasticity of Substitution between Land and Non-Land Inputs in the Production of Housing," *Journal of Urban Economics* (1997): 98-108; Harvey Rosen, "Housing Decisions and the U.S. Income Tax," *Journal of Public Economics* (1979): 1-23.

- Housing demand is unit elastic, meaning an increase in price will provoke an equivalent (in percent terms) reduction in demand; and
- The price of mitigation land is $100,000 per acre.

Suppose that 100 of the projected 200 homes are to be built within critical habitat, and that avoidance requirements result in the loss of 5 homes, or 2.5% of the overall pre-regulation housing stock.

Since demand is unit elastic, this output reduction implies a 2.5% increase in the overall price of new housing, so the post-regulation price of new housing is now $512,500, or

$$\frac{dQ}{Q_0}\frac{P_0}{dP} = -1 \Rightarrow \frac{dQ}{Q_0} = -\frac{dP}{P_0}$$
$$\frac{dQ}{Q_0} = \frac{Q' - Q_0}{Q_0} \approx -.025 \Rightarrow \frac{dP}{P_0} = .025$$

where $Q_0$ is the initial quantity of housing within critical habitat and $P$ is the pre-critical habitat price of housing.

The welfare loss calculation has three components. First are impacts to producer and consumer surplus.[56] The surplus impacts for this example total $1,031,250.

Second are mitigation costs. Suppose that developers must mitigate impacts at 2:1 at a cost of $100,000 per acre of disturbance. Calculating the total land footprint within critical habitat requires knowledge of the incremental gross urban density. Assume it is two homes per acre. Then a total of 47.5 acres of habitat must be mitigated at 2:1. This yields a total of $9.5 million in mitigation costs.

The final component of welfare loss is due to delay. Delay is calculated using a 7% discount rate for 182 days. Assume for the purpose of this example that the purchase price of land is $200,000 per acre. Then the incremental carrying cost of land is $7,000 per acre for a total of $332,500.

Total lost surplus in this example is then $10.9 million.

## IV.4 Results of the Analysis

In the base scenario where critical habitat reduces the amount of new housing, designation of critical habitat results in over $497 million in losses to consumers and producers between the present and 2025. In the event that on-site avoidance can be accomplished through increases in density, welfare losses from critical habitat are $323 million over the same time period. Table IV-2: Market Impacts of Designation shows how critical habitat perturbs the housing market equilibrium in the case where critical habitat results in construction of fewer housing units. For each Census tract, the table

[56] As explained in the appendix, these losses are given by the expression $-\left[\frac{dP}{2} + (P - c)\right]dQ$.

shows the number of new housing units projected to be built, as well as change due to regulation.

On-site avoidance requirements result in the loss of a certain number of housing units. The market price of housing must increase to clear the market and reestablish a new equilibrium. The last two columns display the pre-regulation price of new housing and the imputed change in the price of housing resulting from protection of critical habitat. The predicted price changes are modest when viewed in relation to the generally high price of new housing in the study area. However, these price increases are applied to all new housing to be built in the Census tracts containing critical habitat since this is the relevant market. Thus, critical habitat may cause housing market impacts well outside of the immediate footprint of critical habitat.

Table IV-3: Welfare Impacts of Designation combines these market impacts with mitigation expenditures to arrive at welfare losses in each Census tract, along with annualized impacts. (Table IV-4: Welfare Impacts in Rationed Housing Model, Descending Order presents these impacts in descending order.) Losses per Census tract range from $0 to over $45 million for the rationed housing analysis.

Table IV-5: County-Level Impacts displays impacts at the county level. Figure 1 through Figure 6 display maps of the counties with the highest impacts.

**Table IV-1: Socioeconomic Characteristics of Affected Tracts**

| FIPS | County | Median Home Price | Average Square Footage | Projected Population Increase | New Households |
|---|---|---|---|---|---|
| 06001450701 | Alameda | $2,070,809 | 4,447 | 2,109 | 734 |
| 06001450721 | Alameda | $715,850 | 2,236 | 6,155 | 2,319 |
| 06001451101 | Alameda | $647,508 | 2,058 | 5,704 | 2,054 |
| 06001451202 | Alameda | $599,200 | 1,670 | 3,121 | 1,077 |
| 06007002400 | Butte | $250,818 | 1,819 | 2,058 | 877 |
| 06009000210 | Calaveras | $301,395 | 1,699 | 4,582 | 1,706 |
| 06009000300 | Calaveras | $246,967 | 1,533 | 2,125 | 907 |
| 06013303200 | Contra Costa | $520,263 | 2,375 | 14,156 | 4,882 |
| 06013304000 | Contra Costa | $568,117 | 2,633 | 2,269 | 864 |
| 06013313103 | Contra Costa | $502,271 | 2,595 | 2,223 | 793 |
| 06013313202 | Contra Costa | $387,542 | 1,895 | 1,715 | 578 |
| 06013347000 | Contra Costa | $1,192,682 | 2,896 | 658 | 274 |
| 06013355104 | Contra Costa | $1,158,514 | 3,016 | 9,275 | 3,672 |
| 06013355106 | Contra Costa | $538,684 | 2,834 | 3,741 | 1,311 |
| 06013355200 | Contra Costa | $526,397 | 2,474 | 8,744 | 3,061 |
| 06013355304 | Contra Costa | $883,117 | 2,816 | 1,238 | 484 |
| 06013356002 | Contra Costa | $733,044 | 2,507 | 1,366 | 495 |
| 06017031301 | El Dorado | $512,848 | 2,260 | 587 | 236 |
| 06017031302 | El Dorado | $327,126 | 1,606 | 630 | 262 |
| 06017031404 | El Dorado | $412,506 | 2,198 | 365 | 132 |
| 06017031405 | El Dorado | $357,547 | 1,603 | 387 | 143 |
| 06017031406 | El Dorado | $324,335 | 1,664 | 631 | 240 |
| 06029004500 | Kern | $161,913 | 1,398 | 1,888 | 388 |
| 06037135203 | Los Angeles | $496,132 | 2,312 | 788 | 393 |
| 06037800201 | Los Angeles | $1,543,262 | 2,994 | 3,555 | 1,379 |
| 06037800302 | Los Angeles | $979,475 | 3,107 | 2,374 | 1,356 |
| 06037920014 | Los Angeles | $125,316 | 1,592 | 1,259 | 295 |
| 06037920103 | Los Angeles | $563,710 | 2,541 | 7,614 | 2,474 |
| 06037920104 | Los Angeles | $541,210 | 2,829 | 2,574 | 720 |
| 06041132200 | Marin | $731,493 | 1,819 | 140 | 43 |
| 06041133000 | Marin | $809,662 | 2,463 | 511 | 202 |
| 06047002100 | Merced | $378,243 | 2,201 | 1,965 | 609 |
| 06053010202 | Monterey | $627,600 | 2,047 | 454 | 131 |
| 06053010304 | Monterey | $565,980 | 1,971 | 2,388 | 791 |
| 06053010606 | Monterey | $426,336 | 1,743 | 33,851 | 8,593 |

| FIPS | County | Median Home Price | Average Square Footage | Projected Population Increase | New Households |
|---|---|---|---|---|---|
| 06053011000 | Monterey | $946,702 | 2,085 | 401 | 164 |
| 06053011201 | Monterey | $271,049 | 1,528 | 7,609 | 1,584 |
| 06053011600 | Monterey | $1,253,800 | 2,160 | 29 | 14 |
| 06053011700 | Monterey | $1,292,612 | 2,274 | 65 | 29 |
| 06055201002 | Napa | $427,399 | 1,895 | 1,981 | 834 |
| 06055201400 | Napa | $925,511 | 2,274 | 349 | 134 |
| 06055201800 | Napa | $318,542 | 1,895 | 41 | 10 |
| 06057000801 | Nevada | $493,349 | 2,009 | 2,367 | 920 |
| 06057000900 | Nevada | $317,514 | 1,668 | 911 | 379 |
| 06065043224 | Riverside | $585,358 | 2,851 | 6,908 | 2,875 |
| 06069000200 | San Benito | $412,810 | 2,009 | 2,062 | 673 |
| 06069000800 | San Benito | $807,560 | 2,350 | 2,525 | 905 |
| 06079010300 | San Luis Obispo | $349,711 | 2,122 | 9,046 | 3,130 |
| 06079010400 | San Luis Obispo | $611,395 | 1,971 | 3,673 | 1,703 |
| 06079010500 | San Luis Obispo | $513,564 | 1,743 | 4,249 | 2,051 |
| 06079010800 | San Luis Obispo | $753,840 | 1,895 | 2,762 | 1,143 |
| 06079010901 | San Luis Obispo | $1,193,847 | 1,213 | 2,720 | 593 |
| 06079011000 | San Luis Obispo | $571,710 | 1,781 | 2,840 | 1,209 |
| 06079011200 | San Luis Obispo | $583,986 | 1,971 | 2,471 | 1,012 |
| 06079011400 | San Luis Obispo |  | 1,137 | -2 | -1 |
| 06079011502 | San Luis Obispo | $591,384 | 2,198 | 29,405 | 4,209 |
| 06079012702 | San Luis Obispo | $446,976 | 1,971 | 4,226 | 1,604 |
| 06081603400 | San Mateo | $662,414 | 2,350 | 290 | 92 |
| 06081606900 | San Mateo | $966,329 | 2,501 | 340 | 129 |
| 06081613200 | San Mateo | $1,429,895 | 2,615 | 588 | 176 |
| 06081613501 | San Mateo | $1,096,258 | 2,876 | 660 | 209 |
| 06081613502 | San Mateo | $1,088,588 | 2,760 | 606 | 222 |
| 06081613600 | San Mateo | $908,373 | 2,412 | 417 | 106 |
| 06081613700 | San Mateo | $1,459,271 | 3,311 | 1,272 | 530 |
| 06081613800 | San Mateo | $661,898 | 1,857 | 146 | 69 |
| 06083001701 | Santa Barbara | $1,396,369 | 1,933 | 2,323 | 988 |
| 06083001800 | Santa Barbara | $124,351 | 1,743 | 767 | 263 |
| 06083001901 | Santa Barbara | $509,439 | 1,971 | 4,117 | 1,508 |
| 06083001905 | Santa Barbara | $911,521 | 2,160 | 1,535 | 587 |
| 06083001906 | Santa Barbara | $821,634 | 2,198 | 2,972 | 1,083 |
| 06083002500 | Santa Barbara | $214,893 | 1,668 | 1,304 | 330 |
| 06083002603 | Santa Barbara | $214,893 | 2,047 | 2,472 | 693 |

| FIPS | County | Median Home Price | Average Square Footage | Projected Population Increase | New Households |
|---|---|---|---|---|---|
| 06083002805 | Santa Barbara | $554,501 | 1,933 | 292 | 107 |
| 06083002910 | Santa Barbara | $1,094,993 | 2,085 | 2,611 | 842 |
| 06085503312 | Santa Clara | $1,054,752 | 3,790 | 817 | 223 |
| 06085503319 | Santa Clara | $880,100 | 2,728 | 1,284 | 329 |
| 06085504201 | Santa Clara | $617,285 | 2,274 | 1,064 | 325 |
| 06085504202 | Santa Clara | $868,956 | 3,019 | 663 | 198 |
| 06085504308 | Santa Clara | $610,850 | 2,539 | 3,456 | 1,014 |
| 06085511703 | Santa Clara | $2,276,087 | 3,481 | 746 | 226 |
| 06085512700 | Santa Clara | $1,272,126 | 2,312 | 704 | 266 |
| 06087110400 | Santa Cruz | $313,546 | 1,364 | 3,691 | 857 |
| 06087110600 | Santa Cruz | $394,316 | 1,516 | 2,048 | 535 |
| 06087110700 | Santa Cruz | $399,332 | 1,895 | 4,158 | 1,110 |
| 06087120200 | Santa Cruz | $671,820 | 2,085 | 1,002 | 362 |
| 06087120500 | Santa Cruz | $599,840 | 2,085 | 1,826 | 751 |
| 06087122300 | Santa Cruz | $734,785 | 1,933 | 449 | 158 |
| 06087122400 | Santa Cruz | $613,138 | 2,047 | 2,679 | 973 |
| 06095252102 | Solano | $824,784 | 2,525 | 993 | 344 |
| 06095252104 | Solano | $842,936 | 3,000 | 906 | 260 |
| 06095252202 | Solano | $630,329 | 2,552 | 3,164 | 971 |
| 06099003400 | Stanislaus | $232,036 | 1,895 | 957 | 312 |
| 06111000100 | Ventura | $366,559 | 1,743 | 80 | 50 |
| 06111000902 | Ventura | $449,130 | 1,548 | 246 | 162 |
| 06111001001 | Ventura | $1,252,692 | 4,192 | 279 | 141 |
| 06111001101 | Ventura | $599,064 | 1,932 | 478 | 156 |
| 06111001102 | Ventura | $574,929 | 2,122 | 427 | 335 |
| 06111007404 | Ventura | $1,155,668 | 3,417 | 2,639 | 946 |
| 06115041100 | Yuba | $263,349 | 1,706 | 1,418 | 613 |
| **Total** | | | | **278,724** | **89,201** |

Sources:

(1) DataQuick;

(2) 2000 Census;

(3) ABAG;

(4) AMBAG;

(5) SCAG;

(6) SANDAG;

(7) Kern COG.

**Table IV-2: Market Impacts of Designation**

| FIPS | County | Projected New Housing | Change in Housing Units | Pre-Regulation Housing Price | Change in Housing Price |
|---|---|---|---|---|---|
| 06001450701 | Alameda | 734 | -7 | $2,070,809 | $18,341 |
| 06001450721 | Alameda | 2,319 | -23 | $715,850 | $6,964 |
| 06001451101 | Alameda | 2,054 | -16 | $647,508 | $4,894 |
| 06001451202 | Alameda | 1,077 | -1 | $599,200 | $724 |
| 06007002400 | Butte | 877 | 0 | $250,818 | $0 |
| 06009000210 | Calaveras | 1,706 | -3 | $301,395 | $517 |
| 06009000300 | Calaveras | 907 | 0 | $246,967 | $0 |
| 06013303200 | Contra Costa | 4,882 | -25 | $520,263 | $2,703 |
| 06013304000 | Contra Costa | 864 | -5 | $568,117 | $3,096 |
| 06013313103 | Contra Costa | 793 | -13 | $502,271 | $8,481 |
| 06013313202 | Contra Costa | 578 | -11 | $387,542 | $7,621 |
| 06013347000 | Contra Costa | 274 | -2 | $1,192,682 | $9,288 |
| 06013355104 | Contra Costa | 3,672 | -32 | $1,158,514 | $10,024 |
| 06013355106 | Contra Costa | 1,311 | -16 | $538,684 | $6,539 |
| 06013355200 | Contra Costa | 3,061 | -7 | $526,397 | $1,252 |
| 06013355304 | Contra Costa | 484 | -2 | $883,117 | $2,949 |
| 06013356002 | Contra Costa | 495 | -1 | $733,044 | $1,486 |
| 06017031301 | El Dorado | 236 | 0 | $512,848 | $963 |
| 06017031302 | El Dorado | 262 | 0 | $327,126 | $0 |
| 06017031404 | El Dorado | 132 | 0 | $412,506 | $994 |
| 06017031405 | El Dorado | 143 | -3 | $357,547 | $8,692 |
| 06017031406 | El Dorado | 240 | 0 | $324,335 | $385 |
| 06029004500 | Kern | 388 | 0 | $161,913 | $1 |
| 06037135203 | Los Angeles | 393 | -2 | $496,132 | $2,926 |
| 06037800201 | Los Angeles | 1,379 | -2 | $1,543,262 | $2,353 |
| 06037800302 | Los Angeles | 1,356 | 0 | $979,475 | $360 |
| 06037920014 | Los Angeles | 295 | -4 | $125,316 | $1,813 |
| 06037920103 | Los Angeles | 2,474 | -6 | $563,710 | $1,323 |
| 06037920104 | Los Angeles | 720 | -6 | $541,210 | $4,377 |
| 06041132200 | Marin | 43 | 0 | $731,493 | $3,143 |
| 06041133000 | Marin | 202 | -1 | $809,662 | $2,739 |
| 06047002100 | Merced | 609 | 0 | $378,243 | $267 |
| 06053010202 | Monterey | 131 | 0 | $627,600 | $1,637 |
| 06053010304 | Monterey | 791 | -7 | $565,980 | $5,308 |
| 06053010606 | Monterey | 8,593 | 0 | $426,336 | $2 |
| 06053011000 | Monterey | 164 | -4 | $946,702 | $22,533 |

| FIPS | County | Projected New Housing | Change in Housing Units | Pre-Regulation Housing Price | Change in Housing Price |
|---|---|---|---|---|---|
| 06053011201 | Monterey | 1,584 | 0 | $271,049 | $3 |
| 06053011600 | Monterey | 14 | -1 | $1,253,800 | $64,295 |
| 06053011700 | Monterey | 29 | -2 | $1,292,612 | $97,140 |
| 06055201002 | Napa | 834 | 0 | $427,399 | $0 |
| 06055201400 | Napa | 134 | 0 | $925,511 | $353 |
| 06055201800 | Napa | 10 | 0 | $318,542 | $135 |
| 06057000801 | Nevada | 920 | -5 | $493,349 | $2,634 |
| 06057000900 | Nevada | 379 | 0 | $317,514 | $0 |
| 06065043224 | Riverside | 2,875 | -24 | $585,358 | $4,852 |
| 06069000200 | San Benito | 673 | -5 | $412,810 | $3,066 |
| 06069000800 | San Benito | 905 | -6 | $807,560 | $4,921 |
| 06079010300 | San Luis Obispo | 3,130 | 0 | $349,711 | $56 |
| 06079010400 | San Luis Obispo | 1,703 | -52 | $611,395 | $18,620 |
| 06079010500 | San Luis Obispo | 2,051 | -61 | $513,564 | $15,312 |
| 06079010800 | San Luis Obispo | 1,143 | -19 | $753,840 | $12,244 |
| 06079010901 | San Luis Obispo | 593 | -37 | $1,193,847 | $74,008 |
| 06079011000 | San Luis Obispo | 1,209 | -90 | $571,710 | $42,714 |
| 06079011200 | San Luis Obispo | 1,012 | -11 | $583,986 | $6,628 |
| 06079011400 | San Luis Obispo | -1 | 0 | | |
| 06079011502 | San Luis Obispo | 4,209 | -95 | $591,384 | $13,330 |
| 06079012702 | San Luis Obispo | 1,604 | 0 | $446,976 | $8 |
| 06081603400 | San Mateo | 92 | 0 | $662,414 | $750 |
| 06081606900 | San Mateo | 129 | 0 | $966,329 | $0 |
| 06081613200 | San Mateo | 176 | 0 | $1,429,895 | $16 |
| 06081613501 | San Mateo | 209 | -2 | $1,096,258 | $12,475 |
| 06081613502 | San Mateo | 222 | 0 | $1,088,588 | $5 |
| 06081613600 | San Mateo | 106 | 0 | $908,373 | $56 |
| 06081613700 | San Mateo | 530 | -4 | $1,459,271 | $10,110 |
| 06081613800 | San Mateo | 69 | -1 | $661,898 | $6,442 |
| 06083001701 | Santa Barbara | 988 | -17 | $1,396,369 | $23,789 |
| 06083001800 | Santa Barbara | 263 | -9 | $124,351 | $4,028 |
| 06083001901 | Santa Barbara | 1,508 | -1 | $509,439 | $231 |
| 06083001905 | Santa Barbara | 587 | -5 | $911,521 | $7,915 |
| 06083001906 | Santa Barbara | 1,083 | -9 | $821,634 | $7,183 |
| 06083002500 | Santa Barbara | 330 | 0 | $214,893 | $5 |
| 06083002603 | Santa Barbara | 693 | -1 | $214,893 | $259 |
| 06083002805 | Santa Barbara | 107 | -2 | $554,501 | $7,876 |

| FIPS | County | Projected New Housing | Change in Housing Units | Pre-Regulation Housing Price | Change in Housing Price |
|---|---|---|---|---|---|
| 06083002910 | Santa Barbara | 842 | -22 | $1,094,993 | $28,695 |
| 06085503312 | Santa Clara | 223 | -1 | $1,054,752 | $2,898 |
| 06085503319 | Santa Clara | 329 | 0 | $880,100 | $461 |
| 06085504201 | Santa Clara | 325 | | $617,285 | |
| 06085504202 | Santa Clara | 198 | -1 | $868,956 | $5,029 |
| 06085504308 | Santa Clara | 1,014 | -6 | $610,850 | $3,344 |
| 06085511703 | Santa Clara | 226 | 0 | $2,276,087 | $15 |
| 06085512700 | Santa Clara | 266 | -1 | $1,272,126 | $5,772 |
| 06087110400 | Santa Cruz | 857 | -2 | $313,546 | $733 |
| 06087110600 | Santa Cruz | 535 | -2 | $394,316 | $1,522 |
| 06087110700 | Santa Cruz | 1,110 | -1 | $399,332 | $186 |
| 06087120200 | Santa Cruz | 362 | -7 | $671,820 | $12,319 |
| 06087120500 | Santa Cruz | 751 | 0 | $599,840 | $155 |
| 06087122300 | Santa Cruz | 158 | -7 | $734,785 | $30,786 |
| 06087122400 | Santa Cruz | 973 | 0 | $613,138 | $0 |
| 06095252102 | Solano | 344 | -2 | $824,784 | $4,483 |
| 06095252104 | Solano | 260 | 0 | $842,936 | $18 |
| 06095252202 | Solano | 971 | -10 | $630,329 | $6,809 |
| 06099003400 | Stanislaus | 312 | 0 | $232,036 | $1 |
| 06111000100 | Ventura | 50 | 0 | $366,559 | $1,444 |
| 06111000902 | Ventura | 162 | -5 | $449,130 | $14,950 |
| 06111001001 | Ventura | 141 | 0 | $1,252,692 | $4,141 |
| 06111001101 | Ventura | 156 | -2 | $599,064 | $7,038 |
| 06111001102 | Ventura | 335 | -4 | $574,929 | $6,727 |
| 06111007404 | Ventura | 946 | -27 | $1,155,668 | $32,779 |
| 06115041100 | Yuba | 613 | -1 | $263,349 | $230 |
| **Total** | | **89,201** | **-760** | | |

Source: CRA analysis.

**Table IV-3: Welfare Impacts of Designation**

| FIPS | County | Surplus Lost | Annualized Impacts | Surplus Lost (Densification) | Annualized Impacts (Densification) |
|---|---|---|---|---|---|
| 06001450701 | Alameda | $16,035,912 | $1,414,651 | $11,042,124 | $974,111 |
| 06001450721 | Alameda | $26,886,492 | $2,371,864 | $22,994,236 | $2,028,498 |
| 06001451101 | Alameda | $45,017,296 | $3,971,322 | $53,357,632 | $4,707,087 |
| 06001451202 | Alameda | $2,606,839 | $229,969 | $2,899,428 | $255,781 |
| 06007002400 | Butte | $0 | $0 | $0 | $0 |
| 06009000210 | Calaveras | $1,936,340 | $170,819 | $1,872,157 | $165,157 |
| 06009000300 | Calaveras | $328 | $29 | $329 | $29 |
| 06013303200 | Contra Costa | $13,203,474 | $1,164,780 | $11,785,966 | $1,039,731 |
| 06013304000 | Contra Costa | $3,346,232 | $295,197 | $3,236,934 | $285,555 |
| 06013313103 | Contra Costa | $6,303,594 | $556,088 | $5,761,082 | $508,229 |
| 06013313202 | Contra Costa | $6,247,976 | $551,182 | $6,314,633 | $557,062 |
| 06013347000 | Contra Costa | $3,177,857 | $280,343 | $2,409,527 | $212,563 |
| 06013355104 | Contra Costa | $39,737,940 | $3,505,589 | $27,800,912 | $2,452,532 |
| 06013355106 | Contra Costa | $10,361,391 | $914,058 | $10,565,252 | $932,042 |
| 06013355200 | Contra Costa | $3,296,665 | $290,824 | $2,478,051 | $218,608 |
| 06013355304 | Contra Costa | $1,210,494 | $106,787 | $755,810 | $66,676 |
| 06013356002 | Contra Costa | $1,145,493 | $101,053 | $1,076,265 | $94,946 |
| 06017031301 | El Dorado | $317,729 | $28,029 | $239,561 | $21,134 |
| 06017031302 | El Dorado | $0 | $0 | $1 | $0 |
| 06017031404 | El Dorado | $210,593 | $18,578 | $191,229 | $16,870 |
| 06017031405 | El Dorado | $2,348,612 | $207,189 | $2,048,734 | $180,735 |
| 06017031406 | El Dorado | $176,910 | $15,607 | $162,862 | $14,367 |
| 06029004500 | Kern | $2,796 | $247 | $3,263 | $288 |
| 06037135203 | Los Angeles | $555,784 | $49,030 | $48,429 | $4,272 |
| 06037800201 | Los Angeles | $2,049,840 | $180,832 | $56,365 | $4,972 |
| 06037800302 | Los Angeles | $241,766 | $21,328 | $9,067 | $800 |
| 06037920014 | Los Angeles | $0 | $0 | $190,520 | $16,807 |
| 06037920103 | Los Angeles | $1,658,543 | $146,313 | $185,953 | $16,404 |
| 06037920104 | Los Angeles | $1,391,650 | $122,768 | $217,110 | $19,153 |
| 06041132200 | Marin | $471,425 | $41,588 | $510,364 | $45,023 |
| 06041133000 | Marin | $3,501,464 | $308,891 | $4,306,346 | $379,896 |
| 06047002100 | Merced | $313,798 | $27,683 | $300,862 | $26,541 |
| 06053010202 | Monterey | $139,008 | $12,263 | $89,653 | $7,909 |
| 06053010304 | Monterey | $2,627,927 | $231,830 | $1,701,046 | $150,062 |
| 06053010606 | Monterey | $9,393 | $829 | $11,755 | $1,037 |
| 06053011000 | Monterey | $2,661,892 | $234,826 | $729,711 | $64,373 |

| FIPS | County | Surplus Lost | Annualized Impacts | Surplus Lost (Densification) | Annualized Impacts (Densification) |
|---|---|---|---|---|---|
| 06053011201 | Monterey | $2,089 | $184 | $6,344 | $560 |
| 06053011600 | Monterey | $600,020 | $52,932 | $115,115 | $10,155 |
| 06053011700 | Monterey | $1,929,660 | $170,230 | $382,163 | $33,713 |
| 06055201002 | Napa | $0 | $0 | $0 | $0 |
| 06055201400 | Napa | $98,963 | $8,730 | $90,467 | $7,981 |
| 06055201800 | Napa | $9,128 | $805 | $11,420 | $1,007 |
| 06057000801 | Nevada | $3,484,975 | $307,436 | $2,668,565 | $235,415 |
| 06057000900 | Nevada | $170 | $15 | $150 | $13 |
| 06065043224 | Riverside | $13,885,294 | $1,224,929 | $9,332,120 | $823,258 |
| 06069000200 | San Benito | $1,060,493 | $93,554 | $569,934 | $50,278 |
| 06069000800 | San Benito | $2,936,073 | $259,014 | $572,338 | $50,490 |
| 06079010300 | San Luis Obispo | $92,346 | $8,147 | $90,446 | $7,979 |
| 06079010400 | San Luis Obispo | $21,288,106 | $1,877,988 | $7,133,163 | $629,271 |
| 06079010500 | San Luis Obispo | $20,313,812 | $1,792,038 | $8,076,202 | $712,464 |
| 06079010800 | San Luis Obispo | $9,565,995 | $843,890 | $2,842,274 | $250,739 |
| 06079010901 | San Luis Obispo | $36,953,856 | $3,259,984 | $10,905,969 | $962,099 |
| 06079011000 | San Luis Obispo | $36,245,748 | $3,197,516 | $13,801,727 | $1,217,557 |
| 06079011200 | San Luis Obispo | $4,348,243 | $383,592 | $1,772,881 | $156,399 |
| 06079011400 | San Luis Obispo | | | $0 | $0 |
| 06079011502 | San Luis Obispo | $37,144,976 | $3,276,844 | $42,115,340 | $3,715,318 |
| 06079012702 | San Luis Obispo | $6,769 | $597 | $4,669 | $412 |
| 06081603400 | San Mateo | $71,107 | $6,273 | $43,090 | $3,801 |
| 06081606900 | San Mateo | $0 | $0 | $0 | $0 |
| 06081613200 | San Mateo | $5,081 | $448 | $4,556 | $402 |
| 06081613501 | San Mateo | $4,308,841 | $380,116 | $4,032,906 | $355,774 |
| 06081613502 | San Mateo | $1,491 | $132 | $1,165 | $103 |
| 06081613600 | San Mateo | $10,528 | $929 | $9,730 | $858 |
| 06081613700 | San Mateo | $8,501,778 | $750,007 | $7,439,267 | $656,275 |
| 06081613800 | San Mateo | $6,820,789 | $601,714 | $8,796,547 | $776,011 |
| 06083001701 | Santa Barbara | $17,040,264 | $1,503,253 | $555,911 | $49,041 |
| 06083001800 | Santa Barbara | $0 | $0 | $351,281 | $30,989 |
| 06083001901 | Santa Barbara | $193,386 | $17,060 | $26,040 | $2,297 |
| 06083001905 | Santa Barbara | $3,185,995 | $281,061 | $186,552 | $16,457 |
| 06083001906 | Santa Barbara | $5,021,032 | $442,944 | $363,647 | $32,080 |
| 06083002500 | Santa Barbara | $562 | $50 | $451 | $40 |
| 06083002603 | Santa Barbara | $32,666 | $2,882 | $41,491 | $3,660 |
| 06083002805 | Santa Barbara | $505,507 | $44,595 | $58,189 | $5,133 |

| FIPS | County | Surplus Lost | Annualized Impacts | Surplus Lost (Densification) | Annualized Impacts (Densification) |
|---|---|---|---|---|---|
| 06083002910 | Santa Barbara | $15,088,389 | $1,331,063 | $964,956 | $85,126 |
| 06085503312 | Santa Clara | $882,961 | $77,893 | $849,512 | $74,942 |
| 06085503319 | Santa Clara | $195,801 | $17,273 | $152,644 | $13,466 |
| 06085504201 | Santa Clara | | | | |
| 06085504202 | Santa Clara | $1,708,214 | $150,695 | $1,634,430 | $144,186 |
| 06085504308 | Santa Clara | $5,533,227 | $488,129 | $5,103,690 | $450,236 |
| 06085511703 | Santa Clara | $4,938 | $436 | $3,469 | $306 |
| 06085512700 | Santa Clara | $5,273,962 | $465,257 | $5,816,762 | $513,141 |
| 06087110400 | Santa Cruz | $406,349 | $35,847 | $456,660 | $40,286 |
| 06087110600 | Santa Cruz | $467,407 | $41,234 | $418,614 | $36,929 |
| 06087110700 | Santa Cruz | $98,855 | $8,721 | $102,391 | $9,033 |
| 06087120200 | Santa Cruz | $2,972,185 | $262,199 | $979,617 | $86,420 |
| 06087120500 | Santa Cruz | $71,406 | $6,299 | $24,938 | $2,200 |
| 06087122300 | Santa Cruz | $3,533,725 | $311,737 | $1,013,777 | $89,433 |
| 06087122400 | Santa Cruz | $0 | $0 | $0 | $0 |
| 06095252102 | Solano | $1,226,624 | $108,210 | $584,820 | $51,591 |
| 06095252104 | Solano | $4,538 | $400 | $2,801 | $247 |
| 06095252202 | Solano | $6,903,767 | $609,034 | $4,530,923 | $399,708 |
| 06099003400 | Stanislaus | $448 | $40 | $425 | $38 |
| 06111000100 | Ventura | $32,064 | $2,829 | $6,683 | $590 |
| 06111000902 | Ventura | $1,103,747 | $97,370 | $175,899 | $15,517 |
| 06111001001 | Ventura | $264,547 | $23,338 | $19,557 | $1,725 |
| 06111001101 | Ventura | $628,668 | $55,460 | $119,505 | $10,542 |
| 06111001102 | Ventura | $1,311,472 | $115,695 | $106,317 | $9,379 |
| 06111007404 | Ventura | $14,813,216 | $1,306,788 | $1,604,476 | $141,543 |
| 06115041100 | Yuba | $262,126 | $23,124 | $226,099 | $19,946 |
| **Total** | | **$497,647,833** | **$43,901,341** | **$322,654,240** | **$28,463,811** |

Source: CRA analysis.

**Table IV-4: Welfare Impacts in Rationed Housing Model, Descending Order**

| FIPS | County | Surplus Lost | Cumulative Percent |
|---|---|---|---|
| 06001451101 | Alameda | $45,017,296 | 9.0% |
| 06013355104 | Contra Costa | $39,737,940 | 17.0% |
| 06079011502 | San Luis Obispo | $37,144,976 | 24.5% |
| 06079010901 | San Luis Obispo | $36,953,856 | 31.9% |
| 06079011000 | San Luis Obispo | $36,245,748 | 39.2% |
| 06001450721 | Alameda | $26,886,492 | 44.6% |
| 06079010400 | San Luis Obispo | $21,288,106 | 48.9% |
| 06079010500 | San Luis Obispo | $20,313,812 | 53.0% |
| 06083001701 | Santa Barbara | $17,040,264 | 56.4% |
| 06001450701 | Alameda | $16,035,912 | 59.6% |
| 06083002910 | Santa Barbara | $15,088,389 | 62.6% |
| 06111007404 | Ventura | $14,813,216 | 65.6% |
| 06065043224 | Riverside | $13,885,294 | 68.4% |
| 06013303200 | Contra Costa | $13,203,474 | 71.1% |
| 06013355106 | Contra Costa | $10,361,391 | 73.1% |
| 06079010800 | San Luis Obispo | $9,565,995 | 75.1% |
| 06081613700 | San Mateo | $8,501,778 | 76.8% |
| 06095252202 | Solano | $6,903,767 | 78.2% |
| 06081613800 | San Mateo | $6,820,789 | 79.5% |
| 06013313103 | Contra Costa | $6,303,594 | 80.8% |
| 06013313202 | Contra Costa | $6,247,976 | 82.1% |
| 06085504308 | Santa Clara | $5,533,227 | 83.2% |
| 06085512700 | Santa Clara | $5,273,962 | 84.2% |
| 06083001906 | Santa Barbara | $5,021,032 | 85.2% |
| 06079011200 | San Luis Obispo | $4,348,243 | 86.1% |
| 06081613501 | San Mateo | $4,308,841 | 87.0% |
| 06087122300 | Santa Cruz | $3,533,725 | 87.7% |
| 06041133000 | Marin | $3,501,464 | 88.4% |
| 06057000801 | Nevada | $3,484,975 | 89.1% |
| 06013304000 | Contra Costa | $3,346,232 | 89.8% |
| 06013355200 | Contra Costa | $3,296,665 | 90.4% |
| 06083001905 | Santa Barbara | $3,185,995 | 91.1% |
| 06013347000 | Contra Costa | $3,177,857 | 91.7% |
| 06087120200 | Santa Cruz | $2,972,185 | 92.3% |
| 06069000800 | San Benito | $2,936,073 | 92.9% |
| 06053011000 | Monterey | $2,661,892 | 93.4% |

| FIPS | County | Surplus Lost | Cumulative Percent |
|---|---|---|---|
| 06053010304 | Monterey | $2,627,927 | 94.0% |
| 06001451202 | Alameda | $2,606,839 | 94.5% |
| 06017031405 | El Dorado | $2,348,612 | 95.0% |
| 06037800201 | Los Angeles | $2,049,840 | 95.4% |
| 06009000210 | Calaveras | $1,936,340 | 95.8% |
| 06053011700 | Monterey | $1,929,660 | 96.1% |
| 06085504202 | Santa Clara | $1,708,214 | 96.5% |
| 06037920103 | Los Angeles | $1,658,543 | 96.8% |
| 06037920104 | Los Angeles | $1,391,650 | 97.1% |
| 06111001102 | Ventura | $1,311,472 | 97.4% |
| 06095252102 | Solano | $1,226,624 | 97.6% |
| 06013355304 | Contra Costa | $1,210,494 | 97.9% |
| 06013356002 | Contra Costa | $1,145,493 | 98.1% |
| 06111000902 | Ventura | $1,103,747 | 98.3% |
| 06069000200 | San Benito | $1,060,493 | 98.5% |
| 06085503312 | Santa Clara | $882,961 | 98.7% |
| 06111001101 | Ventura | $628,668 | 98.8% |
| 06053011600 | Monterey | $600,020 | 98.9% |
| 06037135203 | Los Angeles | $555,784 | 99.1% |
| 06083002805 | Santa Barbara | $505,507 | 99.2% |
| 06041132200 | Marin | $471,425 | 99.2% |
| 06087110600 | Santa Cruz | $467,407 | 99.3% |
| 06087110400 | Santa Cruz | $406,349 | 99.4% |
| 06017031301 | El Dorado | $317,729 | 99.5% |
| 06047002100 | Merced | $313,798 | 99.5% |
| 06111001001 | Ventura | $264,547 | 99.6% |
| 06115041100 | Yuba | $262,126 | 99.7% |
| 06037800302 | Los Angeles | $241,766 | 99.7% |
| 06017031404 | El Dorado | $210,593 | 99.7% |
| 06085503319 | Santa Clara | $195,801 | 99.8% |
| 06083001901 | Santa Barbara | $193,386 | 99.8% |
| 06017031406 | El Dorado | $176,910 | 99.9% |
| 06053010202 | Monterey | $139,008 | 99.9% |
| 06055201400 | Napa | $98,963 | 99.9% |
| 06087110700 | Santa Cruz | $98,855 | 99.9% |
| 06079010300 | San Luis Obispo | $92,346 | 99.9% |
| 06087120500 | Santa Cruz | $71,406 | 100.0% |

| FIPS | County | Surplus Lost | Cumulative Percent |
|---|---|---|---|
| 06081603400 | San Mateo | $71,107 | 100.0% |
| 06083002603 | Santa Barbara | $32,666 | 100.0% |
| 06111000100 | Ventura | $32,064 | 100.0% |
| 06081613600 | San Mateo | $10,528 | 100.0% |
| 06053010606 | Monterey | $9,393 | 100.0% |
| 06055201800 | Napa | $9,128 | 100.0% |
| 06079012702 | San Luis Obispo | $6,769 | 100.0% |
| 06081613200 | San Mateo | $5,081 | 100.0% |
| 06085511703 | Santa Clara | $4,938 | 100.0% |
| 06095252104 | Solano | $4,538 | 100.0% |
| 06029004500 | Kern | $2,796 | 100.0% |
| 06053011201 | Monterey | $2,089 | 100.0% |
| 06081613502 | San Mateo | $1,491 | 100.0% |
| 06083002500 | Santa Barbara | $562 | 100.0% |
| 06099003400 | Stanislaus | $448 | 100.0% |
| 06009000300 | Calaveras | $328 | 100.0% |
| 06057000900 | Nevada | $170 | 100.0% |
| 06081606900 | San Mateo | $0 | 100.0% |
| 06087122400 | Santa Cruz | $0 | 100.0% |
| 06055201002 | Napa | $0 | 100.0% |
| 06037920014 | Los Angeles | $0 | 100.0% |
| 06007002400 | Butte | $0 | 100.0% |
| 06083001800 | Santa Barbara | $0 | 100.0% |
| 06017031302 | El Dorado | $0 | 100.0% |
| 06079011400 | San Luis Obispo | $0 | 100.0% |
| 06085504201 | Santa Clara | $0 | 100.0% |
| Total | | $497,647,833 | |

Source: CRA analysis.

**Table IV-5: County-Level Impacts**

| County | Surplus Lost | Surplus Lost (Densification) |
|---|---|---|
| San Luis Obispo | $165,959,851 | $86,742,671 |
| Alameda | $90,546,539 | $90,293,420 |
| Contra Costa | $88,031,116 | $72,184,432 |
| Santa Barbara | $41,067,801 | $2,548,517 |
| San Mateo | $19,719,615 | $20,327,261 |
| Ventura | $18,153,714 | $2,032,437 |
| Riverside | $13,885,294 | $9,332,120 |
| Santa Clara | $13,599,103 | $13,560,507 |
| Solano | $8,134,928 | $5,118,543 |
| Monterey | $7,969,990 | $3,035,788 |
| Santa Cruz | $7,549,927 | $2,995,997 |
| Los Angeles | $5,897,583 | $707,443 |
| San Benito | $3,996,567 | $1,142,272 |
| Marin | $3,972,888 | $4,816,709 |
| Nevada | $3,485,145 | $2,668,715 |
| El Dorado | $3,053,845 | $2,642,386 |
| Calaveras | $1,936,668 | $1,872,486 |
| Merced | $313,798 | $300,862 |
| Yuba | $262,126 | $226,099 |
| Napa | $108,092 | $101,887 |
| Kern | $2,796 | $3,263 |
| Stanislaus | $448 | $425 |
| Butte | $0 | $0 |
| **Total** | **$497,647,833** | **$322,654,240** |

Source: CRA analysis.

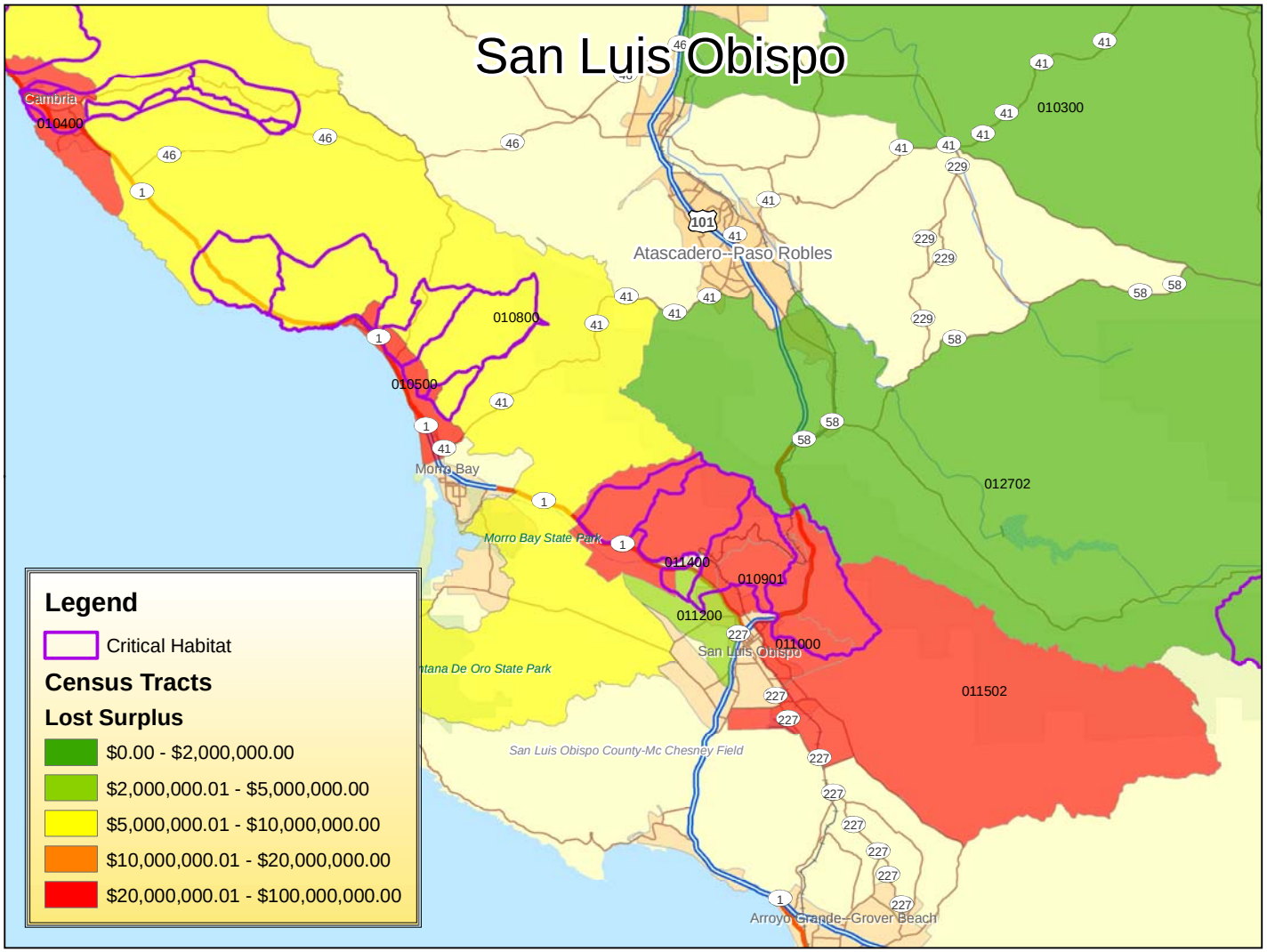


**Figure 1: San Luis Obispo County Impacts**

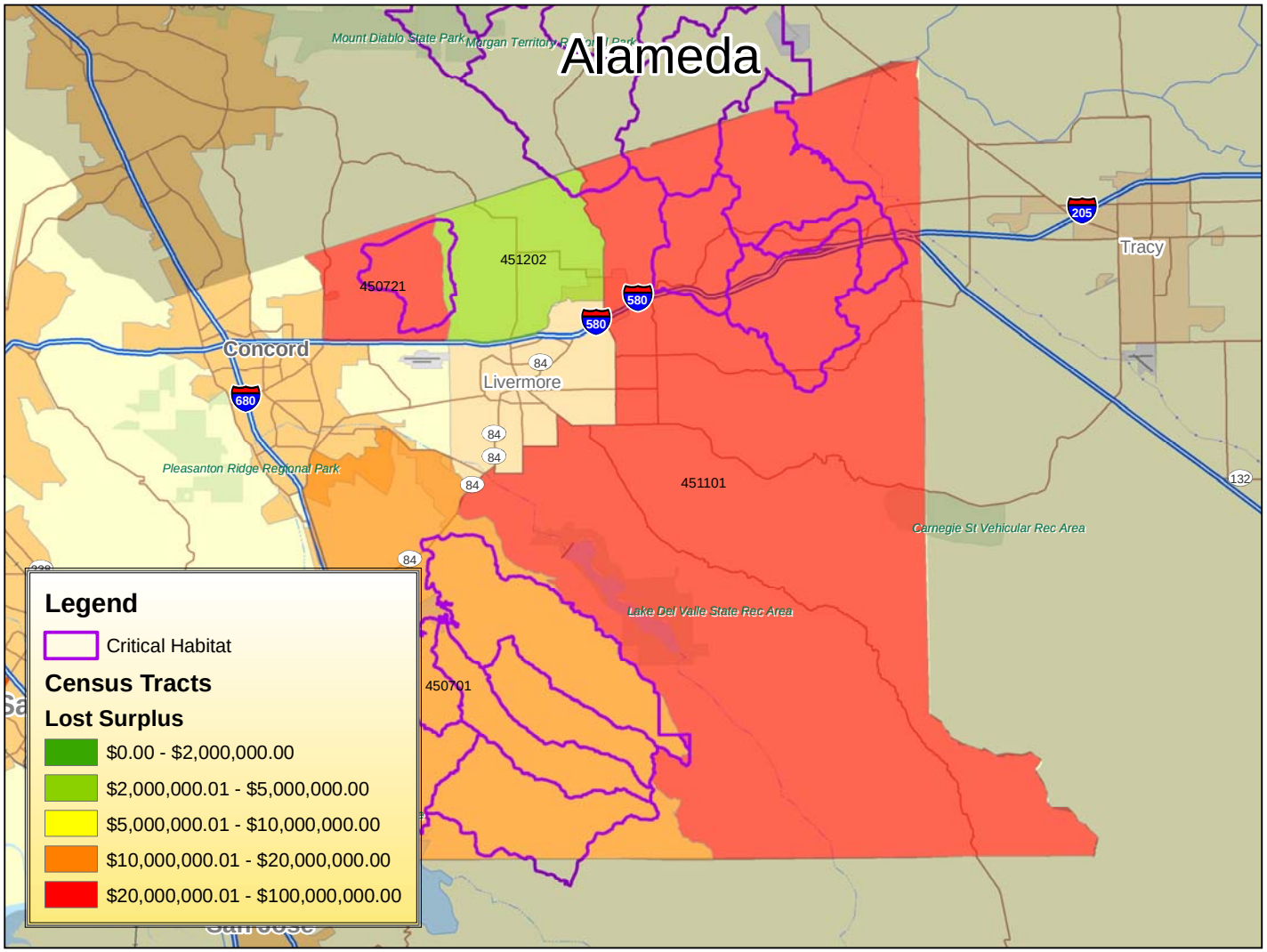


**Figure 2: Alameda County Impacts**

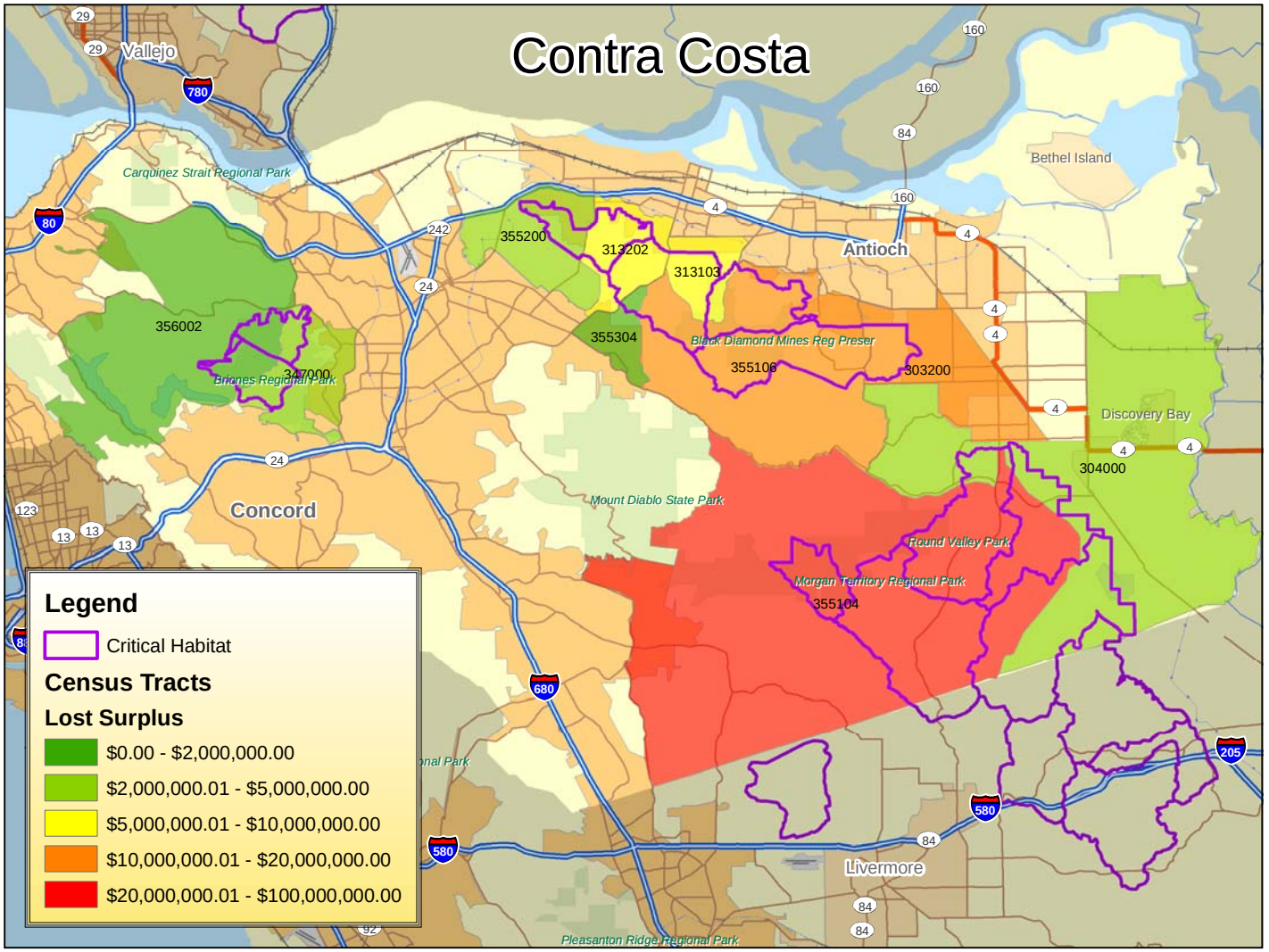


**Figure 3: Contra Costa County Impacts**

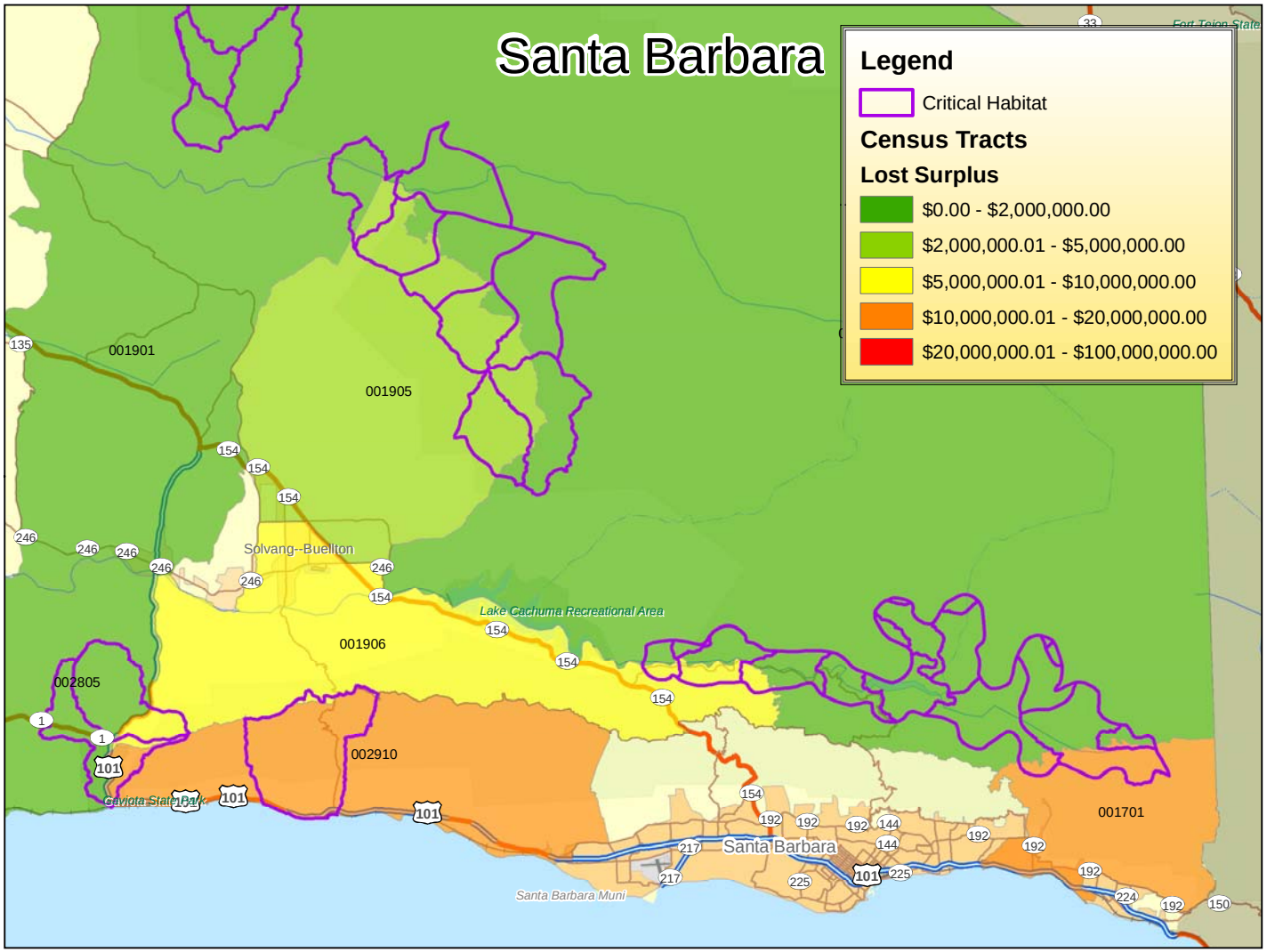


**Figure 4: Santa Barbara County Impacts**


**Figure 5: San Mateo County Impacts**

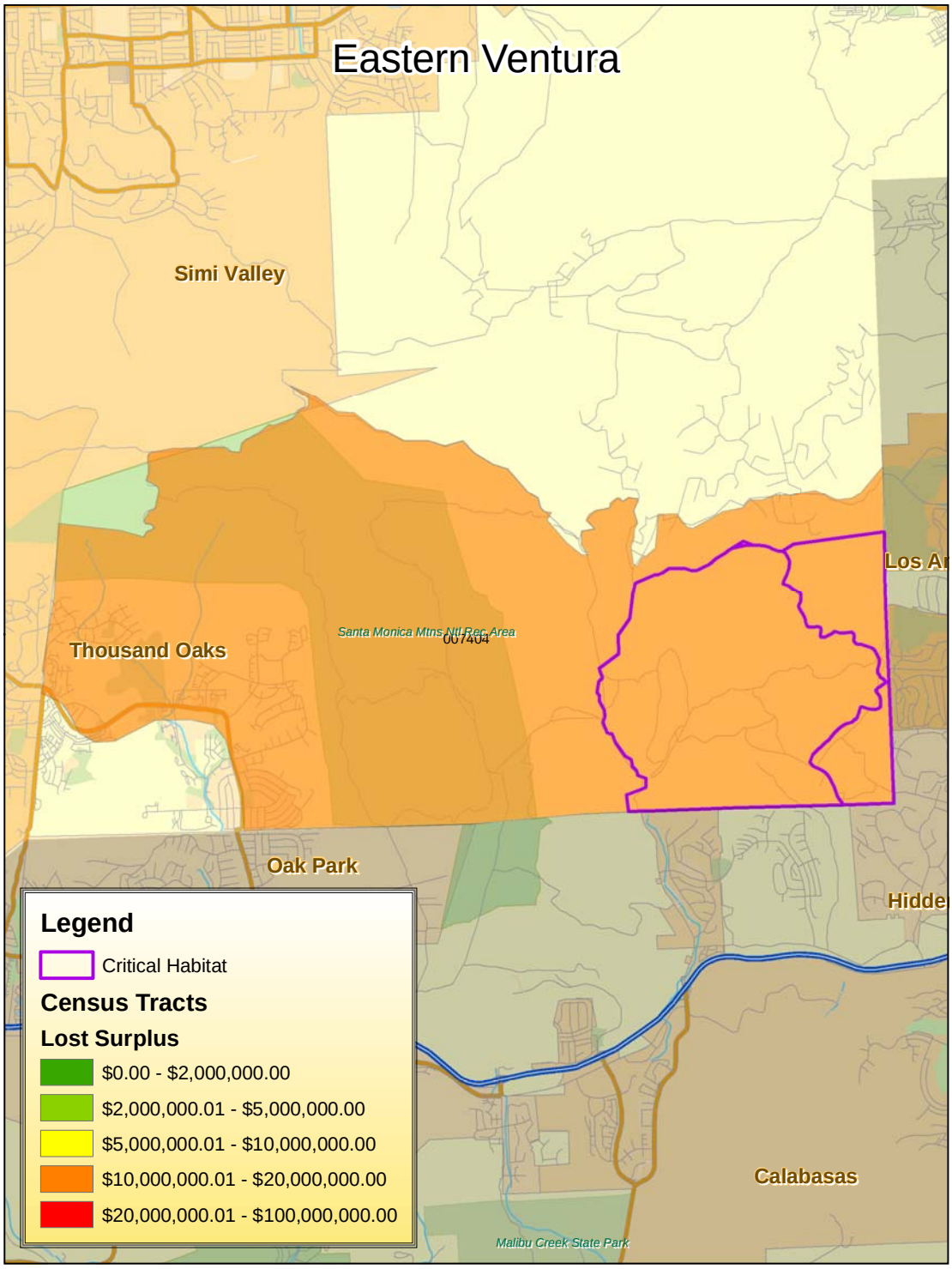


**Figure 6: Eastern Ventura County Impacts**

# V ECONOMIC IMPACTS ON PUBLIC PROJECTS AND ACTIVITIES

This section reviews the potential economic impacts on transportation projects and the energy industry as a result of critical habitat designation. In addition, the possible impacts to activities by the Department of the Defense, the Bureau of Land Management, the Bureau of Reclamation, the Forestry Service, the Fish and Wildlife Service, and the Bureau of Indian Affairs are examined.

## V.1 ECONOMIC IMPACTS ON TRANSPORTATION PROJECTS

The Federal Highway Administration (FHA) and the California Department of Transportation maintain GIS databases of current and predicted transportation projects. The FHA data, known as the National Highway Planning Network, includes information for interstates, principal arterials, and rural minor arterials.[57] The California Department of Transportation source, known as the California Transportation Investment Tool (CTIS Tool), incorporates information about projects overseen by the State Transportation Improvement Program, the State Highway Operations and Protection Program, the Interregional Transportation Strategic Plan, the California Aviation System Plan, and various regional transportation planning organizations.[58] Aviation, rail, highway, transit, bicycle and pedestrian projects are all represented. Developed to assist transportation planners, the CTIS Tool is a Geographic Information System that displays the mapped location, as well as the timeframe and cost of the projects. Version 1.3.2 was used for this analysis; version 2.0 should be released in spring 2005.[59]

The data layers contained in the CTIS Tool were mapped onto the habitat boundary files provided by the Service to determine the number of proposed acres affected by each transportation project. No aviation, rail, bicycle, transit, or pedestrian projects overlapped with critical habitat.

Table V-1: California Highway Projects that Intersect Critical Habitat displays the highway number, miles of impacted acres, total project cost (in 2004 dollars), and county location of the three California projects that cross RLF habitat units.[60] The capital costs of all of the impacted projects total $115 million, in 2004 dollars. A total of 9.14 miles of California highway projects overlap with critical habitat units. No impacts were identified from the overlap of the FHA data and the critical habitat maps. To determine the effects of designation, the impacts of mitigation requirements and project delays were calculated. For the analysis, only projects with a start date of 2005 or later were considered.[61]

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[57] U.S. Department of Transportation, Federal Highway Administration, http://www.fhwa.dot.gov/planning/nhpn/

[58] California Department of Transportation, Office of State Planning, http://www.dot.ca.gov/hq/tpp/offices/osp/ctis.htm

[59] Version 1.3.2 is current through 2001. This analysis will be updated once Version 2.0 is released.

[60] Values were inflated to 2004 dollars by using the Producer Price Indexes for Construction Materials and Components, recorded in Table B-65 of the Economic Report of the President, published in February 2005.

[61] Start date of a project was determined by the "Line_yr" variable, which represents the "year the funding is expected to be awarded for expenditures". The "Total_Cost" variable equals the total funds set aside for

To determine the costs stemming from the delays in project completion, it is necessary to calculate the forgone benefits, which are best framed in terms of changes in ridership patterns and commute times. At this time, the economic impacts due to project delays have not been evaluated.

## V.2 Economic Impacts on Water Supply Projects

Water projects, which accompany urban and agricultural growth, have had a negative effect on California red-legged frogs and their habitat. The construction of large reservoirs, such as Lake Oroville, Whiskeytown Reservoir, Don Pedro Reservoir, Lake Berryessa, San Luis Reservoir, Lake Silverwood, Lake Piru, Pyramid Lake, and Lower Otay Lake, have eliminated California red-legged frog habitat or fragmented remaining aggregations.[62]

The timing and duration of water releases from reservoirs, particularly on the central California coast, can render a stream unsuitable for California red-legged frog reproduction and maintain populations of exotic predators in downstream areas that would normally be dry in summer. Reservoirs are typically stocked with predatory species of fish and bullfrogs. These species often disperse into surrounding California red-legged frog habitat disrupting natural community dynamics.

Water diversions, groundwater well development, and stock pond or small reservoir construction projects can affect critical habitat. Diverting water from natural habitats to these projects disrupts the natural hydrologic regime. During periods of drought, reduced availability of water within natural drainages combined with drawdown from the impoundments, disrupts reproduction, foraging, estivation and dispersal.

After a review of biological opinions issued by the Service in response to proposed projects involving water districts, one project was identified as potentially restricting the water supply. The planned action, located on the Fox and Alder Creeks in Santa Barbara County, is managed by staff of the Los Padres National Forest and the Montecito Water District. In operation since 1935, the project diverts water from the creeks above their confluence points into the Santa Ynez River. Due to the potential impact on red-legged frog habitat downstream from the project, the Service tentatively determined that diversions should be suspended between April and November. This recommendation, however, was contingent upon creek flow analyses, which were not complete at the time the biological opinion was issued.

The listing of the California red-legged frog has had significant economic implications in the Carmel River watershed. In the defined low-flow season (roughly late June through

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the project. The "Doc_Year" identifies the year the transportation project was approved, and therefore, the base year from which the project costs are inflated to 2004 dollars (CTIS Data Dictionary, 2000).

[62] Jennings, M., M. Hayes and D. Holland, A petition to the U.S. Fish & Wildlife Service to place the California red-legged frog and the western pond turtle on the list of endangered and threatened wildlife and plants. 21 pp.

November), all production sources in the upper Carmel Valley are rendered unusable due to the need to maintain minimum instream flows. These restrictions flow in part from the listing of the California red-legged frog. During this period, water is produced from groundwater wells near the coast and conveyed up-valley to water users. The economic implications of this change in the place of water extraction are both capital expenditures to accommodate a switch in the source of supply and incremental conveyance costs due to the need to lift water from the cost to elevations where it is to be used.

Proposed or existing water diversions on the central coast potentially affect the following drainages: San Simeon, Santa Rosa, Van Gordon, Villa, San Luis Obispo, Pico, and Little Pico Creeks, Arroyo del Puerta, and Arroyo Laguna in San Luis Obispo County; the Carmel and Salinas Rivers in Monterey County; and Canada del Refugio in Santa Barbara County.

At this time, it is not possible to determine which of these projects are likely to be constructed and, if so, what mitigation or incremental changes in their operation are likely to be required as a result of the listing of the California red-legged frog. We seek comments on the potential impacts of designation on water supply projects.

## V.3 Economic Impacts on the Energy Industry

Pursuant to Executive Order 13211, Federal agencies are required to submit a summary of the potential effects of regulatory actions on the supply, distribution, and use of energy, assuming those actions meet certain criteria outlined by the OMB:[63]

- Reductions in crude oil supply in excess of 10,000 barrels per day;
- Reductions in fuel production in excess of 4,000 barrels per day;
- Reductions in coal production in excess of 5 million tons per year;
- Reductions in natural gas production in excess of 25 million mcf per year;
- Reductions in electricity production in excess of 1 billion kilowatt-hours per year or in excess of 500 megawatts of installed capacity;
- Increases in energy use required by the regulatory action that exceed any of the thresholds above;
- Increases in the cost of energy production in excess of one percent;
- Increases in the cost of energy distribution in excess of one percent; or
- Other similarly adverse outcomes.

Table V-2: Proposed Energy Facilities lists the energy production facilities that are planned or under construction in the counties with critical habitat. A GIS analysis was

[63] U.S. Office of Management and Budget, "Memorandum for Heads Of Executive Departments And Agencies, And Independent Regulatory Agencies," July 13, 2001.

used to compute their proximity to the nearest critical habitat designation.[64] All planned facilities are at least one mile from proposed critical habitat and are judged to be at low risk of disruption.

## V.4 Economic Impacts on Public Lands

This section describes potential impacts of designation on lands administered by the Federal government. The analysis is divided among the various Federal agencies that are impacted, since each may potentially have its own set of development requirements and costs associated with designation.

An overall breakdown by agency and department of overlap between critical habitat and Federal lands is given in Table V-3: Impacted Federal lands by Agency and Department. The largest areas of overlap are administered by the Forest Service.

### V.4.1 Impact on the Department of Defense

Critical habitat intersects Vandenberg Air Force Base. We seek comments on any potential impacts this may have.

### V.4.2 Impact on the Bureau of Indian Affairs

Critical habitat intersects 6 acres of land on the San Manuel Indian Reservation. We seek comments on the potential effects of this overlap.

### V.4.3 Impact on Other Governmental Agencies

Critical habitat intersects various areas of wilderness refuge, public domain, and park land. While we do not expect designation to impact these agencies, we seek comments to quantify potential impacts.

[64] Because some plants are only in the planning stages, precise location information was not available for all plants. Whenever possible, plant locations were geocoded to the nearest intersection or city block. While this may cause this section's estimates to differ slightly from the ultimate facility locations, it should not affect the results.

**Table V-1: California Highway Projects that Intersect Critical Habitat**

| County | Caltrans District | Highway Route | Project Length (miles) | Project Start Year | Total Cost, (thousands) | Impacted CH (miles) | Additional Costs due to Designation, (thousands) |
|---|---|---|---|---|---|---|---|
| Kern | 6 | 46 | 7.3 | 2008 | 35,000 | 2.12 | 404 |
| Merced | 10 | 152 | 4.7 | 2012 | 15,000 | 1.3 | 171 |
| Riverside | 8 | 79 | 5.4 | 2005 | 18,250 | 0.9 | 112 |
| San Luis Obispo | 5 | 46 | 5.7 | 2012 | 46,885 | 4.8 | 0[b] |
| **Total** | | | **23.1** | | **115,135** | **9.14** | **687** |

Sources:

(1) California Transportation Investment Tool, Version 1.3.2, California Department of Transportation, Office of State Planning, http://www.dot.ca.gov/hq/tpp/offices/osp/ctis.htm;

(2) Critical Habitat Boundary Files, U.S. Fish and Wildlife Service;

(3) CalTrans District 5 Status of Projects, http://www.dot.ca.gov/dist05/projects/pdf/d5sop.pdf

(4) CalTrans District 10 ongoing construction, http://www.dot.ca.gov/dist10/media/docs/county.doc

(5) Route 46 Corridor Improvement Project Draft Environmental Impact Report, http://safer46.dot.ca.gov/pdf/EIRVol1_web.pdf

**Table V-2: Proposed Energy Facilities**

| Plant | Status | Capacity (MW) | City | County | Nearest CHD (Miles) |
|---|---|---|---|---|---|
| Tesla Combined Cycle - FPL | On Hold | 1120 | Tracy | Alameda | 1.07 |
| Valero Cogen. Unit 2 | Const. On Hold | 51 | Benicia | Solano | 1.53 |
| East Altamont - Calpine | On Hold | 1100 | Byron | Alameda | 1.79 |
| Morro Bay – Duke | On Hold | 1200 | Morro Bay | San Luis Obispo | 1.84 |
| Contra Costa – Mirant | Const. On Hold | 530 | Antioch | Contra Costa | 3.82 |
| Los Esteros Combined Cycle - Calpine | 12-mo. AFC | 140 | San Jose | Santa Clara | 7.19 |
| Inland Empire Combined Cycle - Calpine | Preconstruction | 800 | Romoland | Riverside | 11.88 |
| Russell City – Calpine | On Hold | 600 | Hayward | Alameda | 13.03 |
| Riverside Energy Resource Center - City of Riverside Phase 1 | Construction | 48 | Riverside | Riverside | 18.44 |
| Magnolia - SoCal Power Authority | Construction | 328 | Burbank | Los Angeles | 19.20 |
| SMUD Combined Cycle Phase 1 | Construction | 500 | Herald | Sacramento | 19.34 |
| Avenal Combined Cycle - Duke | 12-mo. AFC | 600 | Avenal | Kings | 19.65 |
| Malburg - City of Vernon Combined Cycle | Construction | 134 | Vernon | Los Angeles | 26.83 |
| Walnut Energy Center - Turlock Irrigation District | Construction | 250 | Turlock | Stanislaus | 29.60 |
| Roseville Combined Cycle - Roseville | Preconstruction | 160 | Roseville | Placer | 34.59 |
| San Joaquin Valley Energy Center - Calpine | On Hold | 1087 | San Joaquin | Fresno | 48.03 |
| Salton Sea Geothermal | Preconstruction | 215 | Calipatria | Imperial | 69.28 |
| Three Mountain - Covanta | On Hold | 500 | Burney | Shasta | 75.80 |
| Blythe II Combined Cycle - FPL | 12-mo. AFC | 520 | Blythe | Riverside | 124.06 |

Source: California Energy Commission, Energy Facilities Siting / Licensing Process. http://www.energy.ca.gov/sitingcases/index.htm

**Table V-3: Impacted Federal lands by Agency and Department**

| Agency | Area | Acres Impacted |
|---|---|---|
| Air Force (DOD) | Vandenberg Air Force Base | 5,591 |
| Bureau of Reclamation (BOR) | San Luis Reservoir | 745 |
| Fish and Wildlife Service (FWS) | Ellicott Slough National Wildlife Refuge | 159 |
| Indian Reservations (BIA) | San Manuel Indian Reservation | 6 |
| National Forest (FS) | Angeles National Forest | 7,149 |
| | Cleveland National Forest | 4,158 |
| | Eldorado National Forest | 861 |
| | Los Padres National Forest | 106,634 |
| | Plumas National Forest | 7,838 |
| | San Bernardino National Forest | 13,694 |
| | Tahoe National Forest | 1,726 |
| | Total | 142,060 |
| National Monument (BLM) | California Coastal National Monument | 734 |
| National Monument (NPS) | Pinnacles National Monument | 1,170 |
| National Oceanic and Atmospheric Administration (NOAA) | Elkhorn Slough National Estuarine Research Reserve | 511 |
| National Recreation Area (NPS) | Golden Gate National Recreation Area | 14,740 |
| National Seashore (NPS) | Point Reyes National Seashore | 13,072 |
| Public Domain Land (BLM) | | 6,052 |
| Wilderness (FS) | Garcia Wilderness | 5,105 |
| | Machesna Mountain Wilderness | 377 |
| | Matilija Wilderness | 502 |
| | San Rafael Wilderness | 25,303 |
| | Santa Lucia Wilderness | 7 |
| | Sespe Wilderness | 4,762 |
| | Ventana Wilderness | 1,313 |
| | Total | 37,369 |
| Wilderness (NPS) | Phillip Burton Wilderness | 13,094 |
| Wilderness Study Area (BLM) | Pinnacles Wilderness Study Area | 1,559 |
| **Total** | | **248,066** |

# VI REGIONAL ECONOMIC IMPACTS

## VI.1 METHODOLOGY

The distributional effects of critical habitat designation are quantified using IMPLAN Economic Modeling Software.[65] The IMPLAN Model is a widely used tool for analysis of economic events such as a change in industrial output. IMPLAN was developed by the U.S. Forest Service, which continues to use it today, and is now also used by 1,500 agencies and companies, including the California Energy Commission, the California Departments of Finance, Transportation, Water Resources, and Labor and Employment, San Diego State, Stanford, U.C. Berkeley, and numerous private consulting companies.[66]

The core of IMPLAN is an input-output model. This type of model traces the "multiplier effect" of an industry making purchases from other industries.[67] The economy is described by 509 IMPLAN industry sectors, which are based on the North American Industry Classification System (NAICS) and the Bureau of Economic Analysis (BEA) commodity classifications. "Direct effects" are the changes in final demand being modeled (the goods and services produced or purchased from an industry). "Indirect effects" estimate inter-industry purchases. Regional purchase coefficients are used to estimate the proportion of inter-industry purchases occurring within the study area. In addition to the interactions between the 509 IMPLAN industries, "induced effects" estimate the impact of household spending caused by the change in final demand.[68] In the table and discussion that follow, the sum of indirect and induced effects are referred to as secondary effects.

Critical habitat designation reduces the construction of new housing, as described in Section IV. IMPLAN is used to describe how this decrease in new home construction results in a decrease in the demand for inputs from other industries. The change in final demand for new housing construction is calculated as the product of building costs per house multiplied the change in number of houses built. The calculation of building costs for each census tract is described in Section IV.2.

San Luis Obispo, Contra Costa, and Santa Barbara were selected for IMPLAN analysis because they are projected to incur the largest change in residential construction demand.

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[65] MIG, Inc., IMPLAN Professional Version v.2.0.1024, 1997-2004.

[66] http://www.implan.com/references.html

[67] For a detailed discussion of this modeling method see, Ronald Miller and Peter Blair, *Input Output Analysis, Foundations and Extensions*, New Jersey: Prentice Hall.

[68] Direct impacts – the direct purchases by the facility under study – and indirect impacts –the purchases made by the firms supplying the facility – are captured in the standard input-output model. Induced impacts – purchases by employees of the facility and indirect firms – are captured when the model is "closed" with respect to households. The version of IMPLAN used here is closed.

The change in final demand for residential construction in these counties represented greater than or equal to 0.1% of the county's pre-designation industry revenue. The change in building costs are aggregated for the three counties and annualized. Note that in this analysis, the direct effects are the costs associated with the construction of new homes which is different from the price paid by homebuyers for a new home. Restricting the supply of new homes may increase revenue to home sellers, but it will decrease the demand for inputs needed to construct new homes.

In addition to the IMPLAN model of the impacts on new home construction, the distributional impacts of CHD resulting from mitigation costs and a change in home prices are discussed below.

## VI.2 RESULTS

Table VI-1: Secondary Impacts of Designation demonstrates that the secondary impacts from decreased new home construction are small relative to the industry output of the three-county region. Critical habitat designation of the RLF has a relatively small effect on the regional economy. Total annual industry output is reduced by approximately $7.7 million directly and another $5.1 million secondarily. These combined reductions represent only less than 0.01 percent of the region's output. Included among the most affected industries are wholesale trade and architectural/engineering services.

Note that mitigation costs are not accounted for in this analysis. Mitigation costs, principally land acquisition costs, are incurred by the individuals or businesses developing the land. If the land developers do not currently own the land, these costs may be borne by the landowners through a decrease in land price. The mitigation expenditures are a transfer to a conservation bank, i.e., a transfer from one landowner to another or a transfer from a land developer to a landowner. At the census tract level of examination, mitigation expenditures flow out of the census tract and are a cost to producers. Regionally, however, mitigations costs are a transfer that would have minimal distributional effects.

In IMPLAN, the decrease in dollars spent on new housing construction results in decreased spending by the employees in the construction industry. IMPLAN allocates a large portion of this decrease in spending to "owner-occupied dwellings" and "real estate." Note that another larger group of consumers may increase spending in "owner-occupied dwelling" as the supply of housing is restricted and home prices increase. This group of consumers may be diverting money from entertainment, travel, or other industries in response to higher mortgage payments. These dollars flow to home sellers, who in turn may spend more on entertainment, travel, or other activities. In this regard, the diversion of one group of consumer expenditures to new housing may result in another group of consumers spending more on other activities.

**Table VI-1: Secondary Impacts of Designation**

| Industry[69] | Study Area Data: Industry Output | Model Results: Direct Effects | Model Results: Secondary Effects[70] | Impacts as a Percent of Output |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4)=((2)+(3))/(1) |
| New residential 1-unit structures- nonfarm | 2,490,212,000 | -7,700,000 | 0 | -0.31% |
| Owner-occupied dwellings | 5,275,105,000 | 0 | -364,679 | -0.01% |
| Wholesale trade | 3,061,900,000 | 0 | -325,185 | -0.01% |
| Motor vehicle and parts dealers | 1,169,955,000 | 0 | -209,076 | -0.02% |
| Real estate | 7,082,671,000 | 0 | -206,615 | 0.00% |
| Architectural and engineering services | 1,630,022,000 | 0 | -200,528 | -0.01% |
| Food and beverage stores | 1,483,145,000 | 0 | -163,282 | -0.01% |
| Food services and drinking places | 2,279,069,000 | 0 | -154,733 | -0.01% |
| Offices of physicians- dentists- and other health | 2,352,843,000 | 0 | -144,441 | -0.01% |
| Monetary authorities and depository credit interme | 3,662,859,000 | 0 | -138,243 | 0.00% |
| General merchandise stores | 626,544,000 | 0 | -123,788 | -0.02% |
| Hospitals | 1,705,779,000 | 0 | -111,733 | -0.01% |
| Insurance carriers | 1,419,775,000 | 0 | -111,281 | -0.01% |
| **Total, All Industries** | **112,698,724,000** | **-7,700,000** | **-5,134,608** | **-0.01%** |

[69] Only industries with "Total Effects" greater than $100,000 are listed in this table.

[70] "Secondary Effects" include indirect and induced effects.

# VII ECONOMIC IMPACTS ON SMALL BUSINESSES

According to the Regulatory Flexibility Act, as amended by the Small Business Regulatory Enforcement Fairness Act, an agency has to determine whether proposed legislation will have a "significant economic impact on a substantial number of small entities."[71] There are three categories of entities: small business, small government, and small nonprofit organizations. The impacts on non-profits and small governments are expected to be negligible and are not examined in this analysis.

The effects of CHD on small businesses in new home construction, however, are examined. In some census tracts, the quantity of new housing decreases as a result of CHD. This results in decreased revenue to home construction. The impact to the new home construction industry is characterized as the decrease in the number of housing units multiplied by the average building cost per housing unit. The change in building costs is calculated for each census tract and then summed by county. This is conservative, as some construction firms may actually gain from an increase in housing price when the supply of housing is restricted.[72] In this analysis, the total but-for revenue is equivalent to building costs per house multiplied by the pre-regulation projected number of housing units. Table VII-1: Impact of CHD on New Home Construction Revenue summarizes the revenue loss by county.

To isolate the revenue losses attributable to small businesses we examined the share of new housing construction permits reported in Sacramento County.[73] To estimate the number of affected small businesses, the number of houses built per small firm was calculated. Next, the number of housing units lost to small businesses was calculated as the percent housing permits to small firms multiplied by the change in housing units from CRA's housing model. Then, the number of lost housing units attributable to small firms was divided by the average number of houses per small firm. This provides an estimate of the number of affected small businesses. These calculations are presented in Table VII-2 and Table VII-3.

As shown in the tables, the annual number of affected small firms is less than two for all counties examined. Counties not listed have even smaller small business losses. Consequently, less than three small firms are projected to suffer annual revenue losses equal to their expected annual revenues. In view of expected home price increases, it is

[71] EPA, "Revised Interim Guidance for EPA Rulewriters: Regulatory Flexibility Act as Amended by the Small Business Regulatory Enforcement Fairness Act," 29 March 1999, p.11.

[72] On one hand, there a fewer homes for construction companies to build; on the other, if construction companies are selling the houses to consumers, rather than being hired by another company, then they will obtain the benefits of increased price.

[73] Sacramento County serves as a proxy for the effect counties for both practical and empirical reasons. The county maintains electronic, readily-available (at a price) permit records. The county is also home to a large number of small businesses.

possible that demand for these projects will increase.[74] In addition, rising home prices generate greater demand for home remodel projects likely to be met by small firms.

[74] If two firms close in the first year, then these same two firms will be affected in subsequent years; that is, the number of small firms supplying homes will decrease by two for the entire study period. This new number of small firms will not decrease every year.

**Table VII-1: Impact of CHD on New Home Construction Revenue**

| County | Annual Pre-regulation Revenue | Annual Change in Revenue | Annual Change in Housing Units |
|---|---|---|---|
| San Luis Obispo | $640,255,341 | -$4,089,243 | -18.28 |
| Contra Costa | $1,404,125,9 | -$2,343,708 | -5.73 |
| Santa Barbara | $751,545,393 | -$1,130,230 | -3.25 |
| Ventura | $1,552,355,564 | -$1,001,858 | -1.93 |
| Alameda | $1,840,515,586 | -$857,463 | -2.29 |
| Riverside | $5,478,556,581 | -$514,649 | -1.57 |
| Los Angeles | $7,523,824,809 | -$306,057 | -1.04 |
| Monterey | $524,234,524.50 | -$214,610 | -0.73 |
| Santa Cruz | $309,233,509.63 | -$196,792 | -0.90 |
| San Mateo | $1,007,102,451.28 | -$194,701 | -0.34 |
| Solano | $592,356,242.40 | -$193,257 | -0.62 |
| Santa Clara | $2,048,695,658.05 | -$160,895 | -0.43 |
| San Benito | $70,854,432.00 | -$132,791 | -0.53 |
| Nevada | $211,356,008.70 | -$57,439 | -0.25 |
| El Dorado | $329,821,439.34 | -$41,652 | -0.23 |
| Calaveras | $81,351,998.25 | -$24,635 | -0.15 |
| Marin | $345,169,420.54 | -$14,858 | -0.04 |
| Merced | $297,345,305.34 | -$4,857 | -0.02 |
| Yuba | $113,175,723.84 | -$3,868 | -0.03 |
| Napa | $94,968,597.10 | -$814 | 0.00 |
| Kern | $1,332,732,428.26 | -$20 | 0.00 |
| Stanislaus | $869,921,162.86 | -$10 | 0.00 |
| Butte | $411,311,601.50 | 0 | 0.00 |

**Table VII-2: Small Business Impacts From Residential Construction**

| County | Proportion of Houses built by Small Businesses[75] | Total Revenue, Annualized76 | Total Housing Units, Annualized[77] | Average Building Cost | Average Revenue per Small Business[78] |
|---|---|---|---|---|---|
| | [1] | [2] | [3] | [4]=[2]/[3] | [5] |
| San Luis Obispo | 22% | $640,255,341 | 2,998 | $213,542 | $775,000 |
| Contra Costa | 22% | $1,404,125,958 | 3,747 | $374,740 | $775,000 |
| Santa Barbara | 22% | $751,545,393 | 3,406 | $220,633 | $775,000 |
| Ventura | 22% | $1,552,355,564 | 4,372 | $355,082 | $775,000 |
| Alameda | 22% | $1,840,515,586 | 6,158 | $298,900 | $775,000 |
| Riverside | 22% | $5,478,556,581 | 21,961 | $249,471 | $775,000 |

**Table VII-3: Small Business Impacts From Residential Construction**

| County | Annual Houses built per Small Business | Annualized change in number houses[79] | Annualized change in number of houses to small businesses | Number of affected Small Businesses |
|---|---|---|---|---|
| | [6]=[5]/[4] | [7] | [8]=[1]*[7] | [9]=[8]/[6] |
| San Luis Obispo | 3.6 | -18.3 | -4.1 | -1.1 |
| Contra Costa | 2.1 | -5.7 | -1.3 | -0.6 |
| Santa Barbara | 3.5 | -3.3 | -0.7 | -0.2 |
| Ventura | 2.2 | -1.9 | -0.4 | -0.2 |
| Alameda | 2.6 | -2.3 | -0.5 | -0.2 |
| Riverside | 3.1 | -1.6 | -0.4 | -0.1 |

[75] From Department of Building Inspection, Municipal Services Agency, Sacramento County.

[76] From CRA's housing model.

[77] From CRA's housing model.

[78] RMA data on revenue by size class and D&B data on number of firms in each size class.

[80] From CRA's housing model.

# Appendix A WELFARE IMPACTS OF CRITICAL HABITAT DESIGNATION

The model of urban growth and the markets for land and improvements to land is adapted from the standard Alonso-Muth-Mills model of urban economics. The approach taken in this study is a partial equilibrium analysis for various portions of the overall critical habitat. Given the relatively small land and housing price changes resulting from critical habitat, together with the localized nature of housing supply and demand, the use of a partial equilibrium approach seems justified.

At each location, the housing developer is assumed to solve the following maximization problem:

$$\max_{H,L,\lambda} pH - k(H) + \lambda(\bar{N} - HL)$$

where *p* is the price of housing (taken as constant by an individual developer), *H* is the number of housing units constructed, *k* is the cost of building *H* units of housing, *L* is the amount of land per housing unit, and $\bar{N}$ is the amount of developable land at the location. Landowners earn rents equal to $\lambda$, which is determined in equilibrium. The profit-maximization conditions for the developer's problem are as follows:

$$H: p(H,L) - k_H - \lambda L = 0$$
$$L: p_L - \lambda = 0$$
$$\lambda: \bar{N} - HL = 0$$

The second term indicates that the price of land will equal the consumer's marginal valuation of lot size in equilibrium. Rearranging the first two equations, it follows that

$$p_L = \frac{p - k_H}{L}.$$

This expression implies that the intensive margin value of land ( $p_L$ ) will equal the extensive margin value of land ( $\frac{p - k_H}{L}$ ) when the quantity of developable land is fixed by geography or regulation. In this scenario, further limitations on the stock of developable land will increase the price of housing and increase the price of developable land.

When the amount of new housing is also limited by regulation, the developer's profit maximization problem becomes

$$\max_{H,L,\lambda,\mu} pH - k(H) + \lambda(\bar{N} - HL) + \mu(\bar{H} - H).$$

The first-order conditions for this problem are

$$p(H,L) - k_H - \lambda L - \mu = 0$$
$$p_L - \lambda = 0$$
$$\bar{N} - HL = 0$$
$$\bar{H} - H = 0$$

The first result of interest is to develop a test for rationing of new housing. From the first order conditions in the housing-rationed scenario, we see that

$$\lambda = p_L > \frac{p - k_H}{L} \text{ if } \mu > 0 .$$

Thus, when housing is rationed the intensive margin value of land will be less than the extensive margin value. A comparison of $p_L$ and $\frac{p - k_H}{L}$ is equivalent to a test for rationing of the new housing stock.

In the empirical analysis, two special cases of these scenarios are used to measure the impacts of critical habitat designation. In the first approach, housing is assumed to be rationed and lot size fixed. Since density cannot adjust and the stock of land is fixed, on-site avoidance requirements can only be accommodated by reducing the housing stock. The second approach makes the opposite assumption that avoidance requirements have no effect on the housing stock, and critical habitat is accommodated entirely through densification. As shown in the comparative statics results, a combination of these two responses may well occur in reality. Understanding impacts in the extreme cases helps to bracket actual welfare changes.

In the event where housing is rationed by regulation and lot size is fixed, the housing market equilibrium can be described with the aid of the following figure:

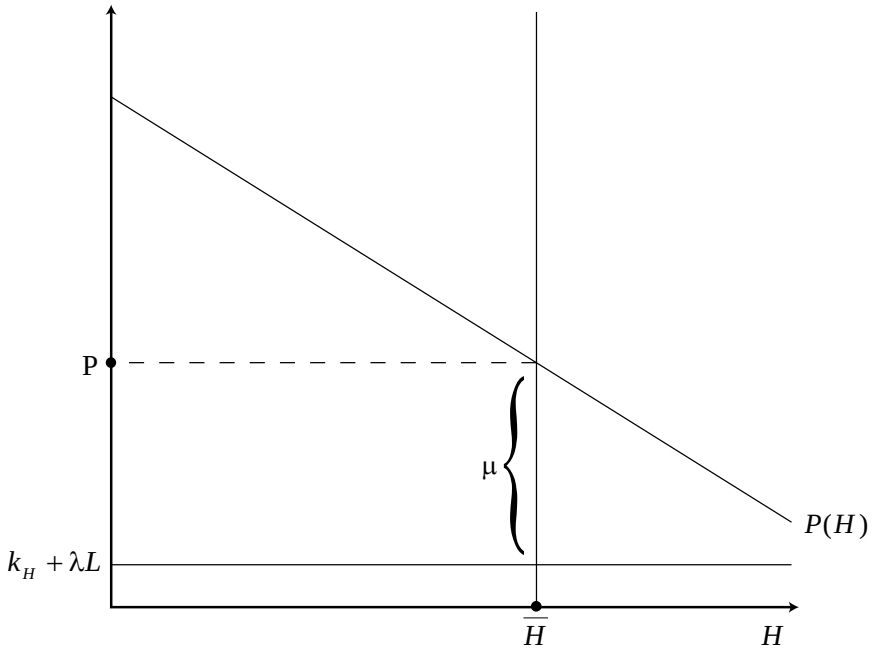


**Figure 7: Rationed-Housing Model**

Critical habitat designation has three main effects on consumer and producer welfare. First, critical habitat tightens the housing constraint, resulting in higher housing prices and lost rents to developers and landowners. Second, mitigation requirements drive up the marginal cost of housing development, subtracting from the rents earned through the production of scarce housing. Third, the need for Section 7 consultations can delay the completion of housing projects, resulting in surplus losses to producers as land and other fixed inputs must be carried for a longer period of time.

When the number of housing units are unaffected by critical habitat and all adjustments occur through reducing consumption of land, the relevant market equilibrium is described by the following figure:

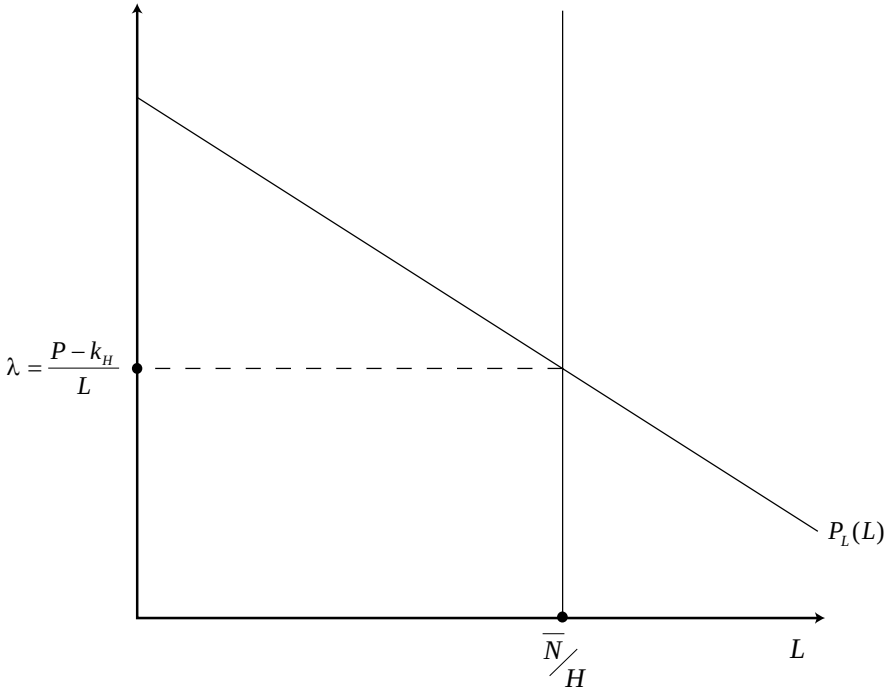


**Figure 8: Densification Model**

In the densification scenario, critical habitat has similar effects as in the rationed housing scenario: further constraints, increased costs and delay. The next section discussed specification of empirical demand and supply curves to estimate the surplus changes described in this section.

## A.1 Empirical Estimation

Empirical estimates of welfare impacts on the land market are based on the conceptual model outlined and on the spatial and socioeconomic data described earlier. This analysis adopts a supply and demand model for housing and land to compute the welfare impacts of designation. The model's primitives are functions describing the producer's marginal cost (the housing supply function), and the marginal benefit to consumers (the demand functions for land and housing). Estimating these functions permits measurement of the regulatory impact.

The analysis can be broken down into several steps:

1. Identify the supply and demand functions and determine the market equilibrium "but for" the regulatory action.
2. Determine the effects of regulation on consumers' marginal benefits and / or producers' marginal costs.
3. Estimate the resulting new market equilibrium and resultant changes in producer and consumer surplus.

The median home price per census tract was obtained from DataQuick, which maintains a database of new home transactions for the state of California. This analysis uses data on all new homes bought or sold in counties containing critical habitat after 1998 for a total of approximately 60,000 observations.

In some tracts, DataQuick had no observations on new home sales. For these tracts, the median home price and median number of rooms from the 2000 Census were used to approximate new home price and size.[81] Since California home prices have exhibited considerable volatility in recent years, it is necessary to inflate all home prices to present value. This was accomplished using the Freddie Mac Conventional Mortgage Home Pricing Index.

Marshall and Swift's Residential Cost Handbook provides detailed estimates of construction costs per square foot for houses of various size, material (e.g., stud framed, masonry), and quality. DataQuick data provides median square footage estimates per census tract. By using a single-story, stud-framed, stucco house estimates as the basic house profile and assigning construction quality based on median home price, building costs estimates were then generated in each census tract.

In addition to these "vertical" costs of homebuilding, it is also necessary to include development costs (not counting the developer's profit or returns to the landowner). There are two types of development costs that should be considered: "soft" costs and "hard" costs. Soft costs include the cost of design, permitting, marketing and sales. Hard costs of development include costs of grading, construction of local roads, installation of water collection systems, construction of parks, clubhouses and other amenities within the development, bringing utilities to the project, installation of streetlights, and other physical costs. These costs are summarized in table. For purposes of this study, total horizontal costs are assumed equal to 23% of the vertical cost of homebuilding. The sum of the building cost, soft cost and hard cost is the builder cost of new housing.

To determine the supply function for land, this analysis assumes the supply of developable land is fixed within each census tract (the supply curve is vertical.) The pre-regulation supply of land in census tract $i$ is set equal to the total acreage of projected greenfield development:

$$q_0^i \equiv G_i$$

[81] The median number of rooms is defined in the census to include bedrooms, kitchens, living rooms and dining rooms but not bathrooms, closets or hallways. This measure was inflated to square footage by assuming each "gross" room was 380 square feet. This estimate was obtained by an auxiliary regression of the DataQuick data.

To determine greenfield development in each census tract, we adopt a method used by Landis and Reilly (2003), in which the overall urban footprint (including residential, commercial and public development) equals total new population divided by the gross density of people per acre, scaled to account for infill development.[82] Mathematically, projected greenfield development $G$ is expressed as

$$G_i = (1 - F_i)\frac{\Delta P_i}{D_i},$$

where $F$ is the infill share, $P$ is population, and $D$ is the gross density of persons per acre.[83]

Determining the change in population requires forecasts of population at the end of the analytic timeframe and estimates of present-day population. Population forecasts are derived from several sources, in order of preference. Wherever available, they were derived from the region's federally-designated metropolitan planning organization (MPO). Typically created by county governments, these forecasts are the preferred source for growth estimates because they are created using detailed knowledge about local growth trends and characteristics, potentially resulting in higher quality data than those obtained with mathematical forecasting techniques.

For counties where such forecasts were not available, the analysis uses projections created by researchers at UCLA and CalTrans for transportation planning.[84]

Present-day population figures were obtained from Applied Geographic Systems, a private supplier of demographic data. These data draw from a wide range of sources, including the Census, Internal Revenue Service, the Bureau of Labor Statistics, the United States Postal Service and the credit reporting agency, Experian.

The demand[85] function is identified using the pre-regulation equilibrium quantity and supply of land, along with an estimate of the elasticity of demand for land derived from the land economics literature. This elasticity is taken to be -1.0. The quantity of land to be developed must equal the fixed supply discussed in the preceding section. The price of land is determined by estimating bid-rent functions for the area designated as critical habitat and using intensive margin land values.

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[82] John D. Landis and Michael Reilly, "How We Will Grow: Baseline Projections of the Growth of California's Urban Footprint through the Year 2100" (August 1, 2003). Institute of Urban & Regional Development. IURD Working Paper Series. Paper WP-2003-04. http://repositories.cdlib.org/iurd/wps/WP-2003-04

[83] For brevity, the $i$ subscript is omitted in future formulas. All calculations are indexed at the census tract level.

[84] See "California Travel Trends and Demographics Study," California Department of Transportation, Division of Transportation Planning, Office of State Planning. December 2002.

[85] For purposes of calculating changes in the price of land, the demand curves for land and housing are assumed to be linear. This is a valid assumption since only small deviations around the initial equilibrium typically result from critical habitat designation.

Combining the pre-regulation equilibrium price and quantity of land demand with the elasticity of demand for land identifies the land demand curve. Let $\eta$ be the elasticity of demand for land. Then,

$$\eta = \frac{dQ}{dP}\frac{P}{Q} \Rightarrow \frac{dP}{dQ} = \frac{p_0}{q_0\eta} \Rightarrow P = \frac{p_0}{q_0\eta}Q + \beta \Rightarrow P = \frac{p_0}{q_0\eta}Q + p_0\left(1 - \frac{1}{\eta}\right).$$[86]

The rationed housing scenario uses a similar method, with prices and quantities expressed in terms of new housing units in each census tract. New housing units are calculated using the same procedure as for the densification scenario, but also accounting for average numbers of persons per household in each census tract, obtained from the 2000 Census.

## A.2 Spatial Allocation of Economic Activity

A key assumption implicit in the above model is the ability to accurately predict the spatial distribution of housing and land development.

The quantity of development within critical habitat is calculated probabilistically using a mathematical identity. First, divide the census tract enclosing one or more habitat units into one-hectare grid cells, supposing there are *n* cells. The analysis proceeds according to whether the tract is covered by the CURBA model.

If so, then the CURBA model gives a probability that each cell will be developed by 2025. Define the CURBA prediction function $C : \{1,\ldots,n\} \to [0,1]$ mapping each cell to its respective probability of development. The analysis assumes the identity

$$G = \lambda \sum_{i=1}^{n} C(i)$$

holds—in other words, the sum of probability scores within each census tract, scaled by a fixed multiplier, is identically equal to the total projected greenfield development for that tract. Now solve for $\lambda$ and let the sets $H_A$ and $H_B$ be those cells that fall in Group A and B critical habitat. Then the expected development in Group A habitat is given by

$$G_A = \lambda \sum_{j \in H_A} C(j),$$

with $G_B$ defined similarly.

[86] This calculation is valid as long as there is developable land within the census tract, i.e. $q_0 > 0$. If there is no developable land than the impact of designation is zero.

# Appendix B ECONOMETRICS

A hedonic regression was used to estimate the regional intensive margin value of land within the main regions of the study area. Using DataQuick data on new home sales, we fit the model

$$price = \beta_0 + \beta_1 lotsize + \beta_2 sqft + \beta_3 beds + \beta_4 baths + \beta_5 stories + \boldsymbol{\beta}\mathbf{tract}$$

for each region affected by critical habitat designation, where:

- *lotsize* is the size of the home's lot in square feet;
- *sqft* is square footage of the dwelling unit;
- *beds* is the number of bedrooms;
- *baths* is the number of bathrooms, including half bathrooms;
- *stories* is the number of stories; and
- **tract** is a vector of indicator variables capturing fixed effects for each census tract.

Coefficient $\beta_1$ denotes the marginal effect on price of an acre increase in lot size, holding the other major determinants of home price constant. Table B-1 through Table B-3 display OLS results for each major region where data are available.[87] Observations were subsampled to eliminate outliers and present a representative estimate of the type of greenfield development expected to be affected by critical habitat designation.

The values contained in these tables denote the intensive margin value of an acre of land. In a perfectly competitive market, these estimates will equal the extensive margin value of land, defined as the producer's margin on new home production, scaled by lot size.[88] If the values differ, they suggest that housing is rationed, lending support to that portion of this analysis as the relevant method of assessing the economic impacts of designation. A secondary analysis reveals that, among the five census tracts with highest projected developed in critical habitat, the extensive margin value exceeded the intensive more than 97% of the time; a *t* test strongly rejects the null hypotheses that the two are equal (*p*-value: 0.000).

[87] Because data availability and completeness vary by county, it was not possible to estimate the full model for every region or county affected by critical habitat designation.

[88] Extensive margin = (price – buildcost) / lot size

**Table B-1: Regression Results for Bay Area**

| Independent variable | Coefficient | Standard error | t | p-value |
|---|---|---|---|---|
| lotsize | 13.2 | 0.9 | 15.3 | 0.000 |
| sqft | 159.0 | 4.3 | 37.2 | 0.000 |
| bed | 9,852.9 | 2,572.5 | 3.8 | 0.000 |
| bath | -925.7 | 2,121.9 | -0.4 | 0.663 |
| stories | | N/A[89] | | |
| Constant | 159.0 | 4.3 | 37.2 | 0.000 |
| $N$ | 3.471 | | | |
| $R^2$ | 0.7549 | | | |

**Table B-2: Regression Results for Southern California**

| Independent variable | Coefficient | Standard error | t | p-value |
|---|---|---|---|---|
| lotsize | 12.6 | 0.4 | 32.0 | 0.000 |
| beds | -40,495.6 | 1,170.5 | -34.6 | 0.000 |
| baths | 96,684.9 | 2,176.8 | 44.4 | 0.000 |
| sqft | 165.2 | 2.1 | 78.7 | 0.000 |
| stories | -83,576.6 | 2,441.7 | -34.2 | 0.000 |
| Constant | 14,696.6 | 4,693.6 | 3.1 | 0.002 |
| $N$ | 48,677 | | | |
| $R^2$ | 0.6413 | | | |

**Table B-3: Regression Results for Central Valley**

| Independent variable | Coefficient | Standard error | t | p-value |
|---|---|---|---|---|
| lotsize | 5.9 | 0.4 | 15.5 | 0.000 |
| beds | -3,795.4 | 1,301.9 | -2.9 | 0.004 |
| baths | 17,356.1 | 2,859.6 | 6.1 | 0.000 |
| sqft | 118.2 | 2.6 | 45.7 | 0.000 |
| stories | -32,432.8 | 3,129.6 | -10.4 | 0.000 |
| Constant | 10,144.6 | 5,093.1 | 2.0 | 0.046 |
| $N$ | 7,967 | | | |
| $R^2$ | 0.7279 | | | |

[89] Variable not available for Bay Area counties.