Transforming Urban Environments for a POST-PEAK OIL FUTURE

A Vision Plan For the City of San Buenaventura

Yarnie Chen | Matt Deines | Henry Fleischmann | Sonya Reed | Isby Swick
606 Studio Department of Landscape Architecture California State Polytechnic University, Pomona 2007

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abstract

The peak in global oil production, or Peak Oil, will necessitate a change in the way communities function. While most planning for post-Peak Oil focuses on the generation of alternative energy sources to compensate for depleted oil supplies, the goal of this plan is to decrease energy consumption through community design and planning. This approach requires the localization of resources and transformation of urban environments and lifestyles, and therefore provides an opportunity to enhance quality of life.

The *Post-Peak Oil Vision Plan* analyzes probable implications of Peak Oil on the City of San Buenaventura and the surrounding region, and describes a vision for post-Peak Oil planning that responds to these implications by building upon positive trends that are already taking place. This vision is supported by planning and design guidelines, as well as a phased implementation plan. The regional vision emphasizes preservation of natural resources, concentration of the developed footprint, and intra-regional collaboration.

The 2050 vision for the City of San Buenaventura demonstrates the potential for transformation of urban environments. Under this vision, 85 percent of the population lives on less than a third of the city's land and is within walking distance of daily needs; 50 percent of the food supply is grown within city limits; and greywater and roofwater supply over 75 percent of urban irrigation needs. The community design that results from this plan includes a significant reduction in energy demand and an increase in quality of life.

how to use this document

This document can inform planning decisions at the regional, city, community, and household levels. The City of San Buenaventura and Ventura County can use this document as a reference tool for planning efforts, including General Plan updates and plans for new projects. The framework presented here can be adapted by other municipal governments to guide strategic conversations about a future without oil. This document also identifies guidelines that developers, entrepreneurs, and community members can use to assist in the transition from energy-intensive developments to post-Peak Oil communities.

PART I introduces the reader to the project goal, scope and context, and provides background information on the city of San Buenaventura and surrounding region.

PART II provides an in-depth analysis of eight critical community support systems, revealing their strengths and vulnerabilities in a post-Peak Oil context. Goals and objectives are generated for each system, which will be further explored in PART III. A scenario illustrates a probable future for the city and region based on information derived from the analysis, from feedback from a questionnaire sent to community members, and from assumptions gathered from current trends, projections, and historical and probable events.

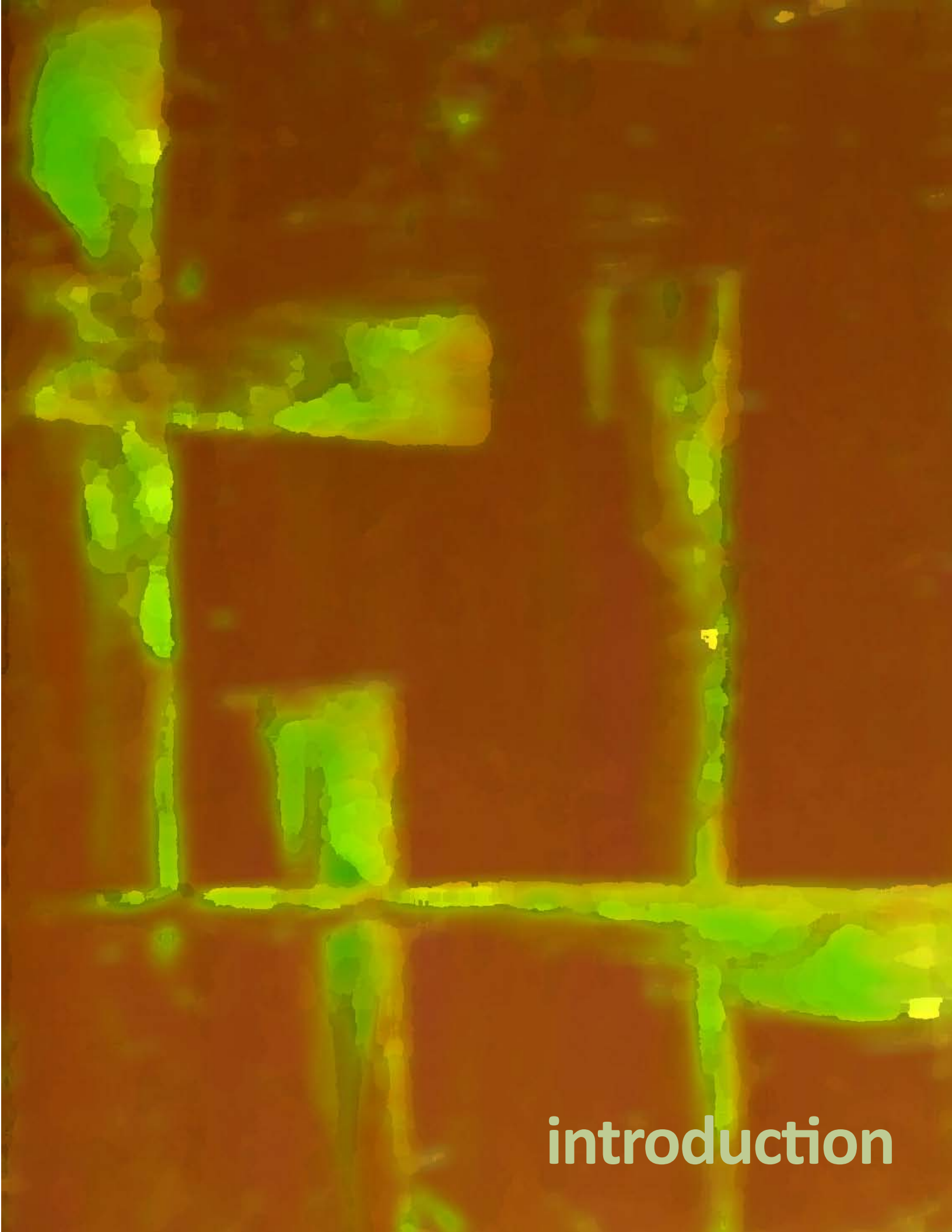
PART III explores the project's conceptual overview and overarching strategies for design, demonstrates planning and design at the regional and city scales, and provides detailed guidelines for how to meet systems objectives for a post-Peak Oil community.

PART IV demonstrates transformative planning and design at the site scale, and provides a pictorial manifestation of a day in the life in San Buenaventura in the year 2050.

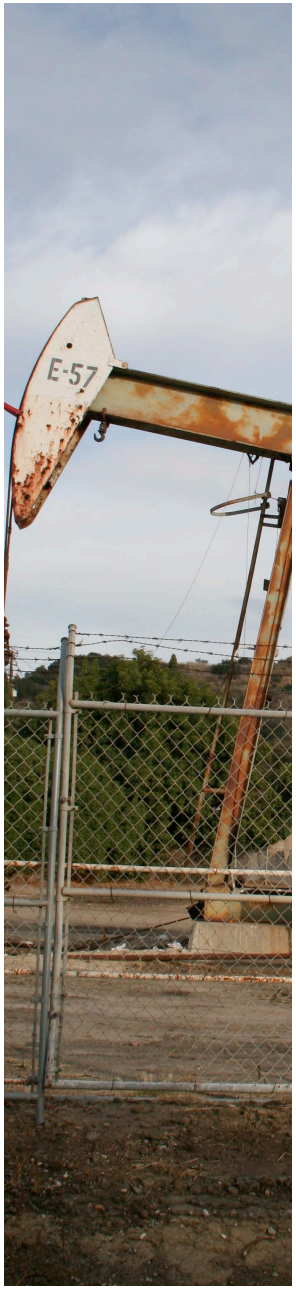
The APPENDICES offer additional resources that further explain the context and process of the *Post-Peak Oil Vision Plan*. These resources include a literature review of post-Peak Oil plans and additional readings that provide in-depth discussions of critical topics for post-Peak Oil planning.

PART one

INTRODUCTION
PROJECT CONTEXT



introduction



PROJECT PURPOSE

The purpose of this *Post-Peak Oil Vision Plan* is to initiate a strategic discussion between civic leaders, developers, and members of the community in San Buenaventura, California about the world that will be left for future generations in light of decreasing oil supplies.

Why is it important to start this discussion? It is becoming impossible to ignore the impact that the use of oil is having on the planet and communities. Many of the growing threats to environmental and political systems have direct links to oil consumption, including the global impact of climate change, health problems from contaminated environments, and resource warfare (Cohen 1990).

Despite the complexity of these challenges, their tie to oil offers a potentially simple solution: consume less. This solution will be forced by the predicted peak in global oil production, referred to as *Peak Oil.* Peak Oil can either be looked at as compounding current challenges, or as providing an impetus for change. In order to prepare for the eventuality of Peak Oil, cities will need to be flexible, as profound changes in policy will be necessary for the post-Peak Oil transition. Because communities are designed around the availability of cheap oil, this transition will require a change in the way communities are designed. This cannot be achieved without putting forth an organized and cohesive effort in the city and region. Policies must preemptively address energy and resource consumption practices from the regional scale down to the neighborhood scale. A combination of incentives and deterrents may work best in the effort to change preferences, values and ultimately, lifestyles.

The urgent actions needed to prevent a Peak Oil crisis fit with the actions needed to improve quality of life and leave future generations with a healthy planet. Quality of life has been defined in many ways throughout the millennia. In this study, quality of life refers to the affordability of basic goods, the viability of social networks, the allocation of personal time, and the health of humans and the environment.

Oil industry experts, scholars and scientists believe that oil production has already reached or is soon to reach its peak, after which a terminal decline is inevitable. The decline is predicted to be between two and five percent annually. Not only will this decline make current growth patterns impossible (Hopkins 2005), but it could result in a serious global economic, environmental, and political crisis, which oil alternatives may not be able to quell. This is the theory of "Peak Oil." (See sidebar: ***Peak Oil Theory*** on page 4). While Peak Oil refers to a specific point in time, post-Peak Oil refers to the expanse of time that follows Peak Oil in which society will no longer be able to use the energy resources that pre-Peak Oil societies have at their will. The following are probable implications for a post-Peak Oil society, as extrapolated from Heinberg (2005), Thayer (2006), Kunstler (2007), and the Community Solution. The Community Solution is an organization that studied Cuba's response to a sudden, and long lasting, oil shortage (see sidebar: ***Case Study: Cuba*** on page 5).

- ***Personal Travel*** - As private, oil-dependent, automobiles account for 88.1 percent of personal transportation (United States Department of Transportation 2007), drastic increases in oil prices will hinder residents' ability to move from place to place. Public transportation and energy-efficient alternatives will not be enough to handle the increased demand.
- ***Consumer Goods*** - The current production system rewards consolidated processing and mass production of goods. Post-Peak Oil will make this production system economically inefficient due to increased cost in the transportation of goods.
- ***Agriculture*** - Industrial food production relies on fossil fuels to maintain productivity. Peak Oil will require more land and human labor to produce food for survival (Heinberg 2005).
- ***Water*** - As pumping and moving water is energy-intensive, deep groundwater wells and water that is imported from long distances will become cost-prohibitive. Local sources will be heavily relied upon.
- ***Housing*** - Sprawling suburban developments typical throughout the United States are energy-intensive to maintain, disperse communities, and isolate individuals without transportation options.

- ***Employment*** - Peak Oil will necessitate a major shift in employment types as work becomes more labor-intensive and the availability of consumer goods is significantly reduced. Extensive education and training will be needed to transition the labor force from oil-consumptive practices.
- ***Carrying Capacity*** - Cheap energy has allowed human populations to grow to numbers previously impossible. The loss of oil as a cheap energy source, as well as a major contributor to increased agricultural production, will reduce the amount of people able to be sustained.

The influence and impact of oil on the critical systems listed above leave little question as to whether Peak Oil will require a shift in the way communities are designed post-Peak Oil. The quality of this transformation, what happens during the shift, and what new patterns emerge, will depend upon the preparations initiated by individuals and governing bodies. However, there are relatively few planning efforts that address post-Peak Oil society. At the national and state levels, the greatest preparation for rising oil prices is increased investment in alternative energy sources (Heinberg 2005). On a smaller scale, a handful of communities in the United States are developing Peak Oil resolutions, including the cities of Portland, Oregon; Oakland, California; and Franklin, New York. Several forward-thinking professors have also begun to spearhead change through design studios that explore opportunities for post-Peak Oil society (see sidebar: ***Design for Peak Oil*** on page 10). The community-based efforts, though peripheral to mainstream development, demonstrate the growing awareness of the need to envision the future with Peak Oil in mind. Despite efforts on the part of communities to develop these Peak Oil resolutions, design for post-Peak Oil communities is in its infancy. (See sidebar: ***Peak Oil Resolutions in United States Cities*** on page 8).

Peak Oil Theory

Peak Oil theory assumes that oil and other fossil fuels are finite resources, and that there will come a time when the oil available in the ground is too difficult or expensive to extract. Marion King Hubbert was the first to assert this idea in 1949. By 1956, Hubbert had created a model to predict peak dates by measuring known oil reserves and production rates (Figure 1). Using this model, Hubbert correctly predicted the continental United States' oil production peak date, which occurred in 1970. He also predicted that a peak in worldwide oil production would occur in 2000. Many believe this would have happened if the 1970s oil shock and its consequential fuel-efficiency and conservation efforts had not occurred.

Since Hubbert predicted a peak in global oil production (Peak Oil), many have speculated on the actual point in time the event would occur. Worldwide oil discoveries peaked in 1962, giving analysts a basis from which to look at possible production peak dates. Some experts, such as Matthew Simmons, a former energy advisor to George W. Bush, and industry expert Ken Deffeyes feel that the peak may have already occurred (both believe Peak Oil occurred in December 2005). While predictions for Peak Oil range from now (Oil Depletion Analysis Centre: 2007) to within the decade (Colin Campell of the Association for the Study of Peak Oil and Gas: Spring 2010), to more conservative estimates within the next thirty years (United States Geological Survey: after 2030), there is little debate about the inevitability of Peak Oil. Even oil companies are talking about the coming crisis, with Exxon Mobil predicting a peak will occur in five years, and Chevron claiming in an ad campaign that the "era of easy energy is over" (oildecline.com). While the actual date may not be agreed upon, it is widely assumed that a peak will occur and that it will have a significant effect on humans live. Compounding the problem of diminishing oil reserves are changes in third-world countries, most notably China and India, which are industrializing and demanding an increasing share of resources. This problem will only increase as their economies grow and people demand the luxuries many in the United States have come to view as necessities.

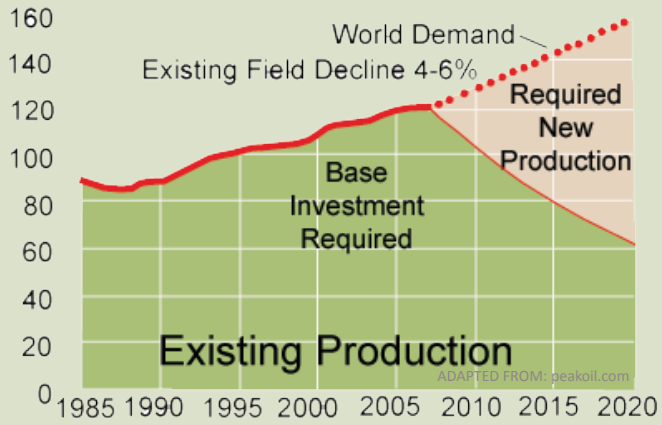


FIGURE 1
Millions of Barrels Per Day of Oil Equivalent

Case Study: Cuba

When the communist regime in Russia fell in 1989, Cuba lost 50 percent of its oil resources. What happened in the proceeding years is a sobering example of the effect Peak Oil could have on an oil-based society. Cuba immediately lost 80 percent of its import-export market, and due to political isolation, was cut off from the rest of the world. Agricultural production, bolstered by cheap oil-intensive pesticides, fertilizers, and farming methods, began to fail, resulting in the average Cuban losing 20 pounds over the next five years. The automobile was no longer a viable transportation mode for the majority of Cubans, and the trucking of goods within the country was dramatically reduced. Housing and commercial buildings were reconfigured, becoming smaller while accommodating more people. The people of Cuba adjusted by growing food within the city, employing organic farming methods, and substituting human and ox labor for past oil-intensive farming practices. Bicycles imported from China became the popular mode of travel. Trucks in Havana were retrofitted into buses, and city officials still able to drive cars were required to pick up passengers along their routes.

PHOTO SOURCE: The Community Solution, "The Power of Community: How Cuba Survived Peak Oil," 2006.

Quality of life in Cuba eventually established new lifestyle patterns that led to the improvement of both environmental and human health due to reduced oil-based pollution of the natural systems, increased walking, and healthier (fresher, unprocessed) food. Cubans today lead the way in healthcare and sustainable farming innovations. However, what happened in Cuba may not be a good indicator of what will happen in the United States. The communist regime in Cuba made quick changes to systems, producing immediate results. An example of this can be seen in the agricultural system: food supply was rationed, farmland was given to people willing to farm, a shift was made towards organic farming, and educational programs were implemented to ease the transition into more labor-intensive practices. In the United States, due to a democratic political system, capitalist economic system, and economic inequality, the transition away from oil will likely take more time and face greater resistance than it did in Cuba. Despite this, Cuba's experience is a good indicator that agriculture, transportation, and housing will be strongly impacted by Peak Oil.

(SOURCES: "The Power of Community" video, and Funes 2002).

CHOOSING A PATH TO ADDRESS PEAK OIL

Addressing the depletion of oil supplies will have a fundamental impact on the kind of world that is left for future generations. The most common approach and the approach taken by the *Post-Peak Oil Vision Plan* are discussed below.

The Path of Least Resistance: Reliance on Alternative Energy Sources

The most common approach to these challenges is to consider alternative and renewable energy and conservation measures to satisfy American appetites at their current levels. Sources of renewable energy include wind, sun, ocean energy, and bio-mass, and have the potential to be useful in making up for the loss of fossil fuels. However, current infrastructure and technology is far from being able to provide for increasing needs (Heinberg 2005).

Much of the renewable energy that currently provides six percent of United States' energy needs comes from ethanol and hydroelectricity. Neither of these energy sources can be easily expanded. An additional problem with this approach is that renewable energy sources are generally not as easily transported, energy dense, or as adaptable as oil energy. As a result, energy uses that are not directly tied into the electricity grid, such as those of the transportation and agricultural systems, would require major structural transformations in order to take advantage of renewable energy. The infrastructure transformation that would need to occur in order to transition to renewable energies is, in itself, highly energy-intensive. In addition, the trend in alternative energy continues to focus on non-renewable, potentially harmful and environmentally destructive technologies such as coal and nuclear power. Coal-fired power plants are a major contributor of greenhouse gasses responsible for Climate Change (accounting for 93 percent of utility-based carbon dioxide emissions in the United States (EcoBridge.

org), and the safe storage and disposal of radioactive nuclear waste remains a challenge (See ***PART II: Analysis: Energy***, page 28, for more information).

Therefore, it is probable that even with the appropriate infrastructure, no alternative energy source could adequately or safely provide for future generations at the current rate of consumption (Heinberg 2005). Beyond the risk that this approach includes, it fails to thoroughly address quality of life. Human and environmental health would be impacted, costly infrastructure would affect the affordability of energy, and development patterns would continue to sprawl – isolating individuals and requiring increasingly long commute times.

The Path of Least Consumption: Reducing Energy Demand

An alternative approach, the one taken by the *Post-Peak Oil Vision Plan*, is *to reduce energy consumption and enhance quality of life through planning and design.* Reducing the amount of energy required to build and maintain human settlements is the cheapest, cleanest, and quickest way to decrease reliance on fossil fuels. Taking such an approach involves the utilization of renewable energies but does not assume that alternative energy sources will resolve the challenges faced by society, nor does it devote more land than needed to renewable energy infrastructure. This approach addresses the energy crisis posed by Peak Oil and transforms the lifestyle patterns which render them vulnerable to other disruptions – such as the economic, political, and natural crises that cause sudden shifts in global supply chains. For this reason, emphasis is placed on the ability of society to adapt to changing situations, rebound from disruptions, and be buffered from external disruptions without severing ties to the outside world.

In order to weather these disruptions and adapt to a changing world, a shift in the way people live must begin now. As the surrounding context shifts, the established attitudes, routines and values of a society can hinder progression. In the case of a post-Peak Oil world, policy-makers, planners, and individuals need to be resilient, flexible, and open to experimentation in the effort to seek solutions and generate ideas.

A closer examination of the role of oil in American life, in American consumption patterns, and in environmental and human health will reveal the opportunities for a positive shift in lifestyle choices and development patterns.

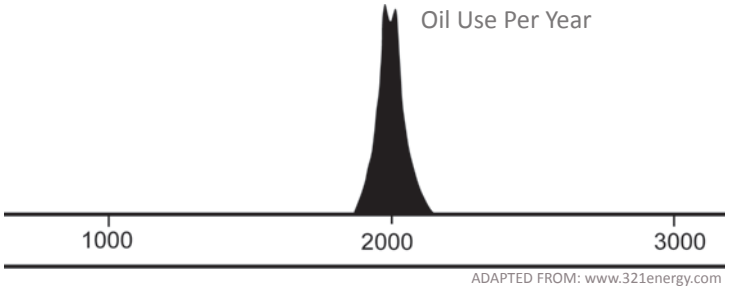
OIL AND AMERICAN LIFE

History

Despite the dominant role of oil in modern human civilization, the actual period of oil use is a relative blip in human history. In fact, until the late 1900s, societies depended chiefly on human and animal labor, wood, water, wind and coal to meet their basic energy needs. Although oil was used as far back as 500 BC, it was not until 1859 that technology was developed to enable the extraction of oil in large quantities (San Joaquin Geological Society). Demand for oil rose sharply with the industrial revolution. By the 20th century, the petroleum era had begun, as agriculture and transportation began to use oil for machinery and for the internal combustion engine.

Today, little more than 150 years after large-scale oil extraction began, oil is in nearly all human enterprises, including the

The goal of the *Post-Peak Oil Vision Plan* is to reduce energy consumption and enhance quality of life through planning and design.



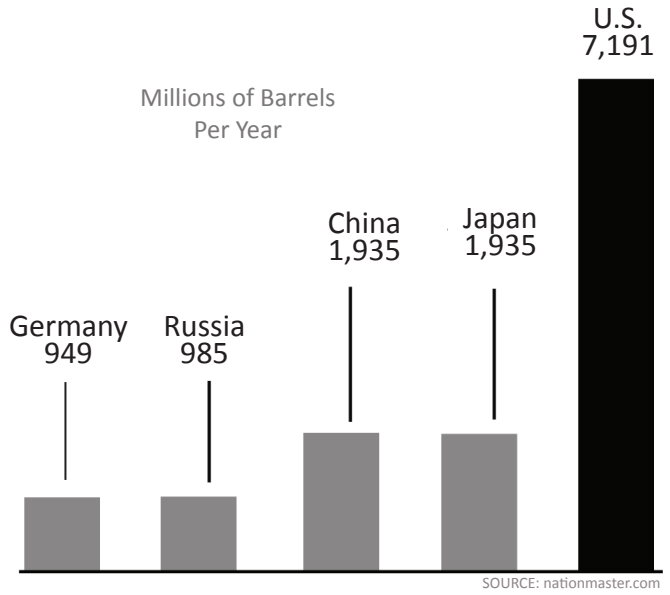
ADAPTED FROM: www.321energy.com

History of Global Oil Use

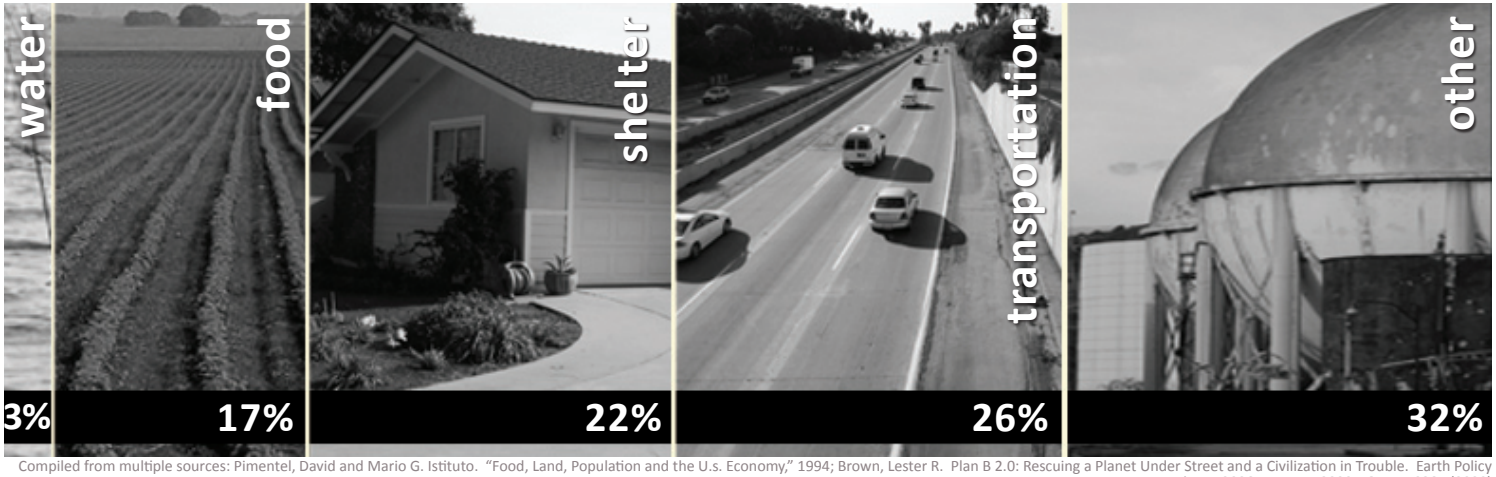
A historical look of oil extraction illustrates the brevity of oil's influence.

production and movement of clothing, medicine, food, computers and other consumer goods; transportation; and the heating and cooling of buildings. (See sidebar: ***Things Made From Oil*** on page 8). In this relatively short period of time, oil has become entrenched in daily lives, not only as a manufacturing material and energy source, but as a driver of development patterns and lifestyle options. The availability of oil, a cheap energy supply, enabled the rise in personal automobile transit and the sprawling development patterns ubiquitous since World War II (Crawford 2002). Current development patterns dedicate large amounts of land to the automobile, and necessitate the use of the automobile to perform basic errands, resulting in the paving over of millions of acres of agricultural land and habitat (Farmland Information Center 2006).

Without oil, it would not have made sense to locate neighborhoods so far from city centers, to design houses that require high levels of energy to heat and cool, or to create expansive private yards that require petrochemicals and imported water to maintain. Not only are current



United States Consumption of Crude Oil



Compiled from multiple sources: Pimentel, David and Mario G. Istituto. "Food, Land, Population and the U.s. Economy," 1994; Brown, Lester R. Plan B 2.0: Rescuing a Planet Under Street and a Civilization in Trouble. Earth Policy Institute, 2006; EIA, AER 2000 DOE-EIA 0384 (2000)

United States Energy Consumption by Sector

development patterns energy consumptive and automobile dominated, but research has shown that they result in a decrease in social capital. This is especially true for residents who are unable to drive, including the young, the elderly, and the poor, as they are often isolated from social networks and basic services. In light of Peak Oil, it is prudent to realize that current development patterns, contrary to popular belief, do not support a wealth of lifestyle options. The lifestyles they support are those which are dependent on automobile commuting and promote the procurement of underused private space and unnecessary goods. (See ***Appendices C-1 and C-3: Fleischmann*** and ***Chen*** for more information.)

Consumption

The development patterns described above, compounded with consumptive consumer patterns, result in the United States consuming far more than its own resources can provide, and more energy per capita than nearly every other nation. Americans consume 24 percent of the world's energy, yet account for only 5 percent of the world's population (EIA 2005). The United States' share of the world's energy is expended largely to build and maintain buildings (22 percent), to fuel the industrialized food system (17 percent), and to maintain an automobile-dominated transportation system (26 percent). (See ***United States Energy Consumption by Sector***, p. 7.)

The United States' oil consumption stems directly from a pattern of overall consumptive habits, especially regarding land, water, and consumer goods. When compared with consumption rates of other countries, the United States appears dangerously irresponsible. According to the United Nations statistics from 1997, 30.8 acres of productive land per capita are required to provide for overall American consumption (Wackernagel et al. 2001). As only 13.6 acres are available per capita, it is clear that America is drawing from the resources of other regions.

United States' high rate of consumption of oil and other resources renders the impact of Peak Oil especially daunting. However, though these statistics suggest that Americans use more than their share of resources, there is potential to decrease consumption rates and to maintain, or even improve, quality of life. The Italian diet, for instance, uses a fraction of the land that the American diet does (Pimentel 1994), and it is healthier. (See ***PART II: Analysis: Food***, on page 56, for more information.)

Peak Oil Resolutions in United States Cities

Several forward-thinking cities and towns in the United States have already begun to adopt Peak Oil resolutions. On April 11, 2006, San Francisco, California, became the first city in the United States to enact a Peak Oil Protocol. The Protocol, signed by the Board of Supervisors, resolved to support the adoption of a global Oil Depletion Protocol. The Protocol supports the undertaking of a city-wide assessment study, with the aim of developing a comprehensive city plan of action and response to Peak Oil. The Protocol urges the mayor to provide funding and direction to city departments for the development of a response plan.

On May 10, 2006, the Portland, Oregon, City Council unanimously passed a Peak Oil Resolution which led to the establishment of the Portland Peak Oil Task Force. The Task Force was charged with developing recommendations on how to respond to uncertainties in oil supply and affordability. On March 7, 2007, the task force presented a final report, "Descending the Oil Peak: Navigating the Transition from Oil and Natural Gas," to the City Council, which has since adopted a resolution to implement the recommendations.

The City of Franklin, New York, passed a Peak Oil Resolution on December 6, 2006. Franklin is a rural town with a population of fewer than 3,000 people, located in Tompkins County. The resolution has led to the development of the Tompkins County Relocalization Project (see ***Appendix B-2: Peak Oil Plans: A Literature Review*** *for more information).*

SOURCES: www.portlandonline.com; www.energybulletin.net

did you know?

Things made from oil:

Computer chips • Dishwashing liquids • Paint brushes • Telephones •Unbreakable dishes •Insecticides •Antiseptics • Deodorant • Tires •Motorcycle helmets •Linoleum •Clothing •Paint rollers •Floor wax •Shoes •Electrician's tape •Plastic wood •Glue •Trash bags •Hand lotion •Clothesline •Dyes •Soft contact lenses •Shampoo •Panty hose •Cameras •Food preservatives •Fishing rods •Oil filters •Transparent tape • Ink •Anesthetics •Upholstery •Disposable diapers •CDs and cassettes •Mops •House paint •Ammonia •Car battery cases •Hair curlers •Synthetic rubber •Eyeglasses •Vitamin capsules •Movie film •Candles •Rubbing alcohol •Credit cards •Fertilizers •Crayons •Insect repellent •Toilet seats •Caulking •Roofing shingles •Balloons •Shower curtains •Garden hose •Umbrellas •Detergents •Milk jugs •Faucet washers •Cold cream •Bandages •Antihistamines •Hair coloring •Nail polish •Yarn •Toothpaste •Toothbrushes •Perfume •Luggage •Wire insulation •Ballpoint pens •Carpeting •Artificial turf •Lipstick •Aspirin •Shaving cream

SOURCE; Richard Heinberg, ***The Oil Depletion Protocol***

did you know?

In recent years, air pollution and congestion have cost the average household in the Los Angeles Basin about $4,000 a year – about $16 per workday.

Since 1990 the average household in the South Coast Basin has lost four 40-hour workweeks a year to traffic delay.

By 2010, if official models are right, smog costs could stay the same or decline, but congestion costs will rise to $2,850 a year per household, roughly $11 per workday. The average household in the Basin would then lose 10 work weeks a year in traffic delay.

SOURCE: www-pam.usc.edu/

While consumption is necessary for survival, overconsumption can be harmful to personal, social, and environmental health. Perhaps the most vivid evidence of this is the nutritional overconsumption afflicting the majority of Americans. Due to overconsumption of food (made possible by industrialized farming and cheap transportation) and a lack of daily exercise (facilitated by private automobiles and sprawling developments), 20.9 percent of Americans were classified as obese in 2001, 74 percent more than in 1991 (obesityinamerica.org). Other symptoms of overconsumption include private spaces that are too vast to maintain, and garages and storage units that take up land and trigger stress in their owners. Recent research on dual-earner families in suburban Los Angeles found that "families seem to exacerbate their stress and frustration by buying more possessions than their homes can absorb, adding to their debt and routinely conscripting crowded garage spaces to function as chaotic storage units" (Arnold and Lang 2007). Lastly, and perhaps of most concern, is the reality that oil consumption is contributing to the depletion of natural resources, including the devastation of waterways and loss of fertile soils, and to resource wars which are fought in order to maintain consumptive habits.

Degradation of Environmental and Human Health

The degradation of environmental and human health in relation to oil consumption creates an incentive to sever ties with this resource sooner rather than later. The growing concern regarding Climate Change and human health is enough to make this severance desirable.

According to the Environmental Protection Agency (EPA), Climate Change refers to "any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer)" and is a result of both natural and human activities. Global Warming is commonly understood as the result of "increased emissions of greenhouse gases from human activities" (EPA 2006). Of all the carbon dioxide released into the atmosphere, 90 percent is a result of burning fossil fuels (EPA 2000). The temperature on the Earth's surface has increased by 1.2 to 1.4 degrees Fahrenheit since 1900 (EPA 2006). The EPA lists some of the impacts of global warming on the Western United States as:

- Changes in natural ecosystems resulting from higher temperatures and intensified winter precipitation
- Earlier runoff of snowmelt, stressing some reservoir systems
- Rapid population growth coupled with limited, heavily utilized water supplies present significant challenges for securing reliable sources for consumption, power-generation, and agricultural needs
- Higher summer heat; reduced winter cold
- Increased wildfire potential (EPA 2006)

Despite advances in carbon sequestration, gross greenhouse gases are predicted to rise 18 percent by 2020 (EPA 2006). While the impacts of Global Warming and Climate Change are enormous, experts suggest that taking immediate action could reduce the intensity of global impacts and potentially halt this dire trend.

Many of the natural systems upon which humans depend are showing obvious signs of oil-related distress. Research has found that pollution from oil-based industries and oil-powered transportation decreases the health of rivers and oceans, soil, and the atmosphere (Cohen 1990). In addition, current agricultural practices, including the use of petroleum-based fertilizers and pesticides, are responsible for nearly half of all river and stream contamination in the United States (EPA 2002). Contamination of soil and marine resources add to the list of oil's offenses.

Environmental contamination results in degraded human health in the form of asthma, cancer, and other maladies. In California, the primary airborne carcinogen is particulates created by the burning of gasoline and diesel fuels. These particulates are associated with respiratory problems and have been linked to heart problems and higher cancer rates

in adults (SCAQMP 2000). On the national level, inhalation of soot is responsible for 64,000 deaths a year, which is nearly double the number caused by automobile accidents (Moore 1997). Annual increases in asthma rates among Californian children can also be directly linked to petroleum-based air pollution from traffic congestion (Lund 2003).

LOCALIZATION AND PEAK OIL

The relationship between the United States and oil suggests both that there are benefits to decreasing oil consumption and opportunities to do so through planning and design. Scholars and community activists are considering localization, or living in place, as a potential solution for the social and environmental problems communities are facing. Localization is also a critical link between decreasing the need for energy in urban areas and enhancing quality of life.

In 1978, Peter Berg and Raymond Dasmann wrote "Living in place means following the necessities and pleasures of life as they are uniquely presented by a particular site, and evolving ways to ensure long term occupancy of that site … It is not, however, to be thought of as antagonistic to civilization, in the more human sense of that word, but may be the only way in which a truly civilized existence can be maintained" (McGinnis 1999, page 23). The Relocalization Network, an online network established in 2003 as an initiative of the Post Carbon Network, suggests that localizing the governance and the production of food, energy, and goods is an optimal way to prepare for a post-Peak Oil society. Benefits of implementing this strategy include an increase in energy security, strengthened local economies, and improved environmental conditions and social equity (Relocalization Network 2007).

For the purposes of the *Post-Peak Oil Vision Plan*, localization is defined as the process of reducing the need for imported goods by optimizing the use of local resources. The appeal of localization is that it can build a connection between people and place.

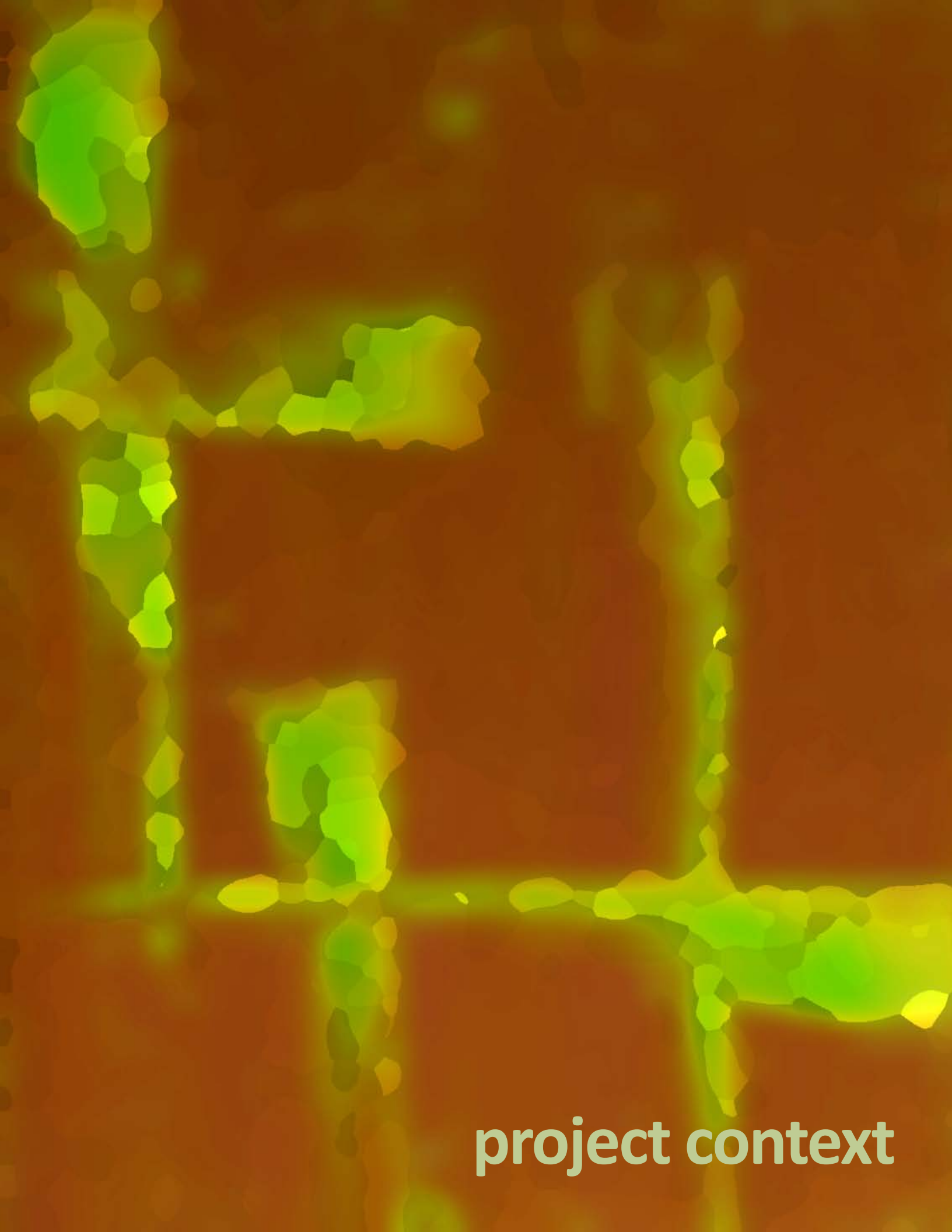
Localized societies require less energy to function than non-localized societies, as daily commutes do not require energy-intensive transportation systems, buildings respond to the local climate, and daily goods require less energy for processing and transportation. Quality of life is enhanced in such a community as local monitoring and regulation protects environmental health, innovation is encouraged in the local economy, and less time is spent commuting. The process of localization requires a society to adapt to its surrounding environment, even as that environment shifts with the seasons and the decades. Societies that are less dependent on external supply chains will be less impacted by Peak Oil and other crises.

Peak Oil provides the momentum for the localization of cities, and offers current societies the potential to define a direction and vision that will influence America for generations to come. This is an opportunity for Americans to transform current lifestyles and development patterns and to contribute to the health and wealth of future generations.

Design for Peak Oil

Permaculture students in Kinsale, Ireland, developed a Peak Oil plan for the city titled "The Kinsale Energy Descent Plan." The plan introduces important topics for post-Peak Oil design.

In addition to California State Polytechnic, Pomona, Robert Thayer of UC Davis and UC Berkeley, Richard Heinberg of New College in Santa Rosa, California, and Bob Scarfo of Washington State University, Spokane, have conducted studios that explore planning and design for post-Peak Oil cities.



project context

SAN BUENAVENTURA, CALIFORNIA

The City of San Buenaventura, located in Ventura County, is taking a proactive approach to addressing the oncoming decline of oil resources through its partnership with the 606 Studio. The timing is critical as the population within the city and the county is expected to increase by over half a million by 2050, and worldwide oil availability is estimated to decrease by 88 percent of its current (2007) availability.

San Buenaventura is poised to be a leader in post-Peak Oil planning for several reasons: 1) its history is tied to oil; 2) the Mediterranean climate is amenable to year-round food production; 3) the variety of settlement patterns within the city reflects patterns found throughout the nation; and 4) the city's progressive policies and active citizens are proactively working towards sustainable practices and reduced oil consumption.

With each action the City of San Buenaventura takes towards transitioning these landscapes from oil dependence, the city will be creating a model from which other communities can learn.

HISTORICAL AND PHYSICAL CONTEXT

Oil has been a major thread of San Buenaventura's industry, economy, and society since 1885, when it was discovered in the city. A hundred years later, in the 1980s, the city's oil industry declined as the wells ran dry. The landscape in San Buenaventura today is a result of its relationship with oil over the last hundred years, from the post-industrial fields along the Ventura River on the Westside, to the mix of industrial agricultural and suburban developments along the highways on the east side.

Locator Map

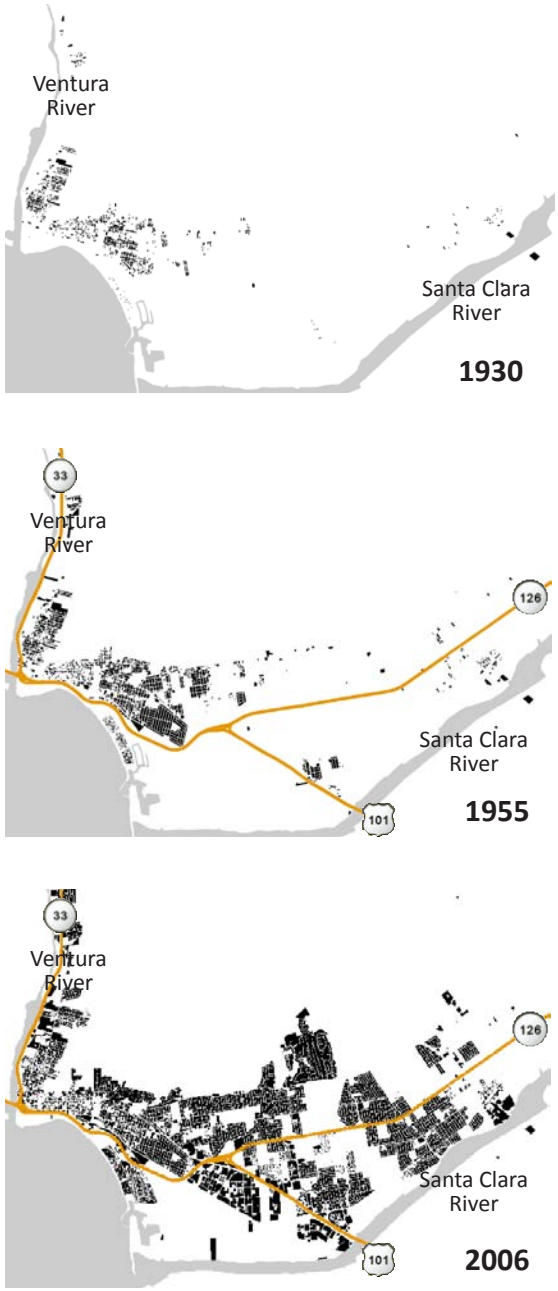
SOURCE: NASA World Wind

Regional Context

Located approximately 70 miles west of Los Angeles, Ventura County's communities rest upon a coastal plain, surrounded by hills. The City of San Buenaventura lies at the north end of this plain, confined by the mouths of the Ventura and Santa Clara rivers, steep slopes, and the Pacific Ocean. The region boasts a mild Mediterranean climate and generous annual rainfall of approximately 15 inches. It is a place rich with natural resources and diverse habitats, wildlife, and plant communities. It is where four major watersheds meet (see Figure 8 on page 34 for map), and where fertile valleys have been carved into a patchwork of farmland.

SOURCE: Google Earth

Project Location



Expansion of San Buenaventura

SOURCE: City of San Buenaventura GIS Department

San Buenaventura is also a place rich with history. Originally home to the Chumash Indians, the region was settled in the 18th century by Spanish missionaries, who were drawn to its bountiful environment. A significant drought occurred during the Mission Era, forcing the division and sale of ranchos. Around this time, a vibrant downtown began to emerge around the San Buenaventura Mission. After the drought, the surrounding plains, with their rich alluvial soil, were developed for agriculture. By 1870, lands on both sides of the Ventura River were used for ranching and agricultural production (California State Coastal Conservancy 2000).

In 1885, oil was discovered on the Westside, north of San Buenaventura's downtown. It was a discovery that would change the city and region's development pattern. By 1930, because of the booming oil industry, the population of San Buenaventura doubled to 11,603 residents. By the 1950s, the region was growing rapidly with the increased use of automobiles. The city of San Buenaventura grew eastward with expansive residential developments encroaching on the agricultural land in the Santa Clarita Valley. Roads were paved over, and Highways 101, 126 and 33 were cut through the region as oil was woven into the fabric of everyday life.

Today, San Buenaventura retains many enviable qualities: the pace is slow, agricultural fields green the landscape, and the ocean is within a short walk from downtown. The hills remain mostly undeveloped, and provide the city with a scenic backdrop, as well as a vantage point to look out over the region and the Pacific Ocean towards the Channel Islands. However, because of their steep slopes and unconsolidated soil, the hills present the potential for landslides. The majority of the lowland plains area is prone to liquefaction, and much of the region is cut with fault lines, making it vulnerable to earthquakes (see Figure 43 on page 77). Ventura County, like much of California, is prone to both prolonged droughts and severe flooding events (See ***Part II: Analysis: Water*** pages 40 to 41). These natural events have carved the features of the landscape over time and contributed to the rich agricultural soil for which the area is known.

Oil's contribution to society has also resulted in a physical alteration of the city and regional landscape. Highway 101 separates San Buenaventura from the ocean, just as Highway 33 separates the city from the Ventura River. Residents now use these roads to commute to jobs in surrounding communities including Santa Barbara, Thousand Oaks, and the fast-growing city of Oxnard. Originally built to transport goods to and from the harbor, railroad lines now transport commuters to and from work. Along these same roads and rails, resources and goods are fed into the city from long distances. Despite the region's prime agricultural land, the region is typical of the United States in that the majority of its food supply is trucked in from an average of 1,500 miles away (Kingsolver 2007).

Oil affects the quality of life throughout Ventura County. As a result of industrial agriculture, regional rivers are polluted, habitats and native plant communities are diminished, groundwater is over-drafted, and clouds of pesticides impair the health of nearby residents and school children (see Table 7 on page 60 for pesticide information). The automobile industry besets the County with air quality below federal and state standards for ozone and particulate matter (see ***Appendix B-1: Air Quality***), and the dominant role of the car in Ventura County's urban planning requires most of its almost 800,000 residents to spend hours each day on the road (Santa Barbara County Association of Governments 2002).

Fortunately, people have begun to reclaim the meaning of place in San Buenaventura, establishing bike lanes, walking and paths, and community gardens, reconnecting with local farmers, restoring rivers, and protecting the remaining agricultural land and hillsides. Residents and local governments, including the City of San Buenaventura, are gathering to address the effects of oil and its impacts, and are recognizing that a higher quality of life can be found while reducing society's dependence on oil.

PHOTO SOURCE: ***Images of America: Ventura***, 2006

1875 Bird's Eye View of San Buenaventura

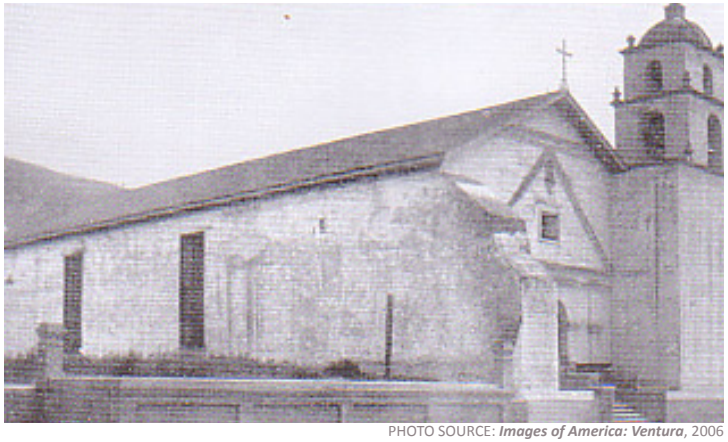


PHOTO SOURCE: ***Images of America: Ventura***, 2006

Mission San Buenaventura Photo Taken in 1899

PHOTO SOURCE: ***Images of America: Ventura***, 2006

Introduction of Automobile to San Buenaventura

A. River

B. Barranca

C. Hillsides

D. Harbor

E. Agriculture

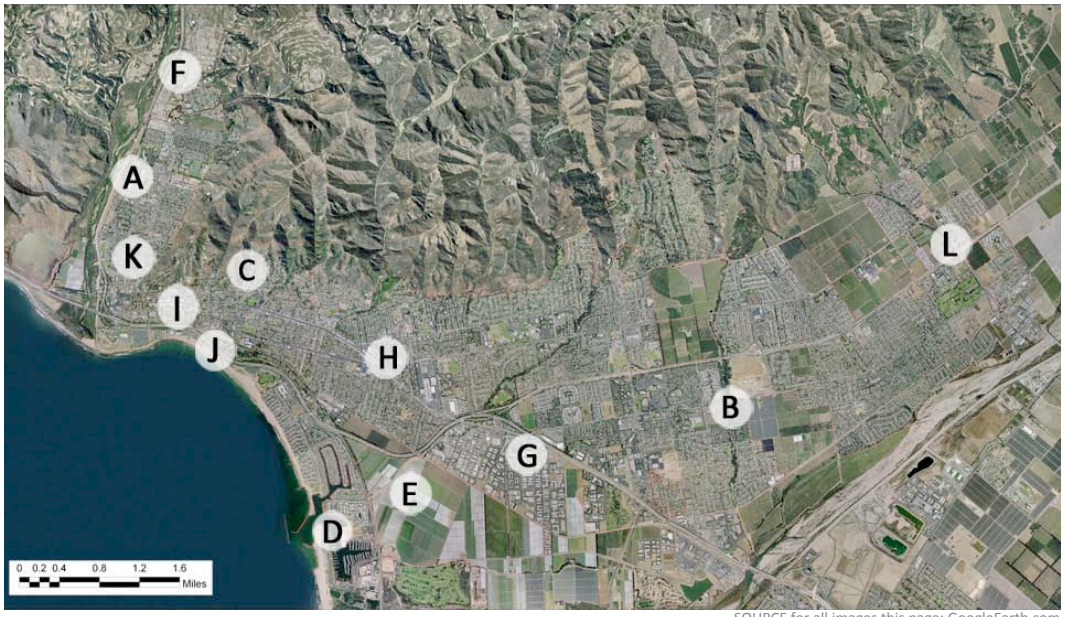
F. Industrial: Westside

G. Office Parks

H. Commercial Corridor

I. Downtown

J. Beachfront



Key Map

K Historical Suburbs

L. Modern Suburbs

SOURCE for all images this page: GoogleEarth.com

San Buenaventura Character Areas

Each of the above sites represents distinct man-made or natural character areas within the city.

CHARACTER AREAS OF SAN BUENAVENTURA

San Buenaventura is comprised of distinct areas of natural beauty, man-made landscapes, and transitioning districts. These areas define the character of the city, and contribute to its ecological, historical, and cultural identity. They will be important areas to protect, emphasize, and/or adapt in a post-Peak Oil society.

Rivers

San Buenaventura's two major rivers are quite different in character. The Ventura River, which runs along the western edge of the city is entirely unchannelized, winds through the Westside's industrial landscape through the city's pastoral countryside to the north. It is thick with riparian vegetation and trees, and is home to several bird and fish species, including the willow flycatcher and steelhead trout. The Santa Clara River is mostly unchannelized, but is characterized by wide expanses of concrete within the city.

Barrancas

The seasonal watercourses that run throughout San Buenaventura are referred to as barrancas. They are mostly channelized within the urban sections of the city, often realigned to follow the street grid, and generally cut off from human access by chain-link fences. Barrancas may be buffered, vegetated and free-flowing. Many of these barrancas run through urban habitat and recreational areas and are used by both wildlife and people.

Hillsides

The hills of the transverse ranges rise 1,200 feet above the city, and are characterized by chaparral, oak woodlands, and riparian willow forest plant communities. The foothills look over downtown and Main Street to the southwest, and over agricultural fields and development to the south-southeast. Many of the neighborhoods along the hillsides to the southeast enjoy views of the ocean and easy access to Los Padres National Forest, beach and downtown.

Rivers

Barrancas

Hillsides

Harbor

Harbor

Located adjacent to Marina Park and South Jetty Beach, the Ventura Harbor is filled with restaurants, shops, and hotels, and currently serves as a tourist attraction. The communities in the harbor area include Pierpointe, an eclectic mix of beachfront homes, mobile-home parks, highway retail, motels, a park, a harbor, and a school.

Agriculture

Agriculture

Agricultural fields of varying sizes are found throughout and at the edges of the city. Much of this land is still unincorporated. Some fields are surrounded by urban and suburban developments, while others are bordered by the Santa Clara and Ventura rivers. Row crops are characteristic of the area's modern agricultural industry, while remnant fields provide picturesque reminders of the city's past. Several of these agricultural plots are currently slated for development.

Industrial (Westside)

Industrial (Westside)

The Westside's industrial history can be traced back to the discovery of oil in the late 1800s. This history is evident in the oil fields, in the industrial buildings, and in the tight urban grid of small lots formed to house oil industry workers. The population of the Westside is predominantly Hispanic. Neighborhood improvements, including street enhancements, a new bike lane, and the addition of mixed-use cultural centers, are currently underway, thanks to strong grassroots efforts on the Westside.

Office Parks

Office Parks

This area is characterized by large blocks with office and commercial condominiums, light industrial parks, warehousing, and ample parking space. It is located at the edge of large expanses of agricultural fields, and near the convergence of three freeways and major arterial roads. Few windows or signs indicate the activity behind the tilt-up facades, making this a highly "introverted" (anonymous, unwelcoming) urban zone.

Commercial Corridors

A mix of civic, cultural, commercial, and residential uses characterize these long, low-density corridors along major roads. This area includes the Midtown community, parts of Main Street and the Telegraph Corridor, several schools and parks, malls, and a few small parcels of agriculture.

Urban Core (Downtown)

Downtown is the historic center and urban core of San Buenaventura. Historical attractions include City Hall and the Mission. The small-town feel of Main Street makes downtown an important place-maker for the city. Narrow streets with small shops, cafes and restaurants, bars, thrift stores, bookshops, and a sprinkling of chain stores characterize this neighborhood. Grant Park, located across from the Mission, plays host to a number of festivals, performances, and other events. Downtown's direct access to the Pacific Ocean and beaches make it an asset for a viable tourist industry.

Beachfront

Seven miles of shoreline habitat, dunes, and sandy beaches stretch from Ventura Harbor to the mouth of the Ventura River. Visitors come year-round for the views of and access to the Channel Islands, to observe beach and marine wildlife, and to participate in activities such as surfing and camping. Other attractions include Emma Wood State Beach, the Ventura Seaside Park and Fairgrounds, and the Beachfront Promenade Park. Freeway 101 hampers access to the Promenade, dividing Downtown from the beach.

Historical Suburbs

Pre-World War II developments are found primarily in the Westside and around Downtown. These neighborhoods are characterized by short blocks, tight urban grids, modest single-family homes, and a mix of amenities such as schools, hospitals, and stores.

Commercial Corridors

Urban Core (Downtown)

Beachfront

Historical Suburbs

Modern Suburbs

Oxnard

PHOTO SOURCE: www.ventura-county-relocation.comcommunities/images/oxnard_plain.jpg

Santa Barbara

PHOTO SOURCE: www.neoimages.com/about/map2.jpg

Simi Valley

PHOTO SOURCE: www.flickr.com/photos/whataboutminnie/126168801/

Modern Suburbs

Modern suburbs are found primarily on the east side of the city. The latest development typologies are represented by Saticoy Village and the Victoria Avenue Corridor (see Figure 46 on page 80 for map). Both developments are mixed-use with primarily single-family homes and condominiums, and boast parks, schools, and other amenities (City of Ventura General Plan, 2005).

THE SURROUNDING REGION

Like San Buenaventura, the surrounding region is undergoing an evident change in character, from agricultural to developed. San Buenaventura is surrounded by the cities of Carpinteria and Santa Barbara to the northwest, Ojai to the north, Santa Paula and Fillmore to the northeast, Oxnard to the south, and Camarillo and Thousand Oaks to the southeast. Carpinteria and Santa Barbara are coastal communities, popular with beach enthusiasts and tourists. Carpinteria hosts a three-day long avocado festival which draws approximately 80,000 people every October (City of Carpinteria). Visitors come to Santa Barbara for its Spanish Colonial style architecture, wineries, and human-scaled downtown. Ojai, Ventura County's smallest city, is a popular destination for artists, musicians and health enthusiasts who seek its relaxed, small-town atmosphere and natural scenic beauty (City of Ojai). The character of Santa Paula and Fillmore is largely defined by intimate downtowns with historical buildings, surrounded by compact suburban neighborhoods and large expanses of agricultural landscapes. Oxnard is a rapidly developing city, and a hub of financial and manufacturing activity mixed with agri-business. It is directly across the Santa Clara River from San Buenaventura, and is distinguished by a single 22-storey tower rising over a flurry of new development. Camarillo is also growing at a fast pace, with several new business parks and high tech industries re-defining the once-agricultural city landscape (City of Camarillo). Thousand Oaks is within Simi Valley, and is characterized by abundant open space, master-planned neighborhoods nestled in the Santa Monica Mountains foothills, and large corporate business parks lining the 101 Freeway.

CITY AND REGIONAL PLANNING CONTEXT

The *Post-Peak Oil Vision Plan* will contribute to the growing body of plans preparing for San Buenaventura's future at the regional, city, and community level. On the regional scale, several organizations are looking into alternative and renewable energies as the answer to the region's growing energy demand. These include the Regional Energy Alliance, Ventura County Environmental and Energy Resources Division, the Community Environmental Council (CEC), and Ventura Climate Care Options Organized Locally (VCCOOL).

The CEC developed the Fossil Free by '33 initiative, which challenges the tri-county region of San Luis Obispo, Santa Barbara, and Ventura counties to identify renewable energy sources and potential conservation measures within the region. The research focus of the Fossil Free by '33 initiative is on alternative energy resources, yet energy conservation programs remain a substantial part of the plan.

San Buenaventura, in an effort to reduce the city's environmental impact, is working with its constituents to protect the area's natural resources, reduce waste, and promote energy alternatives to oil. Several citizen and community groups are examining the effects of oil on society, particularly in terms of environmental, social, and economic health. In

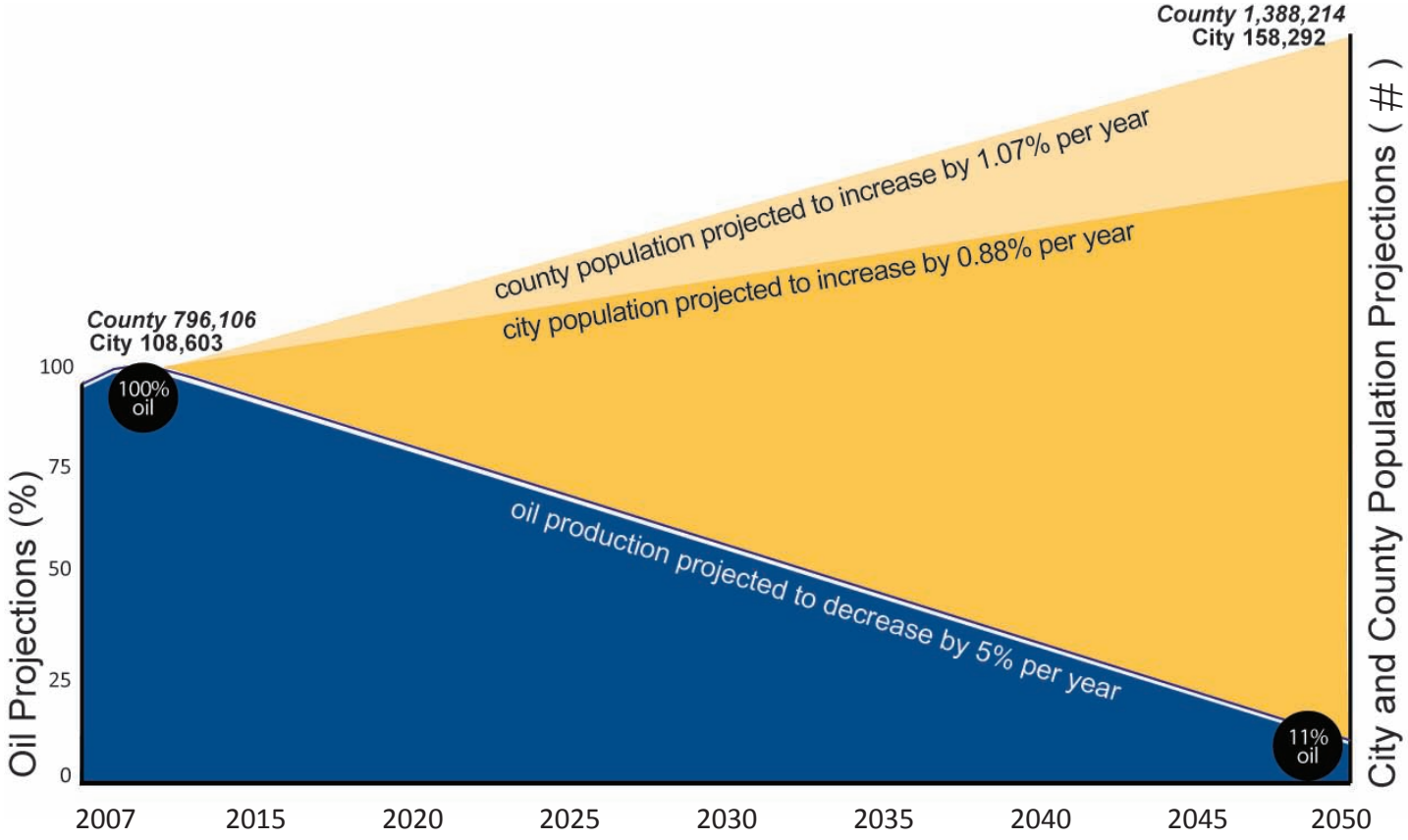


FIGURE 2
Peak Oil Future Projections

Population projections from the City of San Buenaventura's Planning Department.

October 2006, VCCOOL was formed after approximately 300 San Buenaventura residents gathered to discuss global climate change. VCCOOL organizes community meetings, informational fairs, and peaceful protests and actions around issues related to curbing global warming. As demonstrated through city programs and citizen actions, the community of San Buenaventura understands that oil-dependent lifestyles need to be reevaluated. The City of San Buenaventura is taking a bold step towards transforming its relationship to oil by developing the *Post-Peak Oil Vision Plan*.

The San Buenaventura 2005 General Plan is the guiding document for the city's future. The General Plan identifies several goals to which the *Post-Peak Oil Vision Plan* contributes directly:

- **NATURAL COMMUNITY GOAL**: To be a model for other communities of environmental responsibility, living in balance with our natural setting of coastline, rivers, and hillside ecosystems.
- **ACCESSIBLE COMMUNITY GOAL**: To provide residents with more transportation choices by strengthening and balancing bicycle, pedestrian, and transit connections in the city and surrounding region.
- **SUSTAINABLE INFRASTRUCTURE GOAL**: To safeguard public health, well-being, and prosperity by providing and maintaining facilities that enable the community to live in balance with natural systems.
- **ACTIVE COMMUNITY GOAL**: To enhance parks and open spaces to provide enriching recreation options for the entire community.
- **INVOLVED COMMUNITY GOAL**: To work together as a community to achieve the Ventura Vision through civic engagement, partnerships, and volunteer service.

What the General Plan does not consider is the effect Peak Oil would have on the city's future. For the purposes of this project, oil is assumed to peak in 2007, from which point its availability in the United States will decrease by 5 percent a year.[1] At the same time, the population within the city is expected to increase by almost 50,000 people, and by almost 642,000 people in the county between 2007 and 2050 (Figure 2).

PROJECT FRAMEWORK AND METHOD

The method employed by this project includes the development of a scenario as a tool for analysis and evaluation. A scenario is a strategic discussion of a possible future, not a prediction of the future. A scenario builds understanding with regards to implications of current trends to identify possibilities for alternative futures and to evaluate these alternative futures. This method is adapted from work by John Lyle (1999) and Carl Steinitz et al. (2003), and is applied to the project as follows.

The iterative phases that compose this project are discussed in three sections: Analysis, Design and Planning Guidelines, and Transformative Site Design. In the Analysis section (***PART II***), current regional and city planning and trends are described for the systems of energy, water, natural communities, food, mobility, shelter, economy, community, and waste. This section includes a time-based scenario – the *Path of Least Resistance* – in which these systems play out according to current planning and assumptions based on historical and probable natural occurrences, current trends, projections for the future, and feedback from the community (see ***Appendix A*** for the questionnaire used to gather community feedback). In the Plans and Design Guidelines section *(**PART III**)*, overarching strategies for post-Peak Oil planning are identified along with the conceptual framework, which guides planning and design at the regional, city, and site scales. Plans and design guidelines are described and evaluated for each system on a regional and city scale. These guidelines reveal an alternative future – the *Path of Least*

[1] 2007 was chosen as a conservative date from which to make future projections, as estimates of actual year range from 2005 to 2030. The 5 percent rate reflects estimates for global depletion and increased global demand.

Consumption. Transformative Site Design (***PART IV***) discusses the transformation of high- and low-density areas under the *Post-Peak Oil Vision Plan* using target dates of 2015, 2025, and 2050. The site design section concludes with a "Day in the Life" of San Buenaventura in 2050.

PROJECT GOAL

The goal of the *Post-Peak Oil Vision* Plan is to generate a vision to guide the City of San Buenaventura in reducing energy and resource consumption while enhancing quality of life through regional planning and community design. Localization, or the process of reducing the need for imported resources by optimizing the use of local resources, has been identified as the overarching critical factor in achieving this goal. Other critical factors include the city's commitment to act now, to be flexible and open to adaptation, and to collaborate with other cities, regions, and citizens in the effort to realize a successful post-Peak Oil society.

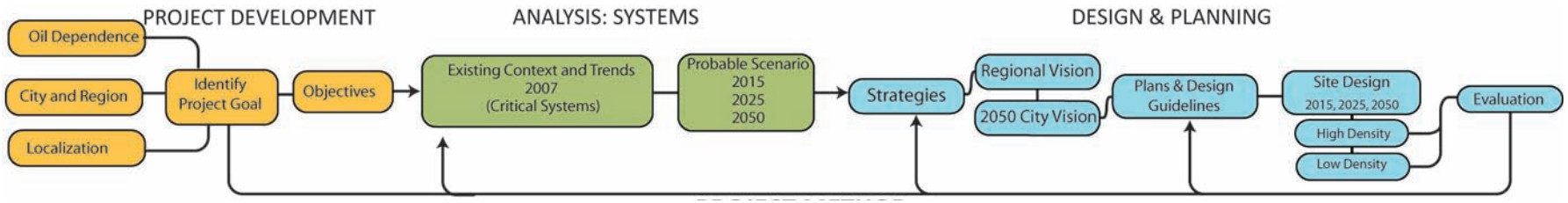
In order to realize this vision, it is necessary to first analyze how the city functions and how its systems rely on oil and other types of energy. The systems analyzed include those that are energy- and resource-intensive, and that are critical to the functioning of a post-Peak Oil community: energy, water, food, shelter, and mobility. Potential impacts of Peak Oil are analyzed for the following systems: economy, and human and natural communities. By examining how people attain their water and food, how they move around, where and how they work, and what kinds of housing they choose to live in, opportunities and constraints for localization become clear.

Goals for Critical Systems

In order to achieve the overarching goal of decreased energy and resource consumption, the critical systems of a community must be localized. As the process of localization will be expressed differently in each system, the following goals facilitate localization:

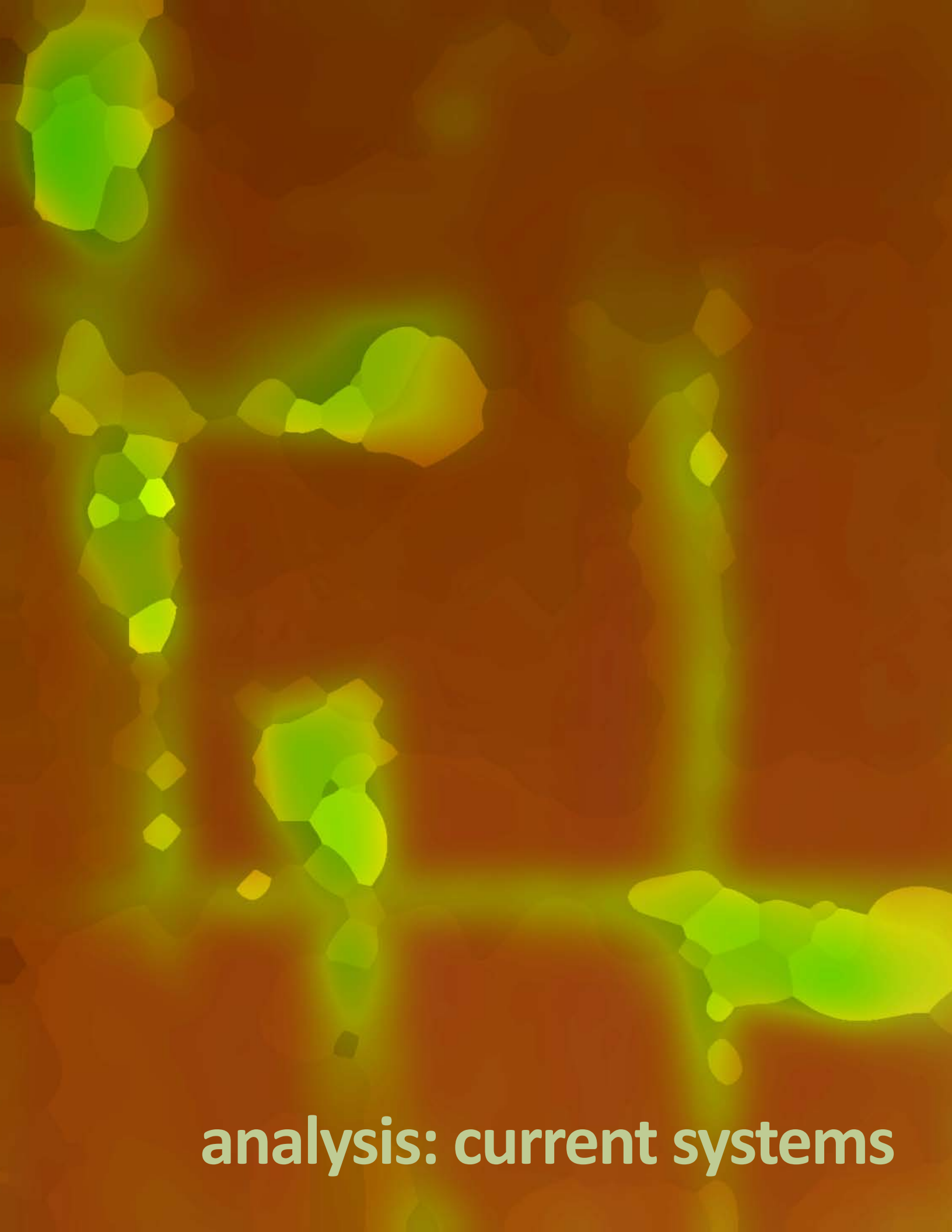
- **ENERGY:** Decrease dependence on imported and non-renewable energy sources
- **WATER:** Use local water sources sustainably and reduce external dependence
- **NATURAL COMMUNITIES:** Preserve and restore local habitats to provide ecosystem services for a post-Peak Oil world
- **FOOD:** Establish a localized food system that is supported by sustainable practices
- **MOBILITY:** Reduce dependence on automobiles and expand existing transit system
- **SHELTER:** Increase dense, mixed-use development and sustainable housing design
- **ECONOMY:** Expand opportunities for a localized economy
- **COMMUNITY:** Localize the needs of residents while enhancing the beauty and identity of San Buenaventura

Further discussion of each system (***PART II: Analysis: Current Systems***) will identify the opportunities and constraints to localization and reveal the current trends which form the basis for the *Path of Least Resistance* scenario (***PART II: Scenario***).



PART two

ANALYSIS: CURRENT SYSTEMS SCENARIO


analysis: current systems

ENERGY

The decline of oil availability will lead to increasing dependence on renewable energy sources. However, alternative energy sources will not be able to compensate for the loss of oil resources and infrastructure for renewable energy generation is land and energy intensive. Due to various limitations, renewable energy is not expected to compensate for the decline of oil resources (see ***PART I: Introduction*** for further discussion). Overdependence upon renewable energy sources in post-Peak Oil societies could lead to the depletion of important resources (such as farmland and building materials) and cause a dangerous delay in reducing energy consumption. Post-Peak Oil, it will be essential for societies to plan for, and limit, the use of renewable energy sources.

GOAL: Decrease dependence on imported and non-renewable energy sources

OBJECTIVES:

- Use local and renewable energies conservatively
- Decrease overall energy use

Non-Renewable Energy

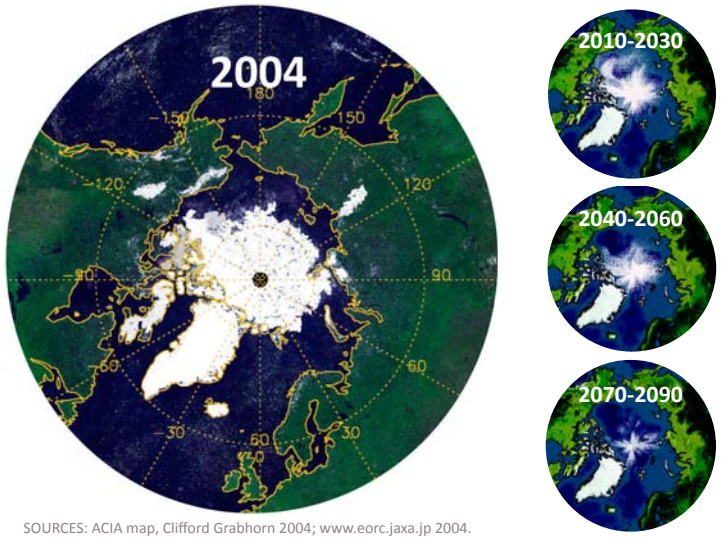
As oil resources are depleted, there will be an increasing desire for communities to shift towards energy alternatives. Natural gas, coal, and nuclear power are the three most common energy alternatives used in the United States today. Although availability and existing infrastructure create an opportunity for at least a temporary shift towards these alternatives, they cannot be relied upon to make up for the loss of oil.

Natural Gas

Natural gas has many of the same advantages that oil has as an energy source, and therefore is the most likely replacement. Much like oil, natural gas is energy dense, versatile, and has a high Energy Returned on Energy Invested (ERoEI).[1] Like oil, natural gas has other uses, such as a fertilizer base. Because natural gas makes up 25 percent of the United States' current energy use, much of the infrastructure needed for this system is already in place. Finally, natural gas burns much cleaner than oil, although it still contributes carbon dioxide gas emissions responsible for Global Warming (Heinberg 2005).

The California Coastal Commission recently rejected a project proposing to build a natural gas terminal off the coast of Ventura County due to the potential environmental damage to sea life, increased air pollution, and safety issues (Polakovic 2007). An additional problem of relying on natural gas as an oil substitute is that it is, like oil, a non-renewable fossil fuel. Natural gas will peak soon after oil, and with a faster depletion rate due to extraction methods. Reliance on natural gas may prolong the inevitable decline, but the cost of new infrastructure and environmental damage would be significant (Heinberg 2005).

[1] ERoEI reveals the net yield of a given energy source. For instance, an energy source with an ERoEI of 5 would yield five units of energy for every unit of energy invested. (The source of all ERoEI measurements in this section is a comparative study conducted by Howard Odum in 1996).



SOURCES: ACIA map, Clifford Grabhorn 2004; www.eorc.jaxa.jp 2004.

FIGURE 3
Projected Ice Extent Due to Carbon Emissions

Electricity generation causes 40 percent of carbon dioxide emissions. Coal accounts for 93 percent of the emissions from the electric utility industry (U.S. Emissions Inventory, 2004; ecobridge.org). The three images above show the average of the projections from five climate models for three future time periods. As the century progresses, sea ice moves further and further from the coasts of arctic land masses, retreating to the central Arctic Ocean.

Coal

The United States has such a large supply of coal (25 percent of the world's reserves), and uses it to generate 23 percent of the country's current energy. There are several problems with using coal as a substitute for oil. First, coal energy is polluting, both during the extraction process and when burning it for use as energy (Figure 3). Second, transforming coal into a portable fuel type that can be used for applications such as the automobile is wasteful. Finally, the process of turning coal into energy is highly inefficient, especially when considering the cleaning neccessary for it to pass environmental regulations (the ERoEI of coal drops from 6.0 to 2.0 when pollution-reducing scrubbers are added). These inefficiencies will only be heightened as scarcity of coal forces energy companies to use extreme methods to access poorer quality deposits. In a study conducted by John Gever, it was determined that by the year 2040, coal would have an ERoEI of 0.5, meaning any amount of coal energy received would take twice as much energy to create (Heinberg 2005).

Nuclear Power

The benefit of nuclear power is that the ability to create energy could be close to limitless, assuming continued progress in nuclear technology to reprocess spent fuel. Nuclear energy does not emit carbon dioxide gases during processing and is relatively inexpensive to generate once the infrastructure is in place. However, it is the most expensive of all conventional energy technologies to build and maintain, and it becomes problematic when safety issues and waste disposal costs are taken into account. While nuclear power is relatively safe today, a combination of public perception and the real possibility of a Chernobyl-like incident make it difficult to convince communities to welcome a nuclear power plant into their neighborhood. The disposal of nuclear waste presents a problem, with approximately 1,000 metric tons of high- and low-level waste coming from each nuclear plant per year. Nuclear waste creates a hazard of which the consequences are not fully understood and produces waste that will be around for thousands to tens of thousands of years. Moreover, converting just coal energy infrastructure to enough nuclear power infrastructure to maintain the United States' current level of consumption would require the addition of 250 new nuclear power plants (Heinberg 2005).

IMAGE SOURCE: explorer.altopix.com

Nuclear Power Plants

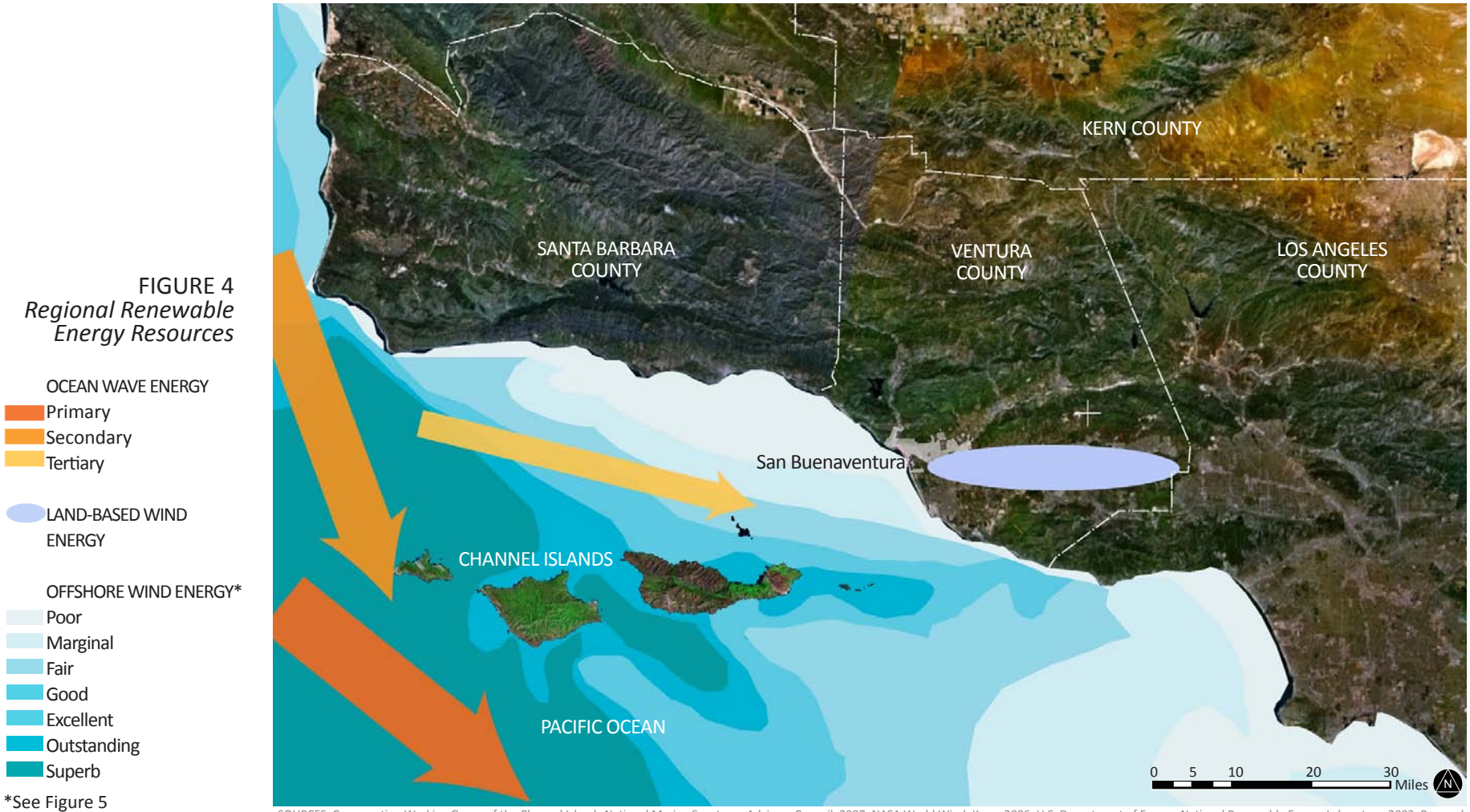
ERoEI (Energy Return on Energy Invested)

The Energy Return on Energy Invested (ERoEI) is one measure of how much energy is generated compared to the energy input (Energy Output/Energy Input). Oil has a high ERoEI, making it a valuable energy source. Although oil has a high ERoEI, it is a limited resource, and like coal and nuclear power, has negative environmental impacts. Renewable energy has lower ERoEI numbers, but has lower environmental impacts.

Oil	*8.4*
Oil shale	*0.7-13.3*
Coal	*6.0-9.0*
Coal with scrubbers	*2.0*
Hydropower	*2.5*
Nuclear	*4.0*
Solar (photovoltaics)	*1.7-10.0*
Geothermal	*1.9-4.0*
Ethanol	*0.7-1.8*
Wind	*2.0*

SOURCES: Heinberg 2005; C.J. Cleveland, R. Costanza, C.A.S. Hall, and R. Kaufmann Howard T. Odum.

FIGURE 4
Regional Renewable Energy Resources



SOURCES: Conservation Working Group of the Channel Islands National Marine Sanctuary Advisory Council, 2007; NASA World Wind; Kane, 2006; U.S. Department of Energy, National Renewable Energy Laboratory, 2003; Research and Development Office, Technology Systems Division, California Energy Commission, June 2005; Yen-Nakafuji.

Renewable Energy

Oil is not the only energy source that abounds in the region and city. In fact, the potential exists to harvest a number of renewable energy sources. The regional map (Figure 4) identifies the areas that are most suitable for renewable energy generation. The designations shown are based upon the presence of renewable energy sources as identified by Yen-Nakafuji (2005) and Kane (2005). The following list discusses the most feasible options for renewable energy generation in the region, based on each energy source's ERoEI.

Wind Power Class	Resource Potential	Wind Power Density at 50m[a] (W/m^2)[b]	Wind Speed at 50m (mph)
1	Poor	0 - 200	0.0 - 12.5
2	Marginal	200 - 300	12.5 - 14.3
3	Fair	300 - 400	14.3 - 15.7
4	Good	400 - 500	15.7 - 16.8
5	Excellent	500 - 600	16.8 - 17.9
6	Oustanding	600 - 700	17.9 - 19.7
7	Superb	>800	> 19.7

a Classes of wind power density for standard wind measurement height of 50m. Wind speed generally increases with height above ground.
b The wind power density, measured in watts per square meter, indicates how much energy is available at the site for conversion by a wind turbine
SOURCE: U.S. Department of Energy, National Renewable Energy Laboratory. "California 50 m Wind Resource Map." Jan. 29, 2003

FIGURE 5
Wind Power Classification

PHOTO SOURCE: www.wherestehachapi.com

Tehachapi Wind Farm

The Tehachapi (California) Wind Farm, with around 5,000 wind turbines, is the second largest collection of wind generators in the world (the largest is at the Altamont pass, near Livermore, California and the San Francisco Bay area), but is now the largest wind power array in the world in output. The turbines are operated by a dozen private companies and collectively produce about 800 million kilowatt-hours of electricity, enough to meet the residential needs of 350,000 people every year. With over 15,000 turbines in the state (7,000 at Altamont and 3,000 at San Gorgonio Pass, near Palm Springs), wind power in California makes up about 1 percent of California's electricity (ludb.clui.org).

Wind

Wind energy is currently the most cost competitive of the renewable energies. Following the installation of wind turbines, no additional inputs are needed except for maintenance. Wind energy is clean as it has no polluting outputs and can be combined with other uses such as farming and ranching. Nevertheless, there are a number of problems inherent to creating wind energy. First, wind turbines are infrastructure intensive and therefore costly. As a result, they are generally cost effective only for large-scale operations. Second, wind energy has a relatively low ERoEI (farm windmills have an ERoEI of 0.03, whereas Wind electro-power has an ERoEI of 2+). Third, wind energy can only be produced when the wind is blowing, requiring an additional energy source for when the wind dies down, or a storage system to hold the excess energy – both of which are often expensive. Wind energy is not easily transportable, requiring electrical infrastructure to carry the current. Wind energy can also cause environmental damage, mainly to birds caught in propellers.

Southern California has two large energy producing wind farms located in Tehachapi and San Gorgonio. Within the county of Ventura, wind power is most plausible at the mouth of the Santa Clara and Calleguas valleys (Figure 4). The City of San Buenaventura, however, is not an optimal site for a large-scale wind farm (Dora 2005). There is potential for offshore wind farms (Figures 4 and Figure 5), but areas with the highest potential for wind energy are located far offshore and therefore require a great deal of infrastructure and energy to transport. Offshore wind power is difficult to initiate politically due to highly prized viewsheds.

Ocean Energy

Ocean energy has the potential to produce substantial amounts of energy. Two types of ocean energy are possible for the region: wave power and tidal power. Wave power uses the up and down motion of waves to capture power, and is most efficient in deep ocean sites. The cost to transport that energy back to land is often prohibitive (Kane 2005). Tidal energy relies on currents to power turbines. The predictability of tides makes this type of energy especially attractive, as tides only fluctuate seasonally. For San Buenaventura, this type of energy is most potent outside of the Channel Islands, where there is a four knot current (Figure 4). However, the cost of transporting the energy makes this scenario less than ideal.

Tidal energy has a very high ERoEI of 15, yet the technology has several disadvantages. Tidal energy requires expensive technology, large amounts of infrastructure, and research before it can be utilized. Other disadvantages of tidal energy include its unknown effect on marine habitats, ocean navigation, and the degradation of scenic ocean-front views. Despite the potential for ocean energy, at this time it is not suitable as a major energy producer (Heinberg 2005).

Solar

Solar energy at a residential scale is promising throughout the region. Solar panels are inexpensive to install and have an average payback period of eight to ten years (even less for commercial buildings) (Fossil Free by '33 2006). With three hundred days of sunshine throughout the year, San Buenaventura is in a position to take advantage of solar energy. Photovoltaic systems installed on rooftops are efficient, as the energy does not have far to travel to the end user. The disadvantages with solar energy include that energy is produced only when the sun is shining, and therefore either has to be tied into the energy grid or stored in battery systems, which, as with wind, are often expensive. Passive solar systems, such as solar thermal technologies, are often used to heat water (which consumes 25 percent of residential electricity use) and are often less expensive than photovoltaic systems (Hunt 2007). On a larger scale, concentrated solar power using mirrors has the potential to make up for the loss of energy due to fossil fuel depletion. However, this technology would require extremely large tracts. The ERoEI for solar energy ranges between 0.4 and 1.7.

For the City of San Buenaventura, the greatest opportunities for photovoltaic systems are found on residential and commercial rooftops. Research for solar power is improving, and by the year 2050, it is plausible that solar energy will be integrated into buildings, playing a significant role in providing energy (Figure 6).

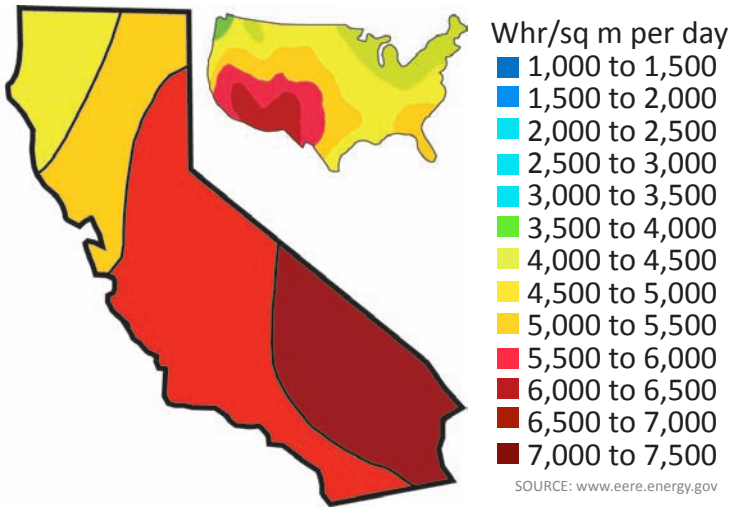


FIGURE 6
Solar Resource for Plate Collector

Using the data in the far right column, one can determine how many hours of peak sun is available. San Buenaventura is located in a region with 5,500 to 6,000 Whr/sq m per day, which means that there will be between 5.5 to 6 hours of peak sun per day on average.

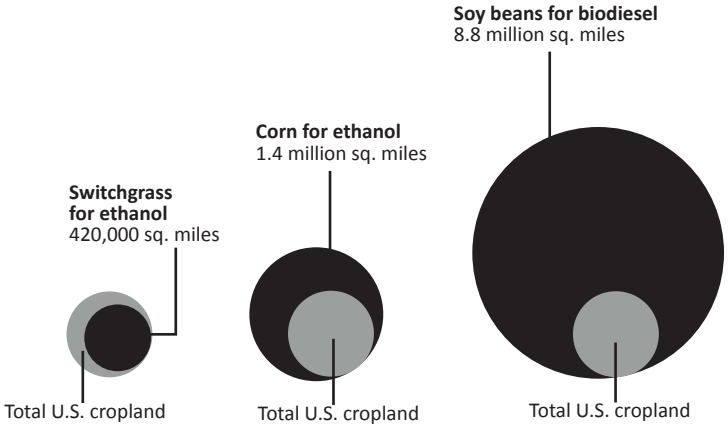
Whr/Sq m = Watt Hours per Square meter.

Biofuels

Biofuels are a popular alternative to oil, as they can be easily used in most of the oil-consuming machinery that runs industrialized societies. However, there are several limitations to this energy source. First, the ERoEI for ethanol (the most common biofuel in the United States) is only 0.81. This means that there is a net loss of energy when producing ethanol. Secondly, the production of biofuels consumes valuable agricultural land. It has been estimated that in order to supply the United States with enough fuel to run all of the cars being used today, it would take 125 percent of all of the farmland in the United States (Heinberg 2005). Brazil, often celebrated for becoming energy independent through alternative fuels, has done so to the detriment of its environmental resources. So much of the farmland has been turned into sugar cane to produce biofuel that it has been considered an "ecological hazard" (Wen 2006). Due to the amount of water and farmland needed to grow biofuels, it is not recommended that the city or region invest heavily in this energy source (Figure 7).

Waste to Energy

Waste energy is accumulated in three forms: municipal waste, agricultural waste, and forestry byproducts. The process of turning waste to energy involves using heat from the decomposition of organic materials to create energy. This renewable energy source has many advantages, including the diversion of landfill waste up to 75 percent (Kay 1998). The process uses existing rather than raw materials to produce energy, and in small operations can be set up relatively inexpensively. The main problem behind waste to energy production is that by using all of the organic materials to create energy, soils are deprived of needed nutrients, which will eventually effect food production and ecological productivity. For the City of San Buenaventura, using existing landfills to capture energy creates an excellent opportunity. However, precaution should be taken in replenishing soils and not using all organic waste for energy.



SOURCE: Yes! A Journal of Positive Future, Summer 2006, p. 39

FIGURE 7
Biofuels Require Land to Grow Raw Materials

Total U.S. cropland is 625,000 square miles. The image above shows the amount of land required to replace U.S. oil consumption with biofuel.

Connecting City and Region

As the best placement for most renewable energies is not within the city's boundaries, and the costs of infrastructure and maintenance for renewable energy systems are beyond the city's budget, collaboration with surrounding cities is necessary. Although renewable energy generation has yet to be pursued *thoroughly* by the City of San Buenaventura and the surrounding region, *Fossil Free by 33* has created a vision for regional collaboration to pursue renewable energies. A comprehensive plan has yet to be developed.

ENERGY CONCLUSIONS

Opportunities and positive trends that increase the region's ability to localize and conserve energy:

- Wind, wave, and solar energy sources can be found within the region
- Urban rooftops, which could support solar panels, are plentiful
- The region has an average of 300 days of sun each year
- Existing landfills are a source for "waste to energy"

Constraints to localizing energy source:

- Many renewable energy technologies have low ERoEI values (see sidebar: ***ERoEI*** on page 28)
- The implications of renewable energies upon natural habitat are largely unknown
- Energy infrastructure and transport is costly
- Renewable energy infrastructure often competes with other land uses, such as agriculture

WATER

Water accounts for only three percent of energy use in the United States (Alliance to Save Energy 2005) (see ***PART I: Introduction***, page 7). However, the percentage of energy use in California for water is higher due to the energy required to transport water by the State Water Project (SWP). Pumping water through the SWP requires between 1,800 and 2,800 kWh of electricity per acre foot (CEC 2007), accounting for two to three percent of electricity use in California (Mono Lake Committee 2007). Six and a half percent of the energy used in the state of California is for pumping and treating water (Mono Lake Committee 2007). Approximately 33 percent of the energy that is purchased by local municipalities in California is used for pumping water.

Human life, the production of food, and ecosystem health depend upon the availability of clean water. Competition for water increases as populations grow and the global climate becomes less stable (Alliance to Save Energy 2005). As energy prices continue to increase and the supply of oil decreases, the cost of pumping, treating, and distributing water will also rise. Dependence on external water supply may result in the region's vulnerability to supply disruptions. By reducing dependence on imported resources, less energy is required for the transportation of water, and the quality and quantity can be monitored by the local population. In order to avoid depleting local water sources, the rate of water consumption must not exceed the rate of groundwater recharge or detract from natural surface water flow. The following analysis addresses both regional and local resources, highlighting water supply and demand for the county and the city.

GOAL: Use local water sources sustainably and reduce external dependence

OBJECTIVES:

- Preserve and enhance hydrologic function throughout the watersheds
- Increase roofwater and greywater capture
- Implement conserving practices for agriculture
- Implement conserving programs for urban users
- Prioritize water for productive uses

Regional Resources

Nearly 75 percent of the county's water supply comes from regional water sources, including groundwater aquifers and surface water sources. The relationship between surface and subsurface water ultimately determines the water supply for the county. These local resources are discussed first in the context of watersheds with a focus on surface water. A discussion of groundwater resources and underutilized water resources (greywater and roofwater) follows. Flooding, drought, and water quality – all determining factors in actual water supply – conclude the resources section. The character of these water sources reveals limitations and opportunities for localizing water supply.

Watersheds and Surface Water

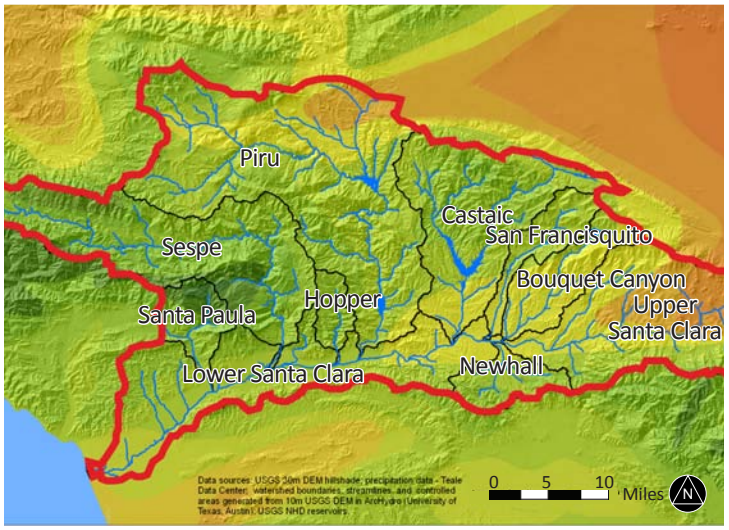
Ventura County is intersected by three major watersheds (the Santa Clara River, the Ventura River, and Calleguas Creek), and four smaller coastal watersheds (Figure 8). These watersheds are drained by the Ventura River, the Santa Clara River, and Calleguas Creek (Figure 10). Along the coast, rainfall averages around fifteen inches per year. At the headwaters of the Santa Clara River the average rainfall is closer to nine inches per year near and is greater than the average at higher elevations within the Transverse Range.

SOURCE: Watersheds Coalition of Ventura County; NASA World Wind

FIGURE 8
Watersheds Within Ventura County

According to the Ventura County Interim Regional Water Management Plan (VCIRWMP), most of the rainfall occurs during the winter months (VCIRWMP 2005) (Figure 9).

The hydrologic function of these watersheds has been altered by agriculture and urbanization. Man-made activities have stressed the watersheds within Ventura County, overdrafting groundwater basins, depleting surface water supplies, and polluting existing water sources. Impervious surfaces reduce groundwater recharge, channelization increases flood intensity, and the construction of dams alters stream flow and reduces natural deposition of sediments. The impact of human activities can be expected to increase with population growth. Preserving and restoring these rivers and the natural hydrologic cycle to their original state is critical to the region's capacity to support human needs for food production, drinking, and household use. The character of each watershed is described below, including natural features and human impacts.



SOURCE: USGS 30m DEM hillshade; precipiation data- Teale Data Center

FIGURE 9
Mean Annual Precipitation – Santa Clara Watershed 1900-1960 (inches)

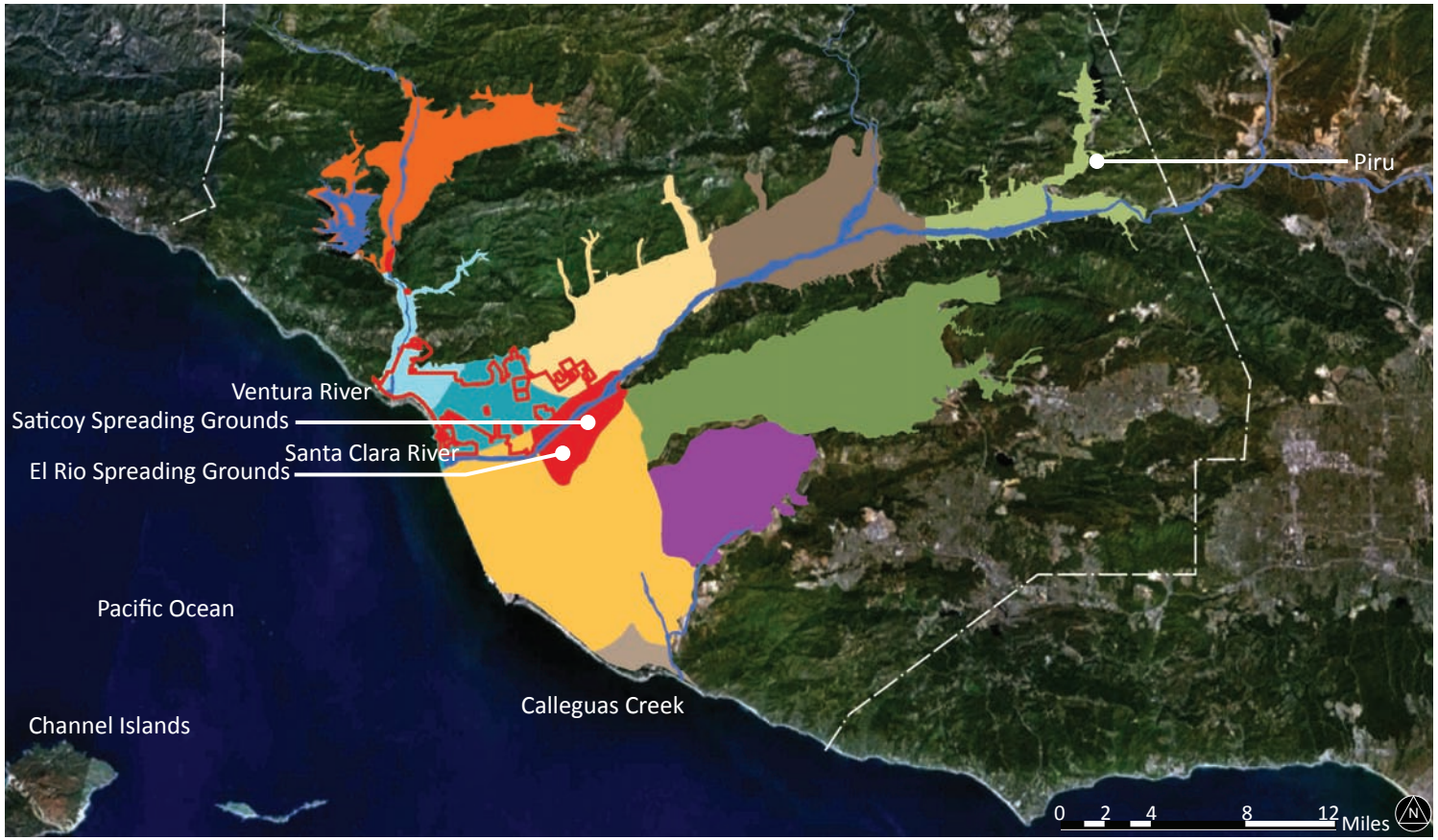
FIGURE 10
Surface Water Within Ventura County

Rivers
San Buenaventura
Ventura County Boundary

SOURCE: Ventura County GIS Department; NASA World Wind

- The Santa Clara River Watershed, which draws from 1,634 square miles, is the largest watershed in the region. Ventura and Los Angeles County divide the lower 60 percent of the watershed lying within Ventura County. The watershed drains into the Santa Clara River, which is one of the few rivers in California that has remained in a natural state. The river stretches from the Mojave Desert to the Ventura coast. Due to the varying topography and climates that it crosses, water flow is perennial. Numerous proposed upstream developments, including Newhall Ranch and the Adams Canyon projects, threaten the Santa Clara River. Such projects could lead to the channelization of the river and add vast amounts of impervious surfaces. (Friends of the Santa Clara River 2007).

- The Ventura River Watershed, at 226 square miles wide and 31 miles long has steep slopes. This watershed receives the most rainfall of any of the watersheds in Ventura County. The Ventura River begins in Los Padres National Forest, and empties from the northern end of the city into the Pacific Ocean. In 1946, the Matilija Dam was built to provide flood control and to serve as a water supply. Since then, the Dam's capacity has been reduced by 90 percent due to sedimentation. This dam has negatively impacted



SOURCE: Ventura County GIS Department; NASA World Wind

FIGURE 11
Groundwater Basins Within Ventura County

- Oxnard Forebay
- Oxnard Plain
- Mound
- Lower Ventura
- Upper Ventura
- Santa Paula
- Fillmore
- Piru
- Los Posas
- Pleasant Valley
- Mugu Forebay
- San Buenaventura
- Ventura County Boundary

downstream habitat, resulting in receding beaches and a decline in steelhead populations. The dam is cited by the Southern California Wetlands Recovery Project as blocking access to over 20 miles of the Southern California's best remaining steelhead habitat (SCWRP 2001). Plans are underway to remove the dam (Matilija Coalition 2007). Water diverted from the Ventura River serves the function of water storage for Lake Casitas. The United Water Conservation District (UWCD) states that Lake Casitas and the Ventura River together provide almost half of the water supply for the City of San Buenaventura (UWCD 2005). Due to a recent ruling (March 2007) the Casitas Municipal Water District (CMWD) is now "required to leave 3,200 acre feet (1 billion gallons) of water from its supply in the Ventura River for the steelhead [trout] every year, instead of diverting the water into Lake Casitas" (Foley 2007).

- aThe Calleguas Creek Watershed is bounded by the Santa Clara Watershed to the north and the Santa Monica Mountains to the south. Significantly smaller than the previous watersheds, this watershed is approximately 343 square miles. Cities including Camarillo, Thousand Oaks, and Moorpark, as well as agriculture surround the watershed and threaten the quality of the creek.

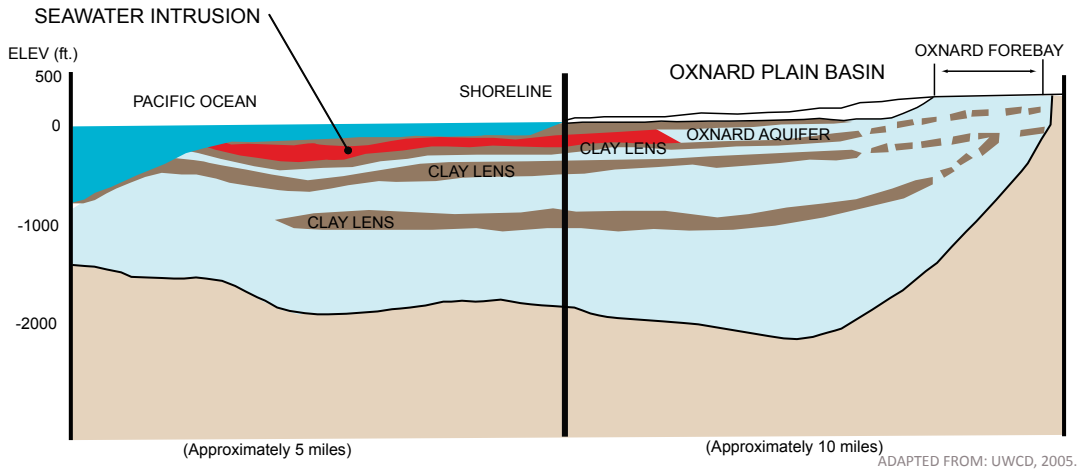
- The coastal watersheds include the South Coast, Ormond Beach, Arundell, and Rincon. The Arundell watershed, which includes the City of San Buenaventrua, begins in the hills to the north of the city and drains through small, natural and channelized barrancas through the city to the beachfront.

Groundwater

The region depends on groundwater for 65 percent of its agricultural and residential supply. Over thirty groundwater subbasins exist within Ventura County, as part of the Santa Clara-Calleguas groundwater basin (Figure 11). Six aquifers occur throughout the basins at varying depths. The Oxnard Plain aquifer is located at a depth of 255 to 425 feet below the Oxnard coastal plain (which encompasses Oxnard, Ventura, Camarillo, Port Hueneme and Santa Paula). This aquifer, composed of sand and gravel, is the primary source of groundwater for the entire Oxnard Plain (UWCD 2005). A layer of clay, called the clay lens, is located above the aquifer and protects it from surface contamination. Although this layer of clay persists throughout the Oxnard Plain and the Pleasant Valley subbasins, the Piru and Fillmore subbasins have few, if any clay layers. Groundwater is recharged both naturally and manually throughout the Santa Clara-Calleguas basin. Groundwater is recharged naturally through infiltration of streambeds, direct infiltration of precipitation on valley floors, and on bedrock outcrops in adjacent mountain fronts (UWCD 2005). However, natural recharge does not adequately replenish the basins as diverted streamflow, imported surface water, and surplus agricultural water artificially recharges the basins.

The Oxnard Forebay is where the lower aquifers including the Oxnard Plain, Santa Paula, and Mound Basin come together and are unconfined by clay lenses (UWCD 2005). The Oxnard Plain basins are recharged by water diverted from the Santa Clara River. There are two spreading grounds within the Oxnard Forebay: the Saticoy spreading grounds and the El Rio spreading grounds. The Piru spreading grounds recharge the Piru Basin. The Mound Basin is recharged mostly by natural infiltration at the base of the City of San Buenaventura's foothills.

There is a substantial body of information regarding the basin storage and yield of regional groundwater basins. However, the regional water management plan acknowledges that estimates of safe yields can only be speculated at this time due to insufficient and/or inadequate information (VCIRWMP 2005). This is due in part to the fact that agricultural users throughout the county use individual wells to pump water from these subbasins in order to irrigate



ADAPTED FROM: UWCD, 2005.

FIGURE 12
Saltwater Intrusion

their crops. Currently water users have rights to the water underneath their property, as well as the responsibility to monitor their wells and ensure their wells are not contributing to groundwater pollution (CVPWA 2005). The regional water management plan recognizes the need for improved monitoring and the challenge posed by private wells which do not have meters (VCIRWMP 2005). Available information, however, suggests that Ventura County is currently using 1.6 billion gallons of groundwater more than is replenished each year (UWMP 2005).

Saltwater Intrusion

Overdrafting exacerbates the natural process of saltwater intrusion, or the flow of seawater into freshwater aquifers, in the region's coastal aquifers. Lowering the water volume in an aquifer also lowers the pressure of freshwater against the saltwater interface. When this happens, saltwater draws further inland and contaminates freshwater supplies. Saline water is not potable or compatible with many agricultural crops.

In Ventura County, saltwater intrusion is most problematic within the Oxnard coastal plain (UWCD 2005) (Figure 12). The majority of the contamination is in silt and sand layers above the clay lens. Urbanization and the prevalence of impermeable surfaces add to this problem by decreasing the rate of groundwater recharge. The scale of saltwater intrusion is difficult to measure in Ventura's coastal watersheds as the contamination caused by saltwater intrusion can be confused with other sources of contamination, like high chloride levels from abandoned wells (UWCD 2005). However, as water demand increases, the threats posed by overdrafting and saltwater intrusion to the vitality of these watersheds will heighten.

Regional water districts recognize the need to minimize saltwater intrusion within the Oxnard Plain by reducing groundwater pumping and artificially recharging aquifers. In addition to the recharge projects at the Oxnard Forebay (discussed above), the county has several projects underway to address these concerns. These projects include the expansion of groundwater recharge facilities, the use of reclaimed water, and the injection of imported and reclaimed water into underlying aquifers (UWCD 2005).

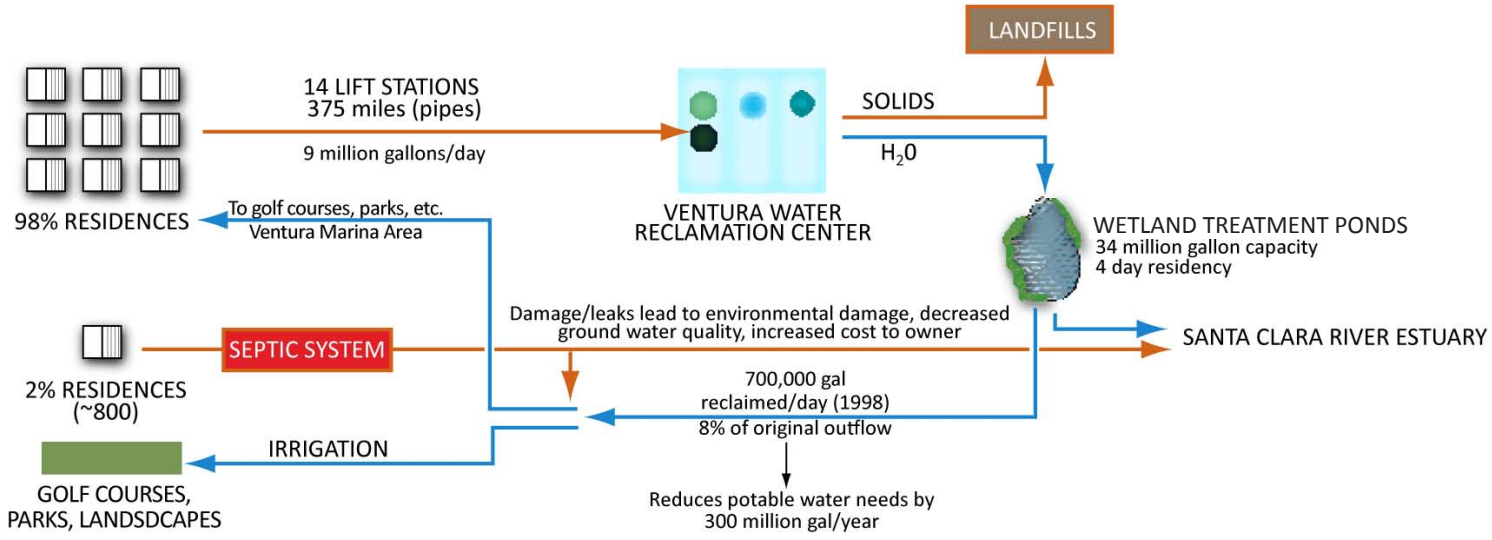


FIGURE 13
Existing Residential Wastewater System

Underutilized Resources

Greywater and Blackwater: Currently, a number of treatment plants within the county treat wastewater from residential and industrial uses. The wastewater is comprised of blackwater, wastewater from toilets, and greywater. Greywater is wash water that comes from showers, laundry, and kitchen uses, and accounts for over half of all wastewater. Greywater needs to be treated before reentering the hydrologic cycle, but does not need to be treated to the same degree as blackwater. Simple greywater systems can redirect greywater from the waste stream to be used for landscape irrigation. Although greywater systems are legal in California, they are not yet legal in the City of San Buenaventura. The implementation of greywater systems could decrease the total water demand by up to 8.7 billion gallons in 2007. These figures are based upon case studies by Oasis Design which suggest that 30 gallons per capita per day can be reutilized through grey water systems (Oasis Design).

The potential to harvest blackwater depends on the existing urban infrastructure and the resources available for treatment. In the City of San Buenaventura, blackwater currently receives preliminary treatment before being released into treatment wetlands. Once treated, the water is released into the Santa Clara River Estuary where it serves as a needed freshwater input and is treated naturally by estuary plants (Figure 13).

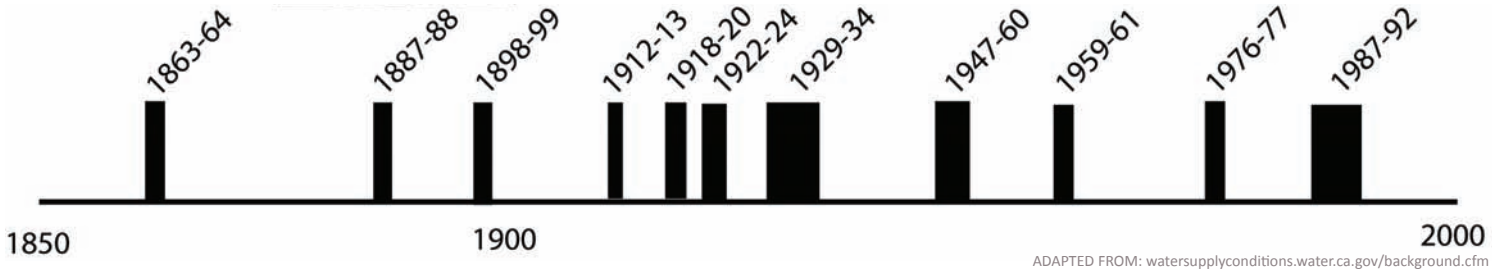
Roof Catchment: An estimated 6.9 billion gallons of water currently fall upon roofs each year in Ventura County. This figure is based on average rainfall, estimated rooftop area, and formulas recommended by the Rain Barrel Guide (rainbarrelguide.com) (Table 1). Current efforts to harvest this resource are evident in only a few individual homes. Rainwater provides an excellent source of freshwater that is ideal for irrigation and certain household uses. In some parts of the world, roof catchment water is the preferred drinking water (United Nations Division for Sustainable Development).

		Per Capita/Year (gallons)	Total Potential Harvest (gallons)
Greywater		10,950	**8,717,360,700**
	Roof Square Footage per Capita	Estimated Total Square Footage of Roofs	Total Potential Harvest (gallons)
Roofwater	964	767,446,184	**6,907,015,656**

Based on 2007 population numbers for Ventura County (796,106). 30 gallons per capita based on case study by Oasis: www.oasisdesign.net/greywater/SBebmudGWstudy.htm; 2007 roof area estimate is based on Crawford, 2002 and sampling of five houses in region; 964 square feet/person roof area based on sampling of five houses in region, divided by average number of residents per unit (2.6), 673 square feet/person. "Car Free Citites" was used to determine average number of square feet/capita for shopping (97) and work space (194) for a total of 964 of square feet.

TABLE 1
County Water Catchment Potential

Runoff: Impermeable surfaces within Ventura County result in increased runoff and a loss in potential utilized water. The amount of runoff can be decreased by increasing the amount of permeable surfaces within urbanized areas. Parking lots and roads can be retrofitted to improve groundwater recharge. Bioswales and stormwater planters are designed to capture, slow, and infiltrate water into local groundwater basins.



ADAPTED FROM: watersupplyconditions.water.ca.gov/background.cfm

FIGURE 14
California's Multi-Year Dry Periods

SOURCE: Ventura County GIS Department; NASA World Wind

FIGURE 15
100 Year Flood Zone

- Flood Zone
- Rivers
- San Buenaventura
- Ventura County Boundary

Flooding and Drought

Ventura County has experienced periods of drought and flooding events throughout recorded history (Figure 14). A significant drought occurred during the Mission Era, forcing the division and sale of ranchos. Droughts within the state of California have lasted from a single year to 15 years, with the last significant period of drought lasting from approximately 1987 to 1992. Recent reports estimate that California is currently in a state of drought that may continue well into the future (Zarembo and Bettina 2007). Although Ventura County survived a seven-year drought in the late 1980s and early 1990s with conservation measures (Stoltz 2007), droughts in the future pose a significant problem as population growth increases demand on the water supply.

While short droughts that endure for three years or less are not expected to have significant impacts on the Oxnard Plain groundwater basin, longer droughts that last for over five years will significantly impact the basin. Under such a drought, groundwater levels drop below the 80,000AF storage limit and deeper aquifers with lower water

quality will be harvested (UWCD 2005). In the instance of a statewide drought, imported water will be limited. If the region compensates for increased demand by further depleting groundwater aquifers, saltwater intrusion will likely worsen.

Flooding is a threat to the region and to areas within the city of San Buenaventura (Figures 15 and 19). During periods of intense rainfall, the steep slopes of the Ventura River can lead to erosive peak flows (VCIRWMP 2005). Despite associated risks, the pressure of urbanization has led to development in Ventura River's flood plains. Due to such development, a flood in 1969 resulted in the deaths of 13 residents. The Santa Clara River has also experienced significant flooding events that caused infrastructural damage (Friends of the Santa Clara River).

Channelization of the Santa Clara River, a potential result of new developments along the river, will compound the threat of both flooding and drought in the region. Although the channelization of waterways prevents flood damage and increases buildable land, it can decrease natural buffers to flooding, such as water infiltration into soil. Channels can increase peak flow during storm events and therefore the probability of greater flood damage. Development increases the amount of impervious surfaces due to new roads, buildings, and sidewalks. Impervious surfaces further influence peak flows and development reduces the total amount of water that is kept on site during storm events. As buildings and infrastructure replace trees and plant communities, the water that would normally infiltrate the soil runs off the site and into existing channels. The decrease in soil water storage can intensify water stress caused by drought situations.

Water Quality

The quality of a water source has direct impacts on the health of the living systems it supports, from individual bodies to entire ecosystems. In Ventura County, contamination of surface water contaminates marine life. Urban and agricultural runoff are significant sources of contamination in the region.

Common pollutants from urban runoff include trash, automobile exhaust, oil and grease, and heavy metals such as cadmium from brake pads. Agricultural runoff is a source of high nitrate levels and chemical compounds that come from toxaphene fertilizers. Contamination from these sources has contributed to portions of the Santa Clara River and Calleguas Creek watersheds being listed under the 2002 303(d) list for various contaminants, including nitrate, coliform bacteria, ammonia, heavy metals, and legacy pesticides. The Ventura River Estuary is listed on the 2002 303(d) list for coliform bacteria, eutrophication, and trash. However, the upper reaches of the river are listed only for stresses caused by pumping and water diversion (Los Angeles Regional Water Quality Control Board 2003) (Figure 16).

Urban runoff and agricultural practices also contaminate groundwater basins throughout the county. Abandoned wells that have improper seals, are corroded, or have collapsed casings, allowing surface water to penetrate through clay lenses and enter underground aquifers (CVPWA 2005). It is estimated that before 1970 there were over 500 wells throughout the county that were improperly covered (CVPWA 2005). Most of these wells are unable to be located, compounding the problem. The same contaminants that are found in surface waters, including nitrates, chloride, and pesticides, have also been found in groundwater basins. Because wells are located throughout the county each subbasin's quality is critical for the overall health of the groundwater supply. Water quality is variable throughout the groundwater subbasins and steps need to be taken to both locate and monitor these areas.

Additional Sources of Ocean Pollution

Contaminated surface water degrades water quality and marine habitat in the Santa Barbara Channel. Oil and gas industries and cruise ships pollute ocean water. According

SOURCE: Ventura County GIS Department; NASA World Wind

FIGURE 16
*303(d) Listed Impaired Water**

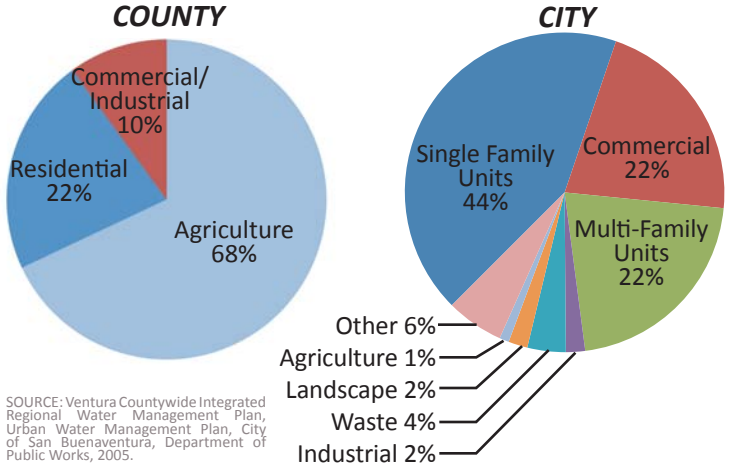
Rivers
San Buenaventura
Ventura County Boundary

* Under Section 303(d) of the 1972 Clean Water act, the listed impaired water do not meet water qualtiy standards

to the Santa Barbara Channel Keepers (SBCK), the oil and gas industry's use of drilling fluids smothers existing larvae within the ocean, which reduces the growth of scallops and lobster (SBCK 2007). In 1969, 100,000 barrels of oil were spilled into the Channel, indicating the potential for future spills. Although cruise ships are required to discharge three miles from shore, they proved to be significant polluters within the Santa Barbara Channel in the past, and may still be polluters because they lack proper oversight (SBCK 2007). In addition to polluting the ocean with such contaminants as bacteria, metals, and nutrients, cruise ships produce exhaust equivalent to 12,000 automobiles per day.

Addressing Water Quality

Many organizations address water quality in the region. Key players in these efforts include the Surfrider foundation, Friends of the Ventura River, Friends of the Santa Clara River, and the Central Coast Regional Water Quality Control Board (CCRWQCB). One critical program of the CCRWQCB is the Waiver for Irrigated Agriculture which mandates farmer education and regular water quality monitoring (CCRWQCB 2006). The City of San Buenaventura has also implemented a program to catch the first flush of storm water before it enters the ocean and return it to the treatment plant.



SOURCE: Ventura Countywide Integrated Regional Water Management Plan, Urban Water Management Plan, City of San Buenaventura, Department of Public Works, 2005.

FIGURE 17
County and City Water Allocation

Supply and Demand

County

The county uses approximately 138.7 billion gallons of water per year. Agriculture uses 68 percent of this supply; 22 percent is used for residential; and 10 percent is used for commercial and industrial. Based on estimated yearly water demand, irrigated agricultural land receives an average of 2.18 acre feet of water per year. Water use per capita in the county fluctuates between 58,680 and 74,946 gallons per year (Figure 17) (VCIRWMP 2005).

	Gallons/Year	Gallons/Day
Current per Capita Use (United States)*	529,250	1450
Estimated minimum per Capita Need (United States)	255,500	700
Current County per Capita Use (2007 County population)	174,223	477
Sustainable use (2007 County population - 796,106)	144,484	396
Sustainable use (2050 County population of 1,388,214)	85,410	234

*Based on estimates by Daivid Pimentel, 1994

TABLE 2
Per Capita Water Use

Calculations for Sustainable Demand	Gallons/Year	Gallons/Day
Current Use	**138,700,000,000**	**380,000,000**
(-) Current Imports	34,700,000,000	95,068,493
(-) Current Groundwater Overdraft	1,600,000,000	4,383,562
(-) Ventura River Water Allocation	1,000,000,000	2,739,726
(-) Santa Clara River Water Allocation	2,000,000,000	5,479,452
Sustainable Harvest of Utilized Local Water Sources (2050)	**99,400,000,000**	**27,232,767**
(+) Potential Greywater Catchment	10,133,962,200	27,764,280
(+) Potential Roofwater Catchment	9,033,108,498	24,748,242
Total Potential for Underutilized Water Sources	**19,167,070,698**	**52,512,522**
Regional Water That Can Be Sustainably Used (2050)	**118,567,070,698**	**324,841,290**

Extrapolated from VCIRWMP, 2005; Oasis Design; Foley, 2007.

TABLE 3
Current vs. Sustainable Use of Local Water Resources

Local groundwater aquifers provide the county with 65 percent of its water supply, and surface water amounts to an additional 8.5 percent (Figure 18). Through its water reclamation project, the County is able to meet an additional 1.5 percent of its need. However, as Ventura County uses more water than is locally available, the California State Project supplies 25 percent of its water (or 34.7 billion gallons) and regional groundwater aquifers are overdrafted by 1.6 billion gallons each year (see Groundwater section) (UWMP 2005). The growing population within the county will substantially increase the demand for imported water and stress local sources (Table 2). These figures make it clear that the county's human and natural populations would be greatly impacted

SOURCE: Ventura County GIS Department; NASA World Wind

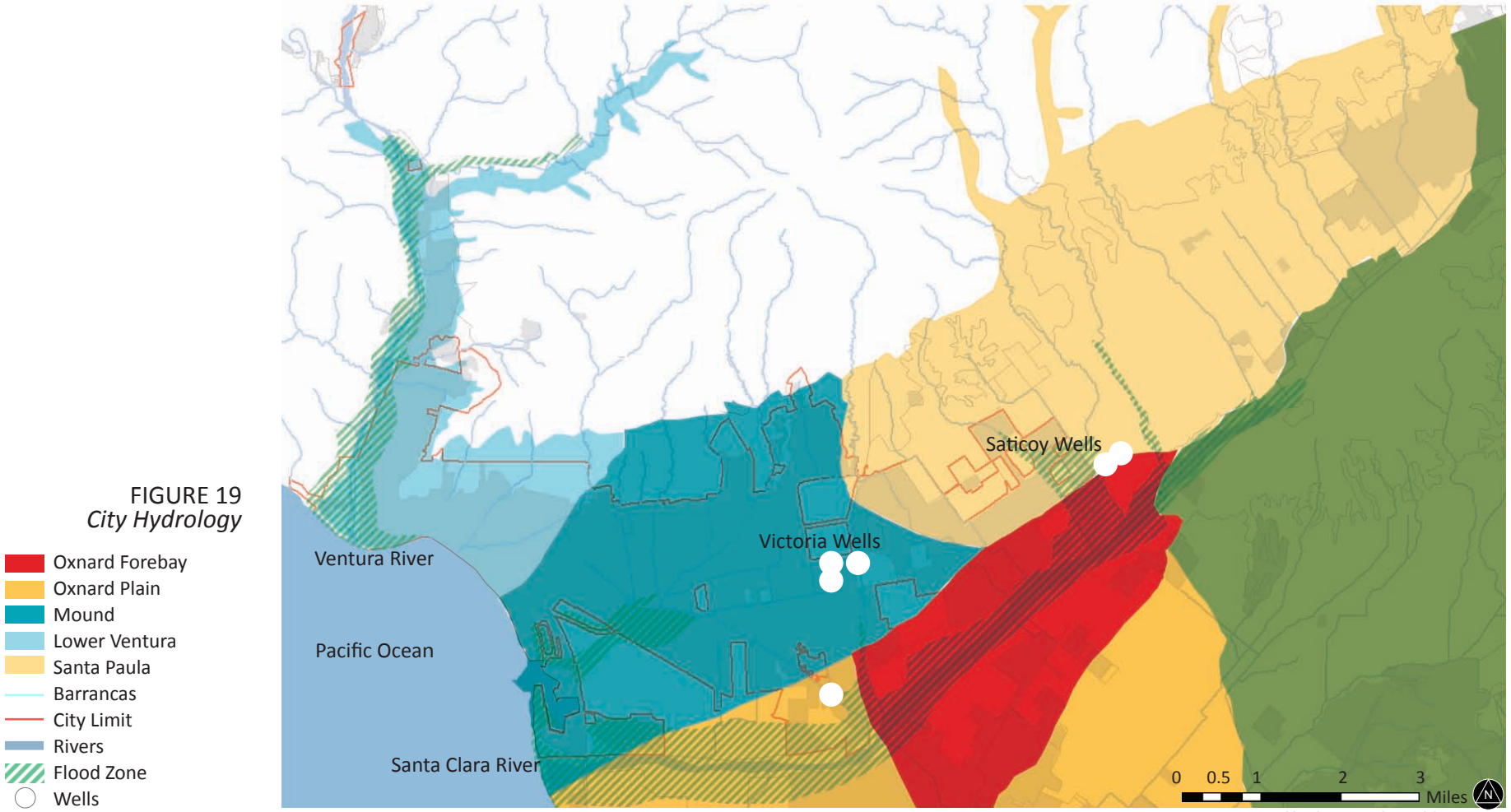
FIGURE 18
Regional Water Supply

Reservoirs
Groundwater Basins
San Buenaventura
Ventura County Boundary

by decreases in the imported or local water supply due to drought and/or competition.

In order to eliminate dependence on imported water and maintain groundwater and surface water levels, water use would need to decrease to 99.4 billion gallons a day. This implies that demand would need to decrease by 39.3 billion gallons a year. It is estimated that if water management is substantially improved per capita, water needs in the United States could be reduced from 1,450 to 700 gallons (Pimentel 1994). Ventura County's current consumption rate is far below this suggested minimum. The reason for this difference is likely the county's dependence on outside resources, such as meat, grain, and manufactured goods that are water intensive to produce. In order to reduce water consumption by the 34.7 billion gallons needed, it would be necessary to employ strong conservation policies and practices for all sectors of use as well as harvest all underutilized sources, such as greywater (Table 3). Unfortunately, establishing baseline data for water use is difficult as over two-thirds of agricultural users pump groundwater from private wells.

FIGURE 19
City Hydrology



SOURCE: Ventura County GIS Department

City

Unlike Ventura County, the City of San Buenaventura does not currently depend on imported water supplies. Fifty percent (4.2 billion gallons) of the city's water is supplied by groundwater basins (Oxnard Plain, Mound, and Santa Paula) and the remainder from the Ventura River and Lake Casitas (2.2 and 2.6 billion gallons respectively) (Figure 19). San Buenaventura's water supply is not expected to exceed demand until approximately 2050. This is due to the available reserves from Lake Casitas, which holds 82.8 billion gallons of water.

The city uses nearly nine billion gallons of water a year. Forty-two percent of this use is attributable to single-family homes, where 50 percent of water supply is used for landscape

irrigation. Multi-family homes account for 22 percent of the city's water use, and commercial users account for 24 percent. Other water users, including industrial, institutional, landscape, and agricultural, account for only 12 percent of water use combined (UWMP 2005).

The city responds to potential shortages in water supply with water conservation policies, the use of reclaimed water, an emergency water plan, and a contract for future use of 20,000 AF of water from the State Water Project (UWMP 2005). However, if the city does not take further steps to localize water resources now, it may have to rely on expensive imported water to meet future needs.

Connecting City and Region

The recent ruling requiring the Casitas Municipal Water District (CMWD) to leave one billion gallons of water in the Ventura river (as discussed on page 36) suggests that San Buenaventura's current water use is detracting from the water supply needed for riparian habitats (CMWD services the City of Ojai and the City of San Buenaventura). One billion gallons is equal to roughly 17 percent of the total water volume used by CMWD customers during an average, non-drought year. It is possible that further lawsuits could force the city to allocate an additional portion of their resources to neighboring cities. For this reason, it is necessary to focus on the regional picture when considering the potential for localizing water supply.

WATER CONCLUSIONS

Opportunities and positive trends that increase the region's ability to localize water:

- Ventura County has a history of effective water conservation policies and drought plans
- The county has multiple sources for freshwater
- Current use of reclaimed water decreases overall water demand
- Water quality groups are actively monitoring and regulating pollution
- Roofwater and greywater are untapped sources for water harvest
- The city's blackwater system enhances local habitats
- The city has implemented a "first flush" program to decrease ocean pollution

Constraints to localizing water:

- Local resources do not meet existing demand
- The cost of transporting and treating water will increase with the cost of oil prices
- Competition for freshwater resources will increase with growing populations
- Overdrafting of local aquifers leads to saltwater intrusion and decreased freshwater supply
- Impermeable surfaces decrease the rate of groundwater recharge
- The potential to utilize greywater is limited by its illegal status at the city level
- Future development will impact natural hydrologic function of watersheds

NATURAL COMMUNITIES

The health of natural communities has a direct impact on the health of human societies and their ability to sustainably harvest local resources. Ecosystem services provided by natural communities include air and water filtration, climate regulation and nutrient cycling. In addition, natural communities provide cultural and recreational opportunities. As there are many distinctions between terrestrial and marine communities, this section addresses them separately. However, the goals and objectives below apply to both.

GOAL: Preserve and restore local habitats to provide ecosystem services for a post-Peak Oil world

OBJECTIVES:

- Manage for sustainable marine resources
- Preserve and expand regional terrestrial habitat
- Enhance urban biodiversity
- Protect rivers and barrancas

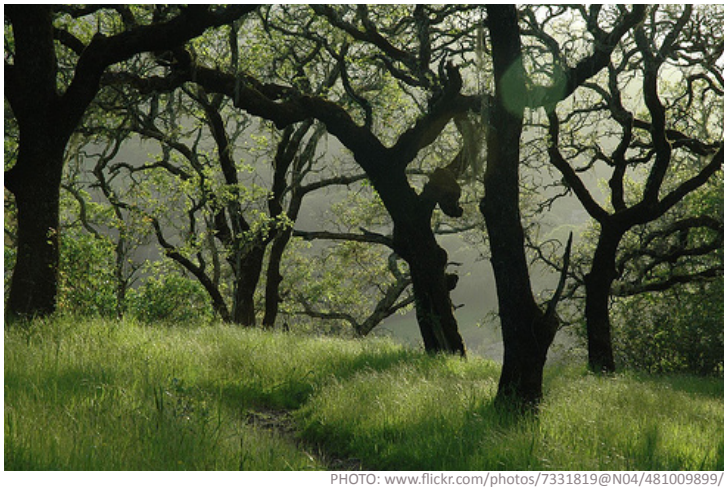


PHOTO: www.flickr.com/photos/7331819@N04/481009899/

Oak Woodland

Terrestrial Communities

The diverse topography, coastal influence, and Mediterranean climate enable a diversity of plant communities to thrive in the region. Remaining vegetation may suggest the region's pre-development state and can contribute to the vision of a healthy future. As the health of future generations and the viability of post Peak-Oil communities depend upon the health of natural systems, it is critical to protect, restore, and learn from natural communities. Regulating agencies currently managing these resources include the California Department of Fish and Game, the United States Forest Service, and the National Park Service.

Regional Resources

Coastal sage scrub, southern willow scrub, pinyon/juniper woodland, chaparral, and oak woodlands are the primary native plant communities in the county (Figure 20). Unfortunately, the range of these native communities has decreased dramatically over the last two hundred years due to the spread of agriculture and urbanization. While humans are responsible for the demise of native plant and wildlife populations, they share in the consequences as ecosystem stability declines. These consequences include a decline in biodiversity, a decrease in permeable surfaces and groundwater recharge, and a decrease in carbon sinks to compensate for destructive human activities.

- The coastal sage scrub community was once dominant along the western slopes of the Pacific Coast but is now only found in small remnants due to urbanization. Native plants, including lemonadeberry, coast sagebrush, California buckwheat, and yarrow, are typically found in this plant community. Coastal sage scrub communities provide habitat for the California gnatcatcher, the cactus wren, deer mice, coyotes, and kangaroo rats. Many medicinal plants live in this community.
- Chaparral is often found at higher elevations and adjacent to the coastal sage scrub community and is characterized by rockier soils and a moister environment.

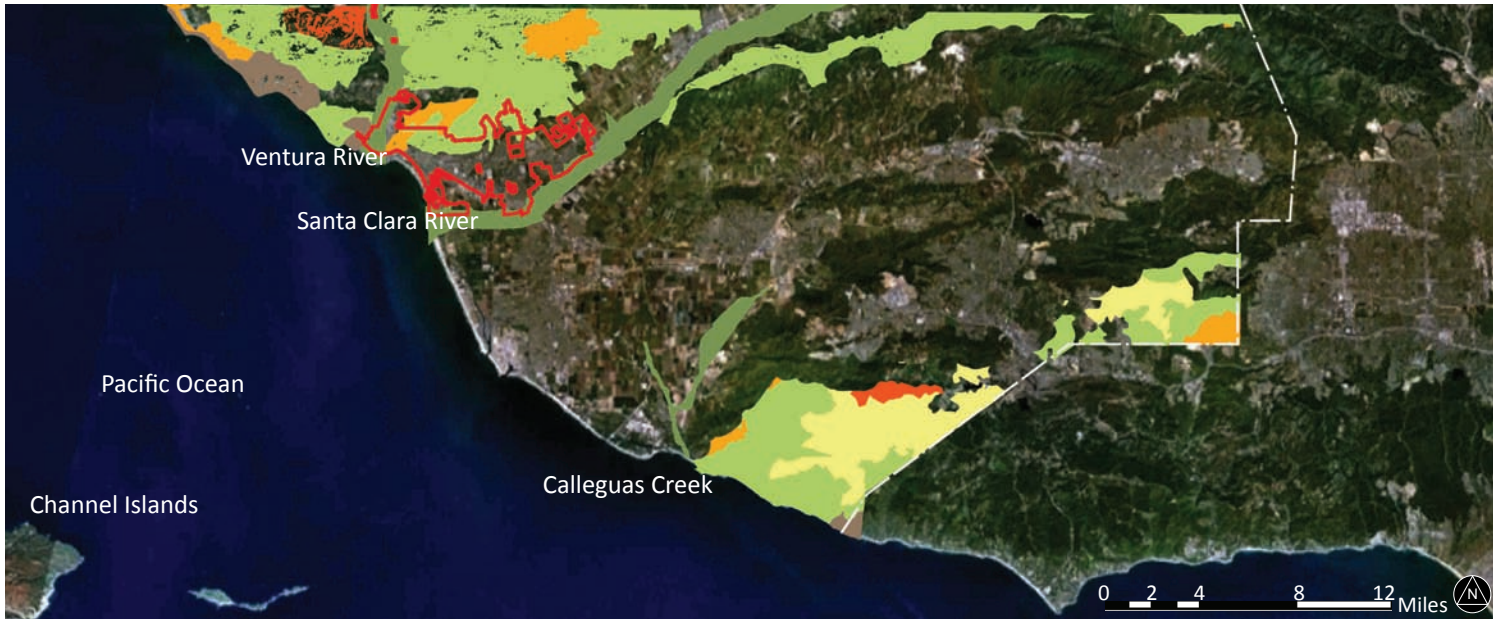


FIGURE 20
Plant Communities

- Coastal Sage Scrub
- Chaparral
- Southern Willow Scrub
- Southern Oak Woodland
- Non-Native Grassland
- Riparian
- San Buenaventura
- Ventura County Boundary

SOURCE: Ventura County GIS Department; NASA World Wind

Summers are hot and winters are mild with most of the precipitation occurring as rain. Steep slopes on mountainsides and narrow valleys are typical of this biome. Chaparral plant communities host a number of plant and animal species that have adapted to the climate, and which provide food for the spotted skunk, fox, and over 100 bird species (Blue Planet Biomes 2006).

- The Southern willow scrub community is found along waterways. Dense, broad-leaved thickets including salix species, cottonwood, and sycamores characterize the Southern willow scrub community. Soils within this plant community are sandy and gravelly alluvium that is deposited near stream channels during flood flows. This community requires periodic flooding events that prevent succession to the southern cottonwood-sycamore forest. This community provides a rich riparian habitat for both seasonal and migratory species.
- Pinyon/juniper woodlands exist at higher elevations, typically between 1,000 and 5,000 feet. Wide temperature variations characterize this plant community with both frost and extreme temperatures occurring throughout the year. The plants of this community include juniper, pinyon pine, sages, and penstemons which provide habitat for pinyon jays, bears, and badgers.
- Southern oak woodlands are often found below 5,000 feet on north-facing slopes, in shaded canyon areas, and in valleys. A variety of oak species, along with walnuts, sycamores, toyon, Mexican elderberry, sugarbush, and lemonadeberry, define this community. This plant community is host to many edible plants, such as the oak, that provided a critical food source to early inhabitants of the region.
- Riparian corridors exist along both the Santa Clara River and the Ventura River. These corridors provide valuable habitat and movement opportunities for a variety of species including the Southern California steelhead, the willow flycatcher, the California red-legged frog, and the California brown pelican.

SOURCE: Ventura County GIS Department; NASA World Wind

FIGURE 21
Habitat and Corridors

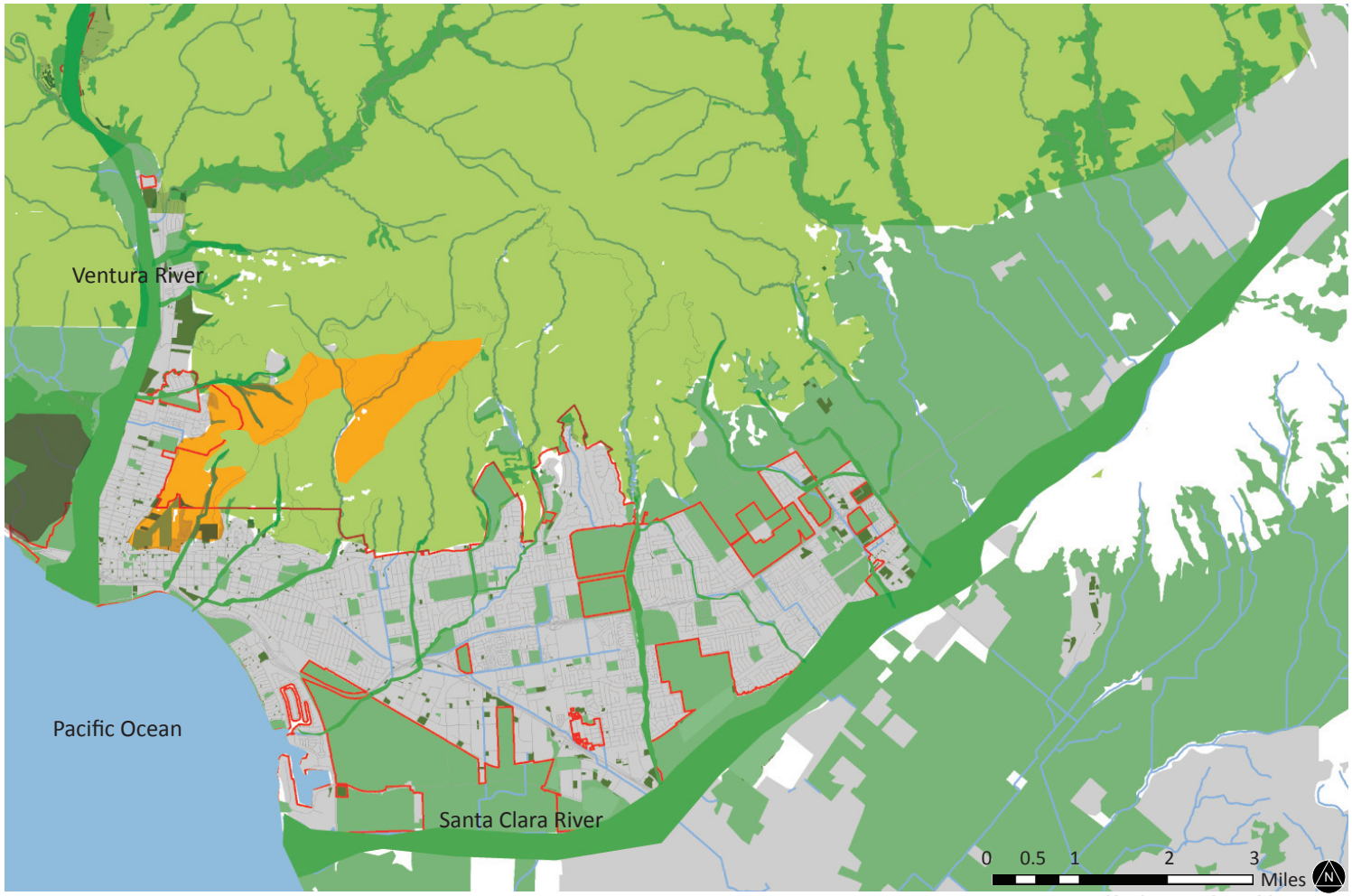
- Wildlife Habitat
- Wildlife Corridor
- Riparian Corridor
- San Buenaventura
- Ventura County Boundary

- Estuaries at the mouths of the Ventura and Santa Clara rivers are breeding grounds and feeding areas for both migratory and resident species. Many fish species depend on estuaries as places to spawn, which has led them to be called "nurseries of the sea" (EPA, May 17 2007). A number of endangered species exist within the four major watersheds, including the Southern California steelhead, least Bell's vireo, brown pelican, and the arroyo toad.

As discussed above, wildlife habitat links directly to native plant communities as well as to undeveloped areas and regional water sources. National forests, mountain ranges, wetlands, marine environments, estuaries, and riparian areas support a great diversity of wildlife and threatened species. Important wildlife corridors exist along the riparian areas of the Ventura and the Santa Clara Rivers. Two corridors also exist between the Santa Monica Mountains and the Los Padres National Forest (Figure 21).

City Resources

Vegetation maps suggest that pre-development, coastal sage scrub and native grassland were the dominant plant communities within in the City. While agriculture and later urbanization has replaced native vegetation within the city, pockets of both can still be found within. The most notable



SOURCE: Ventura County GIS Department

Target Species Habitat

- Loggerhead shrike
- Native bees
- Cooper's hawk
- Big brown bat
- Southern California steelhead

FIGURE 22
Plant Communities

- Ventura Coastal Sage Scrub
- Parks and Regional
- Agriculture
- Southern Coastal Bluff
- Scrub
- Non-Native Grassland
- Riparian Vegetation
- San Buenaventura
- Streams

urban habitat is found within natural barrancas, or steep-sided intermittent water courses that begin in the hillsides and pass through the city towards the ocean. Despite being surrounded by urban development, these barrancas are characterized by riparian communities that provide habitat for a number of bird species, including the least Bell's vireo, willow flycatcher, and yellow warbler (Ventura County General Plan 2005).

Target Species

Eleven species have been identified as target species for protection and monitoring because they are either indicators of the health of natural ecosystems or they are beneficial to the region's agricultural environment. By planning for target species, many other species are addressed (see sidebar: ***Glossary*** on page 52). Target species include the bobcat, the big brown bat, Cooper's hawk, Southern California steelhead, the

PHOTO SOURCE: www.werc.usgs.gov

Big Brown Bat

www.ahlgrenvineyard.com

Cooper's Hawk

PHOTO SOURCE: www.lioncrusher.com

Bobcat

honey bee, native bees, loggerhead shrike, sea lion, sardines and anchovies, squid, and cowcod. These species have been selected from the Green Visions plan (Martino et al. 2005). The Green Vision Plan is a project developed by the University of Southern California that identifies critical habitats and target species to guide conservation and restoration plans for Southern California. Just as target species can indicate the success of planning and restoration efforts, their current status can infer the existing state of natural ecosystems. By planning for the target species discussed below, critical habitat areas for endangered species will also be protected and enhanced. For example, riparian habitat that is enhanced for steelhead populations will benefit the least Bell's vireo, the willow flycatcher, and other riparian species.

Terrestrial Target Species for Ecosystem Health/ Sustainable Agriculture

Bobcat (Felix rufus)

The bobcat prefers riparian areas and coastal sage scrub habitat but is found in all types of habitat, except for urbanized areas. One bobcat was even seen along the Ventura River during a site visit by the 606 Studio team in December of 2006. Bobcats are opportunistic feeders by nature as they will eat arthropods, prairie dogs, bats, snakes, rabbits, and birds, and even animals as large as deer (desertusa.com). The bobcat has been identified by the Green Visions plan as a keystone species because it is a top land predator (Green Visions 2005). Until 1971, the bobcat was not protected and was pursued as an undesirable predator. The bobcat is an important target species for planning because it is sensitive to habitat fragmentation (Green Visions 2005). Urbanization threatens the bobcat by constricting its home range and ability to move. Designated wildlife corridors must be protected in order to ensure future biodiversity and a healthy population of the bobcat (Figure 22).

Big Brown Bat (Eptesicus fuscus)

The big brown bat is found in virtually all habitat types in North America and has been identified by the Green Visions Plan as a keystone species. It has a large range spanning from Canada to the southern tip of Mexico and is often found in suburban areas that are surrounded by agriculture. Insects are a major part of its diet, making the big brown bat a major contributor to healthy environments and to the management of insect populations (Bat Conservation International 2007). Despite general abundance, big brown bats are threatened by urbanization. The population of bats is declining worldwide, making this bat a valuable target species.

Bats and humans can coexist without problems; and thus bats should be planned for in order for communities to benefit from their proximity. Traditionally, bats used caves and cavities in trees for their roosts, but they will also live in artificially built roosts (Bat Conservation International 2007). Older deciduous trees such as oaks need to be preserved for potential roosting. Building bat houses for roosting near urban agricultural areas should also be encouraged, as bats are beneficial for agriculture (Martino et al. 2005).

Cooper's Hawk (Accipiter cooperii)

Cooper's hawks can be found in a variety of habitats including deciduous, mixed riparian, and wetland areas. Cooper's hawks are top avian predators as they control the population of rodents. Populations of cowbirds, which predate on endangered birds such as the gnatcatcher, least Bell's vireo, and willow flycatcher, are controlled by the Cooper's hawk. The Cooper's hawk is listed as protected species under the United States Migratory Bird Act because of population loss due to the use of DDT. Despite the ban of DDT in 1972, the population has not fully recovered, as other pesticides have affected it. The Cooper's hawk is not only susceptible to pesticides and other pollutants but to development pressure as well. If development continues within the county, valuable nesting areas will decrease. An increase in the population of Cooper's hawks would indicate a decrease in pesticide use and urbanization. It is for this reason that the Cooper's hawk has been chosen as an indicator of the overall health of the region (University of Michigan Animal Diversity Web).

Southern California Steelhead

The Southern California steelhead is a target species because it is an indicator of overall riparian health, as it is sensitive to changes in water quality and surrounding vegetation. The population of steelhead has declined by over 99 percent in Southern California (Southern California Steelhead Recovery Project). Steelhead have historically spawned in both the Ventura River and the Santa Clara River. It is estimated that before the 1950s the adult steelhead population in the Santa Clara River was approximately 9,000 (California State Coastal Conservancy 2006). The minute population of steelhead that spawn in these rivers reflects the dramatic decline of this species throughout Southern California. As an anadromous fish, steelhead trout spend most of their adult life in the ocean, only to return to their native stream to spawn. Steelhead require clean and cold water year round, an unhindered route to their spawning grounds, and vegetation along rivers to provide shade and cool water.

In order to encourage steelhead to return to the region, the Ventura and Santa Clara rivers must be returned to their natural states. In particular, this means the natural water flows and native vegetation need to be restored, the natural channels must remain unchannelized and undammed, and the water must be free from pollutants. Unchannelized rivers must be protected from adjacent development as it could negatively impact their hydrologic function. Efforts are underway by the Southern California Steelhead Recovery Coalition, and a recent victory has been achieved as the Ventura River is being restored to 3,200 acre feet of flow per year. As discussed in the water analysis above, the Casitas Municipal Water District is now required, through the efforts of the Southern California Steelhead Recovery Coalition, to divert this amount to the river instead of to Lake Casitas (Foley 2007). Regional efforts to improve water quality are also underway. As steelhead spend a portion of their lives in the ocean, ocean water must also be free from high levels of pollutants.

Honey Bees and Native Bees

Honey bees are either directly or indirectly involved with the production of approximately one third of the current American diet, making them a critical species for the productivity of agricultural land (Johnson 2007). Currently, Colony Collapse Disorder (CCD) threatens the population of bees across the globe. Recent losses are believed to be different than historical losses, as colonies are no longer returning to their hives. Losses have been rapid and have occurred in large numbers (Johnson 2007). The reason for the current collapse is unknown, but planning for both honey bees and native bees such as digger bees, alkali bees, bumble bees, carpenter bees, and mason bees is important for the future viability of productive agriculture. Until the actual cause of CCD is found, steps for attracting and providing nesting are important not only for both the population of bees but for the productivity of agriculture.

Both honey bees and native bees are attracted to plants such as sunflowers, sages, sugarbush, toyon, and California buckwheat. Most bees prefer sun and dry and undisturbed land for nesting, while some prefer wooded areas. Untended areas including hedgerows and weedy areas make good nesting spots (ATTRA 2007).

Loggerhead Shrike

The loggerhead shrike is a rare species found throughout California in open country, woodlands, and in areas with widely spaced shrubs, short trees, and grasses. The loggerhead shrike is relatively tolerant to urbanization but is sensitive to pesticides. Loggerhead shrikes prefer a mosaic of land types, including grasslands, shrubs, and trees. They also prefer edge habitat along hedgerows and windrows. The loggerhead shrike's sensitivities as well as its preference for areas near agriculture render it a valuable indicator of healthy agricultural and rural areas. Current trends towards urbanization and continued use of pesticides could prevent the loggerhead shrike from successful residence in the region.

Keystone species *affect critical ecological processes. "The elimination of a keystone species can result in significant ecosystem changes, including the loss of numerous other species."*

Vulnerable species *are those that face immediate threats such as reduction in home range, pollution, and invasive species.*

Rare species *are considered uncommon or scarce. Populations are very small worldwide and their range may be narrow and/or their habitat fragmented.*

Threatened species *may become extinct if measures aren't taken to protect it.*

Endangered species *are in danger of becoming extinct if its situation is not improved.*

SOURCES: Peck, Sheila. 1998. Planning for Biodiversity. Washington D.C.: Island Press.; en.wikipedia.org/wiki/Rare_species;library.thinkquest; marinebio.org/Oceans/ThreatenedEndangeredSpecies.asp

Marine Communities

Marine Resources

The Santa Barbara Channel is a productive marine environment, thanks to the protection provided by the Channel Islands and to the strong upwelling system concentrated near Point Conception. Although agricultural runoff, the oil industry, and other human activities have negative impacts on this resource, government and community organizations have had success in implementing regulations. Organizations such as the Pacific Fisheries Management Council, the National Park Service, and the California Department of Fish and Game Fisheries monitor fisheries throughout the Santa Barbara Channel. In addition, marine habitat surrounding the Channel Islands is protected as a marine sanctuary.

Proactive management keeps the local fisheries healthy. However, regional reliance on local fisheries will increase post-Peak Oil due to rising food prices, the necessity for local food production, and the need for protein in the diet. As a result, habitat protection programs will need to place emphasis on maintaining and restoring marine habitat to support sustainable and vibrant fisheries. This may require adjustments to existing regulations.

The current approach to marine management may not be the best solution for post-Peak Oil conditions as it limits human catch and does not respond to the fluctuating conditions and fisheries in the channel. For instance, current management of marine resources protects certain marine mammals that compete with humans for ocean resources (such as the sea lion) and vulnerable species (such as the Cowcod), which limit fishable areas. Due to fluctuating ocean conditions, including shifting water temperature, ocean currents, and species populations, it is important that regulations respond to present and future conditions. Post-Peak Oil, ongoing collaborative efforts to monitor and adjust regulations throughout the channel and along the entire California coast will be needed. Monitoring the species discussed below can contribute to these efforts.

PHOTO SOURCE: digitalchocolate.org/i

Sea Lion

Important Species for Marine Ecosystem Health and Sustainable Fisheries

California Sea Lion

California Sea Lions range from Vancouver Island to the tip of the Baja Peninsula and are protected under the United States Marine Mammal Protection Act. Sea lions compete with humans for fish, shellfish, and squid. The California Sea Lion will be of particular importance if the city and region are planning on looking into aquaculture for food production. These species will be particularly prone to opportunistic feeding which could lead to unblalanced populations. It is important to monitor this species because of its role as a top predator in the food chain, its growing population numbers, and because it is in direct competition with humans for food (LaGrange 2007).

Sardines and Anchovies

Sardines and anchovies are common off of the coast of Ventura and represent an excellent food source. Both species are small schooling fish that reproduce quickly and have a high tolerance for being fished. They are an indicator species

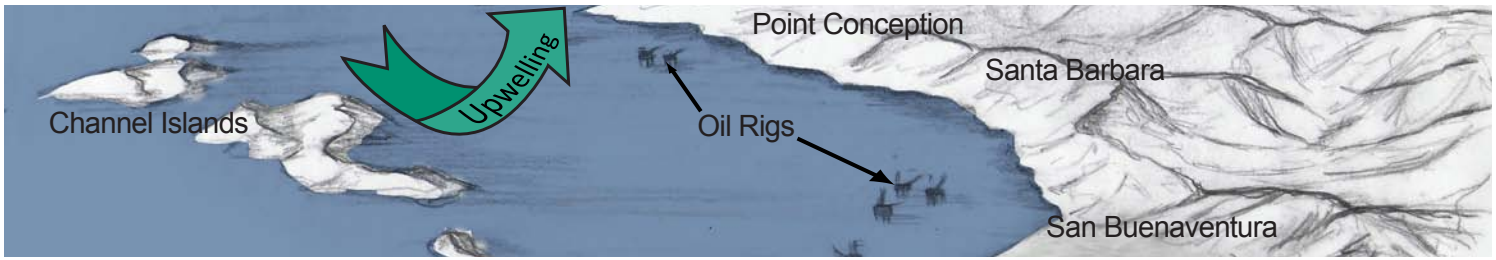


FIGURE 23
Santa Barbara Channel

because they reflect environmental conditions, especially temperature (anchovies do better in cooler waters and sardines in warmer waters). They are close to the bottom of the food chain and represent an important food source for predatory species like the California halibut, rock fish, yellowtail, sharks, chinook, and coho salmon (Wikipedia.com). They are most commonly used by humans as bait.

Squid

Squid represent California's largest fishery by volume and dollar amount (Monterey Fish Market 2001). Squid live all along coastal California but the majority of fishing is off of the shores of Southern California. Populations are vulnerable to environmental disturbances like el Niño and should be monitored and planned for because of their vulnerability and importance to the local food supply.

Cowcod

Cowcod's range extends from Oregon to Southern Baja. They are in rocky outcrops like those around the Channel Islands. Cowcod are long-lived and slow growing, and are vulnerable to being fished before they reproduce (Piner 2005). Due to its sensitivity, the cowcod is a valuable indicator species.

Aquaculture and Marine Health

It is likely that aquaculture programs will be depended upon to provide for growing fish demand in the United States (NOAA Aquaculture Program). The National Offshore Aquaculture Act of 2007 provides a regulatory structure for aquaculture in federal marine waters, and marks the beginning of federal aquaculture programs. Channel Islands National Marine Sanctuary are exploring abandoned oil drilling platforms as potential sites for aquaculture programs in the Santa Barbara Channel (Krop 2007) (Figure 23). However, along with highly productive fisheries, aquaculture poses several problems to marine ecosystems. These problems include impacts to the food web, breeding of pathogens and parasites, and the release of biological pollutants. Currently, regulations are being established to make aquaculture practices more sustainable. Of high priority to San Buenaventura could be mollusk cultivation, which needs no added inputs and filters ocean water. Further research and monitoring must be done to realize the full potentials and detriments of aquaculture off the San Buenaventura coast (Krop 2007 and La Grange 2007).

Connecting City and Region

Urban activities directly influence the natural areas which surround them. The consumption of natural resources and the resulting waste stream (including contaminated water and polluted air), negatively impacts natural communities that must compete for, or be exposed to, these resources. The expansion of the city's urban footprint, increased consumption of local water supplies, and continuance of polluting activities threaten to further degrade natural communities within the region. However, urban areas can also provide important patches of regional habitats. The rivers which surround the city, the barrancas which intersect it, and the landscaping which covers it provide important linkages between larger habitat areas.

NATURAL COMMUNITIES CONCLUSIONS

Opportunities and positive trends that increase the region's ability to preserve and restore natural communities:

- Natural water flow is being returned to the Ventura River
- Active conservation and pollution prevention groups are improving habitat
- Both the Ventura and Santa Clara Rivers remain un-channelized
- Many native species are beneficial to the region's agricultural productivity

Constraints to preserving and restoring natural communities:

- Pollution and habitat encroachment threaten habitat viability
- Natural communities must compete with human communities for water supply
- Upstream development and stream channelization could impact habitat

PHOTO SOURCE: w.aizuddindanian.com

Sardines

PHOTO SOURCE: www.flickr.com/photos/laurelfan/143848438/

Squid

PHOTO SOURCE: scdac.org

Cowcod

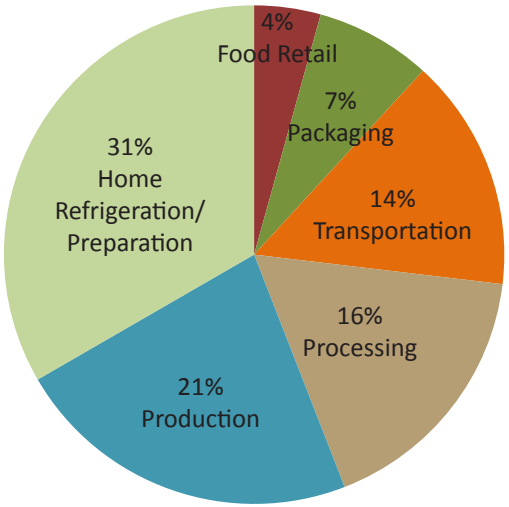
FOOD

While oil is just one of the critical resources necessary for the food system to function, it can be expected to play a significant role in the system's transformation or destruction. The food system depends on oil both as an energy source and as a critical component of pesticides and fertilizers. Although it is likely that oil will be prioritized to support this system, it is inevitable that rising prices and decreasing oil availability will eventually make the industrial agricultural system unfeasible to maintain. Localized, organic food systems can decrease energy expended in agriculture as well as provide a healthier food supply.

Goal: Establish a localized food system that is supported by sustainable practices

Objectives:

- Build market for locally grown goods
- Decrease distance between consumer and producer
- Increase physical and political infrastructure for local production, processing and distribution
- Utilize available resources for urban agriculture
- Produce food with minimal imported materials (i.e. chemical fertilizers and pesticides) in a sustainable manner

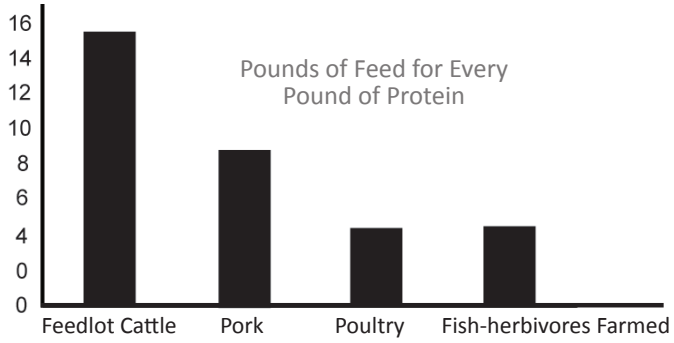


SOURCE: World Watch Institute

FIGURE 24
Energy Breakdown by Food Systems

Food and Energy

The industrialized food system accounts for 17 percent of the United States' total energy budget (World Watch Institute) (see page 7 for energy budget breakdown). This high rate of energy consumption translates into the expenditure of ten calories for every calorie produced (Pimentel 1994). Only 21 percent of this energy is consumed during production, largely by farm equipment and petroleum-based pesticides and fertilizers. Food preparation and transportation account for a large portion of the energy use (Figure 24). Diets, such as the typical American diet, that are rich in animal protein also contribute to high energy requirements (Figure 25). One study has estimated that meat production takes 10 to 20 times more energy than grain production (Environment Canada 1995). Based on the national average, an energy equivalent of nearly 30 million gallons of gas is required to feed the population of San Buenaventura each year, which is enough energy to power over 20,000 homes for a year.



SOURCE: Brown, Lester. Plan B 2.0; World Watch Institute, 2006

FIGURE 25
Comparative Protein Production Efficiency

Energy (and resources) required to produce animal protein varies as shown. Americans' preference for red meat is, in part, responsible for the high amount of energy and land that is required by the typical American diet.

Food and Quality of Life

On the global scale, industrial agriculture is a known contributor to the impairment of water, soil, and air quality. Livestock production alone has been shown to account for 18 percent of greenhouse gas emissions, which is more than that produced by the transportation sector (Food and Agriculture Organization of the United Nations 2006). As discussed in the *Water* and *Natural Communities* sections, agriculture in Ventura County contributes to the contamination the natural resources which humans depend upon. The rise of diabetes, obesity, depression, and cancer in the United States has been connected to poor nutritional practices, the decreased nutritional value of food, and exposure to harmful chemicals such as pesticide residues (see ***Appendix C: Swick***). However, regional agriculture provides approximately 9 percent of the county jobs, a scenic landscape, and the availability of fresh food (Ventura County General Plan 2005). Although current production feeds the dietary habits of typical Americans, Ventura County's Mediterranean climate suggests that a healthy diet could be produced form the land using Mediterranean diets (which are noted as healthy) as a model (American Stroke Association 2007) (Table 4).

Resources

Ordinances and Alliances to Protect the Future of Farming in Ventura County

Ventura County is rich in agricultural resources, with 20 percent of the county being designated as farmland. Most of the county's prime farmland lies either within the Santa Clara Valley or on the Oxnard Plain. Between 1986 and 2000, farmland decreased by 13.9 percent, while urbanized land grew by 20.4 percent (Fulton et al. 2003). As urban areas encroach upon farmland, challenges to farmland preservation arise: urban adjacency restricts farming practices, and rising land values make it more profitable to sell land for development than to farm the land. Ventura County addresses this challenge by developing ordinances and alliances to preserve remaining farmland and focusing on high-value export crops such as strawberries.

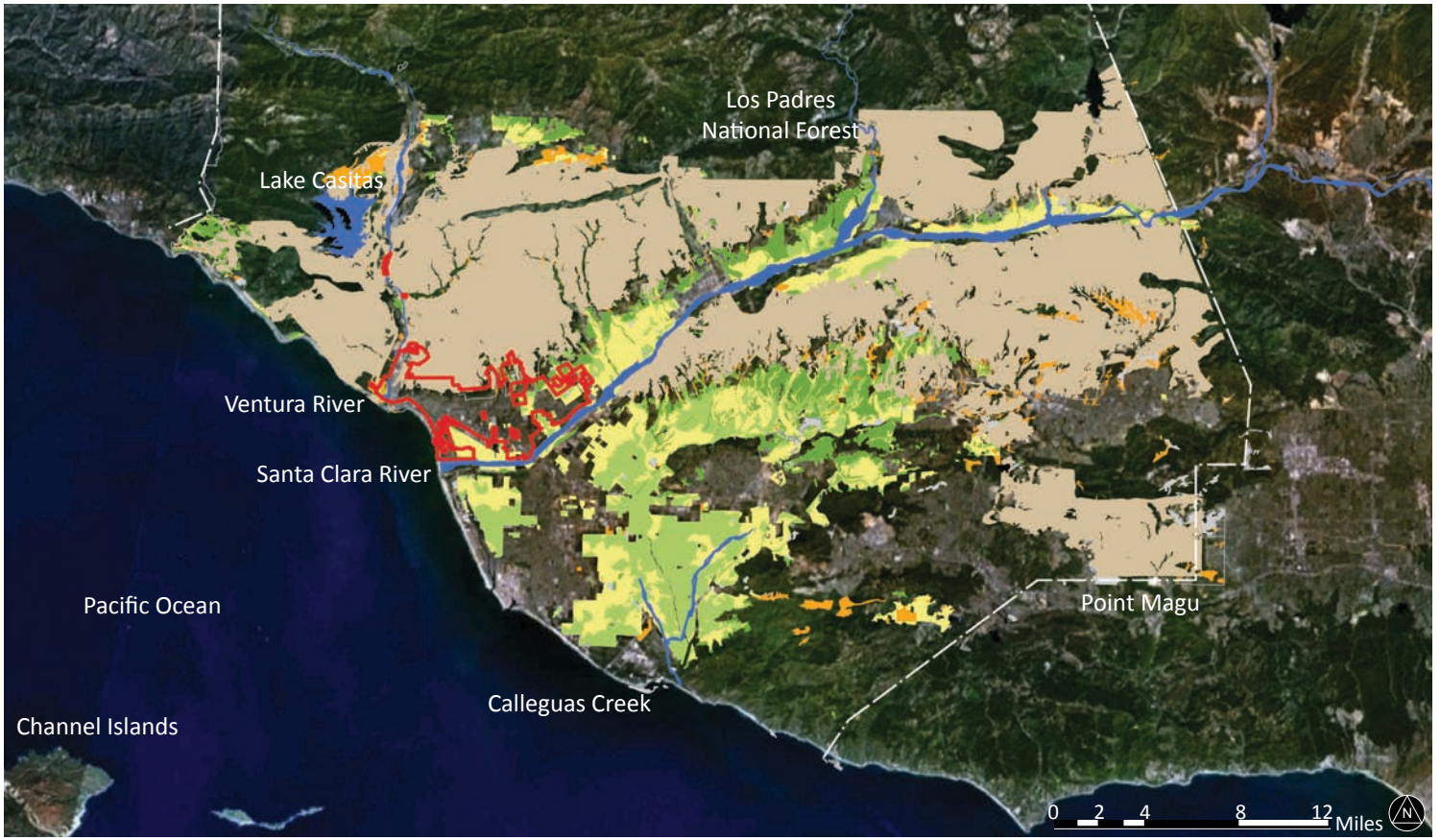
The county and its cities protect agricultural land through Save Open-space and Agricultural Resources (SOAR) ordinances, which establish urban growth boundaries for the region's cities. Land that falls outside of these growth boundaries, whether farmland or open space, cannot be developed without voter approval. SOAR ordinances were initiated by San Buenaventura in 1995. While San Buenaventura's ordinance will expire in 2025, most of the other city ordinances will expire in 2020.

Mediterranean Diet
High consumption of fruits, vegetables, bread and other cereals, potatoes, beans, nuts and seed
Olive oil as source of monosaturated fat
0-4 eggs per week
Moderate consumption of meat
Low to moderate consumption of wine

SOURCE: www.americanheart.org

TABLE 4
Characteristics of Mediterranean Diet

FIGURE 26
Regional Agriculture



- Grazing
- Prime Farmland
- Farmland "Statewide Importance"
- Unique Farmland
- Farmland "Local Importance"
- San Buenaventura
- Ventura County Boundary

SOURCE: Ventura County GIS Department; NASA World Wind

Ventura County's Ag Futures Alliance (AFA), established in 2000, is noteworthy for its success in bringing together diverse community organizations to strategize for the future of sustainable farming in the region. The AFA develops principles for farmers, consumers, and policy makers geared towards the development of a sustainable, healthy food system. The principles address stewardship, land use policy, the provision of farm worker housing, and the prevention of pesticide drift. The AFA now serves as a model for agricultural regions throughout California, and could serve as a model for community collaboration in a post-Peak Oil society.

Land-based Resources

The identification of soil characteristics plays a key role in determining the quality of agricultural land. The Important Farmland Inventory conducted in Ventura County relied on the Ventura County Soil Survey, issued in 1970. Characteristics of the farmland categories located on the map (Figure 26) are discussed below:

- **"Prime" farmland:** This farmland possesses irrigated soils that are over 40-inches deep and that have a water-

holding capacity of four inches or more. These soils are well drained and free from frequent flooding. Soil reaction is neither extremely acid nor strongly alkaline, and the soils do not have salt or alkali problems. The erosion hazard is slight, and farming is not limited by cobbly surface layers, slow subsoil permeability, or freezing soil temperatures.

- **Farmland of "statewide importance":** This is farmland other than "prime" farmland that has a good combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. The criteria are similar to those of "prime" farmland, but there is no minimum soil depth limitation and no permeability restriction. Farmlands of "statewide importance" have broader water-holding capacity and a moderate erosion hazard. Soil reaction may be slightly saline and alkali affected. In Ventura County, lands of "prime" and "statewide" significance represent 106,900 acres.

- **"Unique" farmlands**: In Ventura County, the "unique" farmland designation typically applies to hillside citrus and avocado plantings. There are 20,200 acres of "unique" farmland in the county.

- **Farmlands of "local importance"**: In Ventura County, this pertains to dry-farmed lands and unirrigated "prime" or "statewide" importance lands. Approximately 11,000 acres fall into this category.

- **Grazing land**, or parcels of land 40 acres or larger where existing vegetation is suitable for the grazing of livestock. This land type overlays designated wildlife land almost precisely (Ventura County GIS Data 2007). Both agricultural and grazing lands intersect the designated wildlife corridors that connect Los Padres National Forest to Point Magu and Sespe Creek to the Santa Monica Mountains, and run along the Ventura and Santa Clara rivers. Grazing and habitat can be complimentary, yet often grazing degrades natural habitats. Introduced grazing animals can displace native grazing animals, and can impair tall grass and brush habitat for birds and other ground nesters.

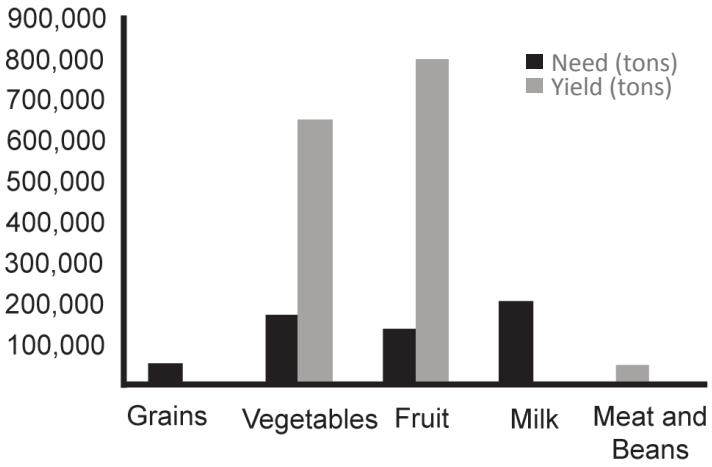
The total amount of agricultural and grazing land per person in Ventura County is less than what is estimated as needed to provide for standard American diets. However, it is more plentiful than what would be needed to support a vegan diet using biointensive farming practices. Biointensive farming practices, which are most often used on small-scale gardens and farms, focus on producing maximum yields while improving soil quality (Table 5). (It is important to note that, as shown in Table 5 and discussed below, the United States average may be high when considering Ventura County yields).

Compared Required and Available Acreage for Food Production

	Land Use per Person		
	Farmland (acres)	**Grazing Land (acres)**	**% of Grain Crops Fed to Animals**
China	**.75**	**.25**	**25%**
World Average	**.62**	**1.38**	**33%**
United States Average	**1.76**	**2.24**	**69%**
Biointensive Vegan Diet	**0.09**	**0**	**0%**
	Land Available per Person		
Ventura County 2007 Population	**.17**	**.24**	**100%**
Ventura County 2050 Population	**.11**	**.13**	

SOURCES: Jeavons, 2002; FAO Statistics Database June 1997, Ventura County General Plan, Ventura County GIS Dept., and conversations with Ag Commission Staff Member

TABLE 5
Food Production Comparison



SOURCES: USDA Daily Recommendations; Ventura County Agriculture Commissioner's Crop Report, 2005

FIGURE 27
Ventura County Needs and Yields

Agricultural Production in Ventura County

A trend towards specialty crops, including fruit, nuts, vegetables, cut flowers and nursery stock, has been evident throughout the South Coast region over the last 50 years (Siebert 2005). As a result of this specialty cropping, Ventura County currently yields more fruit and vegetables than would be required to feed the county, but not enough grains, milk, or meat (Figure 27). Ventura County's million dollar crops suggest that fruit and vegetable crop diversity does not reflect the typical diet. For instance, strawberries account for 27 percent of total crop sales (Ventura County Crop Report 2005). Based on extrapolations from 2005 yields and the USDA dietary recommendations, it would require 153 percent of Ventura County farmland to meet the 2050 population needs (Table 6). These figures are far more optimistic than the agricultural land per capita table discussed above for two reasons: (1) the figures assume 100 percent consumption of production by weight, and (2) the long growing season, soil quality of river valleys, and fairly dependable rainfall enable Ventura County to achieve higher yields than in other areas of the United States (Hostetler 2007).

While the American diet is rich in meats, little production of meat and feed grain occurs in Ventura County. In 2005, livestock and poultry production accounted for only 0.17 percent (or $2,150,000) of Ventura County Agriculture by value. Livestock (including cattle, hogs, and sheep) account for 91 percent of this value at $1,960,000. All of the grain grown in the county is intended for feed grain, and the total value of field crops (which include alfalfa, pasture, barley, hay, and vegetable seed) accounts for only 0.15 percent of the county's agricultural value. Yields are not reported for the production of field crops (Ventura County Crop Report 2005).

Nursery stock and timber are the only non-food crops produced in the county. As no material crops are produced on a large scale, material needs (such as clothing) must be provided for by imported goods. Although timber is not produced commercially in Ventura County for pulp or lumber, there are 92 acres of Christmas

Land Required to Provide for 2050 Ventura County Population			
USDA Category	County Population Requirements/ Year (tons)	Acres Needed to Provide for Population	Acres as Percent of County Farmland
Grains*	86,189	23,941	17.34%
Vegetables	287,298	17,845	12.92%
Fruit	229,838	17,817	12.9%
Milk*	344,757	16,309	11.81%
Beans	39,503	16,309	11.81%
Meat (chicken and feedlot cattle)*	39,503	119,783	86.74%
Total	**1,027,089**	**93,954**	**153.51%**

*County yields not available, based on national estimates

SOURCES: Extrapolated from USDA dietary guidelines; Ventura County Crop Report, 2005; Hostetler, 2007; and Brown, 2006.

TABLE 6
Farmlands Required for 2050 Population

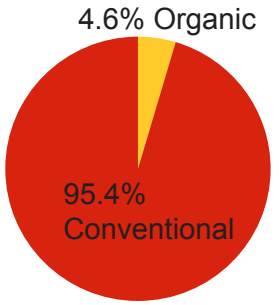
tree farms that are zoned as Timberland Preserves (Ventura County General Plan 2005).

Regional Farming Practices

Despite the abundant natural and human resources of the region, crop production is dependent on external resources such as petroleum-based pesticides, fertilizers and tractor fuel, and the majority of crop yields are trucked out of the region primarily to distribution centers in Los Angeles. The amount of produce that remains in the county is not currently monitored.

As of 2005, 47 organic growers were registered in the county, and farmed a total of 4,712 acres. This acreage accounts for only 4.6 percent of harvested acres (Ventura County Crop Report 2005) (Figure 28). Certified Organic farming requires the rejection of synthetic pesticides and fertilizers, as well as yearly reporting. In the United States, the USDA National Organic Program has been responsible for accrediting organic certifying agencies since 2002. Currently only one Organic Certification business exists in Ventura County (Rodale Institute 2007). In fact, approximately 16 million pounds of pesticides are applied each year in the county, much of which is potentially damaging to human and environmental health (Table 7). Benefits of organic farming include a potential 50 percent decrease in farm energy use (Flex Your Power 2007) and enhancement of the local ecosystem.

While the variation between conventional and organic yields is yet to be thoroughly studied, a major United States survey published in 2001 analyzed results from 150 growing seasons for various crops, and concluded that organic crops yielded 95 percent of the crops grown under conventional, high-input conditions yields (Liebhardt 2001). Experts also estimate that farming without the help of any fossil fuels could decrease yields dramatically (Jeavons 2005, Bracken 2005). Intensive farming practices that do not use fossil fuels, which are most appropriate for small scale gardens and farms, lead to greater yields than conventional farming (Jeavons 2005). It is highly



SOURCE: Ventura County Agriculture Commissioner's Annual Crop Report, 2005

FIGURE 28
Ventura County Organic Produce (By Acre)

	Acute Toxicity*	Carcinogen	Groundwater Contaminant	Developmental or Reproductive Toxin	Pounds Applied
Petroleum oil, unclassified					1,642,743
Methyl bromide	Yes			Yes	1,427,963
Chloropicrin	Yes		Potential		1,383,222
1,3-dichloropropene	Yes	Yes	Yes		733,849
Metam-sodium	Yes	Yes		Yes	339,184
Mineral oil	Slight				170,860
Sulfur	Slight				129,101
Glyphosphate, isoproplyamine salt			Potential		128,621
Sulfur fluoride	Yes				91,621
Captan	Yes	Yes			49,533
Chlorothanlonil	Yes	Yes	Potential		48,921
			Top 11 Pesticides		**6,194,389**
			Total Pesticides		**16,000,000**

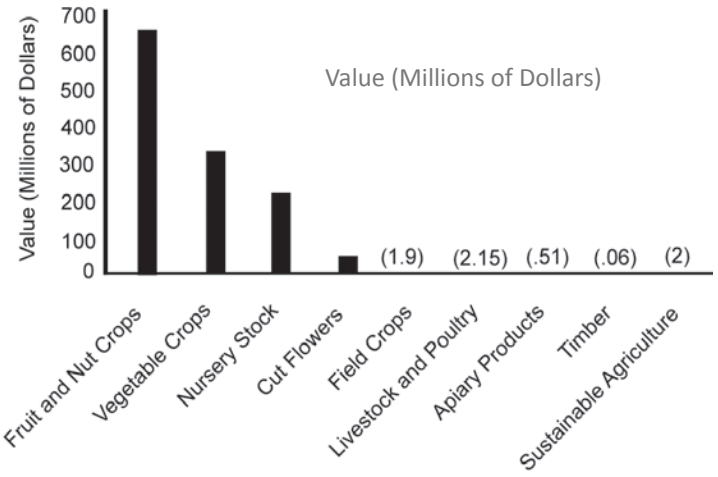
SOURCE: www.pesticideinfo.org/DCo.jsp?cok=56; PAN Pesticides Database- CA Pesticide Use; From Top 50 Pesticides in Ventura County

TABLE 7
Top 11 Pesticides Used In Ventura County

**Acute toxicity refers to the immediate effects (0-7 days) of exposure to a pesticide.*

did you know?

Three million tons of petroleum-based pesticides, herbicides, and fungicides are used on the planet every year.



SOURCES: Ventura County Agriculture Commissioner's Crop Report, 2005

FIGURE 29
Ventura County Crop Report

likely that Human labor, intensive farming practices, and smaller farms will be needed to compensate for the loss of fossil fuel energy.

Regulations on the use of chemical agricultural fumigants are currently being proposed in the State of California to address air quality concerns. These regulations would have significant impacts to strawberry, carrot, tomato, and pepper growers, who currently depend on heavy use of fumigants. Ventura County strawberry growers are expected to be the hardest hit. In order to comply with the regulations, it is projected that up to 10 thousand acres of strawberries will be pulled from production or left as untreated crops. Alternatives are to employ organic farming methods or switch to lower value crops that do not require fumigants (Cone 2007). The challenges and solutions posed by the new regulations may be amplified by rising costs of chemical farming and demand for healthier food and regional resources.

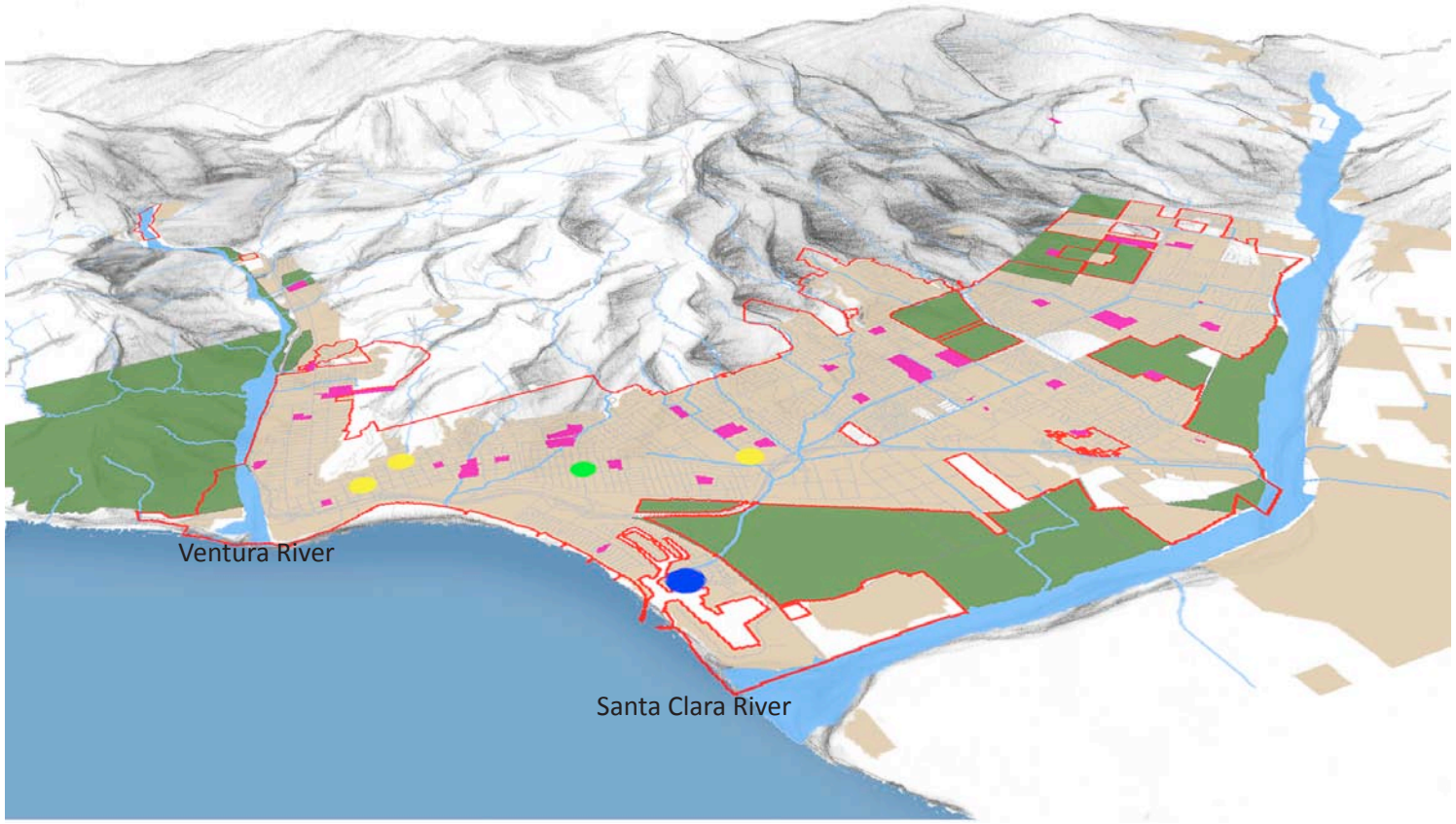
Managing the landscape for beneficial wildlife is an important part of sustainable and organic farming. Beneficial wildlife includes predators of agricultural pests as well as pollinators. The county currently has several programs related to beneficial insects, including commercial insectaries which produce beneficial predators. Apiary products, which include honey, beeswax, and pollinator activity, are a viable business in the county. In 2005, the value of apiary products was greater than $500,000 (Figure 29) (Ventura County Crop Report 2005). Beneficial wildlife can also be encouraged by providing appropriate habitat for native species. For instance, the big brown bat and native bees discussed in the ***Natural Communities*** section are beneficial to agricultural production.

Urban Production

The availability of water, organic material, and labor in urban areas make them an ideal place for food production. However, only a small portion of urban land is used for food production in San Buenaventura.

Supported by grants from California Endowment and the Nutrition Network, the Ventura Unified School District has developed a robust Healthy Schools project over the

Ventura High School Garden



SOURCE: City of San Buenaventura GIS Department

FIGURE 30
Urban Agriculture

last five years. The project includes twenty-six educational production gardens at seventeen elementary schools, all five middle schools, and four high schools. These gardens contribute to the educational programs as well as to student nutrition. Apart from school gardens, only one community garden exists within the city. The combined produce from these gardens makes a minimal contribution to the city's food supply (Figure 30). Instead of producing food crops, many of the city's resources are used to produce lawns. The California Integrated Waste Management Board (CIWMB) estimates that the average single-family home generates 704 pounds of lawn clippings a year (CIWMB 2005).

In addition to lawn clippings, the city generates an estimated 21,497 tons of food waste each year. Food waste comprises 20 percent of San Buenaventura's household waste stream and 18 percent of its commercial waste stream (based on statewide estimates). When energy and resources are expended to transport this food waste, its potential as a resource for food production is unrealized. Food waste can be composted into nutrient rich soil amendments that could be used for gardening, thus decreasing the amount of waste sent to landfills. While the city does not run a composting program for household food waste, it does offer several composting workshops each year and runs a compost demonstration

City Food Programs:

- *Save our Agricultural Resources Ordinance*
- *Healthy Schools Programs (nearly all schools)*
- *Farmers' Markets (3)*
- *Community Garden (1)*
- *Fishers' Market (1)*

did you know?

Why does it take so much energy to produce animal diets?

1) *The low efficiency of meat production requires large amounts of feed grain, and therefore land and energy. (See Figure 25 on page 59)*

2) *Livestock travel an average of 1,000 miles in their lives before they are slaughtered (Humane Society of the U.S., March 2006).*

3) *In general, animal products require more energy for processing, packaging, and refrigeration than plant-based foods, many of which require little or no processing and refrigeration.*

San Buenaventura Farmers' Market

site at the Olivas Adobe. In addition, through a partnership with Green Thumb International, a program has been established that offers compost bins and vermiculture (worm composting) bins at discounted rates (CIWMB 2005).

Land in urban areas, including open space and vacant lots (formerly developed), has the potential to produce crops. As soil contamination is common in urban areas, testing for soil quality is essential to determining the potential for crop production. Challenges with soil quality depend on previous land uses. For instance, soil that has been beneath concrete will likely have decreased fertility and be compacted, but it is less likely that serious contaminants will be present. Soil that has been beneath or adjacent to asphalt will likely contain bitumen and heavy metals which are complicated to remediate. Vacant lots that once contained homes, gas stations, or other buildings, are likely to have a wide range of contaminants from building materials to household chemicals.

The city's reliance on the conventional food system and lack of designated urban agricultural land make their food supply vulnerable to the impacts of Peak Oil. By maximizing the local market, establishing an urban agricultural system, supporting energy efficient technology (including solar ovens), and working with other governing bodies to meet regional food needs, the city could decrease its energy use, become a more sustainable "green city," and better ensure availability of high-quality food for future generations.

Marine Production in the Santa Barbara Channel

The Santa Barbara Channel provides an additional food source for the region. Due to the proactive management practices discussed above (see ***Natural Communities*** section), local fisheries are relatively healthy. Efforts for local, sustainable fisheries in the channel focus upon increasing fishing vessels, connecting to local markets, and providing harbor infrastructure (see Figure 38 on page 70). Residents can purchase international fish for a fraction of the cost of the local catch (due to the cost of local regulations and the smaller catch). Global fisheries are projected to be depleted by 2050, by which time greater pressure will likely be placed upon fisheries in the channel (Figure 23). However, if marine resources are protected and sustainable fisheries and aquaculture encouraged, the Santa Barbara Channel has the potential to be an important source of protein for the region.

Connecting City and Region

The City of San Buenaventura has established connections to regional production through the Farm to Schools program, fishers' markets, and farmers' markets. Three weekly farmers' markets and roadside farmstands supply local produce for the city. As a complement to these markets, the Farm to School salad bar program serves locally grown produce for breakfast and lunch at most schools. Coordinators estimate that 70 percent of the produce for this program is grown in Ventura County, and 99 percent is grown within California.

The program has experienced success not only in connecting students to healthy seasonal produce, but in enabling local farmers to expand their organic farms. The greatest challenge currently facing the program is the lack of local food distributors and processors (Godfrey 2007).

The amount of county produce consumed within the city and county is not tracked. Given the estimate that nearly all of Ventura County produce is exported, it can be assumed that the conventional food system supplies the bulk of the city's food supply.

Ventura County is economically vulnerable to the impacts of Peak Oil due to the lack of connection between county yields and county needs, and because of its dependence on external oil and energy inputs. Increasing infrastructure for regional food system (including food processing and distribution centers), maximizing the local market, and increasing the use of organic and sustainable farming practices, could lead to the following benefits: decreased energy consumption in the food system; increased local economy; the provision of healthier, fresher food for residents; and the enhancement of natural ecosystems.

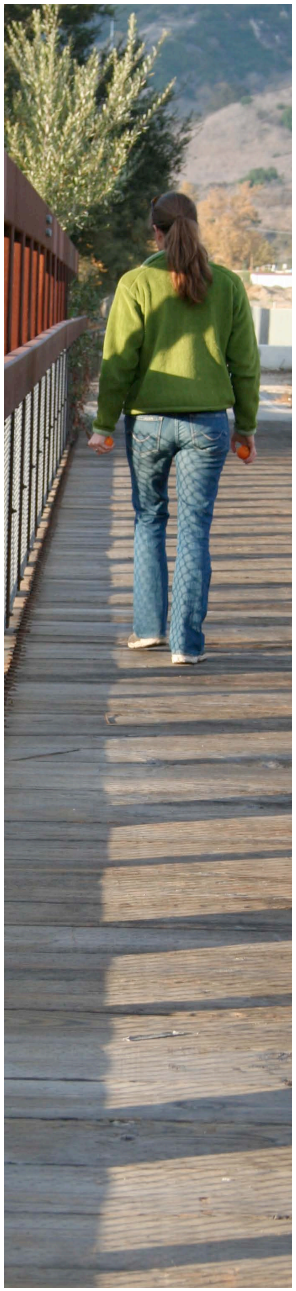
FOOD CONCLUSIONS

Opportunities and Trends that encourage the localization of food:

- Save Our Agricultural Resources ordinance protects regional farmland
- Ag Futures Alliance brings together diverse interest groups to work towards the sustainability of regional farming
- The Irrigated Agriculture Waiver implements sustainable farming practices regarding irrigation runoff
- The Farm to School Program and farmers' markets connect regional farmers to local markets
- The Ventura Unified School District's Healthy Schools program and school garden program initiate urban farming and build agricultural literacy
- Available land for food production can likely meet population needs if diet is low in meat

Constraints to localizing food in Ventura County:

- Most of the region's agriculture depends upon external inputs, such as petrochemical pesticides and fertilizers
- The amount of food produced in the county and city is not tracked
- Nearly all county produce is export
- Infrastructure is lacking for a local food system, including harbor and food processing infrastructure
- American diets are energy and land intensive to produce
- Land in urban areas is has degraded soil quality
- Agriculture and wildlife habitat are often conflicting land uses



MOBILITY

Contemporary urbanized societies exist and function as they do today because of the availability of cheap oil and its consequential influence on city planning. (For further information, see ***Appendix C-1: Chen***.) Access to almost all essential needs, from food to clothing to medicine, relies on freight systems dependent upon oil. In the daily lives of people in the post-industrial world, the most familiar, easily observable role of oil is as fuel for personal transportation. In the United States, 90 percent of people own at least one automobile (The Nielson Company 2007). The impact of Peak Oil on mobility is critical – without oil, American mobility will be fundamentally crippled. As oil prices rise, the greatest impact will be felt by individuals without access to alternative means of transportation, by businesses dependent upon travel and/or the movement of goods, and by cities that fail to build the transportation infrastructure for a post-Peak Oil society.

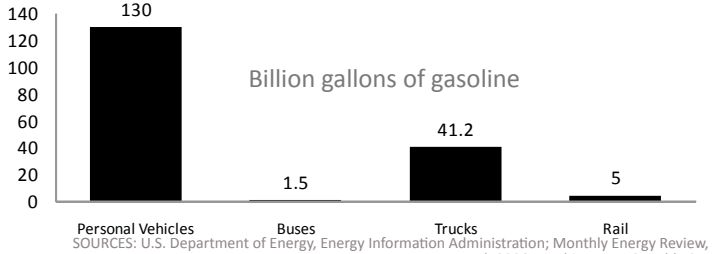
GOAL: Reduce dependence on automobiles and expand existing alternative transit system

OBJECTIVES:

- Build and develop infrastructure for city and regional public transit system
- Prioritize, expand and improve bicycle network
- Increase number of pedestrian nodes within city
- Expand existing regional rail and ocean freight system

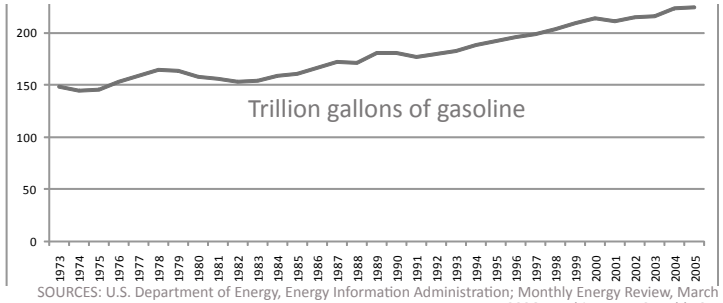
Mobility and Quality of Life

The United States Department of Transportation (USDT) reports that the average cost of owning and operating an automobile (assuming 15,000 vehicle-miles per year) is $7,834 per year (USDT 2007). The cost of owning and driving a car will rise with the price of oil due to higher demand and a decrease in oil supplies, impacting commuters. This will limit opportunities for people who are unable or cannot afford to drive. The young, elderly, and poor in particular become marginalized, losing independence and self-sufficiency in car-dependent areas. Because the majority of Ventura County is designed for the automobile, nearly 97 percent of the county's workforce drive to work in a car and about 1 percent use public transit (Figure 34) (Santa Barbara County Association of Governments 2002).



SOURCES: U.S. Department of Energy, Energy Information Administration; Monthly Energy Review, March 2006, Washington D.C., Table 2.1

FIGURE 31
U.S. Consumption of Transportation by Mode (2003)



SOURCES: U.S. Department of Energy, Energy Information Administration; Monthly Energy Review, March 2006, Washington D.C., Table 2.1

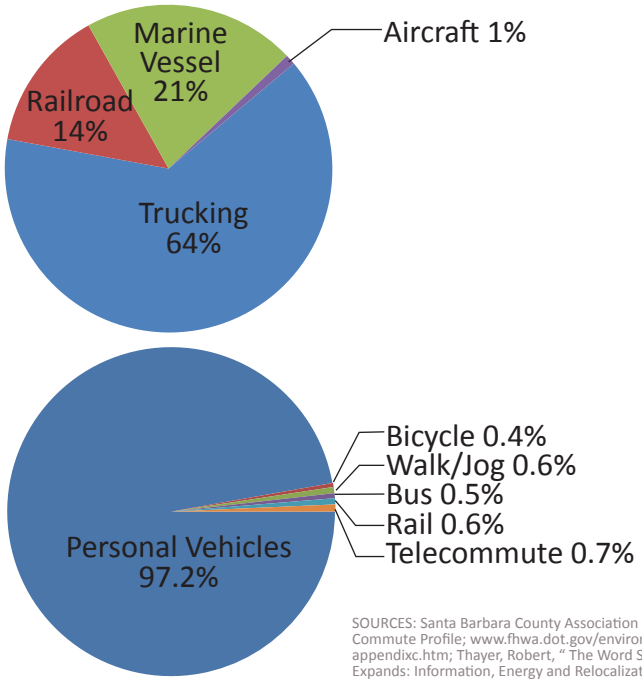
FIGURE 32
U.S. Consumption of Total Energy for Transportation Sector (1973-2005)

Energy and Resources

Transportation, including freight, accounts for over 60 percent of all oil consumed globally; the world's transportation systems are over 90 percent dependent on petroleum (Heinberg 2006). Nearly 28 percent of energy used in the United States goes to transportation, of which 73 percent goes to personal vehicles that include cars, trucks and motorcycles (Figure 31). In 1998, transportation used 11.5 million barrels of oil a day, but the United States produced only 6.2 million barrels. According to the United States Department of Energy (USDE), oil imports creep upward, as domestic production drops and gas consumption for transportation increases (USDE 1999) (Figure 32). Reducing fossil fuel consumption will have dramatic implications for today's automobile-based transportation system.

To understand the land-based impacts of fuel supply peaks and decline for transportation, one must consider the relative intensity, or energy efficiency of the major modes of passenger and freight transport. Figures 33 and 34 compare general values of transportation energy efficiency for different modes for the year 2000. Regardless of which future fuel type is utilized, different modes of transportation have different efficiencies. As transit fuels become increasingly scarce and expensive, more efficient modes will be emphasized while less efficient modes may decline, regardless of the type of fuel used.

Even with extensive bus routes, diesel-powered buses are energy-inefficient. Due to the inconsistent number of passengers per trip and extensive routes, a bus filled with passengers uses 84 percent as much fuel as those passengers would collectively use to go the same distance in private vehicles (Thayer 2005).



SOURCES: Santa Barbara County Association of Governments 2002 Commute Profile; www.fhwa.dot.gov/environment/freightaq/appendixc.htm; Thayer, Robert, " The Word Shrinks, the World Expands: Information, Energy and Relocalization," October 2005.

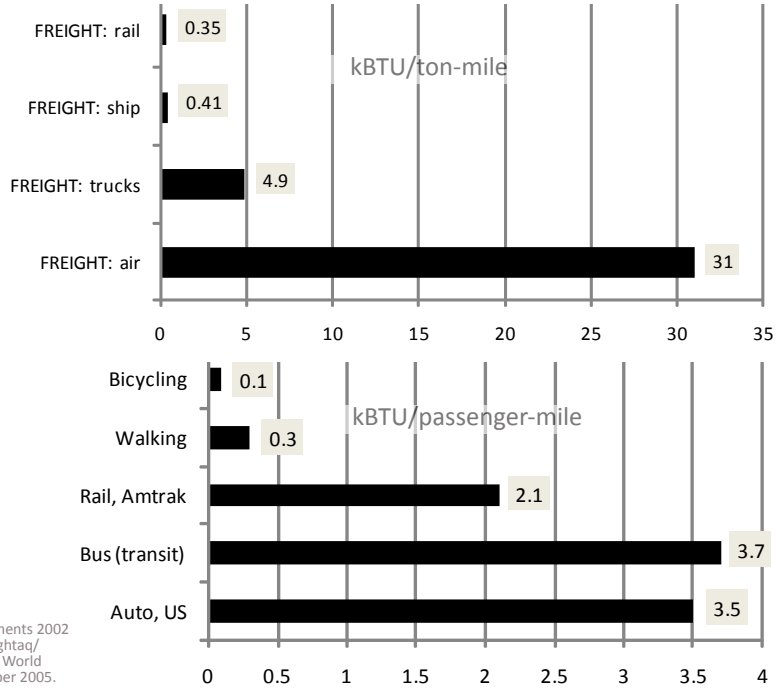


FIGURE 33
Freight Mode of Transport Los Angeles Region (2002) and General Values of Energy
(Los Angeles County, Ventura County, San Bernadino County and Riverside County)

FIGURE 34
Passenger Mode of Transportation for Ventura County (2002) and General Values of Energy

FIGURE 35
Regional Transportation

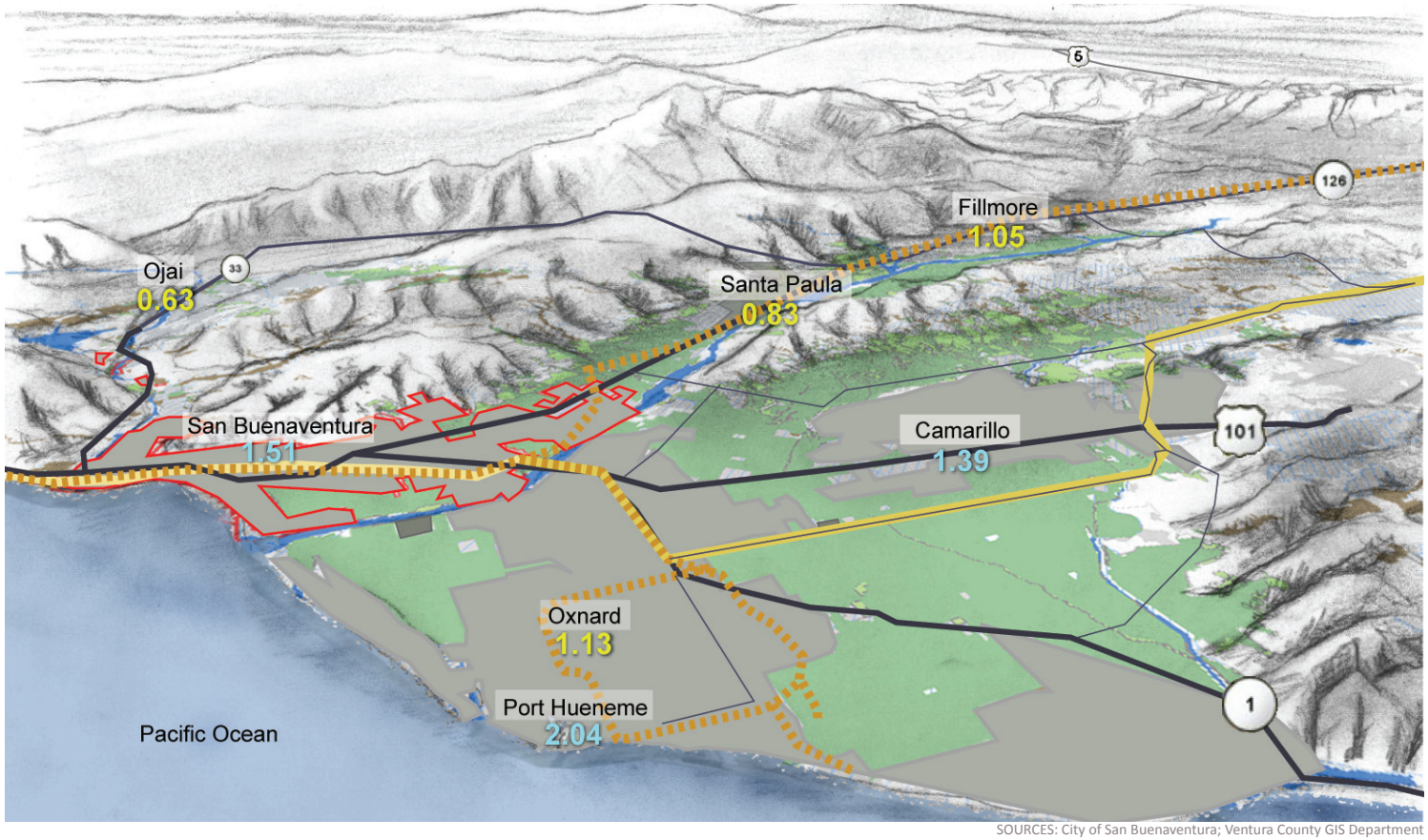
SOURCE: Southern California Association of Governments - Existing Goods Movement System in the SCAG Region.

Freight and the Local Economy

The Los Angeles region (which includes the five counties of Los Angeles, Orange, Riverside, San Bernadino, and Ventura) has a large and diverse economic base, driven by large manufacturing, trade, and transportation sectors. Wholesale trade employment, manufacturing, transportation, and warehousing are the biggest employment sectors for the region, with nearly 60,000 employed in the truck transportation sector alone (USDT 2007).

Marine vessels carry 21 percent of commodities for the region (USDT 2007). The Port of Hueneme is the only deep water harbor between Los Angeles and the San Francisco Bay area, and is the United States Port of Entry for California's central coast region.

Port Hueneme, originally developed for county agricultural exports, is now dominated by imports, including agriculture produced and other goods such as automobiles. Currently, 85 percent of cargo is foreign imports, and 10 percent is foreign



SOURCES: City of San Buenaventura; Ventura County GIS Department

FIGURE 36
Commute Patterns and Job/Housing Ratio for Surrounding Cities

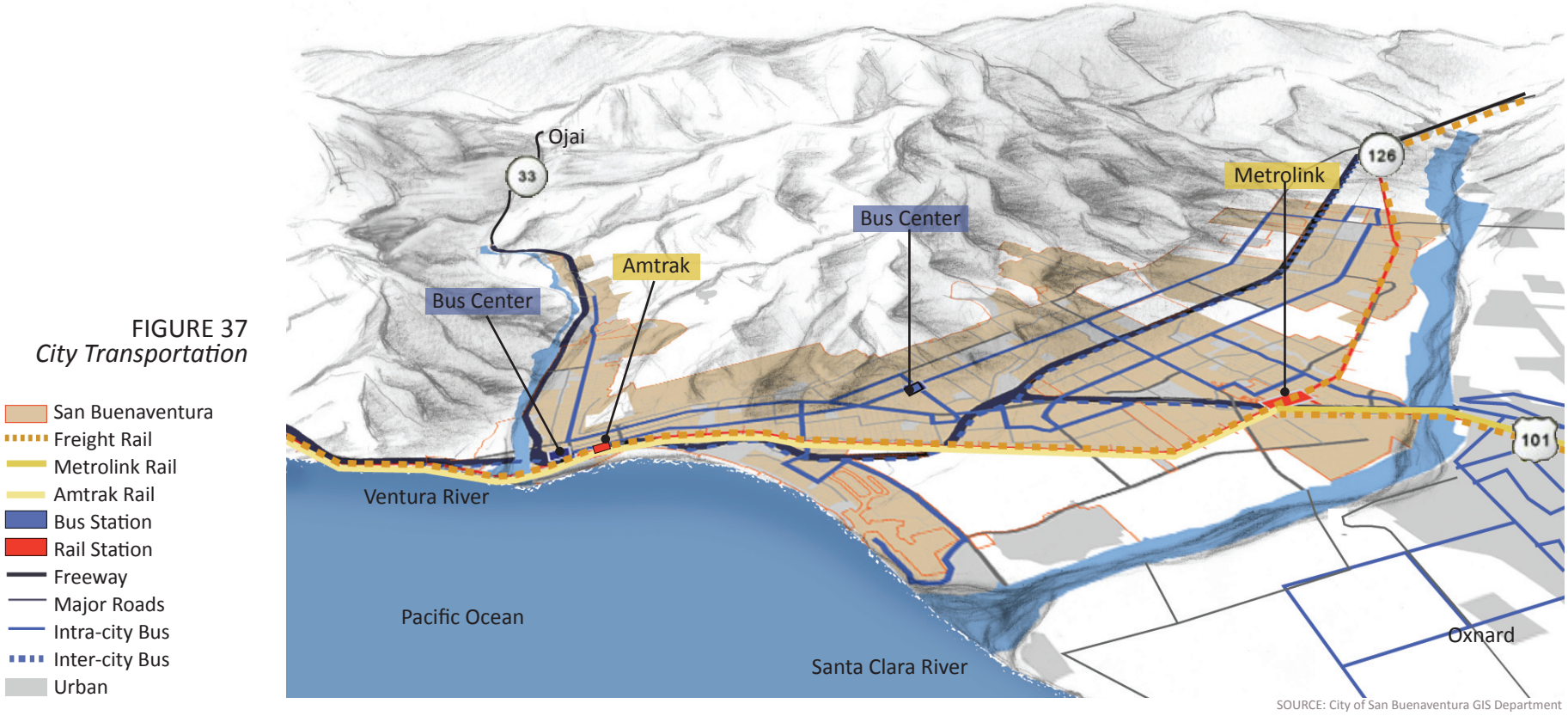
exports, with only 6 percent traveling along the California coast by cargo ship (Port of Hueneme 2007). Rail freight takes up 14 percent of commodity flows in the region, and truck freight takes up the majority of goods transport at 64 percent.

The potential to increase rail freight and decrease trucking through the Santa Clara River Valley is being explored (Forsythe 2007) (Figure 35). It is still more cost-effective to transport goods by trucks – trucking carries 64 percent of interregional freight tonnage in the Los Angeles region. However, because trucks are energy intensive, the increasing cost of fuel will drive up the cost of transported goods, impacting consumers (Figure 33).

Mobility and the Jobs/Housing Balance

The balance between the quality of jobs and the cost of housing has the greatest impact on commute patterns. According to the Ventura County General Plan (2006), the region as a whole is "balanced" within the Southern California Association of Governments (SCAG) region (at 1.26:1), and will continue to be in 2010, with a projected overall jobs/housing ratio of 1.30:1.

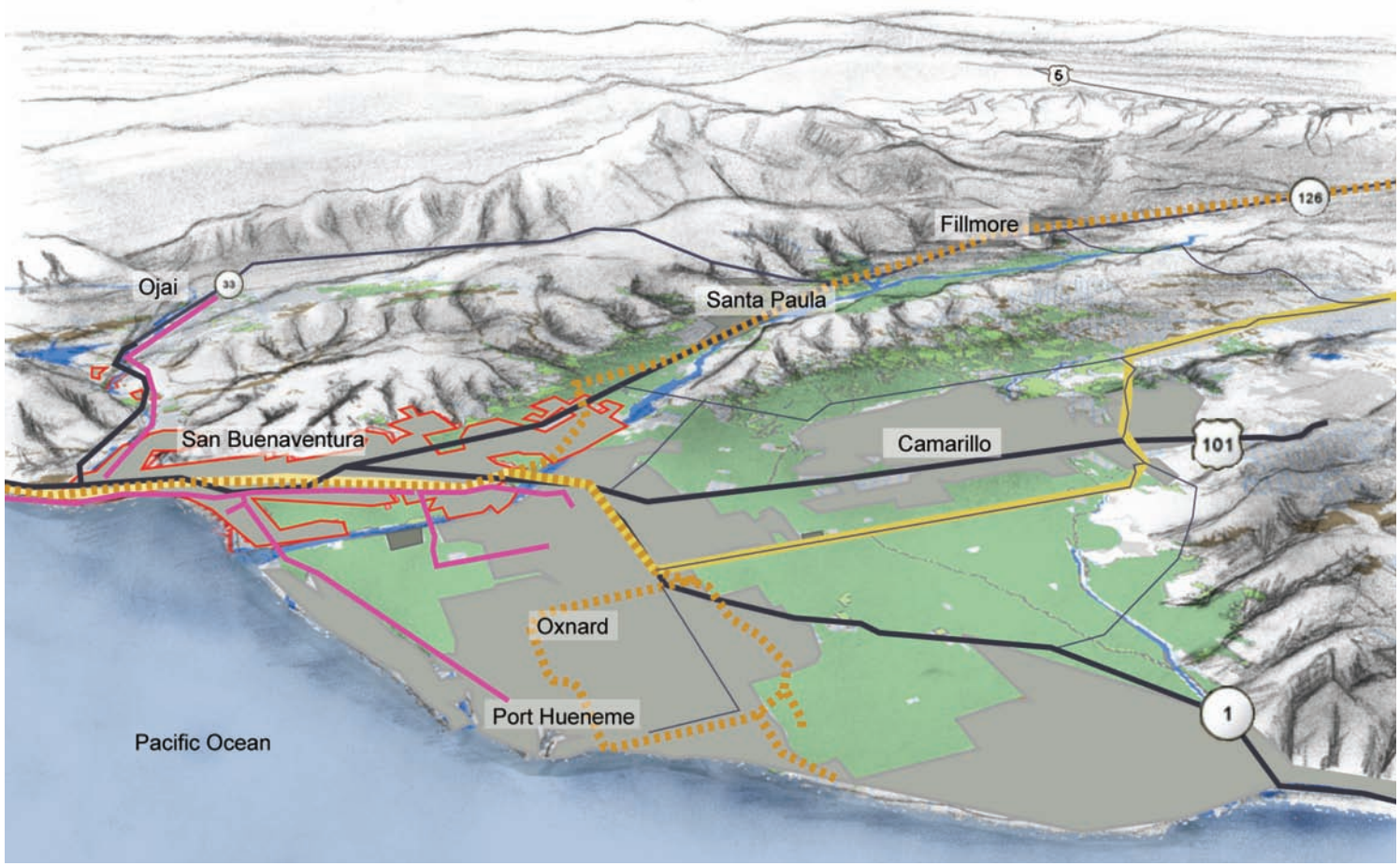
FIGURE 37
City Transportation



SOURCE: City of San Buenaventura GIS Department

For the region, high-paying jobs are in Santa Barbara to the north and Los Angeles to the south. Housing costs tend to be lower in San Buenaventura than these areas, resulting in approximately 24 percent of Ventura County residents commuting to Los Angeles and Santa Barbara (Figure 36). Within the County of Ventura, the *number* of jobs tends to be higher in San Buenaventura, Port Hueneme, and Camarillo than in its surrounding cities of Oxnard, Santa Paula, and Fillmore that are *housing rich*. This imbalance results in increased traffic throughout the region, and reveals an opportunity for reggional public transit (see page 83 for a list of employment sectors in Ventura County).

The rising cost of oil will increase the cost of building transportation infrastructure, utlimately slowing construction. This will be particularly troublesome for the region's commuters; as traffic congestion increases with the population and infrastructure fails to compensate; and later, as the cost of fuel becomes prohibitive and commuting workers are left without access to public transit. The lack of multi-modal transit options in the region will contribute to a jobs/housing imbalance as the cost of oil increases and the population grows.



SOURCES: City of San Buenaventura GIS Department; Ventura County GIS Department

FIGURE 38
City and Surrounding Areas Transportation

- Freight
- Metrolink Rail
- Amtrak Rail
- Freeway
- Major Roads
- Regional Bicycle Connections
- Agriculture
- Urban
- San Buenaventura

Connecting City and Region

Public transportation options are lacking in Ventura County, with a limited number of links among the surrounding cities. Beyond the auto, current transit options – bus and train – remain a very small portion of daily trips in the county despite increases over the past decade (Ventura County Civic Alliance 2004). For many trips in the county, there are few convenient alternatives to the auto. According to the County of Ventura's General Plan (CVGP), while Ventura County's population increased 9 percent from 1992 to 2002, 15 percent more miles were driven during that time, adding further pressure to Ventura's transportation infrastructure (CVGP 2005).

Buses in San Buenaventura are seldom full, and the network of roads still overshadows other modes of transport for the majority of the city. San Buenaventura currently has two bus systems: South Coast Area Transit (SCAT), which operates 15 regular bus routes and a senior/disabled paratransit system;

Class I : Bike Path or Trail

Separate right-of-way for bicycles. Access limited to designated points

Class II: Bike Lane

Restricted right-of-way designated by painted line and signs on road

Class III: Bike Route

Travel lane shared by bicycles and motor vehicles, designated by signs only

FIGURE 39
City Bicycle Network

Class I
Class II
Class III
City Limits

and Ventura Intercity Transit Authority (VISTA), which operates seven regular bus routes and two general public dial-a-ride services.

Currently, approximately 100,000 people commute in and out of Ventura County by car for work per day (Laird 2007). Automobile use is more convenient, as no central station for multimodal transit exists. Neither the Metrolink nor Amtrak station connects to the bus service, which is problematic for residents who rely on alternative modes of transportation to move about the region (Figure 37 and 38). The city recognizes the need for a multi-modal transit center and integrated infrastructure, yet has expressed that there is limited funding at this point.

San Buenaventura has an extensive bicycle network, having spent over $5,500,000 for bicycle facilities over the past 15 years (Figure 39). Bicycle commuters include children attending elementary, middle, and high schools; students attending Ventura College; and employees commuting to

work. However, only approximately 400 residents (0.4 percent of the city population) use the bicycle as a primary mode of transport (City of San Buenaventura's General Bikeway Plan 2005). Many bike paths in the city are Class II lanes with restricted right-of-ways designated by painted lines and signs on the roads (see side bar). Many of the Class I paths that are designated right-of-ways for bicycles are disconnected from the bicycle network, specifically on the east side of the city. As more planned developments are underway, more Class I and Class II bike lanes will be needed to connect these areas.

The city is working on connections to outlying areas, but expects that more bicyclists will commute to places of employment, schools, and shopping in the future. To further enhance bicycle commuting, the city plans to actively promote the construction of bicycle parking and storage facilities.

The current freeway infrastructure and transit systems will be strained in the future by the lack of adequate public transit options and regional connectivity. Both Amtrak and Metrolink serve commuters to Los Angeles and Santa Barbara, with minimal connections to the surrounding areas such as the Santa Clara Valley (Santa Paula, Fillmore), and Ojai (Figures 35 and 38). As oil prices increase, construction for both automobile and public transit infrastructure will become more expensive. Without public transportation infrastructure in place, it will be more challenging for residents to get to destinations and jobs, marginalizing much of the population. It is therefore advantageous to build infrastructure now while energy costs are relatively low and stable.

MOBILITY CONCLUSIONS

Opportunities and trends that encourage reduced dependence on automobiles:

- The city is well-served with bike paths (connections and safety will need improvements)
- The small size of the city, flat terrain and mild climate favor walkability/bikability
- Public transit routes (bus) are well connected
- Existing rail lines have the potential to link and expand routes and services for commuters
- Shorter blocks in older sections of the City are pedestrian-friendly
- Freight access to Port Hueneme via rail with potential for linkage with the larger regional rail system

Constraints to reducing dependence on automobiles:

- 97 percent of commuters use private auto as primary mode of transportation
- More incentives than disincentives to drive (i.e, ample free parking and extensive roadways)
- Infrequent service and lack of convenience deter the use of public transit
- Metrolink and Amtrak are not centrally located (skirts the southern part of the city)
- Bus stations and rail stations are located in different parts of the city (no primary multi-modal center)
- Bus system still fuel-dependent (CNG)
- Trucking is the dominant mode of transport for goods
- Most of the city is designed for the use of automobiles, with few walkable neighborhoods
- Due to the city's service-based economy, low-income workers commute in from elsewhere in the region, while many higher paying professional jobs are found beyond the city and county, requiring commuting out

did you know?

How many passengers can pass along a 10 to 13 feet wide road within one hour?

Mode	Persons/hour
Car	*900 - 2,300*
Bus	*7,000 - 10,000*
Cycling	*13,300*
Tram	*18,000 - 25,000*
Walking	*20,000*
Rapid rail	*40,000*
Commuter train	*50,000*

You can move 25 times as many people along a single right-of-way if they are in trains instead of cars.

SOURCE: www.greenpeace.org

SHELTER

Current housing types depend on oil and energy for everything from initial infrastructure to daily maintenance and upkeep. Typical development patterns are resource intensive, excessively large, unsustainably designed, and environmentally damaging. Federal transportation funding and zoning ordinances continue to encourage a pattern of sprawl. Unfortunately, the California Environmental Quality Act (CEQA) does not currently address energy in new housing and development (Cooke 2006). The ongoing trend of building energy-intensive, single-family homes in greenfield developments will fail to meet the land and energy needs of future generations. Unsustainable low-density developments in a post-Peak Oil situation will have a negative impact on affordability, comfort, human health, and the allocation of personal time. In order to prepare for a post-Peak Oil society, density, mixed-use developments and energy-efficient, sustainable housing design must be prioritized. In order to improve quality of life through shelter, attractive, affordable, and comfortable housing must be located near jobs, transit, and amenities.

GOAL: Increase dense mixed-use development and sustainable housing design

OBJECTIVES:

- Develop infrastructure and policy for dense, affordable, mixed-use development (nodes) within areas of existing intense activity, near public transit, and outside of hazard zones
- Decrease density outside of nodes
- Retrofit existing homes and require all new homes to be energy and resource efficient
- Promote adaptive reuse of buildings and underutilized urban infill land

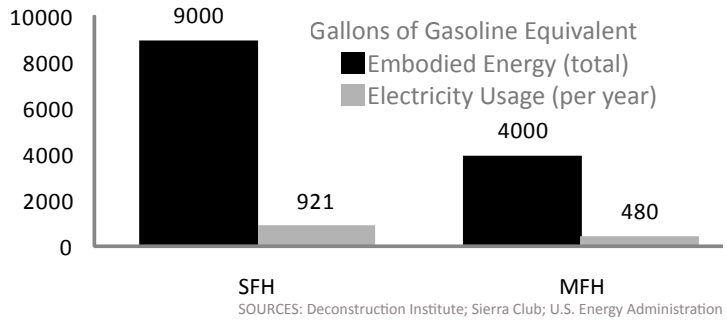


FIGURE 40a
Energy Comparison Between Single Family Housing and Multi-Family Housing

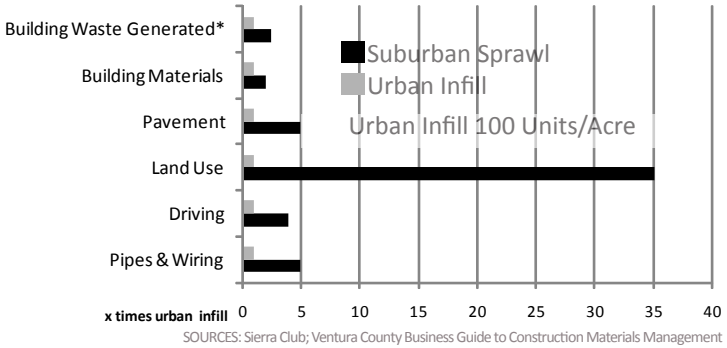


FIGURE 40b
Impacts of Suburban Sprawl Relative to Urban Infill

Energy and Resources

Infrastructure and Maintenance

The typical American house is seldom designed to be energy-efficient, while Americans continue to increase energy consumption. According the Bureau of Land Management, America's energy use increased nearly 20 percent during the economic boom of the 1990s, and is predicted to increase 40 percent from 2002 to 2025 due to a projected increase in population and energy demand (Bureau of Land Management 2005). Lighting alone accounts for approximately 40 percent of overall household energy use. Single-family homes especially are energy intensive, requiring almost twice as many equivalent gallons of gas to build and maintain (Figure 40a), and embodying over two times the overall energy of multi-family homes. Embodied energy is "all the energy required to extract, manufacture and transport a building's materials as well as that required to assemble and finish it" (The Architectural League of New York 2000). Low density suburban developments are also energy-intensive, requiring two to thirty-five times as much embodied energy as urban infill (Figure 40b). Single family homes and low density developments will become increasingly expensive to build and maintain as the price of oil increases.

Homes consume about 32 percent of the electricity used in Ventura County. According to the City of San Buenaventura's Comprehensive Plan Background Report (CVCPBR), the city has over 64 percent single-family homes (CVCPBR 2002). Average electricity costs for a single-family home in Ventura County range from between $48 and $110 per month, while natural gas costs average between $90 and $100 per month during the winter months (Ventura County Regional Energy Alliance 2006). The reduced availability of oil will increase the cost of energy for homeowners and renters in the city and region.

Building Materials: Embodied Energy, Waste, and Re-use

Construction timber has the benefit of being one of the most easily reusable building materials, with one of the lowest embodied energy ratings. Timber is one of the few renewable building materials and one of the most common in American housing construction. The Deconstruction Institute (DI) states that "a typical 2,000 square foot wood frame home can yield 6,000 board feet of reusable lumber…This is equivalent to 33 mature trees, or the yearly output of 10 acres of planted pine (7 football fields)" (DI 2007).

The quantification of embodied energy for any particular material is not an exact science. It "requires a 'long view' look at the entire manufacturing and utilization process, and [is] filled with a large number of potentially significant variables" (Mumma 1995). It is most useful for indicating the energy benefits of using recycled materials rather than virgin materials. The reuse of building materials can save approximately 95 percent of embodied energy which would otherwise be wasted. For example, because aluminum requires 250 million Btus (British thermal units) of energy to produce one ton (and therefore has a very high embodied energy rate, or EER), the energy saved by using recycled aluminum is 95 percent (one of the highest energy savings for common building materials). While glass takes only 15.6 Btus to produce one ton, it requires more energy and processing to be reused, therefore giving it a low energy savings of only 5 percent (Mumma 1995). Some materials suffer damage losses in reuse; reuse of bricks and tiles, for example, lose 30 percent. Long transport distances may result in more energy use for reprocessing (Recovery Insulation 2005).

The County of Ventura disposed 41,606 tons (or 10.7 percent) of business-related construction and demolition (C&D) waste in 1999. The City of San Buenaventura disposed of approximately 8,000 tons, or 10.6 percent of its business C&D waste (1999), and 4.5 percent, or 1,850 tons of residential C&D waste in 2004 (California Integrated Waste

Plastic Lumber Alternative:

Plastic lumber is a non-toxic, long-lived and sustainable lumber substitute. It is usually made of 100 percent recycled, post-consumer, high density plastic, and can be combined with wood waste to make a composite version. This timber alternative is impervious to color fading, insects, mildew, mold and saltwater (thus requiring no staining or sealing), and doesn't crack, splinter, rot or chip. It is maintenance-free, and re-manufactured without chemicals or other pollutants. Although non-structural, it can replace most other lumber needs, such as decking and furniture, leaving wood timber as a resource for structural use.

- Dunne 1999

Other Sustainable Building Materials:

- *Products made from agricultural waste material, such as wheat straw, sunflower stalks, and rice hulls.*
- *Products made from rapidly renewable materials, such as bamboo flooring, natural linoleum, cork and textiles made from wool, sisal, hemp and organic cotton.*

- Green Building Resource Center (2004)

Management Board 2005). Several C&D recycling and reuse centers exist within the city and county, including Ventura County's own Materials Exchange (VCMAX) program, yet new housing development construction continues to use new building materials. In the United States, building construction accounts for 30 percent of all raw materials use (Green Building Resource Center 2004). The city and county could significantly reduce their C&D waste streams through the recycling and reuse of common building materials (Table 8). Overall energy could also be reduced through the use of materials with low embodied energy such as clay products, concrete and timber.

Passive Energy Design

San Buenaventura's older homes present an opportunity for sustainable retrofitting. As of 2000, 54 percent of housing units in the city were over 30 years old and 14 percent were over 50 years old (Figure 41). As a general rule in the housing industry, structures older than 30 years begin to show signs of deterioration and require reinvestment. In addition, unless properly maintained, homes older than 50 years require major renovations to remain in good working order (CVCPBR 2002). The greatest concentrations of older homes in the city are in the western and central areas closest to Downtown. These areas are likely to have the greatest rehabilitation needs, and are therefore the best candidates for retrofitting for reduced energy consumption.

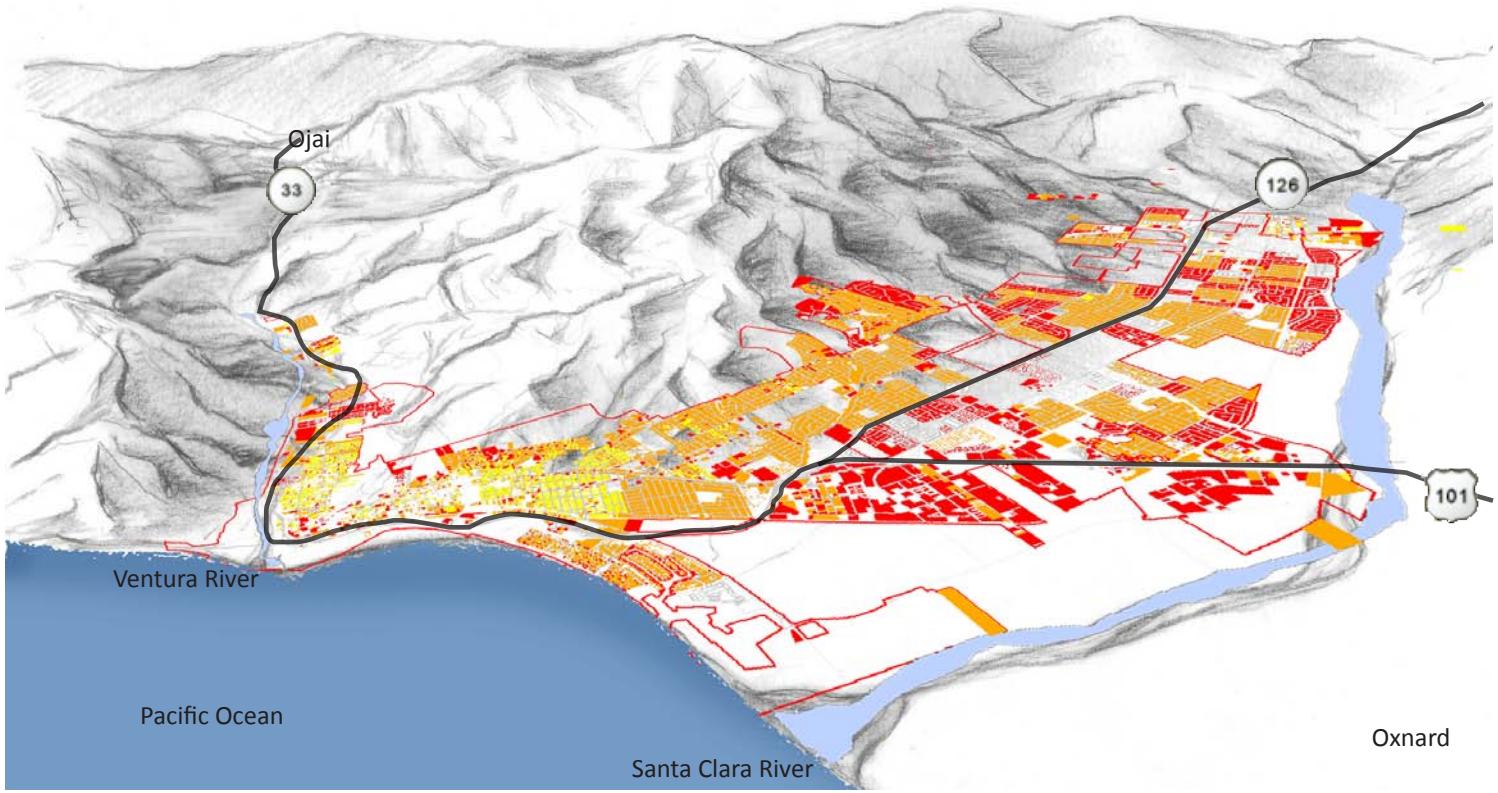
Cooling, ventilation, and lighting are California's top household energy users (Figure 42). New housing would benefit considerably from the sustainable design and orientation of buildings. Because of San Buenaventura's Mediterranean climate, passive heating and cooling design could significantly reduce or even eliminate the need for air conditioning and space heating. The addition of deciduous trees on the south side, operable clerestory windows, and high thermal mass materials (such as brick, concrete and stone) could reduce electricity use by at least 25 percent and gas consumption by 44 percent. Solar panels and solar water heaters could cut electricity and gas use by an additional 50 percent or more each. Because of the region's average 300 days of sunshine, natural daylighting could cut electricity use by 37 percent (California Energy Commission 2005). Greenroofs can also reduce heating and cooling needs, as well as offset the heat island effect and reduce runoff. Roof and vertical gardens provide space for outdoor activities or food production. Greywater and rainwater catchment systems provide on-site water supplies.

The reduced need for energy can also provide financial relief for lower-income households. Global Green USA reports that "families significantly below the poverty level have been shown to spend as much as 19 percent of their income on utility bills. While in some areas of the United States as many as a quarter of evictions of low-income renters were due to inability to pay utility bills" (Global Green USA 2006). A reduced energy design – utilizing solar power and passive design strategies, for example – can lower net energy consumption by 70 percent or more (Global Green USA 2006), a benefit to all sectors of the population.

TABLE 8
Construction and Demolition

Top 10 Disposed Materials: Overall C&D in Four Metropolitan Areas of California, 2005			
Material	Divertible	Estimated %	Estimated Tons
Composition Roofing	Yes	10.2	318,494
Remainder/Composite C&D	No	8.3	261,161
Large Asphalt Pavement without Re-bar	Yes	8.1	253,286
Dirt & Sand	Yes	6.6	206,729
Other Aggregates	Yes	6.4	199,544
Clean Dimensional Lumber	Yes	5.9	185,276
Large Concrete without Re-bar	Yes	5.2	163,483
Painted/Stained Wood	No	4.6	145,333
Clean Gypsum Board	Yes	4.5	140,348
Clean Engineered Wood	Yes	4.5	139,975
Total		**64.3**	**2,013,629**

Cascadia Consulting Group, www.ciwmb.ca.gov, 2006

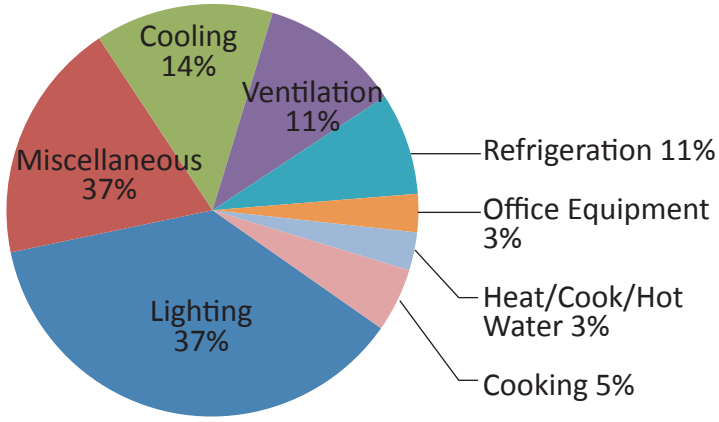


SOURCES: City of San Buenaventura; Ventura County GIS Department

FIGURE 41
City Housing Age

Adaptive Re-Use of Buildings and Land

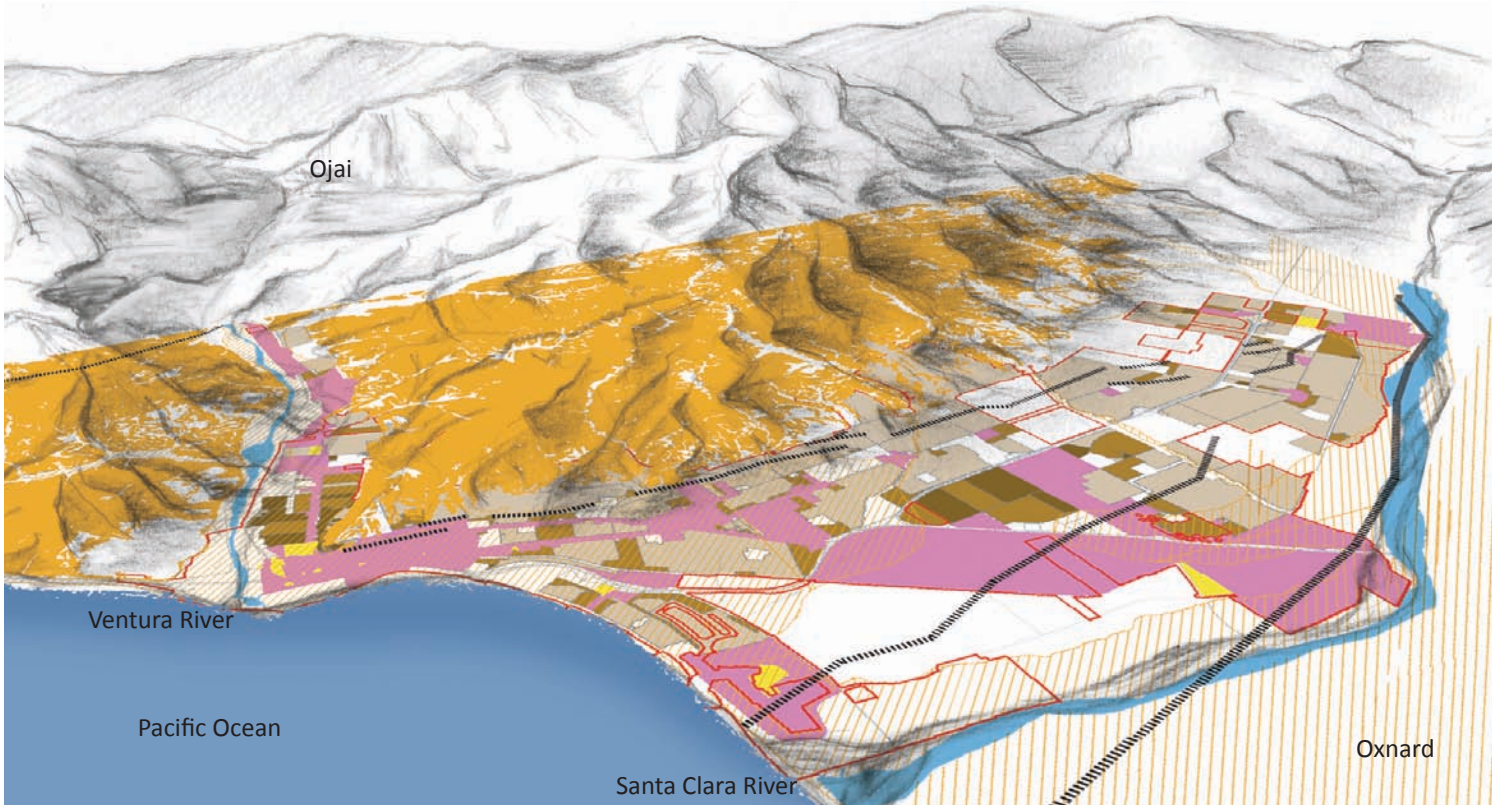
According to a report from the California Center for Land Recycling (CCLR), as the population continues to boom in California, "(the state) can expect to lose 21 to 26 million acres of currently undeveloped greenfields to urban sprawl over the next 30 years" (Brewster 1998). Urban infill – or the adaptive reuse of existing buildings and the redevelopment of land that has been classified as brownfields, grayfields, vacant, or underutilized – could save Ventura County's greenfields from future development. San Buenaventura, like most industrialized cities, has many existing brownfields and potential grayfields that could be remediated and developed for re-use. The Westside neighborhood alone is believed to contain approximately 30 brownfield sites (CVCPBR 2002). (For further information, see ***Appendix C-4: Reed***.)



SOURCE: California Energy Commission

FIGURE 42
Annual Electricity Use Per California Household

FIGURE 43
Development in Hazard Zones



SOURCES: City of San Buenaventura GIS Department; Ventura County GIS Department

Hazard Zones and Future Development

A significant portion of the both the region and the city – including much of its planned medium- to high- density and infill development – lies within a liquefaction zone (Figure 43). The Southern California Earthquake Center (SCEC) describes liquefaction as "a temporary loss of strength in the ground that can occur when certain water saturated soils are shaken during a strong earthquake. When this occurs buildings can settle, tilt, or shift." The edge of the Transverse Mountain Range, north of the city, is prone to landslides. Because faults run throughout the region, "most areas of Southern California will experience heavy earthquake shaking" (SCEC 2007). Modern engineering can reduce or even eliminate these hazards, but the potential degree of devastation remains unpredictable. As discussed earlier in the ***Water*** section (see page 41), much of the region is also subject to flooding, particularly along the Ventura River. The forested hillsides present a wildfire hazard. Ventura's last major wildfire occurred in November 2005, and burned over 2,000 acres in School Canyon, a community located in the hillsides between San Buenaventura and Ojai (Associated Press 2005). In order to minimize the potential destruction, loss of embodied energy, and costly rebuilding of infrastructure in the event of an inevitable natural or man-made hazard, new building and densification should only occur within zones outside of these hazard areas Rebuilding will be more expensive and slower post-Peak Oil because of increase cost of materials and infrastructure.

Demographic Trends

Several important demographic trends are occurring within the city. Married couples without children and singles comprise the greatest percentage of the city's population. The number of non-traditional, or "other" families, such as single mothers, grew in the 1990s by 22 percent (to 6,291 by 2000), and is expected to continue to grow (Figure 44a). The number of singles is on the rise throughout the country, and increased by 17 percent in the city. Singles include young working professionals and elderly persons living alone (CVCPBR 2002). In Ventura County, young adults (ages 20-34) and the elderly (60 and over) are expected to grow the most by 2050, at 0.2 percent and 3 percent, respectively (Figures 44b and 44c). Seniors over 60 tend to be on restrictive incomes – earning approximately a third of the county's median household income (Ventura County Area Agency on Aging 2005) - and tend to be less independently mobile. This demographic group is therefore in need of affordable, low-maintenance, and transit-oriented housing choices near amenities.

Women, including elderly and single women, are a growing demographic in United States, and will continue to outnumber men in Ventura County in 2050 (Figures 44d and 44e). According to a recent New York Times article, "unmarried women fifteen and older outnumber those who are married for the first time in [United States'] history by a 51 percent to 49 percent margin" (Roberts et al. 2007). Women still earn less than men – the American Association of University Women (AAUW) Educational Foundation found that college-educated women earn 69 percent of what their male counterparts make (AAUW 2007). These trends indicate a growing need for affordable housing throughout the region.

Baby-boomers (who will be the elderly demographic group of 2050) are a significant and growing demographic category throughout the region, and "increasingly dominate housing markets because of their accumulated wealth and relatively high incomes, which allow them to relocate primarily for quality-of-life reasons" (CVCPBR 2002). The city predicts that some of the aging baby boomers who decide to stay in the region will choose to live in smaller, more convenient and secure housing that accommodates seniors (e.g., wheelchair accessible and low maintenance). As a result, when baby boomers leave their current dwellings, their neighborhoods will change. The "established tendency of echo boomers [the

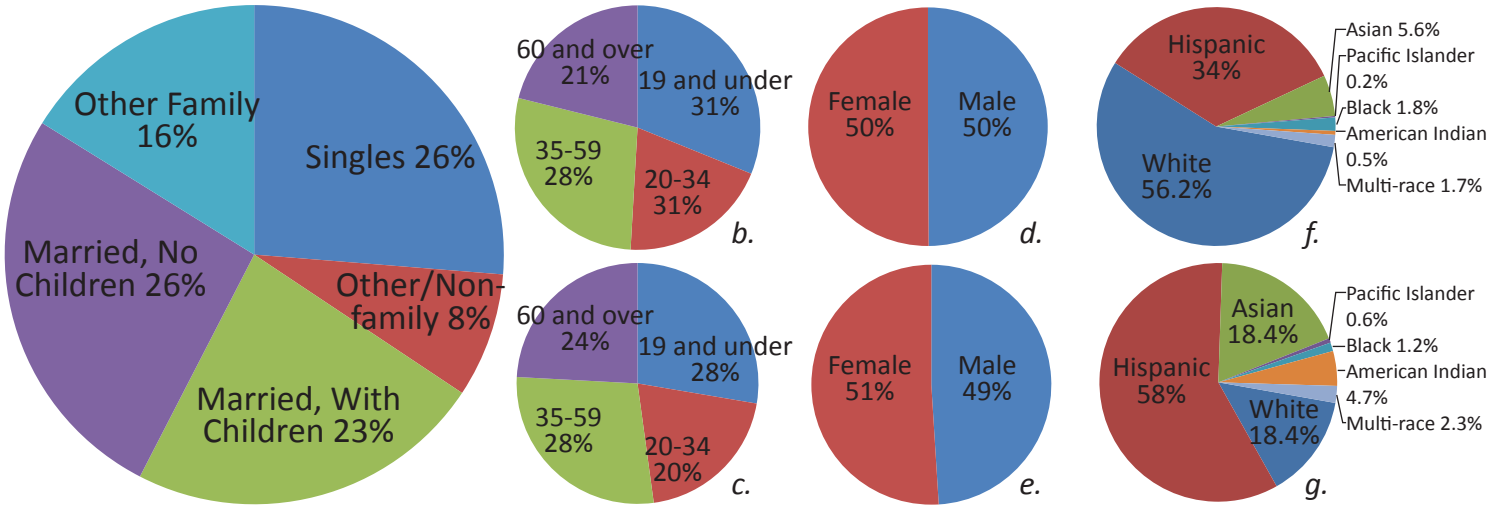
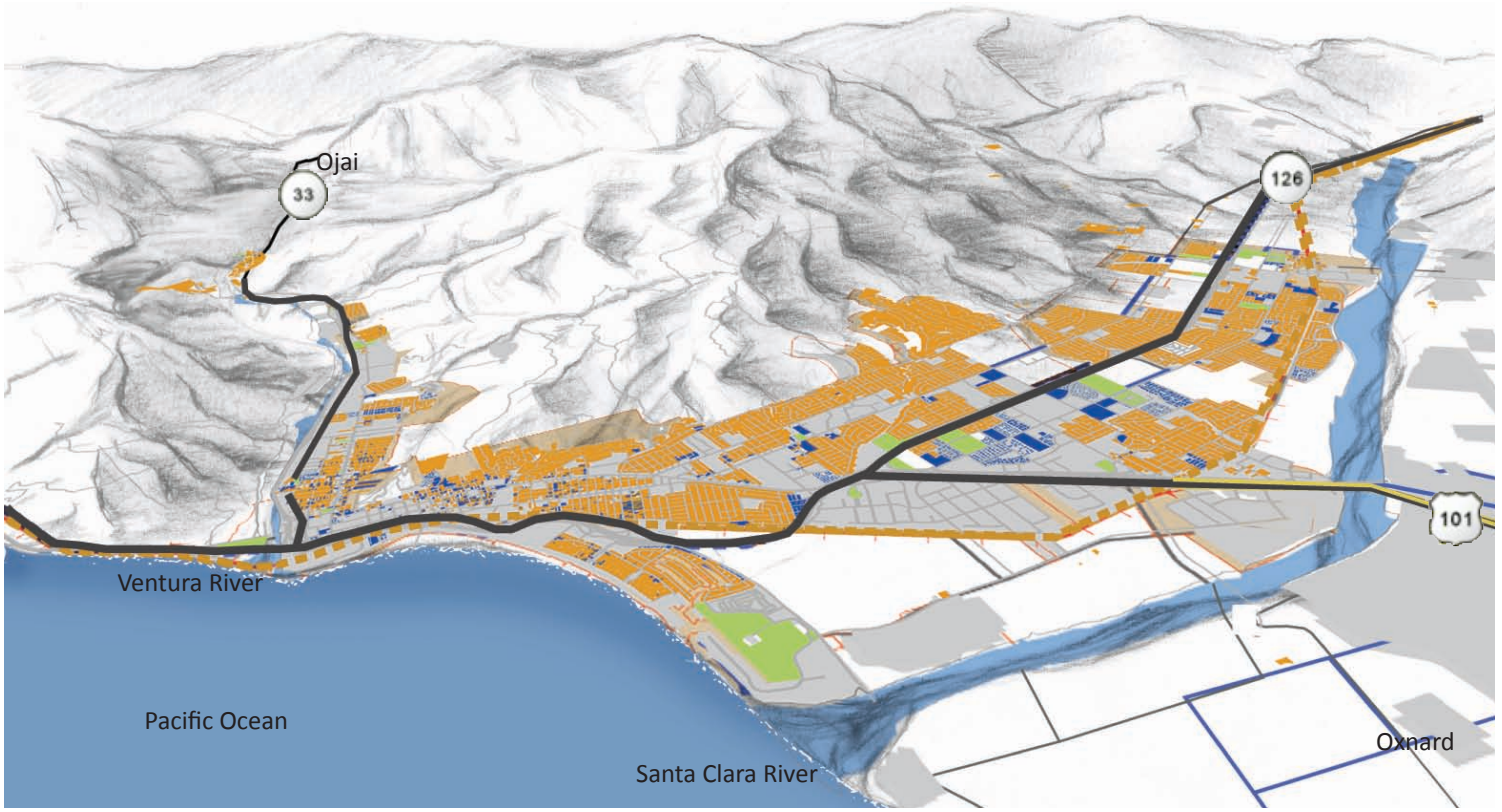


FIGURE 44
Demographic Trends

a. San Buenaventura Population by Housing Type
b. Ventura County by Age Group (2000)
c. Ventura County by Age Group (2050)
d. Ventura County by Gender (2000)
e. Ventura County by Gender (2050)
f. Ventura County by Race/Ethnicity (2000)
g. Ventura County by Race/Ethnicity (2050)

Total Pending Units:
SFHs: 825
Condos: 1,211
Apartments: 463
"Affordable": 128



SOURCE: City of San Buenaventura GIS Department

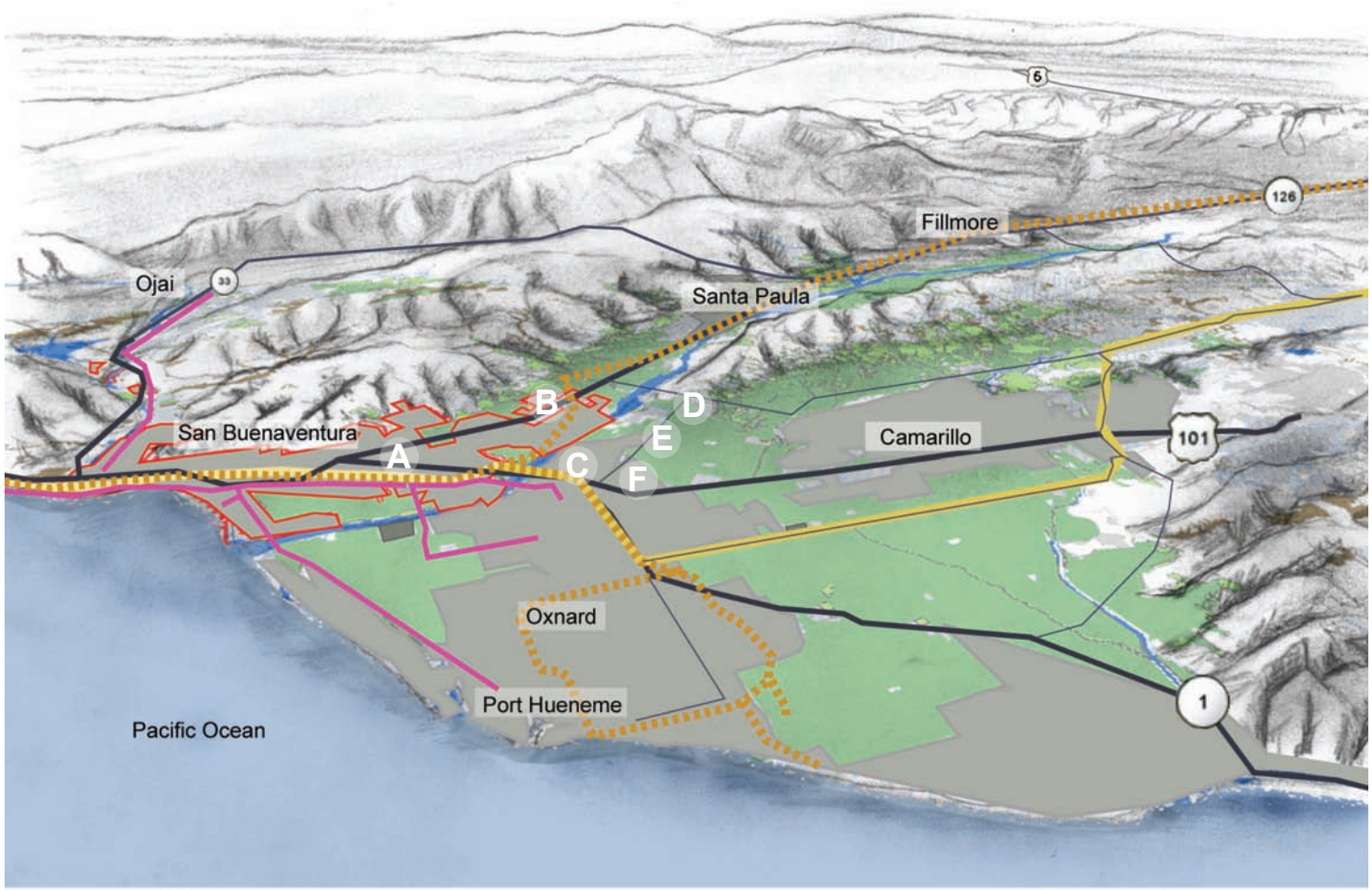
FIGURE 45
City Housing and Development Types

children of baby boomers] to leave the city in their early twenties will probably be tempered measurably only if local businesses may look to increase employment in this age group" (CVCPBR 2002).

The CVCPBR states that "mixed-use is especially beneficial and appropriate for communities that lack vacant residential land, creating the opportunity for new housing through infill development and decreasing housing costs through shared amenities and parking." Mixed-use developments offer a variety of social options, and are therefore more attractive to singles and the elderly than suburban, single-family developments. Hispanics – the fastest growing racial demographic group in Ventura County (Figures 44f and 44g) – also show a preference for affordable, mixed-use, urban development (Autler and Belzer 2002).

City and Regional Developments

As seen previously, the population of San Buenaventura is expected to grow .88 percent per year, resulting in an additional 49,689 people, or a need for approximately 19,100 units (at 2.6 people per unit), by 2050. The city's General Plan capacity for additional potential units is 29,910, which would meet the unit needs of the population, but not its future demographic, housing type, and zoning demand needs.



SOURCES: City of San Buenaventura GIS Department; Ventura County GIS Department

A Victoria Avenue Corridor:
Mixed Use
120 SFH
104 Condos (Senior)

B Saticoy Village:
Mixed use
366 SFH
327 Condos
60 Apartments

C River Park:
2,800 Units

D Channel Islands Center:
800 Units

E Topa Financial Place:
Mixed Use
Six High Rises, including a 37-storey residential tower

F Wagon Wheel:
Mixed Use
Two 20-storey residential towers
1,200 row houses

FIGURE 46
Regional Planned Development

- Freight
- Metrolink Rail
- Amtrak Rail
- Freeway
- Major Roads
- Regional Bicycle Connections
- Agriculture
- Urban
- San Buenaventura

Within the city, 64 percent of the housing stock (25,731 units) is single-family homes (Ventura County General Plan 2005) (Figure 45). Several new mixed-use residential projects are underway, including the Victoria Avenue Corridor and Saticoy Village (Figure 46). The units are mostly single-family homes and condominiums, a trend throughout San Buenaventura. The city has many residential developments pending approval (City of San Buenaventura 2007). Although demand for apartment zoning will increase by a difference of 85 percent by 2020 (Figure 47), most of these 2,500 proposed residential units are single-family homes and condominiums. And even though single adults, the elderly living alone, and non-traditional families, including single moms, comprise approximately half the current population – with this number expected to grow – only 128 of these proposed units are classified as "affordable."[1]

[1] The average rent for a 2-bedroom apartment in San Buenaventura is $1,146 (CVCPBR 2002); the Fair Market Rate for a 2-bedroom apartment in Ventura County: $780 (AHACV)

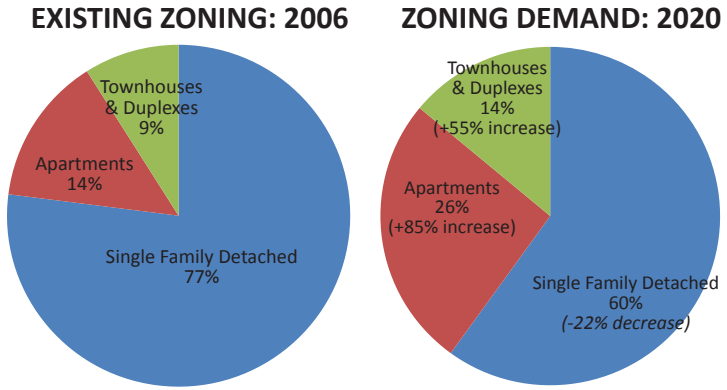


FIGURE 47
City Zoning

SOURCES: VCBR, 2006

Ventura County is projected to grow with the region, with over half a million people expected by 2050, resulting in the need for approximately 227,733 units. Population within Southern California is expected to grow by 6.3 million people by 2030 (SCAG 2004). The existing housing stock within Ventura County consists of approximately 252,000 units. Nearly 68 percent of this housing stock is over 30 years of age (as of 2000) (County of Ventura 2005). City councilmember and planner William Fulton states that "under current policies, the planned capacity (maximum) of the county is targeted at somewhere between only 293,500 and 298,500 housing units," or an increase between 16.5 percent and 18.5 percent over the existing housing stock. Several new developments are going up in the area, which may alleviate some of the housing need in the region (Figure 48). However, because they are located near the intersection of the 101 and 126 freeways in Oxnard, these mostly mixed-use, high-rise developments are expected to significantly worsen traffic conditions. RiverPark alone is expected to add another 80,000 vehicles to the region (Polakovic 2007). None of these new developments link to a public transit hub. In addition, these units will be mostly market-rate condos, making living within proximity to San Buenaventura financially unfeasible for many, further increasing the jobs/housing ratio imbalance in the region.

Current city residential density zoning (CVCPBR 2002):

- High density (maximum 54 units/acre)
- Medium density (maximum 36 units/acre)
- Low density (1-7 units/acre)

Ventura County has one of the highest Median Family Incomes (MFI) in the state and the nation, with 63.5 percent in the Middle/Upper Income (above 80 percent of area MFI – $77,400, County of Ventura 2006). However, this is "not sufficient to adequately cover the high cost of housing in the county for lower- and moderate-income households (36.5 percent of the population)." According to the June 2004 CAR Affordability Index, only 17 percent of households in Ventura County could afford to purchase a median-priced home at $614,850.

The growing cities of Santa Paula, Fillmore, Port Hueneme, and Oxnard have the highest proportions of lower-income households in the county, with low- and moderate-income households comprising 57.9 percent, 56.5 percent, 54.1 percent, and 50.9 percent of the total (in 2000), respectively. San Buenaventura comprises 60.1 percent middle/upper, 16.8 percent moderate, 11.3 percent low, and 11.8 percent extremely low-income, with a medium household income of $55,137 (CVCPBR 2002). The average rent in Ventura County is $1,388 for a 2-bedroom apartment, and the demand for multi-family housing outpaces the construction of these units. The shortage of affordable rental units, combined with economic and political conditions that favor single-family development, will sustain tight market conditions (County of Ventura 2005).

Connecting City and Region

The city is examining how to meet its projected population and demographic needs by planning for increased medium- to high-density residential zoning and promoting infill (see Figure 43 on page 77). However, the city's planned neighborhood density and infill zoning trends indicate a continued preference for low-density growth. The city is designating approximately 400 acres for residential infill on vacant and under-utilized land primarily on the north and southwest portion of the city with a total of 3,700 units

planned. At this rate of density, the number of people expected to populate the city by 2050 would require approximately 1,600 acres of land – or more than four times the acreage of the city's designated infill area.[2]

According to William Fulton, "the trend for cities in Ventura County is to approve 20 percent below zoned density capacities, and 45 percent below General Plan capacities" (Fulton et al. 2001).

Agricultural land, which is critical to a post-Peak Oil society, is at risk of being developed for residential and other use. Fifty-nine percent of Ventura County's 555,953 acres is agricultural and 17.5 percent is urban. According to the California Department of Conservation (CDC), 9,480 acres – 5,487 of it agricultural – were urbanized between 1990 and 2000. Between 1998 and 2000, 1,713 acres – 1,243 of it agricultural – were re-classified as urban. In the previous mapping cycle, 2,639 acres were urbanized, indicating a slowdown in the conversion of agricultural land to urban uses. The population trends for the county will continue to place development pressure on agricultural land in the foreseeable future (CDC 2001). With an estimated increase of over 592,000 people by 2050, the County will need approximately 228,000 units (at 2.6 people per unit).

The planned city and county capacity maximums would meet the projected need for by 2050 (at 2.6 people per unit), but likely at the expense of undeveloped and agricultural land. In addition, if the trend of building energy- and resource-intensive single-family housing continues, oil and natural resources will be depleted at an unsustainable rate.

Without planning for public transit, traffic will become untenable in the region as tens of thousands of vehicles are added. The lack of affordable housing will create an imbalance in the region, increasing the traffic problem, and marginalizing a growing number of people within the region. In order to contribute to a functional and thriving post-Peak Oil society, cities throughout the region will need to develop transit-oriented nodes around high paying jobs and amenities (Figure 48). The nearby city of Oxnard, in particular, will play an increasingly important role in San Buenaventura's and the region's jobs/housing balance post-Peak Oil. Therefore, collaboration with Oxnard, as well as with other cities in the region such as Camarillo, Santa Paula, Fillmore, and Thousand Oaks, is needed in order to determine the best locations within these cities for dense development and to ensure a balance of employment options (see ***Economy*** section on page 83 for more information).

SHELTER CONCLUSIONS

Opportunities and trends that promote dense, mixed-use, sustainable development:

- City promotes policy of "infill first" and has designated extensive infill zones
- Mixed-use developments and zoning promoted
- Projected demographic groups indicate preference for dense mixed-use development
- Climate highly amenable to passive heating and cooling (energy) design and retrofit

Constraints to dense, mixed-use, sustainable development:

- Majority of city is single-family homes in suburban developments
- Region and city are developing at a fast pace
- Most developments are single-family homes
- Few affordable units being built
- Few developments near transit or employment
- Sustainable, energy-efficient design not required/ not prioritized
- Most of existing and new development is within hazard zones
- Higher paying employment located outside of city

2 At 2.6 people per unit; 9.6 units per acre (from CVCPBR 2002).

ECONOMY

GOAL: Expand opportunities for a localized economy

OBJECTIVES:

- Identify economic sectors based upon sustainable resource use that will thrive post-Peak Oil
- Provide employment opportunities that encourage innovation, enhance local economy, and provide the population's needs
- Link employment opportunities to housing and transportation regionally

Peak Oil will significantly alter economies across the world, and every city will have to adapt. Housing, jobs and transportation systems are intertwined and will continue to be so into the future. The City of San Buenaventura must work with adjacent and near-by cities in order to identify and coordinate employment opportunities that will best benefit the city and surrounding region post-Peak Oil. Regional planning is essential to the protection, production and management of critical natural resources such as fresh water, ocean fisheries, and agricultural land. Regional transportation should link cities to each other and to existing ports.

In order for the city and region to transition their economy towards a successful post-Peak Oil economy, a full economic study needs to be conducted. The following analysis identifies the present employment trends that are the basis of the city's and region's economy, and distinguishes employment sectors that have the potential to thrive post-Peak Oil.

The City of San Buenaventura has an economy typical of the United States, with about 78 percent of jobs found in the service sector (Table 9). The County has a smaller percentage of people employed in service sector jobs, yet the top 10 employers in the county are mostly service-related (Table 10). Although there will be a shift towards labor-intensive jobs such as those found in manufacturing and food production, services will still be important in a post-Peak Oil community. However, the nature of service jobs will shift with the economy. For example, the retail sector, which currently consists of 21 percent of jobs within the city, and 12.2 percent in the county, will most likely transition from energy-intensive big-box retail stores to smaller, local shops selling basic necessities. Other services, including healthcare and education, may not see a decline in the number of jobs due to their critical role in society. They will, however, function differently in

Job Sector	County % Workforce	City of San Buenaventura % of Workforce
Services	**57**	**78**
Financial/Real Estate	13.4	4
Other	3.3	15
Health	9.1	11
Public Sector	9.2	12
Retail	12.2	21
Business	2.0	7
Wholesale Trade	7.8	4
Agricultural		2
Infrastructure	**23.4**	**10**
Construction	5.9	6
Transportation	17.5	2
Utilities		2
Manufacturing	**12.3**	**8**
Non-durable		3
Durable		5
Resource Utilization	**7.3**	**4**
Agriculture	7.1	3
Mining	.2	1
Total	**100%**	**100%**

SOURCE: City of Ventura Comprehensive Plan, 2005.

TABLE 9
Ventura County and City of San Buenaventura Employment by Industry (Annual Average)

a post-Peak Oil society, as the economy will necessarily be more concerned with the preservation than the exploitation of natural resources. Certain sectors, including financial, insurance and certain businesses such as consulting, will experience an easier transition, as much of the work depends upon the exchange of information.

Oil and energy are critical to exploit resources and increase economic output. In the United States, the industrial revolution enabled output produced per worker-hour to "grow dramatically, not because workers have worked harder but because workers have been controlling ever more energy in order to accomplish their tasks" (Heinberg 2005). Post-Peak Oil, a decreased energy supply will result in the shrinking of worldwide economies, leading to recessions, which will compel economic adaptation and transformation. The following is a list of probable economic outcomes extrapolated from Richard Heinberg, Howard Kunstler, Robert Thayer, and The Community Solution's observations on Peak Oil's affect on Cuba:

- Efficiency gained from oil-powered machinery will decrease, while manual labor will increase
- Commuting patterns will significantly decrease
- Telecommuting and home offices will increase
- The virtual environment and computer age will continue to increase in importance
- The transportation of high-mass, low-value goods will decrease significantly, while the transportation of low-mass, high-value goods will decrease slightly
- There will be a general trend towards localization of resources and production, but not necessarily towards consolidation of ownership
- Necessary goods such as food, tools, and clothing will become more expensive
- Fewer goods will be produced, lowering consumption throughout the economy

San Buenaventura and the region should use this information to guide the transformation of its economy and labor force early in order to lessen the economic blow of Peak Oil.

Efforts to shift the local economy need to begin with information and education. Important jobs will include educators familiar with the skills necessary for a post-Peak Oil economy, sustainable designers, post-Peak Oil consultants, and experts in fields such as food production, water systems, transportation, land-use planning, waste recycling, and economics. More attention and organization will need to be given to these systems, as collaborative efforts at the neighborhood, city, regional, and national level will have to be made. Therefore, it will be important to establish governmental positions that coordinate and organize these efforts, facilitate the research and study of system impacts, and compile and distribute this information.

The reduced availability of oil will have a profound impact on jobs that are vulnerable to changes in oil supply (such as those dependent on machinery, transport or travel), as one gallon of gasoline equals approximately five hundred labor hours (Pimentel 1994, USDE 2004). Jobs that do not

2004 Top 10 Major Employers		
Major Employers	Industry	Jobs
County of Ventura	Public Administration	7,424
Ventura Unified School District	Public Administration	2,318
Ventura County Health Care Agency	Health Care and Social Assistance	2,100
Ventura County Community College District	Public Administration	1,927
Community Memorial Hospital	Health Care and Social Assistance	1,700
City of Ventura	Public Administration	1,039
Ventura County Star	Information	430
Buenaventura Medical Clinic	Health Care and Social Assistance	421
The California Mushroom Farm	Agricultural Production	385
ARC Industries	Health Care and Social Assistance	300

SOURCE: City of Ventura Comprehensive Plan, 2005; State of California, Employment Development Department 2005

TABLE 10
Ventura County Major Employers

Post-Peak Oil Employment Examples

- *Organic farming*
- *Handmade textiles*
- *Sustainable fisheries*
- *Eco-industrial reuse/ recycling*
- *Telecommuting*
- *Sustainable Design*
- *Holistic Healthcare*
- *Peak Oil Consulting*

rely on oil or that can be adaptable, that are local, and that utilize natural resources sustainably, such as information technology, will thrive in a post-Peak Oil community. Food production and manufacturing are two industries that will be hit hardest by the loss of oil resources, and will therefore see extensive changes. High-mass goods of necessity will need to be produced locally, more labor will be needed to produce these goods, and the materials available will become costly and scarce. The food production sector can expect an increase in job opportunities in organic farming, textile crops, aquiculture and fisheries, and urban agriculture organization and labor. In manufacturing, a likely increase will be in jobs in local processing, clothing and textile manufacturing, the production of renewable technologies, and the re-use of materials (repair, scavenging, and recycling).

Waste and the Re-Use Industry

The development of the recycling and re-use industry is one of the most important trends in the United States, and has the potential to be the basis of a post-Peak Oil economy. Everything from yard waste to plastic bottles, to carpet, to cars, to water, can be re-used and/or recycled, reducing the impact on existing resources. As new technologies and strategies emerge, the energy input into recycling products will continue to decrease, making the reuse/recycling industry one of the most energy- and resource-efficient, and therefore, profitable, particularly post-Peak Oil. According to a 2001 study for the National Recycling Coalition (NRC) the recycling and reuse industry generates an annual payroll of nearly $37 billion, and grosses over $236 billion in annual revenues. In addition, it consists of approximately 56,000 establishments that employ over 1.1 million people (NRC 2001).

As seen earlier under ***Water*** and ***Food***, greenwaste and sewage water accounts for a significant amount of potentially reusable resources. Other resources that could be recycled and re-used include household and business waste, such as packaging (glass and plastic), paper products, and appliances. Despite sustained improvements in waste reduction, household and business waste remains a constant concern. Trends indicate that the overall tonnage Americans create continues to increase (EPA 2003). In 2000, the national recycling rate of 30 percent saved the equivalent of more than five billion gallons of gasoline, reducing dependence on foreign oil by 114 million barrels per year (EPA 2002).

Ventura County residential disposal rates have increased by approximately 11 percent over the last 10 years, while business rates have increased almost 20 percent. Ventura County currently diverts approximately 1,100,000 tons of waste to landfills per year, at a cost of approximately $1,500,000 (CIWMB 2005). Waste not diverted by San Buenaventura's system is sent to one of seven landfills, only one of which is located within the county (CSBESD 2007, CIWMB 2005). Not only does re-use and recycling divert material from landfills, but it contributes to the local economy by providing over 450 jobs – compared to the 27 jobs provided by the local landfill.

Patagonia Incorporated: Striving Towards Sustainable Business in Ventura

Since its establishment in 1985, the San Buenaventura based company, Patagonia, Inc., has become a model for other companies to work towards sustainability and wilderness protection. Habitat protection in both terrestrial and marine environments is also a significant concern for the company. Patagonia's ethical foundation initiated the non-profit corporation "1% For the Planet," whose business members donate 1% of their net annual sales to grassroots environmental organizations.

Patagonia and Peak Oil: *Despite its impressive efforts towards sustainability, the company realizes that it will face increasing pressure in a post-Peak Oil economy. For instance, although Patagonia has made steps towards decreasing the distance products must travel, the company still depends primarily on conventional shipping methods that are heavily reliant on oil. The cost of shipping goods post-Peak Oil could significantly impact company profits if stronger local markets or alternative shipping methods are not established. In addition to having a global market, Patagonia has deep ties to the community of San Buenaventura, where it funds projects, provides employment, and serves as a model business. This connection to the local community, regional environmental issues, and the surrounding landscape will become more critical in a post-Peak Oil economy. Innovation and research are needed to reconfigure business models for post-Peak Oil conditions. Patagonia, along with other business leaders in San Buenaventura, can aid in the transition to a local and sustainable economy.*

Source: www.patagonia.com

The San Buenaventura Environmental Services department has achieved great success in waste diversion in recent years. The State of California recognized the city for reducing its waste stream by 66 percent (equal to 200,000 tons) in 2004. The city recycling program accepts newspapers, cardboard, metal containers, magazines, glass, and plastics #1-7. The city accepts yard waste, holds hazardous waste pick-ups every month, and reclaimed a high volume of motor oil through its Certified Oil Collection Centers (34,000 gallons were recorded in 2003). The city reports that less than 1 percent of residents take advantage of the hazardous waste collection program. Although there is not currently a compost program for household organic waste, the city does run educational programs to encourage household composting.

Although overall waste is increasing, many cities are taking a proactive approach to changing consumption and waste habits. Cities such as Oakland, Berkeley and San Francisco, California; and Portland, Oregon, are leading the way in eliminating non-renewable disposable products. In June 2006, Oakland, California joined at least one hundred other cities, including Portland and Berkeley in banning Styrofoam food containers. The polystyrene in Styrofoam is a major polluter of waterways, and responsible for 15 percent of the litter collected in storm drains (Zamora 2006). San Francisco became the first city in the country to ban plastic shopping bags from major supermarkets and chain pharmacies within six months to a year, saving the city approximately 180 million plastic bags – which take over 770,000 gallons of oil to manufacture, and end up in rivers and landfills (Goodyear 2007). As non-renewable and disposable products become less acceptable to society, opportunities emerge for innovative technologies to create products that are biodegradable, easily re-usable, and not resource-intensive.

Connecting City and Region

The city of San Buenaventura will play a significant role in the future economy of the region. Because of its location, it could serve as both a tourism hub and a freight center for the region. Because of higher transportation costs post-Peak Oil, residents within the county and surrounding region (including residents of Los Angeles) will elect to spend their vacation time closer to home. Because of its beaches, proximity to the Channel Islands, and access to open space, San Buenaventura has an opportunity to capitalize on this new economy and serve the entire region as a destination point. Beyond tourism, the region will need to investigate opportunities for local economic growth in sectors that support food processing and distribution, public transportation, re-use of waste, education, and public administration.

ECONOMY CONCLUSIONS

Opportunities and positive trends for creating a localized post-Peak Oil economy:

- Natural resources and existing industrial and transportation infrastructure provide opportunities for San Buenaventura to localize a food production and manufacturing economy
- Organizational and educational efforts can build upon a forward-thinking government and the sizable public administration job sector
- City and county incentives and programs have reduced overall waste stream significantly over last 10 years
- Waste can be converted into reusable products (and create job opportunities)

Constraints to creating a localized post-Peak Oil economy:

- People employed in the service sector will have to be move into production-oriented jobs
- The majority of major employers are concentrated in public administration, health care, and agricultural production, indicating a lack of diversity in employment options for the city
- Waste continues to increase within city and county per capita

COMMUNITY

GOAL: Localize the needs of residents while enhancing the beauty and identity of San Buenaventura

OBJECTIVES:

- Designate and design public areas, and improve quality of private spaces
- Provide flexible public spaces
- Preserve, protect, and make accessible San Buenaventura's places of beauty

San Buenaventura is a city designed around oil, and will therefore need to make major adjustments, post-Peak Oil, in the way people eat and acquire goods, how people move, where people live, and how people use energy. This will cause a disturbance in the existing neighborhood fabric of the city. The biggest challenge in transforming the city to a post-Peak Oil society is how to accomplish this while respecting the existing community's identity and preserving its attributes.

Community centers, farmers' markets, promenades and plazas, schools, churches, and parks are social nodes within any city where people gather to talk, share with, and learn from each other, building social capital in a community. Social capital is the "social, political, and economic networks and interactions that inspire trust and reciprocity among citizens" (Dannenburg 2003). These places also include the "third places" in a community, such as cafes and bars, where people gather to relax and mingle with neighbors and friends; shopping centers and grocery stores, where spontaneous interaction occurs on a regular basis; and historical sites, which contribute to an community's identity and sense of place. These places of social interaction will be vital to the formation of community and support groups and to exchanging knowledge and generating solutions for a post-Peak Oil world.

For the purposes of this project, these areas were mapped along with major employers (greater than 100 employees) and multi-family housing units as nodes of intense activity. In a post-Peak Oil world, these social nodes will be critical places in which people will need to work together towards creating a vibrant and viable society. The nodes of intense activity contain a diverse mix of uses, and a high number of highlighted sites (Figure 48). This broad-stroke method is used to locate areas that have existing infrastructure and community activity, where the city could emphasize new mixed-use density.

SOURCE: Ventura Hillsides Organization

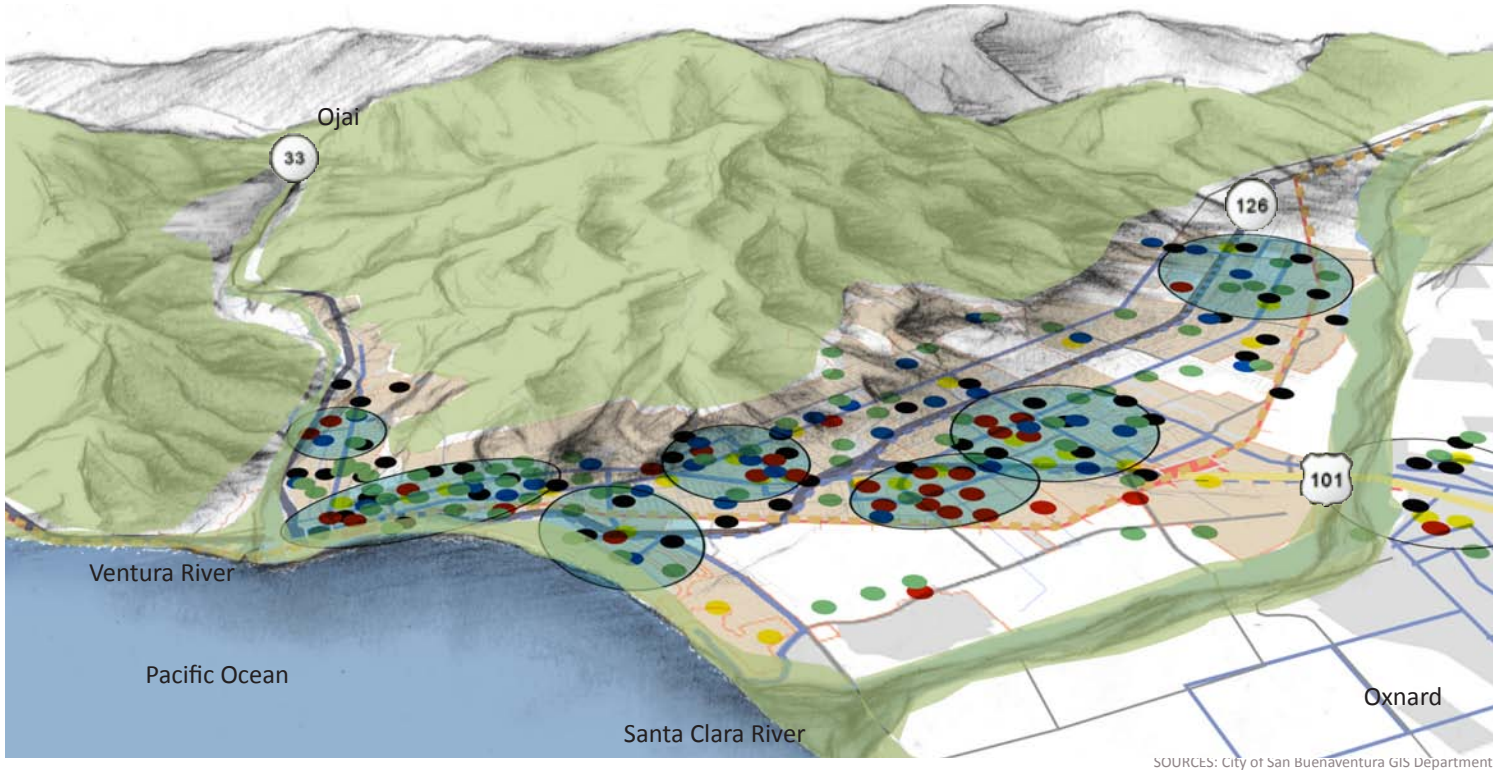
Yearly Ventura Hillsides Organization Festival

San Buenaventura's places of beauty include many of the character areas described in ***PART I: San Buenaventura's Character Areas*** (page 17). The barrancas, hillsides, beaches and rivers are as essential to the charm and identity of the city as its agricultural and industrial landscapes. The natural areas must be protected, enhanced, and made accessible where this does not interfere with the functioning of natural and human systems.

Connecting City and Region

Community extends beyond political boundaries, including those of San Buenaventura. Work, shared interests, and shared amenities and destinations (such as hospitals, waterfronts and music venues) lead to the development of relationships between residents of different cities and regions. Shared identity of the region connects people. The unique characteristics of individual cities and neighborhoods expand the cultural horizon of the region- as it provides diversity.

Post-Peak Oil, stronger community networks will form between neighbors. However, ties to surrounding cities and regions must be nourished in order for successful collaboration to take place. Collaborative efforts for the preservation of agricultural lands, habitat, and water resources will be necessary. The identity of individual neighborhoods and cities will become more depended



Community Events

Family-oriented
- *Kids Swap Meet*
- *Cottontail Day*
- *Cowboys, Hero's and Outlaws*

Community-oriented
- *Art Walks*
- *Mayor's Arts Walk*
- *Street Festivals*
- *Discover Ventura Days*
- *4th of July Street Fair*
- *Holiday Street Festival*
- *Olivas Adobe Music Under the Stars*

Environmentally-oriented
- *VCCool Earth Day/ Global Warming Fair*
- *Ventura Hillside Music Festival*

FIGURE 48
City Potential Development Areas

- Commercial Centers
- Cultural Features
- Learning Features
- Major Employers
- Multi-Family Housing
- Areas of Activities
- Areas of Scenic Beauty

upon to provide cultural diversity. Communities can seize the opportunity to emphasize their identity through the protection of watersheds and celebration of their agricultural past, by making their unique places of beauty accessible, and by developing local economies.

Marina Park is a third place and a scenic hangout spot

Lalo's Tacos is a popular meeting place on the Westside

COMMUNITY CONCLUSIONS

Opportunities and positive trends that will enable the community to adapt to post-Peak Oil society:

- Community councils established and active throughout the city
- Established areas exist throughout the city that foster identity: historic downtown, hillsides, coastline, agricultural land, rivers and more
- Established areas of intense activity exist in areas amenable to dense development

Constraints to a post-Peak Oil transformation:

- Current landscape is dependent on the automobile as the personal mode of transportation, thus decreasing social capital
- Many areas of intense activity located in areas best suited for other uses such as agriculture
- Private development in areas of scenic beauty blocks access

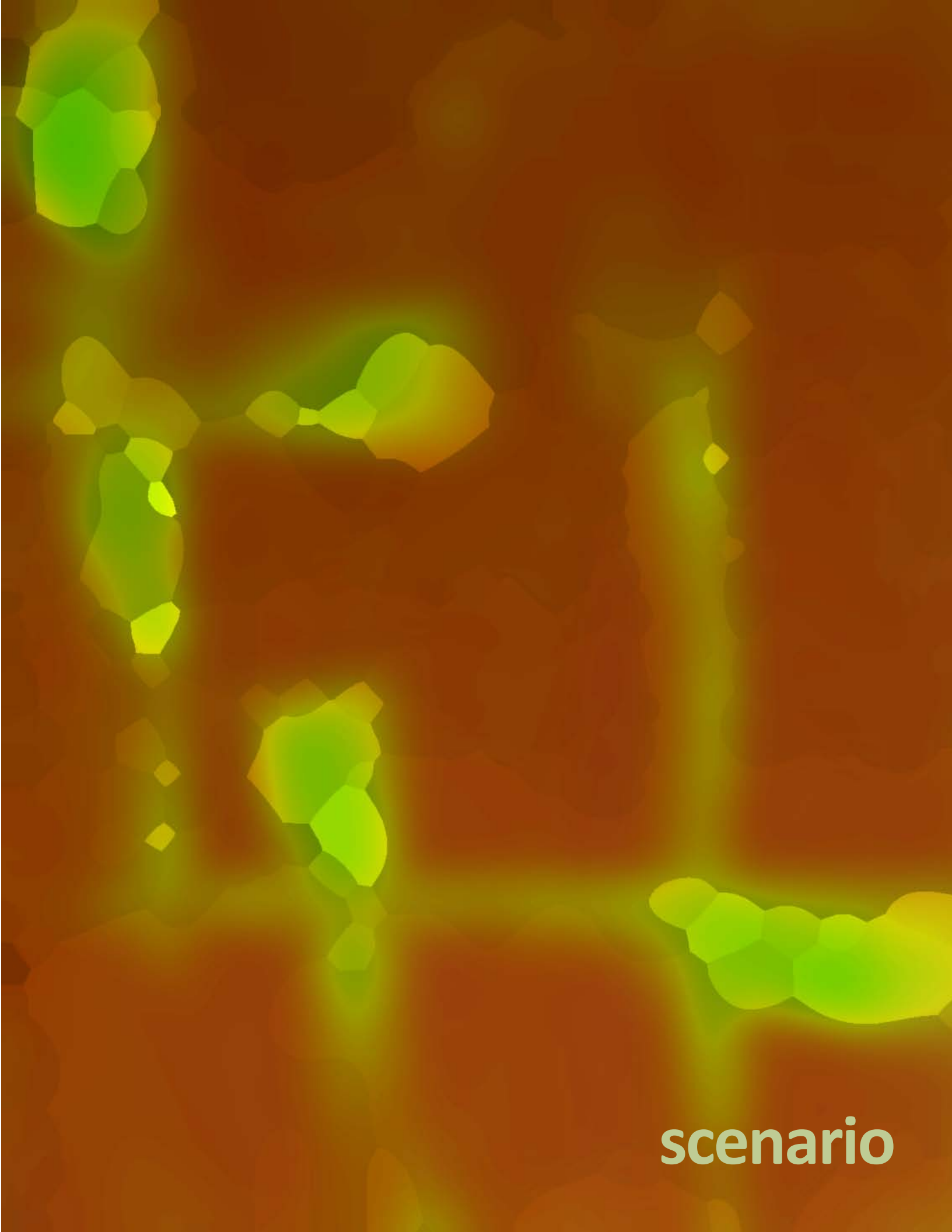
CURRENT SYSTEMS: CONCLUSION

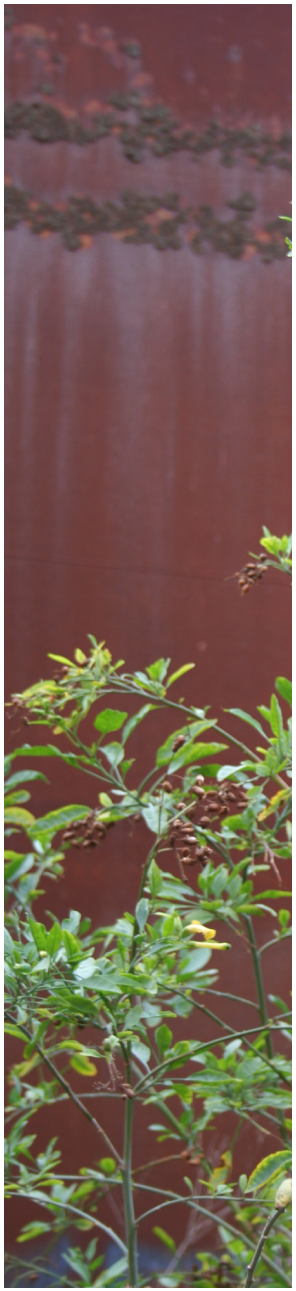
The built environment must function as one system – integrating systems for durability, resiliency, and efficiency. Multi-modal transit, local employment options, and sustainably designed mixed-use development are the key components of a thriving non-oil based society. In order to meet the needs of all demographics within the City of San Buenaventura, a mix of high paying jobs and affordable housing must be prioritized.

By aligning local water with local food production, energy needs and costs will decrease, and local agricultural employment will increase. By reducing water consumption and reallocating water usage, a thriving local and regional agricultural system will emerge to meet the needs of the projected population.

By transitioning from a sprawling, single-use, automobile-centric city to a dense, multi-functional, multi-modal city, the needs of the projected population and changing demographics will be met within the city. By reducing waste in these systems and overall, significant energy gains will be made, natural systems will be revitalized and protected, and employment opportunities will be created.

The following scenario will explore a probable future based on the analysis of current systems. The scenario reveals that localization of these systems is the key to adapting the city and region to a post-Peak Oil society.


scenario



ASSUMPTIONS

The purpose of this scenario is to imagine a likely future of how the City of San Buenaventura and the surrounding region would respond to Peak Oil, and how current critical systems would be impacted based on this response. As oil allocation for the City of San Buenaventura is unpredictable in a post-Peak Oil world, the following scenario is based on assumptions drawn from current trends and projections for the overall United States. In addition, historic and probable occurrences within the region, including drought and earthquakes, inform the scenario.

1. **Oil is assumed to peak in 2007, from which point its availability in the US will decrease by 5 percent per year.** 2007 was chosen as a conservative date from which to make future projections, as estimates of actual year range from 2005 to 2030. The 5 percent rate reflects estimates for global depletion and increased global demand (Figure 49).

2. **Rising oil prices and population increases will stress the following systems:**
   - ENERGY will become expensive and potentially unavailable
   - WATER will become expensive and potentially unable to sustain projected population needs
   - NATURAL SYSTEMS will continue to be impacted by development and pollution
   - FOOD will become expensive and potentially unavailable
   - MOBILITY will decrease, leaving sections of the population isolated
   - SHELTER will be potentially unable to meet the needs of the projected population and demographics
   - ECONOMIC sectors dependent upon oil, non-renewable resources, and mobility will become unstable
   - COMMUNITY will potentially fragment as mobility decreases and isolation increases

3. **Drought and earthquakes within the Southern California region are probable events by the year 2050.**
   - The *Los Angeles Times* reports that a recent study concluded that much of the Southwest region has been in a drought since 2000 and predicts a permanent drought by 2050 (Zarembo and Boxall 2007).
   - The Southern California Earthquake Center states that Southern California has an 85 percent chance of experiencing a magnitude 7.0 or greater earthquake by 2024 (SCEC 2001).

4. **Communities will need to localize in order to meet the demands of a post-Peak Oil world** (see ***PART I: Introduction: Localization and Peak Oil***).

5. **Quality of life is a key concern for Americans.** Studies and current trends indicate that Americans are expressing frustration with long commutes, an increased desire for healthy food and lifestyle options, and concern over the implications of oil-dependence – particularly pollution, environmental degradation, and international turmoil (Pooley 1997).

"PATH OF LEAST RESISTANCE" SCENARIO

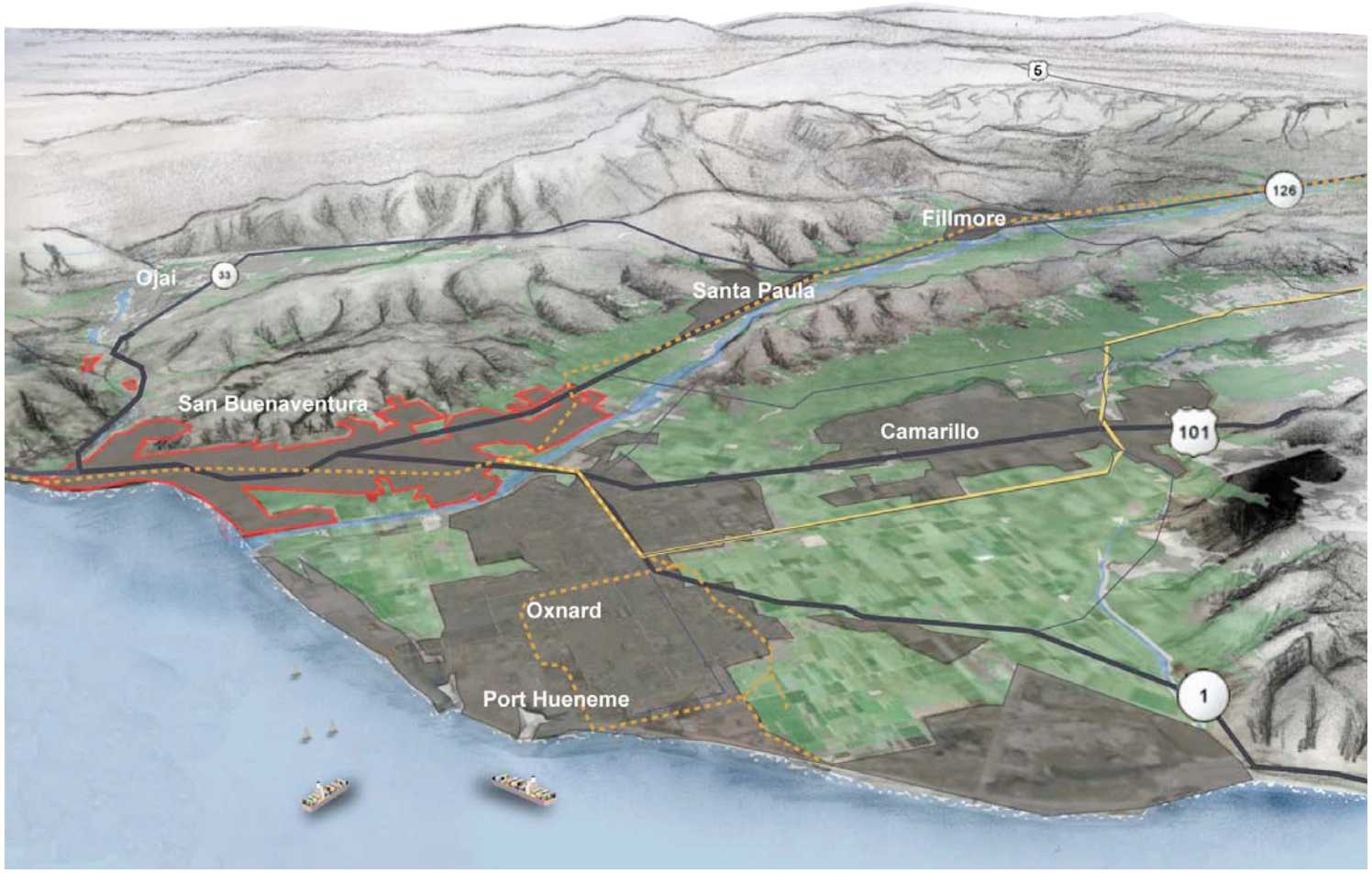


FIGURE 49
2007 Existing Conditions

2007

The county is using more water than can be sustainably supplied by the region. As a result, groundwater is overdrafted and the county relies on the California State Water Project for 25 percent of its water supply. Urban and agricultural pollution further degrade regional water supply, despite efforts by community groups and government agencies to curb pollution. Natural habitat is affected by the same sources of pollution, and must compete with human and agricultural land uses for space and resources. Ordinances are established to protect hillside habitat and agricultural lands, and both government and community groups are working to improve the health of regional watersheds.

Despite the bounty of this agricultural region, most of the residents' food supply is imported as a result of the region's focus on high value export crops and the lack of local infrastructure for processing and distribution. Nearly all the farmland in the county is dependent on pesticides and fertilizers, which are degrading local soil, water, and air quality.

Nearly all residents depend on personal automobiles to navigate the auto-centric landscape, and most reside in energy-intensive single-family homes. Unfortunately, the rapid development throughout the region is largely unconnected to the few existing public transit options.

The region's plans for decreasing oil supplies are focused on renewable energy generation. Although little infrastructure has been built, there is a sense of optimism about utilizing sun, ocean and wind to power the region.

2015

It is the year 2015. World oil production decreases to 66 percent of 2007 levels. However, wealth enables the United States to continue consuming at nearly 2007 levels. Investment continues in existing infrastructure for private automobile transportation, single-family housing, and conventional food systems.

Lack of funding leaves regional rail, boat, and pedestrian-oriented modes of transportation neglected. The majority of people still drive, but there is a significant trend towards the use of hybrid vehicles. While these vehicles get better gas mileage, the prioritization of oil for food production and water pumping further increases the cost of gas. Dense, mixed-use housing is in high demand, but since 2007, development has spread sporadically throughout Ventura County and into annexed agricultural land. A disconnect between housing, employment and public transit occurs across the region, increasing the jobs/housing imbalance and commute times.

The rising cost of oil is a burden on the agricultural system, as fertilizers, pesticides, transport, and the use of fuel-inefficient machines are more expensive. Still, the conventional agricultural system provides for the increasing demand for food in the region. Other agricultural land is transitioned to resource-intensive biofuel crops such as corn – now highly profitable due to the increased demand for alternative fuel. The intensive practices involved in these conventional food systems strains soil fertility and threatens natural habitats. Unfettered development along waterways also contributes to impacted habitats, as well as polluted rivers, streams and oceans; increased flood potential along rivers; reduced clean water supply; and declining fish stocks.

The greatest change felt by residents of Ventura County and the City of San Buenaventura is the cost of living: the price of basic goods, food, water, transportation, and housing is noticeably increasing. The steady increase in cost of living since 2007 is fueling a shift in perception regarding the realities of Peak Oil and future outlooks – similar to what occurred in the 1970s, when the United States' oil supply peaked and caused nationwide stagflation.

SUMMARY (Figures 49 and 50):

- Lack of infrastructure for multi-modal transportation stresses systems and results in increased traffic and commutes
- Lack of investment in dense, mixed-use developments near transit and employment increases jobs/housing imbalance
- Continued dependence on conventional agriculture impacts health of natural systems
- Upstream development stresses waterways and natural systems
- Continued depletion of natural resources and consumption of non-renewable energies

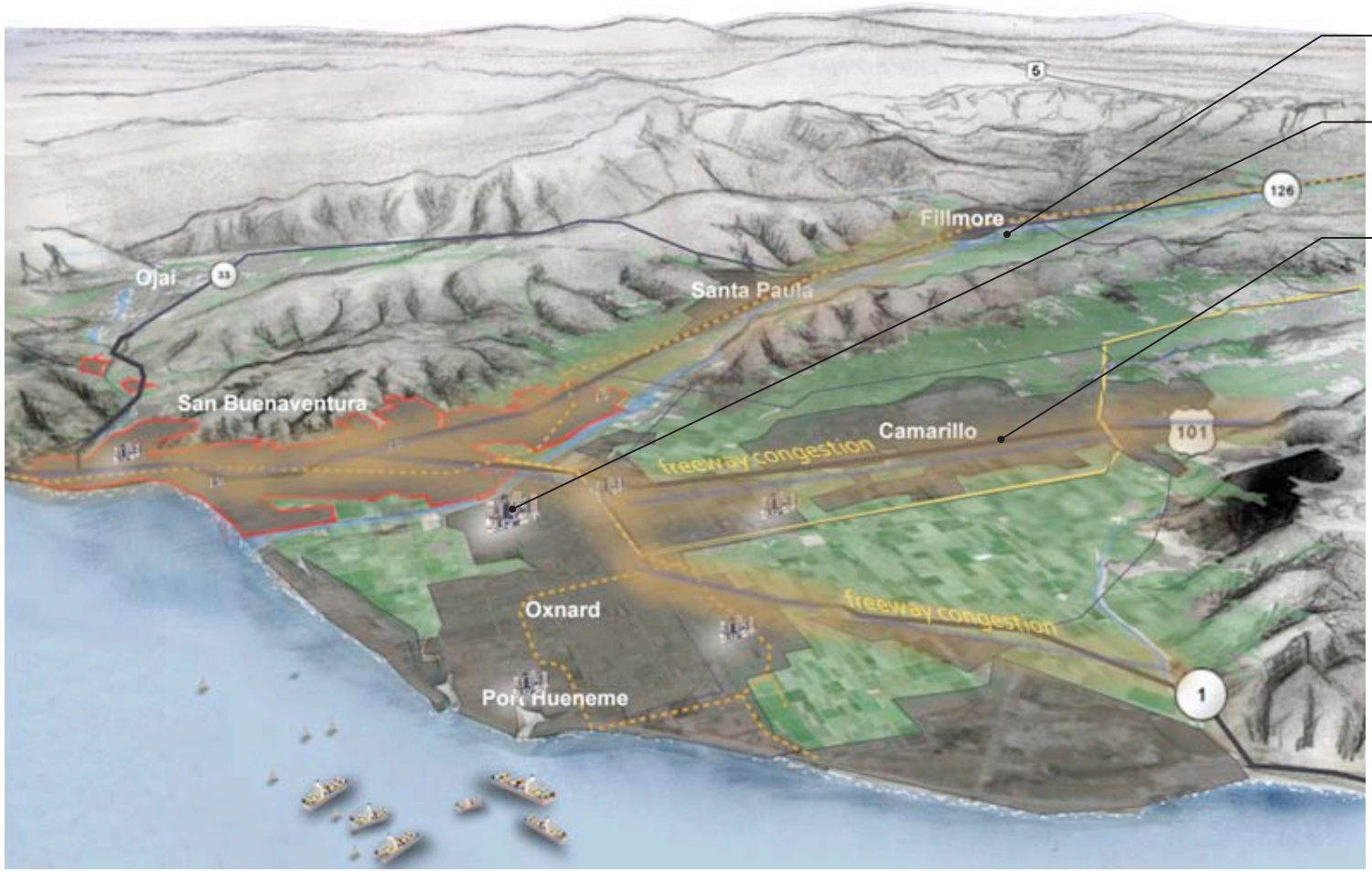


FIGURE 50
Year 2015

2025

In 2025, oil prices are significantly higher, as oil production falls to 44 percent of 2007 levels. Residents can no longer afford to maintain oil-consumptive lifestyles, and make adjustments and sacrifices that enable them to afford the basic cost of living, impacting the quality of life for most residents. Because of the forward-thinking planning of such organizations as the Regional Energy Alliance and Community Environmental Council, alternative energies fill in some of the gap left by the reduced availability of oil-based energy. However, alternative energies, including solar and wind power and liquid natural gas, prove to be less adaptable than oil, and cannot keep up with energy demands brought on by the population increase and the inefficient design of most buildings. Reluctantly, the region turns towards coal, natural gas, and nuclear energy in order to maintain consumption levels. This has a detrimental effect on air quality, pollutes the local fisheries, and increases the potential for a natural gas spill.

Existing housing and transportation infrastructure are overburdened due to the growing population, while new infrastructure is slow to be built due to rising material costs. New building materials are scarce and expensive, while the majority of construction and demolition waste is still deposited in landfills because it is not easily reused or recycled. Transportation systems are increasingly overburdened and inefficient due to a lack of intra-regional connectivity. Private auto transit is still used for short-distance trips, but more people use bikes and walk now due to the high cost of owning a car. A lack of safe pathways and walkable streets results in injuries and stress for bicyclists and pedestrians. The majority of housing remains energy-intensive and expensive to maintain, resulting in the dysfunction, deterioration, and finally, the abandonment of many suburban homes and neighborhood tracts.

2025 marks the fifth year of drought conditions for region, not uncommon for Southern California. Competition for imported water has led to prohibitive costs, and thus local water sources are becoming heavily stressed. Continued saltwater intrusion due to lowered groundwater tables further limits freshwater availability. Food production has become less efficient and more expensive due to the water shortage, and to the depleted soil fertility which has resulted from years of conventional farming practices (which now poses a challenge to farmers attempting to grow organically). Because land is scarce throughout the region, this drought brings about a subdivision of some of the few remaining inner-city agricultural lands into expensive, high-rise residential housing developments similar to those found throughout the region. Because of continued industrial agriculture and unsustainable development, most of the waterways, reservoirs, and what little groundwater remains are polluted, requiring the city and county to enforce strict water quotas and penalties.

Local fisheries struggle due to polluted waterways and a lack of infrastructure. Few residents can afford the cost of increasingly rare imported fish. Agricultural production is inefficient and expensive due to the water shortage, and much of the available derelict land within the city is claimed for makeshift urban agricultural plots. As a result of the increased urban agriculture and ongoing drought, the city landscape becomes a checkerboard of struggling produce gardens and dry, dusty lots.

SUMMARY (Figure 51):

- Auto-based infrastructure does not facilitate mobility for the majority of the region, and new infrastructure for public transit is costly
- Lack of sustainable building design and practices significantly increases energy and construction costs, as well as continues to impact natural systems and deplete natural resources
- Lack of intensive water-conservation programs compounds impact of drought
- Lack of planning for urban agriculture and sustainable fisheries makes fresh food unaffordable for many residents
- Pollution from development, industrial agriculture, transportation, and alternative energy production impacts waterways and natural habitats

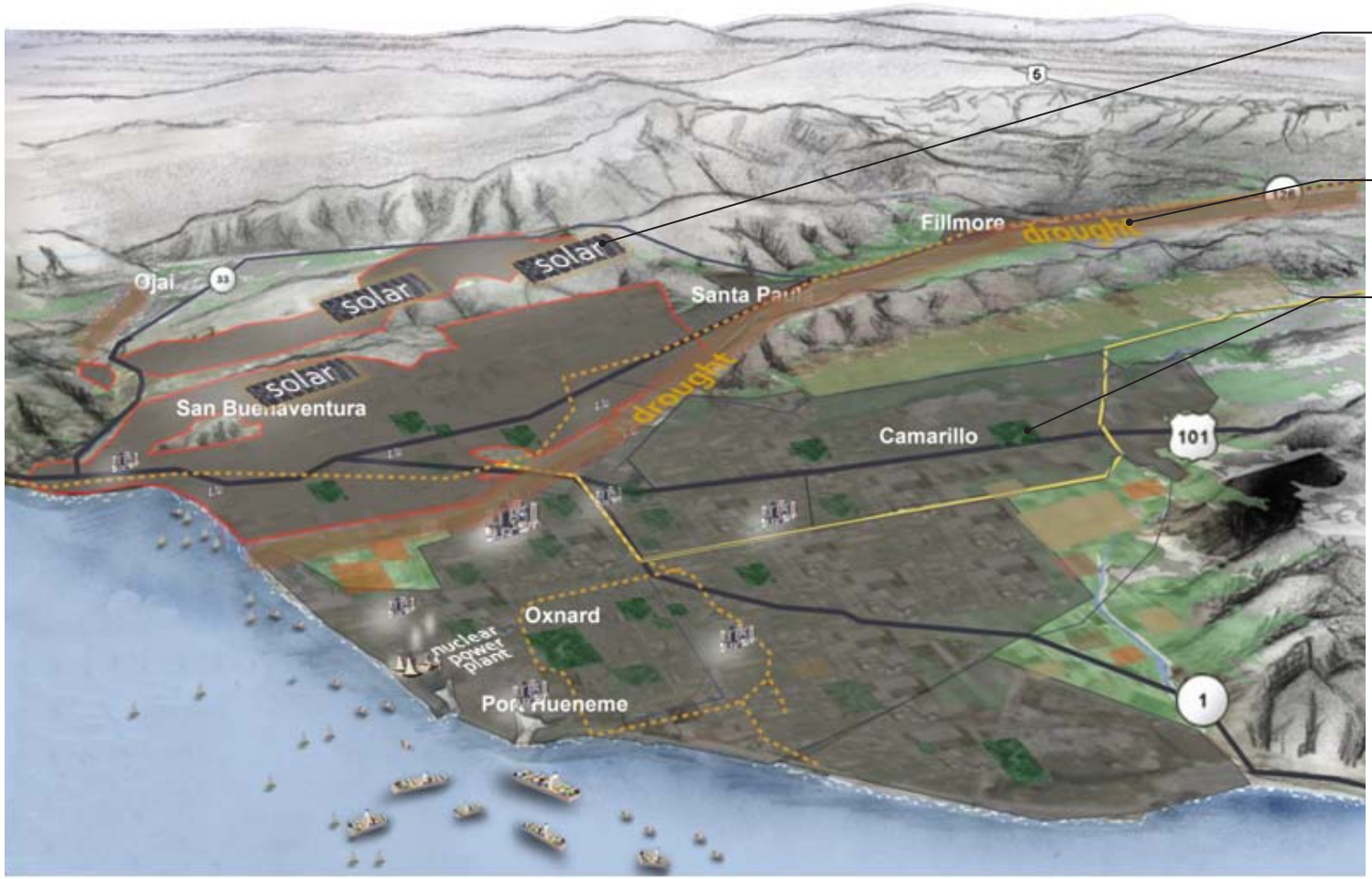


FIGURE 51
Year 2025

2050

It is 2050. Oil production falls to 11 percent of 2007 levels, and prices skyrocket. Compared to many places in the nation, the Ventura region's rich resource base allows them to adapt many of their basic needs to post-Peak Oil conditions. However, because of urbanization and the 20-year drought, the water supply within the county has dropped significantly. The City of San Buenaventura is now importing water from the State Water Project at an extremely high cost, as demand far exceeds city supply.

Renewable energies are found throughout the city but still cannot meet the demand necessary to keep up with consumption patterns. The solar panels that cover rooftops across the region only provide for basic residential energy needs, and do little to contribute to regional energy demands.

Regional agricultural production is better aligned with regional needs, but the cost of labor-intensive food production forces residents to spend 30-50 percent of their income on food. Intensive agriculture within the city becomes essential in order to compensate for these high costs. Agricultural workers are in demand, but due to a long history of unaffordable housing and lack of public transit, the region has a deficit of laborers. A lack of protein in the diet pressures what few local fisheries remain, but polluted and depleted waterways provide little opportunity for expanding the fishing industry in the region.

The high cost of living leads to changes in lifestyle that are not easily accommodated by existing infrastructure. For example, because of the deficit of dense, mixed-use communities located near employment and public transit, the suburbs of the auto era are still housing the majority of residents, and people expend considerable time and money commuting to work and running errands. The high-rise developments built in the previous decades are becoming run-down due to their initial hasty construction, and because of subsequent disinvestment due to high maintenance costs. Because of their isolation and lack of community amenities, some neighborhood tracts are abandoned; others become overcrowded due to the shortage of affordable housing in the region.

The great inefficiency of the urban landscape, including sprawling development and resource-intensive agriculture, degrades the important landscapes that once defined Ventura. Hillside and agricultural development leads to channelized rivers, and the ocean is polluted and obstructed by development and the 101 freeway. The great age of spending on transportation infrastructure in non-metropolitan areas ended in 2035. Bicyclists and pedestrians make use of oversized and under-maintained streets, avoiding potholes where possible. Portions of the freeway, unusable by vehicles due to disinvestment, are populated with squatters, gangs, and criminals.

SUMMARY (Figure 52):

- The city is not prepared for the shift to a labor-intensive economy
- Local fisheries are collapsing and unable to meet the nutritional needs of the population
- Conventional land use and development patterns fail to meet population needs
- Communities are dislocated and neighborhoods collapse due to isolation and lack of planning
- Natural systems are dysfunctional and collapsing due to pollution, resource depletion, and encroachment

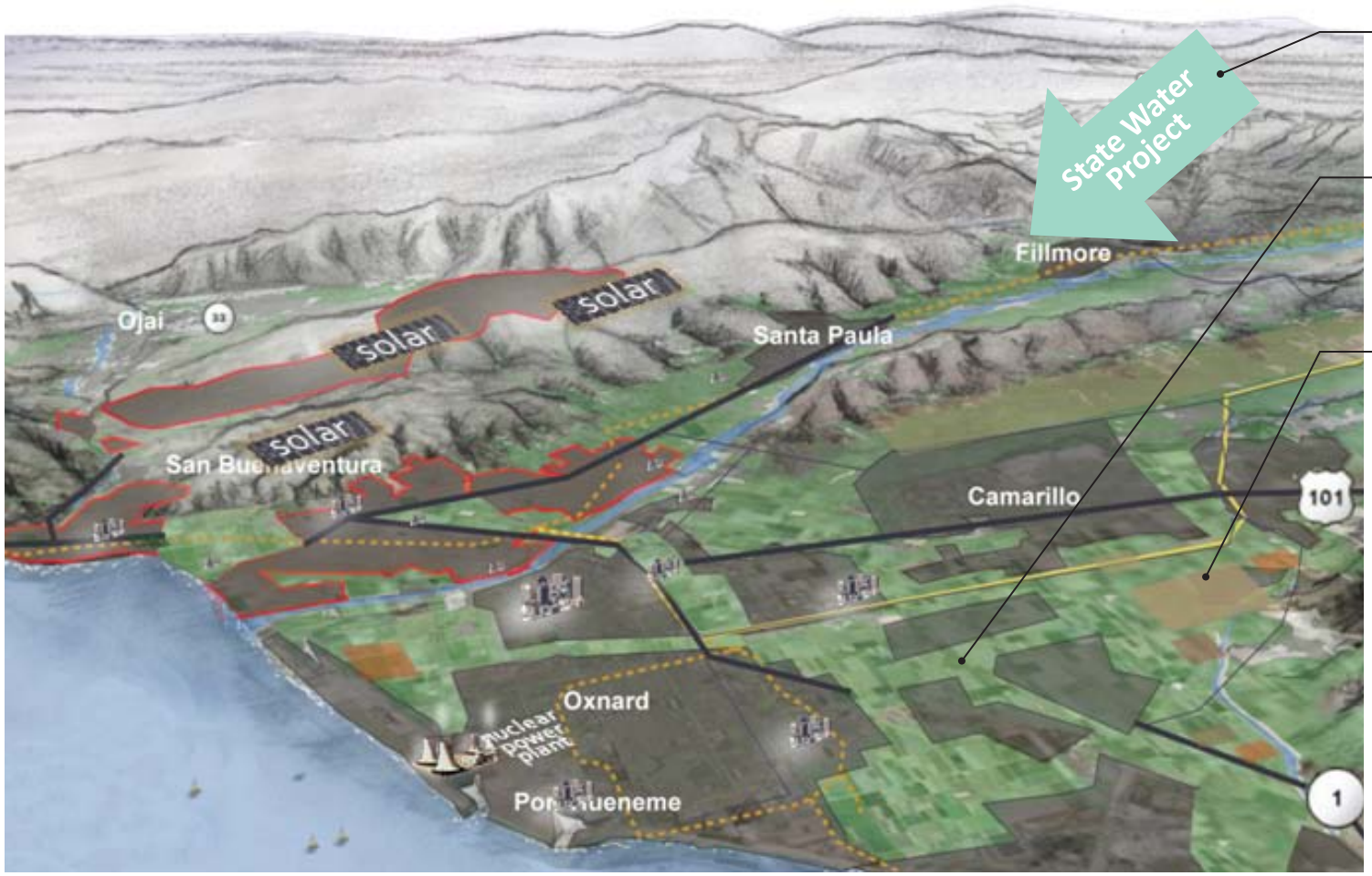
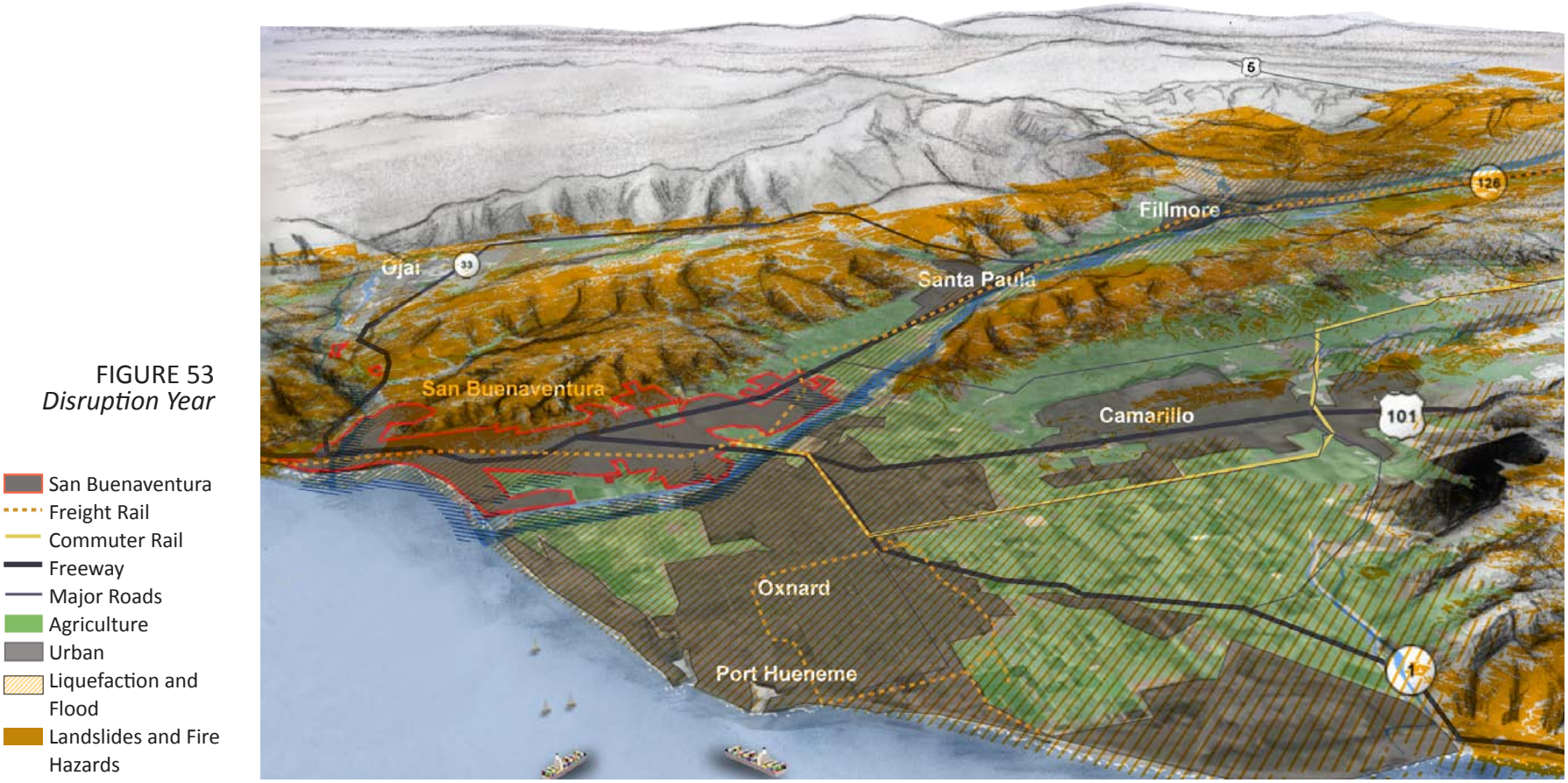


FIGURE 52
Year 2050

FIGURE 53
Disruption Year



Intensified impacts from natural hazards are an indirect threat of Peak Oil that has the potential to disrupt life in the region. With fault lines running through the region and extensive flood and liquefaction zones, it is probable that natural disasters will occur in the future, as they have in the past. Liquefaction is a risk in post-Peak Oil San Buenaventura, as an earthquake could destroy or damage entire sections of the city. In the event of a natural disaster in the scenario portrayed above, recovery and rebuilding are likely to be slow and expensive – if not impossible – due to the lack of oil resources. The later in the scenario the event occurs, the greater the damage and dysfunction would be, as the greater the lack of oil and other resources would be. Much of the development in the region and the City of San Buenaventura would no longer be functional; the remaining, safe infrastructure would be unable to accommodate the misplaced population.

SUMMARY (Figure 53):

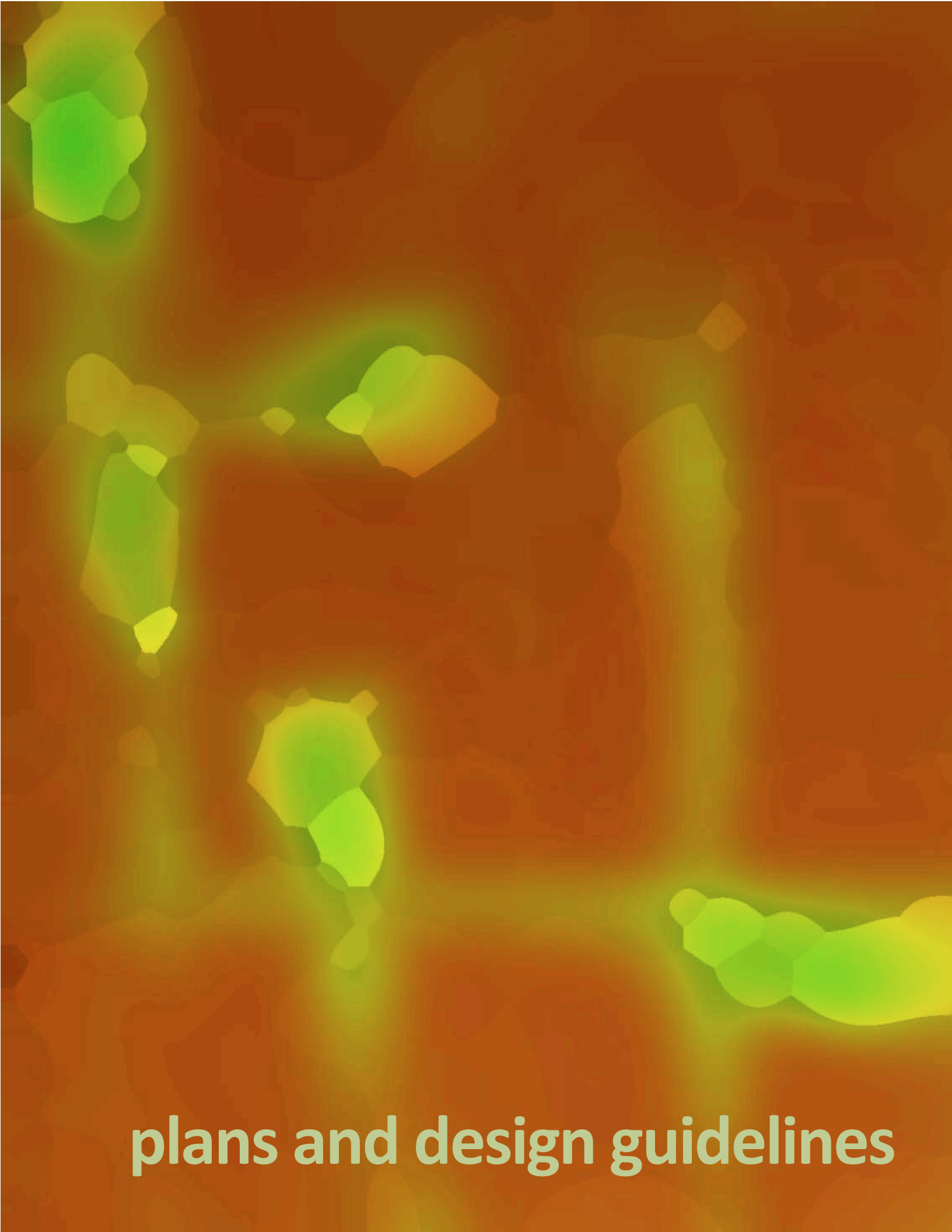
- Economic and infrastructural impacts of flood, earthquake and liquefaction will be magnified post-Peak Oil scenario

CONCLUSION

The probable scenario portrayed in this sectionreveals the potential for Peak Oil to severely impact San Buenaventura and cities across the region. It also brings to light opportunities that could be taken to avoid a head-on collision with Peak Oil. The lack of regional cooperation, resiliency in the face of change, sustainable and timely planning, and localized community emerge as critical factors in the degeneration of a post-Peak Oil society. The factors inform the design and planning strategies and recommendations in the following section.

PART three

PLANS AND DESIGN GUIDELINES
EVALUATION



plans and design guidelines

PLANS AND DESIGN OVERVIEW

The Path of Least Resistance scenario reveals four strategies for creating an alternative future: *localize, act now, adapt, and collaborate.* The following conceptual 2050 vision for design and planning are derived from these strategies. By implementing these strategies, the City of San Buenaventura can buffer itself from the negative impacts of Peak Oil, and serve as a model for other cities for reducing energy dependence and resource consumption while enhancing quality of life. Target dates of 2015, 2025, and 2050 are used to demonstrate this transformation.

OVERARCHING STRATEGIES

LOCALIZE. Localization is the overarching critical factor in reaching the goal of reducing energy and resource consumption while enhancing quality of life. By building a greater connection between people and place, an increased respect and understanding of the land and its systems is cultivated. The following strategies are necessary in order to localize:

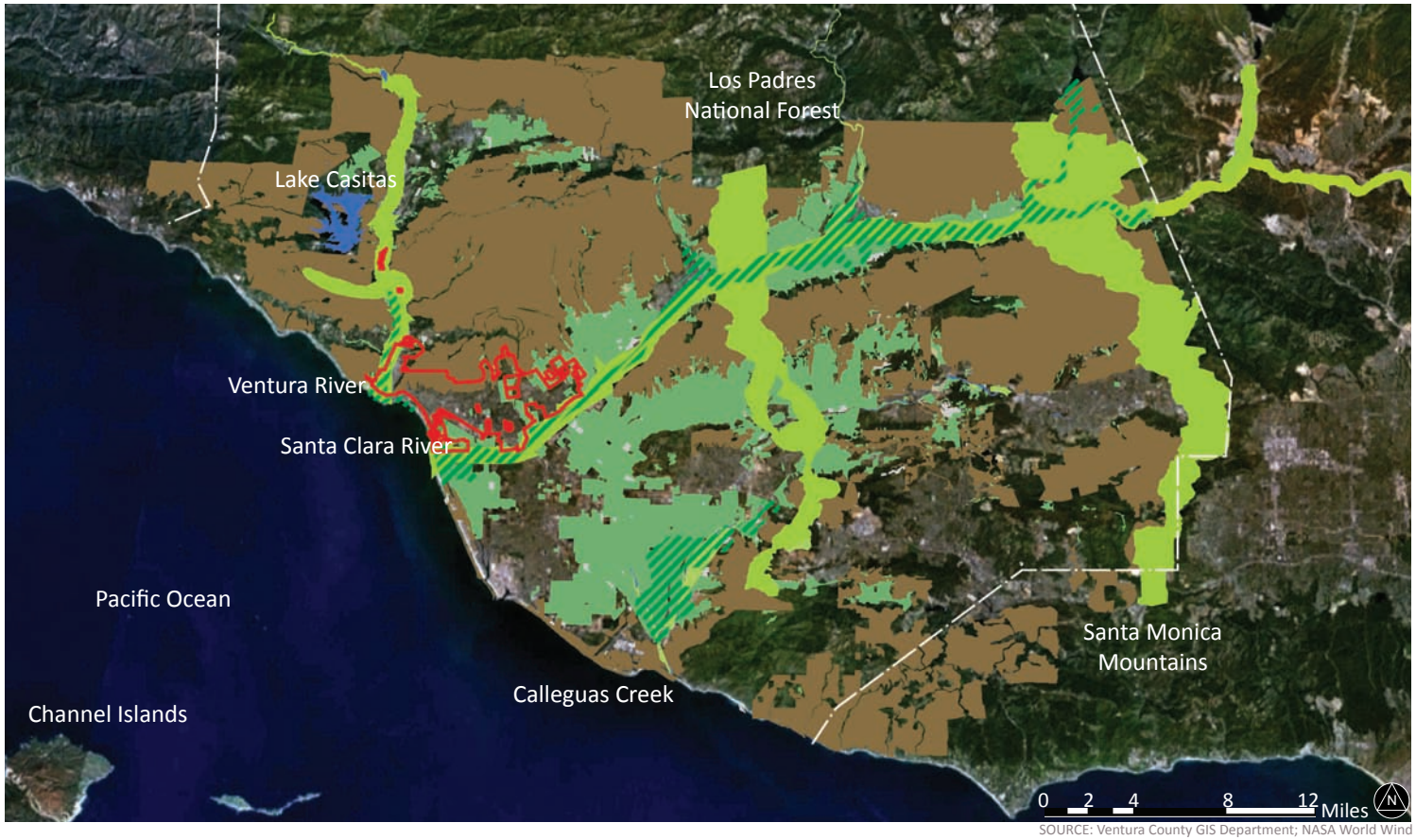
- **Act Now.** Begin research, experiments, and education programs that will facilitate the post-Peak Oil shift in society and its critical support systems.
- **Adapt.** Transition existing infrastructure, land use, and lifestyles in order to meet the needs of future generations. Numerous possibilities exist for the conversion of misallocated and underutilized lands, buildings, and roads to uses that fit the needs of a post-Peak Oil community. By inviting transformation and establishing flexible spaces, policies, and systems, communities will be equipped to adapt to changing conditions.
- **Collaborate**. Connect governing bodies and citizen groups throughout the region in order to protect the wealth of resources, including water, agricultural land, transportation systems, and human resources in order to thrive and prosper post-Peak Oil.

REGIONAL VISION: COLLABORATION

In a post-Peak Oil world, it will become even more important to conserve and protect existing resources throughout the City of San Buenaventura and region. This cannot be achieved without putting forth an organized and cohesive effort by all communities within the region. The regional plan envisions communities throughout the region shrinking their urban footprints; respecting the area's abundant natural resources, waterways, fisheries, and open space; bringing agriculture into the city and expanding upon productive land adjacent to the city; and working with surrounding communities to decrease automobile transportation by linking cities throughout the region with public transportation networks, affordable housing, and quality employment. Localization cannot occur if cities within the region do not work together to create and commit to a common vision.

GUIDELINES:

- ***Establish Councils*** – Develop councils to monitor and organize efforts to preserve resources and prepare the city for a post-Peak Oil situation. Many efforts are already being established by local governments, community organizations, and entrepreneurs, but these efforts can be made more effective and efficient if organized at the regional scale. Councils should be designated for all of the major systems, including agriculture, water, transportation, shelter, natural landscapes, ocean resources, and the local economy.
- ***Monitor Resources*** – Departments within cities are typically required to monitor the resources with which they are affiliated. For example, water departments monitor quality, supply and demand, and the consumption of different users including the residential, commercial, and agricultural sectors. These departments work within a monetary budget, but not an energy budget. Resources need to be monitored not only to assure reliable distribution for human use, but for energy consumption. Systems such as housing and transportation also need to be monitored for their energy consumption. Once a



SOURCE: Ventura County GIS Department; NASA World Wind

Protection of regional resources, including groundwater recharge areas, rivers, agricultural land, and open space is critical to the region's ability to support human and wildlife. Collaboration is necessary to protect, enhance, and share these essential resources.

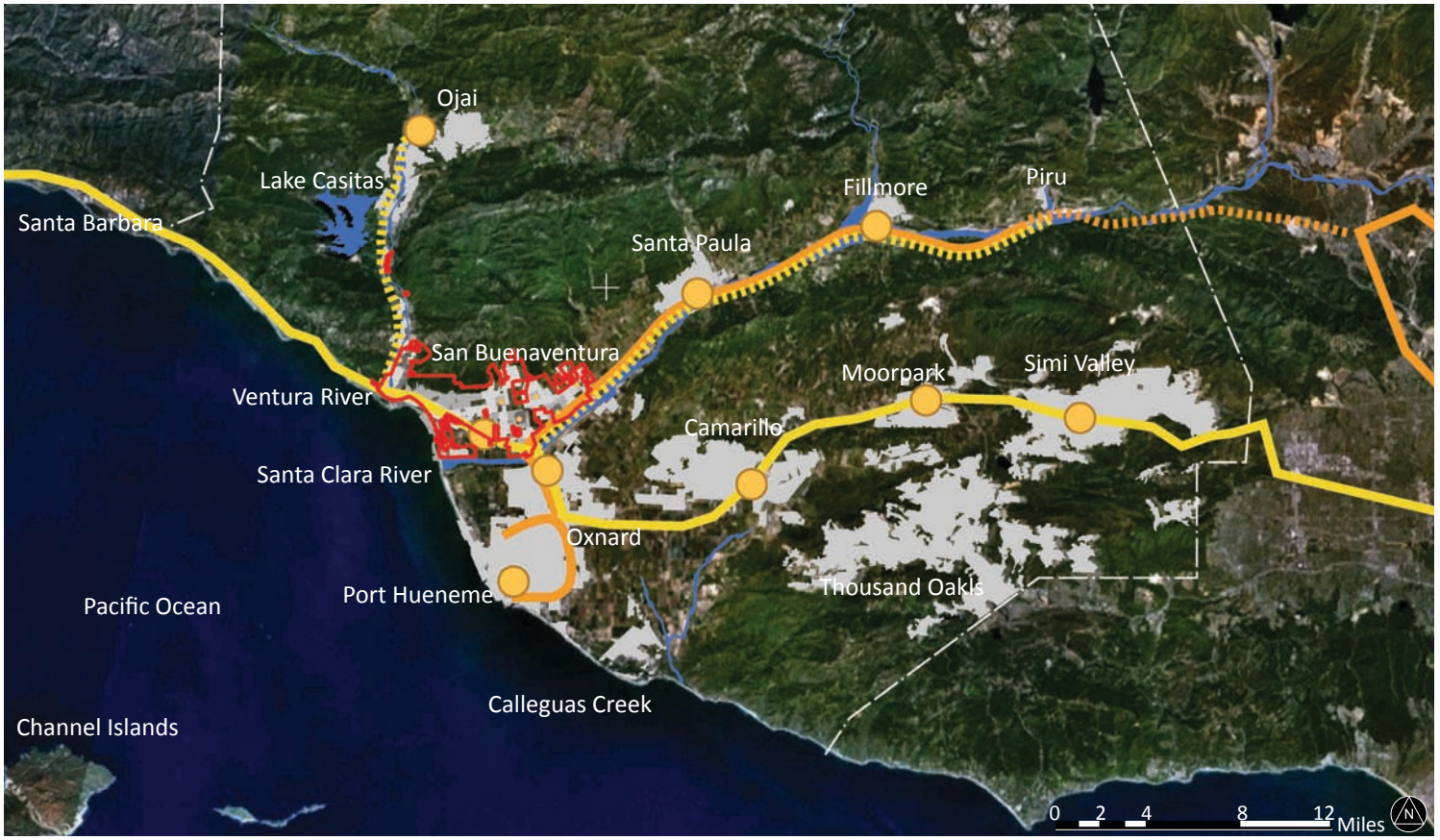
FIGURE 54
Regional Preservation Areas

baseline of this information is determined, goals should be set to reduce energy losses in the system. Another consideration for cities is to promote monitoring of resource and energy use at the home and neighborhood scales.

- ***Protect Critical Resources*** – In order to localize on the regional scale cities are going to have to collaborate with one another to protect critical areas, establish regional connections, and decrease developed footprint. River beds, flood zones, are important areas for hydrologic function and natural habitat; these areas are unsuitable for development. The county has the potential to eliminate their dependence on imported water if they maintain healthy surface and groundwater sources, implement conservation measures for agriculture and urban users, and utilize roof and greywater. Additional areas to be protected include designated wildlife corridors and habitat areas, estuaries, and ocean resources, which provide valuable ecosystem services. Lastly, agricultural land needs to be protected from development pressures, as local food production is critical for localization. Combined, these critical areas for water, food, habitat

Housing, jobs, and transportation systems are currently intertwined and will continue to be so into the future. San Buenaventura needs to collaborate with nearby cities such as Oxnard, Camarillo and Santa Paula in order to identify and coordinate housing and employment opportunities on a regional basis

FIGURE 55
Regional Development



SOURCE: Ventura County GIS Department; NASA World Wind

form a boundary for development. As many of these areas are already protected through city and regional ordinances, planning should focus on strengthening and expanding existing preservation efforts (Figure 54).

- ***Concentrate Development*** – The regional vision not only prevents development footprint from expanding, but it recommends that existing footprints condense- creating more opportunities for open space, and providing the critical density needed for public transportation to be efficient (Figure 55).
- ***Establish Infrastructure*** – As rail transportation, for both commuters and freight, will be highly depended upon post-Peak Oil, regional agencies must collaborate to expand existing infrastructure for rail. This includes connecting existing rail lines to Piru, and links to major ports (Figure 55). Infrastructure for wind and wave energy will also need to be established on a regional scale, once research confirms the suitability of these energy sources.

2050 VISION FOR SAN BUENAVENTURA

The Concept

Localization in the city includes condensing the built footprint and optimization of urban resources. The conceptual design for the City of San Buenaventura that fulfills these goals is the development of community districts around proposed transportation stops. Density centers around transportation stops, and decreases as distance from the stops lengthens. This concept can be described as a bulls-eye in which the concentric rings each denote a different density. The distance between each ring is based on walkable distances of ¼, ½, and ¾ of a mile (Calthorpe 1997). The dense zones located along the transit stop are referred to as nodes.

A community designed with dense nodes has many benefits. The compact nature of nodes minimizes the development footprint, concentrates development, provides increased access to expansive open space, cultivates a better understanding of the local landscape, and integrates the city with the region's natural patterns. The nodes house a majority of the city's residents within walking distance of public transportation which connects the community with the surrounding city and region. Nodes create densities that enable amenities such as markets, hospitals, schools, jobs, and diverse housing choices to reside within a short distance of each other, providing for the daily needs of residents. This greatly reduces the amount of energy needed for transportation, while increasing the amount of land that can be used for local food production, groundwater recharge, and habitat restoration.

Assumptions based on post-Peak Oil predictions indicate that people will migrate towards transportation hubs as personal automobiles are no longer an affordable mode of transportation. As suburban areas become isolated and less of an ideal place to live, land that was once developed can be restored to habitat or become farmland used to support community districts. During this transformation, the urban fabric will change dramatically (see ***Transforming the Urban Grid*** on page 178).

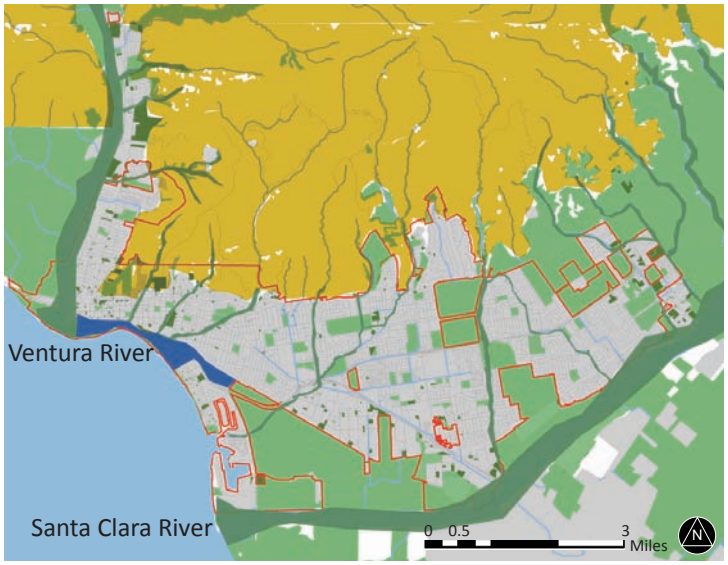
Zones

The criteria for the city plan is based on areas that are to be preserved, hazard zones, existing concentrations of intense activity, and existing infrastructure. The designated zones for the post-Peak Oil transformation of the City of San Buenaventura are: *Concentrate*, *Preserve*, and *Release.* These three zones provide a framework for prioritizing the investment of city resources and for transitioning land uses to meet new demands (Figure 60).

Preserve

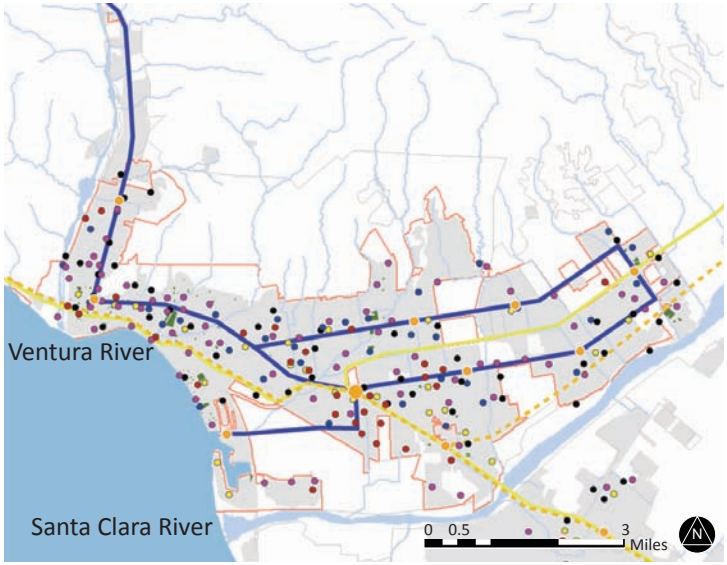
The *Preserve* zone includes the natural habitat, barrancas, agricultural land, and civic beachfront (Figure 56). The goal for this zone is to maintain existing density while preserving or enhancing scenic beauty, character and function. For the civic beachfront, this means residential and commercial structures are maintained with minor retrofits to enhance tourism, trade, and fishing (i.e. harbor infrastructure). Existing agricultural land is preserved here, regardless of parcel size, although farming practices and crop diversity are enhanced. Public and private owners orient their production to meet local demand. Large agricultural parcels not connected to urban areas employ greater water-conserving farm practices, as little to no supplemental water from urban catchment is available. Additional housing required to compensate for higher labor needs is clustered around existing structures. Local markets are prioritized over national chains. Natural habitats, including barrancas and hillsides, are preserved and expanded where possible in order to restore natural processes (including groundwater recharge). Vacant lots with the potential for remediation are precluded from development. These areas are enhanced with habitat and/or crop production.

FIGURE 56
Preserve Zones



It is critical to avoid development in floodplains and habitat areas (along barrancas, rivers and hillsides), agricultural land, and the civic beachfront to maintain scenic beauty, enahance character and function, and preserve habitat value.

FIGURE 57
Areas of Intense Activities



New transportation routes and transit hubs are based on existing commercial corridors and areas of intense activity.

Concentrate

The *Concentrate* zone (in purple) represents the pulse of dense, mixed-use development. These zones are in areas of intense activity, in close proximity to transit hubs, and lie outside of hazard zones. This zone is characterized by concentrations of high-density (five to six storey) and medium-density (two to four storey) developments. It is in this zone that city resources are concentrated, as dense developments require the least energy to maintain while providing a high quality of life for its residents. By defining this zone early on and providing incentives for developers, these zones become vibrant, walkable communities. By 2050, all Concentrate zones are car-free, allowing access only to emergency and transport vehicles and carts. Food production in these dense urban areas includes roof gardens, community gardens, intensive urban agriculture, and commercial farming operations conducted on leased public land. Water for these gardens and farms is provided by greywater, roof catchment, and city water supply.

The *Concentrate* zones form the 11 major community nodes of the city. Each node maintains a unique identity that stems from its cultural and physical context. Critical systems, including water, food, shelter, mobility, energy, economy and community, are concentrated and localized where possible. The nodes are also connected by public transportation. The location of the public transportation routes are based on existing commercial corridors throughout the city along Ventura Avenue, Main Street, Telephone Road, and Telegraph Road. Transportation hubs are located near areas of intense activity, taking into account existing housing density, schools, major employers, commercial activity, public space and parks, and cultural centers (Figure 57). The size of each node is derived using ¼-mile for high density and ½-mile for medium density. This allows the greatest number of community members within walking distance to public transportation. Finally, by using the existing grid, the conceptual rings take shape by adapting to the existing form of the city (Figure 58).

Release

The *Release* zone (in lavender) includes all built areas that are not within the *Concentrate* or *Preserve* zones. The *Release* zone is dominated by low-density developments which are located in hazard zones. Areas designated for new and concentrated development are located outside landslides, fire hazards, liquefaction and flood zones (Figure 59). Peak Oil will render these neighborhoods expensive to maintain both for the city (roads and utilities) and residents (transportation, building maintenance, and private open space). The goal for these areas is to reduce density and return land to open space, either in the form of agriculture or habitat. This involves a slow transformation driven by rising prices, changing preferences, and proactive policy. By 2050, many of these areas develop minor community nodes and function like the small rural California towns of 2007. Much of the land in the *Release* zone comes under public domain, although it may be leased for commercial agricultural use. The process of releasing begins with a natural exodus to denser areas, followed by decreased city maintenance of roads and infrastructure. This enables the continued maintenance of dense urban areas. Food production in these low-density areas includes private gardens, shared gardens, and agricultural corridors similar to those found in dense urban areas. Urban catchment water supplements the need for city and groundwater sources.

The final city plan concept that evolves from San Buenaventura's landscape and the need to localize is the development of dense nodes which maintain a small town feel yet decrease energy demand and build community (Figure 60).

- Concentrate development footprint and increases the amount of land that can be used for local food production, groundwater recharge, and expansion of natural habitats
- Create density that enables amenities to be located within short distance of residents
- Provide critical mass needed for public transportation

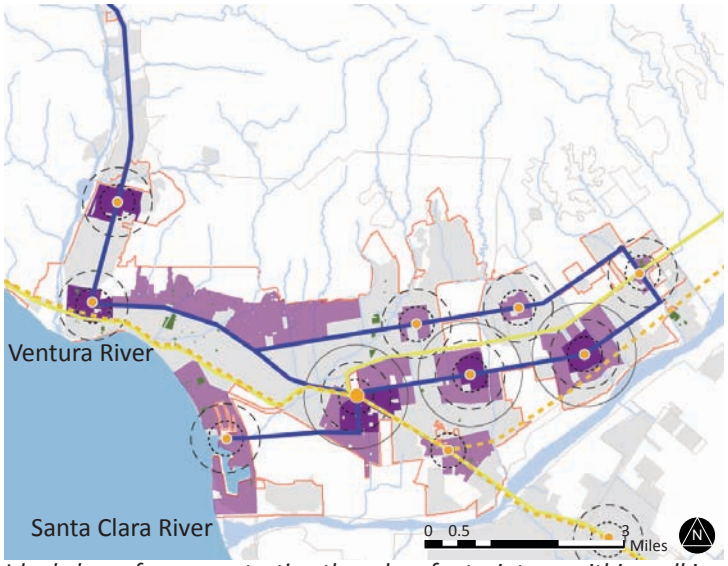


FIGURE 58
Concentrate Zones

Ideal places for concentrating the urban footprint are within walking distance of transit nodes shown as concentric rings of ¼, ½, and ¾ mile. Density of development is based on these concentric rings and the existing grid. The medium and high density areas comprise the Concentrate zone — shown in dark purple.

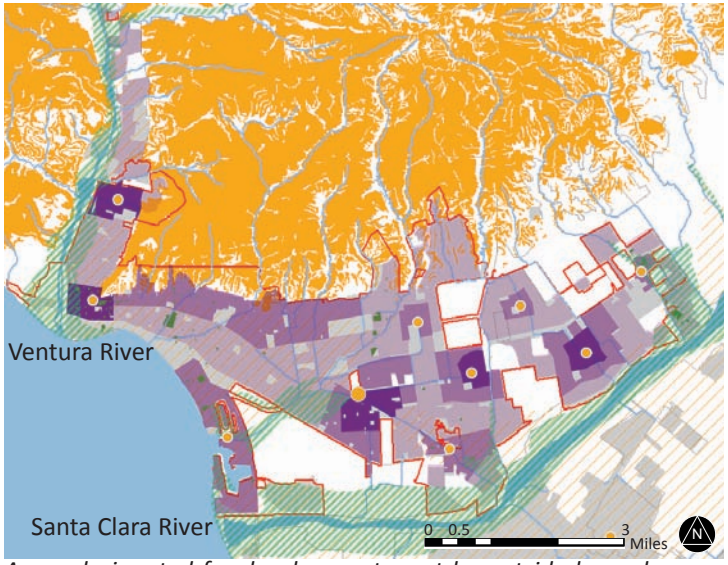
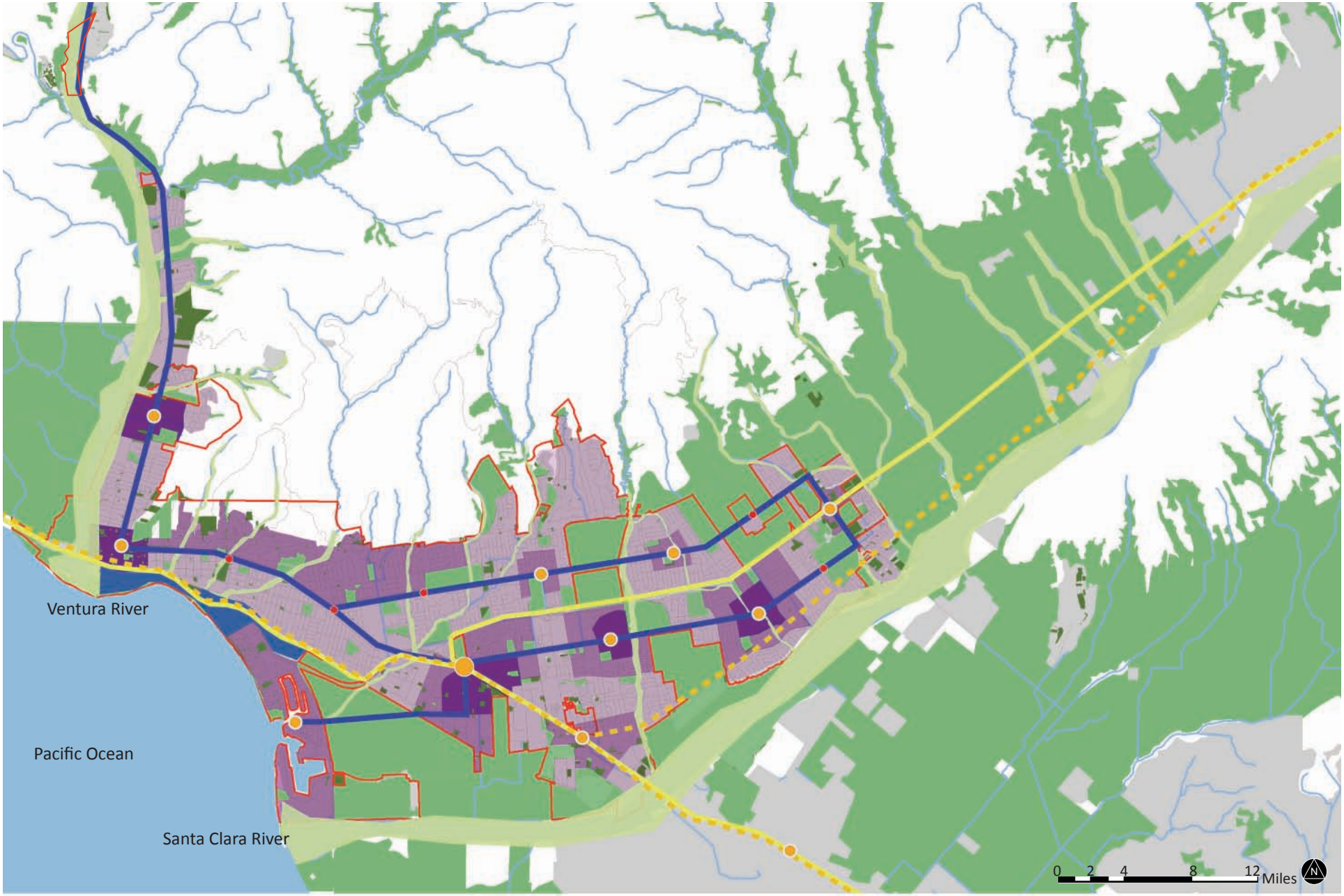


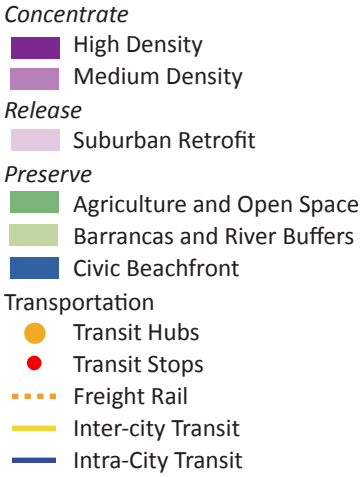
FIGURE 59
Hazards

Areas designated for development must be outside hazard zones, including areas prone to landslides. The lavender area, or low density area, designates the Release zone.


Ventura River
Pacific Ocean
Santa Clara River
0 2 4 8 12 Miles
N

The city vision seen here concentrates human development while integrating natural communities, agriculture production, and linkages to the region

FIGURE 60
City Vision



Zone	Total Acres	Percent of City Land	Percent of Population Residence	2007 Permeable Surfaces (%)	2050 Permeable Surfaces (%)	Urban Agriculture (% of land)	Urban Habitat (% of land)	Percent of Irrigation Demand Met by Greywater and Roofwater Catchment
Concentrate	4,297	32%	85% (134,548)	5%	66%	20%	12%	148%
Release	5,233	39%	15% (23,744)	46%	67%	40%	18%	44%
Preserve	3,928	29%	0% (0)	NA	Same as 2007	91%	9%	NA

TABLE 11
Zones Characteristics

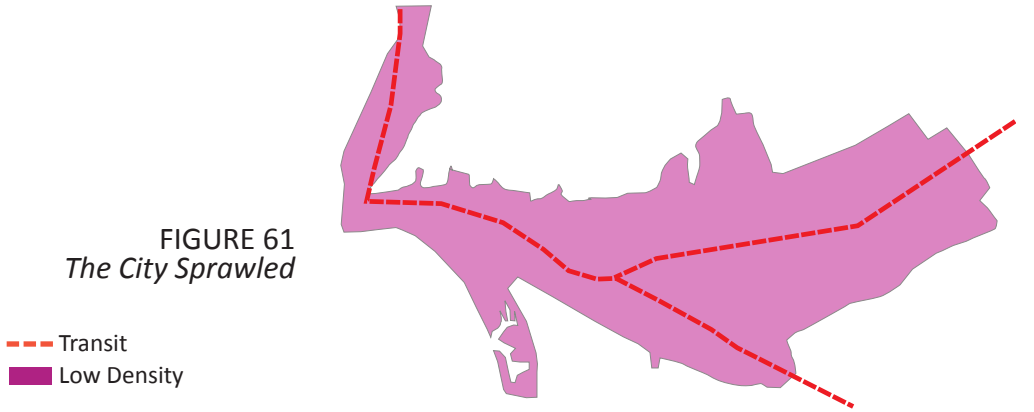


FIGURE 61
The City Sprawled

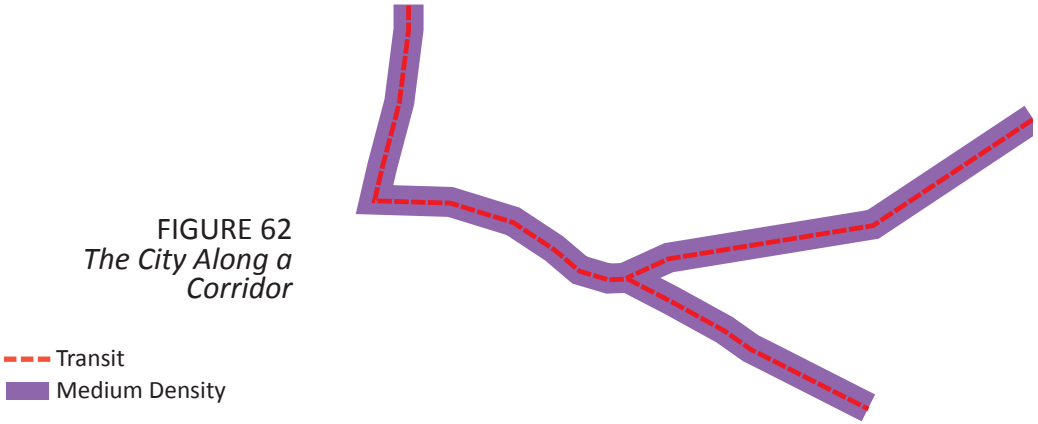


FIGURE 62
The City Along a Corridor

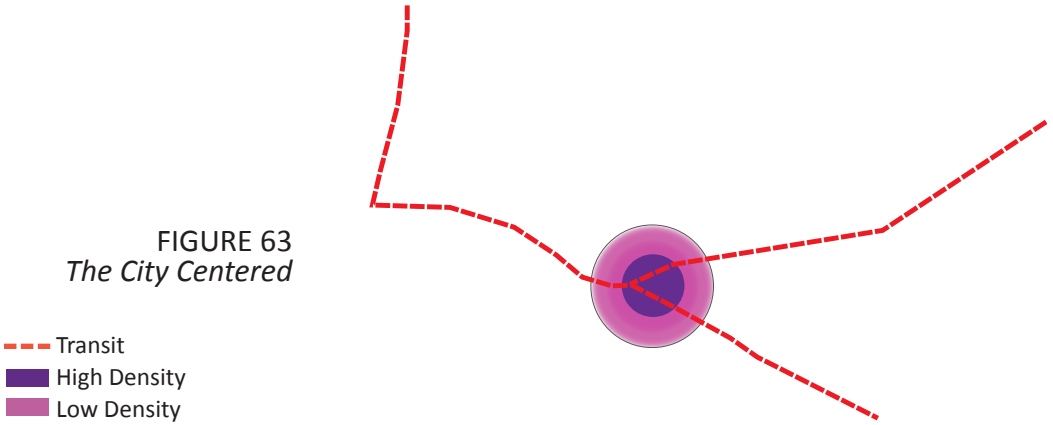


FIGURE 63
The City Centered

Alternatives

In developing a design for the City of San Buenaventura, several other conceptual designs were considered before selecting the node model. The following is a brief description of the concept, and the reasons why they were deemed unfeasible or insufficient for a post-Peak Oil city vision.

The City Sprawled

At only 10 miles across at its greatest width, it is possible, through the addition of public transportation, for the city to maintain its current footprint and develop density within these boundaries (Figure 61). The benefits of this type of plan include the use of already established infrastructure for housing and a less dramatic change for San Buenaventura's residents. Continuing with the existing form would involve additional transportation infrastructure, as the current car-based freeway system would be extremely inefficient in 2050. The thinly spread population would require more energy in maintenance and servicing systems (water, sewer, and electrical), shelter (heating and cooling), and transportation (infrastructure and efficiency), and the recapture of natural resources and agricultural land would be difficult. Finally, functioning communities and district centers would be more difficult to establish, as they would lack the needed population density to support commerce and public space.

The City Along a Corridor

Much like the node plan, a design based on a transportation corridor is efficient because of its location along a single line of public transportation (Figure 62). The benefits of this type of plan are that current major transportation corridors (Ventura Avenue, Main Street, Telephone Road, and Telegraph Road) have enough density and activity to remain functional, and could be retrofitted to support a higher density of people and uses. Open space and agricultural land would remain within close proximity of residents as density would eventually form a thin line around the transportation corridor. Reasons

to not choose a corridor-based plan are that densities would most likely spread throughout the liquefaction zone, putting the city at risk of earthquake damage. A corridor plan would spread the population along a line, making it difficult to establish populations dense enough to support active community centers. Finally, a corridor plan would need a large number of stops along the route in order to facilitate movement for all of the people living along the transit stops. This would result in a more decentralized population, as each stop could then support a ¼-mile radius.

The City Centered

A final alternative considered establishing the entire city within one district outside of the liquefaction zone (Figure 63). This type of design creates the greatest transportation and land efficiency, as the majority of movement within the city could take place on foot or bike. The need for public transportation would occur only at a regional scale, and the land saved could be used for agriculture and returned to natural open space. The disadvantages of this type of design are: it would turn its back on the city's historic center, as the downtown is located in a liquefaction zone; the character of the existing city would suffer, as the needed development to contain all of the population within one district would require a greater density and storey height; existing infrastructure and housing would be largely disregarded, as development would be pulled from existing neighborhoods and concentrated in the city center; finally, the quality and access to open space and agricultural land would be diminished, as the city's population would be reliant on the areas directly outside of the district boundaries for everyday leisure and food-production activities.

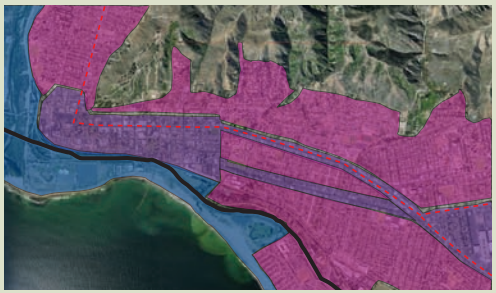
The Beachfront Retreat

In the Post-Peak Oil Vision Plan, as the City of San Buenaventura begins to increase density within the recommended zones, it must consider the future of the urban beachfront. The existing area (in 2007) is a mix of housing, commercial, and civic space. Because of the presence of liquefaction zones and the eventuality of sea levels rising due to Global Warming, the beach area is better suited as a civic space, while density retreats towards safer areas. The following is a timeline for this retreat.

2015 – As density begins to occur along the existing public transportation routes, pedestrian access to the beachfront increases. The freeway still acts as a physical and psychological barrier between most of the city and the beachfront. Although efforts are being pursued by the city to ease this barrier, creative ways to improve access continue. Public facilities for storage that reduce the need for automobiles are also built near the beach.

2025 – The freeway is used less at this point, and pedestrian and bikeways have improved access for everyone in the city. The transportation corridor is now used only for the trolley. Civic space continues to increase along the beach and begins to follow the retreat of density towards the hillsides.

2050 – Housing to the south of the corridor recedes further towards the hillsides. The safe area between the hillsides and the corridor become increasingly dense as second and third units are being added to existing homes. The freeway is now reduced to a single lane for cars, a regional train track has been added, and a major bike/pedestrian path runs along it, affording views towards the ocean.



2015

2025

2050

High Density
Medium Density
Low Density
Civic Beach Area
Intra-city Transit
Highway 101

PHASES OF THE POST-PEAK OIL VISION PLAN

"If you want to build a ship, don't herd people together to collect wood and don't assign them tasks and work; but, rather, teach them to long for the endless immensity of the sea." ~Anonymous

Reaching the 2050 Vision plan described in this *Post-Peak Oil Vision Plan* requires changes in lifestyle and design philosophy, both of which require time. For this reason, the vision includes three phases of implementation which consider the necessary shift in mindset which must accompany the physical transformation of urban environments. The phases are titled *Yearning for the Ocean*, *Building the Ship*, and *Sailing the Ship* in reference to a poem sited in the Kinsale Energy Descent Action Plan. These phases and the target dates associated with them are referred to in design guidelines, as well as in the *Transformative Site Design* section, and are described in further detail below.

(Note: Guidelines are listed under the phase in which they are implemented or in which they receive the strongest emphasis. Most of the guidelines are relevant throughout the foreseeable future).

2007 to 2015: Longing for the Sea

The first phase of the *Post-Peak Oil Vision Plan* is focused on unveiling the potential of the City of San Buenaventura to adapt, and preparing the population for a shift in lifestyle. Education, experimentation, and research are critical during this phase, as they set the groundwork for more dramatic changes in the future. In addition to education, incentives and policy changes are employed which encourage positive shifts in behavior. Perhaps the most influential factor in building the desire for a new way of life is the rising cost of living. Infrastructure development is initiated to prepare for increasing demand on the local food supply, public transportation sector, and dense, mixed-use developments.

2015 to 2025: Building the Ship

Transformation of the built environment is emphasized in the second phase of the *Post-Peak Oil Vision Plan*, or "building the ship." Trends and experiments initiated in the first phase have come to fruition as major retrofits, land use conversions, and shifts in behavioral patterns become evident throughout the city.

2025 to 2050: Sailing the Ship

The final phase of the *Post-Peak Oil Vision Plan* is to be reached by 2050. Although "sailing the ship" is the last phase, it is only the beginning of the journey towards a fully realized post-Peak Oil community. By 2050, energy-consumptive lifestyles and development patterns are seen as a distant memory. During this phase, land use conversions have slowed down substantially and change is more subtle. The city is buffered from external disruptions as much of its food supply and economic base is centered in the region.

REALIZING PROJECT OBJECTIVES

E ENERGY
- Use local and renewable energies conservatively

W WATER
- Preserve and enhance hydrologic function throughout the watersheds
- Increase roof water and greywater capture
- Implement conserving practices for agriculture
- Implement conservation programs for urban users
- Prioritize water for productive uses

N NATURAL COMMUNITIES
- Manage for sustainable marine resources
- Preserve and expand regional terrestrial habitat
- Enhance urban biodiversity

F FOOD
- Build market for locally grown foods
- Decrease distance between producer and consumer
- Increase physical and political infrastructure for local processing and distribution
- Utilize available resources for urban agriculture
- Produce food with minimal imported materials (i.e. chemical fertilizers and pesticides) in a sustainable manner

M MOBILITY
- Build and develop infrastructure for city and regional public transit system
- Prioritize, expand and improve bicycle network
- Increase the number of pedestrian nodes within the city
- Expand existing regional rail and ocean freight system

S SHELTER
- Develop infrastructure and policy for dense, affordable, mixed-use development ("nodes")
- Retrofit existing homes and require all new homes to be energy- and resource-efficient
- Promote adaptive reuse of buildings and underutilized urban infill land

E ECONOMY
- Identify economic sectors that are based on available resources and will thrive post-Peak Oil
- Provide employment opportunities that encourage innovation and enhance local economy
- Develop industry for sustainable re-use of waste products

C COMMUNITY
- Designate and design more public and communal areas, and improve quality of private spaces
- Provide flexible public spaces that promote community interaction
- Foster community identity
- Preserve, protect, and make accessible San Buenaventura's places of beauty

PROJECT GUIDELINES

The following is a compiled list of recommendations that the region, city, and individuals will need to do to reach the Post-Peak Oil Vision Plan. The ordering of the guidelines is based on when each will be emphasized, but the majority of guidelines will need to begin now and will last through 2050 and beyond.

2007 to 2015: Longing for the Ocean

Research and Monitor

- F W Initiate research and experimentation
- N W Monitor and regulate water quantity and quality
- E Research and monitor energy consumption
- N Design, plan, and monitor for target species as indicators of ecosystem health
- N Manage urban and agricultural landscape for beneficial wildlife

Educate and Demonstrate

- F W Educate citizens on post-Peak Oil opportunities
- F Initiate community celebrations and healthy competitions
- F Develop educational labels for local and sustainable goods
- W Create demonstration sites on civic, commercial, and residential properties

Entice Through Policy and Incentives

- S F N W Implement a moratorium on greenfield development
- C F Designate land for urban agriculture and public space
- W Protect critical recharge areas, habitat areas, and places of beauty
- C Prioritize projects that utilize inter-generation design and foster community identity
- S F Implement flexible building codes and zoning
- W E Create standards and incentives for sustainable landscape and building design
- W Legalize greywater systems
- E Prioritize energy uses
- F N Create a phased plan to eliminate the use of chemical fertilizers and pesticides
- M F W E S Implement creative programming and inconvenient costs
- M Make public transportation free
- M Prioritize transportation money and resources for public transportation
- N Prioritize wildlife corridors for habitat enhancement

Other

- M Build and expand infrastructure for bicycling
- F Increase the number of farm to institution programs
- W Decrease irrigation demand
- C Diversify outdoor space

2015 to 2025: Building the Ship

Transform and Innovate the Built Environment

- M Build and expand infrastructure for public transportation
- M F Build and expand infrastructure for freight transportation
- E F Establish infrastructure for a localized economy
- S M Shrink the triangle (of work, home, employment, and amenities)
- S Emphasize development in concentrate zone
- S Decrease public investment in release zone
- M Convert freeways to rails
- S M F Convert underutilized urban land to more productive uses
- N Implement and monitor sustainable aquaculture systems
- E Develop infrastructure for wind and wave energy

Shift Mindsets

- M Add amenities along pedestrian and bike routes and promote beautification
- F Encourage healthy diets that require less land and energy to produce
- F Coordinate production to meet local needs
- F W Diversify crop production
- F Establish compost collectives
- F Establish food processing and distribution centers
- C Encourage shared backyards

Other

- W Reallocate water to increase natural water flows and support local agriculture

2025 to 2050: Sailing the Ship

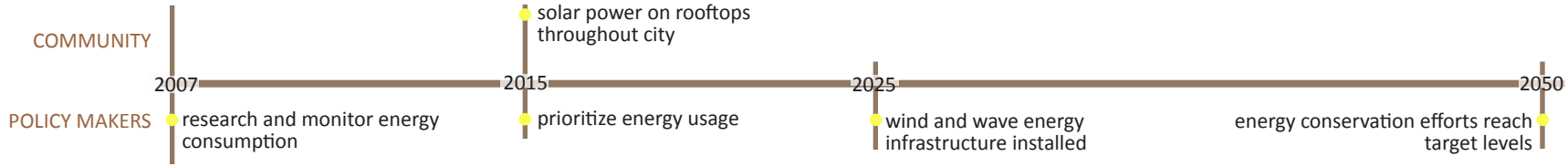
Innovate, Adapt, and Make Livable

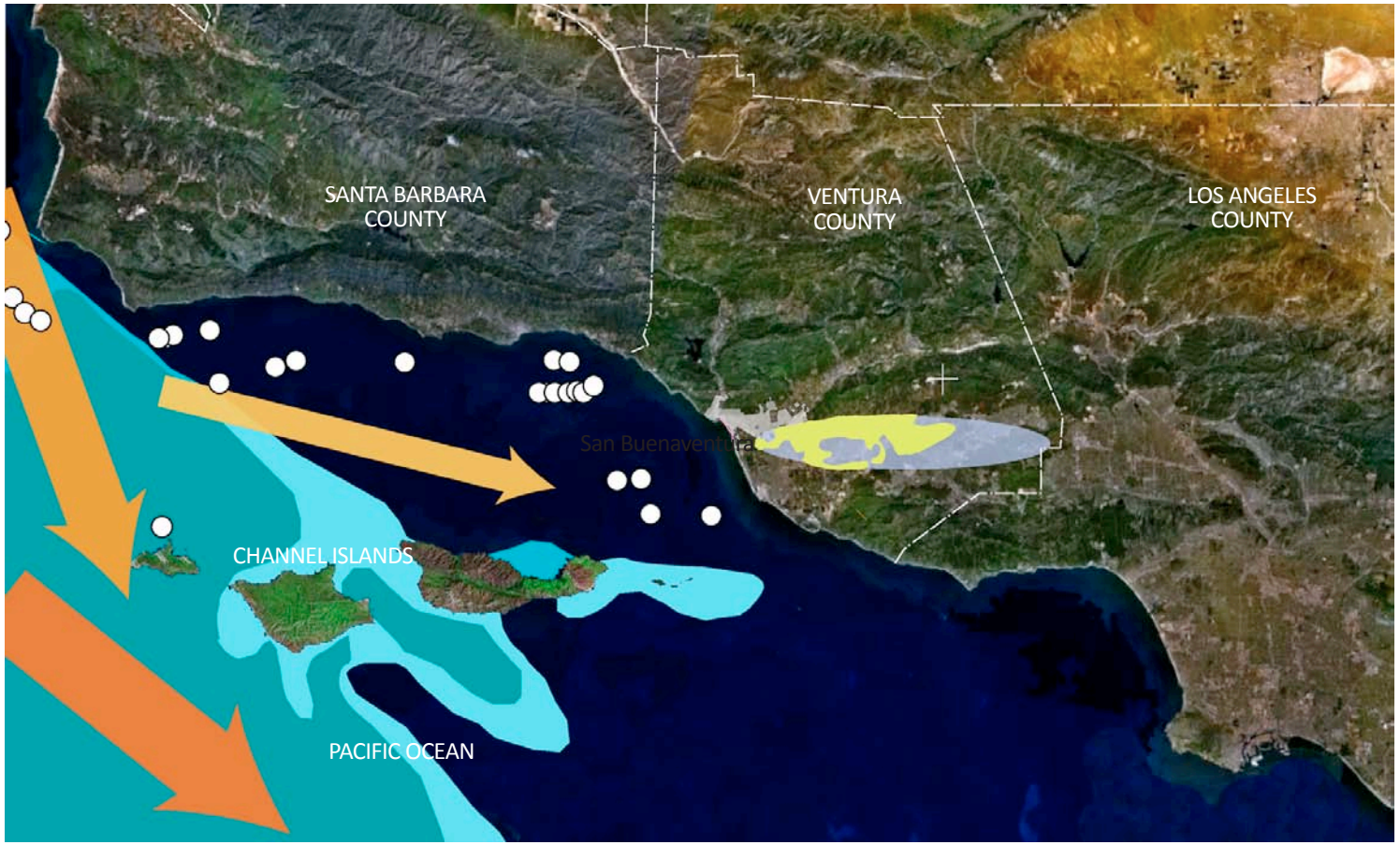
- F Allow for *cyclical landscapes*
- M Establish carfree zones
- S N W Decrease the *urban footprint*

ENERGY

Passive is Massive

Utilizing renewable energies will be necessary as oil and fossil fuel resources dissipate. Non-renewable energies such as coal, natural gas, and nuclear power cannot compensate, and have the potential for serious environmental damage (see ***Part II: Analysis: Energy*** pages 27-28). Drawbacks for renewable energies include: the expense of building infrastructure, lack of reliability, extensive land-use needs, low transportability and adaptability, and inefficiency. Energy conservation efforts made through community design will not only provide the greatest gains in reduction of energy demand, but will improve environmental and human health (see ***Part I: Introduction*** page 6).





SOURCES: Conservation Working Group of the Channel Islands National Marine Sanctuary Advisory Council, 2007; NASA World Wind; Kane, 2006; U.S. Department of Energy, National Renewable Energy Laboratory, 2003; Research and Development Office, Technology Systems Division, California Energy Commission, June 2005; Yen-Nakafuji.

Ventura County is well suited for renewable energies, including, wave, solar, and wind

FIGURE 64
Regional Renewable Energy Vision

Use local and renewable energies conservatively

Energy resources will be volatile post-Peak Oil, as decreases in oil supply will stress energy sources. By decreasing reliance on non-local energies through conservation and renewable energies, San Buenaventura can buffer itself from these energy spikes.

GUIDELINES:

Research and monitor energy consumption. Energy consumption at the personal and city scale are largely untracked.

Prioritize energy uses. The prioritization of energy will have to be considered as many systems cannot function without

energy inputs and some are more important to the greater community than others. The following is a prioritized list of energy demands:

- Water supply
- Emergency and hospital care
- Waste-water treatment
- Refrigeration – lack of refrigeration will lead to the loss of food items
- Public transportation – mass transportation will need to be given priority over personal transportation
- Processing and manufacturing – not all goods have equal importance; construction materials, food processing, and clothing need prioritization
- Freight transportation – the localization of all goods is not feasible or plausible; some energy will have to be allocated for this

Create standards and incentives for sustainable landscape design. Implement solar energy generation in urban areas. Within the city, energy can be gained through the use of solar technologies integrated into buildings. Building codes should incorporate guidelines for solar panels.

Develop infrastructure for wind and wave energy. Collaborate to develop infrastructure for wind and wave energy. Harvesting these resources requires that San Buenaventura work collaboratively with nearby cities to invest in ideal sites for both wind and wave energy, as well as to invest in needed research for wave energy.

Decrease overall energy use

Decreasing energy consumption is critical to achieving the post-Peak Oil vision. Guidlines for decreasing energy consumption are discussed under each system. The following evaluation section summarizes the effectiveness of community design to decrease energy consumption.

EVALUATION:

The following list includes some of the reductions in energy consumption that can be achieved through implementation of this *Post-Peak Oil Plan*. This reduction in demand will enable recommended renewable energies to supply for a greater portion of total energy demand.

Water
The pumping and transportation of water takes up approximately 3 percent of San Buenaventura's energy supply. By cutting water consumption by 50 percent, and by using roof-water catchment and greywater for irrigation, the city can save 2.2 billion gallons of water per year, or 22 percent of the energy expended on water.

Food
The existing food system requires 17 percent of energy supply. By growing food locally within the city and region, using organic farming methods, and limiting the amount of processing, the city could cut up to 67 percent of energy spent on food.

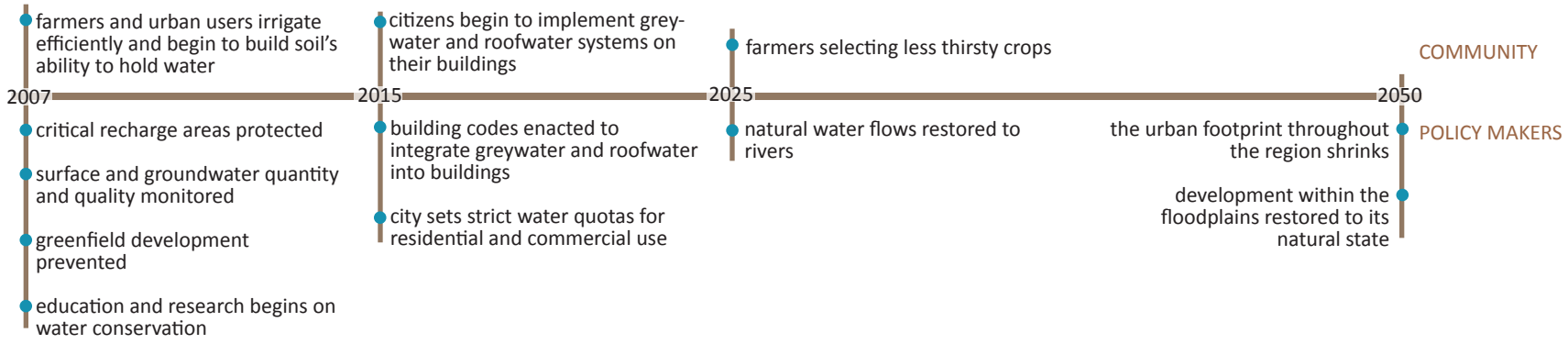
Mobility
The existing transportation system uses 26 percent of energy resources. The largest consumers are the personal automobile and trucking for freight transportation. By shifting to public, bike, and pedestrian transportation, the need for personal automobiles can be greatly reduced or even eliminated. By localizing goods, the City can significantly reduce the amount of freight transportation.

Shelter
Homes in Ventura County consume 36 percent of electricity use. With San Buenaventura's Mediterranean climate, residents can decrease heating, cooling, and lighting costs significantly through passive design and solar power. This would result in a savings of approximately 65 percent of residential electricity demand.

WATER

Recapture Resources

Managing water supply in the watershed, city, and community is necessary for post-Peak Oil societies, as this resource will become expensive to import. By implementing the guidelines discussed and evaluated below, the region and city can decrease (and potentially eliminate) dependence on imported water supplies, while enhancing local supplies.



Preserving the natural hydrologic function of the region's watersheds is critical to ensure future water supply.

SOURCE: Ventura County GIS Department; NASA World Wind

FIGURE 65
Regional Vision for Water

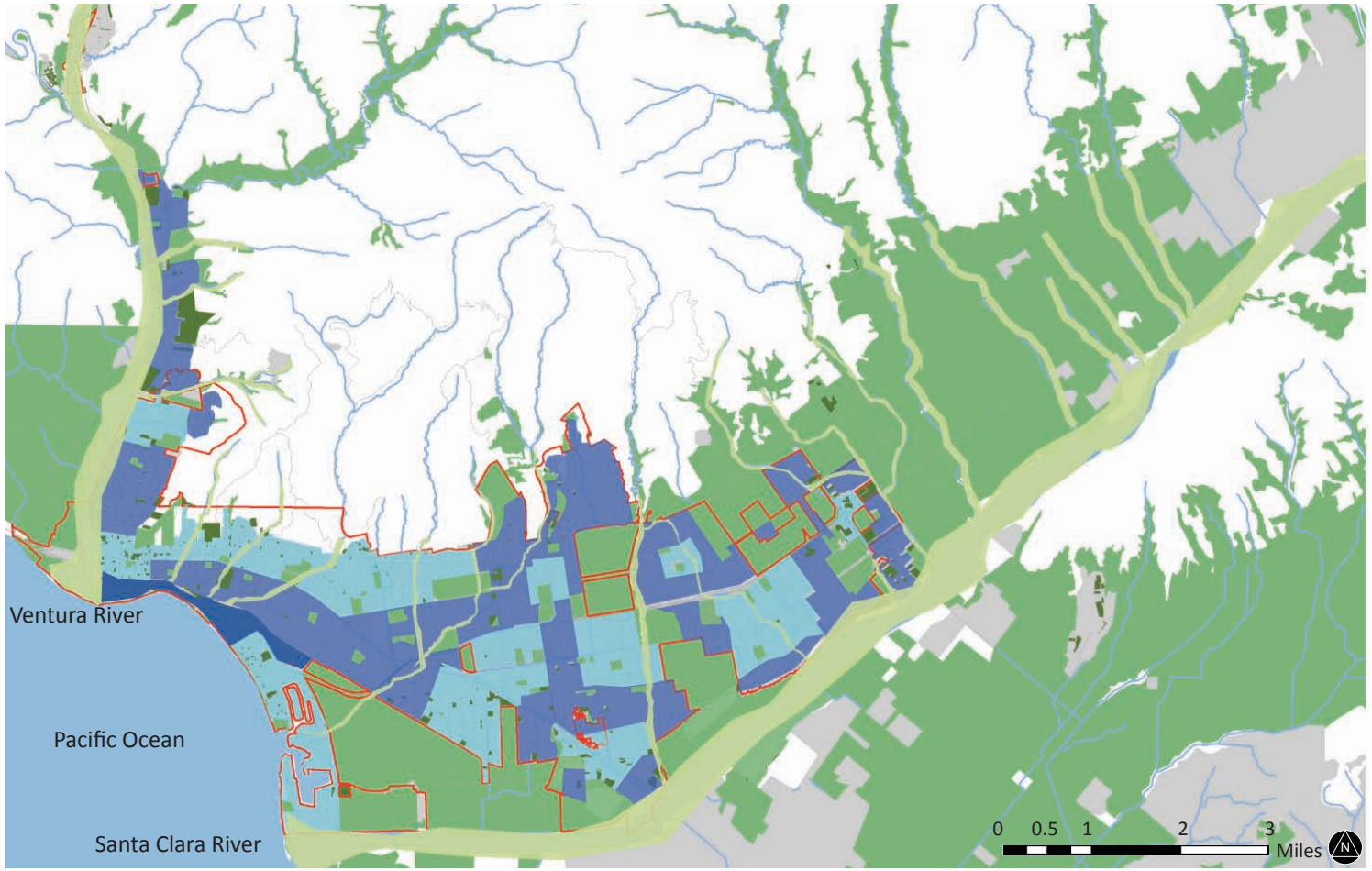
Preserve and enhance hydrologic function throughout the watersheds

The hydrologic function of watersheds directly impacts the quantity and quality of water available for human consumption. While overdrafting of groundwater can lead to saltwater intrusion, decreased river flows can lead to the loss of biodiversity and decreased natural water filtration and treatment. (Figure 65).

GUIDELINES:

Protect critical recharge areas. Critical recharge areas include spreading grounds, hillsides, and unchannelized river and stream beds.

Monitor and regulate surface and groundwater quantity and quality. Baseline data is needed to water quotas for urban and agricultural users, and to assess the status of water sources. Collaborative efforts will be necessary for region wide monitoring and regulation.



SOURCE: Ventura County GIS Department

Increasing permeability and catchment will help ensure water availability for consumption, food production, and natural systems.

Runoff must be treated on-site to protect and enhance groundwater and surface water resources.

FIGURE 66
City Vision for Water

Reallocate water to increase natural water flows. Restore natural flow to rivers to enhance habitat and restore natural hydrologic function.

Implement a moratorium on greenfield development. This will prevent the loss of permeable surfaces.

Create standards and incentives for sustainable landscape and building design. Green infrastructure should be incorporated into all site designs, such as bio-swales and permeable paving.

Decrease urban footprint. Through planning and design, the overall built footprint should be decreased. Land within river floodplains should be returned to natural habitat.

Roofwater and greywater within suburban neighborhoods is collected individually and transported to irrigate communal and individual gardens and agriculture.

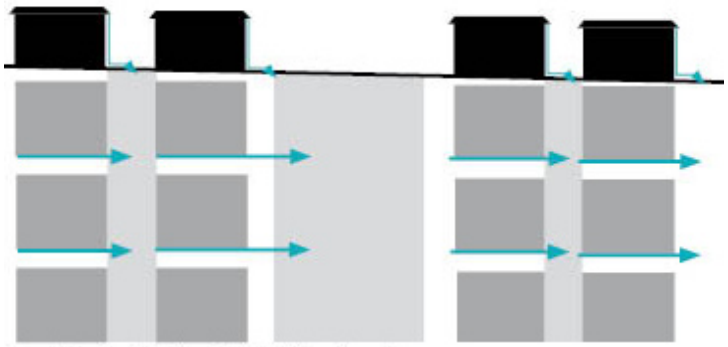


FIGURE 67
Low Density Water Re-use

Water flows from individual buildings downslope to public or private land

Within dense nodes, water catchment and greywater is collected and gravity-fed into agricultural corridors.

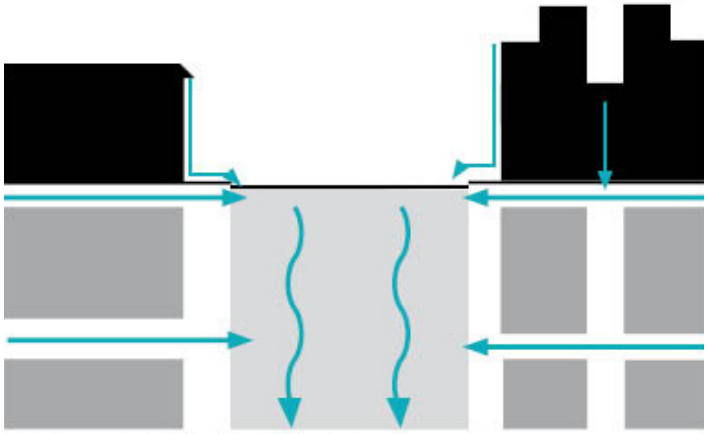


FIGURE 68
High Density Water Re-use

Water flows from individual buildings to agricultural corridors

Increase roof water and greywater capture

Roof water and greywater are underutilized resources in urban areas, including San Buenaventura. Although greywater is suited best for irrigation uses, roof water has the potential for household use (see ***Part II: Analysis: Water*** page 39). Implementing catchment systems at the household and city will result in decreased demand upon fresh ground and surface water (Figures 67 and 68).

GUIDELINES:

Legalize greywater systems. The illegal status of greywater systems creates a barrier that should be removed as soon as possible.

Create standards and incentives for sustainable landscape and building design. Standards should be developed for greywater and roof water catchment. Require greywater and roof water catchment as part of building codes.

Create demonstration sites on civic, commercial, and residential buildings properties. In dense areas that lack private gardens, claim roof water as a public resource.

Implement conserving practices for agriculture

The agricultural sector is the largest water user in the county, consuming 65 percent of the county's yearly supply. Even though agricultural users will continue to receive priority for water use, use will need to decrease for the county to eliminate dependence on imported supplies without degrading local sources. As agriculture will play a significant role in urban areas in 2050. Water conservation will have to be implemented for urban agriculture programs.

GUIDELINES:

Educate citizens on post-peak oil opportunities. Many residents who have little or no farming experience will partake in urban agriculture. Methods for water conservation should be taught through city and private (i.e. consultants) education programs.

Initiate research and experimentation. Greater understanding of current agricultural water consumption and groundwater conditions is needed to assess the sustainable demand. Research and innovation in water-conservation practices and technology appropriate to the region should be encouraged in order to prepare for post-Peak Oil and potential drought conditions.

Decrease Irrigation Demand

- **Build soil's ability to retain water.** Soil's ability to retain water can be improved by increasing organic content, providing shade by closely spacing plants or growing several crops together, and ensuring that the soil has sufficient and balanced nutrient content.
- **Irrigate efficiently.** Water conserving irrigation technology, such as drip irrigation, should be encouraged.

Implement creative programming and inconvenient costs. The establishment of tiered water prices will discourage overconsumption.

Diversify Crops. Select crops that are less thirsty. As water and transportation prices rise, it will be increasingly beneficial to prioritize crops that require less water and meet the needs of regional population.

Implement conservation programs for urban users

Americans use more water per capita than any other nation. While the average American uses 106 gallons each day, the average European uses only 53 gallons a day (Water Aid 2006). This suggests a substantial potential to reduce household water use by adopting new behaviors.

GUIDELINES:

Implement creative programming and inconvenient costs. Implement tiered rates for urban water users. Penalize users who exceed 53 gallons a day per person or per household limit.

Create standards and incentives for sustainable landscape and building design. City codes should encourage water saving technology, including composting toilets and evapo-transpiration controllers.

Prioritize water for productive uses

A large share of city water budget is allocated for household use and landscape management (see ***Part II: Analysis: Water*** page 43). Post-Peak Oil, this allocation will not serve the needs of the population. Water must be prioritized for essential uses (such as human consumption) and productive uses (such as food production) and the restoration of hydrologic function.

GUIDELINES:

Reallocate water to increase natural flows and support agriculture. *It* is important that water savings are not used to enable increased development, but instead that they are reallocated to improve hydrologic health and enable food production.

EVALUATION:

Conservation

- In urban and suburban areas, greywater and roof water could supply an estimated 77 percent of irrigation demand (Table 11).
- Soil with 2 percent organic matter in the top 11 inches can reduce required irrigation by up to 75 percent. Evapotranspiration can be reduced by up to 75 percent when in soil that has sufficient and well-balanced nutrients (Jeavons 2006). Shading soil can decrease evaporation by up to 63 percent (Jeavons 2006). This can be accomplished by closely spacing plants and/or growing several crops together. Using these methods, water consumption can be reduced to 12.5 percent of normal methods for vegetable production by pound, and by 33 percent of normal methods for grain production by pound. Implementing the above guidelines could conserve up to 50 percent of agricultural water budget, or 45 billion gallons per year. This is highly optimistic, considering most farms implement some form of water-conservation practices. More research is needed to accurately estimate potential savings from conservation measures. This estimate is not used in overall calculations, as it does not factor in current practices.
- By reducing household water use to 53 gallons per day per person, county residential water demand could be reduced nearly four billion gallons from 2007 levels – even with the projected population growth.
- Under the *Post-Peak Oil Vision Plan*, permeable surfaces increase by 3,678 acres in San Buenaventura. Permeable surfaces in urban areas increase by up to 225 percent.
- Through conservation and the wise allocation of water supply, it is highly likely that the region can eliminate dependence on imported water supply without depleting local resources (Figure 69).

Supply & Distribution in 2050

- The amount of water that can be used per year without depleting local resources is determined largely by the condition and requirements of groundwater and surface water resources. At this time, further research is needed on groundwater aquifers and on river flow requirements. The estimated sustainable demand of 99.4 billion gallons is based on available information, including groundwater overdrafting estimates and the recent court mandate for returned water flow to Ventura River (Foley 2007) (see ***Part II: Analysis: Water*** page 36). This estimate suggests that a reduction of 39.3 billion gallons from the current 138.7 billion gallon demand is needed to localize water (see page 43 for details).
- An estimated 19 billion gallons of roof and greywater can be harvested on the county scale, including 2.3 billion gallons in San Buenaventura (see page 43 for 2007 calculations).
- Combined with the 65 percent of the county water budget allocated for regional agriculture, this provides enough for an average of 1.77 acre feet of irrigation per typical year on approximately 127,000 acres of irrigated farmland.
- Decreased demand for residential irrigation water enables the reallocation of water to agricultural and rural areas within or adjacent to the City.

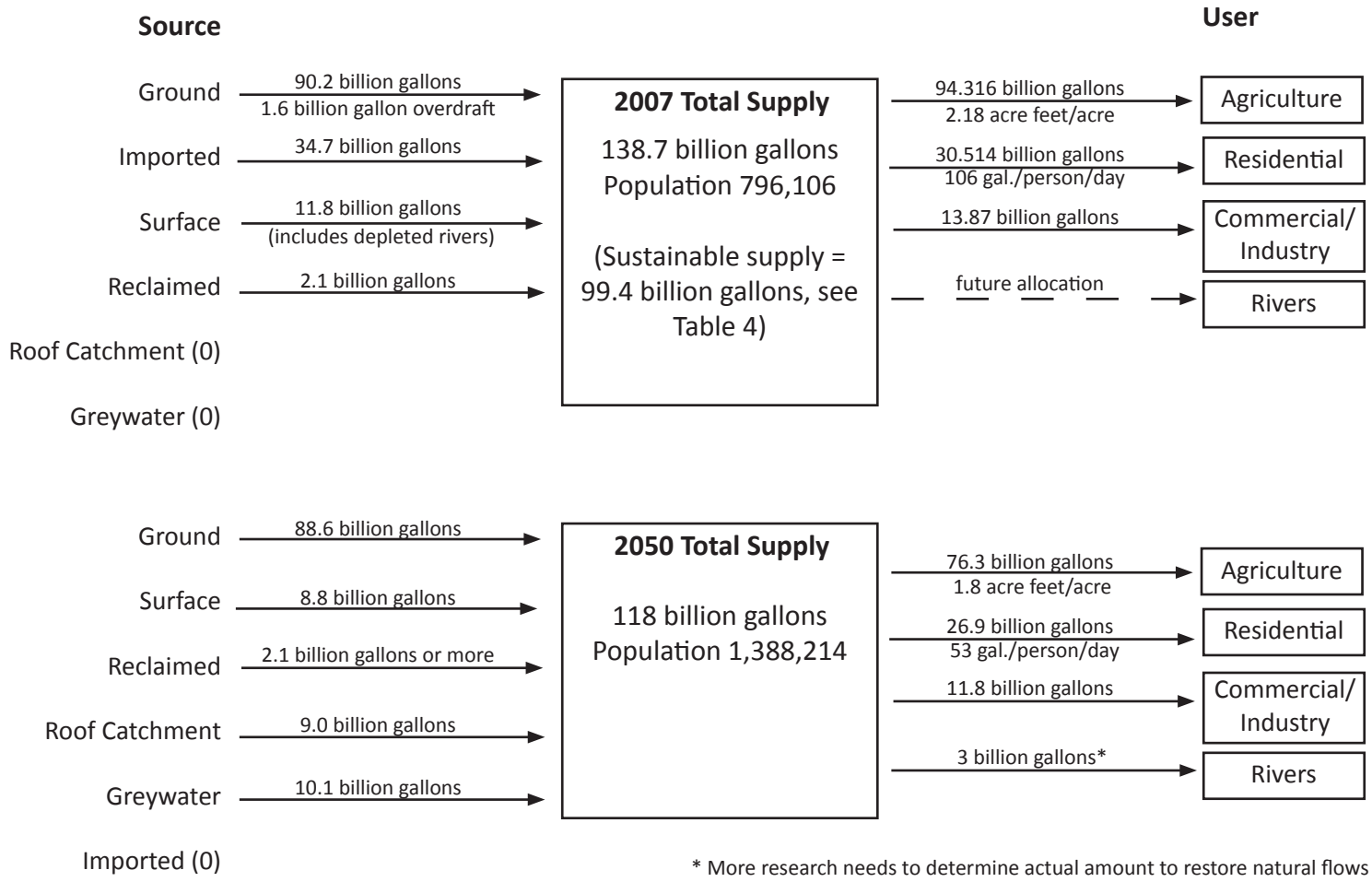


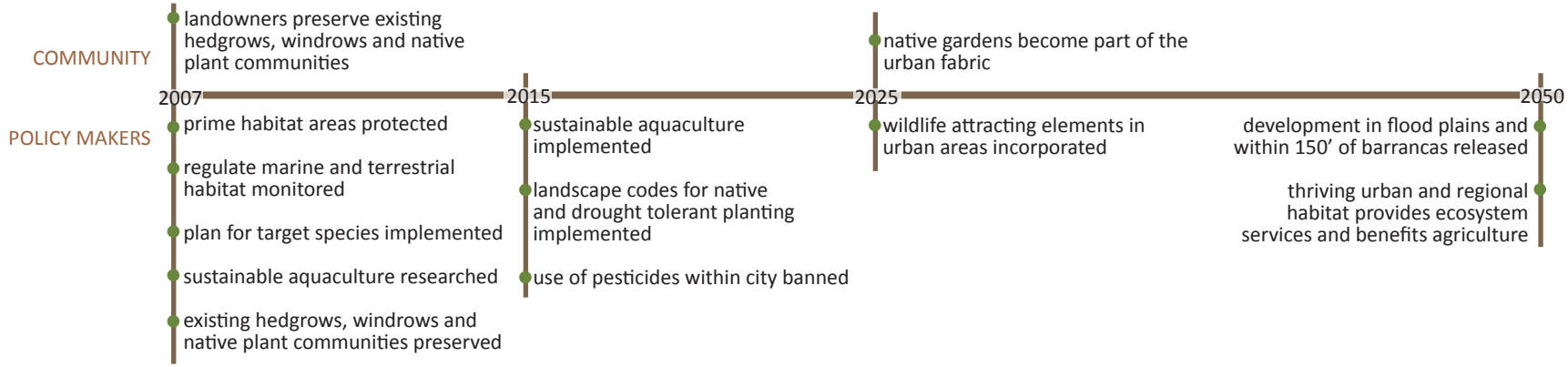
FIGURE 69
2007 and 2050 Ventura County Water Supply and Distribution

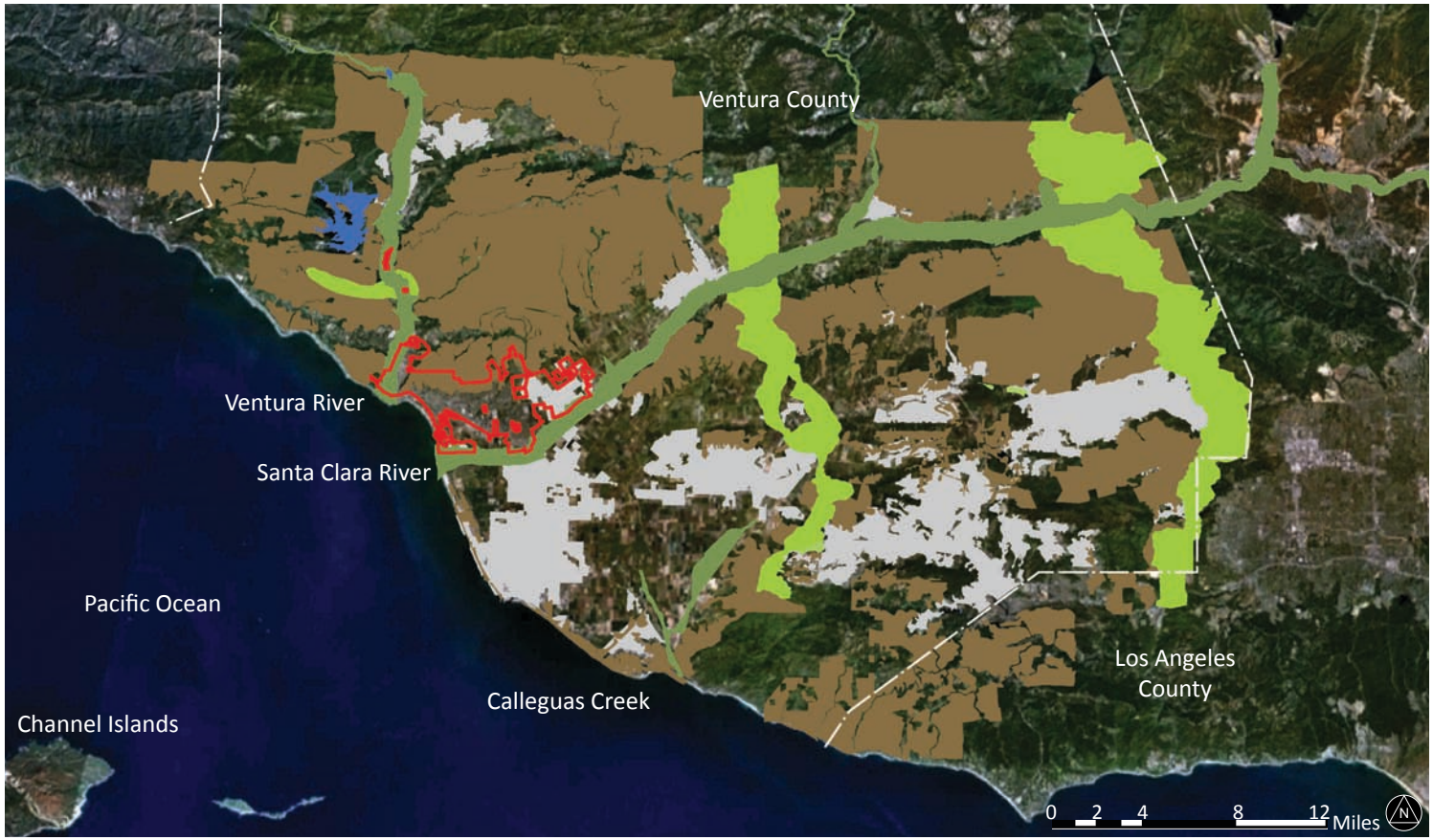
In order to eliminate dependence on imported water without degrading local hydrologic function, it is necessary to reduce water demand from 138.7 billion gallons to 118 billion gallons by 2050. Roof and grey water catchment provide a significant contribution of over 19 billion gallons to this new water budget. However, conservation measures will still be required to reduce water demand to sustainable levels. Residential users will need to cut daily water use in half, and average irrigation for regional agriculture will be reduced from 2.18 acre feet to 1.8 acre feet -requiring shifts in farming practices.

NATURAL COMMUNITIES

Preserve and Enhance

Functioning terrestrial and marine communities provide ecosystem services and food supplies for humans (Figure 70). Clean water, air, and biodiversity are critical to the health of local resources. Growing dependence on local resources increases the necessity of healthy natural communities. The following guidelines are for the preservation and enhancement of natural communities.





SOURCE: Ventura County GIS Department; NASA World Wind

Existing habitat and wildlife corridors must be protected from development. This includes marine and riparian ecosystems.

FIGURE 70
Regional Vision for Habitat

Manage for sustainable marine resources

GUIDELINES:

Design, plan and monitor for target species as indicators of ecosystem health. Monitor marine habitat and regulate fisheries based on identified important species which indicate marine health and fluctuating conditions: California sea lion, anchovies, sardines, cowcod, and squid.

Monitor and regulate water quantity and quality. Develop and enforce strict regulations to prevent ocean contamination from urban and agricultural runoff, cruise ships, and the oil and gas industries

Implement and Monitor sustainable aquaculture systems. Research, implement, and monitor sustainable aquaculture systems to decrease stress on natural fisheries.

Preserve and expand regional terrestrial habitat

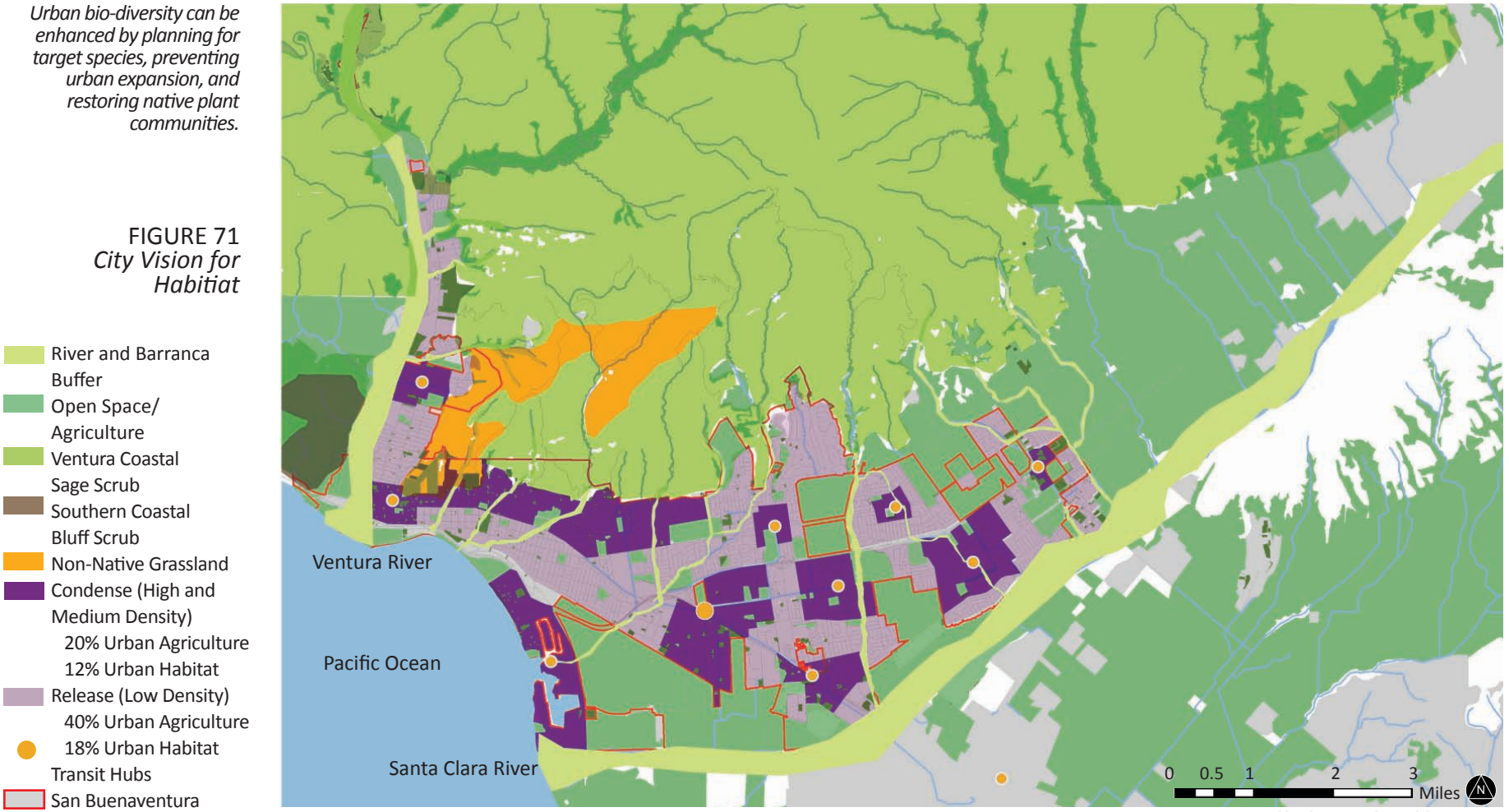
GUIDELINES:

Design, plan and monitor for target species as indicators of ecosystem health.

- Target species for terrestrial habitats: Cooper's hawk, loggerhead shrike, steelhead, native bees, and bobcat
- Target species for riparian habitats: steelhead and Cooper's hawk

Urban bio-diversity can be enhanced by planning for target species, preventing urban expansion, and restoring native plant communities.

FIGURE 71
City Vision for Habitiat



SOURCE: Ventura County GIS Department

Prioritize wildlife corridors for habitat enhancement. As designated wildlife corridors are critical to the health of natural communities, these areas should receive priority for restoration projects.

Monitor and regulate water quantity and quality. Collaborate with regional and state agencies to restore natural flows to rivers and prevent contamination from agricultural and urban activities.

Implement a moratorium on greenfield development. This is essential to maintaining existing habitat.

Decrease the urban footprint. Release existing developments that are in river flood zones back to native vegetation.

Create a phased plan to eliminate the use of chemical fertilizers and pesticides. Eliminate use of chemical pesticides

and fertilizers for agriculture (Targets: Cooper's hawk and loggerhead shrike).

Manage agricultural landscape for beneficial wildlife. Existing hedgerows, windrows, and patches native habitat should be preserved and expanded upon. These elements provide habitat for wildlife and benefit agricultural areas.

Enhance urban biodiversity

Current landscaping does little to encourage wildlife native to southern California. Providing and restoring habitat can enhance local agriculture as it attracts vital pollinators as well as insects and birds that are predators of agricultural pests. In addition to benefitting urban agriculture, urban habitat improves local diversity and the overall health of the region's ecosystems (Figure 71).

GUIDELINES:

Decrease the urban footprint: Release development that is within 150 feet of barrancas back to natural habitat.

Create standards and incentives for sustainable landscape and building design. Land that is not under production or part of a community green should be landscaped with native and drought tolerant plants that attract beneficial wildlife for urban agriculture, connect urban environment to surrounding landscape, and require minimal maintenance and inputs (such as water and fertilizer). Existing landscapes should be modified over time to align with city plant list.

Manage urban landscape for beneficial wildlife. Use design features that benefit farmland and wildlife, such as native plant hedgerows, bat houses, barb wire for loggerhead shrike prey, and windrows (Targets: Cooper's hawk, loggerhead shrike, big brown bat, native bees, and honey bees).

EVALUATION: (See Table 11)

Under the *Post-Peak Oil Vision Plan*, 12 percent of land in the *Concentrate* zone and 18 percent of land in the *Release* zone is dedicated to urban habitat, for an increase of 1,490 acres. In addition, the 2,949 acres of land for urban agriculture provides additional habitat for pollinators, bats, birds, and other wildlife that benefit agriculture.

As urban and agricultural runoff decrease, habitat for marine species is enhanced. Overall, effective management of terrestrial and marine habitat directly benefits food supply, air quality, water quality, and regional biodiversity.

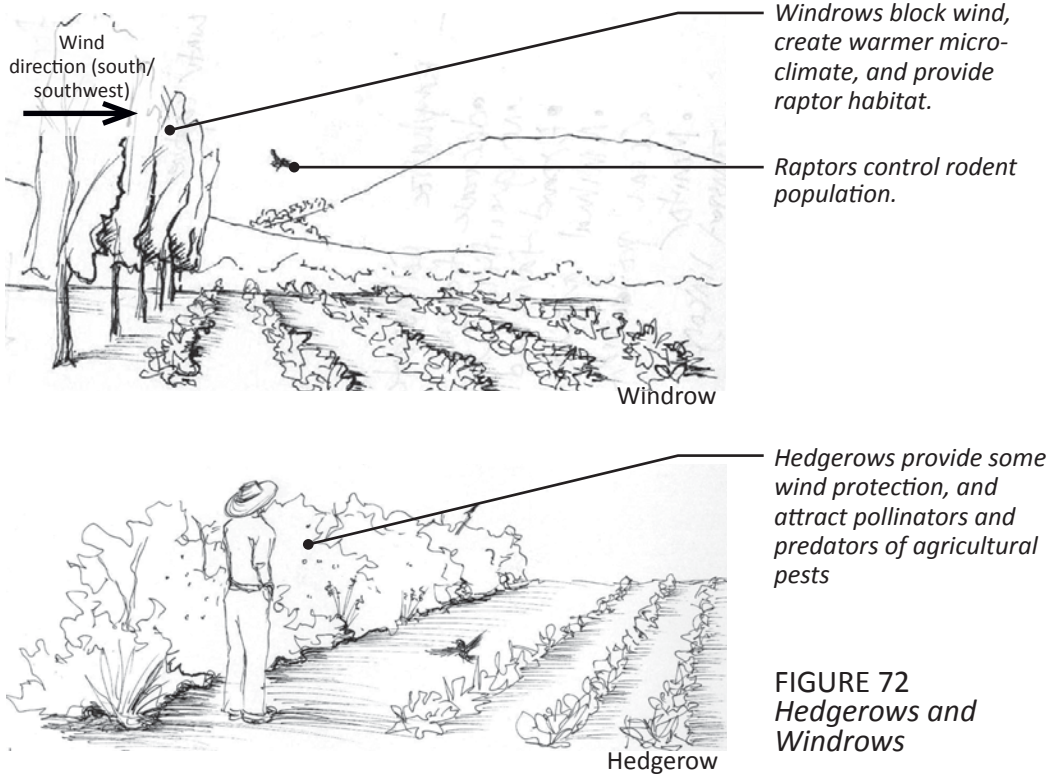
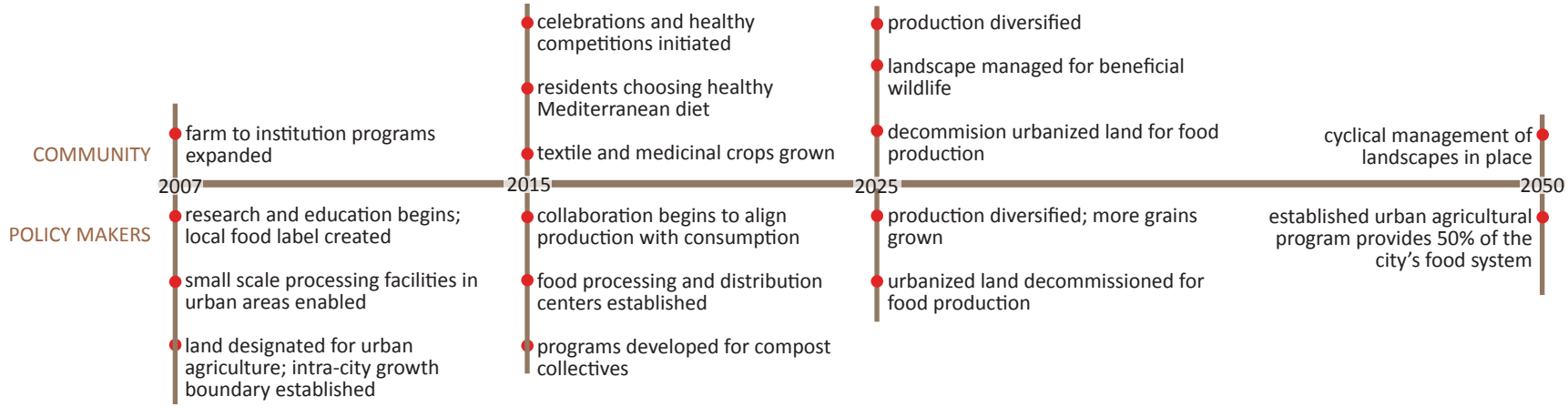


FIGURE 72
Hedgerows and Windrows

FOOD

Grow Local

San Buenaventura residents have the potential to reduce their energy consumption and improve their health simply by eating fresh, local, organic food. Given the region's long growing season and abundance of agricultural land, it is possible for residents to enjoy locally produced food year-round. A localized food system can provide a healthy diet for the population, as well as jobs, exercise, and an aesthetically pleasing landscape that connects to the city's agricultural history. In order to localize the food system, changes in diet, land use, and farming practices are essential. The following discussion will further explore the character, function and implementation of the proposed food system.



Build market for locally grown goods

Programs that encourage consumers to purchase local products and grow their own goods are key to building a social and economic framework for local foods (Figure 72).

GUIDELINES:

Develop educational labels for local and sustainable goods. Local product guides, informative labels, and related publicity and education programs should be implemented as soon as possible to enhance the market for local farmers (Figure 72).

Initiate Community Celebrations. Initiate community celebrations and healthy competitions in order to build and encourage local production and consumption. These include such events as pumpkin growing and salsa making contests.

Increase farm to institution programs. Expand successful programs to serve institutions and businesses. The Farm to School program is one example of this.

Decrease distance between producer and consumer

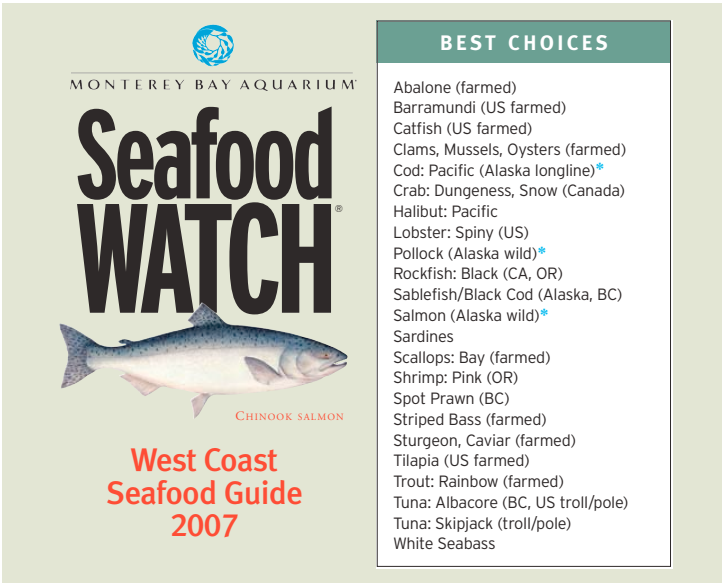
Decreasing the distance between regional production and consumption can increase quality of life, and decrease energy required for food transportation, processing, and packaging. The following guidelines can dramatically decrease distance between producer and consumer.

GUIDELINES:

Encourage healthy diets that require less land and energy to produce. Adjust diets to regional conditions. The Mediterranean diet has been selected as the target 2050 diet for Ventura County residents for the following reasons: (1) the region's Mediterranean climate is well suited to provide for this diet, (2) the Mediterranean diet is one of the healthiest diets in the world (Yang 2000), and (3) the diet requires less

Slow Foods is an international organization that enourages fresh local food.

This Leicestershire certification is an example of a food lable to promote local foods.



Seafood Watch provides a list of environmentally responsible fish for consumption.

FIGURE 72
Local Market Promotions

land and energy to produce than the typical American diet. The diet adapted by residents should substitute native species for non-native species when possible.

Coordinate production to meet local needs. Regional production is currently aligned with the global market, and thus large quantities of specific marketable crops are grown while less valuable crops (such as grains) are infrequently grown. In order for regional production to meet regional dietary needs, production must be coordinated at a regional scale.

Diversify production. Growing less valuable crops (such as grain) is not economical in Ventura County due to high land values. However, as food and transportation prices continue to rise, it will likely become more profitable to produce for local consumption and to diversify crop production. In addition, building domestic biodiversity will result in greater resilience to changing environmental conditions and disease. Crops that are used for medicine, clothing, paper, and building materials can be grown within the region and the urban environment. For instance, urban street trees can be harvested for timber, and crops like bamboo, kenaf, and hemp could be grown in areas where food should not be grown due to soil contamination or exposure. Non-edible crops can be equally useful in reducing energy consumption and in localizing resources (Table 14).

Increase physical and political infrastructure for local processing and distribution

In order to localize food supply on a regional and city scale, infrastructure for food processing, distribution, and storage are needed.

GUIDELINES:

Establish infrastructure for localized economy. Establish food processing and distribution centers close to existing populations, rail lines, and harbors.

Build and expand infrastructure for freight transportation. As agricultural exports and imports will depend more heavily on non-automobile transportation due to the rising cost of fuel, a functional rail system must connect to food processing and distribution facilities (Figure 73).

***Implement flexible building codes and zoning*.** Enable small-scale processing facilities in urban areas that can produce value-added products from urban and regional production. For this to be feasible, county and city codes will need to facilitate the home-scale food industry.

Utilize available resources for urban agriculture

Urban resources that can be utilized for agriculture include roof water and greywater, organic waste, labor, raw land (such as backyards and vacant lots) and underutilized land (such as roads and parking lots).

GUIDELINES:

Designate land for urban agriculture (Figure 73). The preservation of existing prime agricultural land and open space within the city is critical to the success of a post-Peak Oil community and should be a priority. There are numerous fragments of land that can be converted to agriculture in San Buenaventura, as listed below.

- *Concentrate Zone:* roof gardens, community gardens, vertical gardens, converted streets
- *Release Zone*: front yards, backyards, converted streets
- *Schools and Parks:* holding area for livestock that will benefit urban agriculture efforts, but due to smell, noise or other factors, are best buffered from residential areas

Implement a moratorium on greenfield development. Ceasing greenfield development will prevent land that is as suitable for food production or open space from becoming built upon.

Convert underutilized urban land to more productive uses. Soils that have buried under parking lots, streets, driveways, and buildings may be contaminated. However, as cities become pedestrian-oriented, this land needs to be evaluated for eventual food production. After remediation and soil amendment, much of this land will become fertile enough for crops (Table 13). Underutilized land that comes under ownership of the City may be leased at low cost to non-profit organizations and abutting neighborhoods (see sidebar: ***$1 Vacant Lot Program*** page 138).

Allow for cyclical landscapes. Transformation is an ongoing process within natural and urban environments. By acknowledging and working with adaptive cycles, the city can adapt to changing circumstances and optimize the use of local resources. Minor disruptions can be instigated by the city and/or community members to prevent the culmination of large disruptions. These disruptions may include natural lands management practices such as controlled burning, or urban land management practices such as planning for fallow cycles in areas of intense food production.

Educate citizens on post-Peak Oil opportunities (compost and water catchment). A critical part of education efforts should be connecting residents with compost systems that are suited for them. Compost techniques include vermiculture (compost using worms as decomposers), hot compost, rolling compost, and stacked compost. For discussion on water catchment, see ***Water Guidelines***.

Establish compost collectives. While compost can be done on a household basis, a structured program would encourage residents who lack private gardens or compost experience to compost, while providing local jobs.

- As a growing percentage of residents will reside in dense areas by 2050, compost programs that are similar to current recycling programs should be established to prevent the loss of valuable organic waste.
- In the *Release Zone,* centralized community compost programs could be managed by children or retired community members (see ***Part IV: Transformative Site Design*** on pages 197).

Implement creative programming and inconvenient costs. Instate penalties for excessive waste through trash collection fees in order to discourage food waste.

Land Requirements for Food Production in Ventura County

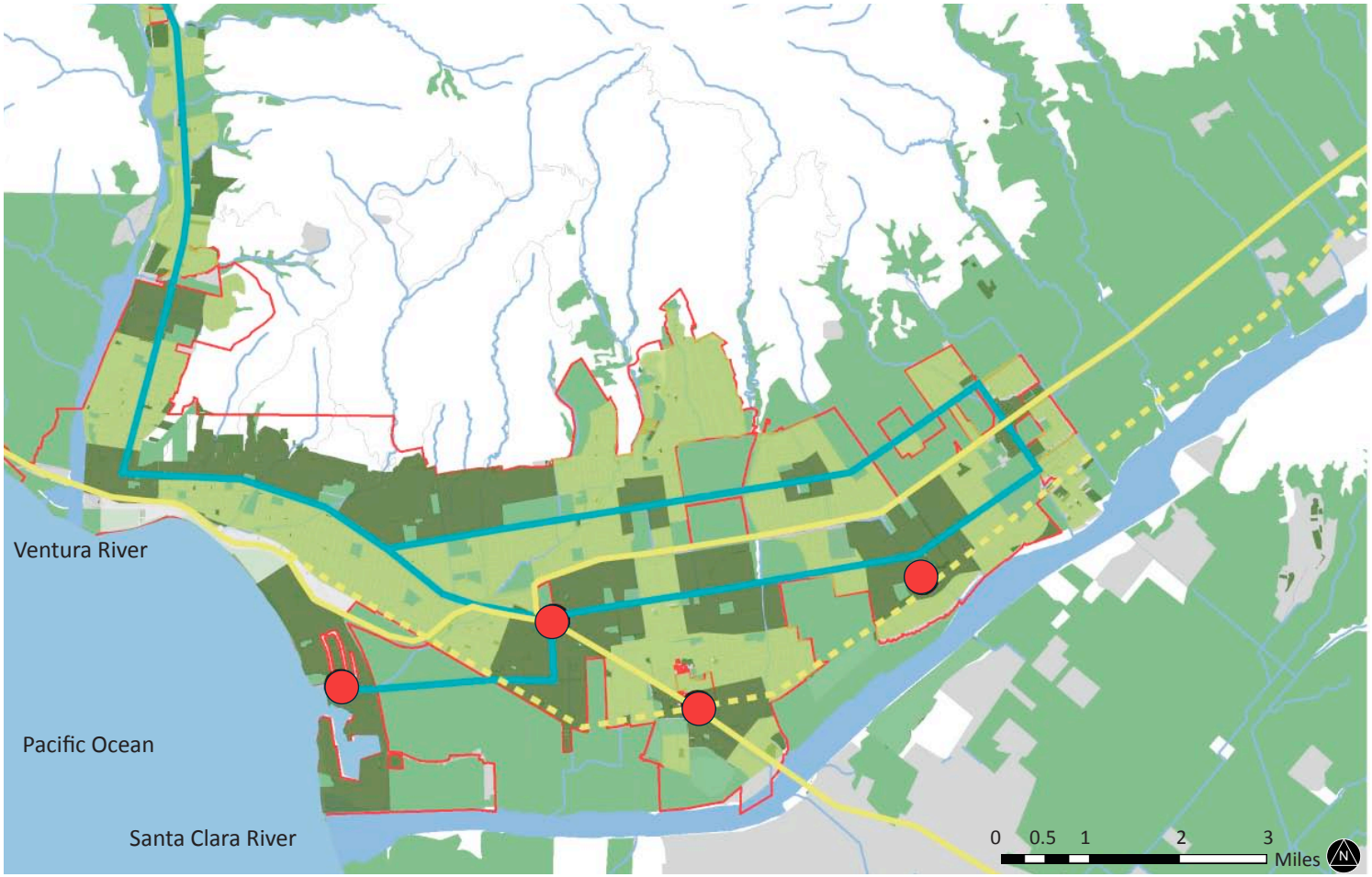
Recommended 2050 Diet for Ventura County (% per person per year)	Acres Needed for Production	Acres as Percent of Total County Farmland (138,100)	Other Suitable Land Sources
35% Vegetables	21,413	16%	Urban
24% Fruit	17,817	13%	Urban
24% Dairy Products	13,271	10%	
12 % Grains (dry weight)	31,922	23%	
1% Olives, Nuts, and Beans	1,513	1%	Urban
1% Eggs	415	.03%	Urban
1% Poultry	6,620	5%	Urban
1% Red Meat	39,669	29%	Grazing Land
1% Fish	Ocean Harvest		Ocean

SOURCE: Jeavons, 2006, http://www.nal.usda.gov/afsic/pubs/altlist.shtml#toc1, http://www.kenaf-fiber.n/kenaf.asp, http://www.hempnation.com

If the population adopts a Mediterranean diet, local production could supply all of Ventura County's projected food needs for 2050.

TABLE 12
Land Requirements for Food Production in Ventura County

Opportunities for food production and processing are abundant throughout the urban environment, including roof tops, roads, community gardens, and private yards.



SOURCE: Ventura County GIS Department

FIGURE 73
City Vision for Food

Produce food with minimal imported materials (i.e. chemical fertilizers and pesticides) in a sustainable manner.

Farming practices have a large impact on environmental and human health. By decreasing dependence on imported farm inputs, food production in the county will be less effected by Peak Oil, and both environmental and human health will benefit.

GUIDELINES:

Initiate research and experimentation in post-Peak Oil farming practices. By developing fossil free farming techniques that are appropriate to the region, the region can more successfully adapt to post-Peak Oil conditions. Utilize greywater, roof water, and urban compost for urban agriculture.


Park


Rooftops


Private Yards


Street

Available urban land for crop production


Textile Crop


Vegetable Garden


Grains


Permaculture Garden

Potential urban crop production

Community and Public Ownership
- Community Garden
- School Garden
- Community Supported Agriculture (CSA)
- Publicly Owned Leased to Private Growers
- Backyard Landtrust

Private Ownership
- Agricultural Corridors
- Small Commercial Farms
- Suburban Homestead

Management Structure

FIGURE 74
Creating a Diverse Urban Agricultural System

Create a phased plan to eliminate use of chemical fertilizers and pesticides.

- Eliminate use of imported fertilizer inputs. Nourish the soil with onsite resources and with techniques such as cover cropping, composting, and crop rotation (see ***Part III: Water Guidelines*** page 126 for more on building soil quality).
- Eliminate chemical pesticides by managing the landscape for beneficial wildlife. Pollinators such as native and honey bees, and predators of agricultural pests, such as big brown bats and loggerhead shrikes, are useful for natural pest management.

$1 Vacant Lot Program

The Providence Redevelopment Agency (PRA) was chartered by the City of Providence to transform blighted land into productive, tax-paying uses. Since 1999, PRA has managed the "$1/Lot Program" which allows non-profit organization and abutting neighbors to purchase vacant lots for $1 on the condition that they will return it to productive uses, such as community gardens and parks (Fleming 1998). This program may prove to be a highly effective model for post-Peak Oil San Buenaventura.

EVALUATION:

Energy

- *Urban (50 percent of total diet under the Post-Peak Oil Plan):* As urban agriculture uses as little as one percent of the energy required for the conventional food system, the post-Peak Oil urban agriculture plan can decrease energy required by the food system by up to 49 percent (extrapolated from Hester 2006).
- *Regional (50 percent of total diet under the Post-Peak Oil Plan):* Adopting organic farming practices can reduce energy required for production by 50 percent. Eating fresh, local food can also reduce energy required for food transportation, processing, and packaging by an estimated 29.5 percent. The post-Peak Oil plan for regional food production can decrease energy required by the food system in the county by up to 15 percent.
- Energy required to feed the population of Ventura County in 2050 can be reduced by up to 65 percent, compared to current per capita requirements.

Land Use

- Based on Mediterranean dietary guidelines and typical regional yields (where information is not available, national averages have been used), the 2050 county population can be fed with 86 percent of existing county farmland (not including fish, which can be provided by ocean catch, and urban farmland) (Table 12). This figure is optimistic in that it assumes that all food produced is consumed (no waste), that market values do not inhibit production of all food groups, that disruptions (such as a prolonged freeze or drought) do not increase the amount of land required, and that increased labor and intensive farming practices are able to compensate for diminished fossil fuel energy. As these factors may increase the amount of land required, the production of fruit and vegetable production in urban areas is essential to meet dietary requirements as well as to enable regional farmland to produce export crops.

- Under the *Post-Peak Oil Vision Plan*, 50 percent of food is grown within urban areas and the remaining 50 percent is grown primarily within the region. Specialty foods which cannot be grown in the region may be imported. Establishing a productive urban landscape enables regional land to be used for valuable export crops which fuel the local economy.

- The *Post-Peak Oil Vision Plan* provides an increase of 3,616 acres of land dedicated for urban agriculture in the City of San Buenaventura, as 36 percent of the *Concentrate* zone and 40 percent of the *Release* zone are dedicated to urban agriculture. This is enough land to provide for nearly 50 percent of the city and county dietary needs.

Quality of Life

- Urban agriculture programs can provide jobs, a healthy food source, a way to green the city, reduction in the waste stream, and opportunities for community collaboration.

- All existing harbors and four urban sites have been identified as suitable for large-scale processing and distribution facilities. Combined with small-scale urban facilities, this system can provide jobs and food supply to the population.

- Residents health improves (Research has shown that a Mediterranean diet decreases incidence of diabetes many cancers, obesity, Alzheimer's disease, and heart disease. As a result, the Mediterranean diet is also associated with higher life expectancy and increased quality of life (Yang 2000). Physical fitness also increases as more residents take up gardening.

Improving Urban Soil Quality Using Plants	
Asphalt (bitumen contamination)	Black Locust, Black Alder, Common Reed
Pesticide Contamination	Mulberry, Rye, Fescue
Herbicide Contamination	Willow, Grasses, Legumes
Heavy Metal Contamination	Sunflower, Mustards, Hops, Dandelions, Nettles
Compacted Soil	Alfalfa, Dandelion, Mustard, Artichoke, Comphrey
Low Soil Fertility (Nitrogen, Phosphorus, Potassium, Calcium)	Mountain Mahogany, Clover, Nasturtiums, Alfalfa, Ceanothus, Chamomile, Oak

SOURCE: www.epa.gov/NE/eco/uep/priority.html, www.engg.ksu.edu/hsrc/97abstracts/p51.html, www.envirotools.org/factsheets/phytoremediation.shtml, Kourick1986

TABLE 13
Phytoremediation Plant List

Potential Textile and Industrial Oil Crops	
Kenaf	paper, fiber, twine, rope
Hemp	paper, cloth, paint, fuel
Bamboo	building materails
Sunflower, Jojoba, Flax	oil products

SOURCE: Jeavons, 2006, http://www.nal.usda.gov/afsic/pubs/altlist.shtml#toc1, http://www.kenaf-fiber.com/en/kenaf.asp, http://www.hempnation.com

TABLE 14
Textile Crops

Hemp *(*Cannabis sativa*) has a long history of cultural and commercial value in many societies throughout the world. Hemp requires only ¼ or less of the land required by timber crops to produce the equivalent amount of building materials and pulp for paper. In a post-Peak Oil society, plants with versatile uses that require relatively little land, water, pesticides, and labor to produce will be especially valuable. Before the advent of petroleum-based plastics and the anti-*cannabis *campaign begun by DuPont and the Hurst Corporation in the 1950s, hemp was used for everything from ship sails to the first body of the Ford Model T. Although there are no psychoactive effects from hemp smoke inhalation as in marijuana (Cannabis indica) smoke, the two species were treated the same legally (Robinson 1996).*

PHOTO SOURCE: www.flickr.com/photos/dale_hameister/

California Strawberry

PHOTO SOURCE: www.flickr.com/photos/174259929/

Buckwheat

PHOTO SOURCE: www.flickr.com/photos/147788382

Sage

PHOTO SOURCE: www.seaweedsofalaska.com

Achillea millefolium

Native edible plants:

California Strawberry
Fragaria californica

California Blackberry
Rubus californica

California Black Walnut
Juglans californica

Nopales
Opuntia basilaris

California Grape
Vitis californicus

Mexican Elderberry
Sambucus mexicana

Pollinator-attracting plants:

Buckwheat
Eriogonum species

Rhus species

Sage
Salvia species

Toyon
Heteromeles arbutifolia

Plants that repel pests or attract pest predators:

Buckwheat
Eriogonum species

Nasturtium species

Lavender
Lavandula species

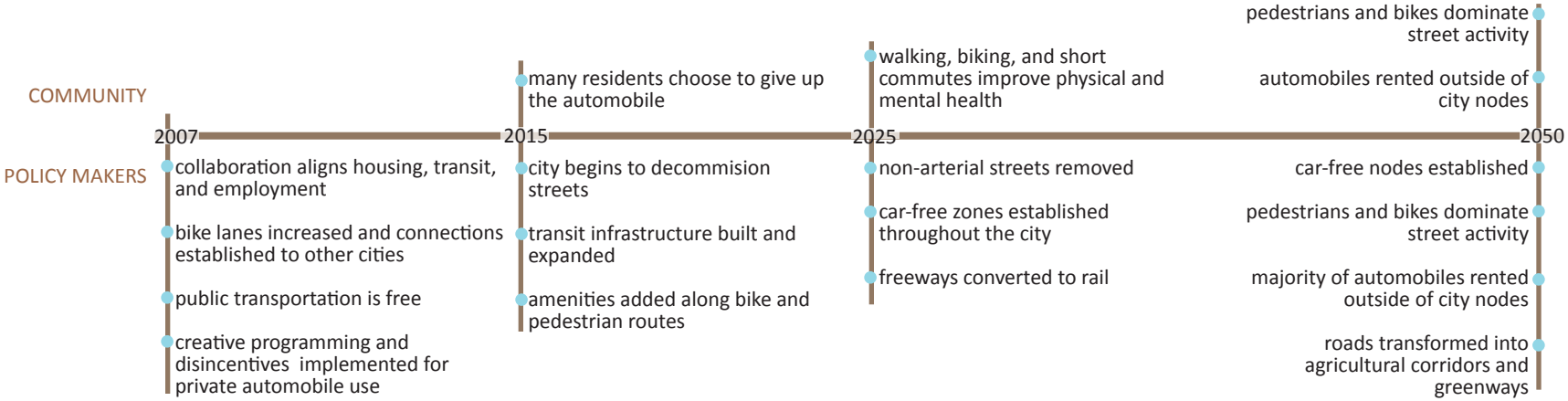
Achillea species

MOBILITY

Reverse the Transportation Hierarchy

Peak Oil will have a profound impact on mobility, as 90 percent of Americans own at least one automobile (Lowry 2007). Reduced oil availability will continue to increase the costs of owning and driving cars. By shifting investment from highways to public transit now, cities would be rewarded with decreased highway infrastructure costs, increased overall space, and reduced environmental impact.

Collaborative efforts to integrate land use decisions and multi-modal transportation planning can reverse the trends that promote single-use, sprawling development, and the need for a private vehicle. Increasing the efficiency of the transportation system will increase capacity, while minimizing the costs and livability impacts of the current system expansion (Figure 75).



SOURCE: Ventura County GIS Department; NASA WorldWind

Regional connections by rail and oceanic travel.

FIGURE 75
Regional Vision for Mobility

Build and develop infrastructure for city and regional public transit system

Currently, 97 percent of Ventura County commuters use private automobile transportation (see Figure 34, page 66). Increased energy costs, diminished resources, and a growing population will render daily commuting by automobile unfeasible, but travel will still be essential for a high quality of life. Because oil and energy prices will rise, it is necessary to adapt and build infrastructure for rail, multi-modal centers, and transit corridors.

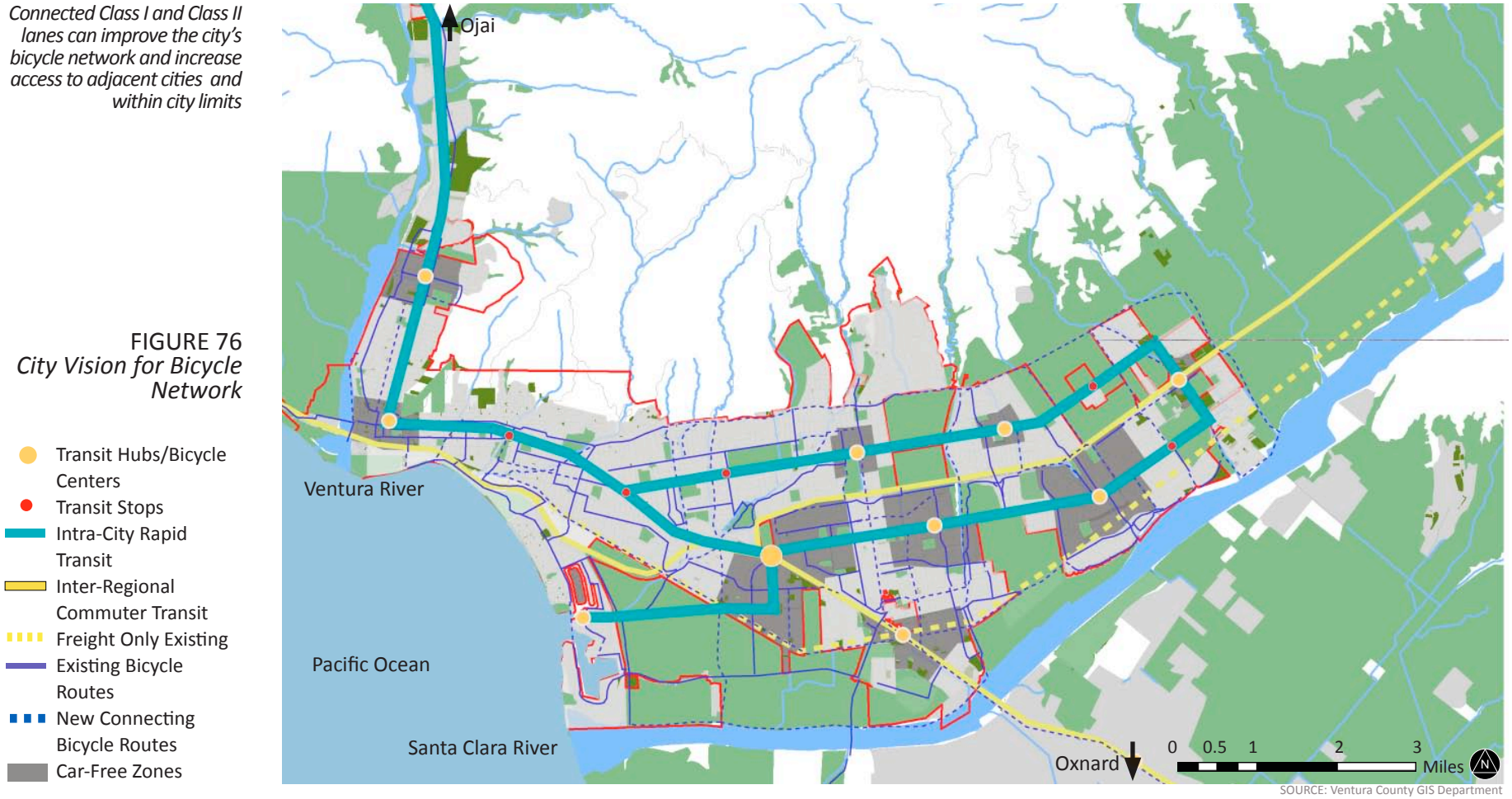
GUIDELINES:

Build and expand infrastructure for public transit. This process can be started by expanding existing transportation. For instance, increasing and linking Metrolink and Amtrak routes; using existing arterial roads like Telephone Road, Telegraph Avenue, and Main Street to create bus only lanes streets; and converting existing highway lanes to rail lines.

Shrink the triangle. Distances needed to commute to work, to shop, and to socialize will shrink as cities and counties

Connected Class I and Class II lanes can improve the city's bicycle network and increase access to adjacent cities and within city limits

FIGURE 76
City Vision for Bicycle Network



SOURCE: Ventura County GIS Department

collaborate to align future public transit with housing needs, amenities, and quality employment opportunities.

Convert underutilized urban land to more productive uses. Designate roads to be decommissioned for public transit right-of-way.

Prioritize transportation money and resources for public transportation. Investing in automobile-based infrastructure is not a wise investment, as it will not serve the needs of future generations.

Prioritize, expand, and improve bicycle network

Additional miles, connections, and improvements are necessary for the city and region to transition from the use of the private automobile to alternative transit modes.

GUIDELINES:

Build and expand infrastructure for bicycling. By collaborating with other cities to connect and increase the number of bike lanes, and to improve existing bike lanes, less reliance on automobiles will decrease the need for commuting (Figure 76).

Add amenities along routes and promote beautification. Amenities include rest stops with showers and public restrooms. Trees provide shading, and plantings make routes more pleasurable.

Increase the number of pedestrian nodes within the city

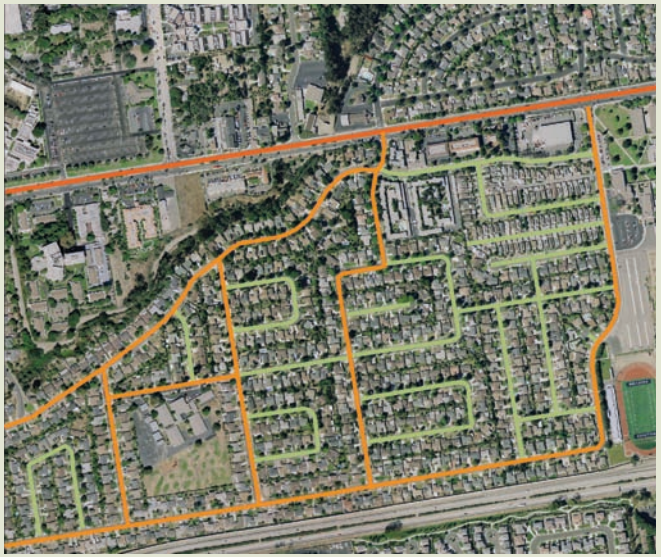
Alternative fuel technologies can alleviate some of the issues associated with automobiles, such as pollution and reliance on fossil fuels, but no fuel substitute will reduce the increasing amount of cars and traffic on the roads and highways. Automobile use harms social systems, causing isolation and aggravation between drivers and non-drivers. Traffic congestion decreases street life and social interaction (see ***Appendix C-3: Fleischmann).*** Finally, the automobile and its infrastructure require space that could otherwise be used for community enhancement. It is estimated that for every car, approximately eight parking spaces are built (Kay 1998).

GUIDELINES:

Make public transportation free. Public transportation should be free when first initiated in order to encourage use by residents not accustomed to taking public transit. The money expended in creating ridership on public transportation systems will be more than made up for in quality of life benefits, and in environmental and human health. After public transit is in place, it should remain free on certain days (i.e. on Mondays, when traffic may be heaviest) or for certain groups (i.e. the elderly, teenagers, and low-income workers).

Decommissioning and Redesigning Roads

As San Buenaventura transitions to a pedestrian-friendly city, certain roads can be decommissioned and used for other purposes. This diagram shows the potential for this strategy, with some roads remaining as access for vehicles and others converting to areas of food production or open space. It is important to note that decommissioning a road does not mean access by residents or emergency vehicles will be eliminated. Paths installed adjacent to existing sidewalks can easily meet this need. Small transit vehicles can use this same path to transport disabled residents, children, or the elderly. As the value of land shifts from automobile use to local food production, asphalt will be removed. Both neighborhoods and government entities should explore opportunity sites for demonstrating this future conversion. Roads that have limited connectivity or that are short in length should be considered first for this transition. New roads are designed using permeable materials to increase groundwater recharge and reduce surface water runoff.



Implement creative programming and inconvenient costs. In order to phase out automobile use, inconvenient costs can help decrease dependence on the automobile. Examples of inconvenient costs include:

- Taxes on driving larger vehicles or for driving in dense nodes (this type of system is employed in New York and London)
- Fees for parking

Creative programming includes:

- decommissioning of streets, highways, and parking lots for pedestrian use
- Nine percent parking maximum - allowing only 9 percent of the urban area for parking helps to create pedestrian-friendly spaces (Alexander 1977).
- "Slow streets" (i.e., bumpouts, speedbumps, or "woonerfs" - a street or group of streets designed to give pedestrians and cyclists legal priority over motorists) (Wikepedia.com).

Establish car-free zones. Car-free nodes are critical to pedestrian-centric, high-quality, urban centers (Crawford 2002).

Expand existing regional rail and ocean freight system

As the rising cost of moving goods begins to affect truck drivers, freight traffic on freeways is expected to decline and shift from trucks to trains. As rail capacity fills with commuters and passengers, the city and region will rely more on ocean freight. Port of Hueneme is the only deep-water harbor between Los Angeles and the San Francisco Bay area, and will be an important hub for post-Peak Oil import and export activity.

GUIDELINES:

Build and expand infrastructure for freight transport. This can be done by collaborating with cities and counties to develop and increase rail and ocean freight capacity.

Convert freeways to rail. The conversion of freeways utilizes surplus capacity on the freeway system for alternate uses such as high-capacity, medium-speed passenger and freight rail service, or for growing textile crops.

Rail systems enjoy several intrinsic advantages over all other forms of transportation:

- low frontal area
- very low rolling resistance
- very high capacity, allowing denser, more energy-efficient land occupancy

The issue is where these new rail lines will go. One solution is to convert part of the existing freeway system. However, structural limitations of conventional rail systems preclude their use in a freeway to rail conversion. Therefore, freeway to rail conversions will have to be based on new rail system designs, even if the underlying technology is substantially the same.

Development of a new rail technology that is cheaply and quickly installed on existing freeway right-of-ways is one rapid response to suddenly shrinking oil supply. The principal construction material required is roughly 215 tons of rail for each mile of track constructed and comparatively small amounts of steel for tie plates and bolts (to fasten the tie plates to the road surface). By far the largest amount of the work has already been done – the construction of the freeway systems. Freeway to rail conversion merely enables their continued utility under energy-limited conditions. Many technical questions will need to be answered or verified, but studies conducted show that there do not appear to be any fundamental technical barriers (Crawford 2002).

Conversion of Freeway to Rail

EVALUATION:

Public Transportation
By 2050, within the city, 72 percent of highways and roads are decommissioned (Figure 76). Some are adapted for rail and other public transit use, such as biking. Approximately 85 percent of the city's population is living within a ½ mile of a public transit hub. Eleven car-free nodes, covering nearly 4,000 acres and housing 128,002 people have been created within the city. Public transportation links neighborhood nodes with each other and to surrounding communities.

Walking
Within the node, residents are within walking distance of all of basic needs. The need for a private vehicle is significantly reduced, as development is now in sync with public transit, amenities, and jobs. Reduced traffic and significant monetary benefits greatly improve quality of life.

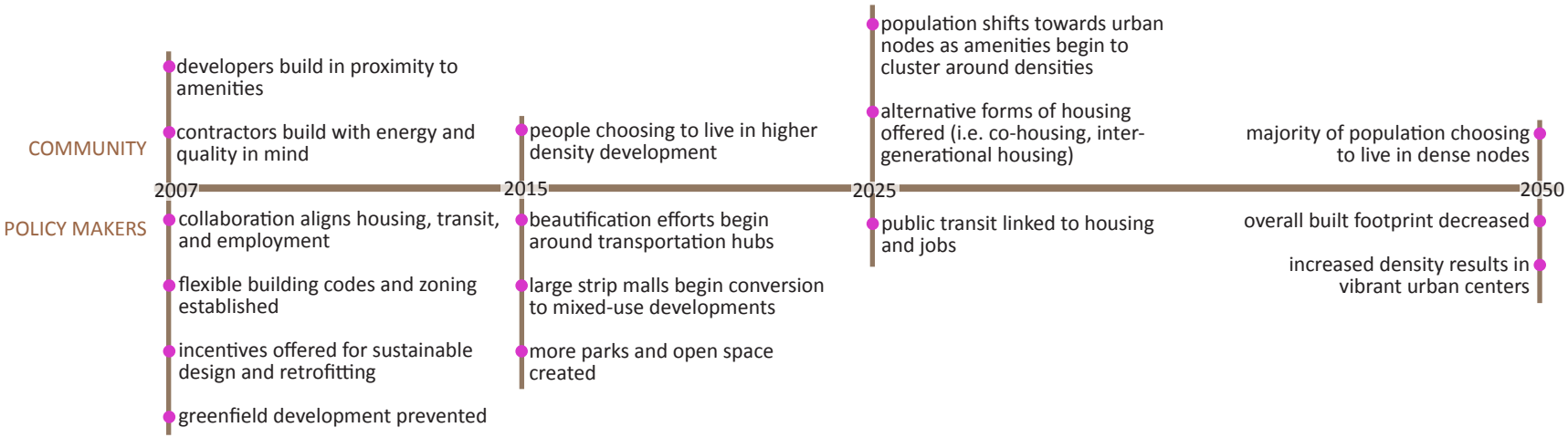
Biking
The city of San Buenaventura is planning on expanding the bicycle network by 50.5 miles between 2007 and 2020, which would give it a total of 151.5 miles of bike lanes (City of San Buenaventura General Bikeway Plan 2005). By 2050, 345 miles of improved Class 1 bike lanes are established. Biking is the primary mode of transportation for the city and much of the region. The majority of cyclists note improved physical and mental health (Figure 76).

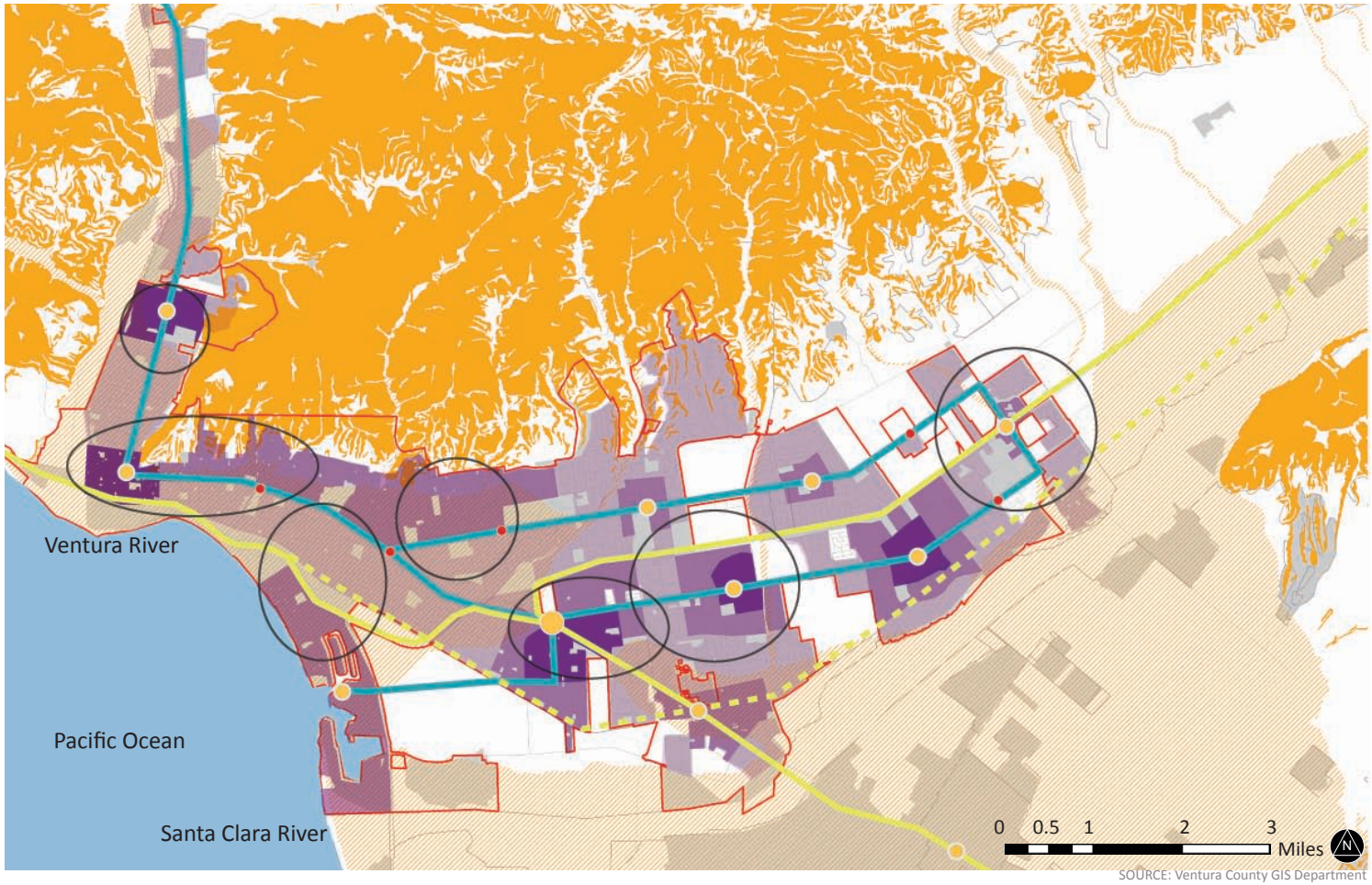
Passenger Rail/Freight
By converting two lanes of freeway to rail, passenger travel capacity increases by 95 percent. Rail infrastructure and capacity are increased; Santa Clara rail line connects to Piru and other regional rail lines (Figure 75); Ventura Harbor freight capacity and infrastructure is expanded.

SHELTER

Make Density Desirable

Increasing dense, mixed-use development is critical in a post-Peak Oil society in order to adequately house existing and projected populations, meet employment needs locally, preserve agricultural land, and reduce the consumption of energy and resources. The City of San Buenaventura and region must work together in promoting density and mixed-use, transit-oriented developments, while not neglecting the importance of diverse, attractive, sustainable, and affordable design. A balance of compromises and enticements can allay the concerns that keep people from embracing development that is beneficial for both human and natural communities. It is important to note that due to the unpredictable consequences of Peak Oil, the location, density, character, and boundaries of these dense mixed-use communities, or nodes, are liable to shift.





Urban nodes provide safe, sustainable, mixed-use housing for residents beyond 2050.

FIGURE 77
City Vision for Shelter

- High Density
- Medium Density
- Suburban Retrofit
- Transit Hubs
- Transit Stops
- Intra-City Rapid Transit
- Inter-Regional Commuter Transit
- Freight Only
- Urban Footprint
- Landslides & Fire Hazard
- Liquefaction and Flooding
- Areas of Intense Activity

Develop infrastructure and policy for dense, affordable, mixed-use development (nodes)

In order to achieve a localized, balanced post-Peak Oil society, several qualities for shelter must be prioritized: local, high-quality jobs (see ***PART III: Economy,*** page 155 for more detail); affordable, dense, mixed-use development; and proximity to public transit (see ***PART III: Mobility,*** page 141 for more detail). Stabilizing the jobs/housing balance for the city and region is critical to localizing society and improving quality of life. Being able to live near work and public transit enables reduced or eliminated commute times, which saves fuel and time. Affordable housing is necessary in order to provide for a diversity of workers and demographic groups. Dense, mixed-use development provides social and practical needs close to home, and prevents sprawl, saving future land from development. Decreasing development outside of dense, mixed-use nodes restores land for agricultural use, habitat, and public open space.

Concentrating the bulk of new development within non-hazard zones will provide extra security in a world in which oil, energy, and resources are increasingly rare and expensive, post-Peak Oil. The potential for flooding, earthquakes, landslides and forest fires is high throughout the region (see page 110), and building within these areas creates more risk than is reasonable as oil availability decreases and Global Warming increases.

GUIDELINES:

Emphasize development in concentrate zones. This can be done by providing incentives and flexible zoning for developers and investors interested in dense development within nodes. Beautification efforts should take place within these nodes in conjunction with incentives efforts.

Decrease public investment in release zones. By decreasing public investment in the release zones, more funding will become available in the concentrate zones. Additional funding will lend to larger communities in the concentrate zone, a necessity to support needed amenities.

Decrease the urban footprint. By concentrating development, land is freed up for other critical post-Peak Oil uses, including agriculture, functioning of natural systems, and groundwater recharge.

***Shrink the triangle*.** Building close to amenities is a critical factor in creating a livable community. Restaurants, pubs, grocery stores, public space, and transportation are all important amenities for complete neighborhoods. Density will occur post-Peak Oil out of necessity, but if properly planned for, these neighborhoods can become fully functional communities rather than isolated single-use developments. In order for this to happen, collaboration with cities to align housing needs with public transit access and quality employment opportunities will need to begin immediately within the city and throughout the region.

Retrofit existing homes and require all new homes to be energy- and resource-efficient

The construction and maintenance of buildings accounts for more than 30 percent of the energy consumed in the United States (Mumma 1995). Sustainable-housing design will reduce energy and resource consumption, as well as improve quality of life post-Peak Oil in several ways: passive heating, cooling, and lighting measures significantly reduce electricity needs; solar power for energy and water heating also reduce electricity needs and costs; and the use of renewable, local, reusable, and recycled building materials reduce resource consumption and waste, while providing local jobs.

GUIDELINES:

Implement flexible building codes and zoning.

- Offer incentives and supportive policy for sustainable design and energy-saving retrofitting.
- Build with energy in mind. As energy costs rise due to Peak Oil, sustainable housing that is built or retrofitted to function "off the grid" will be in high demand. The City of San Buenaventura is fortunate to have a mild, Mediterranean climate, ocean breezes, and ample sunlight. Buildings can take advantage of these natural resources to reduce and even eliminate energy use. Passive heating and cooling design, including site location and building orientation, can significantly reduce energy use and costs. The use of on-site renewable energies can reduce the amount of energy lost in transport, also reducing overall energy costs. Passive energy, heating and cooling design strategies include: (Figure 79)
    - Site placement, and building shape and orientation to accommodate breezes and light, and to buffer buildings (Figures 80 and 81)
    - Thermal mass to decrease energy loss and moderate indoor temperature
    - Solar water heaters and panels to reduce the need for electricity

The region's Mediterranean climate, solar patterns, and ocean breezes are taken advantage of in the building designs of 2050.

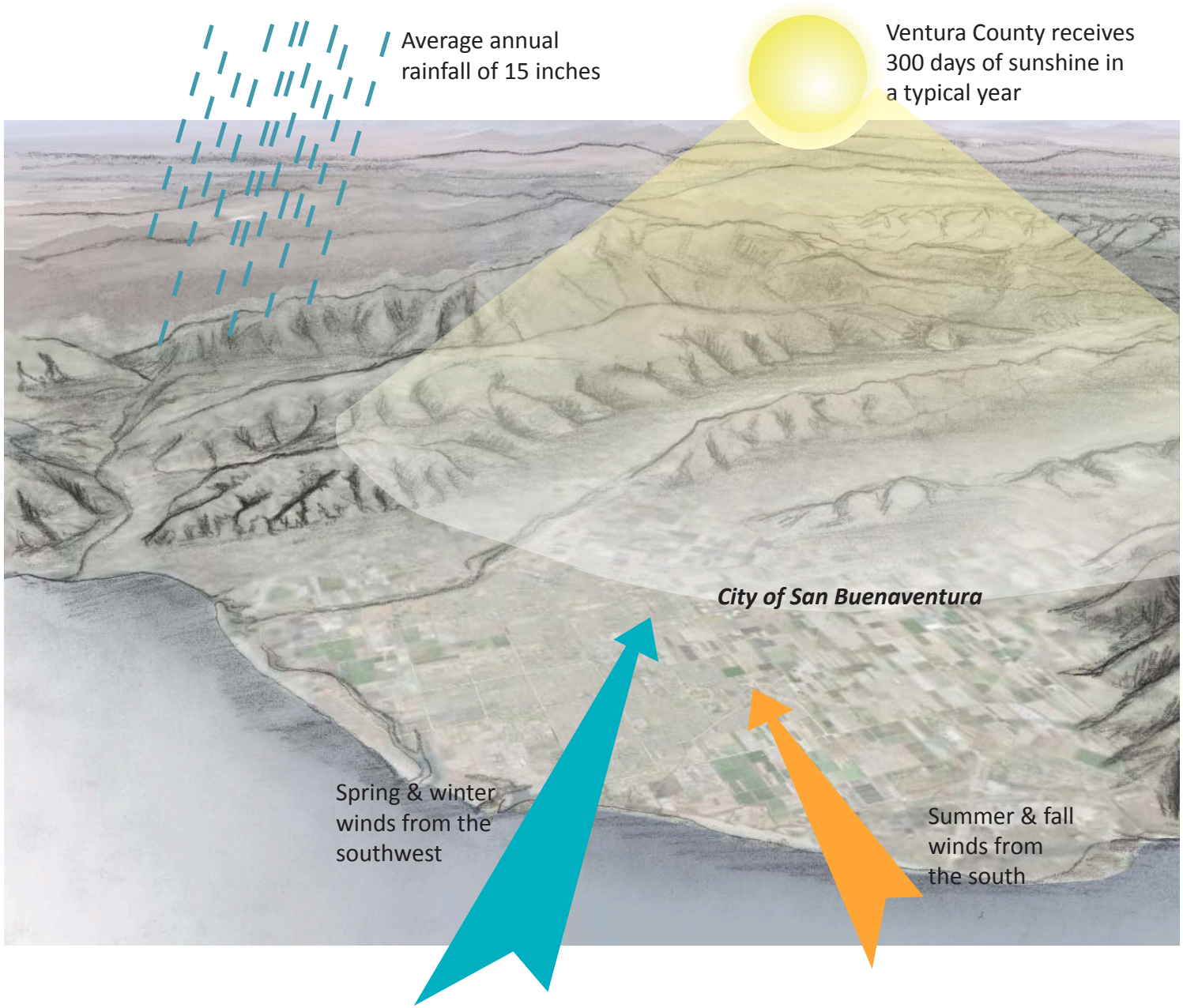
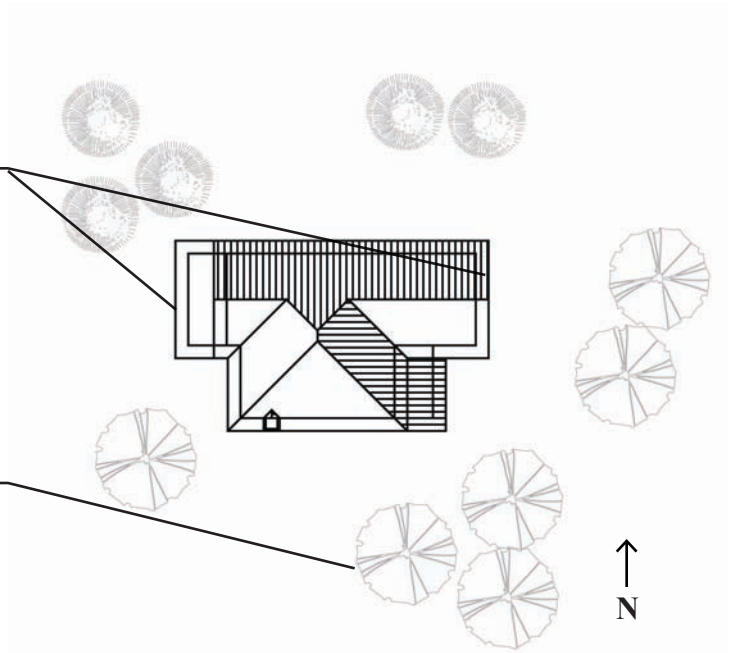


FIGURE 78
Climate Data

FIGURE 79
Landscape Design for Energy-efficient Buildings



SOURCE: http://www.igra-world.com/images/Solar-Green-roof-2.jpg

Greenroof Integrated with Solar Panels

- Shades and shutters to provide cooling
- Deciduous trees on the south sides of buildings for shade (Figure 79)
- Operable clerestory windows and skylights for natural lighting and ventilation (Figure 80)
- Cross ventilation and fresh-air inlets (Figure 81)

BENEFITS OF GREENROOFS:

Decreased energy use
Green roofs can cut energy costs in half in summer and by 25 percent in winter (Curtis 2006).

Increased lifespan
The underlying waterproofing is protected from ultraviolet (UV) rays and daily temperature fluctuations (EPA 2007). Experience with green roofs in Germany shows that 40+ and 50+ life spans for green roofs should be expected (ASLA 2006).

Reduced and remediated runoff
"A typical green roof with just three inches of growing media can be designed to reduce annual runoff by more than 50 percent" (Roofscapes Inc. 2002).Up to 30 percent of the nitrogen and phosphorus contained in urban runoff originates in the dust that accumulates on rooftops and other surfaces. The green roof filters out this contamination (Miller 2003).

Reduced heat island effect
"On hot summer days, the surface temperature of a vegetated rooftop can be cooler than the air temperature, whereas the surface of a traditional rooftop can be up to 90°F (50°C) warmer" (EPA 2007).

Reduced Noise Level
Green roofs absorb sound and can reduce the sound insulation of a building up to 8 decibels (Zinco.com).

Decreased global warming
One square meter of green roof could offset the annual particulate matter emissions of one car (City of Los Angeles 2006).

Cleaner air
Green roofs collect airborne particulates, absorb air pollution, and store carbon (EPA 2007).

Returns greenspace and habitat lost to development footprints
In most cities, the roof area is between 15 to 30 percent of the total land area. Green roofs can be designed to support migratory birds, invertebrates, and butterflies and other beneficial insects (Millet 2004).

- Indoor/outdoor spaces (i.e courtyards and roof gardens) for sun and breeze exposure
- Greenroofs and vertical gardens to reduce heat absorption and heat loss in buildings (for more benefits, see page 151)
- Roof catchment and greywater systems to reduce need to transport water to buildings

- Build with quality in mind. Increased density is viewed in a negative light due to its reputation for cheaply built, low-income apartment buildings that often lower property values. If designed well and built with quality materials, multi-family housing has the potential to be beautiful, comfortable, energy efficient, and long-lived. Material choice is one of the most important considerations. The use of recycled and de-constructible building materials saves resources and embodied energy. Renewable materials ensure the availability of materials for future generations. The following qualities should be prioritized for all new building materials (see ***PART II: Analysis: Shelter*** page 74 for more information):
  - Use materials that are recycled, renewable, and deconstructible
  - Use long-lived, low-embodied energy materials

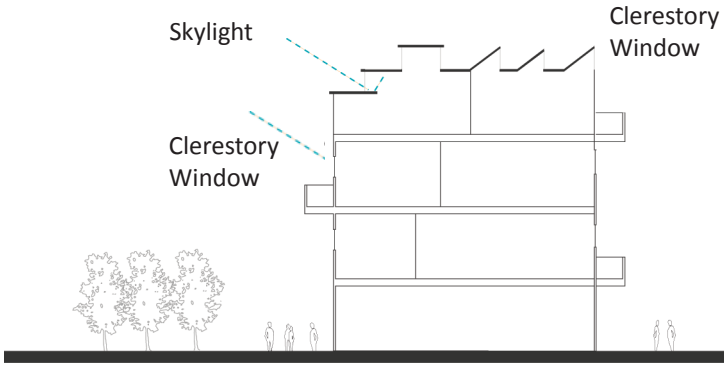


FIGURE 80
Natural Lighting

Clerestory windows are set high in walls or vertical in a roof structure to allow for daylighting. Skylights are set horizontal in roof structure to allow for daylighting.

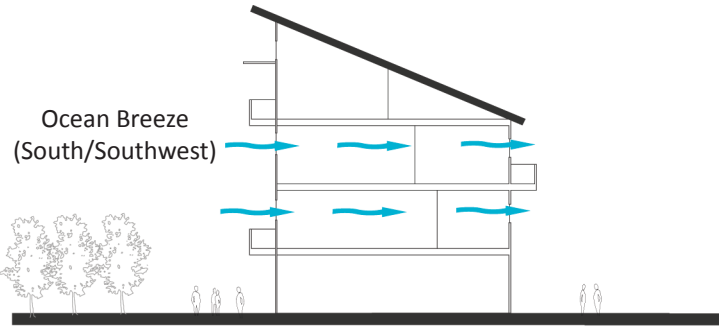


FIGURE 81
Summer Evening Ventilation

Operable windows set high in wallls allow for fresh air to enter and hot air to exit for natural ventilation.

Place buidings an appropriate distance to allow solar access in winter months

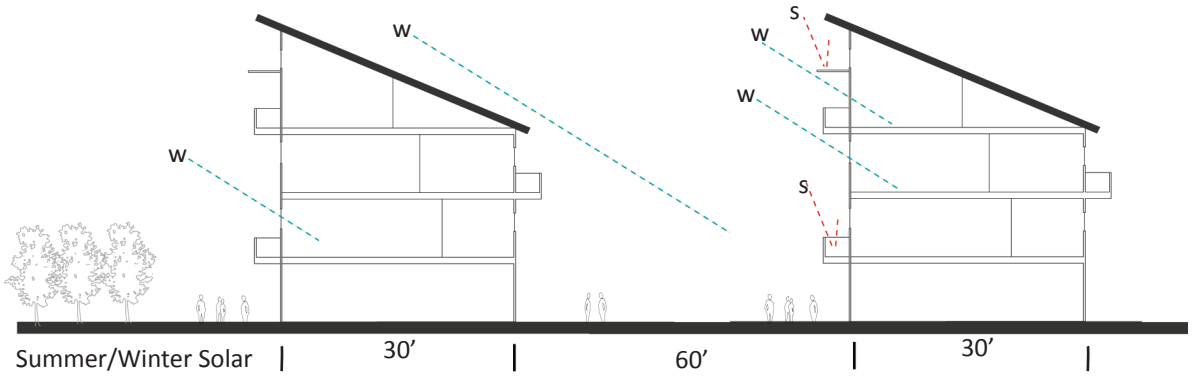


FIGURE 82
Solar Access and Building Distance

Placement of balconies and canopies can allow for solar gain in the winter months, while blocking solar rays during the summer months.

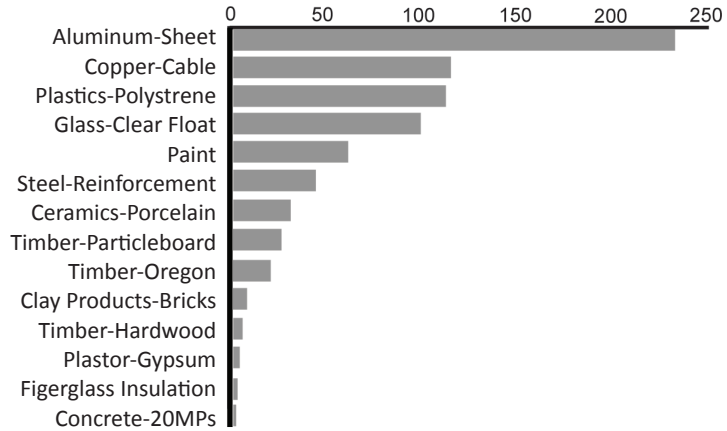


FIGURE 83
Embodied Energy: Common Building Materials

Promote adaptive reuse of buildings and underutilized urban infill land

The adaptive reuse of existing buildings and previously developed, underutilized land promotes infill and saves important habitat, agricultural, and greenfield land from development. (See ***Appendix C-4: Reed*** for more information.)

GUIDELINES:

Implement a moratorium on greenfield development. Hillsides, natural landscapes, remnant agricultural land, and other presently undeveloped land (greenfields) should not be developed, with the exception for post-Peak Oil agricultural uses.

Convert underutilized urban land to more productive uses. Provide incentives to promote urban infill in the form of the re-use of buildings and underutilized land outside of hazard zones to preserve undeveloped land, agricultural land, and habitat.

Implement flexible building codes and zoning. The principles of zoning are based on separating land-uses (see ***Appendix C-3: Fleischmann***). Post-Peak Oil communities will need to make adjustments in zoning laws to reshape the urban environment for a mix of uses and activities. Building codes will need to be more flexible in order to allow dense, sustainable, mixed-use development. Suburban neighborhoods near transportation hubs will be pressured to become denser, and many homeowners will want to add additions as the cost of housing increases and availability decreases. Lifestyle changes throughout the city will prompt such changes. For example, as people rely more on public transit, garages that once housed cars could serve as additional rooms or commercial spaces. As energy costs rise, sustainable features such as solar panels, compost toilets, rainwater catchment, and greywater systems will become more popular.

EVALUATION:

Housing

By 2050, an emphasis on high density and the availability of affordable multi-family housing near amenities, jobs, and public transit alleviates city and county housing needs, and balances the jobs/housing ratio. Eighty-five percent of the city population lives on 32 percent of city's land or 35 percent of the 2007 urban footprint. 45,905 people (29 percent of city population) live in high-density nodes; 88,643 (56 percent) live in medium density; 31,923 (15 percent) live in low density.

The city works with regional governments to prioritize medium- to high-density mixed-use along transit lines and near high-paying employment in to accommodate agricultural land and resource needs.

Building Design

The amount of energy saved through passive and reduced energy design is highly variable, depending on location, individual needs, and the sustainable strategies employed. By using recycled and re-used building materials, over 60 percent of construction and demolition waste could be diverted from landfills.

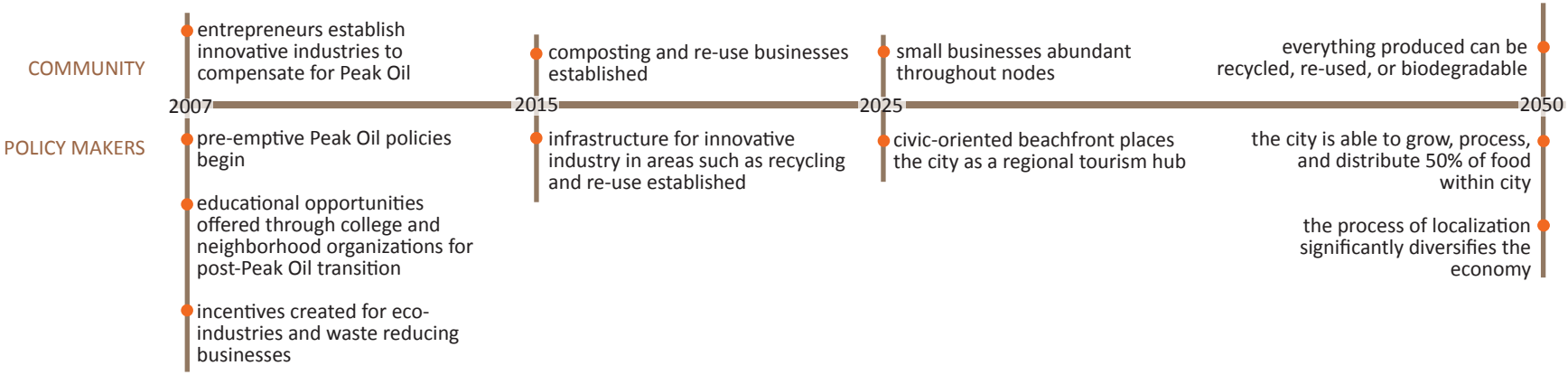
Long-lived materials are the least likely to be responsible for indoor air pollution. The more durable a building material, the less likely it is to produce the emissions and decomposition that lead to respiratory problems and other ailments (Building Green 1992). By choosing durable, sustainable materials, health problems associated with indoor air are significantly reduced.

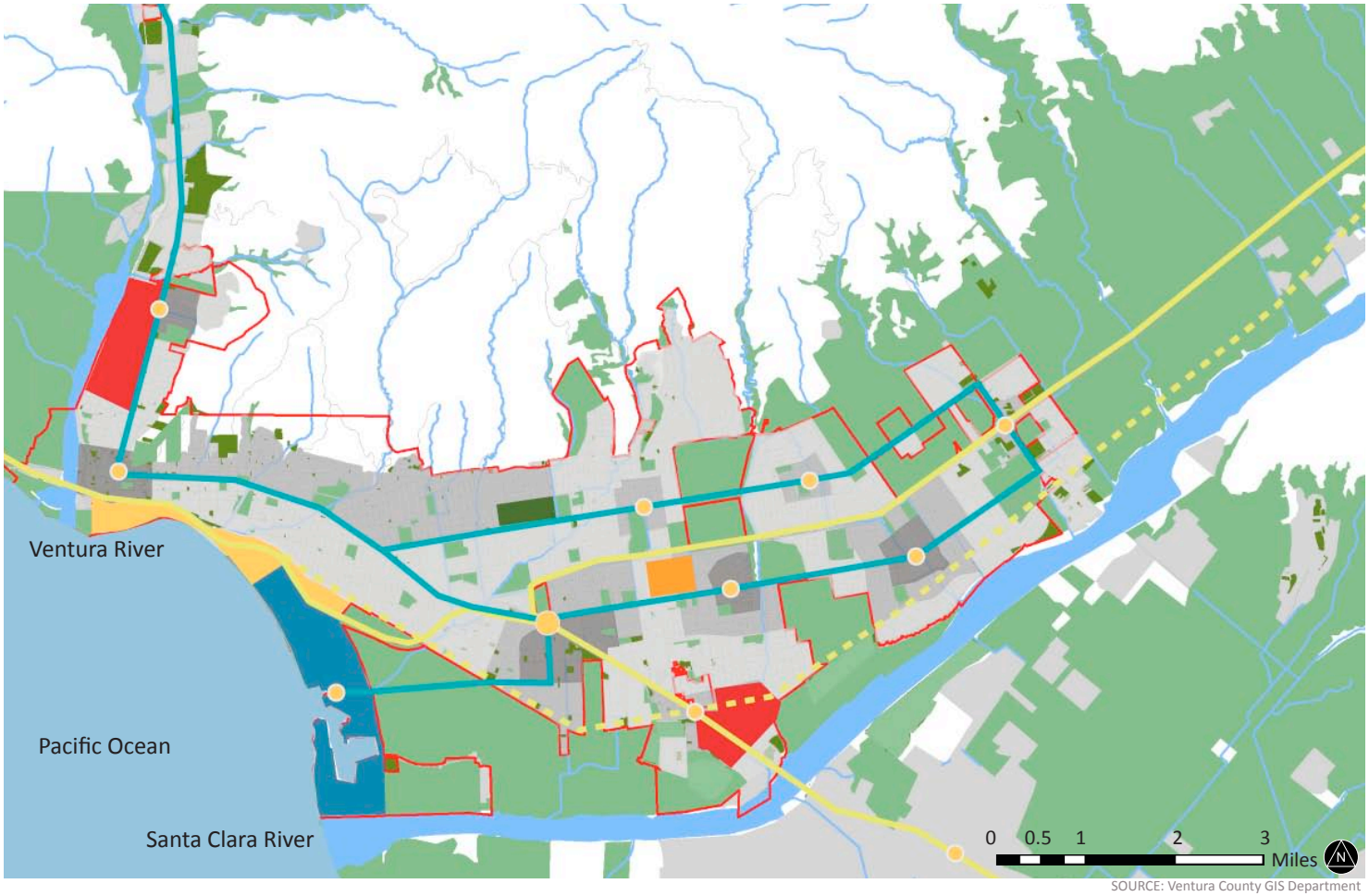
The reuse of existing infrastructure and previously developed urban infill land significantly reduces the need for additional costly and resource-intensive infrastructure and greenfield land. Land within hazard zones can be returned to habitat or developed for agriculture instead, meeting both wildlife and human needs.

ECONOMY

Build Local Economy

Peak Oil will alter economies all over the world, causing the transportation, manufacturing, and processing of goods to become more expensive. San Buenaventura will need to produce these goods locally where possible and where not possible, work with other cities within the region to align production with regional needs. Industries must alter the way in which products are manufactured and processed in order to transition to a post-Peak Oil economy.





SOURCE: Ventura County GIS Department

The City has abundant economic resources that will assist its transition into a post-Peak Oil economy.

FIGURE 84
City Vision for Economic Resources

- High Density
- Medium Density
- Suburban Retrofit
- Transit Hubs
- Transit Stops
- Intra-City Rapid Transit
- Inter-Regional Commuter Transit
- Freight Only
- Agriculture
- Harbor
- Government
- Education
- Industry
- Tourism


Agriculture


Harbor


Government


Education


Industry


Tourism

Identify economic sectors that are based on available resources and will thrive post-Peak Oil

The city of San Buenaventura and the region possess abundant resources that will make the transition to a post-Peak Oil society easier than it would be in other communities.

GUIDELINES:

Establish infrastructure for a localized economy. The following is a list of resources that should be employed when looking for economic sectors to prioritize.

- **Agricultural –** Agricultural land exists throughout the city and region, will be critical to the creation of a locally viable economy. Infrastructure that can

Employment Opportunities Post-Peak Oil		
Employment Sector	**Industry Type**	**Post-Peak Oil Opportunities for Economic Development**
Food Production	Organic Farming	Teachers, Farm Labor, Research and Innovation, Food Processing
	Textile Production	Farming, Processing, Manufacturing
	Oceanic Food Production	Fishermen, Aquaculture, Sustainability Research
	Urban Agriculture	Coordinators, Farmers, Sales People
Manufacturing and Processing	Recycling	Collectors, Adaptive Re-use, Innovative Addaption of Recycled Materials
	Sustainable Industry	Technology, Renewable Technologies
	Repair	Machinery, Basic Needs, Quality Materials
	Scavenging	Material Re-use
Services	Health Care	Holistic Healthcare, Bio-medicinal, general diversification
	Compost Managment	Collectors, Distributors
	Information Technology	Opportunity to create an exportable trade
Government	Councils	Opportunity to organize efforts throughout region, city, and neighborhoods
	Coordinators	Opportunity to organize efforts in industries like Aquiculture, Compost Managment, and Habitat Protection
	Researchers	Opportunity for information gathering in areas like Aquiculture, Agricultural Practices, Economics
Education and Design	Educators	Opportunity to ease transition to post-Peak Oil Economy
	Sustainable Designers	Landscape Architects, Architects, Planners
	Peak Oil Consultants	

TABLE 15
Post-Peak Oil Employment Opportunities

be used for processing and storage within close proximity of these lands should be taken advantage of.

- **Tourism –** San Buenaventura's location offers many tourism opportunities including the harbor, beach, and historic downtown. As the cost of transportation rises, people will choose recreational and vacation opportunities within the region.
- **Industry –** There are two areas within the city that have infrastructure suitable for manufacturing and processing. On the Westside, post-industrial lands can be used for recycling industries. Another industrial opportunity exists on the east side of the city, at the convergence of Highway 101 and the freight line to Piru. This area is within close proximity to a large amount of agricultural land and is located along existing and future rail lines that lead to ocean ports.
- **Harbor –** The harbor area can play multiple functions in a post-Peak Oil community. Currently, it is a recreational and tourism hub. Its restaurants, hotels, and shopping are likely to remain as the area transitions to a post-Peak Oil oceanfront hub. With the ocean resources available throughout the Santa Barbara Channel, the harbor will also play a key role in bringing fish into the city and surrounding region. Ventura Harbor is less than 10 miles from Port Hueneme, but the energy efficiency of shipping will increase its importance as a local harbor.

TerraCycle, founded in 2001 by two Princeton University students, proudly claims that their mass-produced garden products are the only products made entirely out of "garbage." TerraCycle's flagship product, TerraCycle Plant Food™, is an "all-natural, all-organic, 'goof-proof' liquid plant food made from waste (worm poop) and packaged in waste (reused soda bottles)." Their website includes "The Eco-Capitalist Guidebook" -- an in-depth discussion of eco-capitalism as it pertains to industry.

Job Creation: Re-Use and Recycling vs. Disposal	
Type of Operation	Jobs per 10,000 TPY (tons per year)
PRODUCT RE-USE:	
Computer Re-use	296
Textile Reclamation	85
Misc. Durables Re-use	62
Wooden Pallet Repair	28
RECYCLING-BASED MANUFACTURING:	
Paper Mills	18
Glass Product Manufacturing	26
Plastic Product Manufacturing	93
CONVENTIONAL MATERIALS RECOVERY FACILITIES	**10**
COMPOSTING	**4**
LANDFILL AND RECLAMATION	**1**

SOURCE: www.ilsr.org/recycling/recyclingmeansbusiness.html

TABLE 16
Waste Re-Use Industries

- **Information –** As the exportation of goods decreases, the goods traded by communities will change. Information technology will be valuable as an easily and cheaply exported commodity. Ventura College is an asset that can be expanded upon, and used to increase awareness of Peak Oil and the job types that will result can build careers that are geared towards the post-Peak economy.
- **Organization –** As the county seat of Ventura County, San Buenaventura plays an important role in leading the region into a post-Peak Oil future. With the main county building located within the city, the process of collaboration and organization will likely start in the city.

Provide employment opportunities that encourage innovation and enhance the local economy

The decline of oil resources will cause an increase in labor, decrease the transportation of goods, cause all goods to become more expensive, and lower consumption. A significant shift in employment throughout the economy will result (Table 15).

GUIDELINES:

Educate citizens on post-Peak Oil opportunities. Certain employment sectors will transition easier than others, and should be the focus in a post-Peak Oil transformation. Table 14 lists possible post-Peak Oil employment sectors that can be expected to become more essential and that should be emphasized.

Develop industry for sustainable re-use of waste products

The decline of oil resources will make the manufacturing of goods more expensive. The re-use of materials will become more cost beneficial, will help to decrease extraction of local resources, and will form the basis of thriving post-Peak Oil re-use industries (Table 16).

GUIDELINES:

Implement creative programming and inconvenient costs

- Bans on non-recyclable and non-biodegradable products
- Incentives and funding for sustainable products innovations and industry
- Post-Peak Oil industries built around household and business waste include:
    - Recycling collection and distribution centers
    - Innovative recycling and reuse technologies
    - Biodegradable packaging
    - Compost processing

EVALUATION:

Economy

By beginning educational and infrastructural efforts early, San Buenaventura and the region can buffer itself from economic shocks due to Peak Oil.

Waste

Significantly increased diversion rates save city millions of dollars, and reduce landfill needs and costs, while creating new, sustainable industries. Individuals and businesses benefit with reduced pollution, trash and costs.

COMMUNITY

Changing the “Me” to “We”

Adjusting to the Peak Oil crisis will cause people to shift their ideals from what is best for them individually to what is best for the community as a whole. While this will require sacrifices at the individual level, the quality of life for all can be improved if communities work together prior to the oncoming crisis. These sacrifices will need to occur throughout the city, as individuals living in suburban tracts may have to give up their private backyards to set aside land for community food production. The price of gas will force individuals to give up their vehicles and begin taking public transportation. Over time, an increasing number of families will give up their single-family homes and move into areas of higher density with reduced private space.

These sacrifices will not come without benefits. Local food production will improve the quality of eating habits and of human health. Higher density neighborhoods will allow for more amenities within walking distance of people’s homes. The shift to public transportation located near homes and jobs will result in less time spent commuting, improved air quality, and allow for roads and parking lots to become parks, community gardens and greenways.

Current Trends of Typical Backyard:

- *Manicured lawns require heavy maintenance, yet are underused*
- *Owners are self-conscious about yard appearance*
- *Children use backyards limitedly, preferring exploring with friends*

Private Courtyard:

- *Less space requires less maintanance*
- *Money can be spent on quality features such as water features, outdoor furniture and dining sets*
- *Enclosure provides privacy*

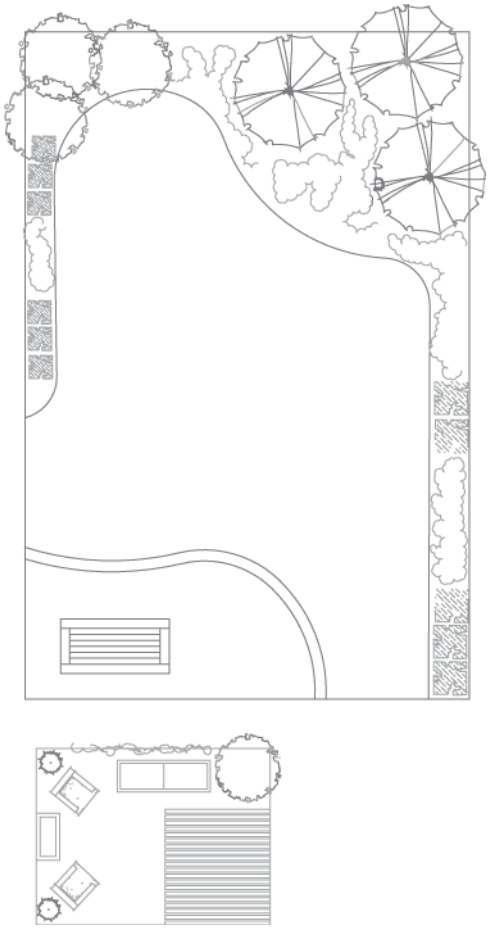


FIGURE 85
Typical Backyard and Patio Comparison

Designate and design more public and communal spaces, and improve quality of private spaces

Cities will need to condense their urban footprint post-Peak Oil. The loss of most private backyards will make the demand for communal recreational and gathering spaces greater and the importance of quality private space more important (Figure 85).

GUIDELINES:

Designate land for public space. Setting guidelines to get to 43 percent open space ratio will provide a quality urban environment that can be dense without seeming overwhelming (Crawford 2002).

Provide flexible public spaces that promote community interaction

A greater reliance on public space due to the loss of private yards will require a shift in how public space is used and perceived.

GUIDELINES:

Diversify outdoor spaces.

- **Create restaurants in the park –** Mixed-activity spaces like restaurants in the park create safe, attractive, 24-hour spaces, where people have flexibility to meet on evenings and weekends. Mixing activities for children and adults in public spaces such as parks, social gathering places, can attract both families and individuals.
- **Establish outdoor markets –** Local marketplaces provide economic opportunities for local farmers and artisans, help to localize the economy, and provide a positive outdoor environment to spur a sense of community and identity throughout neighborhoods.

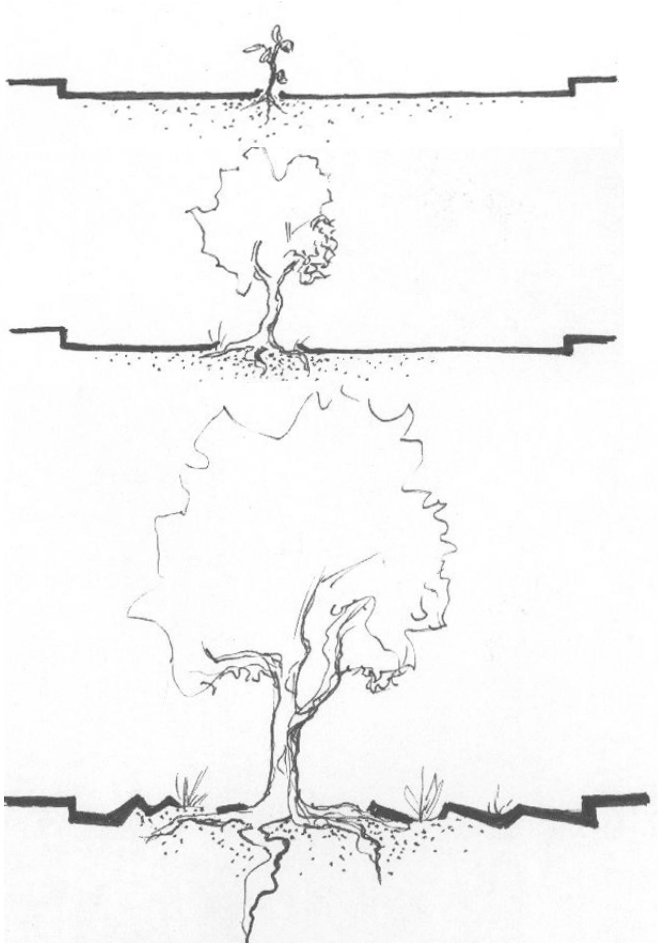
Encourage shared backyards. Bringing down fences to expand the amount of functional space in backyards means more room for shared vegetable gardens, chicken coops, and the potential for renting out land for productive agriculture. By sharing backyards, neighbors can begin to work together to grow more of their own food while building relationships through community work.

Promote inter-generational design. Including design principles that enable inter-generational interaction will prepare communities to better weather the effects of Peak Oil. Inter-generational design encourages relationships

between all generations. The benefits of neighborhoods that have a variety of ages are limitless as they can function better as a unit. The elderly can teach youth about such activities as organic gardening, the younger generations are full of boundless energy to learn and grow, and the recently retired are eager to give back to communities in a variety of ways including opening up small business and volunteering. Each generation also benefits physically, socially, and mentally from these neighborhood models (Figure 87) (see ***Appendix C-2: Deines***).

Foster Community Identity

As the ease of personal transportation decreases, the need for the city to provide diversity in entertainment, economic production, and function is critical. Fortunately, San Buenaventura has great variety and depth in character that can be adapted and enhanced post-Peak Oil. This can be seen in the city design as existing neighborhood characteristics are carried into the nodal designations of 2050 (Figure 88) (see ***PART I: Project Context*** for existing character areas).



This series of sketches illustrates the idea of "timekeepers," community actions that demonstrate a commitment to transformation. The small tree in the first sketch eventually grows and breaks the surrounding asphalt with its roots, reclaiming green space. The community who plants this tree is committing to decommission the road over time.

FIGURE 86
Community Time-keepers

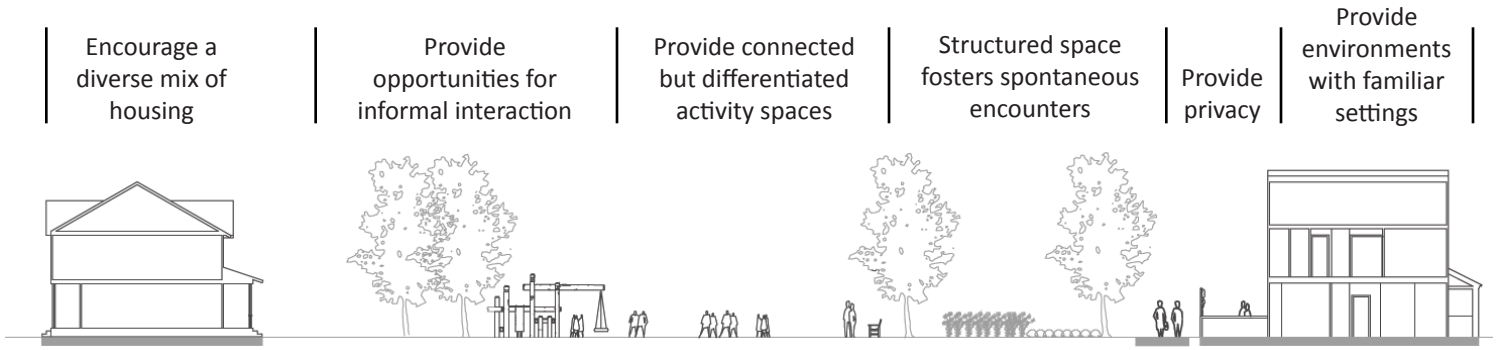


FIGURE 87
Inter-generational Design Concepts

The City has a diverse set of neighborhood identities that will be maintained post-Peak Oil.

FIGURE 88
Neighborhood Nodes

GUIDELINES:
The following is a list of recommended community nodes with a short character description:

(A) The Harbor
The Harbor serves as a recreational and social center for the community, which includes restaurants, shops, and hotels. Post-Peak Oil, the harbor will need to function also as a working harbor, bringing in fish and transporting goods. A small extension of the existing freight line can connect San Buenaventura's fisheries with surrounding communities, providing an alternative to the trucking industry for the import and export of specialty goods. The harbor's proximity to the civic area to the north and to the ocean to the west, and its unique beachside housing, may give this node a distinct coastal identity.

(B) Old Town (Downtown and Beachfront)
While located in a liquefaction zone, the history, location, and existing infrastructure of San Buenaventura's downtown make it a valuable cultural and economic asset to the city. The historical civic and cultural buildings, beachfront location, and Main Street will remain important place-makers post-Peak Oil. Its building character gives the area a small-town feel, while existing density provides enough people and amenities to support a community.

(C) Hillside Community (Hillsides)

A liquefaction zone to the south, and fire hazards and potential landslides from the steep hillside slopes to the north enclose the Hillside community. Packed against the Ventura Hills, topography and natural hazards dictate that development within this area take place along the transportation corridor, outside of the hazard zones, and spread in a line rather than centered on a transportation hub. Hillside and beach access, views to the ocean, proximity to the Downtown, and existing quality housing define this area.

(D) Eco-Industrial: Westside (Industrial: Westside)

Former oil fields and manufacturing sites can be converted to eco-industrial processing and recycling plants. The existing community layout of the Westside industrial area is amenable to walkable streets and moderate, mixed-use densification. Some less-contaminated brownfields can be remediated over time and turned into productive agricultural fields. Other areas throughout the city can also become eco-industrial, as the mixing of residential and industrial neighborhoods will be possible with non-toxic industries.

(E) Eco-Industrial: Southside

Although this area is located off of the main transportation loop of the city, it provides a valuable space for local processing, manufacturing, and recycling industries. It is centered along two major rail routes: one used by Metrolink and Amtrak running north and south, the other running east and west and used primarily for freight rail. Its current use is primarily industrial and commercial, but its proximity to the Santa Clara River and the city of Oxnard provides opportunities for residential and recreational activities as well.

(F) Uptown (Office Parks)

Uptown was chosen as the major node for the city for several reasons. First, it is located outside of natural hazard zones, including liquefaction and flooding. It is located along the convergence of major transportation corridors, including Highways 101 and 124, and Telephone Road, and a natural barranca. It has existing infrastructure (commercial condominiums and industrial parks) that can be retrofitted and adapted to create mixed-use, high density housing. Uptown is within close proximity to large agricultural fields, and its wide north/south streets can be used to transition agriculture into the city. The large commercial complexes with their expanse of parking lots will accommodate an easy transformation to public space. Finally, Uptown's location along the major transportation routes will provide a focal point for those passing through, attracting wanted attention to the post-Peak Oil transformations.

(G) Barranca Junction

This area is located adjacent to the Arundell Barranca, and is surrounded by the County Government Center to the west and Barranca Vista Park to the east. Although the existing urban form is suburban, higher-density housing, civic space, a major employer (the County of Ventura), and its location along Telephone Road make this an ideal space to emphasize development.

(H) Riverfront

Located just beyond the Santa Clara River buffer zone and outside of the floodplain, this node has the ability to link the community to place through interaction with the natural processes of the river. The area's suburban tracts and strip malls will require major transformation to reach the necessary density. The number of parks, including Chumash Park, Junipero Serra Park, North Bank Linear Park, and Bristol Bay Linear Park, as well as the surrounding agricultural land, makes this an ideal place for a post-Peak Oil community.

(I) The Edge (Commercial Corridor)

This former commercial corridor has much potential as an educational and civic node. The Edge contains Ventura College to the west; Buena High School, Balboa Middle School, and Mound Elementary School to the south; Poinsettia Middle School to the north; and the County Government Building to the east. The surrounding hillsides, agricultural land, and adjacent barranca offer outdoor opportunities and connection to place.

Courtyard Restaurant

Beer Garden

Restaurant in the Park

(J) Nestled Greens

Located between agricultural areas and the hillsides, this formerly suburban area will undergo a gradual transition over time, becoming rural in character. This low-density node will resemble the agricultural settlements of early California, with small clusters of homes housing agricultural workers who own and farm the land.

(K) Saticoy (Modern Suburbs)

Originally developed as a rural outlying town in the late 1800s, Saticoy will maintain its identity as San Buenaventura's most outlying node. Development in the early 2000s added enough density, mixed-use, and amenities to make it a viable community of its own. Surrounding agricultural land, a nearby barranca, and its smaller-scale development patterns make Saticoy an ideal spot for a medium density node large enough to support a community, yet small enough to maintain its identity.

Preserve, protect, and make accessible San Buenaventura's places of beauty

The importance of San Buenaventura's places of beauty will only increase post-Peak Oil as residents become much more reliant on the immediate area for recreation and relaxation. The city's coastline, hillsides, agricultural land, rivers and barrancas all represent assets that need to be preserved, protected and made accessible.

EVALUATION:

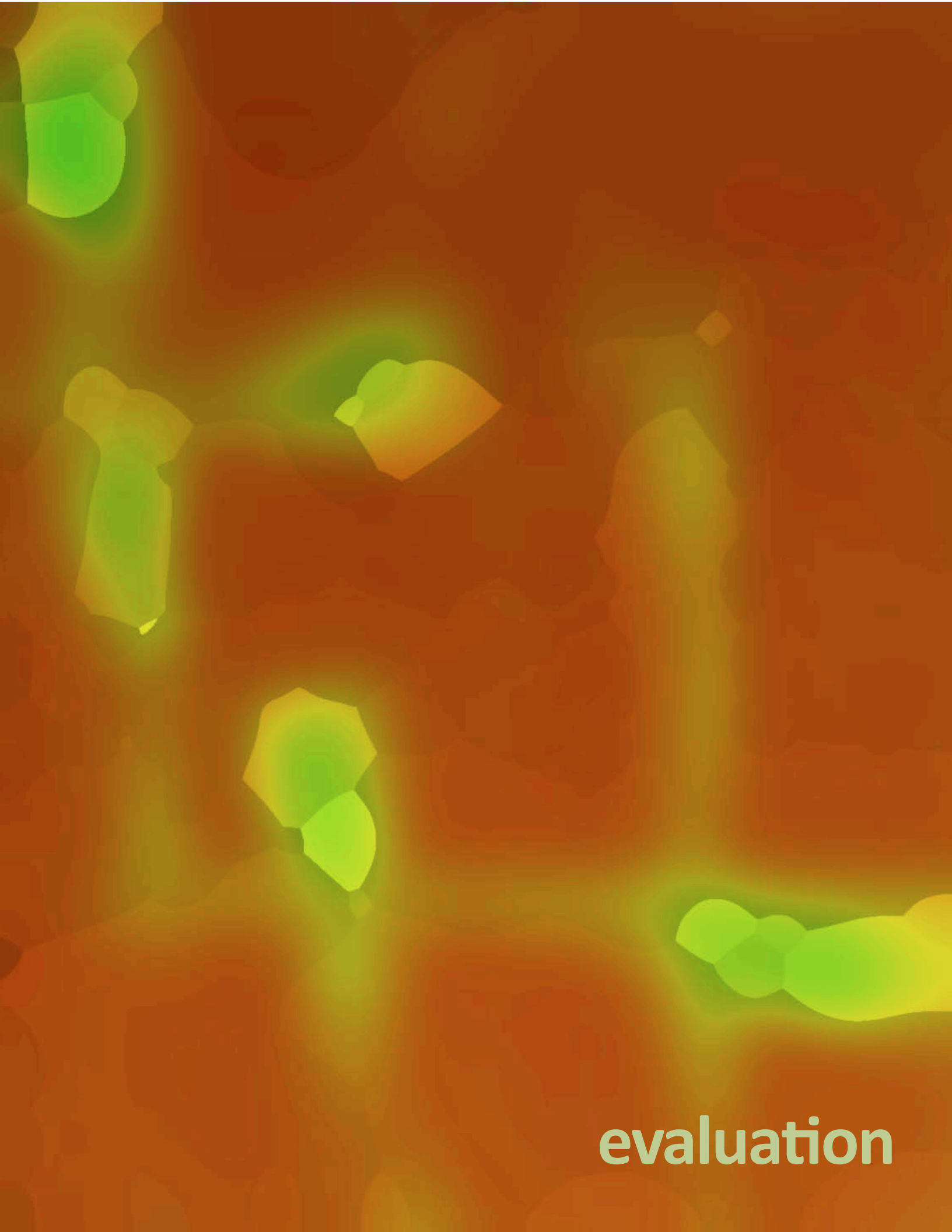
Public Space

The post-Peak Oil city design will increase public space throughout the city, including the beachfront civic area, areas along rivers and barranca corridors, and parks and open space. This will happen gradually, as roadways and parking lots are converted into pedestrian areas and as city populations become more concentrated (see Figure 60 on page 112).

Public space at the site scale will increase significantly. The urban site by 2050 will have 75 percent of the landscape given over to public space in the form of promenades, squares, pedestrian roads, roof gardens, courtyards, and nature paths (see page 135). By 2050, approximately eight percent of the suburban site will be given over to public space in the form of a community green. In addition, shared backyards, community gardens, parks, courtyards, and orchards will become shared resources (see ***Part IV: Transformative Site Design*** *on* pages 187 and 199).

Private Space

High-density dwellers are often deprived of adequate and attractive private space, diminishing overall quality of life. Outdoor patios, porches, atriums, balconies and private roof gardens contribute to the well-being and sense of ownership of multi-family housing residents and should be required for all new dense developments (Figure 85).


evaluation

SYSTEMS EVALUATION

SYSTEM		EVALUATION	
Goal (Energy)	**Decrease dependence on imported and non-renewable energy sources**	**Without Post-Peak Oil Plan**	**With Post-Peak Oil Plan**
Objectives	Use local and renewable energies conservatively	• Reliance on renewable energy and sustained per capita energy demand result in increased pollution and decreased space for food production and open space	• Decreased energy demand through community design (see page 6) • Solar energy generated on rooftops • Wind and wave energy generated through collaborative regional efforts
Goal (Water)	**Use local water sources sustainably and reduce external dependence**	**Without Post-Peak Oil Plan**	**With Post-Peak Oil Plan**
Objectives	Preserve and enhance hydrologic function throughout the watersheds	• Decreased permeable surfaces due to continued urbanization and channelization of rivers • One billion gallons per year allocated to Ventura River	•Permeable surfaces incease by 225% in urban areas (3,678 acres in San Buenaventura) • Rivers remain unchannelized (page 35) • More than one billion gallon per year allocated to Ventura and Santa Clara River (page 128)
	Increase roof water and greywater capture	• Lack of organized roof or greywater capture programs	• 19 billion gallons of roofwater and greywater capture per year (pages 39 and 128)
	Prioritize water for productive uses	• One billion gallons per year diverted from the Lake Casitas into the Ventura River, for river restoration	• Water conservation efforts allow more water to be diverted to the Ventura and Santa Clara rivers (page 35) • Potable water use priortitized for consumption (page 128) • Urban water savings reallocated for agriculture
	Implement conservation programs	• Water demand continues to rise with population growth	• Conservation efforts must account for a 20 billion gallon reduction in demand (page 128) • Household savings account for of 26.9 million gallons
Supply & Demand	Total Water Supply	• Local Supply: 138.7 billion gallons or more • Imported: 25%. Demand may not be met (pg. 128)	• Local supply water supply for county: 118 billion gallons (page 43)
	Total Water Demand	• Based on population growth, county water demand could increase to 242 billion gallons	• Decrease in demand by up to 20 billion gallons (page 128)

Goal (Natural Communities)	Preserve and Restore local habitats	Without Post-Peak Oil Plan	With Post-Peak Oil Plan
Objectives	Manage for sustainable marine resources	• Overuse of marine resources leads to depletion of fisheries and contamination of water	• Management benefits food supply, water quality and biodiversity
	Preserve and expand terrestrial habitat	• Fractured wildlife habitat • Loss of habitat due to urbanization and renewable energy infrastructure (page 49) • Increased development upstream causes damage to riparian habitat and flooding in the lower watershed	• By decreasing the urban footprint , increasing water flows to rivers and barrancas, and establishing a minimum 300 foot buffer zone for rivers and barrancas, the plan will increase the amount of land for habitat and preservation for existing habitat areas
	Enhance urban biodiversity	• There is a lack of collaborative effort to preserve urban biodivetsity	• Native planting in San Buenaventura increases by 1,455 acres, including 18% of Release zone and 12% of Concentrate zone (page 112)
Goal (Food)	**Establish a localized food system that is supported by sustainable practices**	**Without Post-Peak Oil Plan**	**With Post-Peak Oil Plan**
Objectives	Decrease distance between consumer and producer	• Global markets continue to drive food production, but there is a slow progression towards local markets	• 50% of demand is met by produce from the urban environment and up to 50% is provided by regional land and ocean resources combined. • Mediterranean diet adopted and enhances human health.
	Increase physical and political infrastructure for local foods	• Lack of harbor infrastructure and local processing and distribution facilities are a barrier to localizing the food system	• Harbor infrastructure expanded • Food processing and distribution centers are located near rail stops and within mixed use areas (page 137)
	Utilize available resources for urban agriculture	• Minimal collaborative efforts to harvest urban resources for urban agriculture	• 100% of organic waste, greywater, and roof water harvested • An increase of 3,616 acres of urban prodcutive land • 67% energy demand reduction for food supply
	Build market for locally grown goods	• Sales of local goods increases slowly, primarily in reaction to rising prices	• There is an expanded local market and a high agricultural literacy in the population
	Produce food with minimal imported materials	• Continued use of (expensive) pesticides, fertilizers, and water continues to degrade soil and water quality	• Energy required for food production decreases by up to 50% • Soil and water quality are enhanced • Aesthetic appeal to agricultural landscapes is enhanced

Goal (Mobility)	Reduce Dependence on automobiles and develop/expand existing public/ alternative transit systems	Without Post-Peak Oil Plan	With Post-Peak Oil Plan
Objectives	Build and expand infrastructure for public transit	• Automobile infrastructure is prioritized and the public transportation system is under stress and inefficient	•72% of roads throughout the city are decomissioned •Roughly 85% of the city's population is living within a 1/2 mile of a public transportation stop
	Prioritize, expand and improve bicycle network	• The city is currently planning on creating 50.5 miles of bike lanes between now and 2020 (City of San Buenaventura General Bikeway Plan, 2005) If these trends continue a total of 151.5 miles of bike lane will be created by 2050	• By 2050 biking will be a primary transportation option. This will be possible by creating a 345 mile network of class 1 bike lanes that connects existing neighborhoods and prioritizing bikability within the urban areas (pages 71 and 143)
	Increase number of pedestrian nodes in the City	• Continued autocentric development patterns will create poorly functioning isolated communities by 2050, currently only beachfront area is truly pedestrian oriented	• Eleven car-free pedestrian nodes cover 4,000 acres and housing 128,002 people within the City (page 111)
	Expand existing regional rail and ocean freight system	• Rail line through the Santa Clara Valley remains dorment • Rail and port infrastructure throughout the region is slow to be built	• Rail infrastructure and capacity is increased (page 142) • Santa Clara rail line connects to Piru and regional rail lines (page 142) • San Buenaventura Harbor infrastructure expanded

Goal (Shelter)	Increase dense mixed-use development and sustainable housing design	Without Post-Peak Oil Plan	With Post-Peak Oil Plan
Objectives	Develop infrastructure for dense, mixed-use development ("nodes"), and decrease density outside of nodes	• The city's projected population increase of almost 50,000 people by 2050 will require 285 acres at maximum high density • 427 acres at maximum medium density • 2,200 acres at maximum low density (at 2.6 people per unit) (page 76)	• 45,905 people (29% of City population) live in high density nodes • 88,643 (56%) live in medium density • 31,923 (15%) live in low density • City works with region to prioritize high to medium density to accomodate agricultural land needs
		• Dispersed density; 74% or 9,935 acres of City land urbanized in 2007 (GIS City of San Buenaventura); need for housing and current trends will continue to consume land	• 85% of City population lives on 26% of city's land or 32% of 2007 urban footprint (page 112)
	Retrofit existing homes and require all new homes to be energy and resource efficient.	• Current gas demand for residential heating and cooling is 82% (electric is 19%) • Current electricity demand for residential lighting is 28% • Annually, the United States generates approximately 140 million tons of C&D waste, only 20 to 30% of which is recycled or reused (EPA 1998)	•Passive energy design can result in up to 100% less energy used for heating and cooling •Solar technology and site orientation can save up to 70% for other electricity use (page 61) •Water use decreased by 50% comperable to European consumption efforts(pg. water analysis) •Landscape and agricultural water use cut signifigantly through roof water catchment and greywater •All new homes sustainably built •Incentives given for energy retrofit for older homes and the reuse/recycling of C&D waste
	Promote adaptive reuse of buildings and underutilized urban infill land		•Land that lies in hazard zones is returned to habitat or agriculture •Greenfield development prevented
Supply & Demand	Housing Supply	• The shortage of affordable rental units, combined with economic and political conditions that favor single-family development, is expected to sustain tight market conditions (County of Ventura 2005)	• An emphasis on high density, affordable multi-family housing will alleviate city and regional housing needs by 2050
	Housing Demand	City: City: 19,100 new units by 2050 County: 227,733 new units by 2050	City: City: 19,100 new units by 2050 County: 227,333 new units by 2050

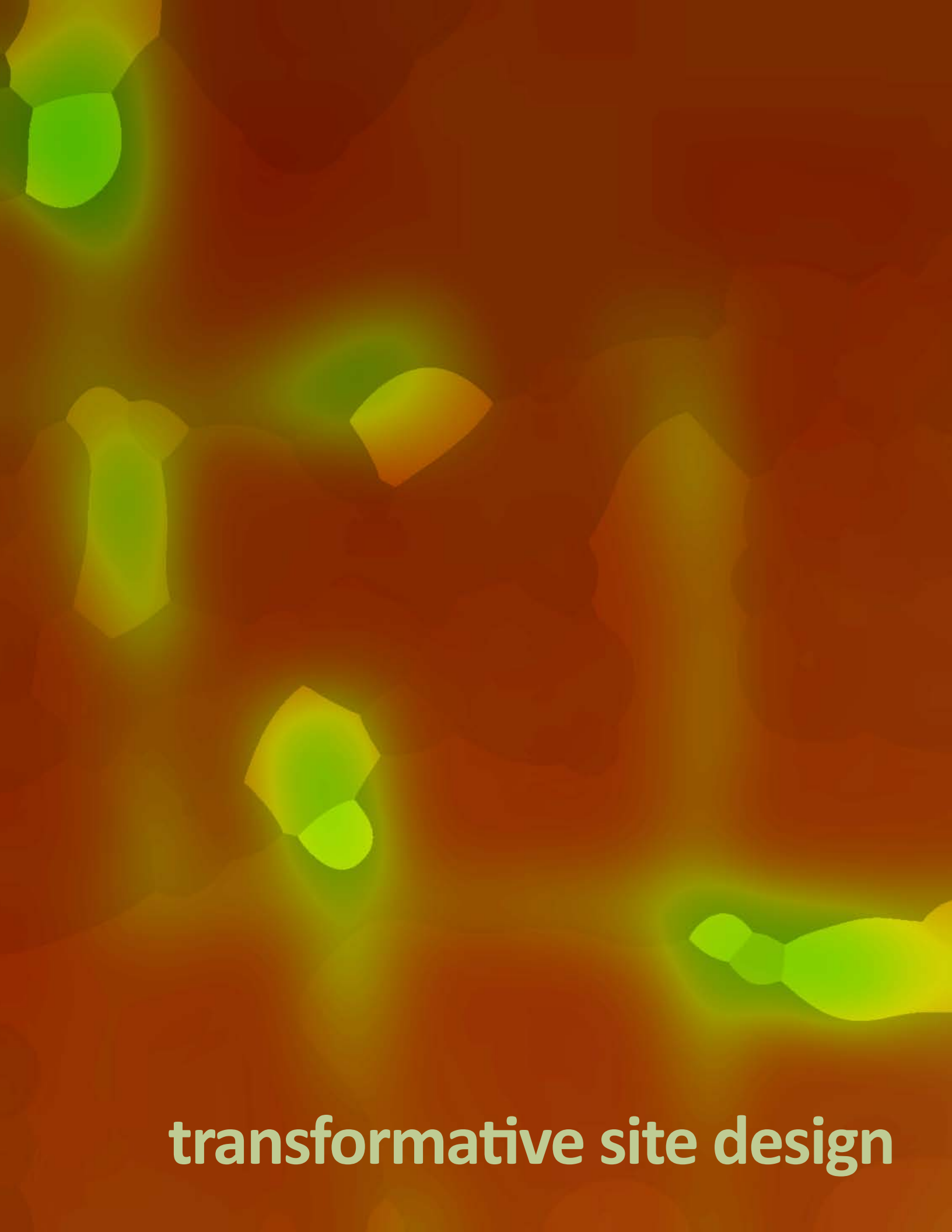
Goal (Economy)	Expand opportunities for a localized economy	Without Post-Peak Oil Plan	With Post-Peak Oil Plan
Objectives	Identify economic sectors that are based on available resources and that will thrive post-Peak Oil	• Educational opportunities, organizations, and lack of forethought create a slow transition into a post-Peak Oil economy	• Planning for at least five growing economic sectors prepares region for post-Peak Oil local economy
	Provide employment opportunities that encourage innovation, enhance local economy, and help to porvide for the populations' basic needs		• Educational opportunities, government incentives, and community organizations create jobs in sectors like food producton, manufacturing, and systems research that help produce a thriving local economy
Goal (Community)	**Localize the needs of residents while enhancing the beauty an identity of San Buenaventura**	**Without Post-Peak Oil Plan**	**With Post-Peak Oil Plan**
Objective	Designate and design more public and communal spaces, and increase quality of private space	• Suburban residents isolated from daily needs (especially young and old)	• 85% of the population is living within nodes where all daily needs are within a walkable distance (page 112) • In suburbs, home conversions supply for many daily needs
	Provide flexible public spaces and allow personal freedoms	• Lack of ownership for public space leaves areas derelict and underused	• Residents of all ages and interests use open space on a regular basis • There is a sense of ownership for public spaces
	Foster community identity and community networks	• Development patterns do not focus on existing or future community identity	• 11 nodes established with unique character and urban function (page 163)
	Preserve, protect, and make accessible San Buenaventura's places of beauty	• Development footprint continues to expand and overrides San Buenaventura's places of beauty	• Civic beachfront, hillside and agricultural land protection enhance San Buenaventura's aesthetic character

QUALITY OF LIFE EVALUATION

Quality of Life Indicator	Without Peaking without Oil Plan	With Post-Peak Oil Plan
Physical health	• Poor quality and availabiltiy of food, exposure to environmental contamination	• Average person walks much more as cities are pedestrian oriented, they spend about two hours gardening (excercising, organic and fresh food decreases diabetes and obesity and other disease dramatically (page 41) • CO2 production from transportation decreased by 13,972,155 lbs
Time and quality of commute	• Residence of Ventura County currently commute an average of 20 miles or 36 minutes per day commuting • Commute associated with stress and isolation	• Majority of population lives within walking distance of a variety of emplyers and employees can get to any of the nodes within ten minutes by trolley • Commutes include social interactions and excercise
Time spent with family	• Decreased time with family due to long commutes and long working hours	• Increased time with family, though often spent sharing laborous tasks (like gardening and maintenance)
Cost of living	• Increases dramatically as cost of oil and imported goods rise	•Availability of local goods keeps the cost of living affordable although less consumer goods are purchased •Diverse housing options offer greater affordability

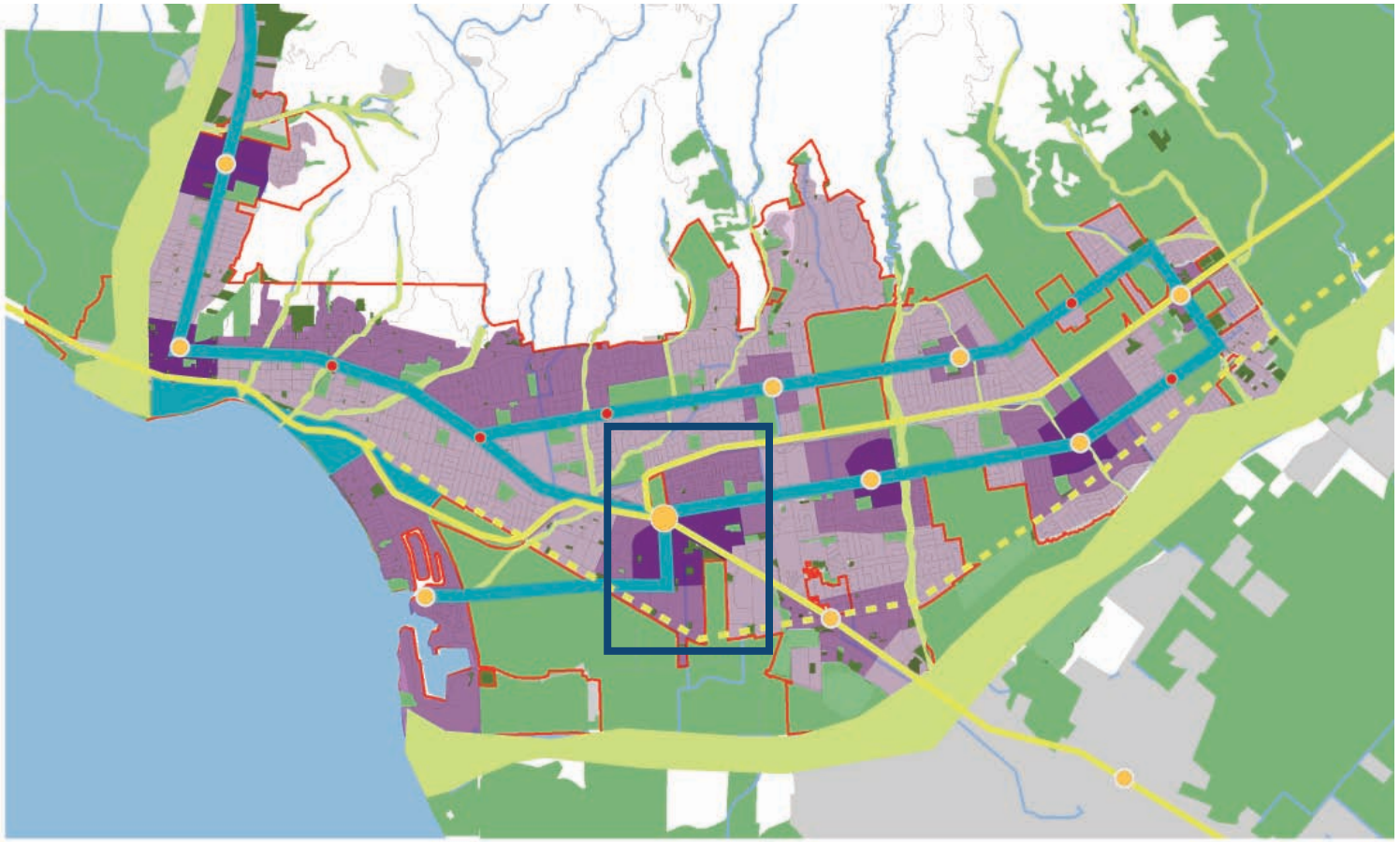
PART four

TRANSFORMATIVE SITE DESIGN
DAY IN THE LIFE


transformative site design

SITE DESIGN OVERVIEW

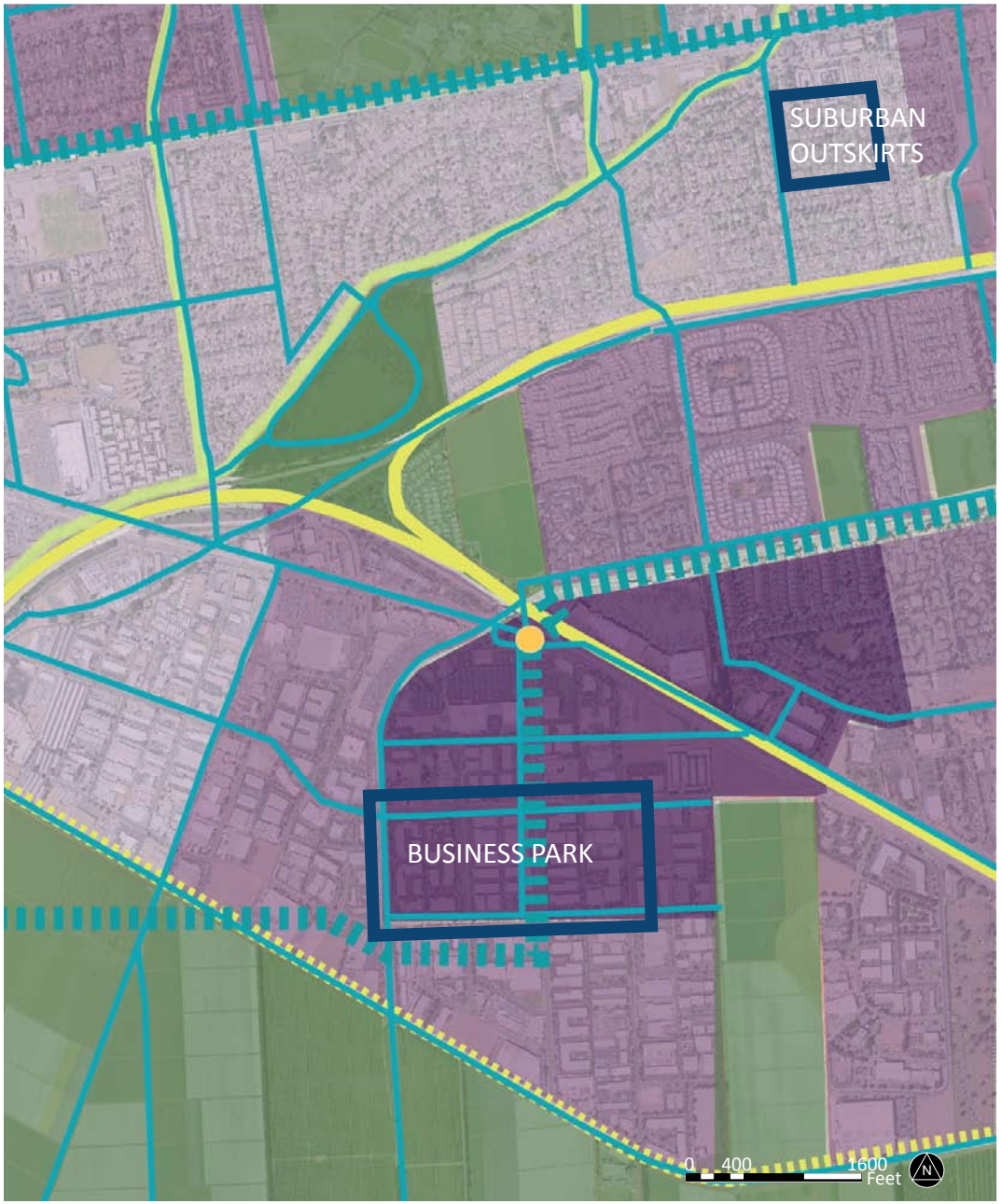
The implementation of the design and planning guidelines in the City of San Buenaventura is revealed in the transformation of two sites – one in the *Concentrate* zone and one in the *Release* zone. This section begins with an overview of the Uptown node then explores the two sites in further detail. The existing character, design framework, and progressive change are discussed for each site.



Uptown Node Locator Map

UPTOWN NODE

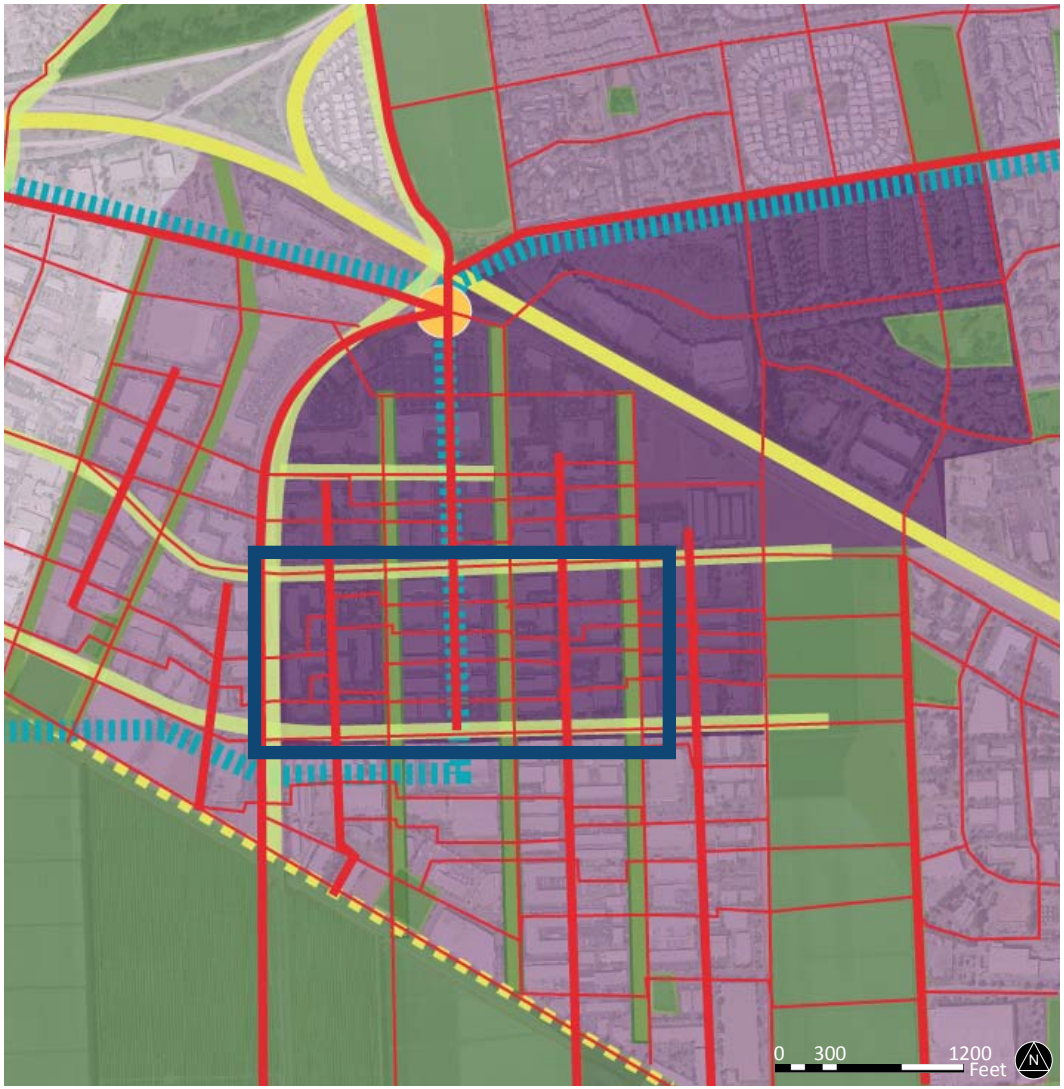
The Uptown node is located at the intersection of the 101 and 126 freeways, with the major arterial — Telephone Road — running through it. This future node was chosen because of the qualities that would make it viable in a post-Peak Oil world: its location at the convergence of several transportation options, central location, existing density, proximity to agriculture, potential for infill and adaptive reuse, and location outside of hazard zones. Because of these qualities, the Uptown node is designated as the new center of San Buenaventura. The existing character of this future node and surrounding area is found in the boxy clusters of office condos and warehouses; the variety of housing development types, including mobile home parks and single-family suburban neighborhoods; multi-family apartments and condos; the remnant parcels of agriculture, vacant lots, and active parks; and in the car-centric outdoor malls and shopping centers located conveniently just off the freeways. Two sites within this node will serve as examples of two *Post-Peak Oil Vision Plan* development zones: the Business Park site is within a *Concentrate* zone, while the Suburban Outskirts site is within a *Release* zone.



LAND USE
- High Density (*Concentrate*)
- Medium Density (*Concentrate*)
- Suburb Retrofit (*Release*)
- Agriculture (*Preserve*)

TRANSPORTATION
- Transit Hub
- Inter-City Regional Transit
- Intra-City Rapid Transit
- Freight (Existing)
- Major Bicycle Route

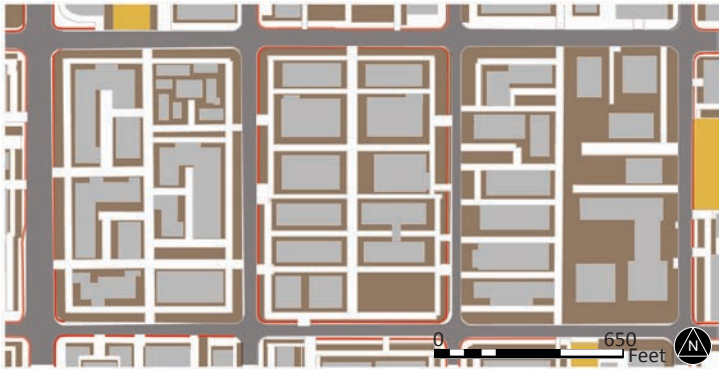
HABITAT
- Barrancas and River Buffer (*Preserve*)



LAND USE
- High Density (*Concentrate*)
- Medium Density (*Concentrate*)
- Suburb Retrofit (*Release*)
- Agriculture (*Preserve*)

TRANSPORTATION
- Transit Hub
- Inter-City Regional Transit
- Intra-City Rapid Transit
- Freight (Existing)
- Major Bicycle/Pedestrian Routes

HABITAT
- Barrancas and River Buffer



Existing

- Roads
- Access Roads
- Parking Lots
- Building Footprints
- Vacant Lots

SITE ONE: BUSINESS PARK

This site within the Uptown area was chosen because of its potential to be a transportation hub, its adjacent agriculture, and because of the opportunities offered by the existing infrastructure. The current landscape is dominated by office parks, industrial warehouses, and large commercial strip malls. Sizable building footprints offer opportunities to redefine the area with mixed-use retrofits, while parking lots provide spaces to be transformed into parks, squares, and pedestrian promenades. Wide, straight roads present an opportunity for conversion to agricultural and agricultural-support corridors, while providing unobstructed viewsheds to the mountains.

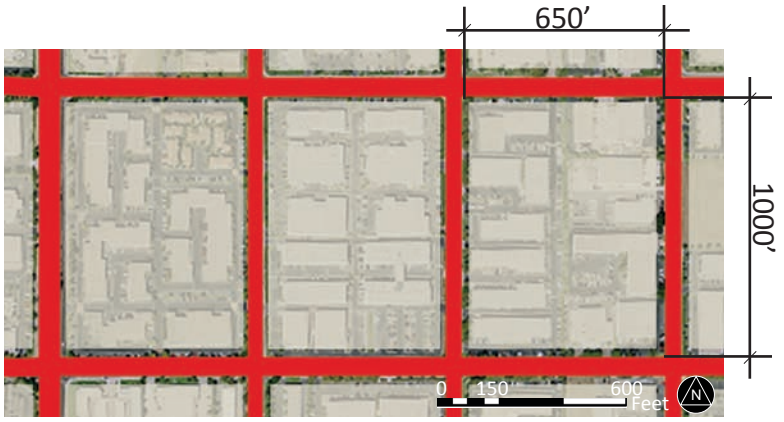
The existing space devotes approximately 34 percent of its space to building footprints, 60 percent for parking lots, 13 percent for streets, and 2 percent of land as public open space (sidewalks). The site houses few to no residents and is used primarily for working and shopping.

Transforming the Urban Grid

The business park site is an example of how the urban form will be transformed to accommodate pedestrians, public transit riders, and cyclists post-Peak Oil.

Existing: The existing block system is roughly 1,000 feet by 650 feet. The distance between buildings across the road from each other is approximately 200 feet – comprised of two- to six-lane roads and 40 to 80 feet of parking on either side of the road. Within the block itself, buildings are separated by interior roadways and parking lots spaced approximately 80 feet across. This is a landscape defined by the automobile. For a post-Peak Oil community, the challenge is how to turn this asphalt landscape into a human-scaled environment.

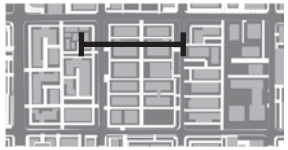
Future: The 2050 view shows the large blocks turning inward, with community activities and major arterial paths taking place on existing interior roadways that are spaced at a more pedestrian friendly 250 feet by 325 feet. Parking areas around buildings have converted to community gardens, pocket parks, and courtyards. Major roadways, once the dominant urban form, have become green corridors, providing a break in the urban environment, protecting neighborhood identity, and providing agricultural land and greenspace in close proximity to urban residents. By 2050, these large automobile-scaled blocks form nodes with their own distinct identity and populations of approximately 1,300. This number is the suggested population size for providing community members with an effective voice (Alexander 1977 and Crawford 2002). Within these nodes, the block will be further broken down to communities of around 500 people. Five hundred is the ideal number of people needed to foster place identity and to create a place where people recognize each another (Alexander 1977).



Existing

2050

Building Block
Path of Travel
Green Divisions



Urban Site: Land Use Conversion Over Time

buildings | roads and paths | greenspace

2007

OFFICE COMPLEX

WIDE ASPHALT ROADS AND AMPLE PARKING

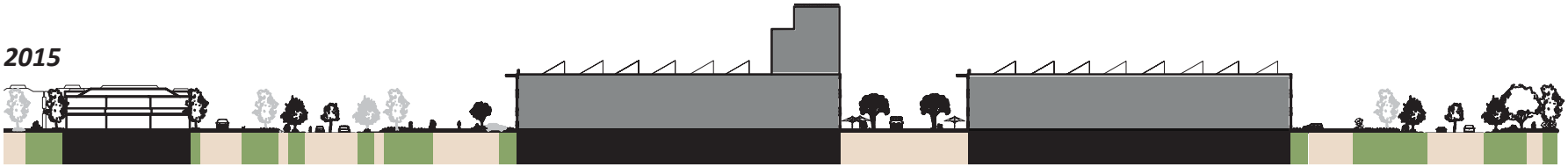
COMMERCIAL OFFICES AND WAREHOUSING COMPLEX

PARKING LOT

COMMERCIAL OFFICES AND WAREHOUSING COMPLEX

FEW PEDESTRIANS ON SIDEWALKS

2015



OFFICE BUILDINGS CONVERTED TO RESIDENTIAL USE

MEDIAN ADDED WITH ROOT INVASIVE TREES

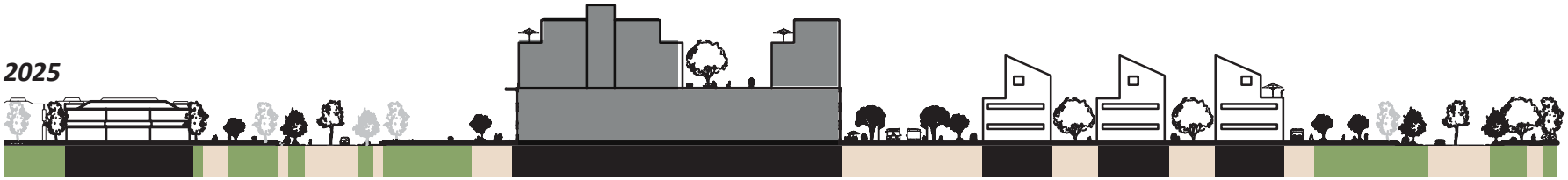
RESIDENTIAL ADDITION ABOVE; MIXED USE BELOW

BUS ONLY LANE

COMMERCIAL OFFICES AND WAREHOUSING COMPLEX

REMEDIATING PLANTING BEDS & BIOSWALES ADDED

2025



COMMUNITY GARDENS

DG BIKE & PEDESTRIAN PATHS ADDED ALONG STREETS & PARKING LOTS

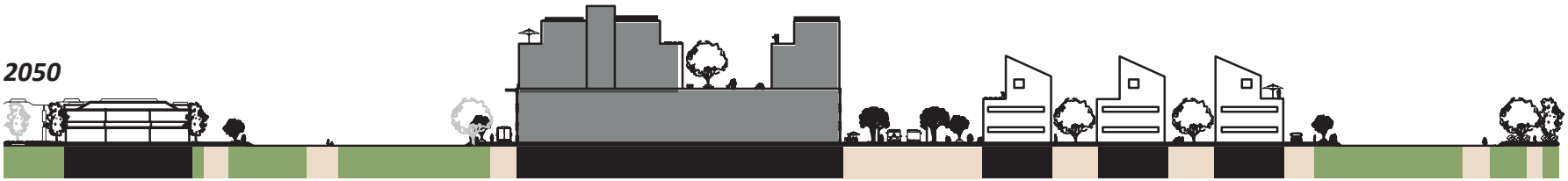
FOOD STORAGE AND PROCESSING FACILITY ADDED BELOW

TROLLEY REPLACES BUS

MULTI-FAMILY RESIDENTIAL UNITS WITH PRIVATE BALCONIES

REMEDIATING PLANTING BEDS EXPANDED

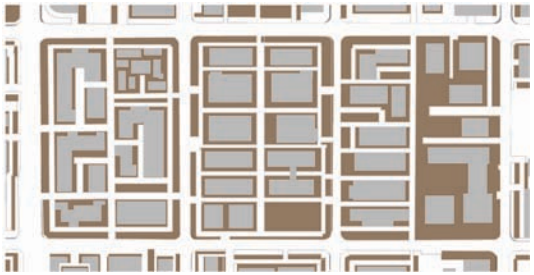
2050



AGRICULTURAL CORRIDORS WITH CLASS I BIKE PATHS

AGRICULTURAL CORRIDORS WITH CLASS I BIKE PATHS

0 25 100 Feet



Existing

Private to Public

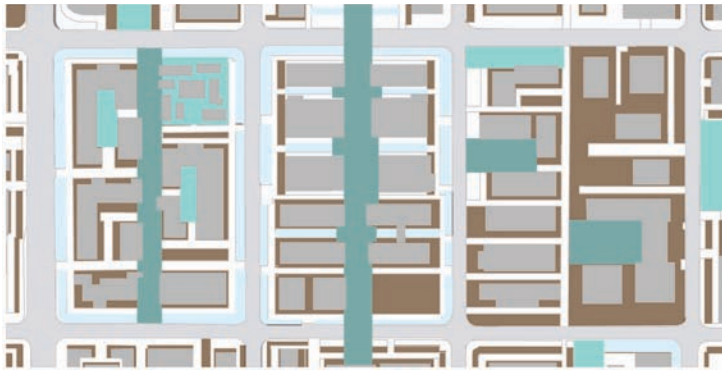
These diagrams show the shift from private parking lots to public plazas and open space; streets to public transit corridors, walkable promenades, and bike lanes; and decorative-only planting strips to functional community greenspace.

By 2015, as residents move in, community gardens begin to replace abandoned and underutilized planting strips along the streets and sides of buildings.

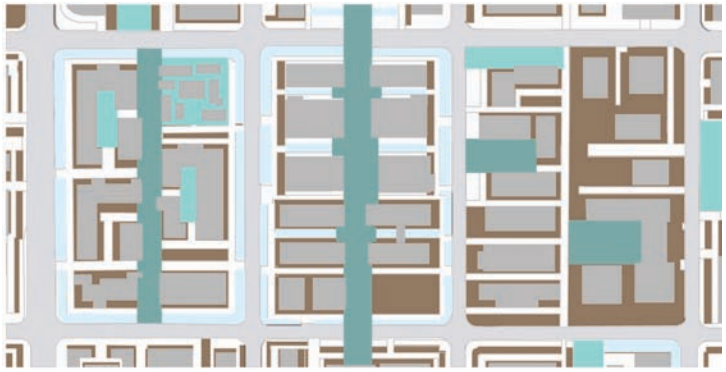
By 2025, several of the major interior access roads become promenades. The arrival of cafes, shops, and other businesses to the interior of the blocks, as well as the influx of new residents, leads to the popularity of these new promenades.

By 2050, more squares and courtyards appear throughout the urban area as density increases. The shift from private to public results in a new urban community where abundant multi-use spaces are accessible to all of its residents.

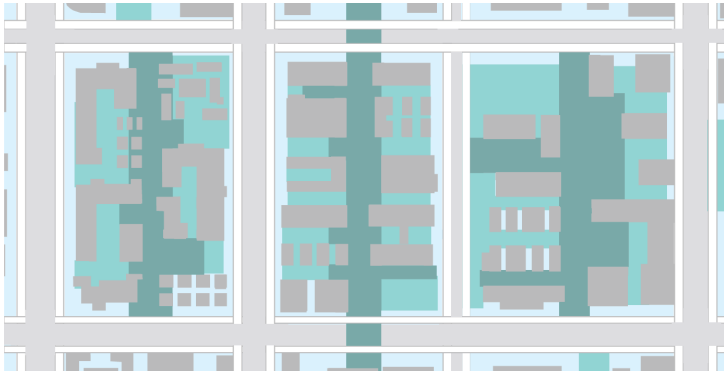
The importance of varying the degrees of activity cannot be understated when proposing to transfer so much land over to the public realm. Within the block system are three degrees of public space; high activity, medium activity, and low activity. An important aspect of housing within the urban node is the necessity of quality outdoor private space (Hester 2006). Personal balconies, courtyards, and entryways need to be a part of all building design in order to create areas that residents can consider their own.



2015



2025



2050

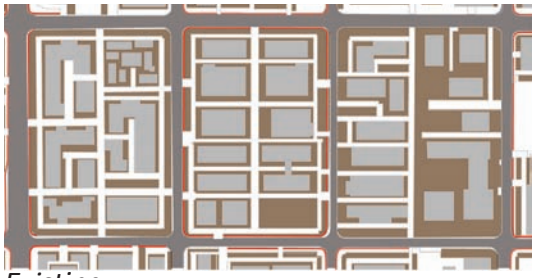
- Access Roads
- Building Footprint
- Parking Lots
- High Activity Zones
- Medium Activity Zones
- Low Activity Zones

The high activity areas are found mainly around the main promenades and public squares located on the promenade. These areas will contain the most intense activities such as restaurants, entertainment, stores, and street performances.

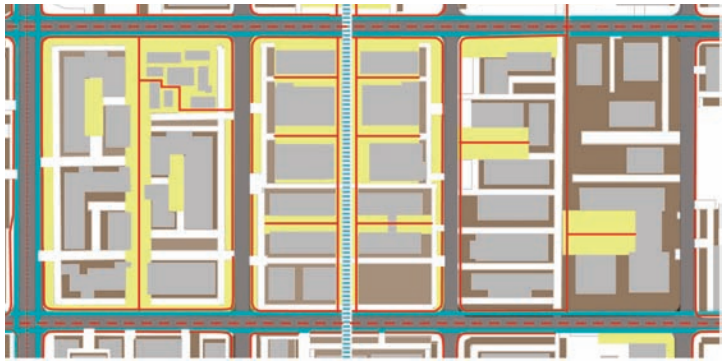
The medium activity zones are located along access streets and within larger courtyards. These areas are places where kids can play, people can meet, and smaller community functions can take place.

The low activity zones are located along small access roads and adjacent to the agricultural and agricultural support corridors. This space will be used primarily for people who would like to escape the commotion of the city, who need a quiet place to rest, read, or reflect.

Major Roads
Access Roads
Building Footprint
Parking Lots
Shared Parking Lots
Car-Free Areas
Pedestrian Paths
Intra-City Rapid Transit
Lane Reduction
Class I Bike Route



Existing



2015

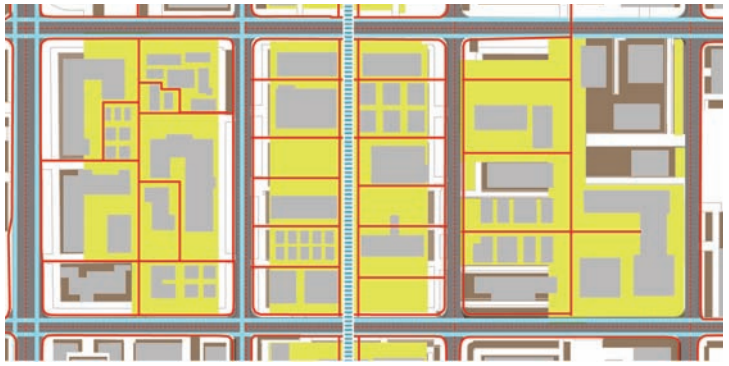
Auto-Centric to Human-Centric

These diagrams show the transformation from a landscape almost completely reliant on the automobile for mobility to one that is scaled for the pedestrian. The existing landscape has two- to six-lane roads, with sidewalks isolated between the wide roads and large parking lots.

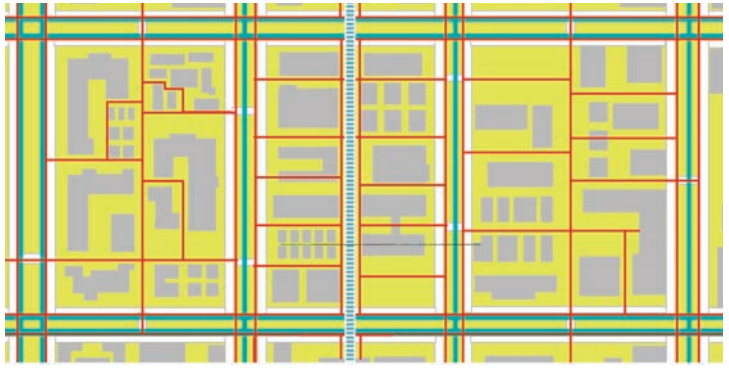
By 2015, arterial roads begin to narrow and interior access roads begin to see more pedestrian use.

In 2025, major bike routes are established along the east-west corridors and along select north-south corridors. Pedestrian activity increases within the blocks.

By 2050, the node is car-free; access roads are for walking, biking, and as recreational space. Bike paths are the primary form of personal travel; and trolley lines promote an active street life along the main corridor.



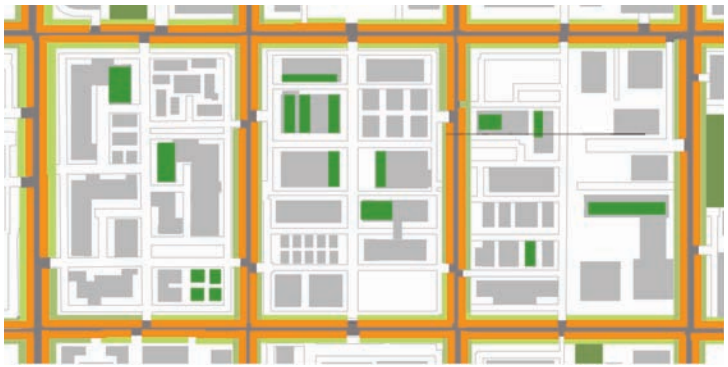
2025



2050

Existing

2015



2025

2050

Major Roads
Building Footprint
Remediation
Park Creation
Green Roofs
Agricultural Support Corridors
Agricultural Corridors

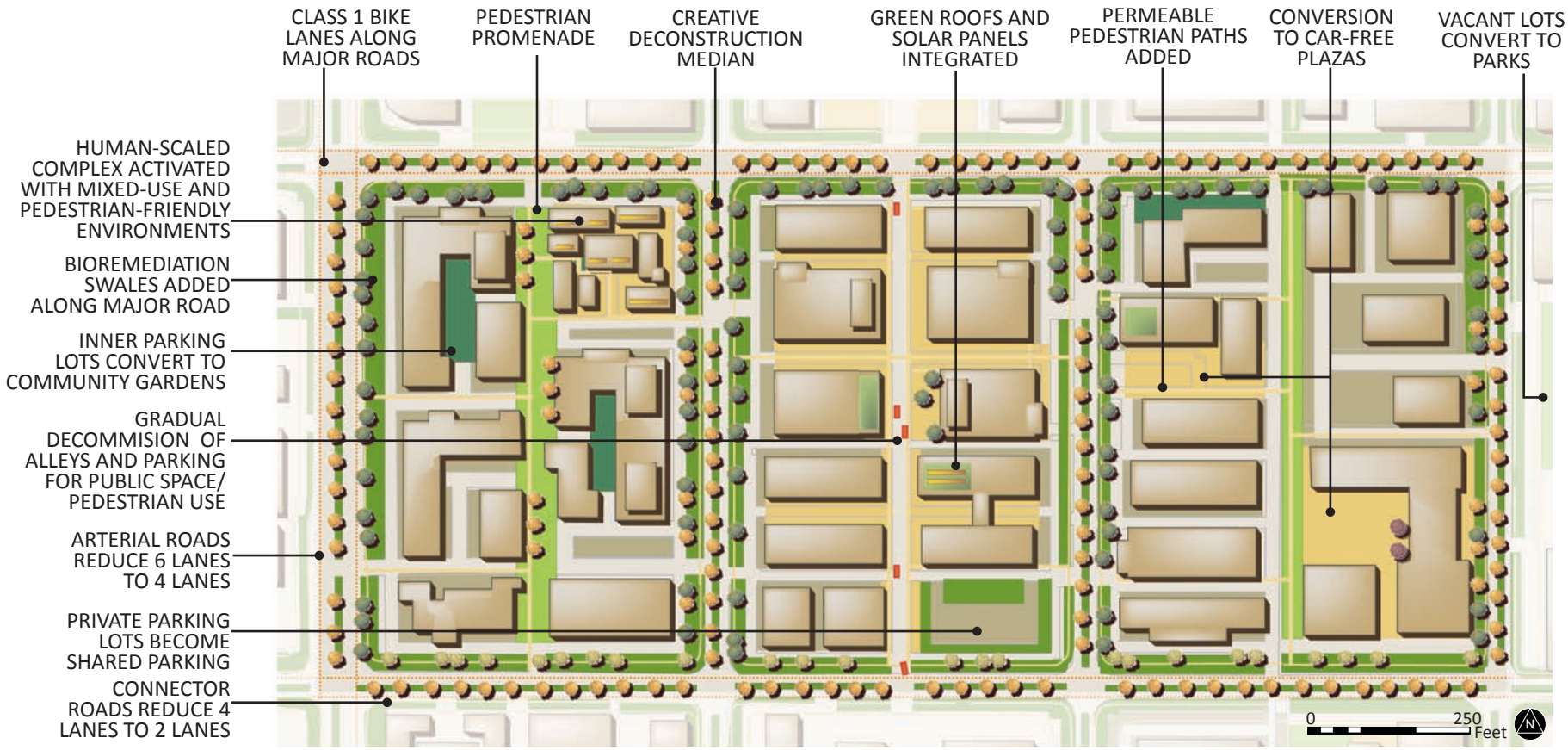
Grey to Green

These diagrams show the conversion of the urban block system from asphalt streets, roofs, and parking lots to agricultural corridors, agricultural support corridors, parks, and green roofs. The existing landscape is grey with only a few median and parking lot plantings. By transitioning from grey to green, public space and habitat is increased, the urban heat island effect is reduced, and agricultural corridors replace roads as the structural element defining the urban grid.

By 2015, the remediation process has begun. Streets are narrowing and lanes are converted to greenspace and bio-swales. Within the built area, vacant lots turn into parks and roof gardens are established.

In 2025, more roads are remediated and past remediation sites are converted to gardens throughout the urban area.

By 2050, the urban fabric transforms into a working agricultural landscape, with food-producing corridors running north-south throughout the neighborhood and agricultural support corridors running east-west through the site. Green roofs and community gardens are abundant throughout the rest of the community.



2015

Longing for the Sea

INTEGRATED VISION FOR UPTOWN

The following integrative vision for the transformation of the Uptown area describes the quality and character of the post-Peak Oil urban landscape at the three target dates. Details of the transformation will be revealed at the business park site scale.

2015: Longing for the Sea

The rising cost of oil combined with city incentives has convinced many urban residents to make changes to their daily routines. To entice residents to utilize public transportation, the city has redirected much of its transportation funding to adding more buses, increasing frequency of routes, expanding bike lanes, developing commuter rail infrastructure, and converting one 101 Freeway lane to rail. Business owners share parking lots and charge parking fees. Large single-use structures are too expensive to build and maintain due to increased material, land, and energy costs, prompting the city and developers to create more mixed-use developments around existing density and public transit stops. Global Warming and high-energy costs encourage residents and business owners to adopt passive cooling and heating measures, including planting more trees, installing solar panels and solar water heaters, and investing in new sustainably designed building construction.

The change in climate and rising oil prices spurs the city to make Uptown completely car-free by 2050. Rising food prices and population growth convinces the city to convert all north-south streets to agriculture and east-west streets to agricultural support fields by 2050. This will preserve viewshed, direct stormwater runoff and provide solar access for buildings.

Water

- Street widths reduced in order to install remediating infiltration bio-swales that recharge groundwater
- Greywater and roof catchment systems legalized; incentives offered for installation

Natural Communities

- City increases tree planting; incentives offered for residential and business tree planting

Food

- Remediation planter strips added along parking lot borders and on the backsides of buildings to begin the process of remediation for food production within the urban node

Mobility

- Fast-growing trees with aggressive shallow roots planted in street medians to break up asphalt over time
- A buses-only lane is added through the center of the node to create public transportation that is convenient and fast
- Maintenance of roads and public parking lots reduced
- Lanes along major roads removed and replaced with Class 1 decomposed granite bike paths

Shelter

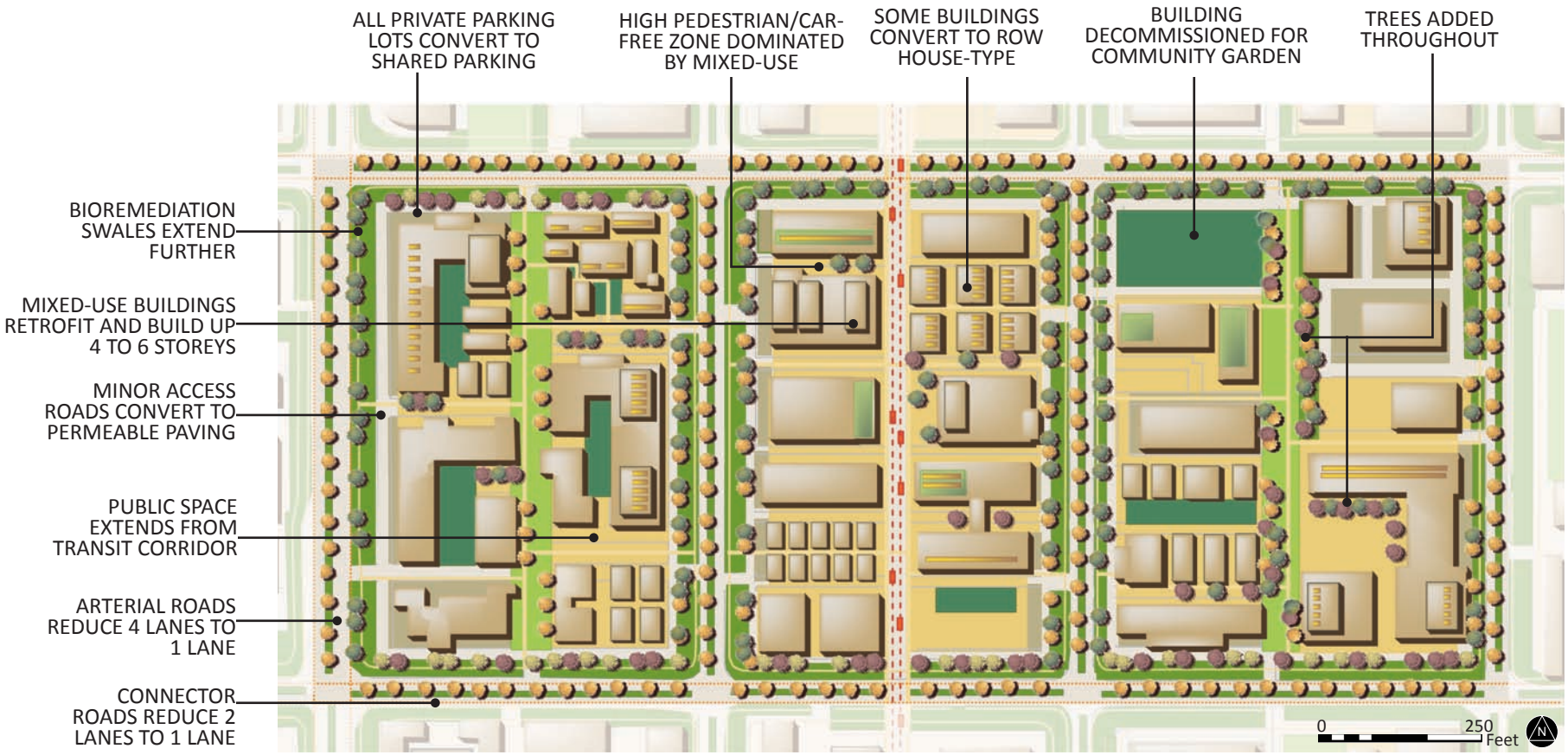
- New buildings around public open space are built, and civic buildings and public art create interest within the area
- Incentives are given to developers for adaptive reuse and mixed-use conversions, spurring development of existing warehouses and office condos; strip malls are renovated to include residential units
- Incentives given for solar panels and water heaters, and new developments required to be compliant with codes based on passive lighting, heating, and cooling

Community

- Several community gardens and impromptu gathering spaces emerge in vacant lots, parking lots, and abandoned semi-public greenspaces to make up for the lack of private space for new residents

Economy

- Incentives offered for waste reduction and funding provided for eco-industrial and reuse business ventures



2025

Building the Ship

2025: Building the Ship

Due to the overall rising cost of living, sustainable mixed-use developments near transit stops and transit hubs are in demand, and attracting more suburban expats, significantly increasing density and activity in the Uptown area. Although residents have somewhat less private outdoor space than they would have living in a suburban neighborhood, they have more communal and public space, and more time to enjoy these spaces.

Water

- Roof catchment and greywater use increase to compensate for high water costs due to drought

Natural Community

- Native, drought-tolerant and beneficial plantings increase throughout the node, with concentrated efforts along the east-west streets

Food

- Community gardens increase as food prices soar
- Planter strips widened and remediation plantings added (later to be replaced with agriculture) along the north-south streets

Mobility

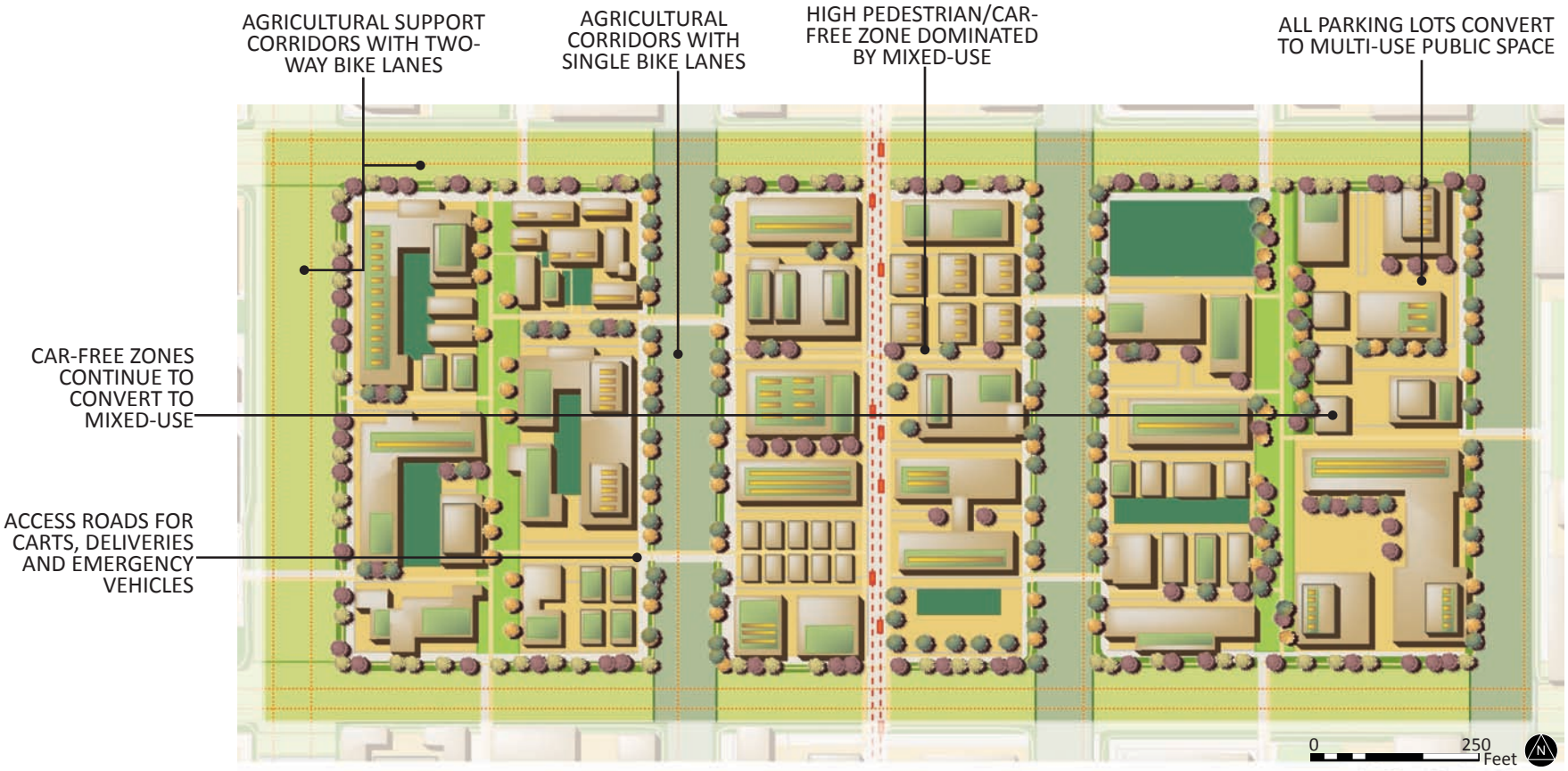
- Solar-powered trolley installed in place of the bus, and line frequency increases
- More bike paths added along streets and corridors
- All streets within the node now one-way, converted to permeable paving, and reduced in width

Shelter

- Urban dwellers save a significant amount of time not having to commute to work
- Commercial uses emphasized along new trolley corridor and within main public squares
- As energy prices rise, the demand for housing with passive heating, cooling, lighting, and renewable technologies increases
- Adaptive reuse and conversion of existing buildings increasingly popular as cost of materials and construction rises

Community

- Only a few parking lots remain; the rest have been turned into community gardens, parks, and public space
- Ample public and communal space, and increased flexibility of public space compensates for a reduced amount of private space
- Increased walking, biking, and public transit use result in more spontaneous interaction with neighbors and community members



2050

Sailing the Ship

2050: Sailing the Ship

By now, the majority of San Buenaventura residents are living within the urban nodes. Forward thinking planning practices and an active citizenry have made this a positive transformation. Public transportation systems have been established and are functioning up to full potential. The agricultural and agricultural-support corridors are established and being used throughout the city. The local economy is healthy, as markets, restaurants, local traders, and recycling businesses thrive within the dense node. Uptown has become a desirable place in which to live because of its active pedestrian streets, popular squares, parks throughout the city, and all the amenities one would need within a short distance. The average block now has 30 percent of its land devoted to building footprints, 15 percent for food production, 12 percent for agricultural support corridors, 5 percent set aside specifically for park space, and 37 percent of land area devoted to pedestrian walks, courtyards, and public squares.

Water

- Greywater systems irrigate agricultural land; catchment provides on-site water compensation

Natural Community

- Native plantings increase throughout the node, with concentrated efforts along streets; birds and butterflies become a common urban sighting

Food

- The urban agriculture program provides a diverse, healthy, local, and inexpensive alternative to imported food
- Remediation strips now fully remediated and converted to agricultural crops on the north-south streets, and to agricultural support corridors on the east-west streets

Mobility

- The Uptown node is car-free
- 17-foot wide permeable paving access roads for emergency and transport vehicles exist along the backsides of buildings

Shelter

- Increased density attracts a variety of local amenities such as restaurants, markets, parks, community centers, and schools
- Passive energy housing design enables people of all income levels to live comfortably

Community

- Shared maintenance and labor for urban agriculture has begun; most residents contribute five to 10 hours a week in exchange for their share of the produce

LAND USE
- Medium Density (*Concentrate*)
- Suburb Retrofit (*Release*)
- Agriculture/Open Space (*Preserve*)

TRANSPORTATION
- Inter-City Regional Transit
- Intra-City Rapid Transit
- Access Roads
- Food Production Streets

- Existing Roads
- Backyards
- Sidewalks
- Front Lawns and Driveways

SITE TWO: SUBURBAN OUTSKIRTS

Under the *Post-Peak Oil Vision Plan*, this suburban site is located one mile northeast of the Uptown business park site and is zoned for *Release*, meaning that development will not be encouraged by the city. This neighborhood was selected for design because it is on the periphery of the Uptown node, and because its character is typical of low-density residential areas throughout the city and region. Like many neighborhoods built post-World War II, this one is dominated by one- to two-storey single-family homes on smaller lots. Standing in the street (the only public open space in this neighborhood), there is little to indicate that the ocean is two and a half miles away, while scenic hillsides and agricultural lands are approximately one mile away.

The existing suburban site devotes approximately 26 percent of land to roads and driveways, 28 percent of land to buildings, 43 percent of land to private open space, and only 2 percent to public open space (or right-of-ways along roads). The design of this neighborhood facilitates the use of private automobiles by providing ample space for roads and car storage. Although the site is within a half mile of public amenities, residents depend on the automobile to run most daily errands. The single-family homes which dominate the site are not only energy intensive to build, but they are energy intensive to maintain, even in San Buenaventura's mild climate. Although the abundance of private yards gives residents a sense of pride, in reality, they are more likely to offer a sense of guilt, as most residents are too busy to spend time enjoying and maintaining the space. Most of the yard space is lawn, despite the fact that it is resource intensive and provides little benefit beyond creating an aesthetic connection between the rows of private space. Fortunately, several homeowners convert their yards to native and/or drought-tolerant gardens. During most hours of the day, few sounds can be heard except the nearby traffic and the occasional chirping of birds.

Retrofitting Suburbia

Making the *Release* zone of San Buenaventura a livable area post-Peak Oil necessitates retrofitting suburban developments to be sustainable and community-oriented. Models for sustainable suburban development respond to critiques on suburban sprawl. These projects alter suburban forms but do not answer the question of how to retrofit the existing suburbs which stretch across America to function in a post-Peak Oil world.

Village Homes of Davis, California, which was built in 1991, is the "Grand Daddy" of green development and continues to serve as a model for other developments (Rocky Mountain Institute). Planned, designed and built with community in mind, Village Homes' success is confirmed by rising property value, decreased automobile dependence, and strong community networks (see sidebar: ***Characteristics of Village Homes***). The *Post-Peak Oil Vision Plan* uses Village Homes to evaluate existing suburbs and identify opportunities for retrofits.

Critical differences between Village Homes and typical suburbs in San Buenaventura include the difference in housing layout, the ratio between public and private space, and the emphasis on bicycle and pedestrian paths (see comparison chart at right). Differences also exist between what Village Homes provides and the needs of post-Peak Oil suburban developments. For instance, post-Peak Oil suburbs will depend on productive land and localized mixed-use to compensate for the rising cost of living.

Based on the model set by Village Homes, critical elements of post-Peak Oil communities, and the character of typical suburban developments, the following priorities for suburban retrofits are identified: (1) enable mixed uses within residential blocks, (2) develop stronger connections between non-automobile paths, (3) increase quality and decrease size of private open space, (4) establish aesthetically pleasing, productive landscapes, (4) transform backyards and streets into intensive food production alleys, and (5) increase opportunities for community building.

San Buenaventura Site

Village Homes

Characteristics of Village Homes

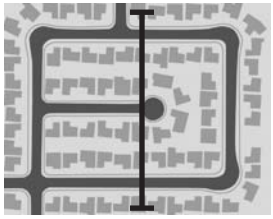
- *In 1995, homes sold for $10-$25 per SF over standard homes in the area.*
- *Homes have a low turnover and sell faster.*
- *Very low crime rate in neighborhood.*
- *Lowered ambient air temperature by 15°F by reducing paving.*
- *Surface drainage system saved $800 per lot, which was applied toward additional landscaping.*
- *Annual household bills range from 1/2 to 1/3 less than surrounding neighborhoods.*
- *80% of the residents participate in various activities promoted by the development.*
- *Average number of cars per household is reduced from surrounding Davis neighborhoods.*

(SOURCE: Rocky Mountain Institute)

Land Use Allocation in Village Homes and 2007 San Buenaventura Suburb*

Land Use Type	Villages Homes	San Buenaventura Suburb
Front Yards	10%	15%
Backyards	12%	20%
Side Yards	4%	9%
Agricultural Areas	17%	0%
Community Area/ Public Space	15%	2%
Houses and Garages	17%	27%
Streets	14%	18%
Driveways	3%	4%
Sidewalks	8%	2%

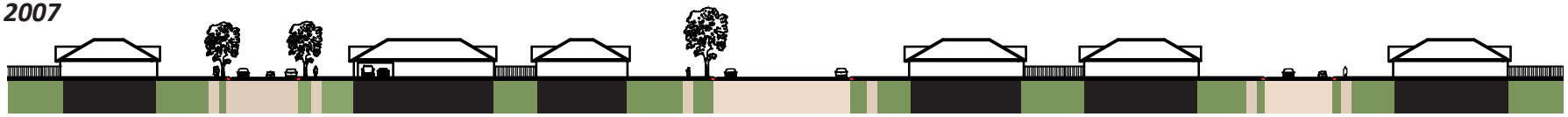
SOURCES: San Buenaventura numbers based on the typical block identified for re-design in this project; Village Homes statistics from "Village Homes' Solar House Designs" by David Bainbridge, Judy Corbett, and John Hofracre, 1979.



SUBURBAN SITE: Land Use Conversion Over Time

buildings | roads and paths | greenspace

2007

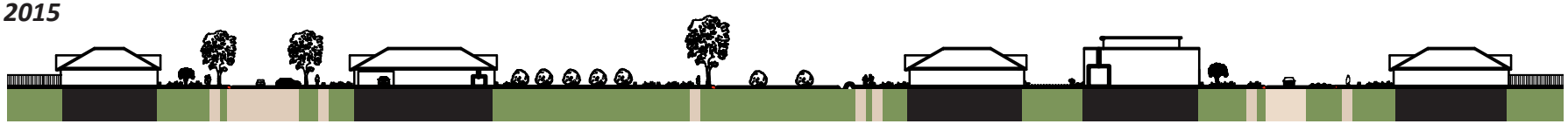


OFFICE COMPLEX

ONLY PUBLIC IS ROAD

UNDER-UTILIZED LAWN

2015



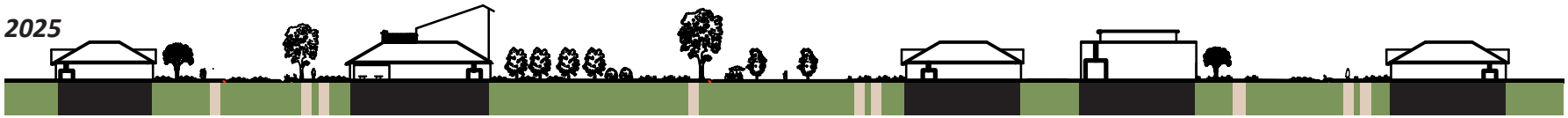
DRIVEWAYS REMOVED, PARKING ON STREET

ORCHARD PLANTED IN VACANT LOT

ROOT-INVASIVE TREES PLANTED IN CUL-DE-SAC

CONVERSION TO MULTI-FAMILY HOME; SHARED BACKYARDS

2025



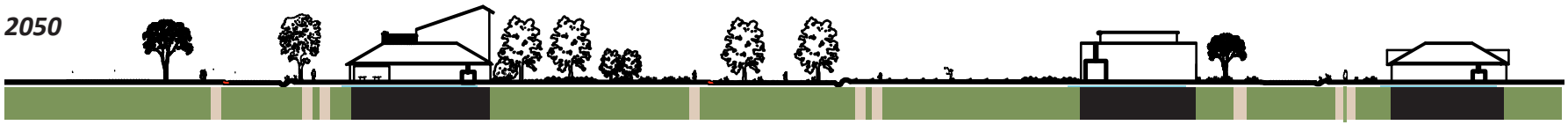
GREYWATER AND ROOF WATER CATCHMENT INSTALLED

CAFE (HOME BUSINESS)

PRODUCTIVE BACKYARDS

REMEDIATING ROAD ACCESS PATH INSTALLED

2050

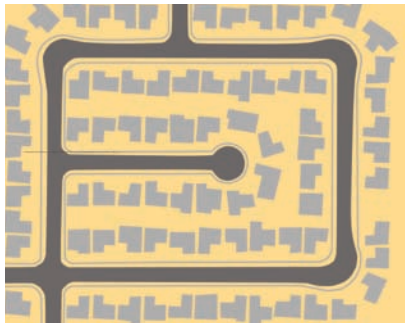


RECLAIMED LOT

PRODUCTIVE FOREST

COMMUNITY GREEN ESTABLISHED

0 80 Feet



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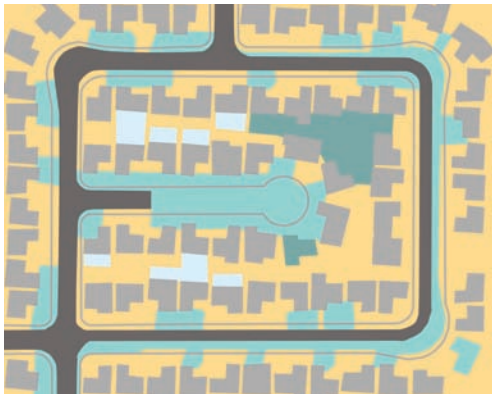
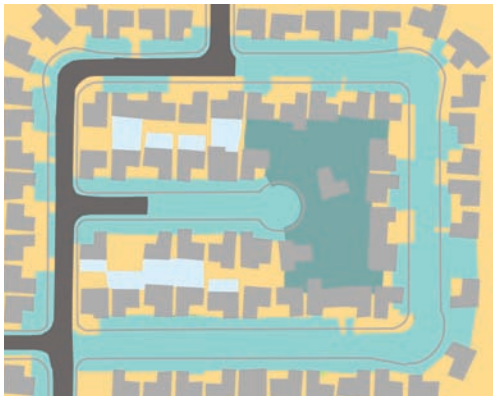
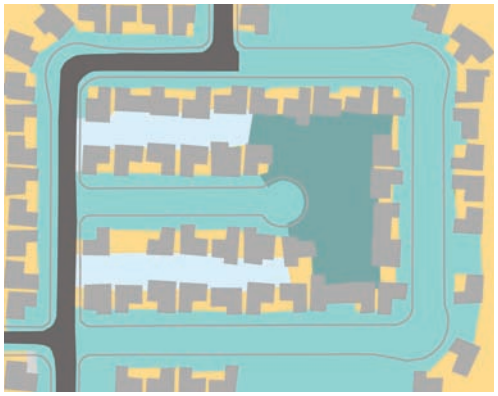


2015



2025



2050

Private
Shared Private
Public
Community Space
Road
Buildings

Private to Public

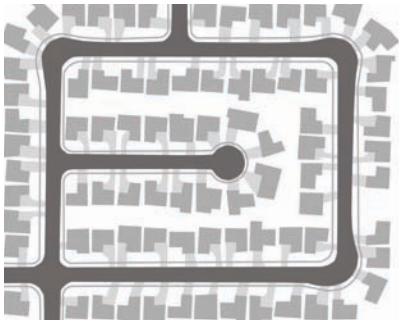
These diagrams show the transition of private spaces including backyards, front yards, and driveways to either shared private, public, or community space.

By 2015, some residents take down the fences in their backyards, creating shared private space. Areas adjacent to the roads become public space as orchards are planted and roads are removed. Poor soil quality beneath these roads is addressed naturally with soil-building plants. By this time, the neighborhood designates an area for community space and neighborhood meetings.

By 2025, shared private space increases as people give up their backyards for small, functional and easily maintained patios. Shared private space is leased to urban farmers or used by community members. Public space increases dramatically with the decommissioning of selected roads. Community space has expanded, as adjacent lots are vacated.

By 2050, the ratio of private to public space has shifted dramatically: community space has become a part of the daily routine for residents within the neighborhood, shared private space has replaced backyards, and front yards are an area for informal interaction.

Road
Remediation
Habitat
Orchard
Food Production
House Conversion
Lawn/Unmaintained



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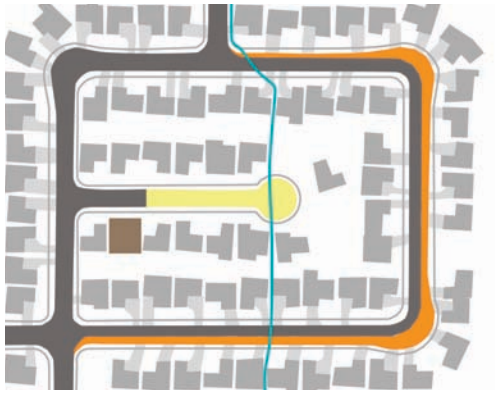


2015

2025

2050

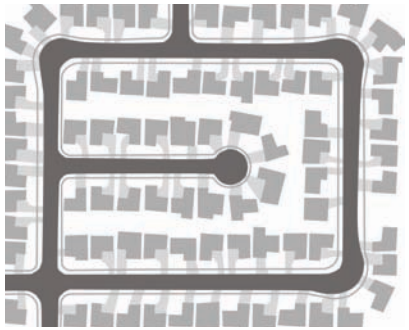
Auto-Centric to Human-Centric

These diagrams show the transition from an automobile-dominated suburban neighborhood to a pedestrian-friendly post-Peak Oil neighborhood. In car-free areas, narrow roads and bike paths replace wide streets and double as emergency access.

By 2015 a bike path has been built, and a permeable parking lot has taken the place of an abandoned lot, enabling some residents to give up their driveways for greenspace. A large portion of the roads have been narrowed to calm (and discourage) automotive traffic, and a car-free zone has replaced the cul-de-sac.

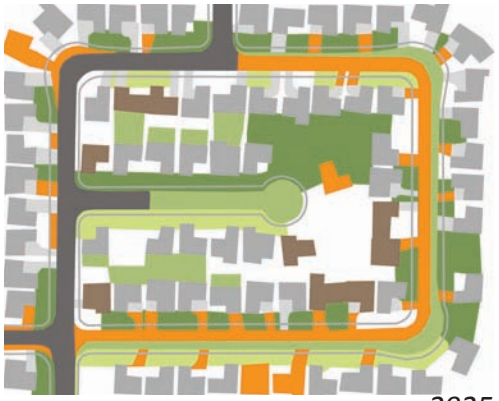
By 2025 the narrow road has become a car-free zone and a small decomposed granite path has been installed parallel to the sidewalk to provide cart and emergency vehicle access to homes.

By 2050, bicycle and pedestrian paths are heavily used, and only major roads are still used on daily basis by auto traffic. Car-free zones have become a standard part of suburban neighborhoods.



Existing

2015



2025

2050

Road
Existing Sidewalk
Driveway
Bike Path
Access Path
Road Narrowing
Car Share Parking
Car Free Area

Grey to Green

These diagrams show the shift from what currently covers soil (conventional lawn, asphalt, and concrete) to more productive and beneficial land covers such as crops, orchards, and native plantings. This transition requires remediation of the now polluted soil from asphalt, petrochemicals, pesticides and household pollutants.

By 2015, residents within the community grow food close to home to compensate for rising prices and to satisfy their craving for home-grown food. Phytoremediating crops (like sunflowers) and textile crops take the place of asphalt and habitat gardens take the place of front lawns.

By 2025, production of textile crops and food increases as orchards and crops continue to replace lawn, and as urban farmers become more skilled with the land.

By 2050, all private lawns have been replaced with an expansive community green that is used for games, barbeques, and gatherings. On the south side of streets, habitat gardens have replaced lawns. The north side of streets and former streets are utilized for orchards and community gardens. Backyards are widely used for intensive vegetable gardens.

2015

Longing for the Sea

INTEGRATED VISION FOR SUBURBAN OUTSKIRTS

The following is an integrative vision for the transformation of suburban outskirts, which describes the quality and character of the landscape at the three target dates.

2015: Longing for the Sea

Residents of low-density suburbs are noticing the rising cost of oil reflected in the cost of daily commutes, home maintenance, and daily goods. As the suburbs become increasingly expensive to maintain, parcels of land (several entire lots and many private yards) are abandoned. Fortunately, the city has formed partnerships with residents to reclaim abandoned land and resources, and to reduce dependence on city infrastructure. These partnerships are part of the city's post-Peak Oil planning, which emphasizes research and experimentation. In addition, residents begin to share resources and ideas on how to adapt to changing society.

Water

- Rising cost and incentives drive residents to take advantage of the City's new greywater policy and roof catchment incentives; some residents install compost toilets

Natural Communities

- Habitat gardens emerge as lawns disappear due to water quotas and city landscape policy

Food

- Edible tree crops are planted and backyard food production is growing in popularity
- Abandoned lots, though few in number, are sold to community members and/or the Backyard Land Trust to be remediated and returned to productive land
- Soil fertility is enhanced on all abandoned building sites and former roads through appropriate planting
- The city's new trash regulations inspire citizens to form a community compost system which neighborhood children help to manage

Mobility

- Instead of investing in new asphalt, the City has invested in permeable bike baths and in the removal of asphalt
- Non-arterial roads are narrowed to 23' by removing asphalt and encouraging curbside parking and shared parking lot

Shelter

- Some residents install solar panels and solar water heaters to reduce energy bills
- Some residents convert garages and underutilized space to small businesses (zoning changes, desire to be with family, and localization due to Peak Oil make home stores possible)

Economy

- Some residents lease their backyards or hire suburban farmers
- The city partners with a concrete recycling business to return driveways to greenspace as a pilot project (residents who can no longer afford cars and who care about increased open space offer their driveways to the city for this conversion)

Community

- Due to city's landscape policing limiting private lawn, residents designate a community greenspace
- The end of the cul-de-sac is planted with trees with shallow roots as an experiment for converting under-utilized lands

2025

Building the Ship

2025: Building the Ship

Rising costs and the attractiveness of the denser urban nodes due to the amenities they offer lead to an exodus from the suburban area. Those who choose to stay form a tight-knit community that shareS resources. Transformation is clearly underway, pushed along by the actions of residents as well as the City. Change in the suburban landscape is evident not only from the changing land uses, but in the strengthening social networks and the level of outdoor activity.

Water

- All houses now harvest roof water, and greywater use is rapidly increasing due to the drought, the cost of water, and policy

Natural Communities

- Native habitat within the neighborhood continues to grow and becomes more continuous

Food

- Textile crops are grown on sites that are not suitable to food production
- Urban farm animals contribute to soil quality, chickens become common in residential areas, sheep and goats are housed at public schools and parks and managed by local herders

Mobility

- Non-arterial streets are removed, access paths provide for non-automobile traffic as well as emergency vehicles (bike path lanes are installed parallel to sidewalks)
- Over half of the site is car-free, due to successful driveway and road removal programs

Shelter

- Houses are retrofitted to increase daylighting, improve insulation, and generate needed energy on site
- The trend towards co-housing and multi-family conversions continues as these housing options prove to be affordable and allow for more time to be spent with family

Economy

- Car rental and car sharing programs, urban farming, and home scale businesses thrive

Community

- The neighborhood council coordinates the planning of food production, tree planting, landscape maintenance, and roof and greywater flow
- The neighborhood council, with the help of the city, purchases a house to store communal supplies, serve as a gathering space, and house farmers and students
- Nearly all backyard fences have been removed to make backyard production more efficient

2050

Sailing the Ship

2050: Sailing the Ship

Residents embrace a new way of life and grow fond of the agricultural landscape and community spaces of suburbia. Human health is improved, the community is established, the commons is active, and the neighborhood collaborates on food production. Labor divisions continue to shift and flex with need. People who were born in 2010 are now 40 years old and accustomed to less-consumptive lifestyles; research and innovation continues on. The population and housing values are relatively stable in the remaining suburbs, as San Buenaventura is now a desirable post-Peak Oil city. The built footprint and roads cover only 23 percent and 8 percent of the land, respectively. Approximately 40 percent of land has been dedicated to food production, and an additional 18 percent to habitat and native plantings.

Food

- Orchards produce and yield local food crops for community
- Backyards and former streets provide for residents' vegetable and fruit needs, as well as eggs and some poultry
- Landscapes cycle at different paces (native plant gardens, orchards and tree crops cycle slowly, while intensive production areas cycle on seasonal basis)

Mobility

- Walking and bicycling (human-powered transportation) are the dominant modes of transportation

Shelter

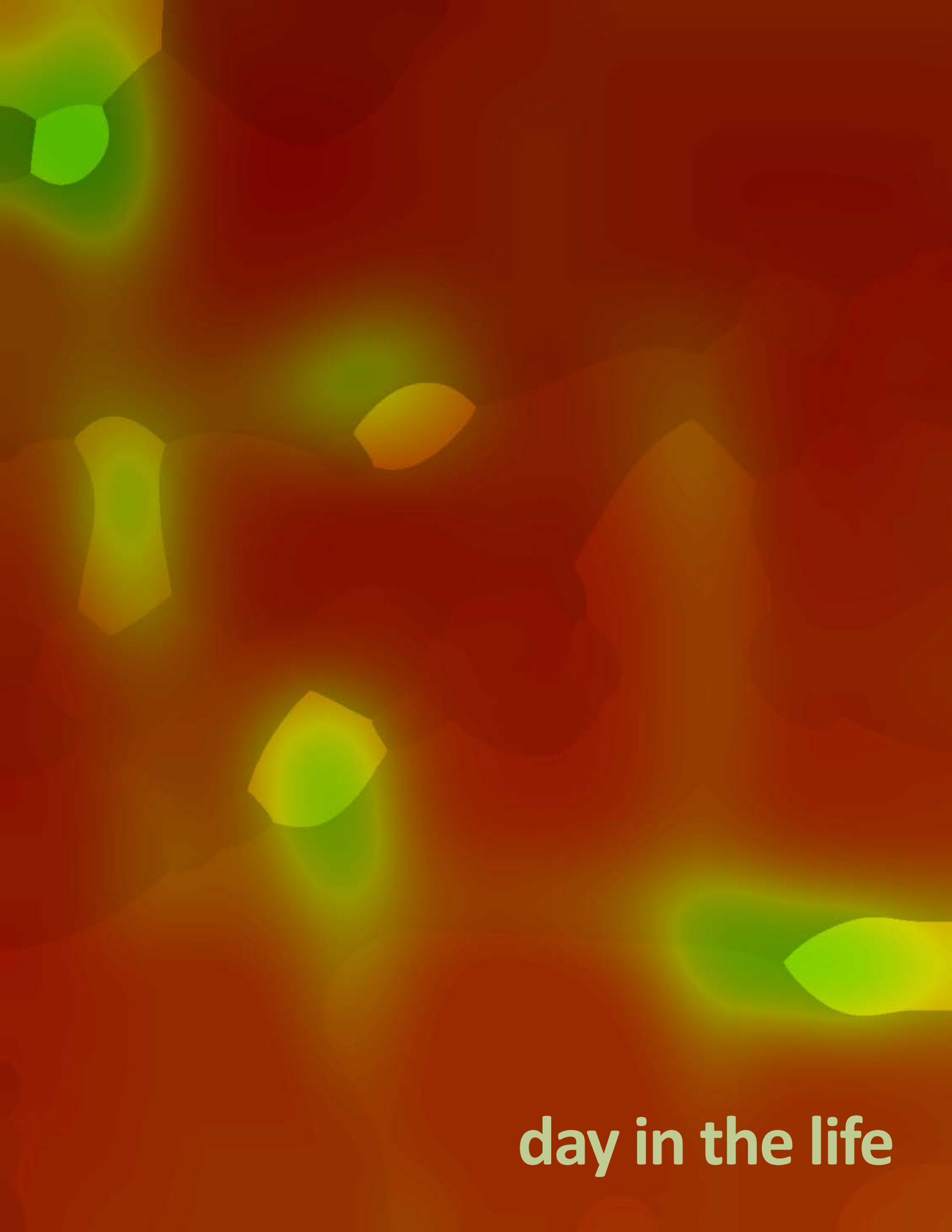
- Houses are well-maintained and well-adapted to the climate, requiring little energy to maintain

Economy

- Autos are rented as needed, and some residents use small carts to complete daily errands

Community

- Residents contribute to the maintenance of shared space
  Ample space exists for children, adults, and the elderly to enjoy shared and individual activities within the neighborhood


day in the life

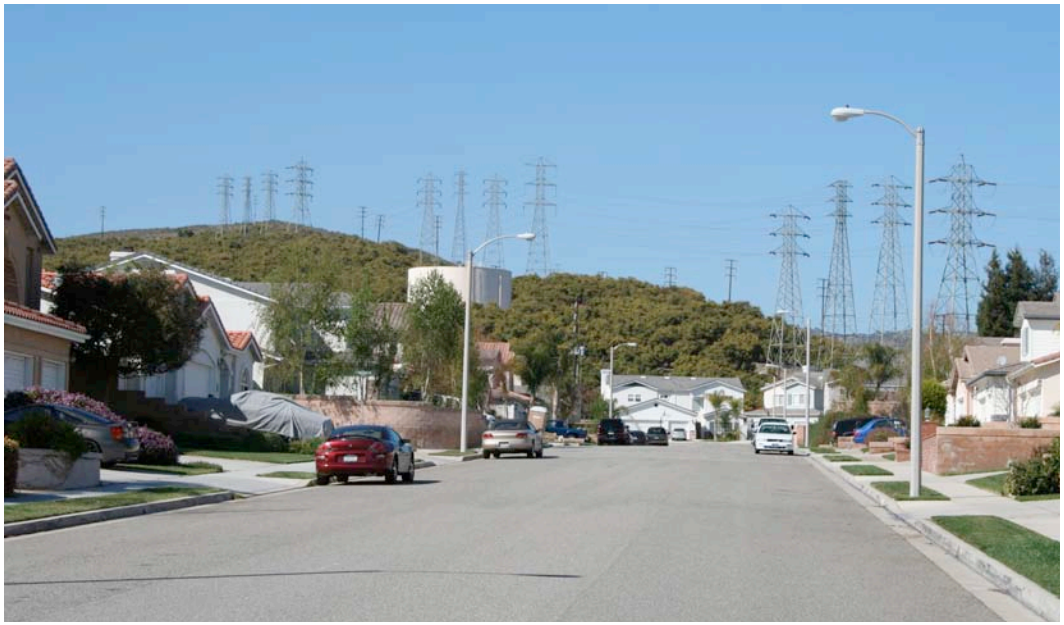
DAY IN THE LIFE

The purpose of this section is to show how quality of life intersects with Peak Oil. *Day in the Life* will follow citizens through a typical day in 2050 San Buenaventura. The primary focus will be on suburban and urban areas of Uptown, but the Harbor, Beachfront, and rural areas will also be visited.

Rural

San Buenaventura resident Ted Baker wakes up to the sunrise and opens his tent door, looking out over the surrounding agricultural fields. He thinks back to when he moved from Minnesota to Ventura because he could no longer afford the high cost of energy and imported food. Although farming is hard work, the climate is forgiving in San Buenaventura, and the lifestyle rewarding. Ted enjoys the early start because of the peace and tranquility of the early mornings. He is part of a group of itinerant farm workers that follow seasonal crops. Because agriculture is labor-intensive now, opportunities abound for year-round farmers. Workers live in comfortable, clustered housing on the farms at which they work. Ted is working towards finding a permanent job here, as he has built a good rapport with Frank Owens, the manager of the farm.

As Ted and his group head to their morning work in the fields, they wave to Sarah Ames, who is biking along the path with friends, heading to a nearby neighborhood learning garden, then later to school.



2007

2050

2007

2050

Suburban Conversion

As Sarah enters the suburban outskirts of Uptown, she passes by the small assisted-living center. The neighborhood has an eclectic mix of housing, gardens, park space, services, and even a small restaurant and learning garden. Like many of the old suburban neighborhoods that have remained and adapted, some of the lots are vacant, as the cost of keeping a home became too high. A few of the homes have been combined and turned into smaller apartments. Some of the garages that once housed autos have now been converted into small apartments for extended families. One garage has converted to a coffee shop, and one house is now a small store that sells basic necessities.

Watching a Behr's Metalmark resting on her window, Maria Lopez finishes breakfast and heads to the neighborhood learning garden. At the age of 70, Maria decided to move from her apartment Downtown into the new assisted-living apartment near her grandchildren. Once a week, she meets with the neighborhood kids and teaches them organic gardening practices. She enjoys sharing her knowledge with this new generation of healthy, curious, and attentive children. Maria is grateful for the apartment in which she now lives, once two single-family homes that have been converted. She is able to live close to her family, including her granddaughter, who works in the garden with her once a week.

The community garden is a part of the new common area that stands where single-family homes once stood. The commons developed gradually over the last 40 years and is now an active social area, not only for the immediate neighborhood, but for people passing through on their way to the regional train station. A diverse group of visitors is drawn to the commons due to its many features: a space for community meetings and gatherings, a turf area for children to play, a passive area for older generations to sit and watch, a community garden for residents, a small postal center, and an outdoor cafe. Attending the neighborhood meeting are Juan and Lisa Santiago, a recently retired couple that has lived in the neighborhood for over 30 years. They are at the meeting to volunteer for the annual olive harvest. Since retiring, Juan and Lisa have been spending their time volunteering in the neighborhood garden, while Lisa particularly enjoys teaching others about planting habitat gardens for bats, birds, and honey bees.

2007

2050

2007

2050

Uptown Node

After the meeting, Juan and Lisa walk to the new uptown district to have lunch with a good friend, Lucy Rudin, a member of the community council focusing on food production. The Slow Foods restaurant at which they are meeting is located in the local park near the Uptown transit station. Since the city zoning codes changed, areas within the city are now active, with commercial, civic, residential and work spaces intermixed with open space. The restaurant – once a vacant office - is a model of sustainable design, incorporating a greywater system, integrated solar panels and greenroof, and an herb and vegetable garden adjacent to the outdoor patio. The restaurant and park attract many people, and Lucy likes coming here because she can watch her son play in the park in the evenings while drinking a local brew with friends. The agricultural corridors provide unobstructed views of the hills to the north, and of the agricultural fields to the south. The agricultural support corridors that the city converted from roads provide picturesque breaks in the urban environment. Lucy enjoys observing the seasonal change, and appreciates the abundance of pollinators these corridors bring to the urban agricultural fields.

After lunch at the cafe, Lucy heads over to the nearby school to walk her son home. On the way home, they pass through the main square where they take a moment to watch Betty Yen, a local artist, setting up in the main square. Betty has been performing in the square in the afternoon and evenings to supplement her work as the neighborhood's Community-Support Agriculture coordinator. The critical mass around the square has added to the activity within the area, allowing her to make a decent living doing what she has always loved.

2007

2050

Lucy prefers living in Uptown because she can walk her son to school, walk to work, and take the trolley to meet with people around town. The three-storey townhome she lives in was added above what was once a large industrial building. Now, the bottom portion of the building is a mix of storage space for food processing and a number of small shops. Her apartment faces one of the agricultural corridors running through the city. From her porch in the early morning, she can watch her husband Hank and the farmers working in the fields as she tends to her own patio flower garden. Hank works with a group from the Urban Agriculture Coalition, a program run by the city that was formed years ago to help support food production within the city. Because of the extensive need for farmers, the Coalition is in charge of hiring workers in exchange for a share of the produce to work the farms for three hours a day before they go on to alternate jobs (where they put in an additional five or six hours a day).

After leaving her son in the care of her neighbor, with whom Lucy shares a plot on the communal roof food garden, Lucy heads to the trolley station. At the station, she goes to her private locker and retrieves her bike for a ride along the coast after her job-related meeting at the harbor.

2007

2050

2007

2050

Harbor and Pier

After a 10-minute trolley ride, Lucy meets with some of the main fishery workers at the harbor to get an update on how the fisheries are faring. She is monitoring food production throughout the county. Currently, the food production council is conducting research on aquaculture and the possibilities for increased ocean infrastructure for shellfish and mollusk farms. The fisheries are faring well, so Lucy wraps up her meeting, and hops on her bike for a quick ride to check out what's happening down at the pier. The multi-functional pier is active with tourists, locals, and weekend boaters enjoying the bountiful supply of fresh ocean fish. The new aquarium/ eco-fishery museum draws thousands every year. Lucy buys a fried fish sandwich before heading to the ocean civic area to her favorite surf spot. Once there, she rents a surfboard from one of the beachside cabanas and heads into the water.

Ocean Civic Area

As the sun sets, Lucy returns to the cabana to turn in her surfboard, where she runs into Marisol Jones. They enjoy catching up and decide to take a ride together along the boardwalk. The Beachfront has access points now along the existing highway. The conversion of two highway lanes into a passenger rail line – leaving two lanes for automobile use – and the addition of bike and pedestrian paths have made the once-divisive highway both functional and human-oriented. Now bikers and walkers enjoy the view of the ocean and wildlife from atop the highway.

Marisol is a professor at the new college located along the main square. She is a landscape architecture professor, and one of the leaders in integrating agricultural production into the urban environment. Colleges throughout the region are small and dispersed in urban areas. Three new colleges are now located in San Buenaventura, all of which focus primarily on thriving post-Peak Oil industries such as carpentry, water and waste management, urban design, information technology, and sustainable farming and fisheries.

2007

2050

2007

2050

Remnant Suburbia

To finish the day, Lucy bikes up to historic City Hall, which is now used as a museum and for special events. Tonight, she is meeting with all of the Peak Oil councils to derive the year's strategies and celebrate the fact that last year, all of the goals set by the city had been met. After the meeting, Lucy decides to ride her bike home. She rides past the neighborhood in which she grew up, and takes a moment to rest. All that exists now of the suburban homes are crumbling foundations and the few remaining gardens that have gone feral. Looking out over the land, much of which has been turned into productive agriculture, Lucy can see Uptown, now the city center, off in the distance. Lucy has fond memories of her childhood home, but is proud of the resiliency of her city, and of all the work it took to get to the vibrant community in which she now lives.

CONCLUSION: BEYOND 2050

Cities are constantly evolving, and just as San Buenaventura has made major transformations over the last 50 years, the transformations taking place up to 2050 will not be the final solution. It is reasonable to believe that there will be a continued migration towards the nodal centers as people become more attracted to the amenities, benefits, and reduced expenses associated with living in dense areas. The suburban landscape left to the outer edges will continue to be converted to farm land and open space. Innovation and technologies will continue to change farming practices, travel habits, living spaces and other factors that affect day to day life. If carefully planned for, what will not be lost is the connection to place, the respect for natural resources, and the strengthened community structure that the movement towards localization reveals to be of greatest importance.

appendices

APPENDIX A: PEAK OIL SCENARIO QUESTIONNAIRE

The Project

The 606 Studio is currently working on a project for the City of San Buenaventura to assess potential impacts of peak oil and build on past planning efforts within the City and County. Our goal is to provide urban design guidelines and policy solutions that promote environmental, community, and economic health while better preparing the city for the eventual impacts of peak oil.

On the following pages you will find a detailed scenario based on the City's and County's current plans, predicted futures, and overall regional and national trends, as identified in the 2007 section below. This scenario is then broken into three future stages for the years 2015, 2025, and 2050. Your comments on each of the stages and their potential outcomes (numbered statements below each stage) are important building blocks in this stage of our process.

Peak Oil

Peak Oil theory explains that oil and other fossil fuels are finite resources that are being exhausted and will eventually be entirely depleted. Once a peak has been reached it has been estimated that production of oil will decline annually by about 2%-3%, at which point current growth patterns will become impossible.[1] When peak oil production occurs, demand for oil will be forced to shrink along with the oil supply. In consequence, the world will be facing a serious economic, environmental, and political crisis which oil alternatives may not be able to quell. Compounding the problem of diminishing oil reserves are third-world countries, most notably China and India, which are industrializing and demanding an increasing share of resources.

The purpose of this questionnaire is not to determine whether or not peak oil will occur, but to imagine how the City of San Buenaventura would respond to peak oil. If you would like further information on the project or would like to discuss the scenario further please contact Henry Fleischmann.

The Scenario

A "scenario" is a tool for us to begin a strategic discussion of the future; it is not a prediction of the future. This method is based on "Alternative Futures for Changing Landscapes" by Carl Steinitz, professor of landscape architecture and planning at Harvard University School of Graduate Design. A scenario-based method is comprised of several iterative phases; the first of these phases identifies important issues and actions that are responsive to planning decisions, allowing an investigation of alternative futures.

Current (2007)

The current population of San Buenaventura is 108,603 and is projected to grow to 158,292 by 2050[2]. For the sake of this scenario the rate of worldwide oil depletion is projected at 5% per year based on projected depletion rates of 2%-3% and coupled with a 2%-3% increased demand from industrializing countries like India and China.[3]

San Buenaventura is dependent on cheap oil for water distribution, food production, shelter and transportation. This dependence has affected human, environmental, and community health. Oil has made possible the daily availability of foods from across the world, cheap consumer goods, suburban development, and private automobile travel. It has had negative impacts on water, soil, and air quality. Despite this, San Buenaventura remains a good place to live. A recent study found that 42% of its residents ranked quality of life in the city "excellent," with an additional 49% ranking it "good."[4] With its Mediterranean climate, agricultural surroundings, existing infrastructure, and forward thinking planning department, San Buenaventura is likely to be better off than most cities in a peak oil crisis.

The following is a list of known trends upon which the scenario is based:

Water

- County water users extract nearly 5,000 acre feet per year more than is replenished. This is primarily taken from the Oxnard plain.[5]
- County currently imports 25% of its water from the state water project.[6]
- 88% of city water is allocated for residential and commercial use, including landscaping and etc.[7]
- City has implemented water conservation policies since 1970s.[8]
- City uses reclaimed water.[9]
- City is entitled to 10,000 acre feet per year from State Water Project for future demand.[10]
- City has emergency water shortage plan for up to a three year drought.[11]
- Local fisheries are doing well in contrast to many international fisheries due to management practices and regulations, yet there are a limited number of fishermen.

Food

- County production is dominated by specialty crops, most of which are exported from the County.[12]
- Agricultural land is being converted for development, despite SOAR ordinances.[13]
- County implemented the SOAR program in 1995 to limit urban sprawl and protect open space and agricultural lands.[14]
- 0.42% of county farmland is certified organic.[15]
- City has partnered with local farms to promote farmers markets and local food production.[16]
- City has initiated Healthy Schools Program to provide fresh local food to students.[17]
- City has implemented the SOAR ordinance that will not expire until 2030.[18]

Shelter

- Zoning and planning for increasing density is limited.
- It is becoming harder to grow horizontally because of local growth control laws and land costs.[19]
- Planned high density, mixed-use development in Oxnard will provide jobs and housing for several thousand people.[20]
- City is currently pursuing increased density through mixed use developments. Ex: Victoria Avenue Corridor, Downtown Specific Plan.

Transportation

- City has a high rate of commuting in and out of city.[21]
- The current development patterns within cities areas are auto-centric.
- City has created a General Bikeway Plan, the goal of which is to expand and link existing bicycling routes.[22]
- City's projected transportation budget is $58,503,665, 39% of this will be dedicated to non-motorized transportation-related projects.[23]
- Planned development in Oxnard and Port Hueneme will significantly increase traffic in the region.[24]

Scenario Phase 2015:

In 2015 world oil production has decreased to 66% of 2007 levels. However, wealth has enabled the United States to continue consuming at nearly 2007 levels. Growing energy needs associated with population growth have begun to be supplemented with renewable energy and efficient technology. There has been continued investment in existing (2007) infrastructure for private automobile transportation, single family housing, and conventional food systems. The greatest change felt by residents of Ventura County and San Buenaventura is the cost of living: the cost of basic goods, food, water, transportation, and housing are noticeably increasing. The local economy has begun to suffer, as has quality of life for residents. The steady increase in cost of living since 2007 is fueling a shift in perception regarding the realities of peak oil and future outlooks.

Predicted Trends (see end notes for sources from which trends were extrapolated):

1. Overdrafting of county groundwater supply continues to be compensated by state water project.

2. The cost of food production increases as water, fertilizer, pesticides, and transportation become more expensive. As a result direct marketing of county produce to county residents increases through farmer's markets and institutional partnerships.

3. Urban farming has increased in San Buenaventura. Most farming takes place on private gardens, although limited space is available in community gardens.

4. The demand for local fish has grown, but supply is limited. Local fish become a food source for the wealthy.

5. Within the City, designated infill is almost at capacity (expected to reach capacity in 2017).

6. Due to rising costs and the aging population, there is an increased demand for housing near amenities. Several new low density mixed use projects within the City and high density mixed use projects outside the City have begun to compensate for this growing need.

7. Shelter retrofitted with solar panels and greywater systems are slowly being adopted.

8. Leisure travel is decreasing, yet many people continue to commute to Santa Barbara and Los Angeles for work. Telecommuting, bicycling, and carpooling increase.

Based on your knowledge of San Buenaventura what is the likeliness of the above trends in a post peak oil situation? Why?

Scenario Phase 2025:

Oil prices have continued to increase as oil production has fallen to 44% of 2007 levels. By 2025 the United States can no longer afford to maintain their oil consumptive lifestyles. Alternative and renewable energies have begun to replace some of the gap left by oil energy but it cannot keep up with energy demand and alternatives have proven to be less adaptable than oil.[25] Residents of Ventura County and San Buenaventura have made adjustments in their lifestyles that enable them to afford the cost of living, yet the quality of life has deteriorated from what it was in 2007. Despite growing relationships within communities, there is a sense of instability in natural systems, government, and the economy. To make matters worse the city is in the middle of a five year drought, which is not uncommon for the area. The drought has caused the city to implement their Emergency Water Shortage Plan. The city landscape has become a checkerboard of lush produce gardens and dry, dusty lots, dotted with deteriorating buildings.

Predicted Trends (see end notes for sources from which trends were extrapolated):

1. County becomes more dependent on State Water Project, although costs have risen due to drought. Available water is prioritized for human consumption.

2. Saltwater intrusion from over drafting and other contamination remain a concern throughout the county.

3. Drought conditions have increased the cost of food production in the County. As a result, crops have shifted towards commodities that produce more value per unit of water. This has caused an increased dependence on non-regional food supply.

4. 10% of County farmland has been converted by development and/or renewable energy parks (i.e. solar).

5. Fishing becomes a profitable local profession. Fishers are better connected to local markets, and are affordable to a larger portion of the population.

6. The County is becoming overcrowded, and cities compete to annex lands for housing projects. Prior development patterns have left the majority of housing low density despite the city being filled to capacity.

7. Existing infrastructure is overburdened while new infrastructure is slow to be built due to increasing material costs and over-tapped funds.

8. Many inhabited buildings within the City are deteriorating and in need of repair.

9. Private auto transit has decreased for short distance trips, and bicycle and pedestrian trips have increased greatly. Public transit infrastructure, such as a light rail, cannot be installed due to the high costs of construction.

Based on your knowledge of San Buenaventura what is the likeliness of the above trends in a post peak oil situation? Why?

Scenario Phase 2050

Compared to many places in the nation, Ventura County and San Buenaventura have adapted to Post-Peak-Oil rather well. The climate has continued to afford them a long growing season and comfortable temperatures. However, the high cost of living has led to changes in lifestyle that are not easily accommodated by existing infrastructure. For example, there is a shortage of land available for urban farming- despite having turned all parks and school yards into agricultural land. Whole neighborhood tracts have become deteriorated and overcrowded. The great age of spending on transportation infrastructure in non-metropolitan areas ended around 2035. Bicyclists and pedestrians make use of now oversized streets, avoiding potholes where possible. The freeway, virtually vacant, has become a high crime zone. Suburban developments isolated from community centers have left the remaining residents separated from daily life within the city.

Predicted Trends (see end notes for sources from which trends were extrapolated):

1. Water availability has dropped to half of what it was in 2007.

2. Ventura County residents are spending 30-50% of their income on food. Intensive gardening has become essential in order to compensate for the high costs.

3. County production has begun to align with county needs, leading to increased grain and tuber production. However, decreased energy and water supplies have reduced production.

4. The decline of global fisheries has increased fishing in the Santa Barbara channel, and is straining the local fisheries. Ecological impacts to the ocean (on a global scale) are being noticed within the Santa Barbara channel.

5. Entire neighborhoods and housing developments have been abandoned due to disrepair, crime, and health problems from failing infrastructure.

6. The City faces a lack of open space and severe natural habitat loss as developments spread up the hillsides and along the rivers in order to meet housing demands and needs.

7. Modest population growth has meant slower economic growth than in the past, which has lead to less funding for infrastructure in general; consequently jobs tend to be concentrated in metropolitan areas where infrastructure grids are already in place.

8. Suburb and exurb communities become isolated as cost of traveling becomes more and more unaffordable, and corridor connections to urban centers are lacking.

Based on your knowledge of San Buenaventura what is the likeliness of the above trends in a post peak oil situation? Why?

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APPENDIX B: SUPPLEMENTAL DATA

Appendix B-1

AIR QUALITY

Ozone and PM2.5 (particulate matter) are the two worst air quality problems in Ventura County. Residents currently breathe air that does not meet federal or state health standards for ozone or state particulate matter standards. In addition, 11.6% of Ventura County children under 18 suffered chronic asthma (Lund, 2003). A 2000 AQMD study linked particulate matter (PM) to heart problems and higher cancer rates in adults. In Southern California, approximately 25% of PM2.5 is from mobile sources (VCAPCD, 1998). Emissions from motor vehicles account for more than half of Ventura County's total air pollution. Other pollution sources linked to petrochemicals include business, industry, agriculture, and household products. Other factors which may be brought on and/or intensified as a result of global climate change (increasingly believed to be a result of human action/oil use – approximately 77% of US carbon dioxide emissions are directly related to the burning of fossil fuels – Ecobridge.org) include warmer weather, stagnant air, and increased solar radiation which allows ozone to form and hover above Ventura County (VCAPCD, 1998). In an effort to clean up the air to meet health standards, the Ventura County Air Pollution Control Board has:

a. Adopted an Air Quality Management Plan (AQMP).
b. Agricultural burning restrictions
c. Lawn mower trade-ins
d. Public awareness campaigns

Ozone	2005	2004	2003	2002	2001	2000
Federal 1 Hour Standard	0	0	2	1	2	1
Federal 8 Hour Standard	11	17	31	15	24	30

SOURCE: www.vcapcd.org/air_quality.htm

Appendix B-2

POST-PEAK OIL PLANS: A LITERATURE REVIEW

Planning for post-Peak Oil is in its infancy, as cities and countries around the world are just beginning to adopt policies that will aid the transition to less energy consumption. *Kinsale 2021: An Energy Descent Action Plan* was developed for the town of Kinsale, Ireland, in 2005. In March of this year, the City of Portland's Peak Oil Task Force prepared a report titled *Descending the Oil Peak: Navigating the Transition from Oil and Natural Gas*. Individuals such as on Richard Heinberg are exploring the implications of Peak Oil on society. In his book, *The Party's Over,* Heinberg begins a critical discussion of the probable effects of Peak Oil on a community's critical support systems. The following is a summary and evaluation of these documents.

Descending the Oil Peak: Navigating the Transition from Oil and Natural Gas

In May of 2006, the Portland City Council adopted a resolution establishing the Peak Oil Task Force. The Task Force examined the city's vulnerability to Peak Oil and developed specific recommendations to reduce the impact of reduced fossil fuel availability. Four committees focused on land use and transportation, food and agriculture, public and social services, and economic change. The Task Force conducted over 40 meetings in an eight month span, and met with business leaders and professionals in preparing their report.

Three possible scenarios were generated for the impacts of Peak Oil on Portland: a long term transition in which prices will increase gradually while supplies decrease gradually; oil shock in which the long term transition experiences sudden disruptions and price hikes; and disintegration in which the impacts are so extreme that social catastrophe occurs. The Task Force focuses on the long term transition scenario, as recommendations resulting from the study of this scenario were deemed most likely to allow for meaningful governmental and individual responses. Examples of implications include: a decline in automobile use, populations shifting to city centers, increasing reliance on rail, maintenance of road infrastructure becoming difficult, increasing cost of household goods (including food) and home maintenance, households growing more of their own food out of necessity, the amount and variety of food produced decreasing, and a short term increase in unemployment. Other implications are that vulnerable and marginalized populations will be hardest hit by Peak Oil, and individualistic and competitive responses to Peak Oil could erode community spirit.

Through their investigation, the Task Force concluded that the City of Portland needs to take immediate action to plan for Peak Oil. The Task Force made recommendations for the city to both reduce its exposure to the effects of Peak Oil and to strengthen community cohesion. These recommendations found the need for the following: a significant reduction in oil and natural gas use, ambitious leadership, better urban design, expanded efficiency and conservation programs, sustainable economic development, social and economic support systems, and improved emergency preparedness.

EVALUATION:

The Portland post-Peak Oil plan is thorough and comprehensive, as the collaboration of experts, community outreach, and stakeholder involvement led to specific actions for the city to adopt. The major energy-intensive systems were addressed, as well as human systems including social services, emergency response, and marginalized citizens. Potential scenarios were outlined, and the plan chose a clear path for the city to adopt meaningful and lasting changes. Potential gaps within the document include the lack of an illustrative vision for Portland's future and a timeline for meeting that vision. The document focuses on the

problems and responses, yet fails to emphasize the positive opportunities associated with Peak Oil.

Kinsale 2021: An Energy Descent Action Plan

In 2005, permaculture students from the Kinsale Further Education College created a plan for Kinsale, Ireland (a coastal town with approximately 7,000 residents) to transition from an energy consumptive town to a town that requires little energy to function. The plan offers a brief overview of present conditions in Kinsale and its vulnerabilities to Peak Oil, focusing on food, energy, tourism, education, and health. The students developed a vision for the town's future, as well as a timeline of possible actions. The document outlines practical steps for each year from 2005 to 2015, and steps for 2016 to 2021 follow a short description for a proposed 2021 vision.

The plan's treatment of the food system illustrates the document's framework. After describing the city's vulnerabilities to Peak Oil, the vision for the 2021 is described— highlighting less dependency on imported food, a deeper connection to seasons, and improved health through activities such as gardening. Specific steps for the town include the early appointment of a local food officer, local food networks, a slow food movement, and community gardens. Later recommendations include establishing aquaculture, food celebrations, and medicinal laboratories. Most recommendations are adopted by 2016, and therefore, by 2021 the town is resilient to shocks in the food system.

Evaluation:

The Kinsale plan is visionary as it is one of the first plans to address Peak Oil. The plan addresses major energy-consumptive systems and issues specific to Kinsale, such as tourism. Youth, the elderly, and education are also addressed. The plan recognizes that it is not comprehensive, and perhaps the greatest gap is in not addressing likely scenarios.

The Party's Over, by Richard Heinberg

The Party's Over by Richard Heinberg is a comprehensive look at the role of energy within society, the diminishing supply of cheap energy (oil and natural gas), and the implications of this diminishing supply. Some of the more critical discussions within the book include: a history of industrial society and the role of oil; predictions on when the oil peak may occur; and why energy alternatives will not make up for the loss of fossil fuels. The author discusses the implications of Peak Oil on such systems as transportation, food, the environment, public health, politics, and energy-resource competition, and offers a list of strategies to deal with potential problems.

In Heinberg's following books, *Powerdown* and the *Oil Depletion Protocol*, he continues the conversation on post-Peak Oil. *Powerdown* looks at different scenarios that might be played out by governments and communities facing the crisis. These scenarios include: competition for resources, self-limitation, alternative energies in order to continue current lifestyles, and a discussion of what makes societies collapse. In his next book, *The Peak Oil Protocol*, Heinberg presents a solution to the Peak Oil crisis, which advises nations to follow the path he presents and voluntarily reduce oil production and imports.

Evaluation:

Richard Heinberg's *The Party's Over*, and his two proceeding books present a comprehensive and well researched look at Peak Oil and it implications. Gaps within these books are how ideas and solutions begin to take shape within cities.

POST-PEAK OIL REALITY: A REVIEW OF CUBA'S RESPONSE TO CRISIS

Cuba and Peak Oil

When the communist regime in Russia fell in 1989, Cuba lost 50 percent of their oil resources, and in effect, faced a Peak Oil crisis. This resulted in a drop in agricultural production, which led to hunger. Automobile and trucking were significantly curtailed. Energy shortages resulted in power outages throughout the city, which resulted in inefficiency in business, food loss due to lack of refrigeration, and water pumping problems. The people of Cuba adapted to the situation by using organic farming methods and by growing food within the city and surrounding area. The buildings became smaller but were designed to fit a larger number of people. Transportation significantly changed, as more people began biking and taking public transportation and personal automobile travel decreased.

Evaluation:

Cuba's experience can provide some idea of Peak Oil's possible effect on systems, but may not be able to reveal how the United States would react to the situation. This is due to the fundamental difference in the two countries' governments. One valuable lesson that can be learned from Cuba is how well the community came together to face the situation. Urban farms, organic farming practices, and business models were implemented immediately. Food rationing was instated to ensure that everyone had enough food to survive. Bikes were given to the public and transportation alternatives were established. These transformations may not be adapted as easily by a capitalist society where competition for resources is seen as a virtue. What American cities do have in their favor is a magnitude of wealth that will most likely stall the effects of Peak Oil and allow for communities to invest in changes in order to lessen the impact.

APPENDIX C: ADDITIONAL READINGS

1. The Love Affair: Americans' Addiction to the Automobile
2. Integrating Multi-generational and Inter-generational Concepts Into Community Design
3. The Consequences of Suburbanization on Social Capital
4. Improving Quality of Life Through Urban Infill Development in California
5. Building a Framework for Urban Agriculture

Appendix C-1

The Love Affair: Americans' Addiction to the Automobile

By Yarnie Chen

"Our transportation is a tangle…As we enter a new century, our vaunted mobility is, in fact, obstructed by a car culture in which every attempt to move is fraught with wasted motion, wasted time, wasted surroundings, wasted money…both the quality of mobility and the quality of life have diminished."

--Jane Holtz Kay, ***Asphalt Nation***

INTRODUCTION

The North American statistics on car ownership and dependency are staggering – stand near any highway and count the number of single-occupancy vehicles. Many people rely on a vehicle for work, shopping, and many other activities. Some commute as many as four hours a day. From the infatuation of the 19th century to the entanglement today, Americans have had over a hundred tumultuous years of romance with the car. Like any relationship, counselors and therapists would recommend reviewing a relationship's track record before trying to solve its problems. Thus, it is essential to examine the development of the automotive affair and identify the factors that have influenced its current state.

HISTORY

Searching for Love: Living the "American Dream"

During the 19th century, a lot of major changes occurred in human travel. In 1825, passenger trains started running in England and quickly spread to other countries. Cable cars and then electric trolleys came to cities in the 1870s and 1880s, carrying loads of urban passengers. When the bicycle showed up around the same time, the public marveled at the personal freedom it allowed. Expectations of travel changed and horizons broadened. Then cars motored into the mix. The automobile achieved dominance remarkably swift – in a single generation – and has since extended that dominance. The freedom to move freely and independently with cars opened up opportunities for expansion, independence, progress, and unrestricted access (Safdie 1997).

Beginnings of the Whirlwind Romance: Advent of the Automobile Production and Domination

By 1901, 130 car manufacturers clustered around Paris; by 1905, 280 had started in Britain; from 1900 to 1908, 485 companies entered the United States' auto business. There was much money to be made, with sales skyrocketing, especially in the United States where motor-vehicle registrations swelled from 8,000 in 1900 to more than 458,000 by 1910 (Flink 1970). At the same time, carmakers and the public were also experimenting with other technological advancement for mobility such as steam, electric, and internal-combustion cars. However, developments like Texas oil discoveries and Detroit carmakers' use of gasoline power helped internal combustion move ahead of the pack.

As gasoline-fueled cars gained ground, the United States made advances in mass production and overtook France in 1904 to become the world's top auto producer. Low raw-material costs, the world's best machine tool industry, and favorable tariffs all fostered the auto industry in the United States. In addition, United States had the world's biggest market for cars with its sizable middle class living in communities dispersed over a large area (Alvord 2000). The Ford Motor Company played a crucial role both expanding United States car production and encouraging mass consumption of cars, by mass-producing inexpensive Model Ts in 1908, then making them even cheaper in 1913 by using a moving assembly line. Cars rolled off the line at the astonishing speed of one every three minutes. Mesmerized by mass production and enthusiastic due to the affordability it gave the Model T, the public flocked to dealers. By 1920, fully half the world's motor vehicles were Model T Fords. Model T sales sparked car cultures in Canada, Australia, and New Zealand where long distances between communities and relatively high, equitably distributed incomes encouraged car sales just as it did in the United States (Flink 1970).

As production picked up in the United States and Canada, car culture in North America and Europe began to diverge. While Europe imposed horsepower taxes, the United States had none; North America had cheaper, more plentiful gasoline. Both factors promoted the manufacture of more powerful but less efficient engines in the United States and Canada: while American carmakers focused on quantity, Europeans retained a labor-intensive, quality-oriented but low-volume production style (Flink 1970). Furthermore, United States carmakers were more aggressive than Europeans about not only satisfying car demand, but expanding it. By lowering prices on mass-produced vehicles like the Model T, paying auto workers wages that helped them afford cars, advertising extensively, and selling cars on credit and loans, United States carmakers induced more and more consumers to desire and buy cars. Shortly after World War I, auto manufacturing was North America's top industry and the power and wealth of the auto business had become immense (Alvord 2000).

Seductions and Promises: The Public Image for Better Quality of Life

From the outset of its diffusion in the United States, the automobile has been given extensive and overwhelming favorable coverage in popular periodicals – coverage well beyond what an objective appraisal of the innovation warranted. Historian James Flink determined that close cooperation between the press and the automobile industry was established early. One such collaboration occurred between car-builder Alexander Winton and Cleveland reporter Charles B. Shanks. In 1899, Shanks documented Winton on an auto-endurance trip from Cleveland, bringing in around million people to watch them pull into New York (Flink 1970). Ensuing reports about cars glowed with enthusiasm, with descriptive language that waxed eloquent about the "great beauty." *Motor World* wrote of the automobile's "charm" (Where the Charm Is, 1901); a 1900 *Scientific American* article admired a car with "distinctive details…dear to the heart" (Flink 1970); New York Times in November 1900 gushed about the auto show showing the "never-ending whirl of animation" and "sweeping curves of the self-propelled vehicles" (Henry 1996).

Many early writers believed cars would make families closer, resolving overcrowding and pollution in cities, save money, eliminate class distinctions and abolish slums. They idealized commuting by car: "Imagine a healthier race of workingmen…who, in the late afternoon, glide away in their own comfortable vehicles to their little farms or homes in the country or by the sea twenty or thirty miles distant! They will be healthier, happier, more intelligent and self-respecting citizens." Another predicted that cars would enhance access to fresh air: "The possession of a car…think of what it means. Every friend within 3,000 square miles can be visited, any place of worship or lecture or concert attended…and with it all fresh air inhaled under exhilarating conditions" (Alvord 2000).

Moreover, the media began selling and carmakers began buying an increasing amount of advertising. Automakers started out using ads to persuade the public of cars' safety and durability. It later shifted to the image of the car. Car ads promised buyers much more than a motorized metal box with four wheels. Many car ads say little about actual product features. Instead, the ads sell images and illusions, maneuvering cars into position as symbols of status, influence, sexual prowess, freedom, fulfillment, and more. People started seeing cars in the ways they were advertised, increasing demand and sales (Horton 1996). Advertising became a powerful tool to bring in greater profits to the auto industry.

The car increasingly replaced other travel means, including horse-drawn wagons, railroads, streetcars, electric cars and bicycles. Adding to the public fervor for automobiles, the government and businesses such as real estate and construction fostered the decline of non-car travel with certain regulatory policies and industry practices. By the 1930s, a pattern of government subsidy for motor vehicles had been established, but in the meantime, serious damage had been done to United States train industry (Alvord 2000).

Due to the destruction of tracks and selling of rights of way that could have formed the basis for modern transit in dozens of cities, and the dismantling of electric streetcar systems, passenger train networks ultimately succumbed to car dependence. The United States took the lead in granting huge government dowries and enacting policies that ultimately helped cars take over the landscape. Instead of subsidizing public transport, millions were spent on roads, with billions more in guaranteed loans for the suburban homes to which many roads led. Moreover, cheap gas, subsidized by the government, encouraged driving. By under-pricing and over-subsidizing the automobile, gasoline, highways and sprawl, the automobile lifestyle became the overwhelming option vanquishing the alternatives.

A Downward Spiral: Paving the Asphalt Nation

Along with massive highway building and car-dependent suburbanization, cars began to dominate the streetscape and changing the landscape. The spread of roads and the proliferation of cars have reshaped the landscape as open and public spaces have converted to parking lots, and rural landscapes to mazes of asphalt. Where cars can park became an issue with towns and cities. For example, by the 1920s, parked cars filled 30 percent of Washington, D.C.'s downtown street space (Flink 1970). This led to the "flight" to the suburbs when those fed up with car-induced urban problems used cars to get out of cities. During that time, many people agreed with demographer Adna Ferrin Weber's 1898 remark that "the rise of the suburbs is by far the most cheering movement of modern times" (McShane 1997). Automobiles vastly extended the range of suburbs and began turning them to sprawl. Cars forced lots to swell for driveways and garages, and homes began to spread out as well.

As car-clogged roads and traffic jams started to become the norm by 1912, bigger roads were quickly proclaimed the answer. This appears not to have been the solution; as pieces of the coast-to-coast Lincoln Highway were built across the United States in the 1910s-1920s, each improvement stimulated more traffic. In 1916, Woodrow Wilson commented that burgeoning numbers of United States motorists "use [roads] up almost as fast as we can make them" (Lincoln Highway Association 1988). Road-building not only failed to keep up with quick growth in car numbers; as paving accelerated, it encouraged more car-buying and driving as it became more convenient and faster to reach destinations.

The auto boom profoundly affected culture and economics. Automobility helped usher in consumerism, allowing the car and consumer culture to roll hand-in-hand through the rest of the 20th century. By funding roads for cars and favoring suburbs, government policies have fed a sprawl spiral. The building of roads supported more car purchases, driving and suburban home sales. Suburbanization in turn encouraged more driving and more congestion; that in turn has inspired more road-building and sprawl. It is a pattern that continues to repeat.

RELATIONSHIP TODAY

Today there are over 234 million passenger cars, motorcycles and light trucks on the road (Bureau of Transportation Statistics 2006). There are now more cars in the United States than licensed drivers and more cars than adults. The number of United States households with three or more vehicles grew six-fold from 1969 to 1995, a change even the Federal Highway Administration considers "startling" (United States Federal Highway Administration 1997). Vehicles have gotten bigger, too. Sales of light trucks, vans, and SUVs climbed aggressively in the 1990s; by the decade's end they accounted for somewhere around 50 percent of new vehicle sales in the United States. More and bigger cars use more land as well. Cars have encouraged developed areas to sprawl at up to 10 times the rate of population growth in United States with driven distances growing. The United States, with its 234 million motor vehicles, has paved some 4-plus million miles of roads — enough to circle the Earth at the equator 157 times.

As a result, distances driven have also grown. In 1970, United States residents drove one trillion miles per year. By 2006, that had more than tripled. Single-driver commuting is increasing,

too. Between 2002 and 2012, vehicle miles travelled from drive-alone daily commuting is expected to increase by at least 15 percent, according to the United States Bureau of Labor Statistics and the EPA, generating an additional 43 million metric tons of carbon dioxide annually. However, daily commutes account for only 18 percent of personal trips (Bureau of Transportation Statistics 2006). Economies have shifted from serving local residents with downtown businesses near residential areas, to serving them with outlying big-box discount stores; therefore, more people drive more miles to do errands. Shopping and errands make up nearly half of all car trips; social and recreational trips account for a quarter of them. Overall, each single-family household generates 10 vehicle trips a day (Martin & McGuckin 1998).

The level of fuel used for all the driving is up, too. By 2006, United States highway fuel use had increased to over 170 billion gallons per year, up from 127 billion twenty years earlier. Nearly 28 percent of energy used in the United States goes to transportation, and of that, 76 percent goes to cars, trucks, and motorcycles – about 21 percent of all energy used by the country (Bureau of Transportation Statistics 2006).

A Contrived Illusion of Love: Stuck Behind the "Glass"

While cars are not the only culprits, they account for a large share of the damage done to the environment and society. They have created a nation in gridlock from its auto-bred lifestyle, an environment choking from its auto exhausts, a landscape sacked by its highways – and the list goes on. The "social ills" of auto-dependency include negative impacts on human health and safety, noise, psychological issues, social isolation and inequities, and financial burdens.

1. Health and Safety

Cars decrease the need for exercise, saving time in the short run but impoverishing human health in the process. The convenience of cars reinforces the addiction; the sedentary lifestyles cars support encourage muscles and motivation to deteriorate. Distances considered walkable have shrunk tremendously since the car literally swept us off our feet. And America has a weight problem; in the United States, about 55 percent of adults are overweight. "Currently, more than 60 percent of American adults are not regularly active," report the United States Centers for Disease Control and Prevention. This contributes not just to obesity but also to heart disease, diabetes, colon cancer, and other diseases (National Institutes of Health 1998). Cars enable this by providing a sedentary substitute for physical propulsion. By driving on short trips, opportunities to stay healthy by being active are lost.

In terms of safety, automobiles have killed over 30 million people in crashes since their debut more than a century ago (Alvord 2000). As of 1990, car crashes ranked as the world's ninth-leading cause of death, and it continues to climb the list. The International Federation of Red Cross and Red Crescent Socities (IFRC) predicts that by 2020, they will be the third biggest killer (International Federation of Red Cross and Red Crescent Societies 1998).

2. Noise

Traffic noise can literally drive people crazy, and some studies show higher death rates in people exposed to chronic high noise levels like those from humming freeways. A significant amount of noise is aerodynamic, from air whooshing past and through the car. As a car's speed goes up, so does its noise level, making high-speed highways the noisiest. Thus, sound barriers are routinely erected along urban highways, thus adding to the large external cost of noise and automobiles. Other external costs include detriments to human and wildlife health. Perceived instinctually as a threat, noise incites fight-or-flight response: increasing stress hormone levels, blood pressure, blood fats, digestive disturbances, heart rate, and muscle tension. Moreover, noise pollution affects wildlife, too, altering behavior and interfering with reproduction (Alvord 2000).

3. Headaches from Traffic and Congestion

More cars also translate into more traffic congestion – Americans are spending more and more time sitting in their

cars going nowhere as freeways and streets become, in effect, parking lots. As cities sprawl, commuter distance lengthens. Longer commuting distances and more congestion en route combine to increase the time spent in automobiles. In 1982, the average motorist experienced 16 hours of delay; by 2003 this number had virtually tripled to 47 hours. Car commuting time is increasing in nearly every United States metropolitan area. Rush hour everywhere is becoming longer as commuters attempt to beat it by leaving work early or delaying their commute until traffic eventually wanes (Brown, October 4 2006). Traffic and congestion create stress because it is a situation that is uncontrollable. Several studies have linked time spent in congestion to increases in frustration, irritability, anxiety, blood pressure, heart rate, and cardiac irregularities (Texas Transportation Institute 1999; Gordon 1991).

4. Psychological Evils Such as Road Rage

On balance, the road still offers more freedom than frustration. Three-quarters of Americans say driving often gives them a sense of independence, and nearly half say it is often relaxing. Four in 10 love their cars — not just like them, but love them. But there is a darker side: About a third can be classified as aggressive drivers. The driving environment is rife with stimuli that encourage aggressive behavior. Six in 10 concede they sometimes go well over the speed limit. Sixty-two percent occasionally get frustrated behind the wheel, more than four in 10 get angry and two in 10 sometimes boil into road rage (Langer, February 13 2007). The National Highway Traffic Safety Administration (NHTSA) attributes road rage to longer commutes, more congestion, and more rushed and stressful lives (USA Today 1997).

The AAA Foundation for Traffic Safety warns that "every driver on the highway is armed with a weapon more deadly and dangerous than any firearm: a motor vehicle." Studies by Louis Mizell for AAA show road rage increasing by about 7 percent a year in the United States, up 51 percent from 1990 to 1995. Road rage has caused an average of at least 1,500 deaths or injuries a year in the United States since 1990 (Mizell).

5. Social Isolation and Inequities

In car-dependent countries, the complaint about loss of community has become more frequent. Cars feed this as they take over public space, cutting social contact. A study by Donald Appleyard shows that as vehicle trips on a given street go up, interaction between neighbors and their sense of community goes down (Appleyard 1981). To get where they need to go, 90 percent of Americans say they usually drive, reporting an average of 87 minutes a day behind the wheel. For car commuters, the average is 100 minutes; for parents with children at home, an average of 104 minutes (compared with 77 minutes for people without kids at home) (Langer, February 13 2007). Highways become sealed chambers of isolation as commuters put in an average of 10 40-hour weeks behind the wheel each year (Kay 1997). With almost two motor vehicles for every household, the car has become the ship of the highway desert.

Because dependence on the car encourages homes and workplaces to sprawl, it limits opportunities to move around without using cars, making travel harder for people who cannot or do not want to drive. The young and elderly in particular become marginalized, losing independence and self-sufficiency in car-dependent areas. The poor are also isolated; even in the car-saturated United States, more than a quarter of households below the poverty level do not own cars. Jobs may be located far from where the poor can afford to live, putting them at a disadvantage by forcing them to take long, convoluted transit commutes to jobs (Kay 1997).

6. Financial Burdens: Maintenance and Repairs

Auto repairs almost always rank among the top three businesses generating the most United States consumer complaints. Even when one buys a top-quality car, chances are slim for getting one without a single flaw. In the first three months after purchasing new 1998 model cars, owners reported 176 problems, on average, for every 100 vehicles sold (J.D. Power and Associates 1998). The average cost of maintaining

a vehicle for an individual in 2005 is $735, assuming 15,000 vehicle-miles a year; similarly the United States spent $195,600 in 2005 for repairs (Bureau of Transportation Statistics 2006).

Blinded by Smoke: Environmental Messes

Not only do cars affect mental well-being, emissions of pollutants and greenhouse gases from tailpipes, auto plants, and oil refineries add up to a lot of damage to health and the environment. When it comes to human health, air pollution hurts the health of four to five billion people every year, say agencies like the World Health Organization and the World Bank. Much of the pollution comes from cars. It has been estimated that one-third to one-half of the United States population lives in areas with air pollution levels that are, by government standards, harmful. Worldwide, automobiles remain the biggest single contributor to air pollution. The following are some examples of ways cars can pollute:

1. Direct Emissions from Cars, Smog and Air Pollution

Since biochemist A.J. Haagen-Smit's discovery of smog from auto emissions in 1950, the nation has been working hard to clean up tailpipe emissions. But increases in numbers of cars and miles driven have offset much of the gain. This pollution starts as little fiery explosions inside internal-combustion engine cylinders send "smoke" out tailpipes as carbon dioxide (CO_2), carbon monoxide (CO), volatile organic compounds (VOCs), oxides of nitrogen (NO_x) such as nitrogen dioxide (NO_2), particulate matter, and a few other components, including the leftovers of gasoline additives. Once emitted, some pollutants react in the atmosphere to form others. Ground-level ozone forms, for instance, when VOCs react with NO_x in the presence of sunlight and heat; this is what accounts for much of southern California's smog (United States EPA, December 1997).

Ground-level ozone exposure produces many health symptoms such as headaches, nausea, and coughing. It is particularly dangerous for the elderly, children and asthmatics. Not to be forgotten, wildlife suffer many of the same effects from air pollution as do people. Ozone affects plant life, too, weakening trees so they succumb easily to stresses like drought or insects. In farm fields, ozone can cut yields by 10-25 percent, and causes $5 billion to $10 billion in damage to United States crops each year. Cars are top emitters of ozone's precursors (Jaret 1989; Liebhardt 1992).

2. Indirect Emissions from Cars, Factories, Refineries

Cars can pollute even when they are not running. Evaporative emissions radiate from fuel left in hot engines after cars are turned off. Filling gas tanks also generates evaporative emissions and exposes the public to carcinogens (Alvord 2000). Moreover, car factories typically show up on lists of top air polluters. Manufacturing cars involves processes and materials that emit a variety of pollutants. Altogether the auto industry sends thousands of tons of CO, NO_x, particulate matter, and sulfur dioxide (SO_2) into the air each year. But the industry's biggest air emissions come in the form of VOCs that contribute to the formation of ozone or other pollutants that can damage vital organs like lungs, kidneys, and the liver as well as the nervous system (EPA 1993). Another big contributor to air pollution is the oil refinery industry. Oil refineries typically emit a long list of toxins that can create health problems for nearby residents. At least half the output from petroleum refineries goes straight to supporting motor vehicle transportation.

3. Global Warming and Ozone Hole

By adding to the greenhouse gases that alter climate, car emissions increased atmospheric concentrations of CO_2, the main ingredient implicated in Global Warming, which are higher than they have been in 160,000 years. As a result, the global average surface temperature has increased by about 0.7 degrees Celsius from 1900 to 1998, incidence of extreme weather events has gone up 28 percent since 1975, sea levels are rising faster – up to 10-25 cm in the last 100 years, and arctic ice is thinning (Intergovernmental Panel on Climate Change 1996; Monastersky 1994; Brown, Vital Signs 1998 1998).

Furthermore, up through model year 1995, auto air conditioners used the refrigerant Freon, also known as CFC-12, one of the more potent of the ozone-depleting CFCs. With the phase-out of ozone-depleting CFCs there are signs the ozone layer may begin to heal. However, corresponding increases in UVB radiation have been detected, changes in the climate and other greenhouse gas emissions, the ozone layer is still occurring at both poles (Kay 1997; ICF Incorporated 1998).

4. Oil Spills and Water Pollution

Oil spills, massive die-offs of birds and wildlife, contaminated drinking water wells, sediment-filled streams, and acid lakes are all reminders of ways the car's abuses range well beyond air pollution. Oil tankers spilled about three million gallons for each 42 billion gallons delivered worldwide from 1980 to 1995. Spills are damaging and deadly, leaving marine mammals and birds blackened with oil, their fur and feathers flattened without the ability to insulate from the cold. They become poisoned by toxins in the crude and suffer immune system, behavioral or reproductive damage (www.enn.com 1999).

Cars leave behind many wastes on the road: tire rubber, oil, gasoline, brake-lining fibers, heavy metals, and other automotive debris. When it rains and water flows off roads and parking lots into storm drains and then into lakes and streams, it takes with it all the effluents cars have left behind. All these contaminants are non-point-source pollutants – they come not from a single specific location like a smokestack or an outflow pipe but instead from widespread small sources. Cars account for a big percentage of non-point-source pollution. Additionally, road building and sprawl worsen water pollution by both paving and destroying wetlands that filter out pollution, and by spreading pollution into more places (Alvord 2000).

There are numerous ways of "divorcing the car":

1. Just walk and bike!

The human body is designed to walk. Walking, as pointed by the United States Centers for Disease Control and Prevention (CDC), can help individuals:

- reduce symptoms or slow progression of several diseases
- keep off extra weight and tone up
- reduce blood pressure, cut heart attack risk, and manage cholesterol
- fend off adult-onset diabetes
- increase bone density and slow osteoporosis
- tune the immune systems
- maintain mental ability
- reduce stress
- relieve depression and anxiety and improve mood and self-confidence
- live longer

How walking helps whole communities:

→Walking makes communities healthier
→Walking can restore a sense of community
→Walking can mean safer communities
→Walking helps community's environment
→Walking helps community's economy

Bicycling has the same kind of health, economic, quality-of-life, and community benefits as walking:

→Bicycling can save lives and maintain health
→Bicycling saves money
→Bicycling saves the air
→Bicycling saves energy
→Bicycling saves time
→Bicycling saves land

2. Keep an open mind with multimodal transportation

All ranges of multimodal transportation provide advantages over using cars:

→Transit cuts congestion, pollution, and energy use
→Transit saves land
→Transit helps jobs and the economy
→Transit saves money
→Transit saves time, hassle –and lives
→Transit restores community and equity

GROUNDS FOR DIVORCE: CAR FREE CITIES

The United States is nearing the end of an experiment begun a century ago; the experiment hypothesis is simply that private automobiles offer everyone the best possible urban transport. This experiment required the demolition of streets, houses, stores – with reconstruction in new locations. It scattered populations across the countryside, devastated city centers, damaged social systems, and battered the planetary ecosystem.

A real response to the problem of the urban automobile can only be achieved by moving cars entirely out of the city – a radical and reactionary solution. Radical because it proposes major changes to American cities, and reactionary because many of these changes are actually a reversion to urban patterns still widely applied just a century ago.

Some cities in the United States have also experimented with car-free areas, although usually on a more modest scale. Some of these experiments have been deemed unsuccessful and reversed, but it appears that most of the unsuccessful trials were in fact "transit malls," which is really another name for an outdoor bus station (Crawford 2002). Removing cars to replace them with diesel buses does little to improve the street in question.

The feasibility of car-free cities requires specific design standards for district nodes. District nodes are localities marked by a distinguishing feature and provide goods and services to the neighborhoods which surround them and the city as a whole. The following design standards are adapted from J.H. Crawford's proposal for car-free cities (Crawford 2002):

Diverse Economy

Many planners still hold to the doctrine of the separation of uses. This doctrine is expressed through zoning ordinances that permit only a single class of land use in any given area. Having stores, homes, and workplaces in the same neighborhood reduces travel distances, counteracts sprawl, and makes walking and bicycling easier. Mixed use planning also creates interesting, vibrant neighborhoods.

- Mix of small businesses with residences
- Workable sites for heavy industry
- Broad range of infrastructure to support innovation
- Practical delivery of standard shipping containers

Energy and Resource Efficiency

Human density and energy consumption are inversely correlated: the higher the density of an area, the lower the per-capita energy consumption is. When buildings touch other buildings on two sides, they use far less energy for heating and cooling. Similarly multi-story buildings use less energy than single-story buildings because of the reduction in roof area per unit floor area. The combined savings can exceed 50 percent.

- Basic services located in every district
- Short runs for utilities
- District heating
- Shared walls
- Multiple stories
- Efficient transport of people and goods

Low Construction Costs

Infrastructure costs in sparsely-settled suburbs exceed infrastructure costs in densely-populated cities. Less-dispersed developments have shorter travel distances – dramatically reducing energy consumption for transportation.

- Low per-capita paved surface area
- Short runs for pipes and cables
- Short transport lines

Rapid Access to Nature

Expansive green space should almost completely surround districts and be within easy walking distance of every doorstep.

- Small gardens around most buildings
- Open natural areas adjacent to every district

Aesthetics

Every building in a city should be unique and human-scaled to offer sense of place and character. Narrow streets are often the most inviting and comfortable parts of the city, provided that no motorized traffic intrudes. Plazas offer gathering spaces for residents and visitors alike.

- Human scale
- Carfree streets
- Richly-textured buildings
- Well-proportioned streets and plazas

- Maximum five-minute walk to transport
- Frequent transit service
- Single-transfer journeys
- Minimal land occupation by transport
- Dense utilization of public transport
- Low capital and operating costs

Good Passenger Transport

Superlative public transport is the only foundation upon which a car-free city can be built. Walking is the most common means of transport within a district. However, walking cannot meet all passenger transport needs; the best practice is to keep every doorstep within a five-minute walk of a transport stop.

- Regular opportunities for informal social contact
- Ease in meeting life's daily needs
- Routine destinations located within the district
- Mixed uses in every neighborhood
- Active street life

High Quality of Life

Many valuable human activities require large groups of people for their support. To abandon the city is to abandon many important cultural institutions. Furthermore, cities offer a depth of social resources that rural areas and suburbs can never match. In compact cities, casual social encounters on the street are a normal part of everyday life.

CONCLUSION

In many metropolitan regions in the United States, a new trend is emerging: people want to live in cities again. Demand for housing in cities and older, denser, inner suburbs is increasing. Quite a few people have had enough of sprawl, endless commutes, and places that are not communities. After a courtship that consisted of wrong turns and manipulated decisions, dependency on cars that is destructive to heath, environment and well-being has reached a turning point. At this critical juncture, individuals must accept the fact that changes in mindset and lifestyle are necessary for better quality of life.

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Appendix C-2

Integrating Multi-Generational and Inter-generational Concepts Into Community Design

By Matthew Deines

"I enjoy thinking about the day we all planted trees together. All of us older folks and the kids just kept laughing and telling stories as we worked. I know those kids will grow up and maybe go on with their lives someplace else. It's more likely than not they'll have to leave. But someday, those kids might come back, to live or visit. And those trees we planted together will have kept growing and growing all the time, so when they see those trees, the kids can look back and remember the day we all worked to put them there. From all those small trees, a forest will grow up someday. That day when we planted them, besides the fun we had, I hope we gave something valuable to the town and some valuable memories for these youngsters to take with them through life, a memory of home that will keep standing here in Tamarack." –Elmer, 80+ Older Adult Partner for Tomorrow, Tamarack, Minnesota (Generations United 2002)

REDEFINING THE FUTURE

Post-World War II community planning practices have neglected to meet the physical and social needs of each generation. Auto-centric development patterns led to increased isolation, a significant decline in physical and psychological health, and a loss of social connection (Jackson 2007). Zoning and land use decisions compartmentalized, rather than integrated all age groups into a segregated framework of communities. The negative impacts of these practices on society are magnified in the most vulnerable populations, the young and the old. The cause of this magnification is simple: the needs of the youngest and oldest generations are the greatest, and most difficult to realize for housing, transportation, and social interaction.

Designing communities that meet the physical and social needs of every generation is critical for the overall health of their residents. By designing for the social well-being of all generations, communities develop better mobility options that serve the entire population. *Multi-generational* design creates places that meet the physical needs of all age groups (Kaplan "out of print"). The goal of *inter-generational* design is to better facilitate interaction among all generations, foster social connectivity, and build social capital. It is through inter-generational design that the social needs of each age group can be met. The purpose of this paper is to build an understanding of the impacts of current planning on the youngest and oldest generations, to explore the benefits of both *multi-generational* and *inter-generational* design, and to introduce a framework for inter-generational design. Multi-generational design has been successful in providing for the basic needs of various generations, but has not focused on contact and interaction among generations. Inter-generational design, however, strives to create environments that foster this kind of interaction among generations. This paper will examine the rapidly increasing need to design for all generations, profile the success and limitations of multi-generational design, and then present principles of inter-generational design and their advantages.

The professions of landscape architecture and urban planning are striving to encourage increased mobility and health through Smart Growth, Transit Oriented Developments, and New Urbanism. However, focus on creating opportunities for social interaction between age groups, referred to as inter-generational interaction, is just beginning to gain momentum within the design fields. Inter-generational interaction research in other fields such as gerontology and public health has led to successful inter-generational programming. The goal of the inter-generational programs is to foster learning, understanding, and interdependence between the young and old. These programs have been implemented in a variety of settings including schools, community centers, retirement homes, and hospitals. Not only do these inter-generational programs benefit individuals but they benefit a community as whole groups often work towards shared goals by planting trees or volunteering (Generations United 2002).

The need for communities to promote both the physical and social well being for all of its residents will only increase with future demographic predictions. The population of

older generations, those 65 and older, is expected to grow significantly in the next 50 years. By 2030, 80 million people over the age of 65 will reside in the United States, accounting for 24 percent of the total population. By 2050 this demographic will account for a third of the total population (Greenberg 2005). If planning continues with its promotion of homogenous, sprawling land uses, the imminent demographic shift in the United States will lead to deterioration in health, mobility, and social connections of all generations.

The combined demographic trend and planning practices has, during the last century, increasingly segregated the different age cohorts. Children now go to their schools, adults go to their jobs, and elderly spend their days in age-isolated housing. The connection between generations has become increasingly limited (Generations United 2002). Most communities have inadequately addressed these issues. Driven by economic development they tend to only design to meet the needs of a few segments of the population and rarely promote social interaction between age groups.

DECREASING PHYSICAL HEALTH

The built environment has been shown to have considerable influence on public health (Jackson). For instance, communities that have limited options for both exercise and social connection impair both the physical and mental health of their residents (Dannenberg 2003). These auto-centric communities contribute to reduced air quality, reduced pedestrian activity and safety, and potentially reduced social capital (Dannenberg 2003). Research has shown that residents of sprawling communities typically have a higher body mass index and are more likely to suffer from hypertension than people that live in more compact communities (McCann 2003).

Sprawling communities also limit access to basic daily needs. More than 50 percent of non-drivers over 65 stay at home on any given day because they lack needed transportation options (Frumkin 2006). As retirees lose their ability to drive, they also lose their independence and become further isolated from basic necessities. A failure to meet the mobility needs of the elderly not only increases safety risks by encouraging them to drive when they should not, but in addition may diminish their health and quality of life (Frumkin 2006).

Communities that are not designed for the elderly often times do not work well for children either. Lacking mobility options (inability to drive, lack of public transportation), children need opportunities for physical exercise and exploration for improved health. For younger generations, the statistics for decreased health due to the built environment are staggering. The percentage of children who walk or bike to school has dropped from 50 percent in 1969 to about 15 percent in 2006. This has aided in the increase in obesity of both boys and girls. Childhood obesity has risen among 6 to 11 year olds from 7 percent in 1976 to 15.3 percent in 2000 (Scarfo 2006). Air pollution stemming from automobiles has also had a dramatic effect as nine million children experience asthma as a result of air pollution (Frumkin 2006).

BENEFITS OF MULTI-GENERATIONAL DESIGN

Although a large portion of post-World War II communities do not meet the physical needs of the young and the old, there are recent examples of communities planned to provide better options for healthy living. Multi-generational communities that successfully cater to residents' needs produce numerous benefits including a reduction in isolation and improved physical health (Kaplan 2007).

Communities with multiple modes of transportation (including walking, biking, and access to public transit) reduce isolation of the youngest and oldest generations. These communities improve access to the community resources and create opportunities for exercise. Walkable and bikeable neighborhoods reduce the necessity for automobiles, thereby also reducing auto emissions. Good air quality is a byproduct

of pedestrian friendly communities, reducing incidents of asthma and other ailments related to air pollution. Pedestrian oriented communities are not only healthier but have the potential to be safer with more people watching all activities. Multi-generational communities promote walking and biking, have safe pathways, provide basic daily needs within close proximity, and have a broad range of housing types in order to unite generations.

BelleFair of Rye Brook *Westchester, New York*

BelleFair, a 261 unit development located outside of New York City, is an example of a multi-generational designed community. It meets the physical needs of multiple generations by providing an assortment of housing, proximity to daily needs of both the young and old, and safe pathways. Housing diversity is built into the community, with homes for older buyers being within short walking distance to local shops, and with family homes having more bedrooms and being closer to playgrounds. Townhouses are intermixed within the community to also attract singles or couples. The community design accommodates extended families by locating these diverse housing options within close proximity to one another. Children's ability to walk to and from their grandparents' residence allows grandparents to be more involved in their grandchildren's lives. The community also has amenities that meet the needs of all ages including child care, a pool, a gymnasium, shops, meeting areas, a shuttle bus to public transportation, and a library (Bellefair).

Silver Sage Village *Boulder, Colorado*

Another excellent example of a multi-generational community is the Silver Sage Village in Boulder, Colorado. The community's vision is to establish a balance between privacy and integration with the surrounding community. The community is small in scale, with 16 dwellings that are either duplexes or attached housing and a community center planned for 1.5 acres in the middle of Boulder. The surrounding community offers the residents their daily basic needs within relatively short walking distances. Restaurants, a community garden, a city park, public transportation, and a bank are among the nearby amenities (Silver Sage Village). Silver Sage Village retirement community is integrated into an existing neighborhood, as a result the residents are not isolated from the rest of the community.

Both Silver Sage Village and Bellefair of Ryebrook are excellent examples of recent community designs that cater to the physical needs of the youngest and oldest generations. While Silver Sage Village was built solely for retirees its placement within the community and its community space provide an opportunity for interaction with younger generations. Both of these communities meet the physical needs of their residents through placement, configuration, and amenities that promote better health.

Both Silver Sage Village and Bellefair of Rye Brook are excellent examples of current planning that provides multi-generational living space in or near their community. However, while these communities provide for the physical needs of each generation, this type of planning can better incorporate the principles and concepts of inter-generational design to better facilitate interaction between generations.

INCREASING ISOLATION

Social capital is defined as "the social, political, and economic networks and interactions that inspire trust and reciprocity among citizens" (Dannenberg 2003). The design of automobile-dependent suburbs can be a factor for weakened social capital since the potential for residents to interact can be limited. Exasperating the problem, suburban developments can be deficient in the quantity and accessibility of community spaces needed for social interaction. The suburbs also require long commutes, which further decrease opportunities for civic engagement (Dannenberg 2003). Due to the lack of community space and necessity of long distance commutes, sprawling community design isolates both the young and the

old, decreasing their ability to contribute to the community (Frumkin 2006).

Some elderly live in isolation from the communities in which they have resided most of their lives. Despite wanting to stay in these communities, they are forced into new living situations due to lack of affordable housing options (AARP 2005). Adding to this issue, the structure of families has changed dramatically in both industrialized and non-industrialized nations. In the Unites States, close to 35 percent of families are geographically separated from elderly family members (Hatton-Yeo 1999). This trend over the past 30 years has resulted in a social separation due to limited inter-generational interaction within families (Hatton-Yeo 1999).

Current planning practices that isolate the elderly also isolate youth. Newer schools are often large, placed farther from community centers than older schools, and lack the availability of routes and appropriate distances for students to walk or bike (Dannenberg 2003). Due to the distance between homes and schools and the lack of pedestrian routes, children are more often driven to school and then driven home, seldom getting the opportunity to travel on their own or with their peers (McCann 2003).

Compounding the problem of youth activities today are more structured than they used to be. Organized sports, extracurricular activities, and academics have taken precedence over non-structured play. Safety concerns, lack of free time, and lack of supervision have limited the opportunities for children to explore and play more freely (White 1998). "Children learn by doing and copying," and thus a lack of connectivity limits children's potential to learn and become active citizens (Alexander 1977). If youths spend their days only at school, in extracurricular activities, and at home, their potential to learn from others within the community is dramatically decreased.

As the young and the old experience isolation from their communities they also become isolated from one another (Hatton-Yeo 1999). This trend goes against a natural connection needed by both generations. Human development theorists have shown that older generations need to nurture, to teach, to communicate positive values, and to leave a legacy. Children on the other hand need to be nurtured, to be taught, to have a cultural identity, to have positive role models, and to be connected to older generations (Hatton-Yeo 1999).

DESIGN CONCEPTS INCORPORATING INTER-GENERATIONAL DESIGN

Incorporating inter-generational concepts into environmental design is new to the planning and design fields. Matthew Kaplan, an associate professor of inter-generational programs and aging at Pennsylvania State University, is part of a growing trend of community designers who are beginning to embrace the concept of inter-generational design. Kaplan, with a team of experts in the architecture and planning fields, is beginning to develop a framework for incorporating inter-generational concepts into community design. His proposed framework provides design principles and concepts that aim to improve people's quality of life experiences. Kaplan considered particular aspects of quality of life including: "sociality and affiliation, autonomy and control, privacy, individuality and continuity of life, awareness and orientation, controlled stimulation, and functional independence" to determine design principles, concepts, and applications necessary to address these needs of inter-generational design (Kaplan, "out of print"). Based on these quality of life considerations, Kaplan developed the following design principles:

- **Increasing social contact** can be enhanced by providing spaces that bring generations together. Spaces that provide passive activities for older generations as well as recreation for youth enable informal interaction.
- **Providing opportunities for structured activities** is also important in fostering inter-generational interaction. Community gardens and shared kitchens adjacent to both child care and nursing care can provide such opportunities.

- The goal of designing for **informal interaction and spontaneous events** is to provide opportunities for social interaction to develop on its own. These spaces should provide proximity, visibility or awareness, convenience, safety and comfort.
- **Providing opportunities for chance meetings** allow for short, non-committal interactions that may develop over time into longer lasting relationships.
- Designing spaces that **provide opportunities for retreat as well as dignified exit routes** increase the emotional comfort for both young and old.

BENEFITS OF INTER-GENERATIONAL DESIGN

Inter-generational programs are designed to benefit the young and old alike. By providing opportunities for interaction, older generations remain more connected to the community, have improved health, and maintain a positive outlook (Kaplan 2007). At the same time, youths get an opportunity to volunteer and learn skills, and the value of service from the older residents. Inter-generational interaction not only positively impacts the participants but also benefits the entire community. A model for this is the Partners for Tomorrow program in Minnesota. Rural communities were concerned with the loss of their youth to larger cities and the diminished connection of older adults to the community. The Partner's program was created to promote community service and leadership through an inter-generational group. The groups regularly gather for events that improve the community including planting trees, documenting local history, and fundraising for schools (Generations United 2002). Both young and old residents within communities participate in these inter-generational programs.

DESIRE TO INTEGRATE

As the demographics of the older population shift, the face of retirement is changing. Retirees are no longer looking to pass their time passively. Retirees are now seeking a more active lifestyle through involvement in community organizations, businesses, and volunteering (AARP 2005). Most retirees have a strong desire to be involved with their surrounding communities (AARP 2005). This has become more evident through the program Successful Aging. Successful Aging promotes, "the ability to maintain three key behaviors or characteristics: low risk of disease and disease-related disability; high mental and physical function; and active engagement with life" (AARP 2005). The concept of successful aging goes beyond simple health issues to state that active community engagement is needed for successful aging.

Youth are also eager for inter-generational interaction. Full of energy and eager to learn, young people hold the limitless possibilities of the future. The *Kinsale 2021 Plan* includes specific steps for the children to become more involved within the community. The steps include visioning activities for what they wish the future to look like, creating a "youth mayor," establishing multi-generational courses, designing a permaculture course, and creating a "Movie Circle," which brings youth together to watch films about sustainability. These specific activities are used to involve youth in a positive manner and help create a vision for the future.

CONCLUSION

A healthy community is one that: "protects and improves the quality of life for its citizens, promotes healthy behaviors and minimizes hazards for its residents, and preserves the natural environment" (Dannenberg 2003). Solutions exist for creating healthy environments for all generations that not only meet their basic physical needs, but also their social needs. The integration of multi-generational design is gaining momentum throughout the United States as existing and newly planned communities seek ways to provide for health, safety, and improved quality of life. Urban planners and landscape architects have the potential to help shape communities that foster multi-generational and inter-generational living.

Increased mobility options, integrated with diverse housing options, decreases dependence on the automobile to create vibrant communities for all generations. Healthy communities have the ability to enhance interaction between the young and the old through inter-generational design that fosters cooperation and collaboration. Over time, youths will become more active citizens, more interactive with the community, and more diversified learners. The older generation will have a higher quality of life, completely integrated into the community in which they wish to live in. Built environments that foster interaction between young and old mutually meet the needs of all the residents while benefitting the community as a whole.

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Appendix C-3

The Consequences of Suburbanization on Social Capital

By Henry Fleischmann

AMERICA'S DECLINING SOCIAL CAPITAL

America's social capital is declining and causing Americans to become less productive, more isolated, and more distrustful (Putnam 1995). How have development patterns encouraged this trend and what can land planners and designers do to turn it around?

Social capital can be defined as "the social, political, and economic networks and interactions that inspire trust and reciprocity among citizens" (Dannenburg 2003). The importance of social capital in a community cannot be understated. It is these networks and interactions that create cohesive neighborhoods, give identity to place, prevent isolation among citizens, and give people a voice within their community. The effects of social capital are far reaching and can be seen in improved personal health, civic participation, social equity, economic and educational success, and trust among neighbors as well as decreased crime rates. (Dannenburg, 2003. Putnam, 1995. Leyden, 2003. Williamson, 2002. Talen, 2006.).

In his article "Bowling Alone: America's Declining Social Capital," Robert Putnam looked at trends since 1960 and discovered that an increasing amount of Americans are interacting less with their neighbors and are becoming less trusting and less civically involved (Putnam 1995). Putnam observed three plausible causes for the decline. First he noted that there was a link between residential stability (measuring neighborhood aspects like age and home ownership) and increased civic engagement within a community, although this explanation was contrary to statistics showing home ownership rising since 1965. Second, Putnam looks at demographic transformations and trends showing a lower percentage of Americans getting married, higher divorce rates, people having fewer children, and lower real wages and how these factors tended to decrease social involvement. Finally he looked at the tendency for technology to privatize and individualize leisure time, and the effect it has had on social capital. As a result, fewer people were spending their leisure time with friends and neighbors.

This paper will focus on a fourth explanation looking at development patterns and their influence on social capital: that the physical quality of place should be examined much like the social aspects of social capital have been examined in the past. Since the 1950s, there has been a mass migration of Americans out of the urban environment into suburban environments. These places are often less dense, revolve less around community nodes and more on commercial centers, provide private recreation spaces, and are designed for the automobile instead of the pedestrian. The purpose of this paper is to explore the effect of suburbanization on social capital, the effect of policy and development patterns on social capital, and solutions that have been suggested to reverse social capital's decline.

SUBURBANIZATION, ISOLATION AND SOCIAL CAPITAL

Suburbanization and its sprawling form have caused environmental degradation due to a loss of habitat and open space and a loss of energy and material resources needed to build and maintain this type of development. Perhaps suburbanization's greatest drawback is the isolation it creates for the people living there and the effect this has on social capital. This isolation can be seen in the segregation that takes place along racial and income lines or measured individually by looking at housing densities, distance between neighbors, time spent commuting, and a lack of spontaneous interactions.

Suburban Segregation

In an urban area, population densities and sheer proximity increase the possibility of people of differing ages, incomes, and races to interact with one another. The inherent nature of the suburbs, creating large tracts of similar design styles and selling prices, has the opposite effect. Suburbia has created a geographic segregation that has allowed the affluent to separate themselves from lower income communities by creating wealthy enclaves, and removing the possibilities of interclass interaction (Williamson 2002; Kwinter 2001). Auto dominant transportation also works to reinforce this by separating travelers from those within the community through which they are traveling. This homogeneous isolation can be further seen by looking at trends of groups people are joining, which tend to be smaller religious-based and self-help groups (Putnam 1995). These groups are largely made up of like minded individuals who feel a responsibility to follow a code of ethics; "Come if you have time. Talk if you feel like. Respect everyone's opinion. Never criticize. Leave quietly if you become dissatisfied" (Putnam1995). These are not the type of groups that can be relied on to open peoples minds or bring new ideas into a community.

The result of this community-wide isolation is that it creates a skewed self awareness within a population about one's own surroundings and place in the world. In order for a community to have complete understanding of issues not directly pertaining to the particular individual there has to be a diverse population in terms of age, race, income level, and beliefs, so as to increase the depth and scale of the debate. Randolph Hester argues that "mixed neighborhoods… help us to expand world views that are artificially simplified by segregation" (Hester 2006). Healthy social capital depends not only on the amount of interactions taking place but the quality of debate as well.

Suburban Isolation

At the human scale, the suburban form creates isolation among individuals as the lack of density fails to create interaction opportunities. Studies have shown that civic engagement is higher in both low-density (rural) and high-density communities than in moderately dense, suburban, communities (Williamson 2002). The high levels of civic engagement in rural areas may be attributed to small social structures, lack of entertainment options, and the need for neighborhood interaction for survival. In high-density areas, the increased level of civic engagement can be attributed to a few things. First, the sheer number of people makes it easier to start the spread of information and as a result find others passionate about similar issues. Second, in high-density areas the number of residents in an area creates a demand for local businesses, cultural, and entertainment facilities which get people out of their houses and into shared spaces. It is in these places that neighbors can meet, discuss ideas, and develop social capital. Many suburban tracts lack the appropriate neighborhood size and meeting places needed to foster social capital found in a rural environment, or they lack the densities needed to create the meeting places and community environment found in urban areas.

Isolation in suburbia has also been affected by the way people travel. Two factors need to be considered when discussing transportation issues and social capital; the methods used to commute, and the time it takes to get to and from the destination. The simple act of driving in a car removes people from the landscape they move through allowing them to tolerate circumstances they would otherwise find appalling, whereas people walking, biking, or even taking public transportation have to interact much more with their surroundings. As a result, non-automobile commuters take on the responsibility of improving and maintaining the areas they move through (Crawford 2002). The suburban form makes it almost necessary to travel by automobile as land uses are separated and cars are often the only viable travel option. In urban areas, land uses are more compact, making public transportation feasible, and walking a possibility, which enhances the opportunity for spontaneous interactions. This tie between automobile dependence and weakened neighborhood social ties has been studied and substantiated.

Lance Freeman conducted a study focusing on Los Angeles, Atlanta, and Boston neighborhoods to determine whether the degree of automobile dependence would have a direct and significant effect on the number of social ties one has within his or her neighborhood. The study found that for every 1 percent increase in an individual's driving alone to and from work, would have a 73 percent decrease in the likelihood of the respondent having a neighborhood social tie. He concluded "neighborhoods that force people into cars and inhibit face-to-face contact somehow undermine social ties among neighbors" (Freeman 2001). Thad Williamson also studied the effect of commuting alone to work as opposed to carpooling or taking public transportation and found that in areas where fewer people were traveling alone, more people tended to be politically active (Williamson 2002). He attributes the rise in political activity to awareness of the diversity in one's community and the ability to talk about relevant issues.

The amount of time one spends commuting also plays a large role in creating social capital. Robert Putnam found that a 10-minute increase in commuter time for an area resulted in a roughly 10 percent decrease in the rate of civic participation (Putnam 1995). Likewise Williamson found that long commute time had a negative correlation with the number of friends a person has, attendance at social functions, social trust, and the person's overall well-being (Williamson 2002). An automobile dependent community leads to isolation from other community members and results in a loss of time that could, and as shown above, would, be spent strengthening a community's social capital.

Finally the suburban form creates isolation and a lack of social capital because it fails to produce spontaneous interactions. In suburban tracts, leisure time and planned interactions take place at home or in the backyard. These activities often take place mainly with those whom established relationships already exist, not necessarily people who live within the community. Spontaneous interactions are important not just for the chance meetings they create but also for the sense of place and trust people develop through these interactions. Interactions as simple as making eye contact, sharing a smile, or waving to an acquaintance can create a sense of trust and a sense of place in the community, which is vital to making a neighborhood feel like home (Alexander 1977). Kevin Leyden studied communities in Galway, Ireland that ranged from the traditional mixed-use, pedestrian friendly neighborhoods to automobile dependent suburbs like those found in the United States. He found that in the walkable neighborhoods where spontaneous interactions were more likely to occur, social capital was much higher. Measurements for social capital included: likelihood of knowing neighbors, social trust, political participation, and social involvement (Leyden 2003). The automobile has disastrous effects on the ability for a community to have spontaneous interactions that are necessary to create a sense of place within that community and build social capital. By creating denser communities that encourage people to get out of their cars, the likelihood of these interactions is much greater.

LAND-USE POLICY AND ITS EFFECT ON SOCIAL CAPITAL

Social capital occurs at the city and community scale. Therefore, it is critical to look at implemented planning practices that hinder the development of social capital. The suburban form was influenced by Ebenezer Howard's 1902 idea of the Garden Cities. These cities were designed to create a getaway from the ills of the city and bring upper-middle class residents the benefits of the countryside while still being close enough to reap the city's benefits. While Howard's Garden City were designed to function as its own entity, the automobile, with its flexibility and efficiency in travel, allowed these cities to become bedroom communities, giving America the sprawling landscape so familiar today. While these design and planning ideals helped shape the beginnings of suburbanization, much of the landscape we see today is the result of policy and land use decisions brought about to make the conditions within cities healthier. For instance, the sprawling form now so prevalent was intended to separate the places where people live from the negative health effects of industry. This

planning method, however, has produced negative health effects caused by automobile-related pollution, as well as negative economic, social and political impacts as a result of diminished social capital.

Euclidian Zoning

In the 1920s, the planning profession was still in its infancy. Struggling to attain respectability, it sought to become more "scientific and efficient" by reducing land uses into single components – "parks, streets, highways" (Talen 2006). In 1926, the United States Supreme Court decided in the Village of Euclid vs. Ambler Realty Company that it was legal to discriminate between housing and land-use types. This decision enabled city planning to be based on issues of land uses, creating the method urban planners are still using today known as Euclidian zoning.

Euclidian zoning has three advantages. The first advantage is that it provides a framework that is fair in terms of maintaining property rights and real estate values, and thus ensuring that investments will remain safe due to a legal basis for keeping industrial or other land uses away from residential properties. Secondly, it is a way to standardize the planning process by making regulations easier and facilitating quick impact assessment on new developments. Lastly, it invites public involvement, although this involvement is set in a very strict framework (Brain 2006). The problem with Euclidian zoning is that it oversimplifies issues into a one-dimensional framework that protects the rights of the single property owner while ignoring the benefit of the entire community. Euclidian zoning has led development in the United States into a homogenous form of sprawl, separating people from their work, from their activity areas, and along racial and income lines, at the expense of community building and the creation of social capital. This can be seen throughout the development process which has taken the voice and creativity away from all sides of the process, from the government to the developer to the citizen.

Role of the Government

The government was quick to embrace Euclidian zoning began in the 1940s subsidize the suburbs through the Federal Housing Administration and Veterans Administration loan programs. By altering banking practices, construction requirements, and the creation of the massive United States highway system, the government was able to provide the American dream of large single-use residential tracts away from the city. This initial investment has remained the dominant urban form seen today and is still seen in contemporary city planning. General Plans and land-use maps used by urban planners today still set the framework of single use areas which are occasionally dotted with areas of mixed-use developments containing only the minimum mix of high- and low-density residential and commercial centers. Even if a city wanted to try something new, or changed its zoning, it would have to fight legal battles and endure a lengthy and convoluted public process (Cole 2005). A few progressive cities are starting to realize the benefits of mixed-use developments. Azusa, east of Los Angeles, California, recently passed a smart growth general plan making it the only city in California where some aspects of smart growth are legal. Other California cities like Pasadena and San Buenaventura are working to create development patterns where land-uses work in conjunction with each other, rather than separately.

Role of the Citizen

For citizens of a community, the Euclidian planning method provides involvement primarily at the site scale. Most public involvement takes place as a community looks to keep certain development types out of their neighborhood (Brain 2006). This leads to a very narrow single-issue approach to development centered on the NIMBY (not in my back yard) approach to public involvement. Focusing on a single issue has multiple negative ramifications. It leads to the loss of the larger planning picture by prioritizing discussion around a particular argument. It tends to divide communities by focusing on differences rather then commonalities. It creates a lack of equity as poorer neighborhoods unable to put together the resources to prevent unwanted development and public liabilities often end up with the most of it (Hester 2006). Finally, it puts developers in an adverse position to the

community, establishing a relationship built on argument rather then cooperation. This method of public participation against a development may prove successful in the short run, but in the long run, a more aggressive and savvy developer may take over a project and sidestep the public process altogether. For public participation to be successful it needs to take place early and to a certain extent needs to be non-place based so as to prevent a NIMBY attitude throughout the evolution of a project.

Role of the Developer

For the developer, taking a creative approach to development is no less daunting. The most successful developers often become those who are able to most efficiently jump through hoops developed by cities and citizens. As a result, developments become standardized, using the existing framework of single-use, low-density, car-based development as the least-resistant model. Land then becomes a commodity for the developer rather than an asset to the community. Those properties with the least risk or public involvement tend to be taken on while more politicized projects that may benefit the community, get put on the back burner. The developer plays a key role in this process as "ultimately the form and character of urban development is determined by developer's ability to work through the highly politicized and unpredictable regulatory process with their bottom line intact" (Brain 2006).

Euclidian zoning was supposed to simplify the development process while protecting and involving the public. Instead it has cut the creativity out of development while placating the public and pitting the developer against them. Other planning models like Smart Growth and SmartCode, which focus more on the built form, offer promising alternatives to Euclidian zoning. At the heart of these models is the perception of the American dream of owning a home with a large yard in suburbia. Until the story of this American dream is told accurately, the sacrifices needed to live this lifestyle (automobile dependence, long commute times, unhealthy environment, and the loss of community) will remain overlooked. Changes in the planning process could help to alter the image of urban life and the general fear of density that often exists in suburban communities. A properly designed neighborhood that contains walkable amenities, shopping, green space, and a sense of community may begin to look favorable over the existing ideal of the large backyard and a three-car garage.

SOLUTIONS TO DECLINING SOCIAL CAPITAL

Form Based Zoning

The first step in creating communities that foster social capital is to stop Euclidian zoning practices and re-imagine a development process that brings cities, developers, and the public together from the beginning to create a project that will be focused on a development's benefit to the community. Once a developer knows what the expected outcome is, the process will be less about jumping through hoops and more about creating something that the community will embrace, which, by expediting the process, will make the project more profitable.

SmartCode is a design-centered planning practice based on form rather than land use. It follows a rural to urban transect that dictates development types along it. In other words, development along the transect follows the building pattern rather than the use given to it. This type of thinking allows those involved "to understand each building, development project, or design decision as tied not just to the individual utility but to a process for sustaining place value" (Brain 2006). This type of process fosters greater creativity in the developer, a higher diversity of land uses and housing types, and by creating a design-centered process, it affords the public a chance to enter the conversation rather than being relegated to veto status. Perhaps most importantly, SmartCode can form a framework for other urban design practices like the creation of third place, pedestrian-oriented transportation, community size, and urban design patterns that increase the potential for social capital.

Third Place

A third place is a place one regularly visits that is not home or work but instead a place in which informal gathering can take place to spend time with friends. Ray Oldenburg, talks of the third place as a "spiritual tonic"; a place where you go when you want and leave when you want. It is these places that may have the greatest effect on social capital, as it is a primary space to meet people and develop relationships which will establish trust and eventually partnerships throughout the community (Oldenburg 1989). In order to function as a third place, a space should be within walking distance of those who most often use it and should have a recognizable clientele at regular time periods throughout the week. Because of this, many third places cannot be found in modern day suburbs due to single use zoning and dependence on the automobile. Oldenburg considers the old soda fountains to be the most ideal third places because they did not discriminate by age or sex. Today many third places tend to take place around restaurants, coffee shops, bars, and the gym.

The importance of a third place when looking at social capital and its role in a community is reflected in the rise of the coffee shop. Between 2000 and 2004 coffee shop chains grew by more than 10 percent annually, which is quite large when compared to fast food chains that grew only 2 percent annually over the same time period (Waxman 2006). As new suburban communities are popping up across America, the coffee shop is filling a void. But are these sufficient to make up for the loss of previous third places? Oftentimes chain establishments like Starbucks or Barnes & Noble, will have all of the right design aspects that create a good third place, such as cleanliness, adequate lighting, a view to the outside, and comfortable furniture (Waxman 2006). But they are often missing two key aspects: a facilitator and a sense of place. Chain retailers will hire employees who work part time and are paid a very low wage, leading to a high turnover rate. Serving as the facilitator, it is important for the employees to have a stake in the interactions taking place or the social capital being created will be minimal (Oldenberg,1989). The other missing piece in these places is the lack of sense of place. The allure of chains is that they are the same no matter where you are, a Starbucks coffee tastes the same in Los Angeles as it does in Omaha, Nebraska. The problem with this is that it lacks place attachment, "Places root us – to the earth, to our own history and memories, to our families and larger community" (Cooper-Marcus & Francis 1998). The ability for a third place to take on the identity of the surrounding community and support the cultural and social interactions that take place there cannot be under-estimated. While the rise of the chain store coffee shop may show the need for a third place it does not necessarily represent the answer. The successes of a third place on creating social capital depends on proximity to the surrounding community, the activity level of its clientele, the ability of its employees to facilitate, and its ability to represent the community's identity.

Community Size

Christopher Alexander, writes about community size and its importance to one's comfort in the urban environment in *The Pattern Language*. He suggests that within a city, suburb, or town, a community of 7,000 and a neighborhood of five hundred people are ideal (Alexander 1977, Crawford 2002). At the community scale, the individual tends to lose his or her voice within the community after the population reaches 10,000. By allowing communities of this size to have a certain amount of self determination, including power over the allocation of funds, residents will inherently have a larger interest in local politics. At the neighborhood scale a population of five hundred is ideal in order to maintain identity, enabling residents to feel a sense of ownership. By maintaining a population of five hundred residents, neighborhoods will be able to recognize their adjacent neighbors and possibly have a friendly exchange, developing trust and friendship within the community. At both scales, it is important that a boundary or defining edge helps identify and differentiate between communities and neighborhoods. Suburbs too often lack these boundaries, run into each other and communities become lost. When communities lack these differentiating factors and are not kept within the appropriate population, people lose their voice and ownership of the place in which

they live. These factors are critical when trying to establish social capital within a community.

Transportation

The automobile-centered transportation system that exists today is possibly the largest hindrance to building social capital within a community. It isolates people in their cars, creates streets that are underused, and disconnects people from where they live, work, and play. The value of a transportation system can be seen in its diversity and ability to get people out of their cars and onto a bike, train, bus, or walkway. In order for a multimodal system to work it needs to have interchanges where different modes of transportation meet. That way, someone going for a long-distance trip that may not be manageable by bike could use a bike path to catch a train. In order for all types of transit to feel safe and fully used, it is also important for modes of transport to be separated from one another. A bike path alongside a roadway without some type of barrier will remain auto-dominated and therefore underused (Alexander 1977). Ultimately, the urban/suburban fabric of a place must be pedestrian oriented. Major commercial areas and promenades should be kept car free. The success of these spaces can be seen throughout the world including the Third Street Promenade in Santa Monica, California; Venice Beach, California; and Pearl Street in Boulder, Colorado. Even when not moving, the automobile serves as a deterrent to the pedestrian environment. Alexander found that if any more than 9 percent of a street was given to parking, the space became unfit for pedestrians. Yet development trends still cater to automobiles as eight parking spaces are built for every car being used (Crawford 2002). A successful transportation system must be diverse, connected at critical points, yet each mode's path must be separated and designed to keep the urban/suburban fabric pedestrian oriented. When all of these factors are apparent, the chance for interaction increases as does the opportunity for social capital within the community.

Urban Patterns

Kevin Lynch defined five urban patterns that can be seen throughout the majority of cities: paths, edges, districts, nodes, and landmarks. Paths are streets, walkways, railroads, or any other channel along which people move and experience their surroundings. Edges are linear elements that can act as either a barrier or the joinery which defines two separate elements. Districts are medium to large sections of the city that have a definite recognizable character that differentiates them from other parts of the city. Nodes are points in a landscape that have concentrations of activity and are usually found along converging paths. Nodes come in many different sizes from small town squares to neighborhoods to entire cities. Landmarks are reference points that provide direction and familiarity to local surroundings. These become stronger the more time a resident spends in a place (Lynch 1960). Urban patterns are, to a certain extent, found in all cities and suburban areas, yet as densities are thinned in the suburban landscape, they tend to become weakened, distorted, and less effective.

Paths in an urban area are typically multi-modal. In a suburban area, they are car-dominated. The results are seen in a degraded building form as attention to detail at the pedestrian scale is lost. Emphasis is put on grabbing the attention of drivers and passengers inside their cars moving through quickly. An example of this can be seen in a city like San Francisco, California. Where people are found walking, the building form is often decorative, setbacks are usually varied, and stores display their goods in the windows. In many suburban areas there is often a parking lot separating the street from the building, storefronts are simple and generic, and windows are usually covered by large advertisements.

The typical suburban form of large residential tracts with nodes of commercial strip malls surrounded by large parking lots weakens the urban patterns put forth by Lynch. Edges are often less prominent as one residential tract bleeds into another. While there may be significant barriers between different land-use types, these edges tend not to have the

same benefits. In the typical suburban development, these barriers work to hinder neighborhood identity as lack of density and mix of land uses tends to homogenize the identity of suburban districts. This is further emphasized by the nodes of commercial activity that have been established as gathering places for neighborhoods. These areas are not sufficient for creating social capital as they are created for the sole purpose of making money. Gathering and loitering are often frowned upon as it tends to detract from the money-making aspect of the space. The types of stores also tend to have a negative effect on the district, as chains do not support the identity of the district to which they belong. In many ways, typical suburban development ignores the urban patterns that have guided the development of many great cities.

The benefits of these urban patterns in creating social capital are immense. Paying close attention to existing patterns and working to emphasize the aspects that are working can be a successful way of creating social capital in an environment that was built ignoring many of these patterns. An example of city using these patterns successfully is Curitiba, Brazil. In 1971, architect and planner Jamie Lerner became mayor of the city. Anticipating impending growth, he began the Institute for Urban Planning and Research. The first action the city took was to look at existing urban patterns of land use and transportation. City planners decided to pave five roads moving out from the center of the city and zone them for high-density residential neighborhoods, creating condensed-activity nodes along the path. Then the city instituted private bus lines along these roads as the major form of transportation. Using the money saved by not installing a more sophisticated transportation system, the city was able to fund neighborhood libraries and recycling programs aimed at employing the poor, plant four million trees, and construct a 125-mile bike and pedestrian system. By concentrating on urban design principles creating dense nodes and prominent paths, on a city-wide scale, Curitiba was able to avoid getting trapped into funding an unsustainable sprawling city and instead used the money to increase social capital.

Conclusion

Current projections estimate that by 2030, half of all buildings in existence in the United States will have been built since 2000 (Nelson 2004). This is a tremendous opportunity to reevaluate land-use and design patterns as they pertain to creating social capital within a city. The emphasis on single-use suburban tracts of the past 60 years has created a segregated landscape that has left many people isolated from their neighbors, community, and city. Declining social capital has resulted from people becoming less trusting of their neighbors, less active within their community, unaware of their surroundings, and less productive. By critically viewing the existing zoning regulations and development patterns that have pushed the built environment to such dysfunction, a new urban form can emerge that fosters social capital, reconnecting urban residents to the places in which they live and with each other.

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Appendix C-4

IMPROVING QUALITY OF LIFE THROUGH URBAN INFILL DEVELOPMENT IN CALIFORNIA

By Sonya Reed

A GLOSSARY OF TERMS

Greenfield:
A piece of undeveloped land, either currently used for agriculture or just left to nature.

Urban Infill:
The use of vacant land and property within a built-up area for further construction or development, especially as part of a neighborhood preservation or limited growth program.

Suburban Infill:
The development of land in existing suburban areas that was left vacant during the development of the suburb.

Brownfield:
Abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contaminations.

Grayfield:
Under-performing and/or declining shopping centre proprieties.

Adaptive Reuse:
The process of adapting old structures for new purposes.

Mixed-use:
Multiple land uses in the same structure or same general area of a community.

MODERN HOUSING DEVELOPMENT SINCE THE AUTOMOBILE

Housing developments since the age of the automobile have seen several incarnations. The majority of urban dwellers in the early 1900s were factory and industrial workers who lived near their work, or in high-density communities just outside the city center, connected to the city by streetcar or rail (Wikipedia 2007). As cultural and social amenities proliferated in major cities, and more white-collar jobs moved in, a growing number of people from the working and middle classes began to move to the city in the 1920s-40s.

By the 1950s, however, as more people found themselves able to afford the personal automobile and federal subsidies promoted expanded growth outside the city, a new development pattern emerged – the planned suburban utopia. Visions of crew-cut lawns and two-car garages, and the promise of open space and home-ownership lured the majority of white, middle-class city dwellers back to the outlying edges. As a result of this "white flight" and the subsequent disinvestment in the city center in the 1970s, many of America's urban cores were either in disrepair, dysfunctional or essentially abandoned altogether. Ninety-five percent of cities with populations greater than 100,000 people in the United States lost population between 1970 and 1975 (Bradbury, Small, Downs). The personal automobile provided the perfect escape for such an independent and wide open frontier-loving society. Ironically, however, this move to the suburbs resulted in the loss of open space and dependence on the automobile for everything from work and school to grocery shopping and entertainment.

In recent years, new attention has been given to redeveloping the urban core, especially in car-centered cities like Houston, Texas; Atlanta, Georgia; and Denver, Colorado; which face ever-growing transportation and congestion nightmares. Progress has been made in particular with mixed-use, transit-oriented urban infill developments (see sidebar for definitions), where attractive and affordable options for working and living within the inner city have reduced the need to commute by car over long distances. As in the case of a city like Seattle, a once deserted downtown has emerged as one of the nation's most vibrant urban centers. However, many cities dominated by the automobile and lacking public transit options – most notably Los Angeles – still find themselves without vibrant, multi-use downtowns.

In addition, some developers still persist in converting what few farmlands and greenfields remain at the edge of the city into sprawling neighborhoods of single family homes with multi-car garages. And homebuyers continue to move out of the city and into these suburban developments faster than they can be built because of the cleaner air, the slower pace of life, the greater affordability, and the newer amenities. More and more, however, people move to the suburbs because the lifestyle continues to be idealized. But at what cost?

Commuting and Quality of Life

Approximately 79 percent of Americans now live in or within the urban perimeter of major cities (US Census Bureau 2000). This indicates that the majority of Americans still choose to live in urban areas over rural areas, but it does not reflect the increasing trend of urban sprawl. Urban sprawl is similar to suburban sprawl in that it refers to a pattern of development that consumes land and requires dependence on the automobile. The difference is that urban sprawl occurs within and between major metropolitan areas, continuing

the separation and imbalance of housing and jobs within the urban zone (radicalurbantheory.org 1996). The imbalance of jobs and housing is a primary contributor to the traffic found in major metropolitan areas. Many suburban residents must commute to the city for work, while in some cases just as many urban dwellers must make the opposite commute. This is particularly true for California, where commuters headed to the suburbs comprised nearly half (48 percent) of all commutes in the state in 2000 (Public Policy Institute of California 2006). As gas prices continue to surge and the addition of new commuters strains the already aging freeway infrastructure, the continued pattern of sprawl will have increasingly dire effects on the quality of life of most Americans. The Southern California Association of Governments (SCAG) estimated that metro region motorists spent "an average of 50 hours of [traffic] delay per person" in 2001. The 2003 SCAG report found that the Los Angeles/Orange metropolitan region had an average of 93 hours of delay per person, the highest in the nation. A recent study estimates that by 2020, traffic within the state will grow by more than 48 percent, and delay time will more than double (Recker 2001).

The financial costs of sprawl-related traffic have also increased. The total cost incurred due to congestion in the entire SCAG region was almost $12 billion in 2003, significantly higher than any other metropolitan region in the United States. This total includes "costs from delay as well as additional fuels used" (SCAG 2003). Transportation infrastructure needs resulting from sprawling suburban development cost American households an average of $630 per year (Sierra Club 2007). The costs of smog and congestion are high for commuters, as well, at about $4,000 per household per year and rising (Elliott 1999-2000).

Mental and physical health impacts of sprawl-related commuting patterns are also on the rise. A recent study has shown that sprawl has a particularly harmful effect on women. In 1999, American women overall spent an average of 64 minutes per day in a car – single mothers spent 75 minutes a day, while married moms spent 66 minutes a day, or almost 17 solid days a year (STTP 2002). The loss of time that could be otherwise spent with family (or alone) adds needless stress to an already burdened segment of the population. In addition, children and adults face increased health problems as a direct result of carbon monoxide and particulate matter pollution from automobile-related smog. Since 1980, the risk of asthma has increased significantly in American children under 18. In California, approximately 14.8 percent of children and adolescents had been diagnosed with asthma, and more than half a million had suffered at least one asthma attack in 2003 (Lund 2003). Increased rates of heart disease in adults have also been found to be directly linked to airborne pollution from cars (SCAQMD 2000).

Land Use and California's Projected Population Boom

According to a report from the California Center for Land Recycling (CCLR), as the population continues to boom in California, "(the state) can expect to lose 21 to 26 million acres of currently undeveloped greenfields to urban sprawl over the next 30 years" (Brewster 1998). And as people continue to spread out, homes continue to increase in size. According to the sustainable building organization, Building Green, "the average American home has more than doubled in size since 1950, growing from about 1,000 square feet to 2,340 square feet in 2004. This has happened even as the average family size has shrunk by one-fourth, from about 3.4 in 1950 to 2.6 in 2004." If this trend of building energy-intensive, overly large homes far removed from the urban core continues, California will neither be able to sustain growth over the next 30 years nor meet the housing and infrastructure needs of the projected population.

Peak Oil and Housing Development

A vital consideration in the evolution of housing developments in the United States is the looming threat of reduced oil availability and affordability as a result of "Peak Oil." The term Peak Oil comes from American geophysicist Marion King Hubbert's peak theory, which is based on the

fundamental observation that the amount of oil under the ground is finite. Most experts, and now many world leaders and oil companies, believe that the earth's resources have already reached or are soon to reach their peak production, after which a terminal decline is inevitable. Many observers fear that global change is inevitable due to modern industrial nations' extensive dependence on oil and the growing reliance on oil of highly populous nations such as India and China.

The increasing cost and depletion of oil will have implications for everything from maintaining a household to food availability. As electricity costs rise, the inability to afford to heat and cool the increasingly large and energy-inefficient suburban homes will stress the finances of the mostly middle and working class families who live in them. In a post-peak oil scenario for California, the booming state will be increasingly burdened with fuel and freeway infrastructure costs, which will be passed on to commuters. Also, what little remaining land that would otherwise be valuable for localized food production continues to be consumed by sprawl.

URBAN INFILL OBSTACLES AND OPPORTUNITIES

The California population is the most urbanized in the nation, with 80 percent of all residents living in metropolitan areas of at least 1 million people (radicalurbantheory.com 1996). The implication of this is that competition for space in which to live and work is increasing, and pressures on the land at the urban edge of cities are becoming more intense. One significant way to address this problem is through the policy of urban infill.

Urban infill refers to development or redevelopment of land that has been classified as brownfields or grayfields, vacant, or underutilized, and includes the adaptive reuse of existing buildings. This policy of urban infill is also known as "land recycling" and according to the CCLR, there are at least 400,000 recyclable sites in the United States, and more than 38,000 in California alone. The total acreage of the sites within California could house 10-20 million families without consuming additional greenfields. Or, to put it another way, by increasing density in existing urban areas to an average of only three housing units per acre, all 18 million projected new residents could be housed (Brewster 1998). This alone would address the need for housing in California over the next 30 years. So why are people still resistant to the idea of density and developers still building unsustainable suburbs rather than mining California's urban infill goldmine? Much of the resistance has to do with policy, but economics, perceptions, and preferences play important roles as well.

Policy and Economics

In the United States, policy has favored the expansion of the automobile and suburban growth since the 1950s. Land-use policies and outdated zoning indirectly promote sprawl by discouraging new mixed-use and dense, multi-family development, and pushing employment to the urban fringe. United States Treasury regulations dictate appraisal procedures for new housing which rely on unit measures (value per square foot of house and lot); therefore, the more square feet in a house, the higher the appraised value, the larger the construction loan, and the less cash the developer must risk (Brewster 1998). A lack of regional planning results in individual communities looking out for their own self-interests, inconsiderate of the costs imposed on other communities.

In California, "[l]arge lot zoning (1 or 2 acres per home) began as a way to defer decision-making by local planning departments. When municipalities and counties realized that families with children put additional burdens on school systems and other services, and that family size was inversely related to house size (young families usually cannot afford the cost of larger houses), they simply kept the large lot zoning in effect. The result has been high land costs for California's housing developers, driving them to build larger, more expensive houses on large lots" (Brewster 1998). Thus, misguided policy and incentives have brought about a pattern

of development that is not only dependent on the automobile, but increasingly costly for both the state and its residents.

Brownfields and the Ghost of Superfund

Despite being created to address the responsibility of contaminated sites, the Environmental Protection Agency's (EPA) Superfund program had unfortunate consequences for urban infill development. Many private and public sector agencies were discouraged from developing these sites because of concerns regarding conflicting regulations, cost and time involved in cleanup, and long-term liability risks. In 1998, the EPA delisted the least contaminated of these as Superfund sites, and listed them instead as "brownfields," hoping to shift the emphasis from punishing polluters to encouraging redevelopment of contaminated sites (Brewster 1998).

However, developers have been slow to take on these sites until recently. Rising land costs combined with incentives for remediation have set the stage for brownfield redevelopment in the inner city. In California, agencies such as the CCLR, Community Redevelopment Agencies, the Trust for Public Lands (TPL), and the California EPA (CalEPA) have began research and programs aimed at promoting the benefits of brownfield redevelopment, with growing success. For example, the CalEPA celebrates Showcase Communities in East Palo Alto and Los Angeles, while TPL's "Brownfields to Parks" program is responsible for several new parks in inner city neighborhoods throughout California.

Shifting Preferences

Many Americans believe that the suburbs still embody the American dream of success, of having "made it" in terms of personal achievement and lifestyle. Many feel that suburbs in general, but especially the shiny new ones, are safer, quieter, cleaner and cheaper than cities. The idealized suburb invokes a neighborly small-town atmosphere, with better schools and more parks per person.

All of these perceptions are true, to some extent. However, the current situation is changing, which may have an impact on individual preferences, especially in California. Three major demographic trends are taking place that will have an impact on housing preferences in the state: the aging baby boomer population, and the increasing number of single women, and immigrants and their children – all of which show a preference for affordable mixed-use, urban development (Autler; Belzer 2002). As the population continues to grow and change, and the cost of oil continues to rise, the true cost of suburban living, especially in terms of quality of life and cumulative environmental impact, will eventually become a burden for all of society to bear.

Getting People On Board

Despite these obstacles, the timing is right for urban infill throughout the United States. It is particularly urgent for California, however, due to the (near) future need for additional energy-efficient housing, and the current, immediate need for reduced commuting and reduced land consumption. Government agencies within the state are beginning to acknowledge the need for urban infill, and zoning changes, incentives and other actions are being taken to move this to encourage this type of development.

However, it will take more than a change in policy to change people's minds about urban infill. One of the biggest obstacles is the resistance of Americans to give up the idealized suburban lifestyle for which they have worked so hard – even though it is becoming increasingly obvious to many that this lifestyle may ultimately cost more than it is worth in terms of time, money, and health. Furthermore, Americans are notoriously adverse to the idea of density. As one urban redeveloper notes, "two things that Americans hate are density and sprawl" (Glenn Isaacson). However, density does not have to mean unsafe, loud, dirty, or expensive multi-storey apartment complexes. Also, many urban theorists believe and studies have indicated that perhaps the reason why Americans still choose to live in the suburbs is because they have not been shown or offered better alternatives, such as moderately dense mixed-use.

Mixed-use is often synonymous with urban infill, as cities look to become more vibrant and more attractive to hesitant, but prime target urban dwellers, such as aging Americans and other people who prefer to live in smaller, more "old-fashioned" towns. In addition to an often small-town vibe and proximity to jobs and amenities, mixed-use neighborhoods are "especially beneficial and appropriate for communities that lack vacant residential land, creating the opportunity for new housing through infill development and decreasing housing costs through shared amenities and parking" (VCBR 2006).

Another way to sell this idea to the average reluctant American is by illustrating the quality of life – or social, environmental, health and economic benefits – of urban infill development. An article in *Times Magazine* concluded that the "signature preoccupation of the decade" is quality of life (Pooley 1997). Another study analyzing the New York City regional economy found that quality of life rated higher than taxes or regulatory policies as "the most significant factor in the region's long-term competitiveness and capacity for positive economic growth" (Brewster 1998). In addition, the baby boomers will "increasingly dominate housing markets because of their accumulated wealth and relatively high incomes, which allow them to relocate primarily for quality-of-life reasons."

THE QUALITY OF LIFE BENEFITS OF URBAN INFILL

By emphasizing the human benefits of urban infill development, a new era for development could evolve. The critical elements of a successful urban infill development are a diverse society, a strong economy, a healthy human population, and a thriving natural environment. Some examples of how communities can achieve these goals are found in the examples below.

Redeveloped and Revitalized Communities

Redevelopment of urban infill properties represents a significant real estate asset in the changing market. One prominent example of this is the Atlantic Station development in Atlanta, Georgia. Atlantic Station is a 138-acre environmentally sustainable redevelopment of the former Atlantic Steel Mill, and the largest urban brownfield redevelopment in the United States. According to a press release (2006), it opened in 2005, and is projected to include 12 million square feet of retail, office, hotel, and residential space (with 5,000 mixed income units), as well as 11 acres of public parks. According to Jim Jacoby, the chairman of Atlantic Station, The Jacoby Development Corporation "paid $76 million to purchase the land in 1999 … Even with the clean-up cost of nearly $25 million added in, the cost works out to about $731,884 per acre. For comparison, the developer of the nearby site for the new home of the Atlanta Symphony paid $22.3 million for 6.36 acres…[equivalent to] about $3.5 million per acre" (Leon 2003). CityCenter Englewood in Englewood, Colorado is another example of a thriving urban infill redevelopment project. This mixed-use and transit-oriented community was built on a grayfield that was once one of the nation's largest indoor malls – Cinderella City Mall – defunct since the mid-1990s. According to the City of Englewood, "[CityCenter Englewood] provides a model for intelligent regional design that directs development into established cities served by transit. This 55-acre public/private project focuses development on a central public place and connects the site with walkable streets, civic and cultural uses, light rail transit station, retail and office space, residential housing, a public library, outdoor performance space, art museum and outdoor sculpture. [It] is revitalizing the community spirit as well as the tax base of Englewood and provides a model for healthy urban redevelopment."

Los Angeles, California has seen a dramatic conversion of its abandoned and ailing downtown office and warehouse buildings. The adaptive reuse of these buildings into artist lofts has been an economical boon to urban developers, although socio-political issues, including the continued lack of urban core vibrancy and gentrification, continue to be raised. In addition, downtown jobs are still lagging, and neighborhood amenities, such as grocery stores and bookstores, have yet

to arrive (DiMassa 2007). Without these critical elements, downtown Los Angeles will continue to lack a sense of community.

The prevalence of gentrification after redevelopment is one of the most controversial issues tied to urban infill. Gentrification is the "process of renewal and rebuilding accompanying the influx of middle-class or affluent people into deteriorating areas that often displaces earlier, usually poorer, residents." This is happening in city after city, where poor, mostly non-white residents are forced to move out as the neighborhood improves and rents increase. This "white in-flight" is occurring throughout Los Angeles, spurred on by the improvements in the downtown area, where older districts – primarily inhabited by working class blacks and Latinos – are being converted into high-rent apartments and artist lofts at an alarming rate. Many of the new mixed-use infill developments popping up in other areas of the city, although touted as affordable, tend to be far outside the price range of many inner-city residents.

Social equity scholars, community organizers and concerned civic leaders are focusing on solving the problem of gentrification in urban infill redevelopment. The Albina Corner project discussed below is one example in which the impact of inner-city redevelopment was beneficial, rather than detrimental, to the existing community.

Social and Economic Ripple Effect in Disinvested Areas

Socially conscious development is essential to ensuring and improving quality of life for all urban residents – existing and new. Public investment in urban infill developments can produce a positive ripple effect in the urban core, stimulating private sector interest and investment in marginal and inner-city neighborhoods. One example of this is the Los Angeles Conservation Corps Brownfields Program (LACCBP), which aims to provide education and employment in brownfield redevelopment to inner city residents within Los Angeles' poverty-stricken Empowerment Zone (Sorrentino 2004). Not only is the program helping to alleviate the area's 18 percent unemployment rate, but, according to the EPA who funds the project, redevelopment activity has steadily increased throughout the Empowerment Zone (EPA 2005).

An example of a successful inner city brownfield conversion project is the Albina Corner in Portland, Oregon – a mixed-use, mixed-income transit-oriented development that became a "gateway" project for Albina and set an example for other struggling urban communities (see sidebar).

This project is proof that a successful conversion of an inner-city brownfield can uplift the existing community rather than become another example of gentrification.

Human and Environmental Health

The reduction of carbon emissions and smog from traffic congestion results in cleaner air and improved health for all. For urban residents, additional health benefits are gained through the remediation and reuse of defunct properties. Not only is air quality improved, but often water quality as well. With the cleanup of abandoned and underutilized properties, neighborhoods see a reduction in crime and improved safety – both real and as perceived by the rest of the community. This results in increased sense of security, pride within the neighborhood, and a greater sense of ownership, as well as increased opportunities for outside interest and investment as others view the neighborhood in a new light.

A study by Donald Appleyard revealed that the more access to public transit one has (thus, the less reliance on cars), the more social interaction and acquaintances one has (Rogers 1997). This has great implications for community building as well as mental health. Likewise, access to urban public space, including plazas, dog parks, playgrounds, and multi-functional parks, creates a sense of calm, safety, and belonging in a neighborhood through encouraging participation and interaction.

As the pattern of suburban encroachment into farmlands, forests, and countryside continues to grow, more and more people are becoming aware of the importance of maintaining

Albina Corner

Albina Corner is an inner-city neighborhood in Portland, Oregon, located on the main street of Martin Luther King Jr. Boulevard. The site is three-quarter acres, and is adjacent to a bus line and near a major light rail station. By the early 1990s, prior to revitalization efforts, Albina Corner was characterized by general deterioration, "an old car lot, a car wash, and a vacant office building along with many small-scale contaminants such as lead paint, asbestos, and some petroleum."

In 1993, a zoning change enabled high-density housing and mixed-use developments in the neighborhood. The new retail shops, along with affordable residential housing, encouraged a positive shift in the local economy.

Today, Albina Corner includes 48 units of low-income housing and over 12,000 square feet of commercial space, including a coffee shop, a bank, a beauty shop, a convenience store, and an art gallery. Through rental income, the commercial sector supports the overall project, covering much of the building maintenance costs. The mixed-use amenities provide residents, especially less mobile senior citizens, with access to banking and other services. Albina Corner also "boasts a child-care center and a second floor courtyard and play lot, well shielded – by 10 feet of first floor commercial space – from encapsulated contamination left on-site as part of the state approved cleanup plan" (Bartsch 2006).

a healthy and balanced ecosystem beyond the city. Stress at the environmental edge affects everyone, whether directly or indirectly, particularly when entire systems are destroyed. The loss of 98 percent of California's wetlands is one from which we may never recover, but which at the least will affect generations to come. Dense urban infill has much less impact on the environment because it requires little to no extra land to develop. It also benefits the environment because it takes fewer resources to provide heating, cooling, electricity, sewage, and other services to people living in clustered communities than those living in single-family homes far from the urban core.

LIFE AFTER SPRAWL

The major implications for the end to sprawl are improved mental and physical human health, greater economic and social opportunities, and overall environmental sustainability. Urban infill can significantly reduce the need to sprawl out to the suburbs. An emphasis on the quality of life benefits and the presentation of attractive development models such as mixed-use neighborhoods can increase the desire to live in urban infill developments rather than sprawling, suburban neighborhoods.

In the coming years, if Peak Oil proves to be as devastating as many theorists predict, the need for urban infill, mixed-use and greater density overall will become even more apparent. Maintaining a high quality of life should always remain a critical consideration in human development, and the best way to ensure this is through creating a lifestyle that is as little dependent on oil and the consumption of land as possible.

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Appendix C-5

Building a Framework for Urban Agriculture

By Elizabeth (Isby) Swick

Urban Agriculture means cultivating plants, cultivating people and promoting a different landscape in cities. *- Agropolis p. 253*

The culture and health of a society is linked directly to its relationship to food. Territories, journeys, and seasonal traditions of early hunting and gathering societies were based largely upon food resources. The first agricultural revolution, 10,000 years ago, enabled people to settle in one place. In the last 50 years, the "green" revolution increased crop yields through the use of synthetic pesticides and fertilizers and mechanized farming practices. Industrial agriculture, the system resulting from the green revolution, has had tremendous impact on both human and environmental health and has created a disconnect between urban areas and the land that feeds them. Discontent with this current system, and a vision of a healthier life is now driving a new movement, perhaps a revolution, to localize food systems. Given projections that by 2020 over half of the world's population will be living in urban areas (Mougeot 2005), urban agriculture – which includes urban and peri-urban (city fringe) production – is a critical component of this movement in both developed and developing countries. In North America, community organizations concerned with social equity, and environmental and human health are a driving force behind urban agriculture. However, the potential for urban agriculture to restructure cities begs the attention of municipal support. Municipal governments have the opportunity to address the need for a more sustainable food system and enhance urban environments by developing a framework for urban agriculture that is supported by land use planning, policy, and action.

THE CURRENT FOOD SYSTEM IS UNSUSTAINABLE

There are several dimensions to the current dissatisfaction with industrial agriculture, including the impact it has on environmental and human health and concern that this high-input system will not be able to sustain itself in the near future. While any system that is either socially, environmentally, or economically unsustainable should be a concern for those who depend upon it, this is especially critical with food security. Food security has been defined by the United Nations Food and Agriculture Organization as the state of all people, at all times, having access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Conventional agriculture is part of an unsustainable food system because it is fragile. Such agriculture is therefore a threat to food security, due to its impact on environmental and human health and dependence on energy-intensive inputs.

Environmental Health

Industrial agriculture's pollution-generating practices are largely responsible for its negative environmental impact. Agricultural practices are responsible for 48 percent of river and stream contamination and 41 percent of lake contamination in the United States (US EPA 2002). Contributing to these high numbers are the use of synthetic pesticides and fertilizers, many of which are petroleum-based, to eliminate unwanted pests and to boost crop yields and related profit. As pesticides are designed to kill living organisms, it is not surprising that they have been identified as a major contributor to the reduction of biodiversity on American farmlands (Kimbrell 2002). The dangers of commonly used pesticides through groundwater contamination range from carcinogenic effects to developmental and/or reproductive problems (Pesticide Action Network).

In addition to causing environmental contamination, the use of synthetic fertilizers erodes the natural fertility of the soil. Soil is a living system in which dead organic matter is recycled

into nutrient-rich matter by microorganisms. Plants absorb the soil's nutrients to grow and live and return the nutrients to the soil upon their death. In the conventional agricultural system, crops (filled with soil nutrients) are shipped far from their source, and their remains are most often deposited into landfills as waste. In order to compensate for this loss of soil nutrients, and to further boost crop yields, synthetic fertilizers are added to the soil. However, these fertilizers diminish microorganism populations, negatively altering soil form. Erosion of fertilizers, which increases as soil form collapses, in turn contributes to downstream pollution.

Genetic diversity is also threatened by practices of conventional agriculture. The Food and Agriculture Organization of the United Nations estimates that since 1900, approximately 75 percent of the world's genetic diversity of agricultural crops has been eliminated (International Development Research Centre). Due to the combined effects of pesticides, fertilizers and habitat destruction, urban areas often have greater biodiversity than rural agricultural areas (Viljoen 2005).

Loss of Farmland

As cities have grown in population, developments have encroached onto farmlands. In the United States, over six million acres of farmland were lost due to urbanization between the years of 1992 and 1997 (Farmland Information Center). Not only does this decrease the country's open space and potential for food security, but it creates a challenging interface between farming and urban communities. Farmers in this situation can face several challenges, mostly related either to restraints on otherwise routine practices or damage to their land from neighborhood vandals, theft, and dogs. Adding to the farmers' burden, encroachment of urban land to neighboring farmlands is often a precursor to impossible farming operations, due to increasing land values, farming restrictions, and the potential to be annexed by the growing city. Urban neighbors of farms face their own challenges of proximity, from undesirable use of pesticides, unpleasant farm odors, and disturbance from nighttime farming.

Human Health

Humans are directly impacted by environmental degradation, as well as by offerings of the conventional food system. In 1998, the Federal Drug Administration conducted a study on pesticide residues. Of the food tested, 35 percent contained pesticide residues (Kimbrell 2002). Subsequent studies have shown that Americans carry high levels of pesticides in their bodies (Pesticide Action Network). Pesticides have been documented to cause nervous system damage, infertility and birth defects, and cancer in humans (Walker 2005, PANNA 2004). Despite this growing body of knowledge, pesticides continue to be produced and applied in the United States.

As a result of the current food system, Americans are consuming unhealthy food. Food that has been transported long distances is of inferior quality to fresh, organic, local food for several reasons. For starters, nutritional content is generally reduced due to the long time between harvest and consumption. For example, research has shown that leafy vegetables lose up to 90 percent of their vitamin C within 24 hours of harvest. (Jones 2001). Secondly, in order to preserve foods during long distance travels, preservatives and additives are applied. Third, while Americans are consuming more calories and preservatives than ever, they are decreasing their intake of fresh whole vegetables and fruit. The United States Surgeon General has determined that diet is the cause of two out of three premature deaths (Kimbrell 2006). The impact of the current food system suggests that continued investment in such a system is questionable. Marion Nestle, author of *Food Politics*, has come to the conclusion that "food companies- just like the companies selling cigarettes, pharmaceuticals, or any other commodities- routinely place the needs of the stockholders over public health" (Nestle 2002).

Unsustainable Practices and Fossil Fuel Dependence

Unsustainable practices of the conventional food system are, in fact, more than a health concern. Through the contamination and over-drafting of water sources, the erosion and fertility loss of soils, the stripping of biodiversity, and

contributions to global climate change, the conventional food system is eating away at the very pillars that support it. While the practices that have led to this current situation are complex, the overarching factor that drives the system is dependence on high energy inputs. The conventional system is unsustainable chiefly because it requires more inputs, such as water, petrochemicals, and energy, than will be available for future generations. Energy consumption in the food system illuminates this grim scenario.

The food system, from production to preparation, is responsible for 17 percent of energy use in the United States (Pimentel 1994). It is estimated that the United States expends 7-10 calories of energy for every calorie of food produced (Pimentel 1994). Oil is a finite resource, one that has greatly influenced human settlements for the last hundred years. Global production of oil has been predicted to peak sometime between the present and 2030, at which time supply will decrease by two to three percent per year and lead to a rise in oil prices and decline in oil availability (Heinberg 2006). Without the availability of cheap oil, petrochemical-based farming, long distance food transportation, and extensive food processing, will no longer be feasible. Given that the American diet currently relies upon this system, there are clear reasons to be concerned with the potential of industrial agriculture to meet current and future needs.

BENEFITS OF LOCALIZING FOOD:

How Urban Agriculture Can Contribute to Sustainable Food Systems and Cities

Urban agriculture has the potential to be a sustainable system because it nourishes the environmental and human systems that support it. In this sense, it has the capacity to be an integral part of a sustainable city. At the United Nations Development Program's World Mayors Colloquium of 1994, the gathered mayors went so far as to list urban agriculture and reducing unemployment rates as first steps in coping with both food insecurity and environmental degradation. This bold act is based on an understanding of the environmental and social benefits of urban agriculture.

Environmentally, urban agriculture programs are situated to preserve biodiversity, contribute to the greening of cities, address urban waste problems, and reduce the amount of energy required to produce and distribute food. In relation to biodiversity, urban agriculture decreases a city's agricultural footprint by taking advantage of unutilized urban space and can generate local, domesticated crop diversity through the establishment of local seed banks and seed exchanges. In addition, urban agriculture is often characterized by organic practices that decrease negative environmental impacts. As local organic waste can be composted and used to feed urban agriculture, a city's waste stream can be greatly reduced. In the United States, food scraps and yard waste alone account for nearly one quarter of the municipal waste stream (US EPA). In addition, urban agriculture can take advantage of waste water and storm water, thus reducing waste water discharge. Simply by being located in proximity to consumers and using sustainable, organic practices, urban agriculture greatly decreases dependence on energy inputs. By decreasing the need to burn fossil fuels, and providing a carbon sink through city greening, urban agriculture also decreases a city's contribution to global climate change.

The major reasons that people cultivate food within cities have been identified on an international level as 1) food security, and 2) income generation (Mougeot 2005). However, there is a multitude of other social benefits that can be associated with urban agriculture, including improved nutrition, community building, and enhanced human connections to local traditions and ecology. Community gardens have been cited as reducing crime in both the United States and the United Kingdom (Viljoen 2005). Research also suggests that urban food production provides opportunities for social, productive activities for groups that are commonly discriminated against, such as women, the elderly, and ethnic minorities (Viljoen 2005). While community food projects offer opportunities to build human relationships and networks, helping things to grow builds understanding of human connection to natural processes and enhances people's abilities to act as stewards of the environment. A speaker for the *Center for Ecoliteracy*

explained that "gardening reconnects children to the fundamentals of food—indeed, to the fundamentals of life—while integrating and enlivening virtually every activity that takes place at a school" (Capra 1999). Could this not be the case for gardeners of all ages?

GOVERNMENT ROLES IN URBAN AGRICULTURE

The role of government in urban agriculture varies, depending on the politics of the place and the nature of the programs. The majority of urban agriculture programs are run by community organizations. While many of these programs are successful, it is crucial that governing bodies support these efforts by providing needed infrastructure. Jac Smit suggests that "promoting urban agriculture requires national action to provide the 'infrastructure' for action by municipalities and communities" (Smit 1996). The following chart, compiled by Smit, indicates potential roles for government in developing this infrastructure.

This chart indicates that, although community organizations can play a large role in instigating urban agriculture programs, the infrastructure required to integrate urban agriculture into existing cities and nations requires government involvement. The roles of cities in developing this infrastructure include the development of supportive, innovative policy, program oversight, and proactive planning. A few cities are setting an example to the rest of the world for proactive municipal involvement in restructuring cities through urban agriculture.

Potentail Roles for Government in Developing Agricultural Infrastructure				
	Community	**City**	**Nation**	**Global**
Survey/document	*	*	*	*
Access to land	*	*	*	
Integration with education	*	*	*	*
Extension and credit services	*	*	*	*
Establish partnerships	*	*	*	*
Food security targets	*	*		
Integrate with waste management	*	*		
Support the disadvantaged	*	*		
Environmental sustainability	*	*	*	*
Adopt policy		*	*	
Information services		*	*	*
Regulation		*	*	
Worker and public safety		*	*	
Enabling legislation			*	
Research			*	*
Tax relief, subsidy		*	*	
Model codes/standards			*	*
Enable public authorities			*	
Global and regional cooperation			*	*

Saclay Plateau, France: Development of Peri-Urban Policy

Saclay Plateau, located just nine miles from Paris, France, is a working model for the development of peri-urban policies. The Saclay Plateau has been threatened by urban sprawl due its proximity to Paris, despite the fact that it has been acknowledged as the most productive farmland in the Ile-de-France for the last 300 years. The plateau consists of approximately 5,000 hectares (~12,355 acres), of which 2,600 hectares are dedicated primarily to grain farming. Realizing the importance of agriculture to the region's economy and the need for green space in urban proximity, the Plateau de Saclay District Authority developed the Countryside Action Plan (CAP) in 1996 with the intent to maintain the plateau's identity as it evolves. While CAP does not prohibit urban development, it sets guidelines to which public and private

institutions must adhere, including the creation of green space networks and pathways, and the preservation of a modern and dynamic image of agriculture. CAP's inclusion of farmland as an alternative use for peri-urban zones has experienced success in maintaining a viable farming community. Farmers have adapted to the urban proximity by developing "U-pick" programs, and direct sales to urban residents. From comparative research of the Saclay Plateau with Sijoumi, Tunisia (a region without the planning foresight), Moez Bourami drew the following conclusions about developing peri-urban policy:

- Government can benefit by realizing the multifunctional character of urban and peri-urban agriculture
- Policy must move beyond rural-urban cohabitation
- The affected communities must be involved in the development of management rules

Havana, Cuba: Recovering from the Fall of Conventional Agriculture

The fall of the Soviet Bloc in 1989 to 1990 and increased sanctions by the United States had dramatic impacts on Cuba. Immediately, Cuba's oil supply plummeted by 53 percent (Fune 2002). The resulting economic crisis touched all aspects of Cuba, including its food supply. Not only was Cuba cut off from a large portion of its agricultural imports, but its own agricultural system, which had been similar to California's in terms of petroleum dependence, experienced a 70 percent decrease in the availability of fertilizers and pesticides, and a 50 percent decrease in the availability of fossil fuel-based energy. The challenge of feeding its population, 80 percent of which lives in urban areas, was eventually met largely due to urban agriculture and the government's prior investment in sustainable farming research. In 1990, the Cuban government instigated reforms which led to the development of the National Alternative Agricultural Model (NAAM). This model replaced high levels of agricultural inputs (such as synthetic fertilizers and pesticides) with local material and integrated pest management practices, restructured large state-owned farms into smaller co-operative farms, and allowed free-marketing of food stuff (Viljoen 2005).

BUILDING BLOCKS OF URBAN AGRICULTURE IN THE UNITED STATES

The wealth of financial and land resources in the United States has given urban agriculture a slightly different meaning than in many developing, or long developed, countries. In general, urban agriculture has been seen as a novelty in developed countries, as opposed to a necessity (Viljoen 2005). However, lessons from other continents, especially those whose programs respond directly to lack of food security, can offer insight for Americans who are beginning to fear a potential lack of food security and loss of farmland. Efforts to localize food systems, and thus to connect people more directly to their food source, are being initiated by a growing number of community organizations and municipalities. Through these efforts, replicable building blocks of urban agriculture have developed. These building blocks include programs that enhance the interface between urban and agricultural life, such as farmer's markets, partnerships, and agricultural parks, as well as programs that bring food production into the city, such as community and school gardens. As will be discussed below, when municipalities work to integrate these programs into city functions, there is a greater opportunity for program expansion and longevity.

Enhancing the Interface between Urban and Agricultural Lands

There are several changes farmers can make to improve their relationship to urban neighbors, from adapting Integrated Pest Management (IPM) practices that replace the need for pesticides, to muffling motors and restricting operation times of noisy farm equipment. However, the cost of implementing these changes can be prohibitive for some farmers. Fortunately, economic advantages of farming in proximity to urban areas can be realized by connecting directly to urban consumers. For this reason, most farms in urban areas are focused on

diverse, high-value crops (Sokolow 2001). Because of these potential rewards, many communities are finding that with proper design and programming, a mutually beneficial relationship between urban and agricultural lands can develop. Developing farmer-direct sales to urban dwellers and connecting urban dwellers to farmland are two techniques being used to improve this relationship.

Local farmers and urban consumers connect most often through direct marketing at farmers' markets, and by building partnerships with schools and restaurants. In the last 10 years, there has been a tremendous increase in farmers' markets, resulting largely from consumer desires for fresh, healthy food. New York City's Green Markets are an example of how farmer's markets – when supported by municipalities- can become better integrated into city fabric. The 40 Green Markets that are held each week in New York City are coordinated by Council on the Environment of New York (CENYC). Although CENYC is a privately funded non-profit organization, it receives some government support and is housed in the mayor's office. Through the Green Market program, New York City residents are connected to regional fishers, bakers and farmers – cumulatively farming 27,335 acres. The median travel distance between farmers and the markets is 90 miles, a small fraction of the typical 1,500 that food travels to reach the American plate. As an established network, Green Markets can offer a larger consumer base to farmers, distribute food resources and education throughout the city, and establish secure market sites. In addition, due to government support, the markets support food stamps and related programs.

While farmers markets provide local food to individual consumers, other programs have been established to connect larger institutions and/or restaurants with farmers. Farms to School is a national program with state branches that connect schools with local farms. The objectives of this program include improving student nutrition, establishing healthy eating habits for students, and supporting local farmers. The program is supported by a coalition of non-profit organizations, and is designed to provide resources to local organizers. Currently, over 400 school districts in 22 states participate in the program. In California alone, 9,000 schools participate.

A different approach to connecting urban dwellers with their food source is to bring the people to the farm. This has been achieved through agricultural tourism, or agri-tourism, which provides a direct revenue source for farmers, and an enjoyable often educational, experience for tourists. The San Francisco based organization, Sustainable Agriculture Education (SAGE), has developed a model for Urban Edge Agricultural Parks that integrates public parkland with working agricultural land. Agricultural parks have direct benefits for natural systems, farmers, and nearby communities, and can be carried out on public or private lands (SAGE 2007). Agricultural Parks offer many opportunities for municipal involvement, from public land allotments to shared infrastructure. The Sunlo Water Temple Agricultural Park is a SAGE project located in Alameda County within driving distance of San Francisco and is expected to open in the near future. Partners in this park include public participants, such as San Francisco Utilities Commission, community organizations, and private businesses. The park's vision, which is to bring agriculture, education, recreation and natural resource stewardship together, exemplifies the potential for Agricultural Parks to meet multiple private and municipal goals.

Farming the City: Programs that Bring Food Production into the City

Common building blocks of urban agriculture include school gardens, community gardens, and Community Supported Agriculture programs (CSAs). According to the non-profit organization California School Garden Network, school gardens can be used to enhance academic achievement, a healthy lifestyle, environmental stewardship, and community and social development. While school gardens are sometimes anomalies in a city, there are a number of California school districts that have integrated school gardens into nutrition and ecological education programs. By establishing city-

wide, or district-wide, school garden programs, not only do more students have the opportunity to learn and eat from the gardens, but resources can be shared and programs are more likely to continue as staff changes. Community gardens offer similar recreational, social, and educational benefits as school gardens. As with school gardens, community gardens can be stronger in number due to resource sharing and greater social/political support. Seattle, Washington, has developed a network of community gardens called the P-Patch program. The program is the result of a collaboration between Seattle's Department of Neighborhoods and the not for profit P-Patch Trust. Together, this public/non-profit team provides garden space in 44 Seattle neighborhoods, serving more than 4,600 residents. P-Patch gardeners enjoy homegrown produce and in addition donate seven to 10 tons of produce to local food banks each year. As part of the P-Patch policy, only organic gardening is allowed in gardens.

Overall Recommendations for Municipal Governments

In order to take full advantage of urban agriculture, *Growing Better Cities* recommends that cities start by asking what urban agriculture can do for them. One role of urban agriculture, for instance, is its potential to transform vacant space into productive space. Since little infrastructure is involved and urban agriculture can be compatible with almost any other land use, it can even be used as a transitional land use. Rooftop gardening and vertical gardening can require more infrastructure but can be highly beneficial to dense urban areas. In assessing their potential for productivity, cities should begin by conducting an inventory of vacant lots and other available space. In order to ensure longevity of gardens, however, gardens can be established on public park land or as part of a permanent urban agriculture zone.

DEVELOPING SUPPORTIVE MUNICIPAL POLICY WITH THE HELP OF FOOD POLICY COUNCILS

Although most urban areas do not have a specific policy for urban agriculture, policies that either assist or create barriers for urban agriculture programs are most often embedded in state and local programs and policies. These programs include: nutrition education programs within schools, Redevelopment Authority, Department of Human Services (Welfare, Employment, and Youth Bureaus), Area Agency on Aging, Public Health Department, and health codes. This range of programs is representative of the potential of benefits of urban agriculture- stretching from nutrition to job creation to transformative land use. Potential barriers of urban agriculture include health bylaws that prevent farmers' markets, bylaws restricting food from being grown in public parks, codes and covenants that encourage lawns and parking lots, and competition with real estate development for land tenure (Roseland, 2005).

In the late 1970s, a professor of urban planning at the University of Tennessee in Knoxville questioned why city governments had departments for water, housing, and health services, but not for food. Wilson saw the need for such departments in the inequity of food distribution, and the inability of many Americans to grow food, or even shop for food, in their neighborhoods. In 1982, Knoxville became the first city to have a food policy council. A food policy council is a group of stakeholders that examine the functioning of a local food system and advise governing bodies on related policies and actions. The Community Food Security Coalition reports that it was not until the last five years that Food Policy Councils gained momentum. Currently, there are approximately 50 councils in North America, 18 of which were authorized by government. Food Security Councils offer a framework for integrating food systems into municipal planning practices.

The Tahoma Food System, Established in 1997

Citizens, farmers, and government representatives in Tacoma, Washington, formed the Tahoma Food System (TFS), a not-for-profit organization. Concerns that led to the formation of TFS include the loss of local farmland and limited food access for low-income residents. TFS, though not officially designated as food policy council, has been noted by the Community Food Security Council for its successful work with the local government in relation to its community garden program. City departments support the community garden program by making Metro Park land available, providing soil amendments (from the Tacoma solid waste program), and providing plumbing and water (from the Tacoma Housing Authority). As an added benefit, these partnerships in city food systems have served as in-kind matches for several grants received by TFS. Due its strong relationship with the local government, TFS has received grants to assist the city plan for garden space (Biehler).

Portland/ Multnomah Food Security Council

The Portland/Multnomah Food Security Council is a citizen-based advisory council to the City of Portland and County of Multnomah. The council's vision is for all residents of the city and county to "have access to a wide variety of nutritious, affordable food, grown locally and sustainably." Amongst the governing principles established for the council are the beliefs that food security contributes to resident health and therefore reduces need for medical care and social services, and that a healthy regional food system supports sustainability goals of the city and county. Through its work with Portland Office of Sustainable Development, the council has been a major contributor to the Diggable Cities Report, which will direct land use policy in relation to urban agriculture.

Diggable Cities: Making Urban Agriculture a Planning Priority, was developed between 2004 and 2005 by students in the Master of Urban Planning program at Portland State University, in response to Portland City Council's resolution to inventory city-owned lands suitable for agricultural uses. Since the completion of the report, the Food Policy Council has been advising the City Council. In February 2006, Food Policy made recommendations to the City Council that the city should identify suitable land for urban agriculture, establish pilot projects, and explore policy changes to remove barriers to urban agriculture. The Food Policy Council will continue to work closely with city and county governments, and with community groups, to fulfill these recommendations. The Portland/Multnomah Food Security Council is an example of successful collaboration of citizen groups and government to address food security through proactive policy and land use (Rhoads et al. 2006).

CONCLUSION

To attain sustainability "we must thoroughly understand the problem of production and begin to see the possibility of evolving a new life-style, with new methods of production and new patterns of consumption: a life-style designed for permanence."
~ E.F. Shumacher

The current food system in the United States is eroding the systems upon which it depends, and thus is failing to provide food security and opportunities for healthy living to the American people. Urban Agriculture is critical component of an emerging new food system that contributes to the health of humans, their communities, and ecological systems. As demonstrated through programs around the world, urban agriculture can be a solution to many of the challenges urban regions face, from waste buildup, to social equity. While most urban areas may never be entirely self-reliant for food supplies, integrating elements of urban agriculture into cities improves local food security and can address degraded natural systems.

Community organizations in the United States have piloted a wide range of tools for urban agriculture. Now it is time for municipal governments to develop policies that will integrate urban agriculture as an enduring element of the city.

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APPENDIX E: THE 606 STUDIO PROFILES

PROFESSORS

Joan Hirschman Woodward, *FASLA*, is Professor and Graduate Coordinator in the Department of Landscape Architecture at California State Polytechnic University, Pomona. She is the author of Waterstained Landscapes: Seeing and Shaping Regionally Distinctive Landscapes (2000, Johns Hopkins University Press) and her work on landscape design with pattern and processes has appeared in Ecology of Greenways (Smith and Hellmund, 1993), Ecological Planning and Design (Thompson and Steiner 1997), and Ecology and Design (Johnson and Hill 2002) Her recent research focus regards designing resilient landscapes in the face of probable disruption.

Ken McCown, *ASLA*, possesses degrees in architecture and landscape architecture. He uses his interdisciplinary background to produce design work for historic landscapes, urban design, design competitions and water infrastructure. He has worked on the Taj Mahal National Park, the United States Military Academy Historic Master Plan and the El Chorrillo and Casco Viejo areas in Panama City, Panama and several award winning competition designs. He has taught interdisciplinary courses in Panama, Brazil and America in urban design and landscape analysis. Ken McCown is the Resident Director and Fellow of the Richard and Dion Neutra VDL Research House II.

Phil Pregill is Department Chair and Director of Cal Poly Pomona's Landscape Architecture in Italy program, in addition to teaching design, history, construction, and graphics in both the graduate and undergraduate programs. He is co-author of Landscape History, and is currently conducting research on abstraction in the design process. Phil is also an accomplished painter, and his works have appeared in numerous juried competitions. He received his BA and his MLA from the University of Oregon.

Doug Delgado teaches advanced landscape planning in the Master of Landscape Architecture program at California State Polytechnic University, Pomona. As a graduate student he co-authored a widely circulated and often cited 606 project, "Reconnecting the San Gabriel Valley." Professionally, he has been actively involved in watershed planning throughout Los Angeles County, especially the San Gabriel River Watershed. His past works include the master plan and landscape design for the Rio Hondo and San Gabriel River Spreading Grounds and the open space plan for the San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy. He has also participated on the steering committees of the San Gabriel River Master Plan and the Ballona Creek Watershed Task Force and has been a frequent speaker at planning venues throughout the region. He received his Bachelor of Arts degree in economics from the University of California, San Diego, his Juris Doctorate degree from George Washington University and his Master of Landscape Architecture degree from California State Polytechnic University, Pomona.

STUDENTS

Yarnie Chen received her undergraduate degree in Environmental Sciences from the University of California, Berkeley and has worked in environmental law preparing environmental documents and reports for numerous years. Since beginning the graduate program in Landscape Architecture at California Polytechnic University, her interests in urban environments have led her to gain various professional experience and wide-ranging skills. She has assisted urban designers and planners at Calthorpe and Associates producing design guidelines and planning for livable communities. She has worked with the Watershed and Coastal Resources Division in the County of Orange developing green infrastructure design guidelines for use by developers and municipalities in urban renewal projects that encourage conversion of traditional infrastructure to multi-objective use. Yarnie's passion is in creating livable and walkable communities, primarily focusing on mobility and function of spaces. She believes that to create vibrant communities for human interaction, innovative solutions for neighborhood and community revitalization is needed, creating a "sense of place" that are not only functional and attractive to users, but also make experiences memorable.

Matt Deines received a Bachelor of Science degree in Natural Sciences/Mathematics from the University of Wyoming. Matt's interest in environmental design was cultivated while working as an Instructor with the National Outdoor Leadership School. Matt spent seven years leading expeditions

teaching wilderness travel, leadership development, and natural history in Alaska, Utah, and Wyoming. Matt has most recently worked for Gillespie, Moody, Patterson Inc. in San Diego working on a variety of large scale projects in California and Arizona. Since moving to the Los Angeles region Matt's interests have expanded from wilderness protection to include urban design, neighborhood redevelopment, and sustainable and healthy communities.

Henry Fleischmann is currently pursuing a Master of Landscape Architecture degree at California State Polytechnic University, Pomona. He received a Bachelor of Arts degree in Economics from the University of California at Santa Cruz. Henry has been working in the field of Landscape Architecture since 2003 as a Landscape Designer for the design build firm, Phil May Landscape Architect. He currently works for Claremont Environmental Design Group, a design firm focused on green development. In addition, Henry has experience working in many areas of construction. His interests include urban design, social equity through landscape, community development, and cultural influences on the built environment.

Sonya Reed has a Master of Landscape Architecture degree from California State Polytechnic University, Pomona. She has a background in fine arts, holds a Bachelor of Arts degree in English Literature, and has completed extensive coursework in Gardening and Horticulture at UCLA Extension. Before settling in Los Angeles for the past eight years, Sonya worked, studied, and traveled throughout the United States and abroad, inspiring her interest in contextual site design. Other professional interests include urban adaptive reuse and revitalization, socio-environmental design, and the design of interactive and dynamic landscapes. In addition to independent landscape design work, Sonya has worked for several landscape and architecture firms in Los Angeles, including ahbe Landscape Architects, Marmol Radziner & Associates, and Melinda Taylor Garden Design. She is currently employed at Mia Lehrer and Associates.

Elizabeth (Isby) Swick received her Bachelors of Science in Natural Resources Interpretation and Planning with a minor in Studio Art from Humboldt State University in 2001. Elizabeth has worked in multiple capacities within the environmental field, including as a restoration coordinator, as a volunteer and outreach coordinator, and as an environmental educator with Marin and Los Angeles Counties. Since beginning her studies at Cal Poly Pomona, Elizabeth has worked with Amigos de los Rios in El Monte, CA in park design, community development, and education, and also with the Claremont Environmental Design Group on a range of projects focused on sustainable design. Elizabeth's studies focus on the edible landscape, ecological design, and community building. Weaving her background in art, ecology, and education into the field of Landscape Architecture, Elizabeth works to promote landscape literacy through revealing design and community involvement.

The availability of cheap oil and the rapid population increases of the past century largely determined the form and function of cities. The resulting growth patterns have deteriorated natural ecosystems, decreased human health, increased global warming, and reduced social capital. The peak in global oil production, or 'Peak Oil,' will necessitate a change in these growth patterns and in community function.

There are three methods for post-Peak Oil planning. The first method, *resource competition*, is an attempt to continue current energy and resource consumption rates, and will lead to increasingly aggressive competition and severe inequalities in resource distribution. The second method, *reliance on technological solutions*, focuses on alternative energy sources. Given the increasing cost of infrastructure and limitations of technology and energy forms, alternative energy sources will not provide adequate supply. This Vision Plan describes a post-Peak Oil plan for the City of San Buenaventura that identifies and develops the third method for addressing Peak Oil: *decreasing energy consumption through community design and planning*. This approach requires the localization of resources and transformation of urban environments, and provides an enhanced quality of life.