

**AN ALTERNATIVE FUTURE FOR THE REGION OF CAMP PENDLETON, CALIFORNIA**



This study of urban growth and change in the region between San Diego and Los Angeles, California, is the product of student work in a graduate-level studio at the Harvard University Graduate School of Design. The project has been sponsored by the Harvard University Graduate School of Design and there is no consultative relationship between any stakeholder organizations or individuals in the study region and Harvard University, its faculty or students. The work presented here is the full responsibility of the students who were members of the studio group.

This summary of the group's findings presents issues, planning strategies, and design proposals. Its primary purpose is one of mutual education: for the students who are or will become professionals in landscape architecture, architecture, urban and regional planning and design; and for the stakeholders of the region, who have the responsibility for developing their own proposals and who may benefit from the insights and ideas developed by the students.

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1997

## **An Alternative Future for the Region of Camp Pendleton, California**

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## Abstract

This report describes the process and products of a Fall 1996 studio at the Harvard University Graduate School of Design. The studio explored urban growth and change in the rapidly developing region located between San Diego and Los Angeles, California, at four scales—the region as a whole, the Temecula Valley, a new urban center, and five typical sites—to the years 2010 and 2030.

This report describes the pressures created by the trend of urbanization, proposes an alternative conservation and design strategy, outlines some important costs and benefits, and offers suggestions for implementation.

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## Foreword

Some Notes on the Organizational Framework of the Study and the Processes of Design  
Carl Steinitz

Studies described in this report are based upon a research program, "Biodiversity and Landscape Planning: Alternative Futures for the Region of Camp Pendleton, California," which explored how urban growth and change in the rapidly developing area located between San Diego and Los Angeles might influence the biodiversity of the area<sup>1</sup>. The research was conducted by a team of investigators from the Harvard University Graduate School of Design, Utah State University, the National Biological Service, the USDA Forest Service, The Nature Conservancy, and the Biodiversity Research Consortium. (Steinitz et al, 1996)

Recently, the U.S. Environmental Protection Agency's Science Advisory Board identified habitat modification and loss of species as two factors which pose the highest level of environmental risk to the country. The intent of the research was to examine the connections among urban, suburban, and rural development and the consequent stresses on native habitats and biodiversity in a region that is one of the most biologically diverse in the continental United States.

The major product of the research is a computer-based Geographic Information System and a set of models which evaluate the complex dynamic processes of the very large study area and the possible impacts on biodiversity resulting from changes in land use. The soils models evaluate the agricultural productivity of the area's soils. The hydrology models predict the 25-year storm hydrographs for each of the rivers and their subwatersheds, flooding heights and water discharge, and resultant soil moisture. The fire models assess both the need for fire in maintaining vegetation habitat, and the risks of fire and fire suppression. The visual model assesses scenic preferences for the region's landscape. Biodiversity is assessed in three ways: a landscape ecological pattern model; ten selected single species potential habitat models; and a species richness model.

A 1995 graduate-level studio at the Harvard Graduate School of Design applied the research framework in the design and comparison of the implications of six alternative regional conservation-development strategies for the study region. The 1996 studio had the challenging task of proposing a "best alternative design."

The studio was organized to answer six questions following the framework outlined by Carl Steinitz (1990), as was the research program which provided a context for this study. The framework as shown in Figure 1 identifies six different questions, each of which is related to a theory-driven model or answer. The framework is “passed through” at least three times in any project: first, downward in identifying the context and scope of the study—*defining the questions*; second, upward in specifying the methods of design—*deciding how to answer the questions*; and third, downward in carrying the design to its conclusion—*providing the answers*.

The six questions with their associated modeling types are listed in the order in which they are usually considered when initially defining a design study:

- I. How should the state of the landscape be described; in content, boundaries, space, and time? This level of inquiry leads to Representation models.
  - II. How does the landscape operate? What are the functional and structural relationships among its elements? This level of inquiry leads to Process models.
  - III. Is the current landscape functioning well? The metrics of judgment—whether health, beauty, cost, nutrient flow, or user satisfaction—lead to Evaluation models.
  - IV. How might the landscape be altered; by what actions where and when? This is directly related to the first modeling type, described above, in that both are data; vocabulary and syntax. This fourth level of inquiry leads to Change models. At least two important types of change should be considered: change by current projected trends, and change by implementable design, such as plans, investments, and regulations.
  - V. What predictable differences might the changes cause? This is directly related to II, above, in that both are based on information; on predictive theory. This fifth level of inquiry shapes Impact models, in which the process models (II) are used to simulate change.
  - VI. Should the landscape be changed? How is a comparative evaluation among the impacts of alternative changes to be made? This is directly related to III, above, in that both are based on knowledge; on cultural values. This sixth level of inquiry leads to Decision models.
- Implementation could be considered another level, but this framework considers it as a forward-in-time feedback to Level I, the creation of a changed representation model.

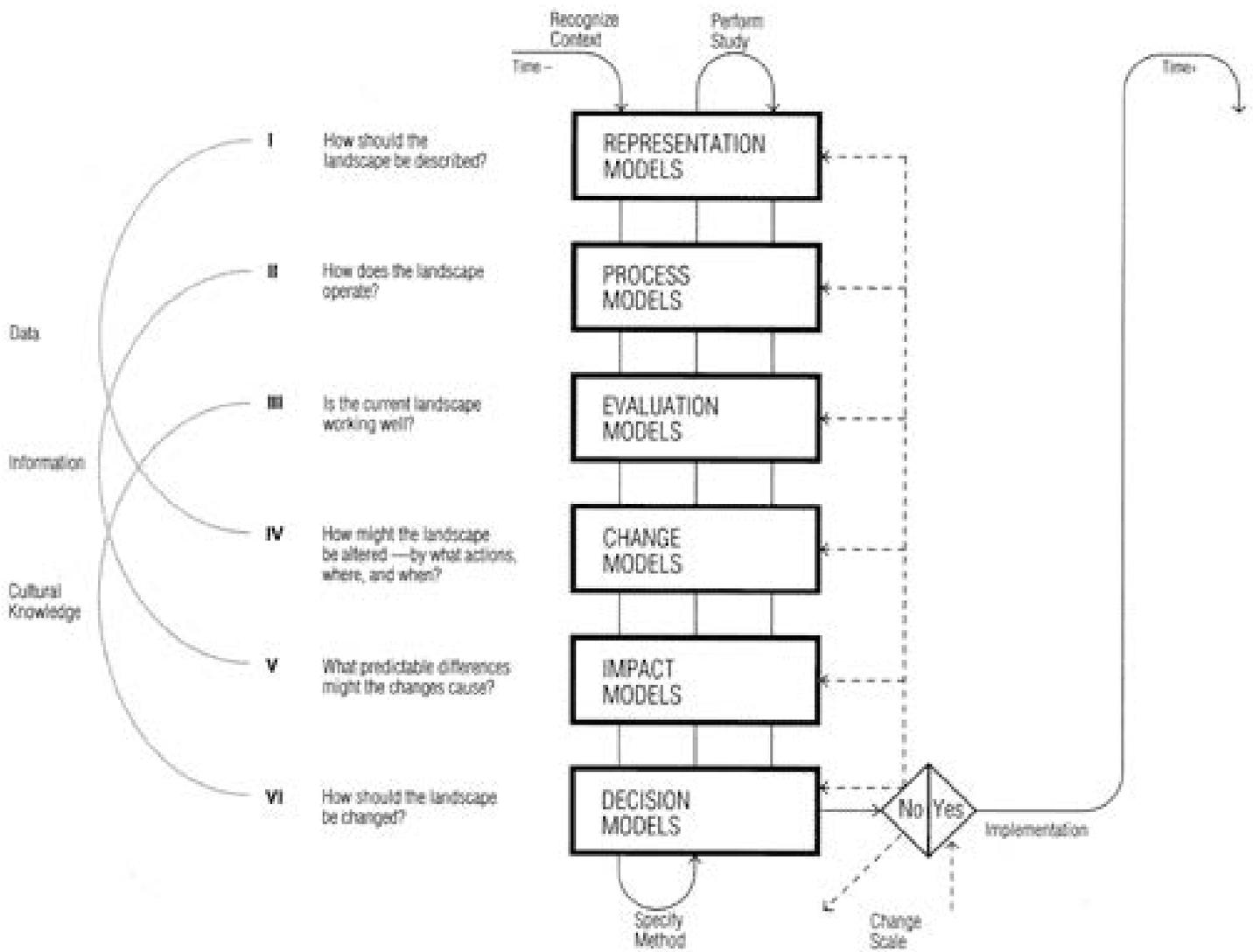


Figure 1 The Framework  
Steinitz (1990, 1996)

Note that the six levels have been presented in the order in which they are normally recognized.

However, it is more important to consider them in reverse order as a more effective way of both organizing a landscape study and specifying its methods. The methods should be organized and specified upward through the levels of inquiry, with each level defining its necessary contributing products from the models next above in the framework.

VI. To be able to decide to make a change (or not) one needs to know how to compare alternatives.

V. To be able to compare alternatives, one needs to predict their impacts from having simulated changes.

IV. To be able to simulate change, one needs to specify (or design) the changes to be simulated.

III. To be able to specify potential changes (if any) one needs to evaluate the current conditions.

II. To be able to evaluate the landscape, one needs to understand how it works as processes; and

I. To understand how it works, one needs representational schema to describe it.

Then, in order to be effective and efficient, a landscape project should progress downward at least once through each level of inquiry, applying the appropriate modeling types:

- I. Representation
- II. Process
- III. Evaluation
- IV. Change
- V. Impact
- VI. Decision

At the extreme, two decisions present themselves: “no” and “yes.” A “no” implies a backward feedback loop and the need to alter a prior level. All six levels can be the focus of feedback; (IV), “redesign”, is a frequently applied feedback strategy. A “contingent yes” decision (still a “no”) may also trigger a shift in the scale or size or time of the study. (An example is a highway corridor location decision made on the basis of a more detailed alignment analysis). In a scale shift, the study will again proceed through the six levels of the framework, as previously described.

A project should normally continue until it achieves a positive, “yes,” decision. A “yes” decision implies implementation and (one assumes) a forward-in-time change to new representation models.

While the framework and its set of questions and models looks orderly and sequential, it frequently is not so in its application. *The line through any project is not a smooth path: it has false starts, dead ends, and serendipitous discoveries*—but our activities do pass through the questions and models of the framework as I have described it, before a “yes” can be achieved. The same questions are posed again and again. However, the models, which are the answers, vary according to the context; this can be seen in the several examples at each scale of design illustrated in this report.

A long tradition of “top-down” decision-making characterizes the realm of physical planning and design. The tradition is reflected in the normal practice of considering scale-related decisions in a hierarchical manner: the larger, regional issues being considered first and the more local, “stakeholder-scale” aspects being considered last. There is also a history of the reverse, of “bottom-up” decision-making, in which the future of an area is considered as being the sum of the actions of its individual parts.

Neither of these approaches defined this study. Rather, four scales of design were investigated *simultaneously*, with each level cognizant of, and necessarily interacting with, the ones “above” and “below” and forward-in-time. At each scale, the previously described six-question framework was explicitly or implicitly the basis for structuring the design activities and for inter-scale discussion. The students working at each scale were also aware of the time dimensions of their realm of design. Thus, this study was the first to “test” the usefulness of the Steinitz framework in its changing-scale and changing-time modes (Figure 2).

Most interesting—both from a pedagogic and a professional perspective—is the differentiation among scale-dependent design studies in the *languages* in which design proposals and decisions were expressed.

The regional-scale design issues were expressed as larger conservation acquisitions and regional conservation-oriented regulatory approaches, and as major public capital infrastructure investments aimed at influencing urbanization patterns. As can be seen in the regional implementation strategy, these would be public actions.

The design issues at a sub-regional scale, such as those considered in the studies of the new City Center area of the Temecula Valley, tended to be expressed in the normal language of urban design: transportation patterns, major land use and zoning decisions, built-massing studies, and diagrammatic activity—relationships such as those among schools, recreation, and residential areas. These would reflect public policies and actions and guide private investment. This scale of design is illustrated in the proposed 2030 design for the Temecula Valley.

At the scale of a large site, where one major investor-stakeholder can control a multi-stage development, the language of design was that of site planning. It included road alignment, “in-scale” land use and building massing, as well as schematic design of major development and built-landscape elements. This site planning approach was applied in the studies of the five typical sites.

Finally, and at the scale of a typical individual stakeholder (for example, the builder of one house on one property), are the various site development guidelines. A study of this type does not yet involve the detailed design that is the common practice of architecture and landscape architecture. There is too much variation; furthermore, there is a potentially excessive infringement of individual judgment. Rather, the focus is on guidelines, which are expressed as diagrammatic “do” and “don’t” principles which reflect public influences on private actions. They shape a design-space within which private decision-making is dominant.

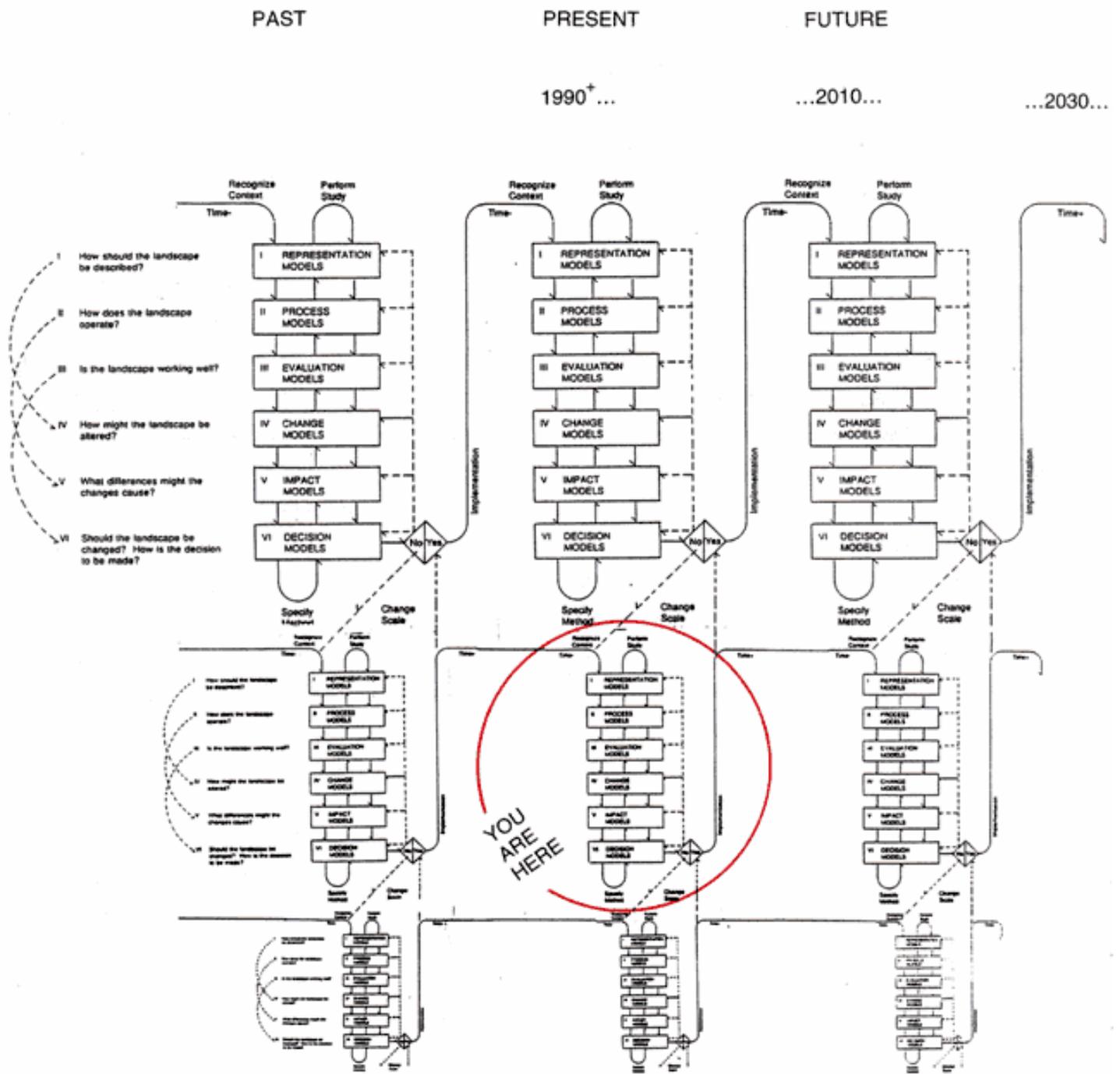


Figure 2 The Framework, Changing in Time and Scale

None of these scale-related modes of representation and design comes as a surprise. But what *is* notable is that at each scale the language of representation of the design is *different*: law, investment, infrastructure, conservation, zoning, massing, schematic design, guidelines, and exemplar cases. *All* of these are *design* languages, especially when acknowledging Herbert Simon's definition: "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones." <sup>2</sup>

Another notable aspect of the study is its non-hierarchical approach across the several scales of design. Each inter-scale negotiation (and there were many) involved at least two representational languages for the same content-issue. And many of these discussions "jumped" scales. Many were discussions with parallel interests. However, many more were directed at resolving conflicts; at one scale the decision may favor conservation, but the same geography, seen through the lens of a different scale, may favor development. Observation of these many negotiations revealed a dominant (but not universal) pattern of resolution. In general, decisions in which "demand issues" were dominant tended to be resolved in favor of the larger area (smaller scale) over the smaller area (more detailed, larger scale). Examples include the location of a needed road, the location of water storage capacity, the area required for institutions or industry. However, situations in which "supply issues" were crucial tended to favor the more detailed over the more general. Examples are the conservation of habitat for the California gnatcatcher and other rare and endangered species, wetlands, historic places, and steep slopes. The more spatially detailed guidelines had a major influence on the regional conservation strategy.

In this study, neither the more commonplace "top-down" or "bottom-up" design approaches would have been as effective as this more complex, interactive one. For stakeholders and designers working to improve the "larger landscape," perhaps this is one of the most important lessons to be derived from the study.

## Introduction

### Representation



The study region is a 9,000 sq. km rectangle that encompasses several major river drainage basins and is seen in its California context in Figure 3. It is one of the country's most desirable places to live, and in 1990, had a population of about one million. The regional planning agencies forecast the population to increase by 500,000 by the year 2010, and it is expected to continue growing beyond that date. Marine Corps Base Camp Pendleton, one of the United States' major military facilities, occupies 50,000 hectares with twenty-seven kilometers of coastline and is the largest unbuilt portion of land on the southern California coast. Camp Pendleton will also be more intensively used in the future as other military bases close.

This landscape has several major physiographic regions that range from coastal to mountain, and includes the Temecula Valley. As a result, the study area is one of the most biologically diverse environments in the continental United States. It includes a wide variety of habitat types including coastal lagoons and estuaries, coastal scrub areas, maritime-influenced chaparral and scrub communities, oak woodlands, coniferous mountain areas, and dry, hot, sparsely-vegetated deserts. Each of these supports a unique range of

animal species. Within the region are over 200 plants and animals listed by federal or state agencies as endangered, threatened, or rare. These include the least Bell's vireo, the coastal cactus wren, and the California gnatcatcher. In addition, a number of plants and animals are of local concern due to declining populations, such as the California cougar.

Most who fly over this area, think of the region simply as "open space" between two large cities. Even though it is the "far end" of three counties—Orange, Riverside, and San Diego—it is, in reality, one of the country's fastest urbanizing regions. Land is very expensive, especially along the coast; the value of private land decreases rapidly with distance from the coast.

All of the region's unbuilt private land is zoned or planned for development. The region has considerable amounts of public land, and the remaining land—belonging to several Native American nations—is exempt from public land use controls.

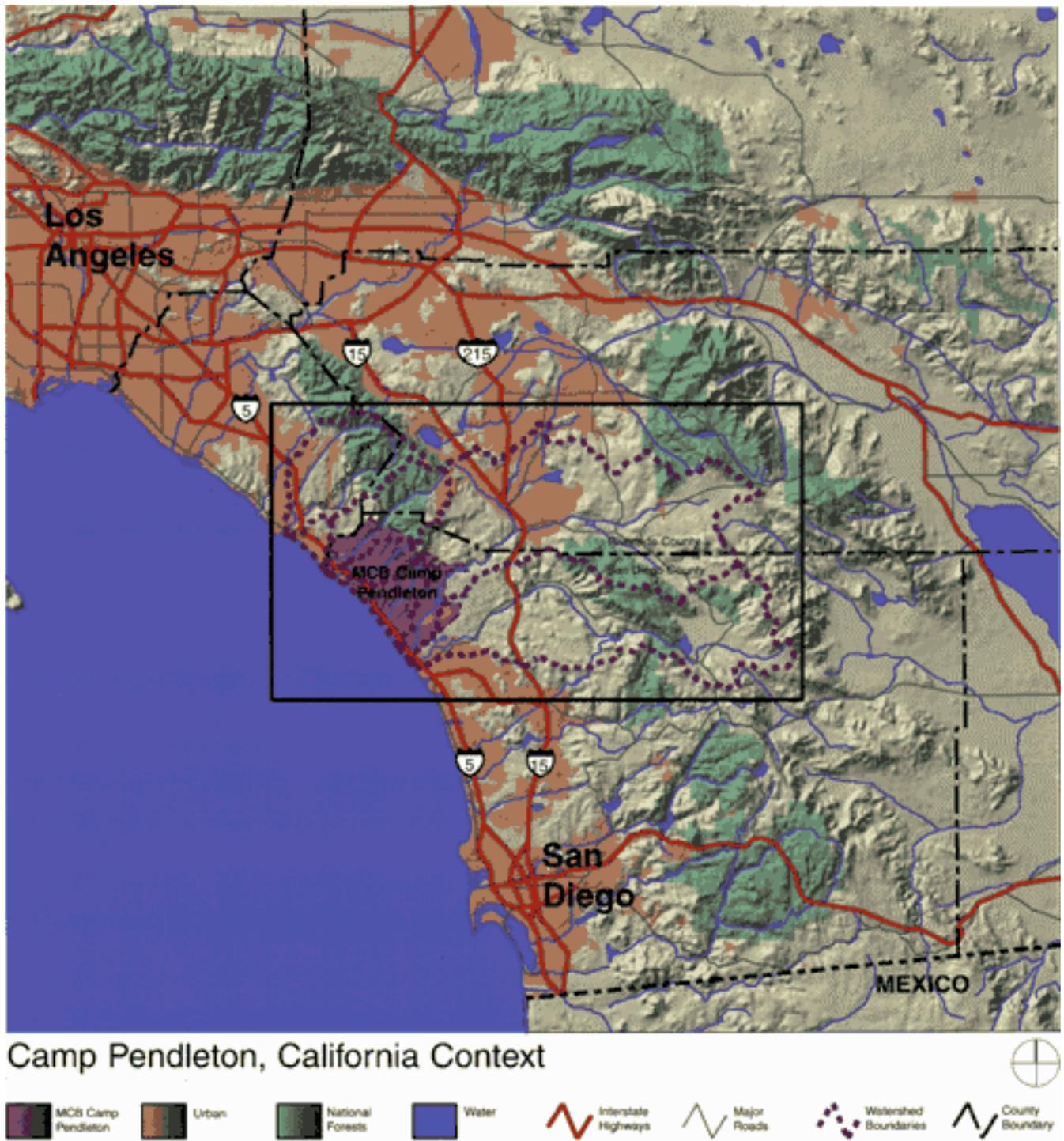


Figure 3

## Alternative Regional Futures

### Change, Impact, Decision



Future change for the region was simulated using the State of California's regional population projections and the complete implementation, or "build-out," of the area's current plans. The projections based on current plans indicate a future urbanization of all currently unbuilt land in the region (Figure 4).

In addition, a Fall 1995 graduate-level studio simulated and compared five alternative scenarios reflecting different development and conservation policies.<sup>3</sup> Alternative #1 illustrated the implications of a continuation of the current spread of extensive single-family and rural-residential growth, with an assumed disregard of the regional plan (Figure 5). Alternative #2 also followed spread development, but it introduced a major conservation effort in the year 2010 (Figure 6). Alternative #3 proposed private conservation by encouraging large lot ownership adjacent to and within important habitat areas (Figure 7). Alternative #4 employed a multi-centers approach based on cluster development and new communities. Finally, Alternative #5 concentrated growth in a new city (Figure 9). All of the alternatives accommodated the projected population forecast and were then extended to build-out. The following are some probable

impacts of the changes between the 1990s baseline and the build-out of existing plans.

With the exception of land on Camp Pendleton, there will be a nearly complete loss of agriculturally productive soil to urban development.

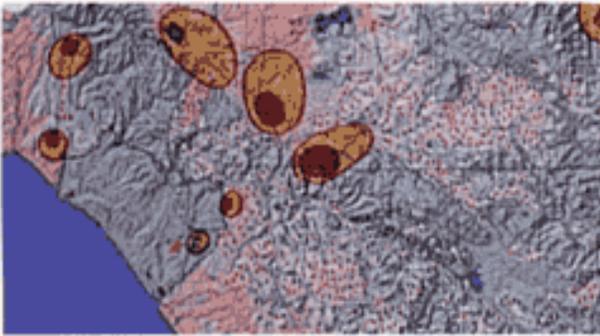
The landscape ecological pattern will transform from a well-connected, natural landscape with urban areas into an urban landscape with fragmented natural areas.

With the exception of those species that live on the biologically well-managed Camp Pendleton and the Cleveland National Forest, several important species, including some that are threatened and endangered, will have significantly smaller areas of habitat.

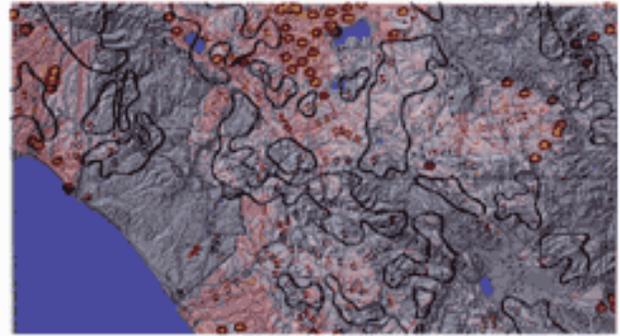
Species richness of the region's 375 vertebrate species will decline. Approximately 20 species could become regionally extinct; most at risk are birds dependent upon riparian habitats.

Vegetation will change due to the suppression of fire that accompanies urbanization. Fuel build-up

Figure 4



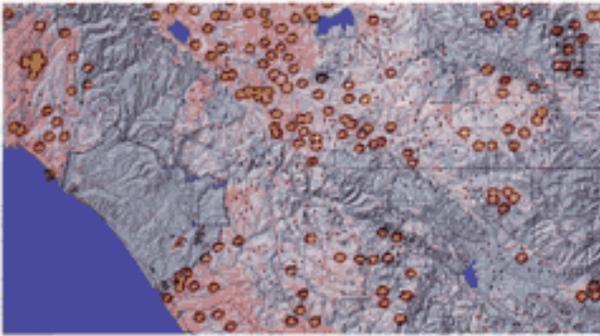
Plans Build-Out



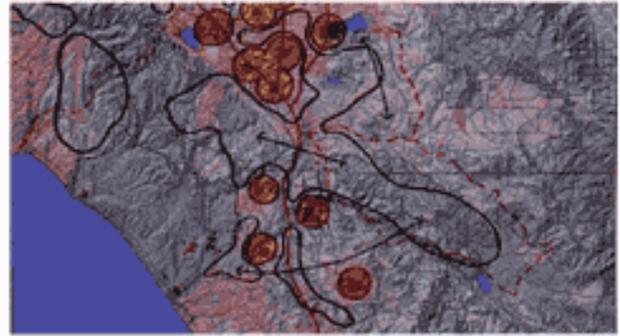
Private Conservation

Figure 5

Figure 6



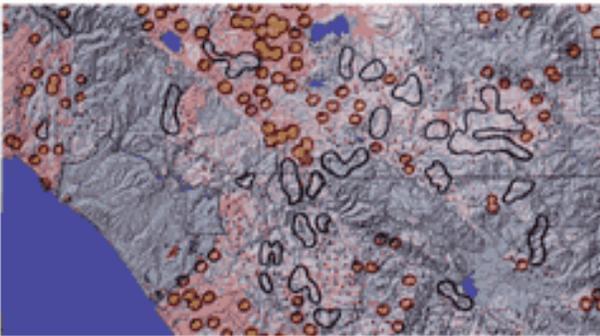
Spread



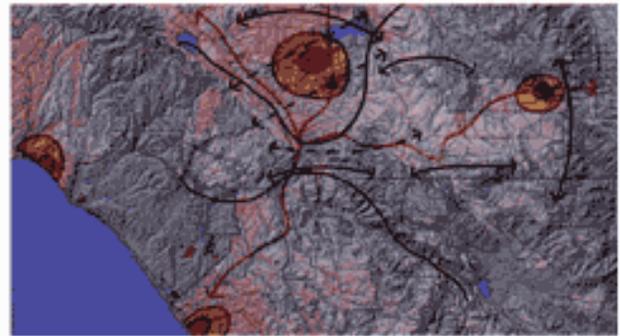
Multi-Centers

Figure 7

Figure 8



Spread with Conservation 2010



New City

Figure 9

in areas of fire suppression will place houses located in fire-prone areas at greater risk.

When the several regional alternatives were developed to build-out and their impacts compared, each exhibited a similar pattern caused by the transformation of a "natural" regional landscape into a predominantly "urbanized" one. The most beneficial and least damaging alternatives from the perspective of biodiversity are those which combine low-density private conservation and the more concentrated new city and multiple-centers approaches; the worst are the existing plans of the region's many jurisdictions and their consequent spread development.

This first comparison of alternative futures had three dominant conclusions. First, there are several key areas where the currently linked natural landscape is vulnerable to fragmentation from future development. Second, the alternative that delayed conservation until the year 2010 demonstrated that by that time it would be too late; there would be little left worth conserving for the maintenance of biodiversity. The third major conclusion was that one of the major hydrological consequences of upstream change would be an increase in storm runoff as areas of higher infiltration potential are paved, causing an increase in flooding in all the major rivers and particularly in the Santa Margarita River Basin; flood peaks would double where the river passes Camp Pendleton's air base.

These three related findings shaped the problem that was posed to the fall 1996 graduate student studio: "What is the best, most feasible alternative for the study area that accommodates at least 40 years' population growth, maintains biodiversity, and minimizes hydrological damage?"

## The Organization of the Study

The 1996 studio began with an introduction to the research data and models and to the alternative futures produced by the 1995 studio. Then, without a pre-identified client, site, or program, all participants went to California, toured the study region, met with people who know the area, and got to know it as best they could.

Upon returning to Harvard, the students performed two short, yet important, exercises. First, each student diagrammed the entire study: its issues, methods, and products. Then each person made a design proposal of what the region should be in 2030. The students compared and discussed these diagrams and designs as the class came to consensus about the organization of the studio and its work. The studio decided to consider three types of change: changes in scale, changes in time, and changes in design strategy (Figure 10). Four scales would be considered: the region as a whole; the Temecula Valley and a new urban center; five areas typical of the region's different combinations of landscape and development; and guidelines for development on the wide range of site conditions found in the region. However, these several scales would be studied simultaneously, rather than hierarchically.

The class adopted a two-stage timeline, with a first stage date of 2010 coinciding with the regional population forecast and a second extrapolation to 2030.

Finally, the class decided to organize into a single team which would try to design one "best" proposal that took into account the realities of the region.

This report describes the pressures created by the predicted population increase and the current trend of urbanization; describes the proposed conservation and development design strategies; shows at four different scales how these influence regional urbanization, the Temecula Valley (the area likely to see the greatest change), the new urban core, and the five typical areas; outlines some of its costs and benefits; and offers suggestions for implementing the design.

# THREE TYPES OF CHANGE

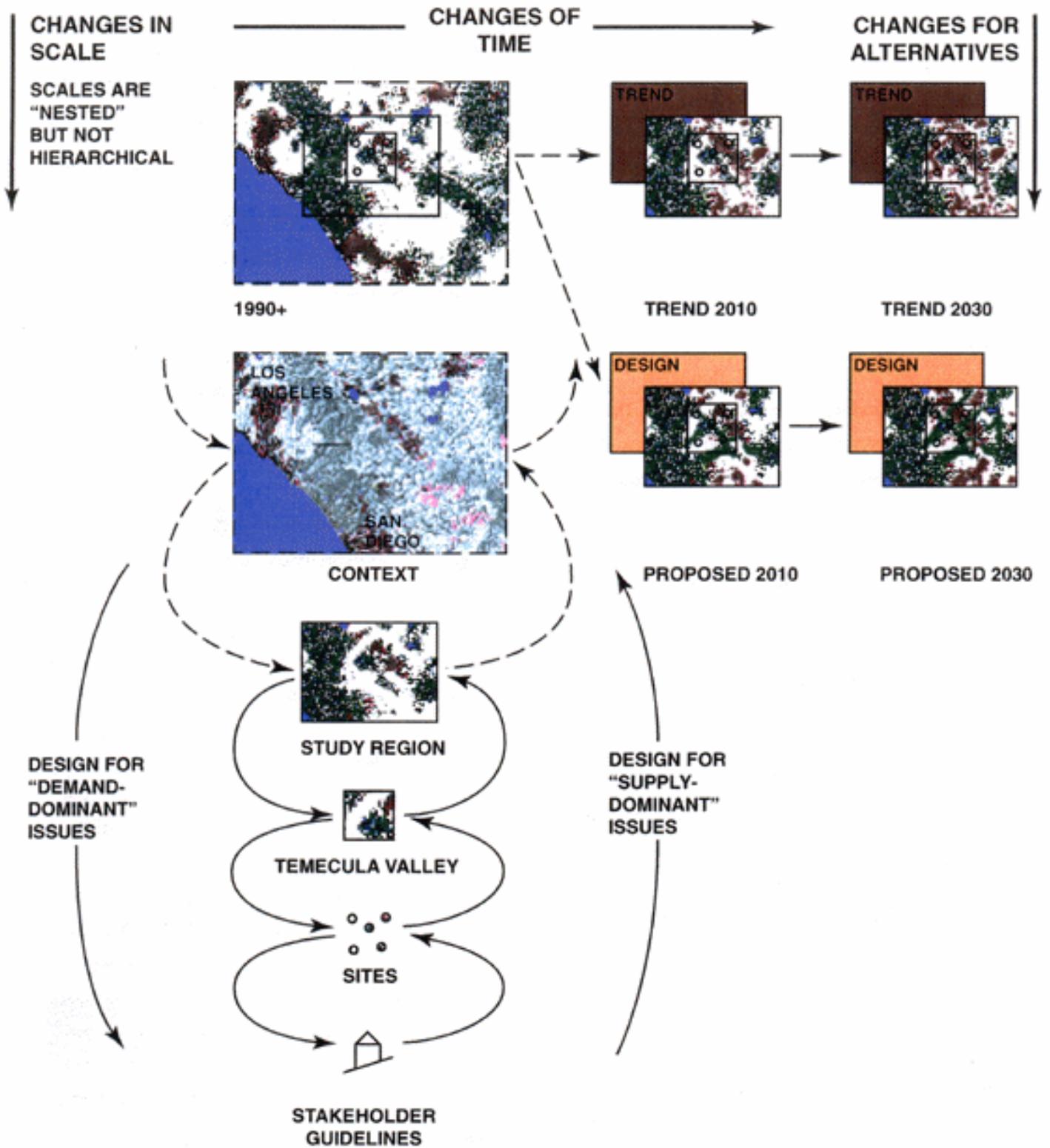


Figure 10

## The Model of Urbanization

### Representation, Process, Evaluation

The strategy of the study required a model of urbanization that could be used to predict how the region would change with the existing trends of development and as a result of alternative conservation and development strategies. The model of urbanization was formulated conceptually and logically, then organized as a GIS-based allocation algorithm.

As described in the flow chart in Figure 11, the model begins with a map representing the state of urbanization at time 1 (1990+), and results in output maps of future urbanization at future times (in this case, 2010 and 2030).

The exogenous changes that trigger the model are new population and the resulting demand for land for new urban uses. New development is allocated according to the four primary categories of urban development recognized by California regional planning agencies: commerce and industry, multi-family residential, single-family residential, and rural-residential development. Multi-family residential occurs at about 20 units per hectare; single-family residential is considered to be 10 units per hectare; and rural residential is considered to be an average of two hectares per unit.

The algorithm begins with an assessment of the land available for future development. Developable land is unbuilt and privately owned.

The model then considers existing local plans, zoning, and other constraining regulations. In the trend, all future allocation will conform to these constraints.

Next, the model identifies zones of development priority based upon two assumptions: that new development occurs on or near existing, accessible utility infrastructure; and it occurs close to existing transportation networks (Figure 12). Three priority levels are defined, the highest of which has existing utility infrastructure and is within 100 meters of major roads and intersections.

In addition, allocation of urban development reflects regional differences in land desirability from the point of view of potential developers. As seen in Figure 13, the land most desirable for development is close to the coast, and intensity of new construction tends to decrease with increasing distance from the coast.

The combination of these attractive factors—available land, zoning, infrastructure, and regional desirability—results in a map of ranked priority zones for each land use group.

While recognizing that these variables are important, they are by no means the only factors governing new development. Therefore, the model incorporates an element of randomness into the new urban development allocation. The randomness does not violate any of the previously described constraints or demands.

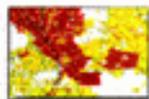
LAND COVER - TIME<sub>1</sub>



DESIGN ACTIONS



CONSERV.

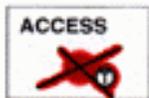


ZONING



INFRASTR.

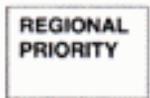
● COMMERCE / INDUSTRY



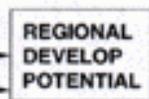
ACCESS



SITE DEVELOP PRIORITY



REGIONAL PRIORITY

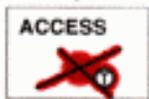


REGIONAL DEVELOP POTENTIAL



NEW COM / IND ALLOCATION

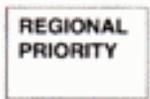
● MULTI-FAMILY RESIDENTIAL



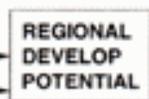
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SITE DEVELOP PRIORITY



REGIONAL PRIORITY



REGIONAL DEVELOP POTENTIAL



NEW M-FAM RES ALLOCATION

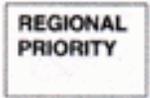
● SINGLE-FAMILY RESIDENTIAL



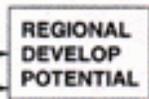
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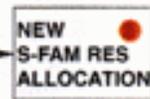
SITE DEVELOP PRIORITY



REGIONAL PRIORITY

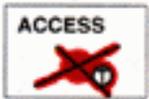


REGIONAL DEVELOP POTENTIAL

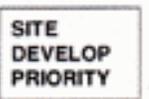


NEW S-FAM RES ALLOCATION

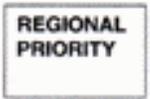
● RURAL RESIDENTIAL



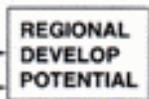
ACCESS



SITE DEVELOP PRIORITY



REGIONAL PRIORITY



REGIONAL DEVELOP POTENTIAL



NEW RUR RES ALLOCATION

LAND COVER - TIME<sub>2</sub>



(REPEAT FOR NEXT TIME PERIOD)

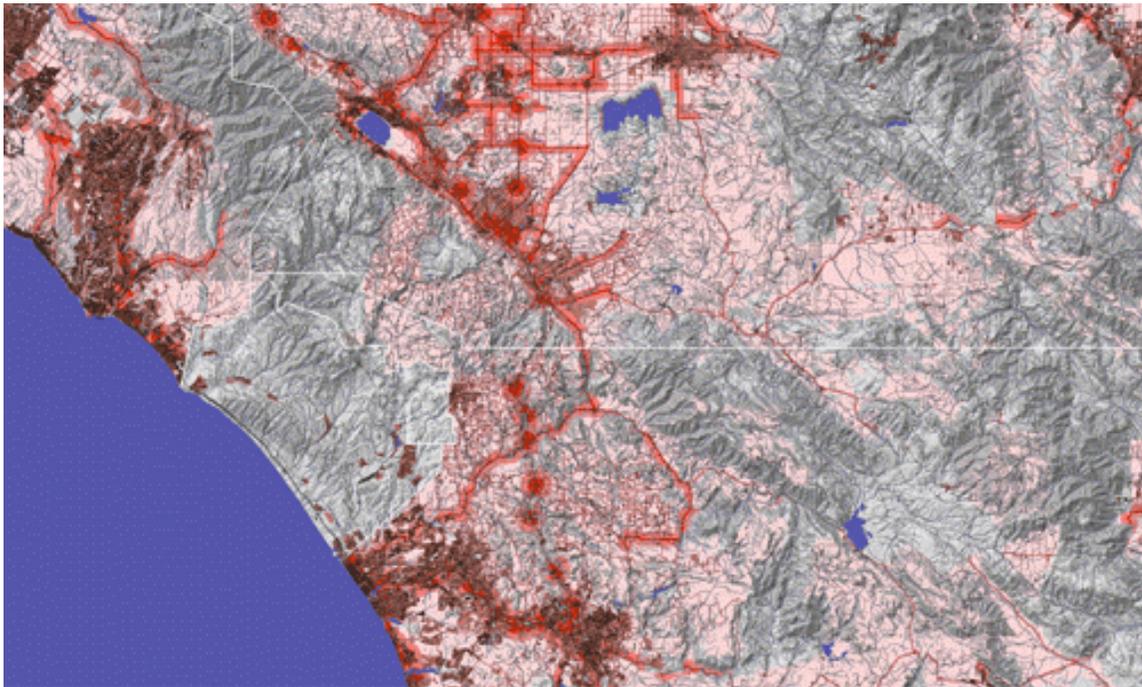
POPULATION CHANGES



LAND USE CHANGES



Figure 11

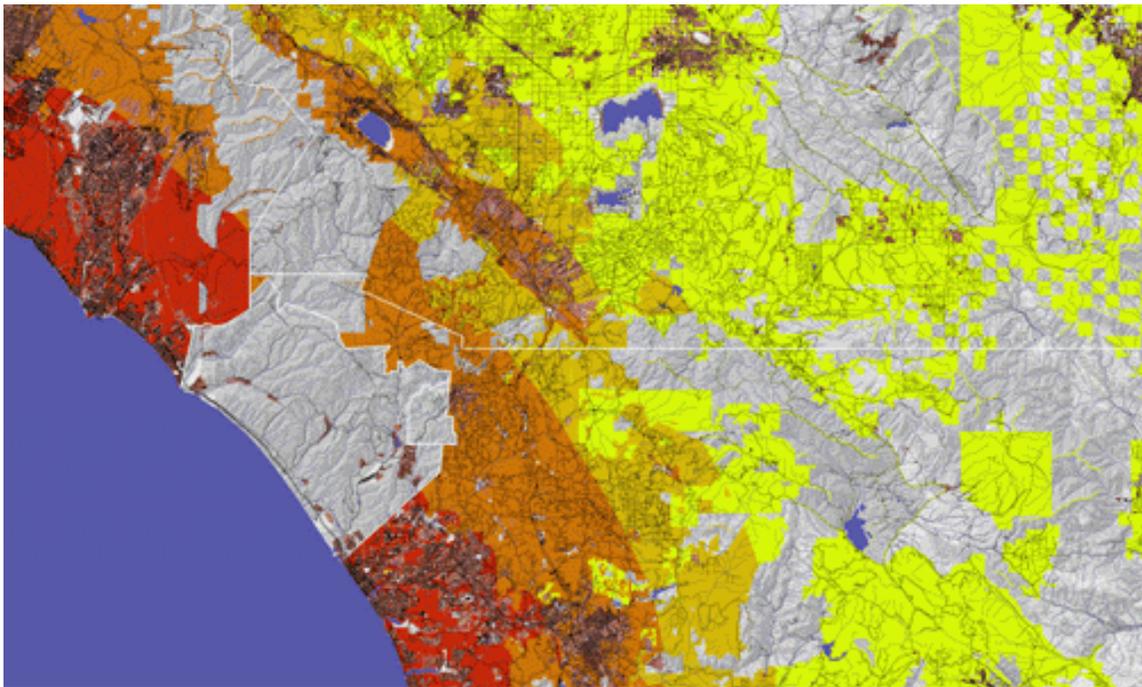


**Access To Roads and Utilities**

 Priority 1 (Highest)	 Priority 2	 Priority 3
 Built 1990+	 Unbuildable or Unavailable	

0 10,000 20,000 Meters 

Figure 12



**Sub-Regional Priority**

 Zone 1 (Highest)	 Zone 2	 Zone 3
 Zone 4	 Built 1990+	 Unbuildable or Unavailable

0 10,000 20,000 Meters 

Figure 13

In each time period (1990-2010, 2010-2030), locations for each of the four major groups of new development are determined in an iterative four-stage process based upon the assumption that priority among land uses is determined by ability to pay. This results in an allocation sequence of commerce and industry first; second, multi-family; third, single-family; and last, rural residential development. The land uses are allocated serially, following traditional pyramidal zoning. That is to say, purely residential zones do not contain intensive activities such as commerce and industry, whereas residential development can and does occur in commercial and industrial zones.

The first use of the model of urbanization projected the trend of future development based on an extrapolation of population forecasts by the State of California.

As can be seen in Figure 14, the population of the study area is currently about 1.1 million. It is projected to grow to about 1.6 million by 2010 and 2.1 million by 2030. Of the counties included in the region—Orange, San Diego and Riverside—most of the increase is expected to take place in Riverside County because it has the most unbuilt land and lower costs of land and construction. Based on current patterns, population growth will cause shifts in lands use as shown in Figure 15.

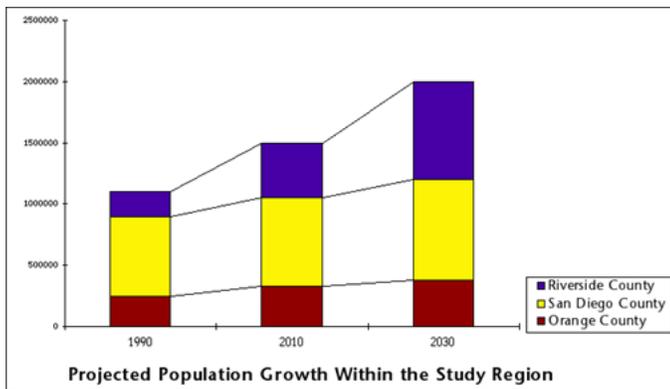


Figure 14

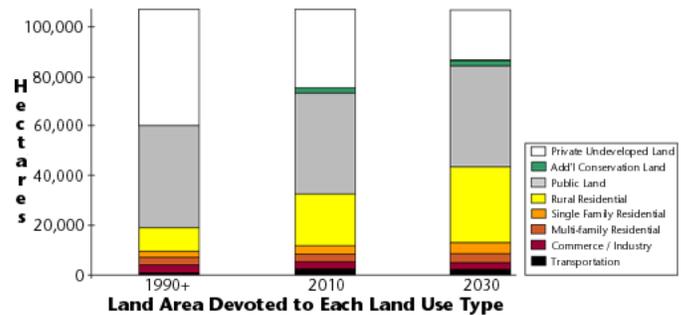


Figure 15

## The Regional Trend of Development Change, Impact



The projected trend of future development is based on current (1990+) urbanization as shown in Figure 16 and assumes no new conservation or regulatory guidelines or policies; it follows the current patterns of ongoing development.

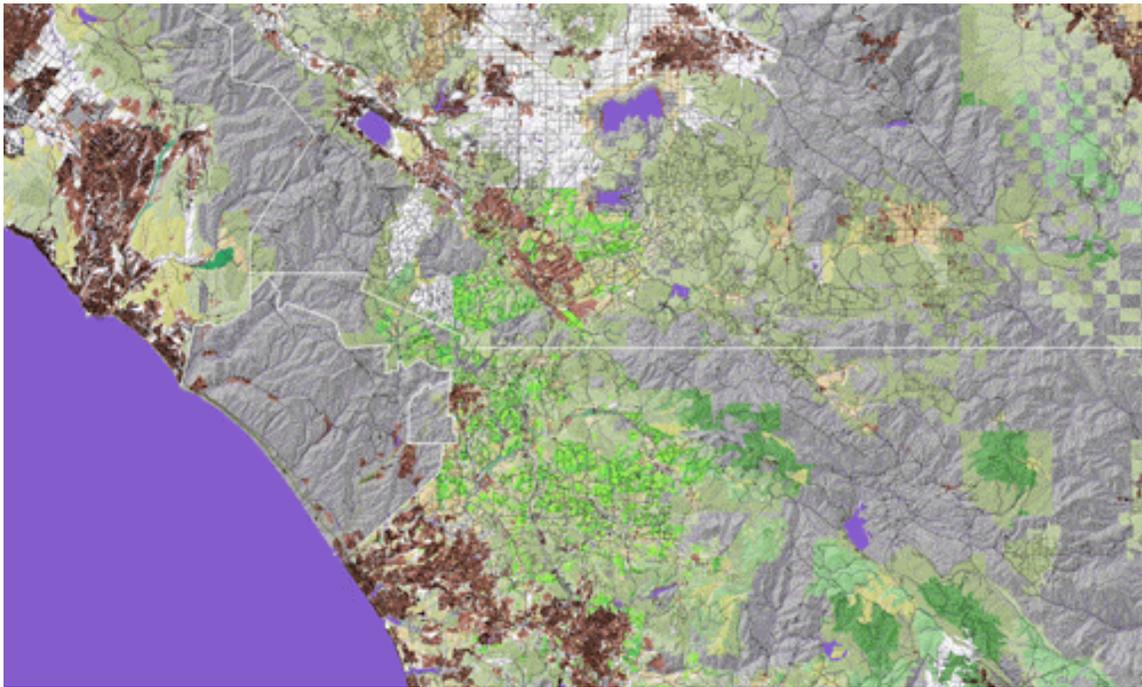
The trend for 2010 shows significant increases and intensification of urbanization in the Temecula Valley region of Riverside County, especially along existing primary road networks. The major corridor of urban intensification illustrates the growing connectivity between the Temecula Valley urban area and Los Angeles to the north. Increasing urbanization of this corridor will act to further inhibit biological connectivity between the Cleveland National Forest and the Mount Palomar area. The projection also shows significant encroachment by rural residential development on orchard and vineyard areas in and around the Temecula area. The consequences of this sprawl are ecologically disastrous: the impacts upon regional connectivity and hydrology may be irreparable after this 2010 projection.

From 2010 to the year 2030, the Temecula Valley will continue to be the primary area of increasing urbanization. By 2030, this will be a heavily developed urban center, with a corridor

of urbanization stretching north toward Los Angeles. Development along major road networks between Temecula and Murrietta will continue to increase dramatically, especially along north-south links. There also will be continuing encroachment upon vineyard, agricultural, and sage/chaparral areas by rural residential development. Figure 17 illustrates that by 2030, all of the region's easily developable land will have been "urbanized."

Of approximately one million+ hectares in the region, 200,000 hectares were developed in 1990; 400,000 hectares are publicly owned and will remain so. The remaining land—approximately 450,000 hectares—is privately owned and available for development. If current plans are followed, about 60 percent of the private land will have been developed by 2030, leaving only 200,000 hectares of less-potentially-developable land for the far future.

Rural-residential development promises to consume the largest amount of private land by the year 2030. Its low density requires more space per dwelling relative to the denser single- and multi-family residential categories.

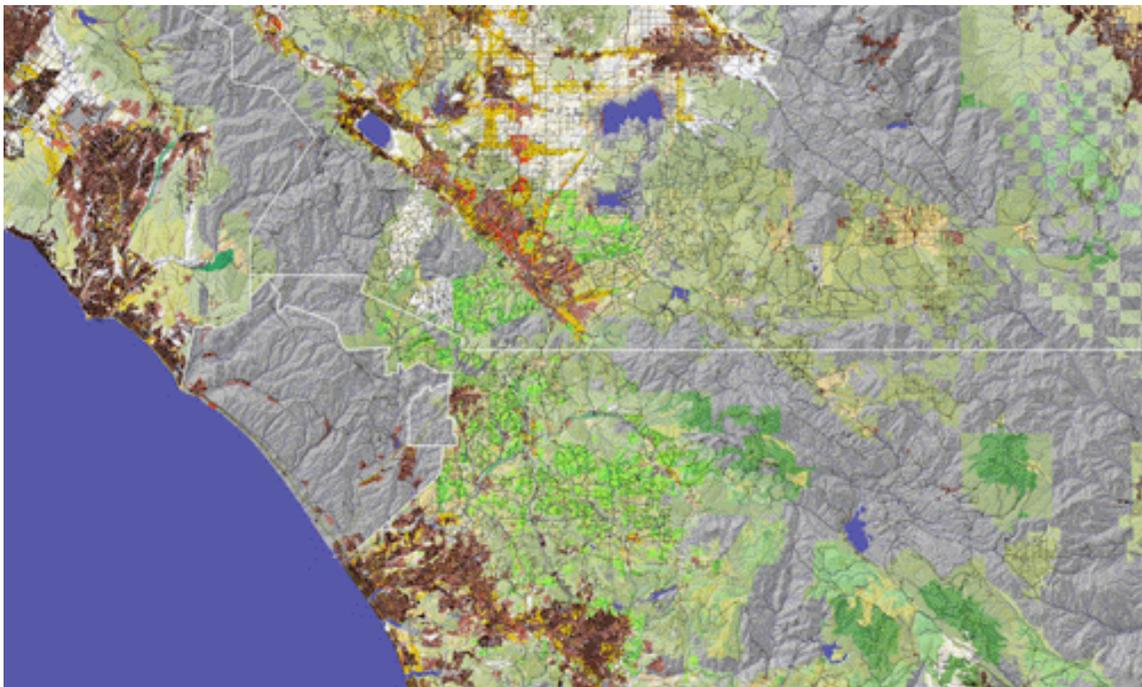


**Urbanization  
1990+**

- |                     |                         |                   |
|---------------------|-------------------------|-------------------|
| Built 1990+         | Urban or Disturbed Area | Public land       |
| Highway, major Road | Agriculture, Grazing    | Orchard, Vineyard |
| Scrub               | Oak-Juniper             | Woodland, Forest  |
| Grassland           | Riparian Vegetation     |                   |



Figure 16



**Urbanization  
2030**

- |                        |                           |                          |
|------------------------|---------------------------|--------------------------|
| Rural Residential      | Single-Family Residential | Multi-Family Residential |
| Commercial, Industrial | Built 1990+               | Urban or Disturbed Area  |
| Public land            | Highway, major Road       | Agriculture, Grazing     |
| Orchard, Vineyard      | Scrub                     | Oak-Juniper              |
| Woodland, Forest       | Grassland                 | Riparian Vegetation      |



Figure 17

The environmental consequences of the trend are the same as those of prior experiments conducted within the research framework: a fragmented landscape, loss of critical habitat, increased fire risk, and major downstream flooding impacts.

An additional consequence of the trend and its assumed growth in population is an increased dependence on importation of water (Figure 18). Using current water consumption estimates, an additional 80,000 acre-feet of water must be provided for each phase of development—from now until 2010, and from 2010 to 2030. Clearly, such an increase in water demand would create the need for increased water importation and new infrastructure, such as storm water and sewage treatment facilities. Water management must be a key aspect of any future for the region.

As these trend projections show, allowing development to proceed in accord with current trends and patterns could accommodate projected population and land use demands, but it would have serious, harmful impacts on the landscapes of this region. The question is: Where to build and where not to build? What design strategies have the potential to shape development in such a way that the integrity of the region’s landscapes would be maintained?

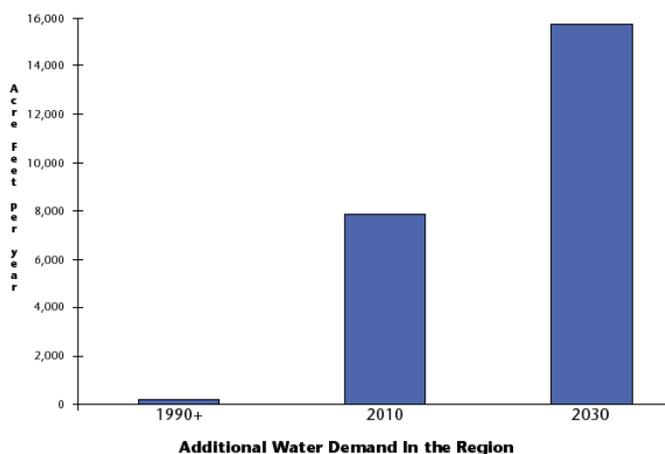


Figure 18

## The Model of Conservation

Representation, Process, Evaluation



The fundamental strategy of the studio's alternative design proposal is to plan the landscape *first* and integrate development with it, rather than retrofitting the landscape to development. Given the great pressures for change in this region, and informed by the alternatives that were initially studied, this strategy is the only one that can maintain biodiversity, avoid harmful hydrologic impacts without costly structural changes, and produce a high-quality living environment.

It was therefore decided that an aggressive conservation strategy was needed to help shape the pattern of future growth. The conservation proposal should retain as much as possible the high quality of the character of the region, both for those who already live there and for newcomers; it should avoid increased flooding and reduction of groundwater recharge, and it should support the region's biodiversity—one of the richest in the United States. Therefore, the model recognizes three major groupings of conservation objectives and values: cultural, hydrologic, and biologic.

Conservation of the cultural landscape is intended to promote a regional landscape of beauty, value, and meaning. It should retain the character of ridges and other landscape features, provide recreational areas and networks, sustain agricultural activities, maintain open space as an amenity, improve site access for schools and civic institutions, and protect historic places.

In order to accommodate the increased population without adverse hydrologic impacts, a strategy of hydrologic conservation should retain infiltration capacity and groundwater recharge, avoid economically and ecologically costly channelization, prevent harm to riparian zones, control flood discharge, maintain water quality, treat sewage and wastewater, and recharge residual water.

A biologic landscape conservation strategy seeks to perpetuate the region's diverse and high-quality ecosystems. It should minimize fragmentation of natural areas, provide connectivity among ecological reserves and other significant habitat areas, protect riparian zones and corridors, maintain hydrologic regimes to sustain landscape types, and permit fire management.

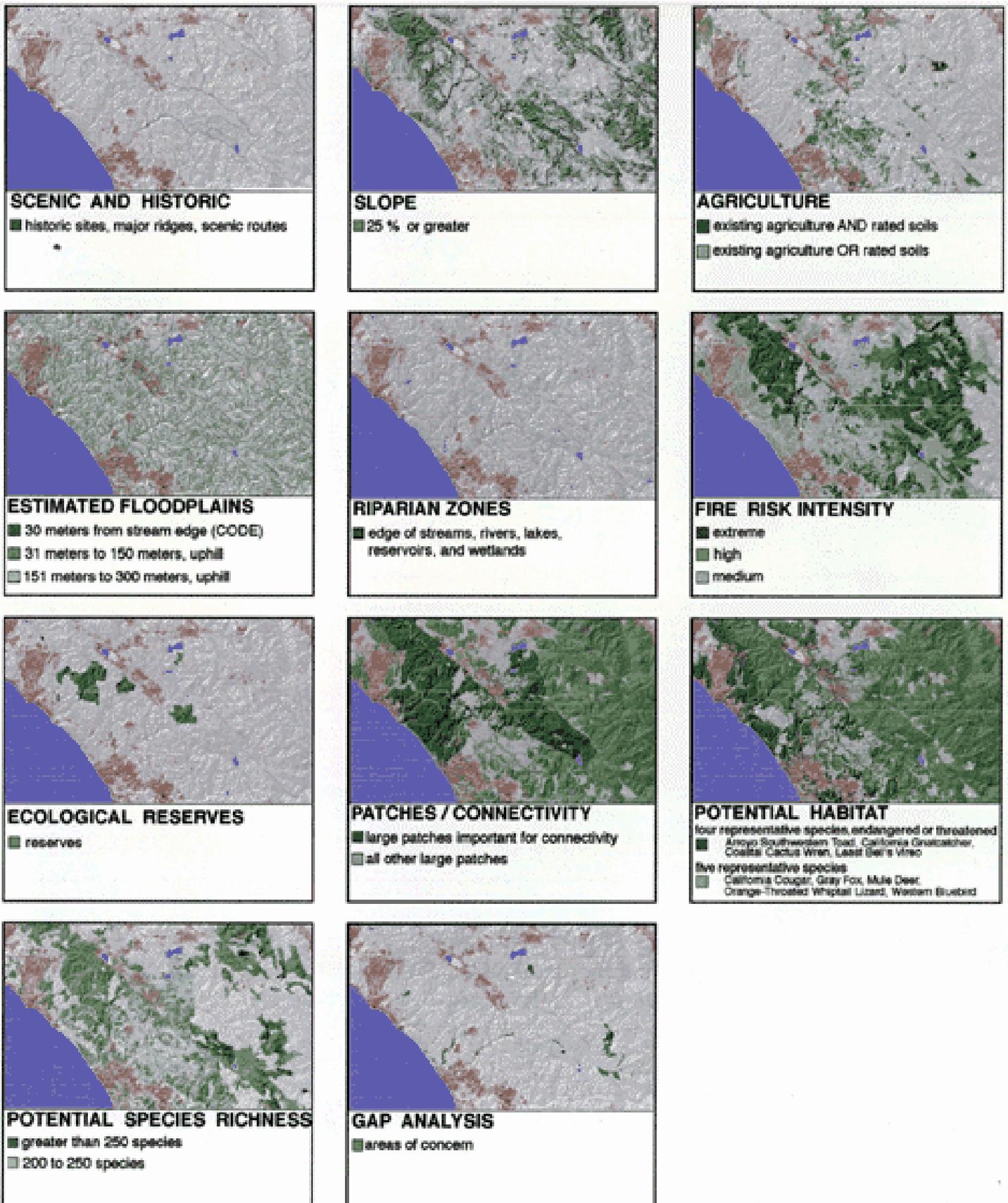


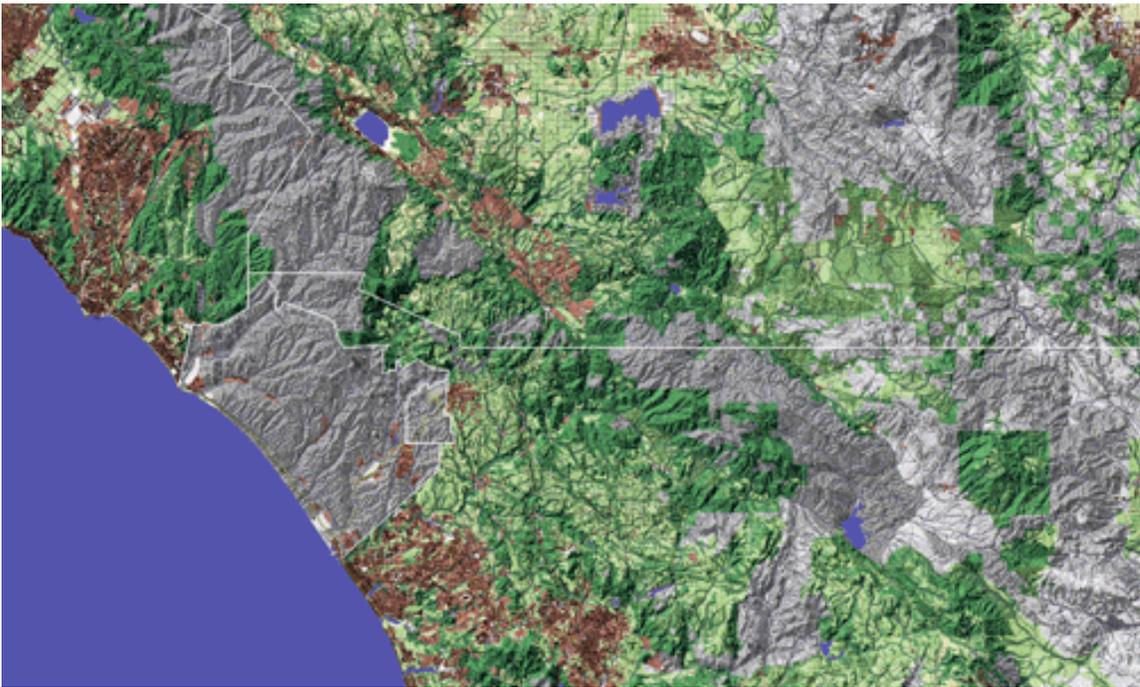
Figure 19

Eleven criteria for conservation were derived from the research models and mapped (Figure 19). Then, in order to determine the relative importance of the conservation criteria, a Delphi method was used. This is a procedure that enables a group to make informed decisions about ranking (Cavalli-Sforza, 1979). From this,

four levels of conservation priority were established. Each 30-meter square map cell was assigned a value of 1 (highest), 2, or 3, based on the highest level of occurrence of any criterion. Cells with no criteria present were assigned Level 4. These levels of priority are also shown in Table 1.

<i>Criteria for Conservation</i>	<i>Priority Level</i>			
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Scenic and Historic - routes and sites, ridges		X		
Slopes - 25% or greater	X			
Agriculture - on / or prime soils		X	X	
Floodplains - estimated distance	X	X	X	
Riparian Zones		X		
Fire Risk Intensity - fire needs among vegetation types considering slope, aspect, fire return interval season		X	X	
Ecological Reserves	X			
Patches/Connectivity - large natural areas and connections to ecological reserves	X		X	
Potential Habitat - for 9 species representative of landscape types	X		X	
Potential Species Richness - greater than 250 species, 200 to 250 species	X		X	
Gap Analysis - areas needed to maintain species diversity, considering protection status	X			

Table 1

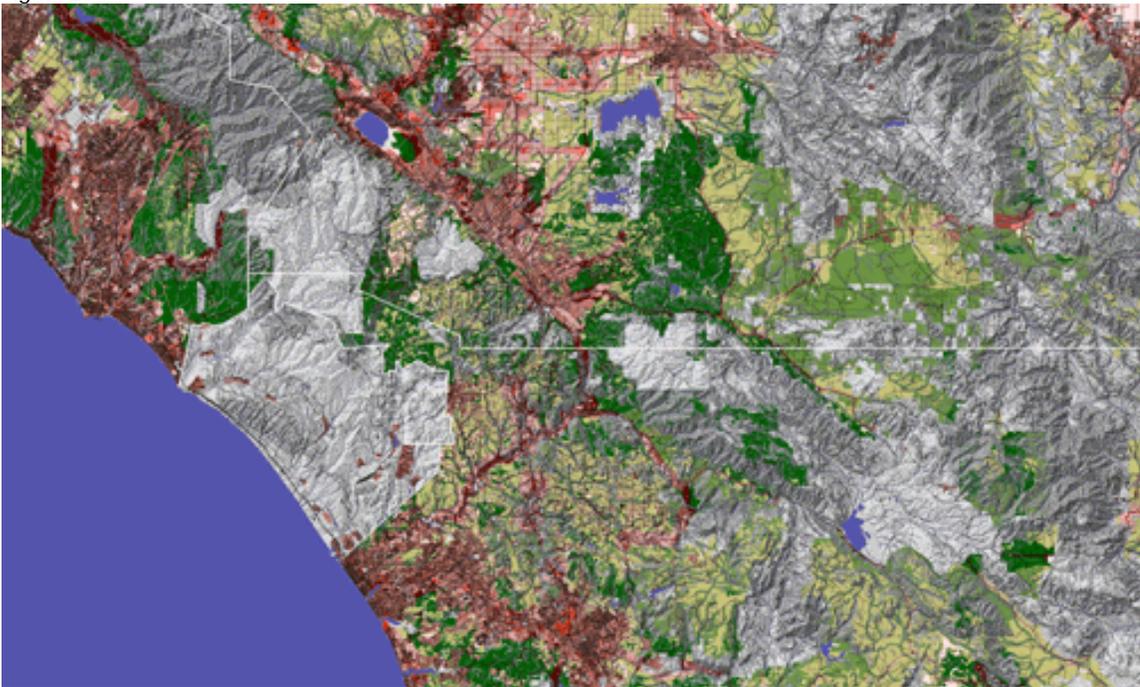


**Conservation Priority**

- |   |   |   |
|---|---|---|
|  Private land - Priority 1 |  Private land - Priority 2 |  Private land - Priority 3 |
|  Private land - Priority 4 |  Public Land - Priority 1  |  Public land - Priority 2  |
|  Public land - Priority 3  |  Public land - Priority 4  |   |



Figure 20



**Development/Conservation Conflict**

- |   |   |   |
|---|---|---|
|  No develop priority / Priority 1 conserve |  No develop priority / Priority 2 conserve |  No develop priority / Priority 4 conserve |
|  Priority 1 develop / Priority 1 conserve  |  Priority 2 develop / Priority 1 conserve  |  Priority 3 develop / Priority 1 conserve  |
|  Priority 1 develop / Priority 2 conserve  |  Priority 2 develop / Priority 2 conserve  |  Priority 3 develop / Priority 2 conserve  |
|  Priority 1 develop / Priority 3 conserve  |  Priority 2 develop / Priority 3 conserve  |  Priority 3 develop / Priority 3 conserve  |
|  Priority 1 develop / No conserve priority |  Priority 2 develop / No conserve priority |  Priority 3 develop / No conserve priority |



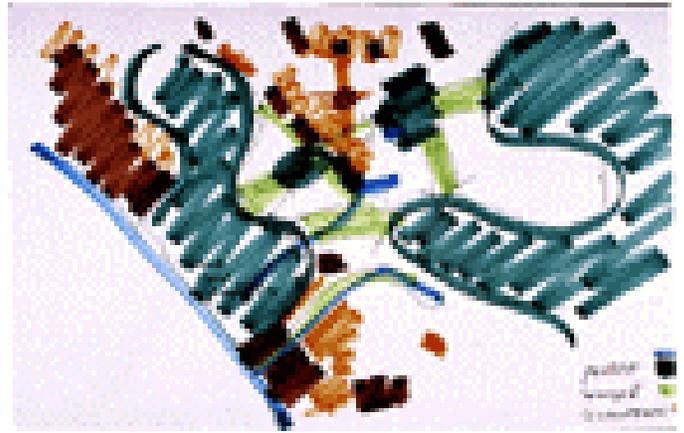
Figure 21

The weighted conservation criteria were then combined as shown in Figure 20, the map of Conservation Priority.

When the locational priorities for development that were identified by the model of urbanization are compared with the evaluation of conservation priority, there are major conflicts of interest. These are shown in Figure 21. The red color range shows areas that are attractive for development, but do not have conservation priority. The green color range shows areas that have high priority for conservation, but have low development potential. Areas shown in brown have priority for both development and conservation; these are the areas in conflict.

Previously, it was seen that development responds to proximity to roads and utilities, and that the greatest development pressures occur near intersections of major roads. Many of these same areas have high conservation priorities and are critical to maintaining the ecological integrity and long-term stability of the region. Analysis of the conflict pattern reveals that the greatest conflicts occur in low-lying, vegetated floodplain areas under high development pressure, and in large contiguous areas of vegetated upland that are both important for habitat connectivity and also desirable for rural residential development.

## The Proposed Design for the Region Change

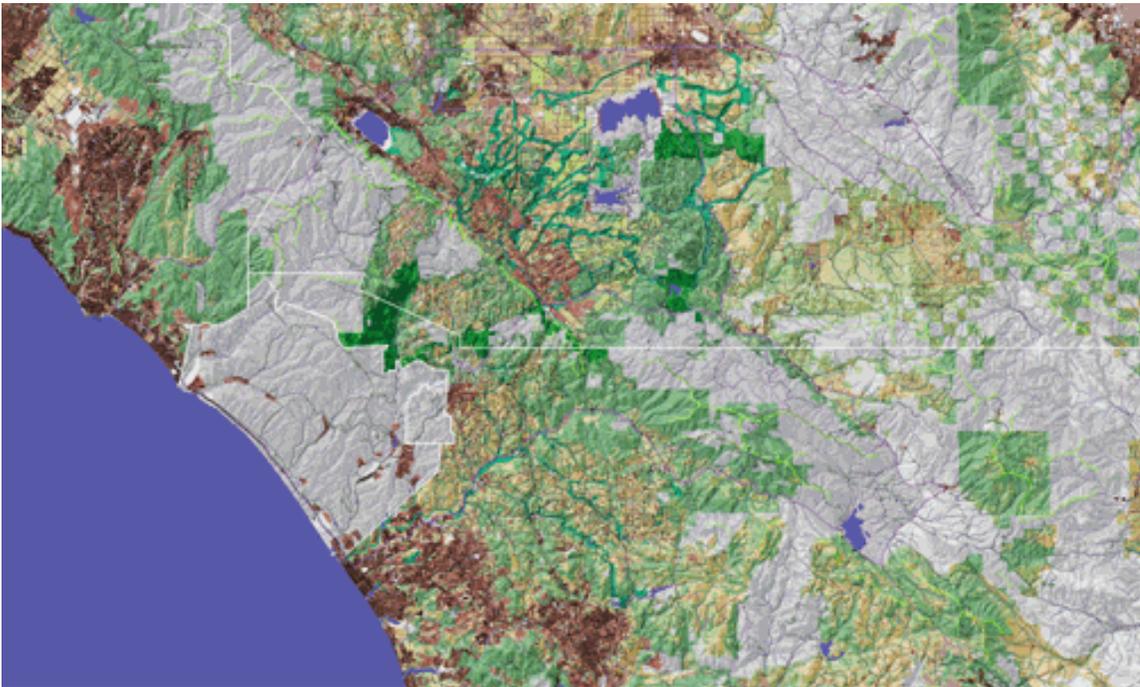


The underlying concept of the regional design proposal involves three basic strategies: protection, connection, and concentration. The regional design is based on the assumption that conservation should precede development. Therefore, after examining the regional pattern of conflicts between conservation and development, a conservation strategy was designed to protect and connect the critical conservation priority areas, especially those threatened with development. Next, urbanization was focused on a new regional development core and into discrete and identifiable communities.

The first priority of the conservation strategy (Figure 22) is to protect biodiversity. Proposed conservation corridors connect the Santa Rosa Plateau, Cleveland National Forest, and Camp Pendleton and complete connections along the Santa Margarita River and across Interstate I-15 to Mount Palomar. Also proposed for conservation are Vail Lake and its connection to Cleveland National Forest and the area east of the new reservoir that connects the Multi-Species Reserve to the San Bernardino National Forest.

The conservation strategy also establishes a flood control network that is crucial to abate flooding and increase aquifer recharge, particularly in the Santa Margarita and San Luis Rey River Basins. The network maintains some connectivity for species movement and protects fragile riparian habitats. It also provides a strong recreational network and may include such uses as parks, campuses, and golf courses. In addition, the strategy identifies a network of regional scenic highways and cycling and hiking trails for conservation and visual management.

Throughout the region, density zoning and special overlay districts address conservation priorities such as minimizing loss of agricultural areas and critical potential habitat. The region as a whole would be further protected by guidelines for proposed development, which are organized in levels that directly relate the four levels of conservation priority. These guidelines are described later in this report.



**Conservation Strategy**

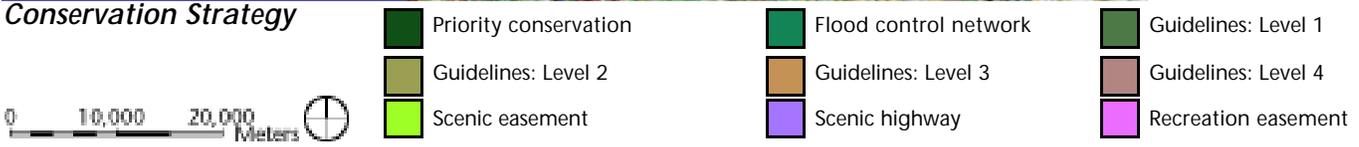


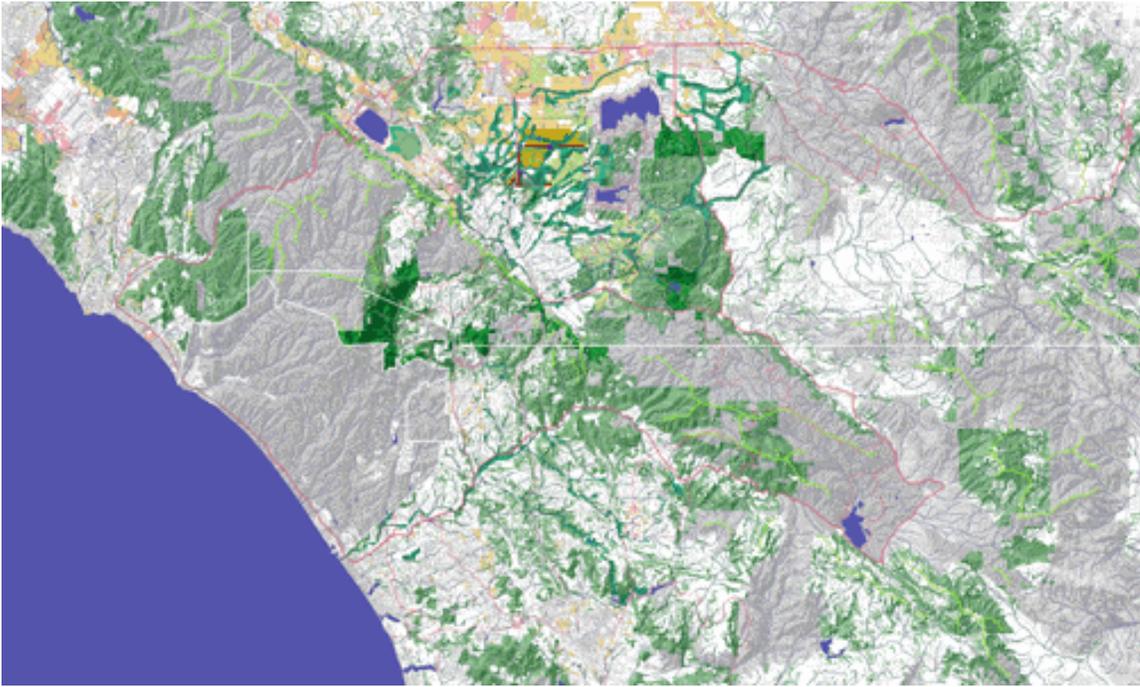
Figure 22

The next step was to conduct a second two-stage simulation of urbanization, this time guided by the proposed regional design. This simulation considered the same population and land use demands as were used in the trend simulation.

The proposed design advocates a considerable investment in conservation in the initial phase (1990+ to 2010) in light of the analysis of development-conservation conflicts and the 1995 studio's finding that conservation measures will be effective only if implemented before 2010.

Therefore, the design actions proposed for the first stage include acquisition of the areas of primary conservation and establishment of much of the flood control network. The proposed actions also include some proposed additions to transportation and sewer infrastructure which, together with some zoning changes, are intended to cause a more concentrated future urban pattern.



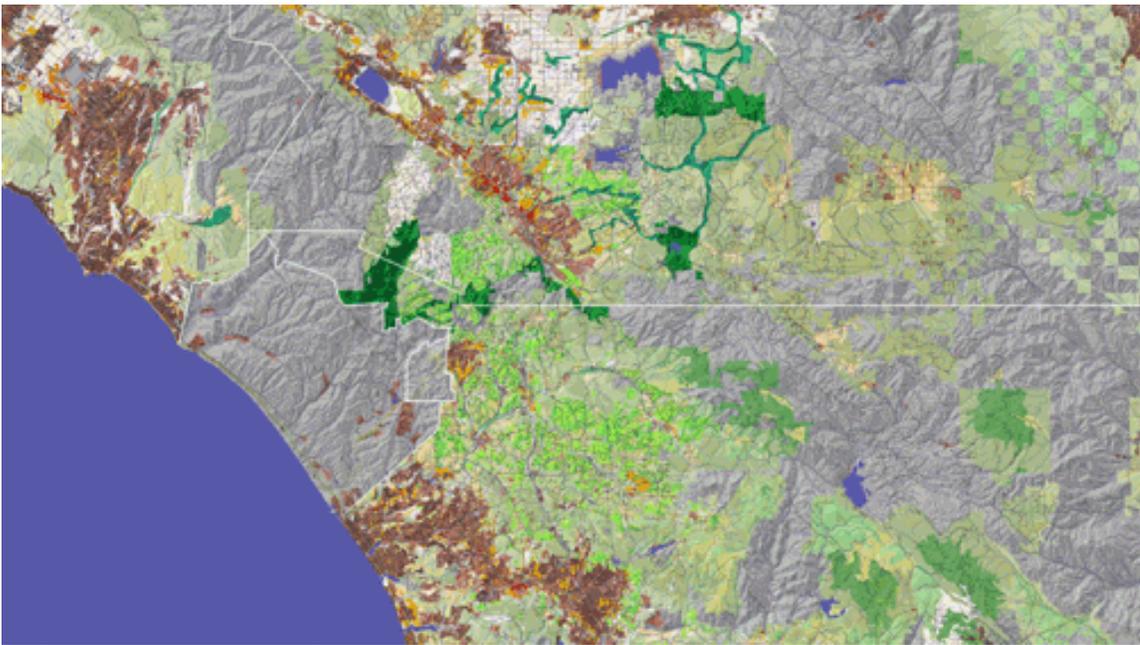


**Proposed Actions**

- Conservation Strategies: Priority Conservation
- Agriculture Overlay District
- Zoning: Commercial / Industrial
- Core: Services Priority - Multi-Family
- Proposed Rail Line
- Scenic Highway
- Flood control network
- Zoning: Single Family
- Civic / Institutional
- Core: Services Priority - Commercial / Industrial
- Right of Way for Proposed By-Pass
- Recreation Easement
- Guidelines: Level 1 5 ac Rural Residential
- Zoning: Multi-Family
- Core: Services Priority - Single Family
- Transportation: Upgraded / New Roads
- Regional Identity: Scenic Easement



Figure 23

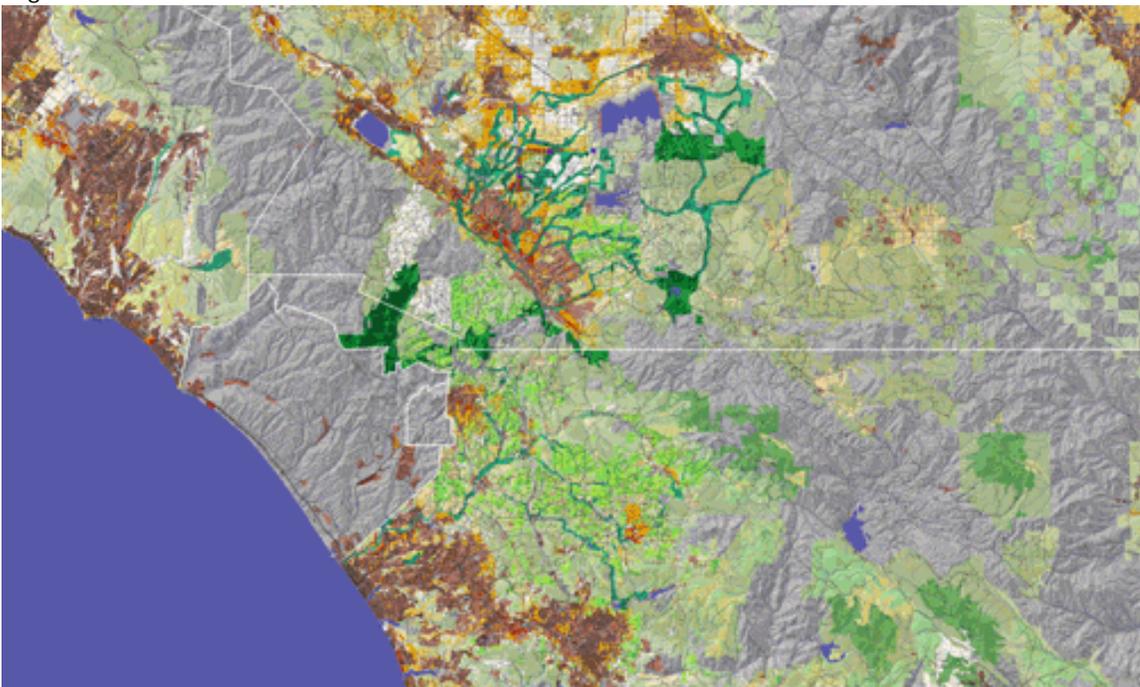


**Urbanization: Proposed 2010**

- |                         |                             |                          |
|-------------------------|-----------------------------|--------------------------|
| Rural Residential       | Single Family Residential   | Multi-Family Residential |
| Commercial / Industrial | Built 1990+                 | Urban or Disturbed Area  |
| Public Land             | Upgraded / Additional Roads | Proposed Rail Line       |
| Agriculture, Grazing    | Orchard, Vineyard           | Scrub                    |
| Oak-Juniper             | Woodland, Forest            | Grassland                |
| Riparian Vegetation     |                             |                          |



Figure 24



**Urbanization: Proposed 2030**

- |                         |                                   |                             |
|-------------------------|-----------------------------------|-----------------------------|
| Rural Residential       | Single Family Residential         | Multi-Family Residential    |
| Commercial / Industrial | Civic / Institutional             | Upgraded / Additional Roads |
| Proposed Rail Line      | Right of Way for Proposed By-Pass | Built 1990+                 |
| Urban or Disturbed Area | Public Land                       | Agriculture, Grazing        |
| Orchard, Vineyard       | Priority Conservation             | Flood Control Network       |
| Scrub                   | Oak-Juniper                       | Woodland, Forest            |
| Grassland               | Riparian Vegetation               |                             |



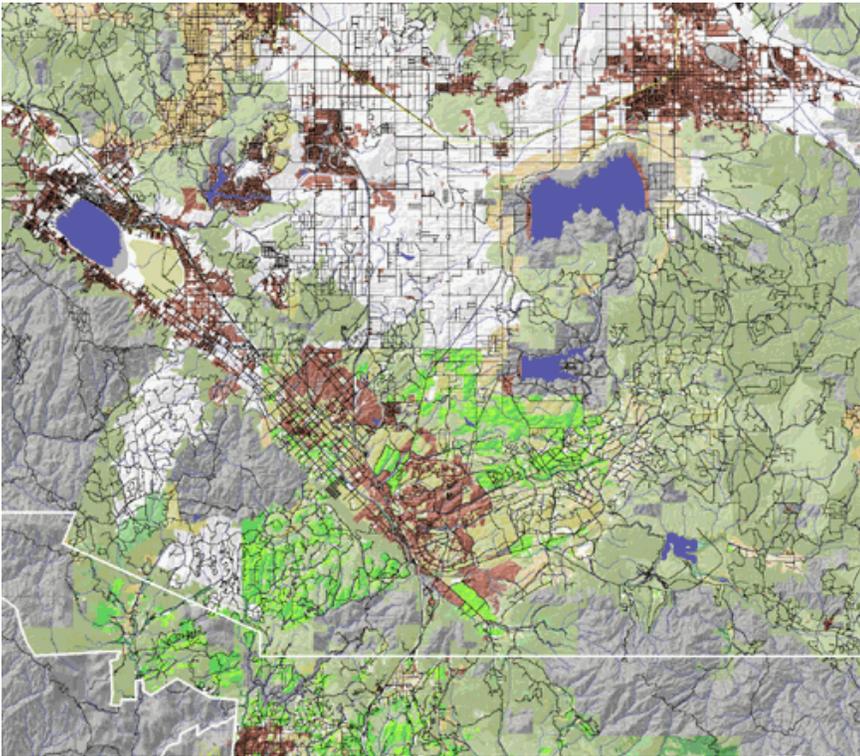
The land cover changes between 1990+ (Figure 17) and 2010 (Figure 25) result from the allocation of the urbanization model after input of the initial stage design actions. Additional actions are proposed within the same overall strategies from 2010 to 2030, resulting in the 2030 urban pattern (Figure 26). The results of the design include a more connected landscape, more concentrated development, and a new regional City Center in the Temecula Valley.

In comparison, the trend development shows an overall lower density of development, no additional open space or conservation areas, and a typical sprawl pattern. Left unchecked, the trend development can evolve into a pattern similar to parts of suburban Los Angeles. The proposed regional design differs from the trend in several ways: (1) conservation corridors precede development; (2) development is clustered and, where appropriate, within existing developed areas; (3) agricultural lands are preserved; and (4) a new regional City Center is created.

## The Trend for the Temecula Valley Change, Impact

The Temecula Valley (Figure 27) will be the focus of most of the region's development-conservation conflicts. This is particularly true for the areas in the Santa Margarita watershed. By the year 2010, it is estimated that 250,000 people will move to the valley; by 2030, 500,000 people will have moved to the area. Such population pressures will drive a large market incentive to build wherever developable land is available. Current growth pressures result mainly from single-family housing as it spreads north from Temecula and Murrietta and south from Riverside, Sun City, and Perris. Perpetuation of the current trend to 2030 will lead to certain urban sprawl and landscape fragmentation—a situation the design proposal seeks to avert.



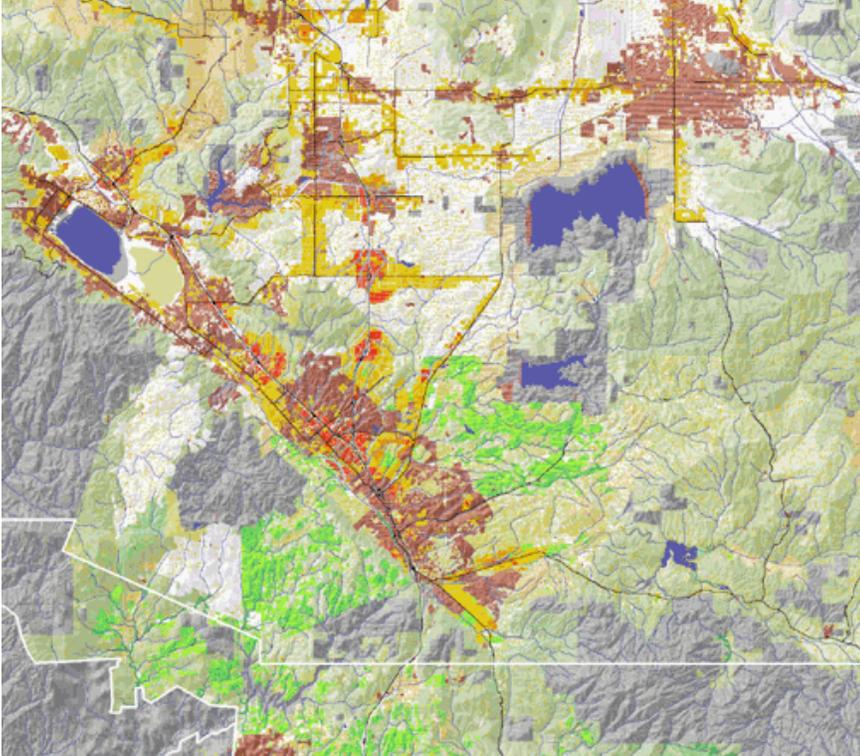


**Urbanization: 1990+**

- |  |   |   |
|--|---|---|
|  Built 1990+          |  Urban or Disturbed Area |  Public Land |
|  Agriculture, Grazing |  Orchard, Vineyard       |  Scrub       |
|  Oak-Juniper          |  Woodland, Forest        |  Grassland   |
|  Riparian Vegetation  |   |   |



Figure 26



**Urbanization: Trend 2030**

- |   |   |  |
|---|---|--|
|  Rural Residential       |  Single Family Residential |  Multi-Family Residential |
|  Commercial / Industrial |  Built 1990+               |  Urban or Disturbed Area  |
|  Public Land             |  Agriculture, Grazing      |  Orchard, Vineyard        |
|  Scrub                   |  Oak-Juniper               |  Woodland, Forest         |
|  Grassland               |  Riparian Vegetation       |  |

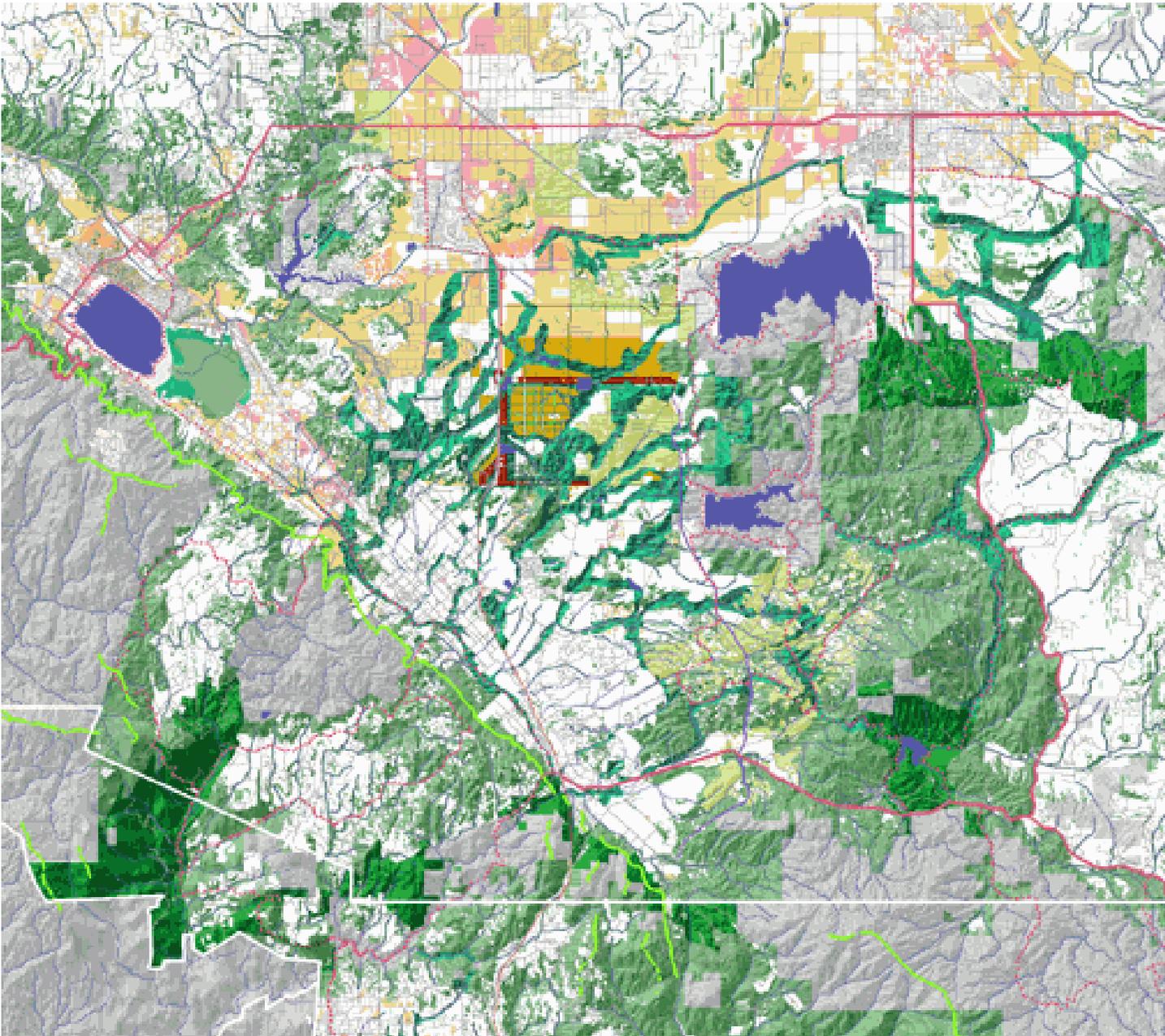


Figure 27

## The Proposed Design for the Temecula Valley Change, Impact



Several current governmental planning efforts were integrated into the design proposal for the Temecula Valley (Figure 28). The Southwest Transportation Corridor Study identifies the transportation alternatives that are either approved or under consideration for the Temecula Valley. Some, but not all, of these proposals are reflected in the design. Similarly, the towns in the Valley have existing town plans with many planned and/or approved subdivisions. If all these are built, residential growth until 2010 can be accommodated within the planned and approved development areas, except where altered by the conservation strategy. Also, every effort was made to respect existing property boundaries.



**Proposed Actions: 1990+ to 2030**

- |  |   |  |
|--|---|--|
|  Conservation Strategies: Priority Conservation |  Flood control network                             |  Guidelines: Level 1 5 ac Rural Residential |
|  Agriculture Overlay District                   |  Zoning: Single Family                             |  Zoning: Multi-Family                       |
|  Zoning: Commercial / Industrial                |  Civic / Institutional                             |  Core: Services Priority - Single Family    |
|  Core: Services Priority - Multi-Family         |  Core: Services Priority - Commercial / Industrial |  Transportation: Upgraded / New Roads       |
|  Proposed Rail Line                             |  Right of Way for Proposed By-Pass                 |  Regional Identity: Scenic Easement         |
|  Scenic Highway                                 |  Recreation Easement                               |  |



Figure 28

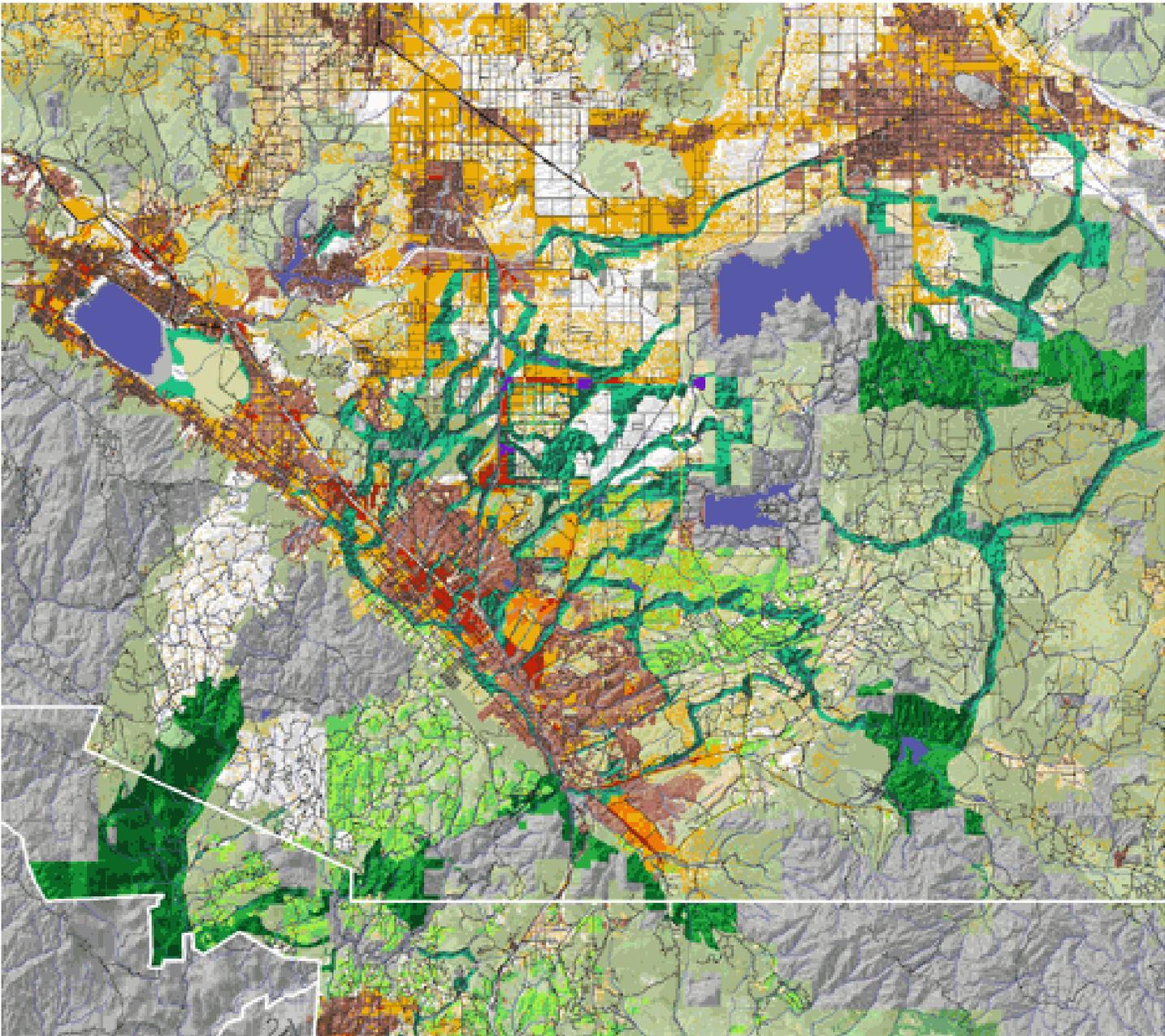
The goals of the design and its proposed actions are to guide urbanization in the Temecula Valley around the areas of the highest conservation priorities. When identifying the conservation areas within the Valley, riparian corridors were given first priority. The natural geometry of the riparian corridors runs diagonally across the existing highway grid; therefore the conservation network also finds its orientation diagonal to the roads. The intersections of roads and the conservation network form ideal locations for civic institutions such as schools. The diagonal pattern also creates alternate car-free pedestrian and cyclist transportation routes that allow children to walk or bike to school.

At this scale, the multiple functions of the conservation corridors include flood control, recreation, habitat, and wildlife movement. These linear spaces, whether “natural” or designed and constructed, also connect the most intense development to its nearby parks and reserves, the new reservoir, and Lake Skinner. Additionally, one expanded conservation area at the base of the Santa Rosa escarpment is proposed as a site for a wastewater treatment facility which would enable increased aquifer recharge and water recirculation.

The urban focus of the design is the new City Center. The Center is an open rectangle shaped by upgraded Scott and Clinton Keith Roads, I-215 and Route 79. The Center would be intensively developed along the linear internal perimeter of the rectangle on three sides. Commerce, multi-family residential, and light industrial development occupy the zone in a mix of uses and densities and with ancillary parking. The northwest “corner” of the Center is designated for civic-governmental uses.

Accessibility to and within the Center is of great importance. For the motorist, the Center is accessible from Scott and Clinton Keith roads, and a proposed new bypass road south from the intersection of Route 79 and Scott Road to I-15. Rail riders will find it convenient, since the proposed rail line follows I-215; it is one of the alternatives in the Southwest Transportation Corridor Study. A major, multi-modal train station is proposed at the intersection of I-215 and Scott Road.

In contrast, the interior of this rectangle is proposed for low-density development, comprised mainly of rural-residential and some single-family housing, agricultural reserves, and conservation corridors. Thus, the most intensely developed areas have some of the most direct access to the regional landscape. The conservation areas should increase the value of the land in the Center and allow many private landowners to have direct frontage on the major recreational amenities that attract residents to the region.



**Urbanization: Proposed 2030**

- |   |   |   |
|---|---|---|
|  Rural Residential       |  Single Family Residential         |  Multi-Family Residential    |
|  Commercial / Industrial |  Civic / Institutional             |  Upgraded / Additional Roads |
|  Proposed Rail Line      |  Right of Way for Proposed By-Pass |  Built 1990+                 |
|  Urban or Disturbed Area |  Public Land                       |  Agriculture, Grazing        |
|  Orchard, Vineyard       |  Priority Conservation             |  Flood Control Network       |
|  Scrub                   |  Oak-Juniper                       |  Woodland, Forest            |
|  Grassland               |  Riparian Vegetation               |   |

0 2,500 5,000 Meters

Figure 29

## Five Example Areas Change, Impact

From the initial assessment of development-conservation conflict emerged five areas in the region that exemplify important and representative landscape change conditions. They are also conducive to a more detailed study of various conservation-development issues related to the impacts of urbanization on agriculture, riparian zones, and other areas of conservation priority.

The five areas, as shown in Figure 30, are:

Site A - a conservation corridor south of the Santa Rosa Plateau;

Site B - the intersection of Warm Springs Creek and Interstate I-15;

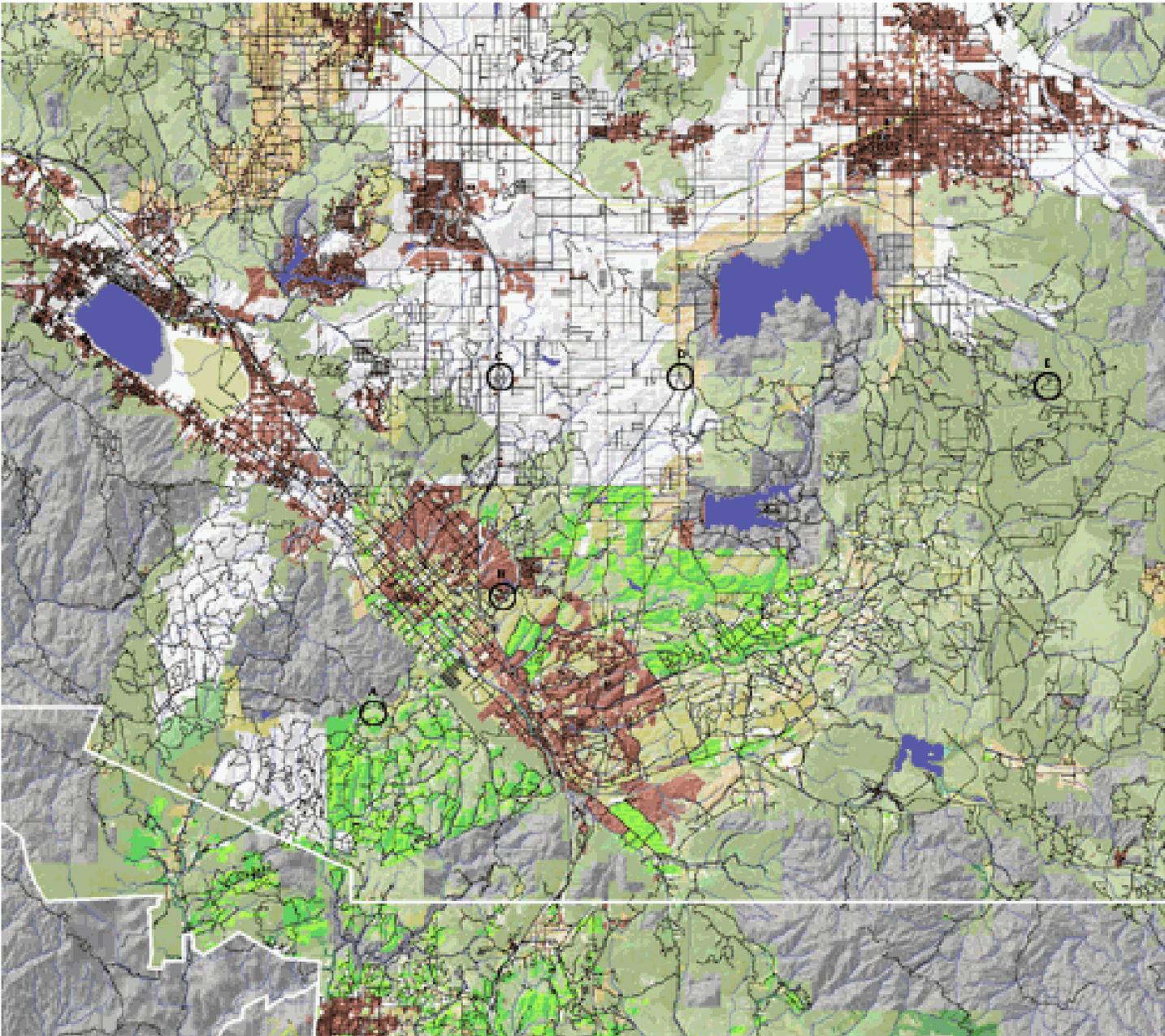
Site C - the intersection of Scott Road and I-215;

Site D - the intersection of Scott Road and Route 79; and

Site E - a conservation corridor east of the Domenigoni Valley Reservoir that is scheduled for completion in the next three years.

Please note that sites C and D are corners of the new City Center.

For each site, existing conditions are identified. The results of the trend of development in 2030 (which ignores any alternative design concept or guidelines) is shown using photo-simulation. Then, the proposed design concept is shown; it attempts to integrate conservation and development and includes guidelines for development. Finally, and for comparison to the trend, the results of the design proposal in 2030 is shown.



**Site Locations**

- |  |   |   |
|--|---|---|
|  Built 1990+          |  Urban or Disturbed Area |  Public Land |
|  Agriculture, Grazing |  Orchard, Vineyard       |  Scrub       |
|  Oak-Juniper          |  Woodland, Forest        |  Grassland   |
|  Riparian Vegetation  |   |   |



Figure 30

Site A lies south of the Santa Rosa Plateau and is upstream from MCB Camp Pendleton. The high-quality habitat and need for connectivity qualify this site for priority 1 conservation status. Still, it contains existing residential and orchard-agricultural areas and has several existing structures built in the floodplain and some on steep slopes (Figure 31). Further development in the area could significantly increase flood vulnerability on Camp Pendleton.

The trend (Figure 32) shows continued building on steep slopes and in the floodplain, as well as new roads bisecting large patches of natural vegetation. Perpetuating these trends will increase fire risk, exacerbate flood hazards, and increase downstream water pollution.

The strategy for this site includes management of the landscape for fire, protection of riparian zones, and conservation of prime areas of habitat for wildlife. (Figure 33)

The proposed design maintains contiguous areas of vegetation, including agricultural areas that can also sustain wildlife (Figure 34). Roads are placed at the edges of natural areas to minimize fragmentation effects on habitat. Construction is not allowed on steep slopes, thus reducing fire hazards and soil erosion. To further reduce impacts of development, structures are placed close together, with on-site retention systems that mitigate water pollution, lessen stormwater runoff, and reduce the potential of downstream flood damage. It is important to note that the same number of houses are added in both the trend and the proposed design.



Figure 31 - Existing Conditions



Figure 32 - Trend Development

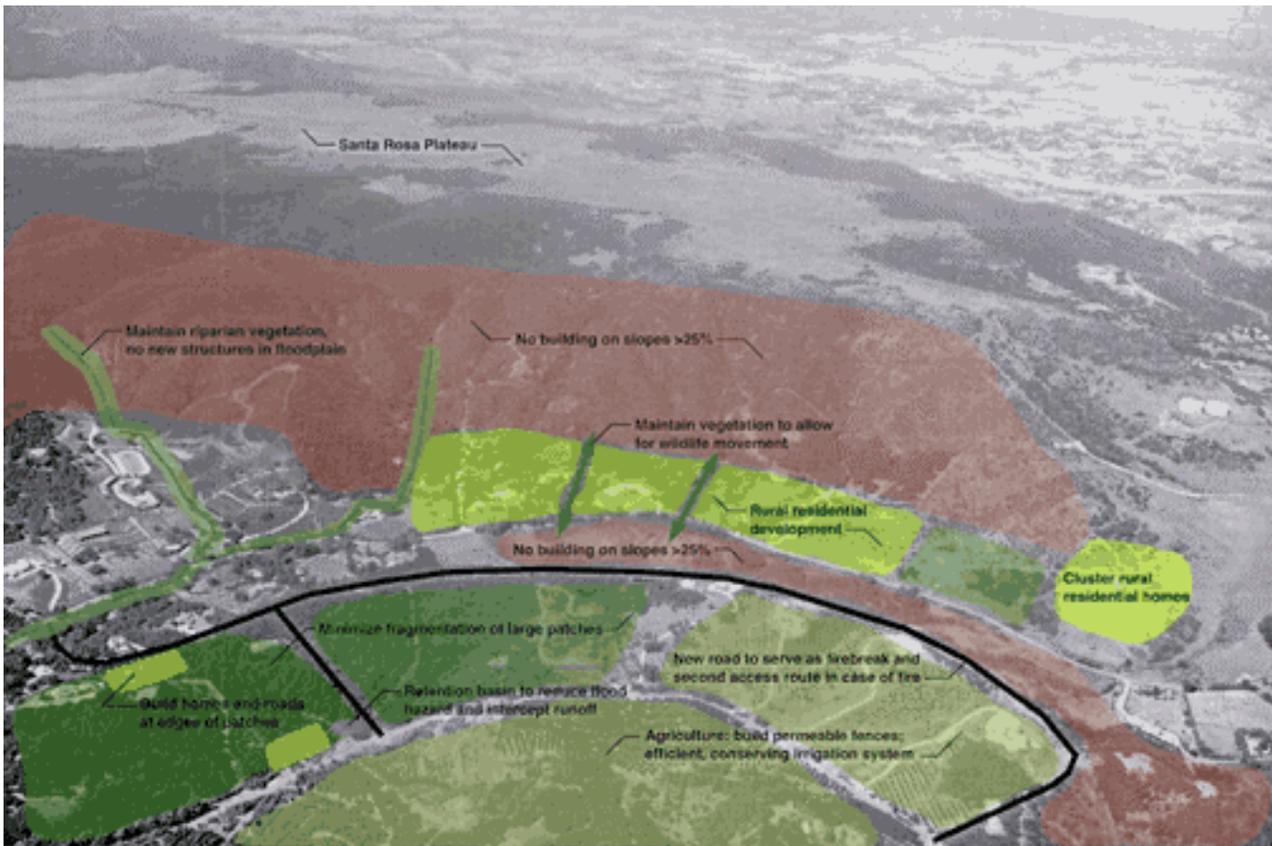


Figure 33 - Proposed Strategy



Figure 34 - Proposed Design

Site B is located at the crossing of Warm Springs Creek and I-15, just south of the intersection of I-15 and I-215 (Figure 35). Located at the edge of the Temecula-Murrieta border and south of Murrieta town center, this site is under intense development pressure; the current prospect of a regional shopping center to be located near this freeway intersection would greatly impact the site.

The trend of development shows commercial and industrial development scattered along all major roads, with industry and housing built in the Warm Springs Creek riparian corridor (Figure 36). If this continues, the creek will become channelized and development will continue to sprawl—which is the antithesis of the design strategy.

The proposed design strategy for this site aims to maintain a flood control network along riparian corridors, cluster commercial development at major intersections, and encourage infill development wherever possible (Figure 37).

The design maintains the integrity of the stream corridor and riparian habitat (Figure 38). A golf course and recreational zone are located near the creek to buffer the stream against the effects of adjacent residential development and to provide emergency flood storage capacity. New commerce and industry are located near the major intersections and in already developed areas.



Figure 35 - Existing Conditions



Figure 36 - Trend Development



Figure 37 - Proposed Strategy



Figure 38 - Proposed Design

Site C, the intersection of Scott Road and I-215, is still largely agricultural, with scattered rural-residential housing (Figure 39). This intersection has great potential to expand as a commercial and residential area in any development scheme. The proposed transit line, which follows Route I-215, will have a major station at this intersection, which marks the northwest corner of the proposed City Center.

If this site were to be developed under current trends, industry and commerce would be scattered along all major roads, and especially near intersections in the case of limited access highways (Figure 40). Single-family housing would fill the area. Development would likely take place in the riparian corridor and streams would become channelized as development pressures increase.

The design strategy is to make this site the civic and institutional core of the new City Center, with commerce, industry, and multi-family housing located in its adjacent linear "arms," and directly accessible from new interior boulevards (Figure 41). Conservation corridors buffer the stream network while enabling adjacent single-family housing. Schools are located at intersections of roads and the new conservation corridors.

In the design proposal (Figure 42) based on development with guidelines, the civic core of the new City Center, multi-family housing, institutional, commercial, and light industrial development are located between Scott Road and the proposed new inner boulevard. The boulevard has high-quality bus service linking the transit station with all parts of the linear higher-density area. Access to institutions and employment is less dependent on cars. The inner core of the City Center consists predominantly of agriculture, conservation, and recreational land, creating a close relationship between the densest development and the landscape.



Figure 39 - Existing Conditions



Figure 40 - Trend Development

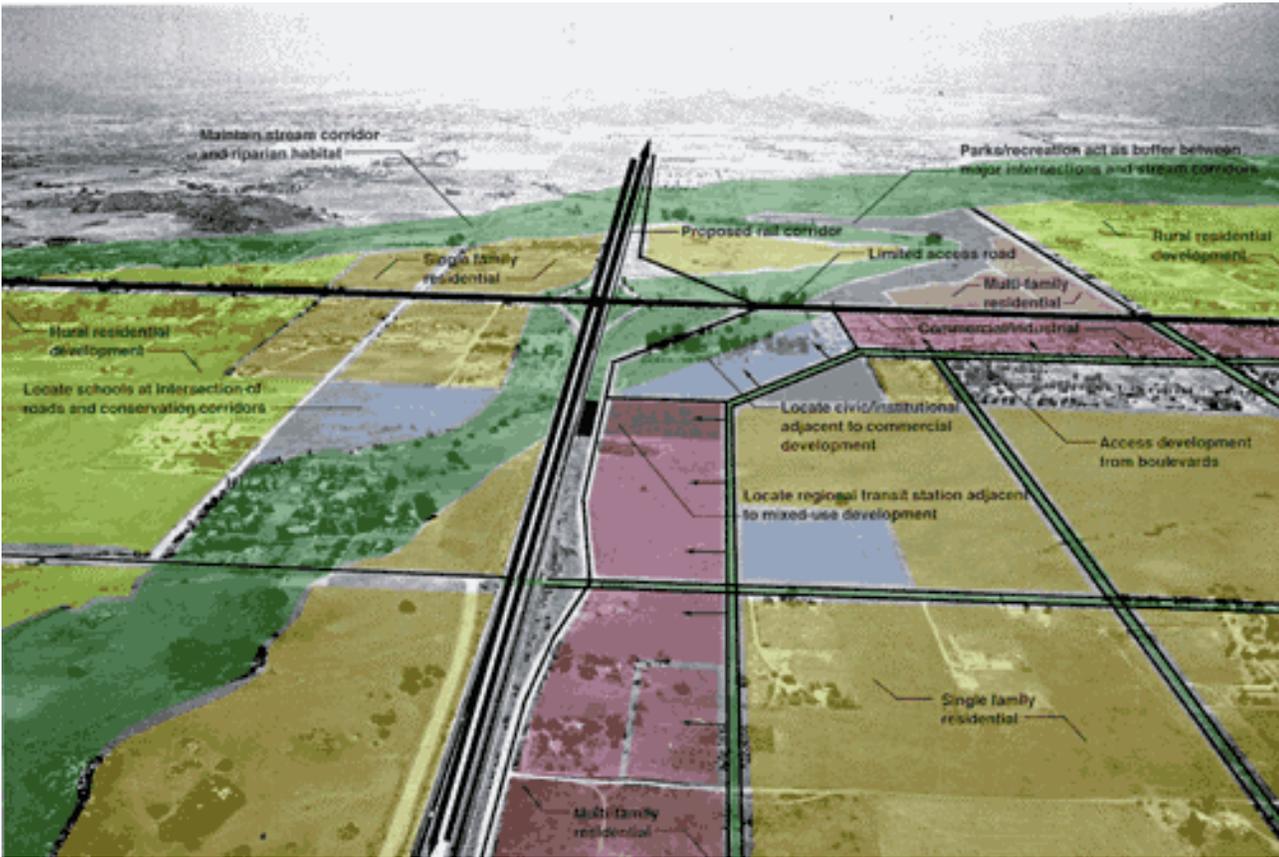


Figure 41 - Proposed Strategy



Figure 42 - Proposed Design

Site D marks the northeast corner of the proposed City Center (Figure 43). Much of the site is owned by the Domenigoni family and has agricultural uses on prime agricultural soils. This site is also important because of its adjacency to Warm Springs Creek, to the future reservoir, and to the reservoir park. Much of the land is of high conservation priority.

Under current trend development, Route 79 will be upgraded (Figure 44). The reservoir will be completed with a park built to the west of it; single-family residential subdivisions will cover much of the prime agricultural soils and priority conservation areas. Commercial strip development will locate along the highway.

The design strategy is meant to conserve the most productive agricultural lands, to use conservation corridors as riparian buffers, and to provide recreational access to the adjacent reservoir reserves. Zoning the area east of Route 79 for very low-density, rural-residential development would encourage private conservation in order to promote both connectivity and low-density, high-quality development (Figure 45).

The proposed design preserves the prime agricultural soils that currently support agricultural activity (Figure 46). High-priority conservation areas are minimally impacted; significant development can be accommodated and farmers can continue to farm. A regional hospital, located southeast of the intersection, would benefit from the serene setting and also be highly accessible. The conservation network provides recreational connections between the City Center and the reservoir areas, as well as a buffer for the segment of the Warm Springs Creek that flows through the site.



Figure 43 - Existing Conditions



Figure 44 - Trend Development

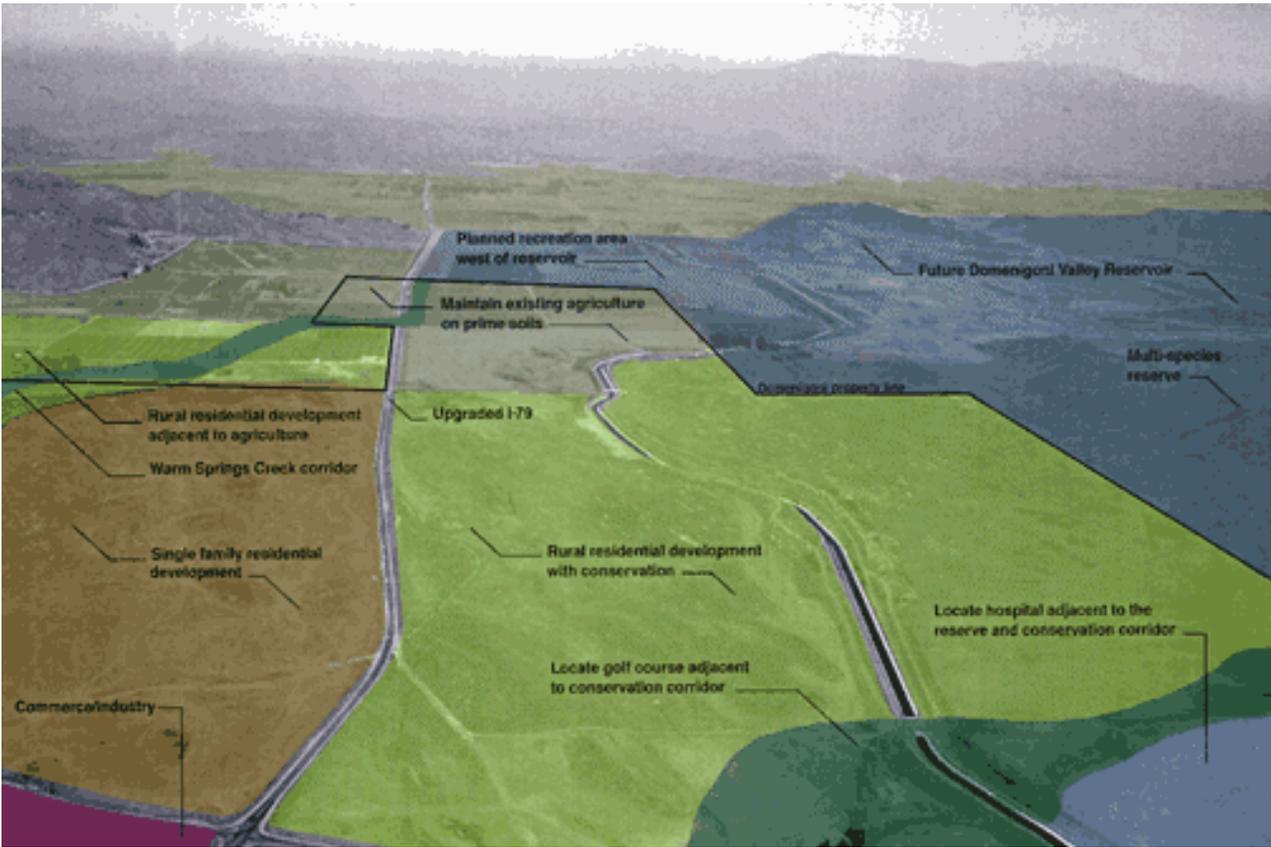


Figure 45 - Proposed Strategy



Figure 46 - Proposed Design

Finally, Site E lies within the proposed conservation corridor east of the Domenigoni Valley Reservoir, which is under construction. This area currently connects key areas of natural habitat while simultaneously allowing rural residential development. Orchards and horse farms are common in this area (Figure 47).

Trend development would continue to fragment the landscape, reducing wildlife habitat, fire management capacity, and the visual sense of an open landscape (Figure 48). Soil erosion and downstream flooding would accelerate as a result of the clearing of vegetation around houses and building of roads on steep slopes.

The design strategy is to cluster residential development as much as possible, maintaining larger areas of natural vegetation as habitat and for wildlife movement and enabling a program of fire management (Figure 49).

In the design, the same number of houses are clustered with natural vegetation maintained along property lines. As a result, considerably more area surrounding the houses has been left open for wildlife movement and fire management (Figure 50).



Figure 47 - Existing Conditions



Figure 48 - Trend Development

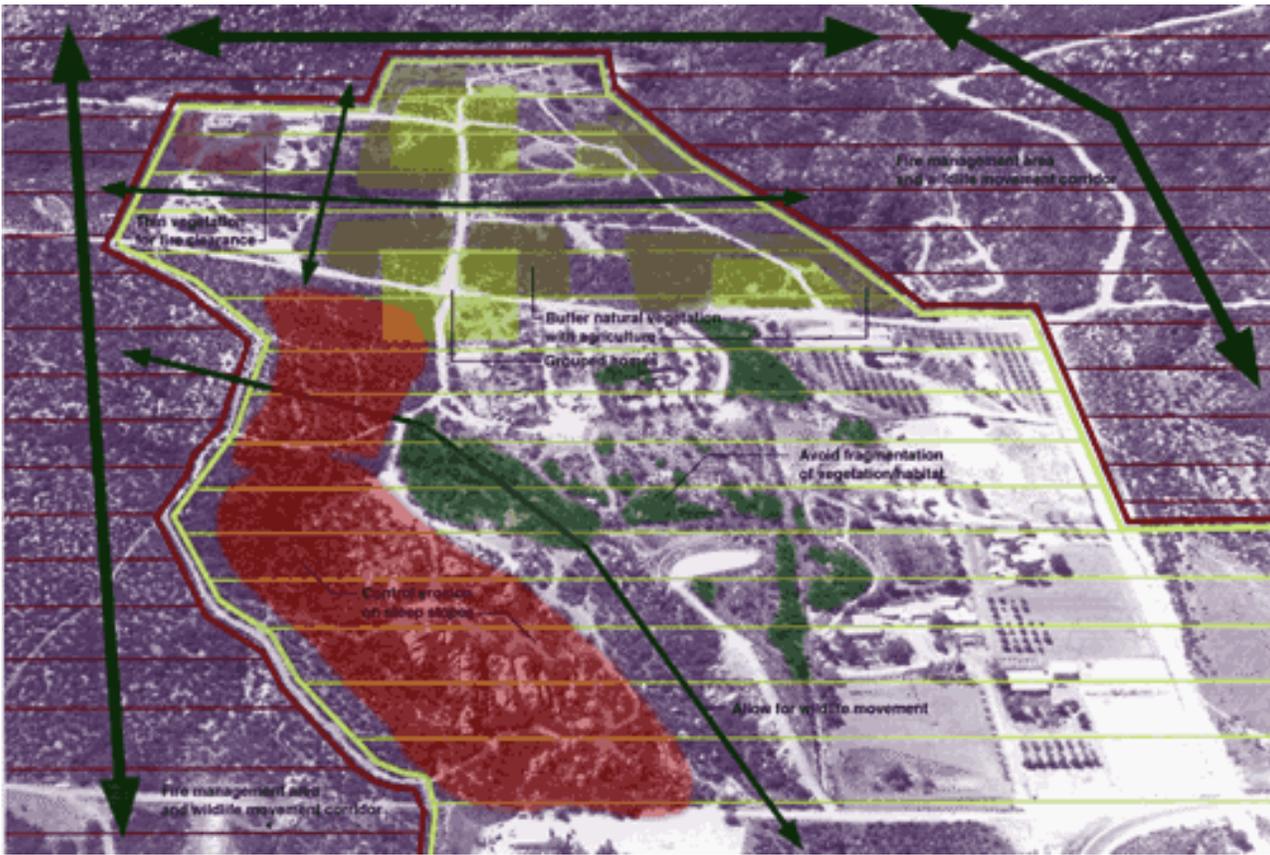


Figure 49 - Proposed Strategy



Figure 50 - Proposed Design

## Site Development Guidelines

### Change, Impact

The concepts illustrated in the proposed designs of the five site areas derive from an investigation at the scale of the decisions of individual stakeholders. The resulting design guidelines aim to accommodate urbanization while protecting the natural landscape and its critical functions. They are described in the guidelines matrix, seen in Figure 51, which is organized by a number of general principles related to terrain, stormwater runoff, fire, vegetation and species habitat, visual quality, roads, streams and floodplains, agriculture, and development. Each guideline corresponds to one or more of four levels of conservation priority. Some promote *good* practice—and others aim to prevent *bad* practice.

In the terrain category, development is prohibited on slopes greater than 25 percent where severe erosion is likely to occur.

The proposed runoff measures include retention systems that reduce downstream flooding and damage to riparian vegetation. On-site retention systems slow the rate of stormwater runoff, consequently slowing the rate of downstream flooding.

The guidelines for fire show potential fire management strategies in areas likely to be developed. The guidelines stress the importance of maintaining larger areas of contiguous vegetation in a fire-managed landscape that can accommodate the processes of prescribed burning.

The visual quality guidelines set development back from roads and restrict development from ridgetops to preserve significant scenic vistas and scenic routes.

The guidelines encourage preservation of the landscape ecological pattern, much of which can be protected through private conservation methods. Residential access roads should run along the edges of natural areas, rather than through their interiors. The ecologically guided placement of roads lessens fragmentation and helps maintain the integrity of the landscape ecological pattern.

Vegetated corridors along streams and rivers should be protected to allow for species movement, erosion control, and other ecological benefits. The guidelines propose, at a minimum, a continuous 30-meter setback along stream corridors to protect the stream from impacts of development such as water pollution, nutrient uptake, and erosion. The buffer also lessens the need for channelization; consequently, seasonal patterns, biological cycles, and wildlife connectivity are maintained.

Generally the stream buffer lies within the floodplain; more often, however, the floodplain is more extensive than the buffer distance. For greater protection of human safety and property, and to enhance the benefits of the riparian corridor, future urban development is restricted in the floodplain. Rather, some kinds of agriculture, institutional settings, and recreational facilities are more compatible uses of the floodplain area.

Existing agricultural areas on prime soils are protected from development for economic, cultural, and ecological reasons.

By reshaping the pattern and quality of development, the design and its guidelines can accommodate the anticipated population in a high-quality environment.

# Site Guidelines

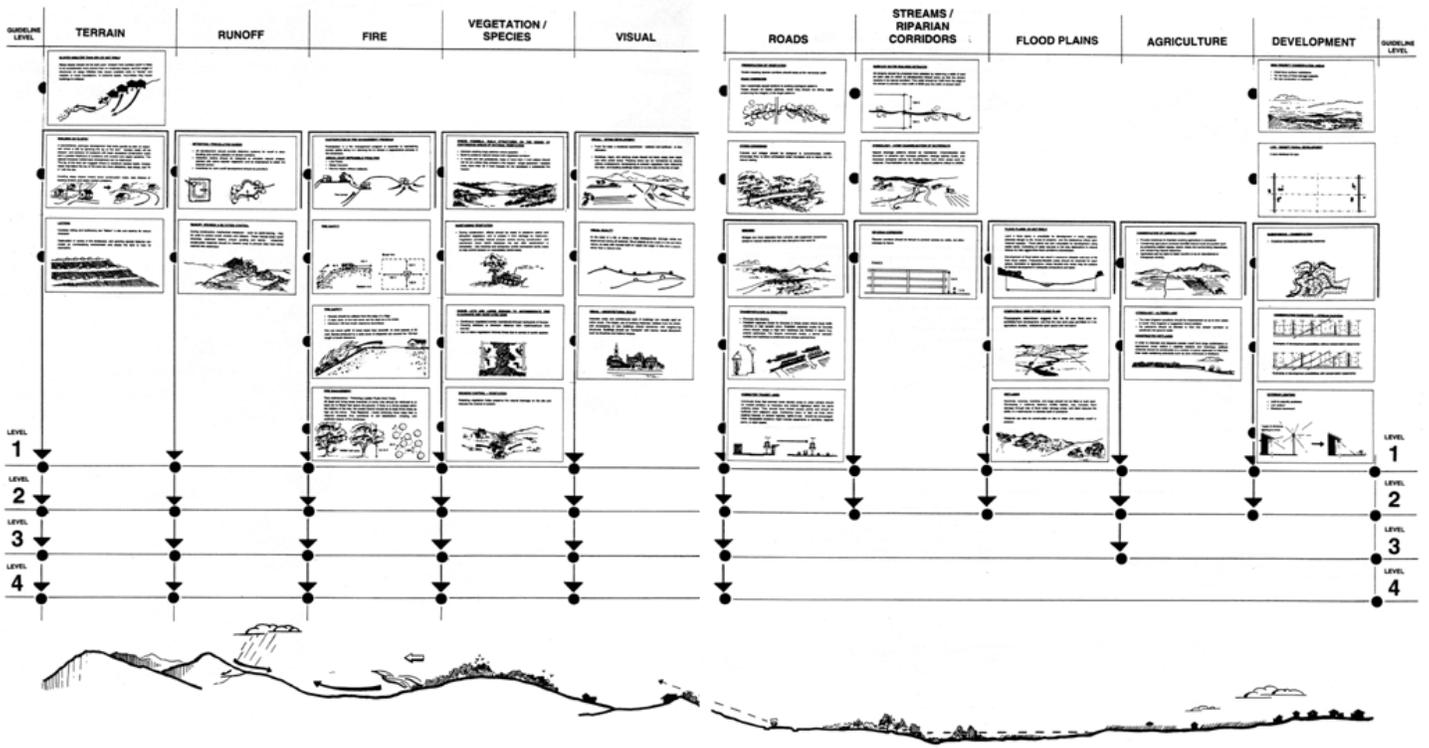


Figure 51

## SLOPES GREATER THAN 25% DO NOT BUILD

Steep slopes should not be built upon. Erosion from surface runoff is likely to be considerably more severe than on moderate slopes, and the weight of structures on steep hillsides may cause unstable soils to "slump" and weaken or crack foundations. In extreme cases, mud-slides may cause buildings to collapse.

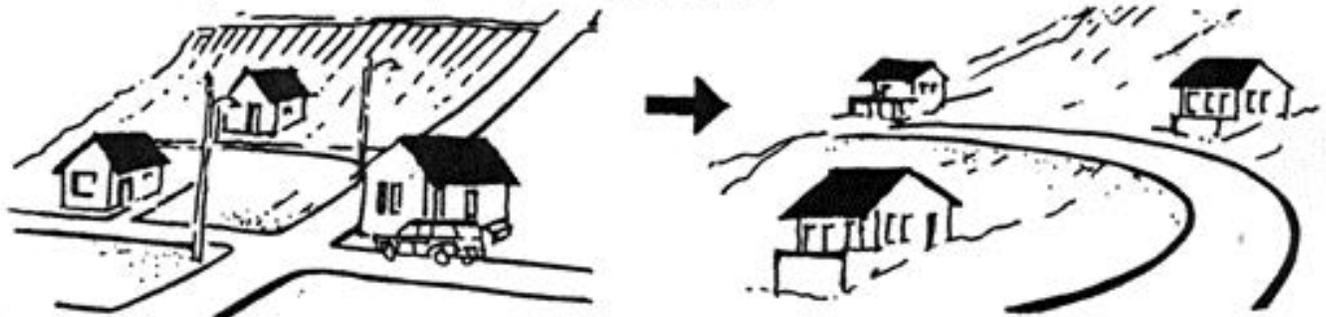


## BUILDING ON SLOPES

A conventional, grid-type development that looks good as plan on will be steeper, and arbitrary locations will mean excessive construction costs and a greater likelihood of problems with erosion and septic systems. The natural character (wilderness atmosphere) can be destroyed.

The lay of the land can suggest where to construct access roads. Access roads that follow the lay of the land are more attractive, less steep, and "fit in" with the site.

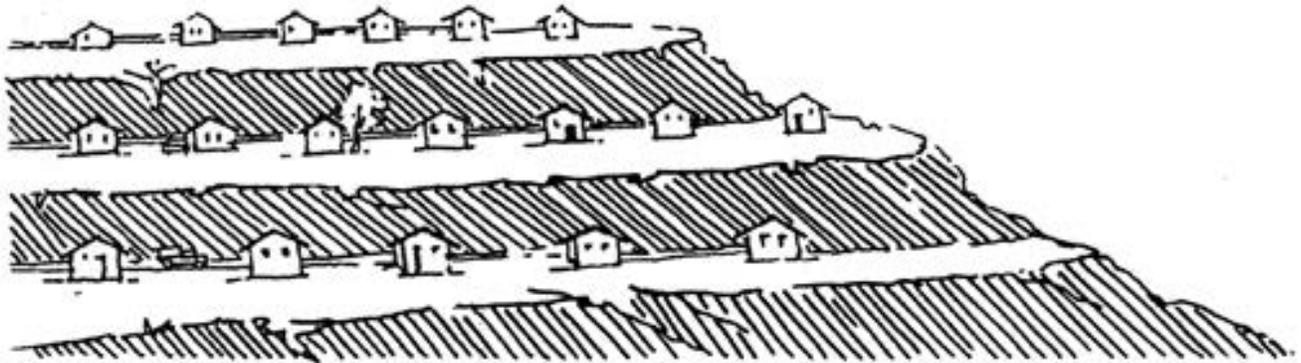
Avoiding steep slopes means lower construction costs, less chance of causing erosion and septic system problems.



## LOTING

Careless lotting and bulldozing can "flatten" a site and destroy its natural character.

Destruction of variety in the landscape - and ignoring special features - can turn interesting land into a parking lot. The land loses its desirability.



## DETENTION / PERCOLATION BASINS

- All development should provide detention systems for runoff to deter flooding and control pollution of stream corridors.
- Detention basins should be designed to natural shapes, planted with native riparian vegetation and be unpinned to attain the designed control.
- Incentives for zero runoff development should be provided.



## RUNOFF, EROSION & SILTATION CONTROL

During construction, mechanical measures - such as earth-moving - may be used to control runoff, erosion and siltation. These include lined runoff channels, sediment basins, proper grading and berms. Cleaning up construction litter is also helpful.

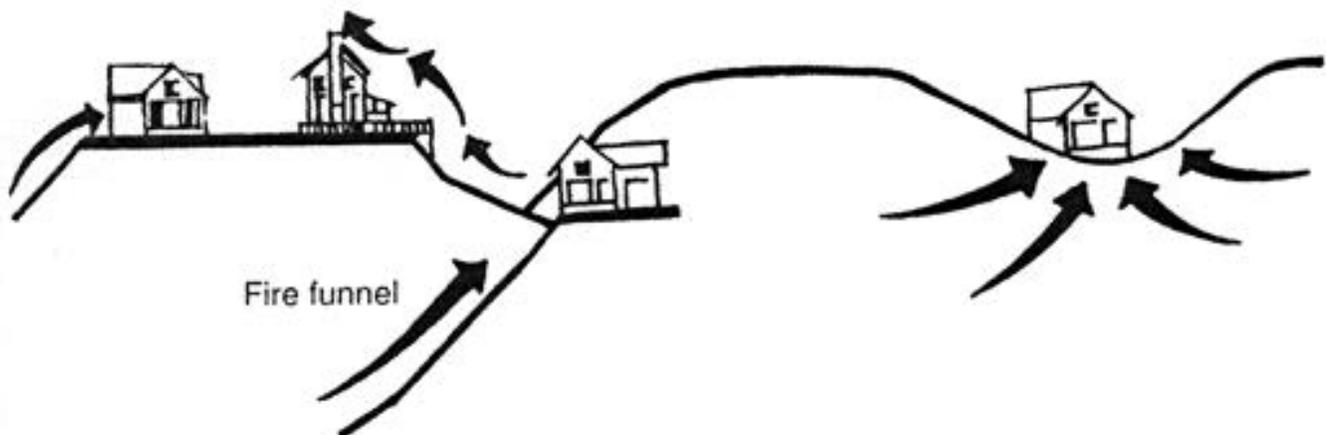


## PARTICIPATION IN FIRE MANAGEMENT PROGRAM

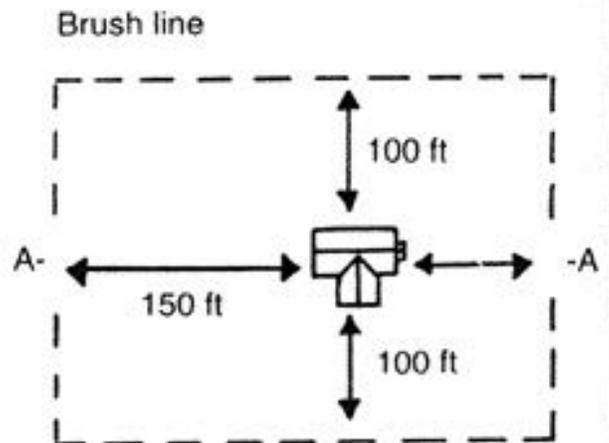
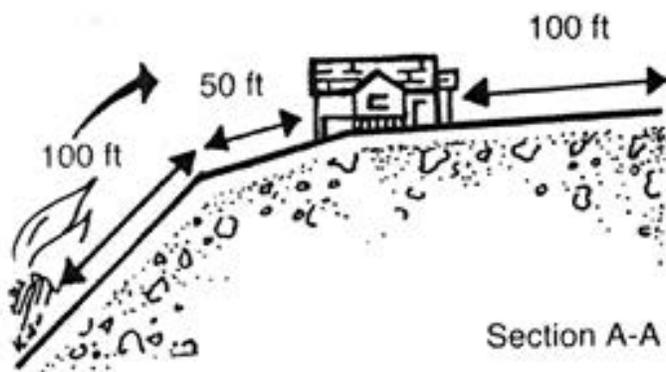
Participation in a fire management program is essential to maintaining human safety along with allowing fire to remain a regenerative process in the landscape.

### AREAS LEAST DEFENSIBLE FROM FIRE

- Low Points
- Steep Canyons
- Narrow ridges without setbacks



## FIRE SAFETY



## FIRE SAFETY

- Houses should be setback from the edge of a ridge
- A road, lawn, or low fuel cover can be used as a fire break
- Minimum 100 foot brush clearance downslope

Fire can travel uphill 16 times faster than downhill. At wind speeds of 50 mph, flames produced by a solid cover of chaparral can exceed the 100-foot length of brush clearance.

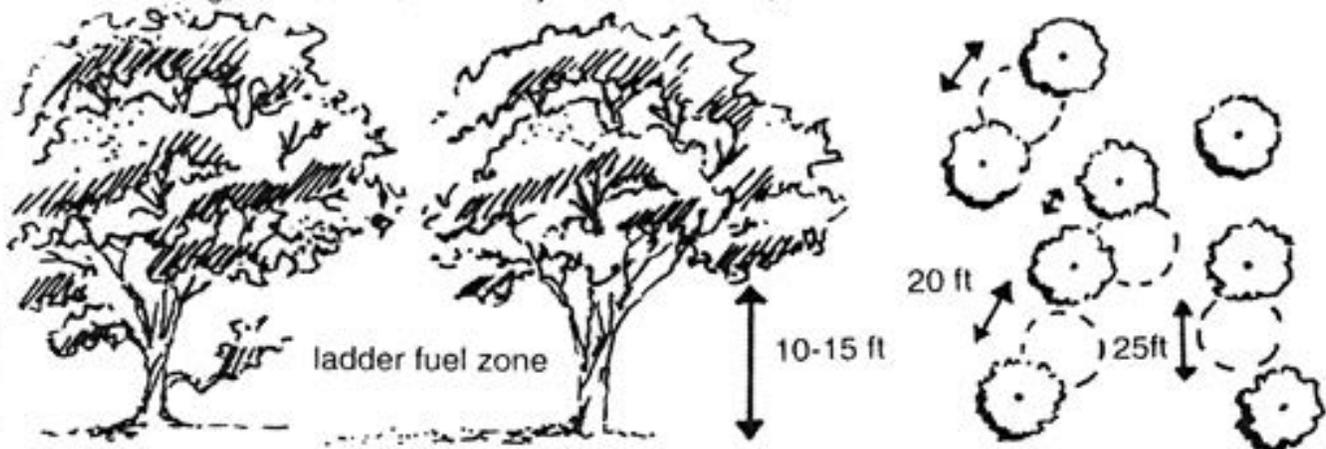


## FIRE MANAGEMENT

### **Tree maintenance - Trimming Ladder Fuels from Trees**

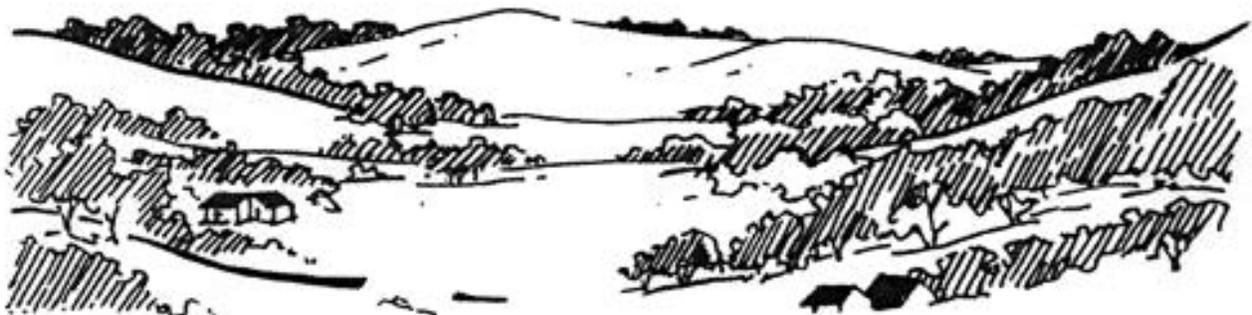
All dead and living lower branches of every tree should be removed to at least ten to fifteen feet above the ground. If there is a shrub located within the dripline of the tree, the lowest branch should be at least three times as high as the shrub.

**Tree Removal** - You don't want to take out any more trees than is necessary because they contribute to soil stabilization, shading, and aesthetic beauty of the landscape.



## WHERE POSSIBLE, BUILD STRUCTURES ON THE EDGES OF CONTIGUOUS AREAS OF NATURAL VEGETATION

- Maintain existing large patches where possible
- Build to preserve natural stream and vegetated corridors
- In woods and oak grasslands, trees of more than 4 inch caliper should not be cut unless they present a fire hazard - single specimen / isolated trees more than 30 ft from houses do not constitute a substantial fire hazard.



## MAINTAINING VEGETATION

- During construction, efforts should be made to preserve useful and attractive vegetation, and to protect it from damage by machinery. Vegetation provides natural erosion control during construction, and permanent cover which stabilizes the site after construction is completed. On unavoidably bared areas, mulches and temporary and/or permanent cover crops help control erosion.



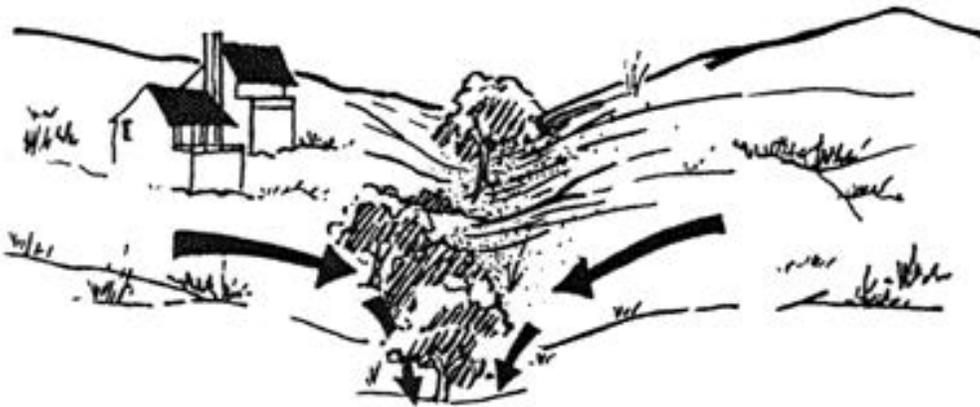
## WHERE LOTS ARE LARGE ENOUGH TO ACCOMMODATE FIRE CLEARANCE AND VEGETATED ZONE

- Continuous vegetated corridor maintained through backyards of houses
- Housing setbacks at minimum distance from road/maximum from corridor
- Use of native vegetation/ minimal threat due to spread of exotic species



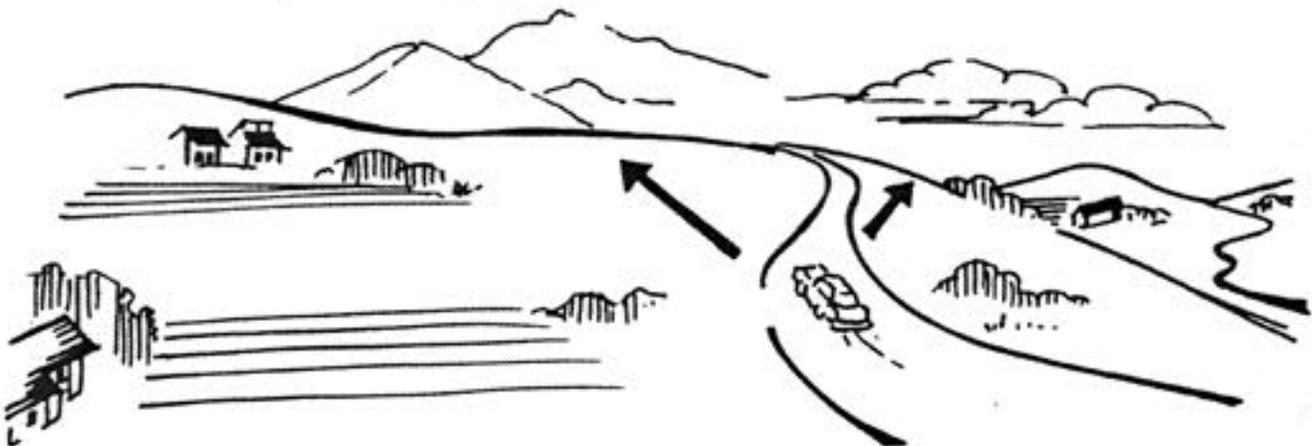
## EROSION CONTROL•VEGETATION

Retaining vegetation helps preserve the natural drainage on the site and reduces the chance of erosion.



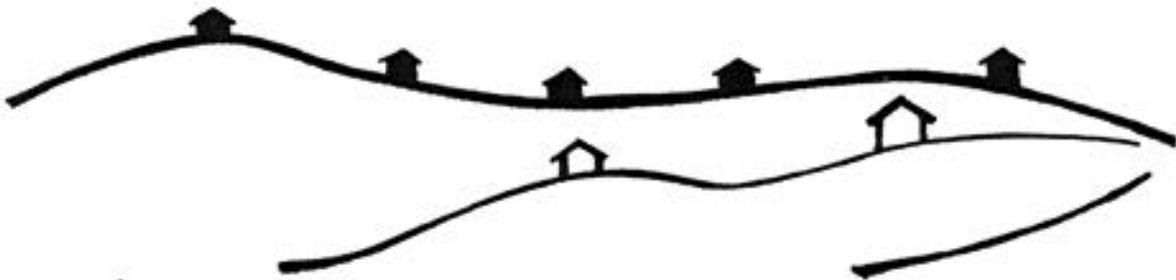
## VISUAL - SITING DEVELOPMENT

- From the road, a clustered subdivision - setback and buffered - is less obtrusive.
- Buildings, signs, and parking areas should not block vistas from roads and other public areas. Pleasing views can be maintained by placing utilities underground, landscaping to prevent vegetation from obscuring the view, and locating buildings below or to one side of the line of sight.



## VISUAL QUALITY

At the crest of a hill, or along a ridge (background), stronger winds are experienced during all seasons. Since objects at the crest of a hill are more visible, then if many peoples decide to build on ridges or hillcrests, an area can begin to look like a suburb, rather than a natural area with wilderness atmosphere.



## VISUAL - ARCHITECTURAL SCALE

Improper scale and architectural style of buildings can visually spoil an entire street. The height, use of building materials, setback from the street, and landscaping of new buildings should harmonize with neighboring structures. Buildings should not "compete" with nearby visual attractions such as churches and historic houses.

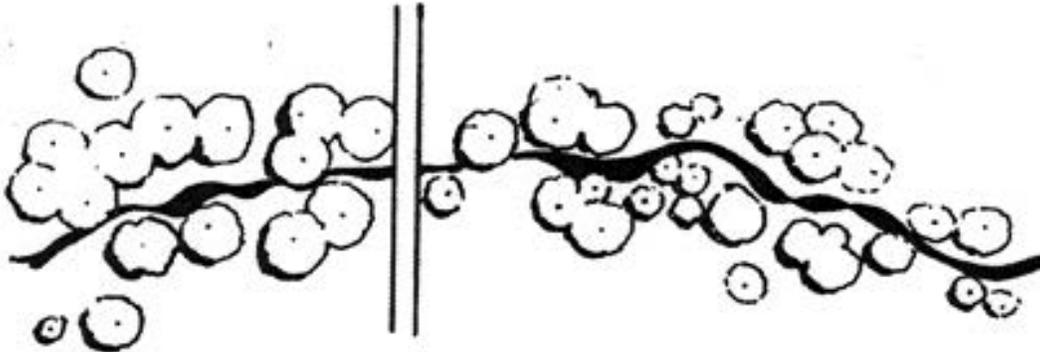


### PRESERVATION OF VEGETATION

Roads bisecting riparian corridors should cross at the narrowest width.

### ROAD CORRIDORS

New roads/trails should conform to existing ecological patterns. Roads should not bisect patches, rather they should run along edges preserving the integrity of the larger patterns.



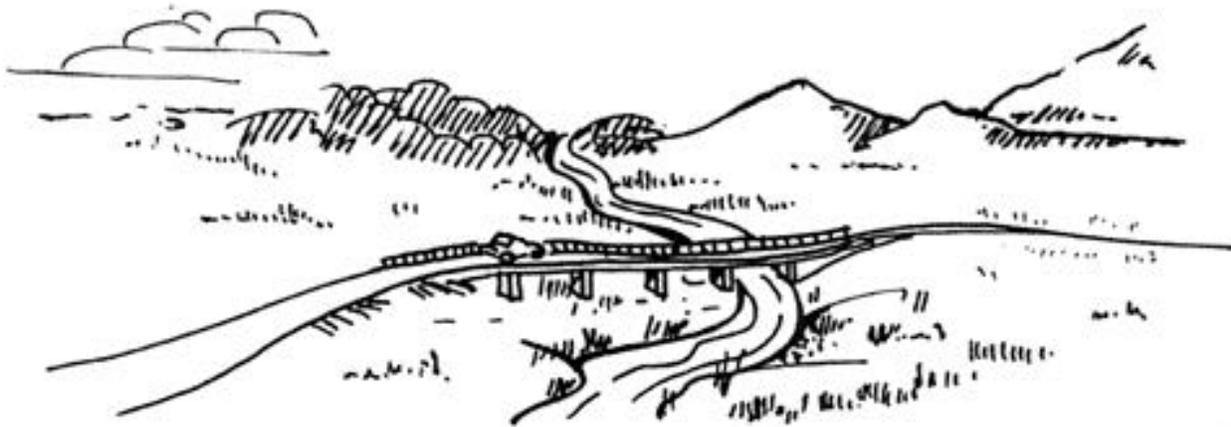
### HYDRO-CROSSINGS

Culverts and bridges should be designed to accommodate wildlife, encourage flora, to allow unimpeded water circulation and to blend into the natural setting.



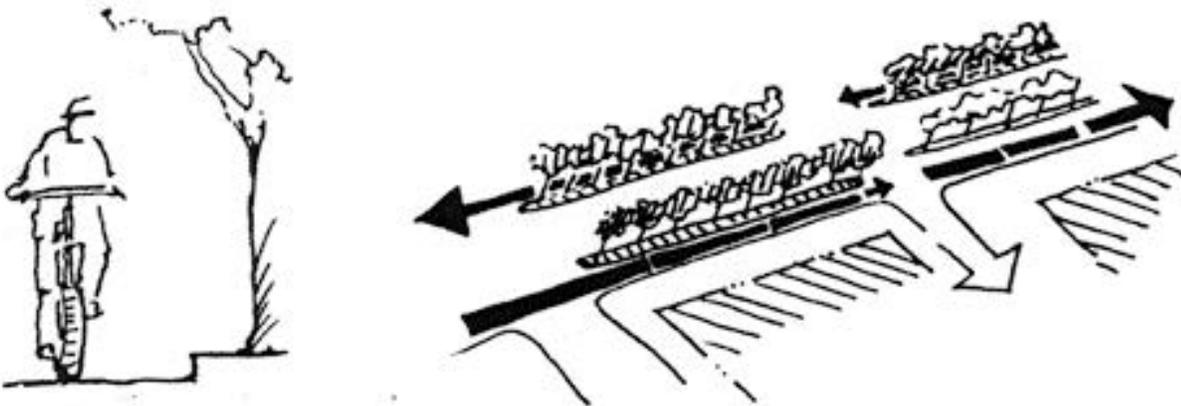
## BRIDGES

Bridges are more desirable than culverts; pile supported causeways preserve natural habitat and are less disruptive than solid fill.



## TRANSPORTATION ALTERNATIVES

- Promote ride-sharing.
- Establish separate routes for bicycles in those areas where large traffic volumes or high speeds occur. Establish separate routes for bicycles where bicycle usage is high and roadways are limited in space (e.g. arterial parkways). For bicycle commuter routes, a barrier between cyclists and roadways is preferred over simple painted lines.



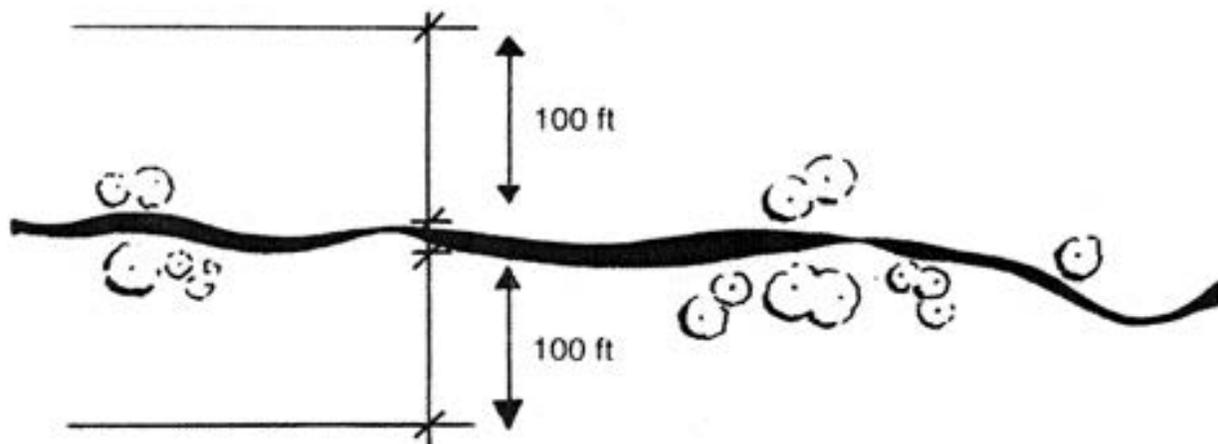
### COMMUTER TRANSIT LINES

Commuter lines that connect lower density areas to urban centers should be treated similarly to freeways and arterial highways within the same outlying areas. They should have limited access points and should be buffered from adjacent uses. Combining heavy or light rail lines within existing freeway or arterial highway rights-of-way should be encouraged. Other acceptable locations might include easements or corridors, regional parks, or open space.



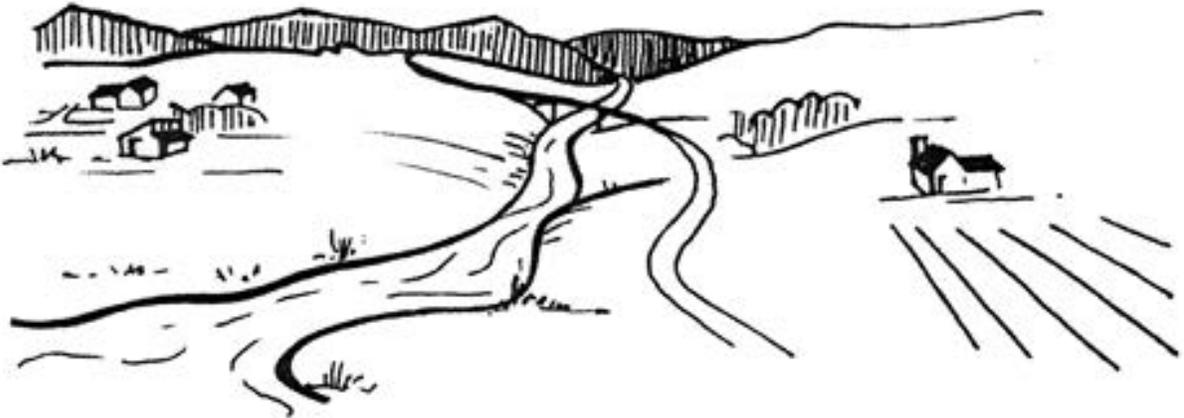
### SURFACE WATER BUILDING SETBACKS

This suggests that all streams be protected from pollution by reserving a width of land on each side on which no development should occur so that the stream remains in its natural condition. This width should be 100ft from the edge of the stream to provide a total width of 200ft plus the width of stream itself.



## HYDROLOGY- AVOID CHANNELIZATION OF WATERWAYS

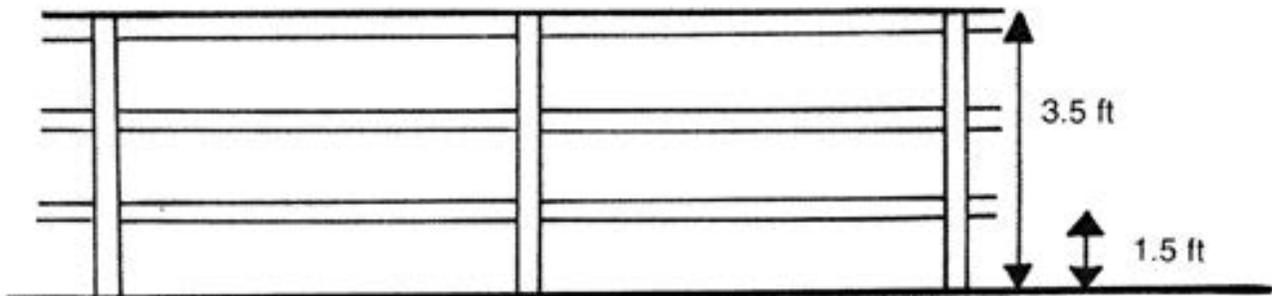
Natural drainage patterns should be maintained. Channelization and diversion of streams can increase pollution, change salinity levels, and decrease biological activity by diverting flow from other areas such as wetlands. Channelization can also alter seasonal patterns critical to wildlife.



## GRAZING

Grazing should not be permitted in riparian corridors which should be fenced to prevent access by cattle, but allow passage by native fauna.

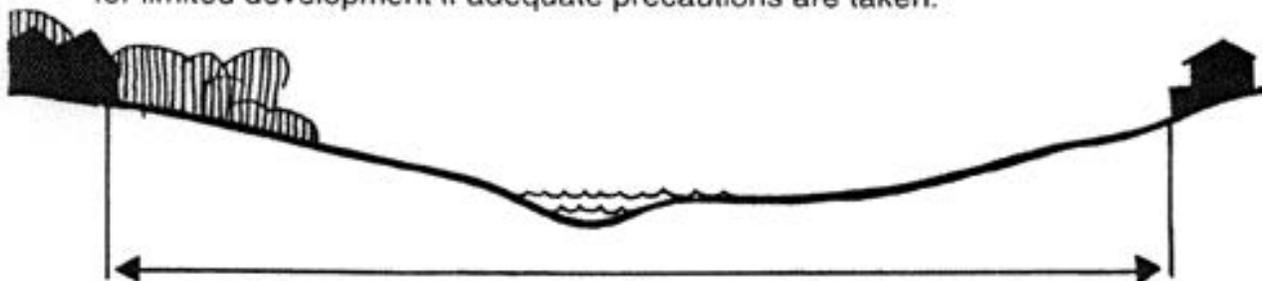
### FENCES



### FLOOD PLAINS: DO NOT BUILD

Land in flood plains is unsuitable for development in many respects: potential danger to life, threat of property, and the deleterious effect upon channel capacity. Such lands are also unsuitable for development using septic tanks. Culverting of water courses is not only destructive to natural beauty but also aggravates flood conditions downstream.

Development of flood plains can result in economic disaster and loss of life from flood waters. Frequently-flooded areas should be reserved for open space, recreation or agriculture; areas flooded only rarely may be suitable for limited development if adequate precautions are taken.



### COMPATIBLE USES WITHIN FLOOD PLAIN

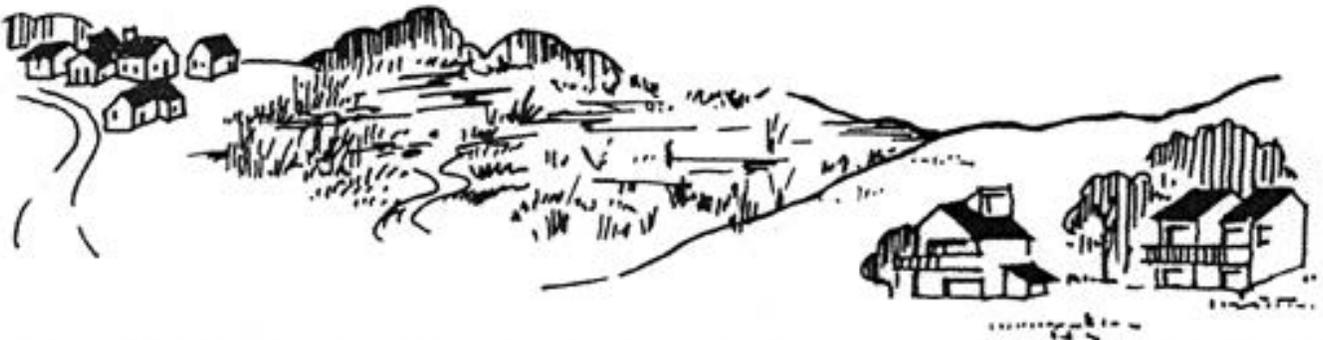
Physiographic determinism suggests that the 50 year flood plain be prohibited from development, and that the only land uses permitted on it be agriculture, forestry, institutional open space and recreation.



## WETLANDS

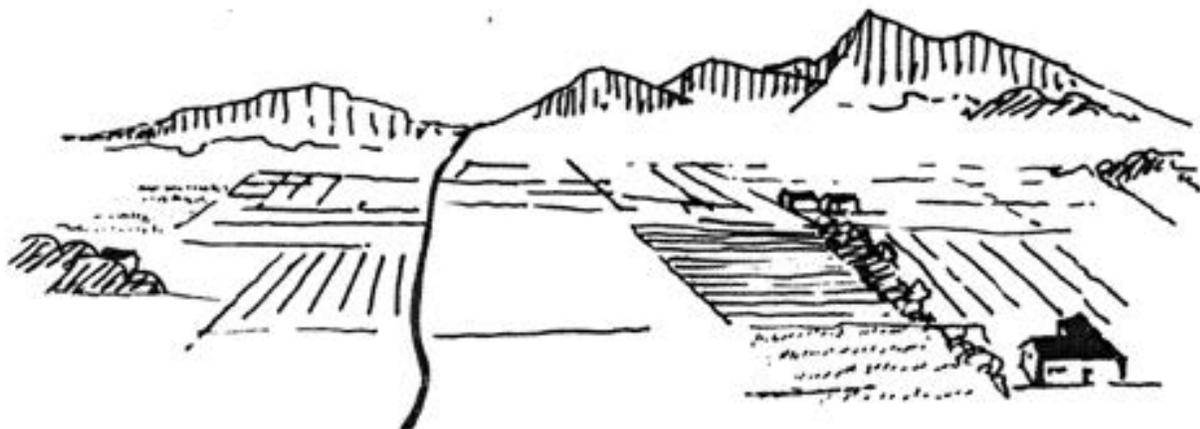
Generally, swamps, marshes, and bogs should not be filled or built upon. Developing in wetlands destroys wildlife habitat, may increase flood damage through loss of flood water storage areas, and often reduces the ability of a watercourse to cleanse itself of pollutants.

Wetlands can also be constructed on site to retain and cleanse runoff or pollution.



## CONSERVATION OF AGRICULTURAL RESOURCES

- Provide incentives for maintaining existing agriculture in perpetuity.
- Agriculture can be used to foster tourism or as an educational or therapeutic amenity.



### HYDROLOGY - ALTERED LAND

- The best irrigation practices should be implemented so as to limit waste & runoff. Drip irrigation is suggested where suitable.
- No toxic chemicals shall be allowed to flow off into stream corridors and penetration into ground water should be avoided.

### CONSTRUCTED WETLANDS

In order to intercept and disperse excess runoff from large subdivisions or agricultural areas before it reaches streams and riverways, artificial wetlands should be constructed at a number of points upstream to hold and treat water containing pollutants such as lawn chemicals or fertilizers.



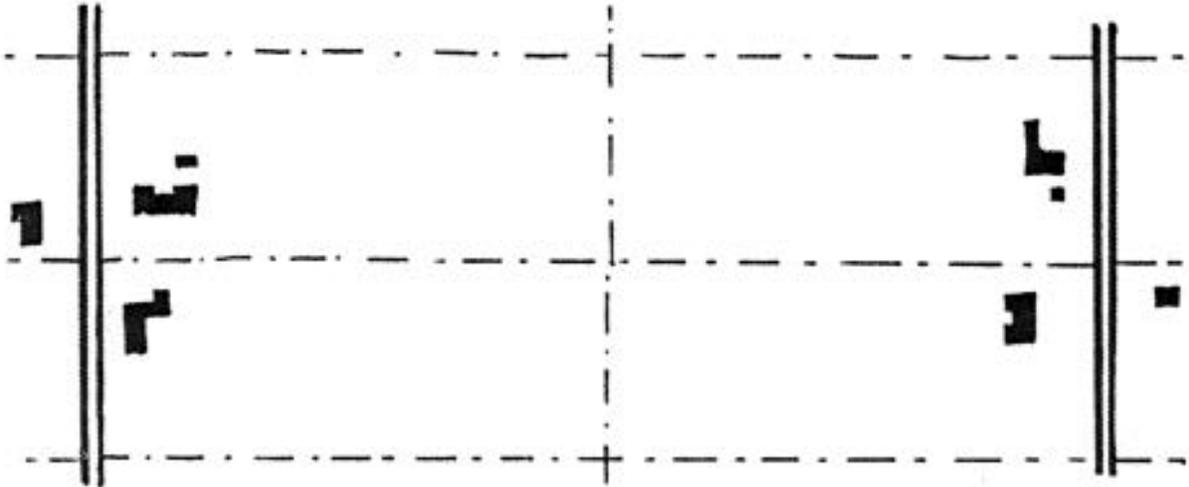
### HIGH PRIORITY CONSERVATION AREAS

- Impervious surface restrictions
- No net loss of flood storage capacity
- No new production or extraction



## LOW - DENSITY RURAL DEVELOPMENT

5 acre minimum lot size

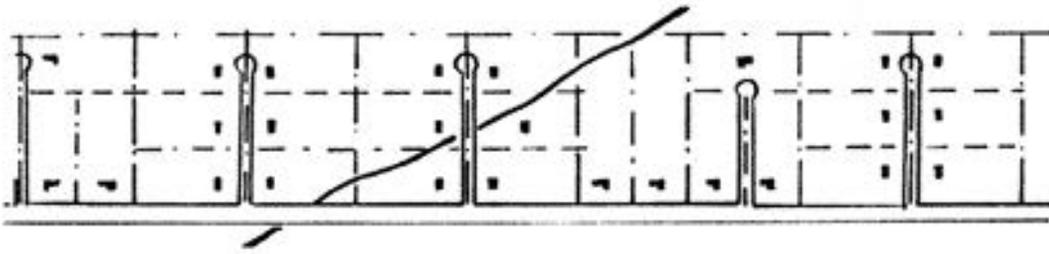


## SUBDIVISIONS + CONSERVATION

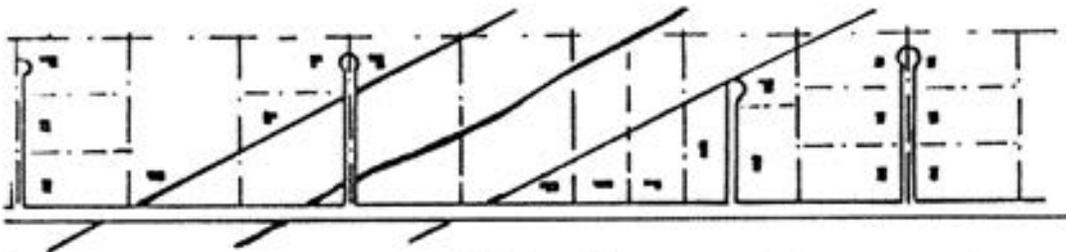
- Clustered development preserving waterway



## CONSERVATION EASEMENTS + STREAM BUFFERS



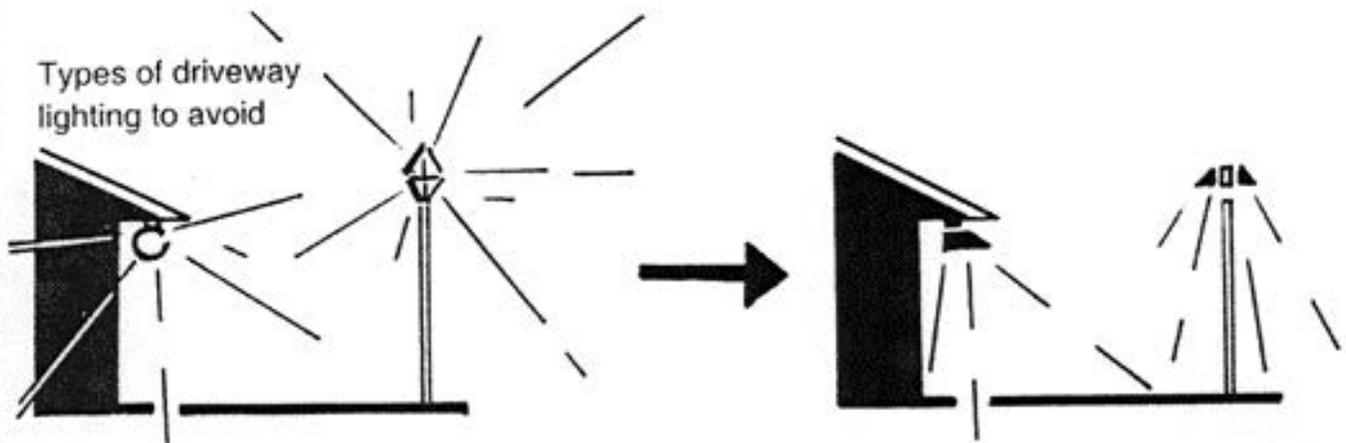
Examples of development possibilities without conservation easements.



Examples of development possibilities with conservation easements.

## EXTERIOR LIGHTING

- Limit to security purposes
- Low sodium
- Shielded downward



## Comparing the Trend and the Proposed Design Impact, Decision



Clearly, the proposed design is different from the trend... but is it better? Some of the most important costs and benefits of the proposal as compared to the trend are shown in Table 2.

Some of the costs are not calculated in dollar amounts, but they are recognized as costs all the same.

Politically, the design requires much more complex implementation and more exacting environmental management. For some landowners, there are opportunity costs in the areas that have been downzoned. This may require compensatory measures.

Housing in the proposed design, which incorporates the guidelines, is generally more expensive than in the trend. On average, land costs increase \$5,000 per unit for rural-residential; decrease \$500 per unit for single-family residential; and increase by \$1,000 per unit for multi-family residential development. However, the added cost may be offset by greater increases in value. Clearly, the largest financial cost of the design proposal is associated with the land acquisition program for conservation, which is estimated at around \$270 million.

Some of the benefits of the design are also not calculated in dollar amounts. Benefits include: the efficiencies of concentrated development; higher-quality residential environments (which should be more

valuable); improved air quality; improved fire management; protected agricultural land with its economic potential; higher rates of aquifer recharge; and a more sustainable urbanization strategy in the long term. While these benefits cannot be assessed easily in monetary terms, they do represent improvements on the trend.

The conservation strategy, which seeks to protect streams from channelization for ecological reasons also protects the taxpayers from the costs of channelization. At an average cost of between \$1 million and \$10 million per linear mile, channelization in the conservation zones would have a cost estimated at \$250 million under conditions of trend development. Without channelization, the \$250 million saving in the proposed design almost offsets the cost of conservation strategies. In the Santa Margarita River Basin alone, the design could save about \$150 million in channelization costs.

Remember that one goal of the hydrologic conservation strategy was to lessen the projected increase in downstream flooding, particularly on MCB Camp Pendleton. With lessened flood threat, it is less likely that the Camp will need to relocate its air base at a possible savings of *more than \$2 billion*. The benefits of foregoing this enormous public expense would more than offset the public costs of the proposed design.

***Some Estimated Costs of Proposed 2030***

More complex politics of implementation		N/A
More exacting environmental management		N/A
More expensive development (in short-term) due to reduced supply of land and more stringent guidelines	Land Cost:	
	Avg. Rural Residential	+\$5000/unit
	Avg. Single Family	-\$500/unit
	Avg. Multi-Family	+\$1000/unit
Opportunity costs of some down-zoning		N/A
Land costs of conservation:		
Corridor @ full control (100%)		\$35,000,000
Corridor and reserve partnership @ 70%		\$70,000,000
Corridor - Private conservation @ 40%		\$8,000,000
Flood Control Network 2010 @ 90%		\$100,000,000
Flood Control Network 2030 @ 90%		\$40,000,000
Scenic Highway Easement @ 30%		\$16,000,000
<hr/>		
Total land costs for conservation		\$270,000,000

***Some Estimated Benefits of Proposed 2030***

Efficiencies of concentrated development		N/A
Higher quality (and higher value) residential environment		N/A
Improved air quality		N/A
Improved fire management		N/A
Protected agricultural potential		N/A
Increased water infiltration and aquifer recharge		N/A
Protection of priority - a more sustainable urbanization strategy:		
Cultural Landscape		N/A
Hydrologic Landscape		N/A
Biologic Landscape		N/A
Cost avoidance of stream channelization		> \$250,000,000
<hr/>		
In Santa Margarita River Basin:		
Cost avoidance of channelizing Santa Margarita River		\$150,000,000
Reduced rate of downstream flooding, and therefore no need for MCB Camp Pendleton to relocate Air Base		\$2,000,000,000

Table 2

## Implementing the Proposed Design



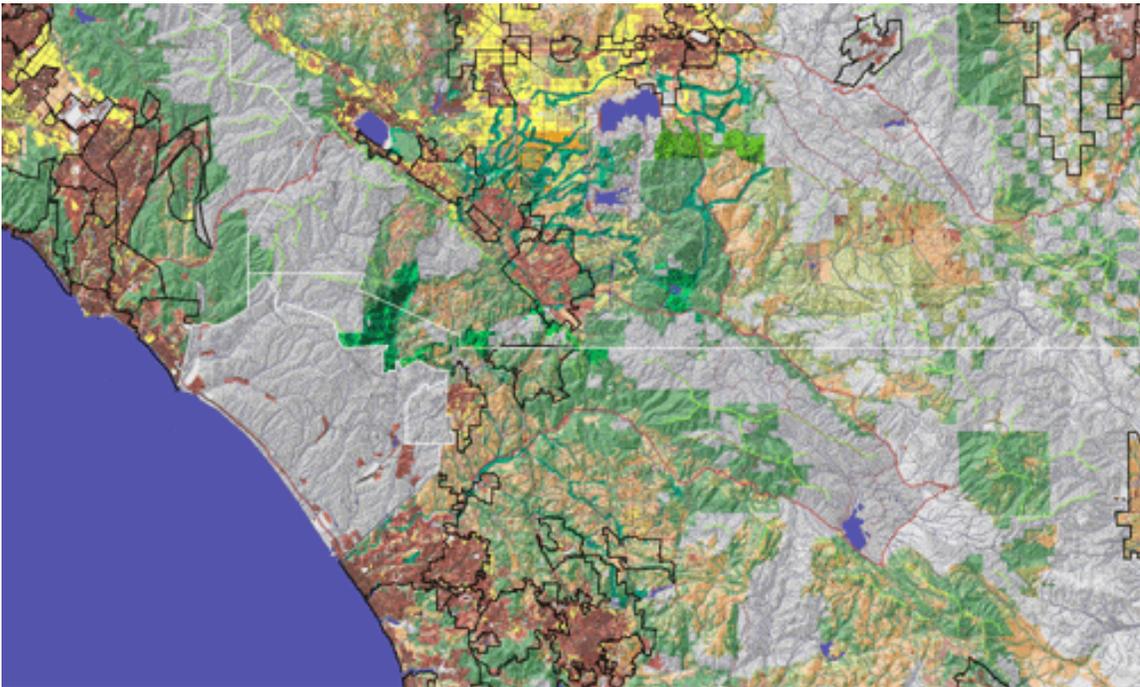
The implementation of the proposed design, with its large and complex geography, many stakeholders, long time-span, and several scales of decision, is a process that involves many techniques, responsible agencies, and organizations. The implementation chart (Table 3) shows the major strategies incorporated into the design and their respective implementation techniques, based largely on *Alternative Techniques for Managing Growth* by Irving Schiffman (1989). The list of agencies and stakeholders which have responsibility for the various aspects of implementation is expanded from those described by the Santa Margarita River Association (1995). It is only through regional coordination and inter-agency cooperation that the major strategies can become implemented.

Figure 52 shows some of the major implementation responsibilities. For example, the priority conservation lands and the flood control network may be protected through three types of techniques: full-fee acquisition, cooperative partnerships, and private conservation. These are achievable only through shared responsibility between the public and private sectors.

As described previously, the design guidelines address the management of areas outside the priority conservation lands. Most of these guidelines can be implemented at the local level within traditional zoning ordinances. Others may require regional coordination.

Transportation upgrades and the proposed rail line would be carried out via the currently responsible agencies of government, as would improvements connected to water management.

Clearly, a major, coordinated, regional effort will be necessary to gain the support of the public to facilitate the private and inter-agency cooperation needed to implement such major design strategies as those proposed herein. The conservation investments, infrastructure improvements, zoning strategies, and guidelines can positively influence flood control, fire management, and long-term preservation of the regional landscape ecological pattern and its high biodiversity.



**Implementation**

- |   |   |   |
|---|---|---|
|  Corridor - Full Control                       |  Corridor and Reserve Partnership Conservation |  Corridor Private Conservation         |
|  Flood Control Network - Shared Responsibility |  Guidelines: Level 1                           |  Guidelines: Level 2                   |
|  Guidelines: Level 3                           |  Guidelines: Level 4                           |  Transportation: Upgraded / New Roads  |
|  Proposed Rail Line                            |  Right of Way for Proposed By-Pass             |  Zoning Changes                        |
|  Core Zone: Services Priority                 |  Regional Identity: Scenic Easement           |  Regional Identity: Scenic Highway    |
|  Regional Identity: Recreation Easement      |  Jurisdictions: County Boundaries            |  Jurisdictions: Municipal Boundaries |



Figure 52





## Conclusion

In conclusion, the major assumption of this study is that the trajectory of trend development *can* be changed and that regional cooperation directed toward a design proposal can improve *both* the landscape and its urban pattern. This report has outlined a design approach, which is an alternative to the trend at several scales, and its expected results if implemented. The proposed design is a complex solution to a complex problem. Although the study has focused on the ecological, social, and hydrological aspects, it is important to note that the design may also provide considerable economic benefits.

It seems clear that moving away from the trend of development and towards the strategies incorporated into the proposed design would be mutually beneficial to MCB Camp Pendleton and to its surrounding region.

The authors believe that these proposed design strategies for conservation and urbanization, if implemented, will best fulfill the region's long-term objectives.

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