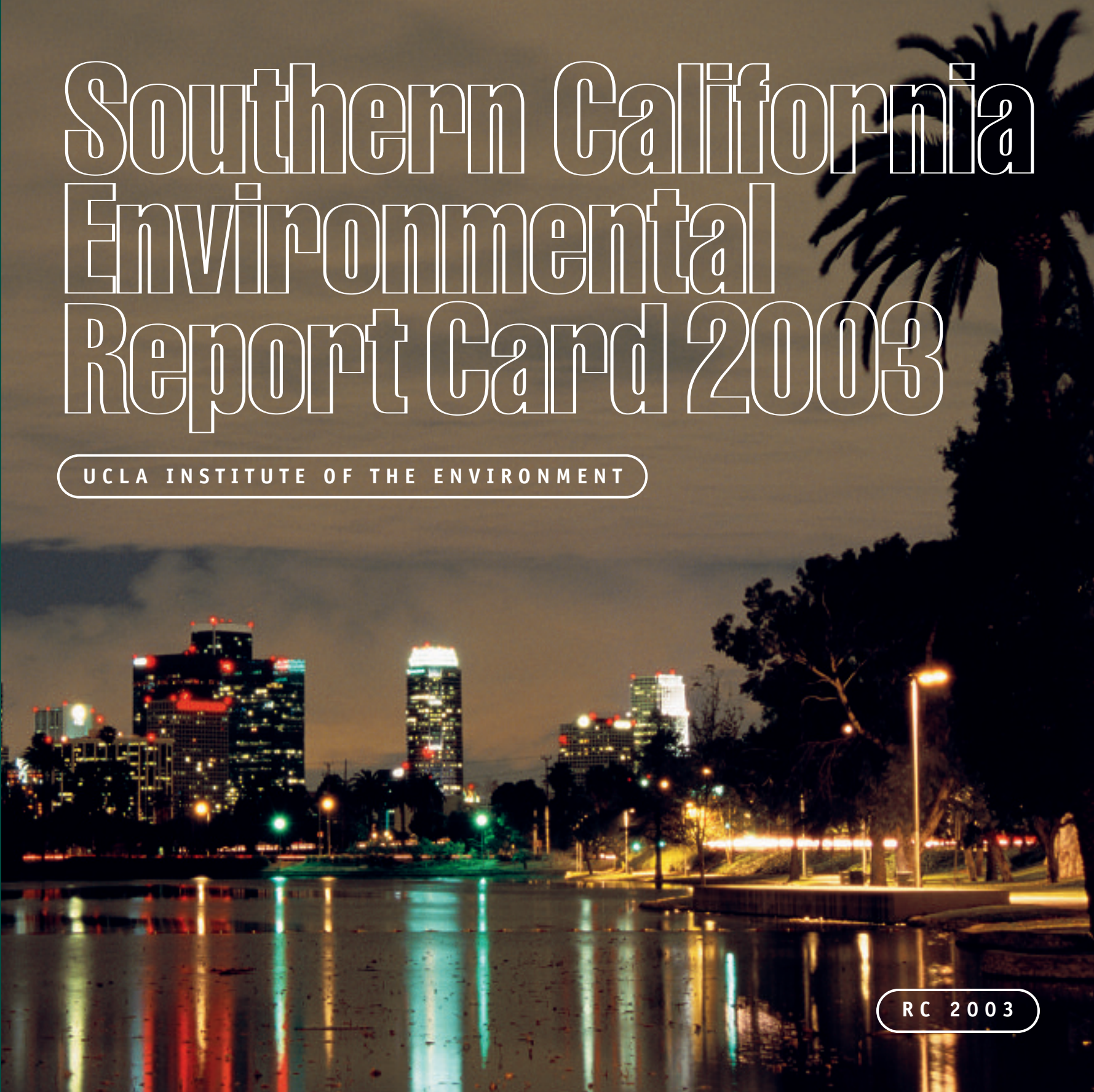
Southern California Environmental Report Card 2003

UCLA INSTITUTE OF THE ENVIRONMENT



RC 2003

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From the Editors

The 2003 Sixth Annual Southern California Environmental Report Card, sponsored by the UCLA Institute of the Environment and written by an interdisciplinary group of nationally recognized UCLA scholars, examines four key environmental issues of special import to the region. This year's Report Card grades the efforts of public agencies to address Invasive Species, Marine Conservation, Smart Growth, and Air Quality.

Since its inception in 1998, our Report Cards have addressed twenty-four environmental topics of crucial importance to Southern Californians. We've graded the region's approaches to issues ranging from air pollution to storm water pollution to greenhouse gas emissions to environmental justice. This year we re-examine one of Southern California's most notorious environmental problems, air pollution. We do so in part because an article by Arthur Winer in the 1998 Report Card forecast that clean-air progress in southern California would stall and begin to reverse in this decade. Unfortunately, as the present article by Suzanne Paulson shows, the 1998 RC forecast appears to be proving accurate. In fact, many of the articles in IoE's Report Cards of the past six years have contained forecasts of the consequences for regional environmental health of inaction or of effective policies, and we consider these forecasts to be one of the most important values of this publication.

We have several other goals in issuing an annual report card as well. UCLA has a broad range of faculty with environmental expertise in relevant disciplines including medicine, law, public health, geography, biology, public policy, engineering and economics. The Report Card allows us to bring this multidisciplinary expertise to bear on key environmental issues in an objective, careful fashion. We also strive to make our expertise available in a way that is accessible to the general public and that will provoke careful, reasoned consideration by policy makers and public officials responsible for the stewardship of our environment. Finally, we hope to stimulate public debate about the importance of strong, scientifically-based environmental policies in order to safeguard our precious natural and physical environment.

We believe the region cannot solve complex environmental problems with simplistic, back-of-the-envelope solutions. Instead, bringing together experts from multiple disciplines to find effective solutions based on the best science, economics and public policy available is our best hope for tackling thorny environmental problems. We hope the 2003 Report Card is one step forward in the region's efforts to protect and enhance Southern California's environment.

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Editors
Southern California
Environmental Report Card

From the Director

NEW ACTIVITIES LAUNCHED

The fundamental mission of UCLA's Institute of the Environment (IoE) is to build the knowledge that will lead to effective solutions of pressing environmental problems. To meet this challenge, the Institute's programs are highly integrative, reflecting a wide range of campus interests in natural and urban environments. Indeed, the IoE's overall program represents an emerging field of interdisciplinary environmental analysis and assessment. To sustain this new enterprise, a multidisciplinary training program, and a reliable foundation of financial support, are required. To meet these needs, the IoE is launching a new interdisciplinary graduate degree program, and is embarking on a major fundraising campaign, to assure the future of core Institute activities such as this Report Card.

The IoE has designed a new doctoral program leading to a Ph.D. in *Environmental Systems and Analysis*. The degree emphasizes relationships that link physical and biological factors to social influences and impacts. A plan to implement the program was submitted to the UCLA Academic Senate this past summer. The goal is to train environmental experts with much broader understanding of environmental issues than graduates of more traditional disciplinary departments. Among the hallmarks of the program is an interdisciplinary core curriculum, which surveys techniques and methodologies employed by specialists in related fields, and offers seminars on current research findings and frontiers. Entering students also participate in a multidisciplinary project under the supervision of a cross-disciplinary faculty team. The Institute has commitments from more than fifty faculty from across the campus to support the program, making it the most diverse educational activity at UCLA.

The Institute recognizes the importance of attracting excellent graduate students through fellowships and awards, of fostering independent research that breaches academic barriers, and of engaging community leaders in the design of effective regional and international policies. A reliable long-term resource base for such efforts should be built upon endowments. Indeed, support from the community is a necessity at a time of shrinking state budgets for higher education. The IoE has therefore launched a focused fundraising effort under the leadership of a new Director of Development and External Affairs, Sarah Burns. The aim is to bring together concerned citizens to promote the Institute's environmental programs. A number of "friends of the environment" are already collaborating with the Institute through a series of *Eco Salons*, at which IoE supporters and faculty explore pressing local and global issues. The first *Eco Salon*, for example, emphasized the complex nature of species conservation and biodiversity, highlighting creative research sponsored by the Institute. We believe the IoE's mission is so important and compelling that our ventures in environmental education, research and outreach will soon be propelled forward by a powerful core of active local supporters.

Richard P. Turco, Ph.D.
Director
UCLA Institute of the Environment

GRADE D

Invasive Species

by Philip W. Rundel, Ph.D.

Department of Organismic Biology, Ecology and Evolution

INVASIVE SPECIES AS A GLOBAL PROBLEM

There is international recognition in the scientific community that invasive species represent perhaps the single most significant global ecological problem for the 21st century. Invasions of certain alien species threaten the sustainable use of, and access to, natural resources, biodiversity, and human health and welfare. Moreover, current projections suggest the pace of harmful invasions by plants, animals and microbes continue around the world today at an accelerated rate with massive economic costs to society. This can be readily illustrated by a few examples.

The introduction of rabbits to Australia can be traced back to a single man, Thomas Austin, who imported 24 European rabbits from England in 1859 and released them on his property in Southern Victoria. Mr. Austin hoped to provide his gentlemen friends with sport hunting, and in this he was spectacularly successful. Just seven years later it was reported that his friends had shot more than 14,000 rabbits on his property alone. It was at this time that Australians began to realize the significance of the expression, "Breeding like rabbits." Despite complaints from farmers about damage to their crops, sportsmen actively expanded the range of rabbits by deliberate releases, leading to a rabbit advance across Australia that has been called the "gray blanket." By the early 20th century rabbits had spread to all parts of the country, the fastest spread of any colonizing mammal known in the world. At their peak of population numbers around 1950, Australia was estimated to be home to more than a billion rabbits. The grazing pressure on the landscape of this rabbit population is equivalent to that of 60 million sheep. Beyond massive destruction of native vegetation, competitive pressures from rabbits led to the extinction of many native Australian vertebrates. Even today with large programs of biological control of rabbit populations, the direct economic damage from rabbits is estimated to exceed $110 million annually.

A shipload of nursery stock arrived in New York City from Asia around 1900, one of many such deliveries. This one, however, accidentally introduced a fungus called chestnut blight. At that time the American chestnut was one of the most common and tallest trees in our eastern hardwood forest. Much as the Native Americans had no natural defenses against smallpox, the American chestnut was highly susceptible to infections caused by this Asian fungus. Spread by birds and mammals, wind and rain, chestnut blight quickly invaded chestnut trees from Maine to Georgia. By 1940, more than 3.5 billion American chestnut trees had perished from these infections and this species was functionally eliminated from the forests where it had once been so common.

Sometime in 1979 or 1980 a cargo ship left the east coast of the United States bound for a Russian port on the Black Sea. As common practice at that time, this ship took on ballast water from the coastal seas off the U.S coast before proceeding on its three-week voyage. On its arrival at its Black Sea destination the ship unloaded its cargo and pumped out its ballast tanks. Two years later a Russian oceanographer collecting routine samples of plankton in the Black Sea captured a two-inch comb jellyfish that was unknown to him. Careful museum study back in Moscow identified this "new" organism as an American ctenophore (*Mnemiopsis leidyi*), a common species along the Atlantic Coast from New England to Brazil. By 1988 this small jellyfish had reproduced in enormous numbers and spread throughout the Black Sea. Maturing in just two weeks, a single individual can produce 8000 offspring. In November 1999, it appeared in the Caspian Sea for the first time and by the following

Oak savannas have been dramatically impacted by invasive annual grasses.

summer had multiplied such that enormous populations were present. Now termed the "Caspian Sea monster," with populations reaching hundreds of jellyfish per cubic meter of water, these zooplankton feeders quickly harvested all of the available food resources used by small anchovy fish called kilka. The result has been that populations of kilka, a key indigenous food resource in northern Iran and surrounding areas, have now crashed to less than a tenth of their former levels. The sturgeon that feed on these kilka are also impacted, threatening the caviar industry.

WHAT ARE INVASIVE SPECIES?

In discussing invasive plants and animals, it is important to define a few key terms. An **alien species** is a plant or animal whose presence in a region is due not to natural causes but rather to either intentional or accidental introduction as a result of human activities. Other terms for these are **exotic**, **non-native**, or **non-indigenous species**. A **naturalized species** is a plant or animal that is introduced to a new area and is able to successfully reproduce and sustain its populations over multiple life cycles without direct intervention by humans. This reproduction by naturalized species is often adjacent to parent plants or animals and does not necessarily involve any colonization of new areas of disturbed or natural ecosystems. Finally, an **invasive species** is a plant or animal that is able to produce offspring that successfully colonize areas at considerable distances away from the parents. These offspring are often produced in large numbers and thus have the potential to spread over an extensive area.

Most of the plants in our gardens as well as our furry, feathered, and scaled pets are introduced alien species. Human have deliberately, or unintentionally, brought these into our gardens, homes, or agricultural areas. Most of these species only survive because we cultivate, feed, water, or otherwise care for them, but reproductive barriers keep them from living on their own. One out of about ten of these species, however, readily adapts to our environment and is able to survive quite nicely without human care. These are the species such as house mice and roof rats or garden plants from other mediterranean-climate regions that break through this reproductive barrier and become naturalized around human dwellings or disturbed sites. Of these naturalized species, another one in ten (or about 1% of the introduced

Our natural environments have been dramatically and significantly affected by invasive species.

Giant reed (*Arundo donax*) is an aggressive invader of stream habitats.

species), based on past experience, can be expected to become invasive. They break through a dispersal barrier and are able to establish themselves at considerable distances from their parents in disturbed or natural ecosystems.

The invasion potential of alien species is not always easily predictable. Rapid maturity to reproductive age, production of large numbers of seeds or vegetative propagules, and effective seed dispersal are common but not universal attributes of invasive species. Moreover, many naturalized species with little or no expansion of their range for many years, appear to suddenly become invasive after a long lag phase. These lags in the development of invasiveness may be due to genetic changes in populations of invasive species or because of the newly added presence of a critical pollinator, seed dispersal agent, or symbiont. Thus, caution is always important in making predictions about potential invaders.

SOUTHERN CALIFORNIA AND INVASIVE SPECIES

Although Southern California has to date largely been spared the horror stories of invasions such as those by rabbits in Australia or Dutch elm disease in the eastern United States, our natural environments have been dramatically and significantly affected by invasive species. Nearly 30% of all of the plant species in the Santa Monica Mountains, for example, are naturalized aliens. The great majority of these have ranges largely restricted to disturbed sites in wasteplaces or along roads and trails. Familiar examples of these are wild mustard and castor bean. Many of our riparian habitats and oak woodlands and grasslands, however, have been dramatically transformed by invasives.

Early European settlers in California brought with them a large bamboo-like grass called giant reed (*Arundo donax*) to stabilize eroding streambanks. Giant reed proved spectacularly successful at this role, forming immense thickets 20-30 feet in height that tenaciously held the soil. However, sections of stems and roots easily fragmented and were carried downstream by floods where they showed equal success in colonizing wherever they came to rest. The result has been the establishment and growth of dense stands of giant reed along many lowland rivers throughout California. The basin of the Santa Ana River in Southern California, for example, now holds more than 10,000 acres dominated by giant reed. These massive stands exacerbate flood problems by choking stream channels, create fire hazards in stream habitats otherwise relatively free of flammable tissues, and destroy native riparian habitat for rare and endangered species of birds and other wildlife. Moreover, billions

The South African ice plant *Malephora crocea*, forms dense masses along the coastal bluffs of Anacapa and other Channel Islands, choking out native species.

Many invasive species, new to Southern California, present potentially serious ecological and economic threats.

of gallons of water are lost in Southern California each year from transpiration by the masses of giant reed choking many of our rivers and streams.

Our perennial streams in Southern California are now widely populated not only by invasive plants, but by invasive crayfish, mosquito fish, large-mouthed bass, and a variety of other deliberate and unintentional animal introductions. Where present, these species have dramatically negative effects on populations of native amphibians such as salamanders and frogs. A major aspect of the decline of the California newt and red-legged frog in Southern California has been predation by these invasive stream animals.

The oak woodlands and grasslands of California contain a matrix of annual grasses and broad-leaved herbs that are native to the Mediterranean Basin of Europe. More than 99.9% of the biomass of grasses in these habitats today are alien species. These aliens evolved over thousands of years as agricultural weeds adapted to the agricultural practices in the earliest human civilizations of the Middle East. We have only a poor idea how these grasses and other annuals came to California but they likely arrived with the earliest European settlers in animal feed or as seeds in the fur of sheep or cattle. Although their invasion was unintentional, these annuals rapidly spread to replace the native perennials in our California grasslands and transform their environment. Much of the problem of poor reproduction by valley and blue oaks in California over the last century has been caused by the manner in which these alien grasses are able to outcompete first-year oak seedlings for soil moisture.

Yellow star thistle (*Centaurea solstitiales*) is a weedy member of the thistle family that stands up to three feet tall and is armed with needle-sharp spines. As an aggressive invader of California grasslands with stems as tough as rawhide cord, star thistle tangles mowers and other farm equipment, and prevents cows and other grazing animals from feeding on associated grasses. Beyond the severe economic problems it causes to rangelands, the biggest reason to hate this plant comes from the experience of trying to walk through a field of yellow star thistle. As anyone can attest who has ever had the displeasure of feeling these spines penetrate thick pants and shoes, "It really hurts!" From its humble beginnings in central California in the middle of the 19th century, yellow star thistle has expanded today to dominate more than 8 million acres in the northern and central parts of our state. Now, in just the past few years, it has relentlessly advanced into Southern California.

The list of other aggressive plant invaders in Southern California is a long one. These include such deliberate introductions as wild tree tobacco and Spanish broom, once widely planted to revegetate road cuts, and ice plant, once widely planted to stabilize coastal

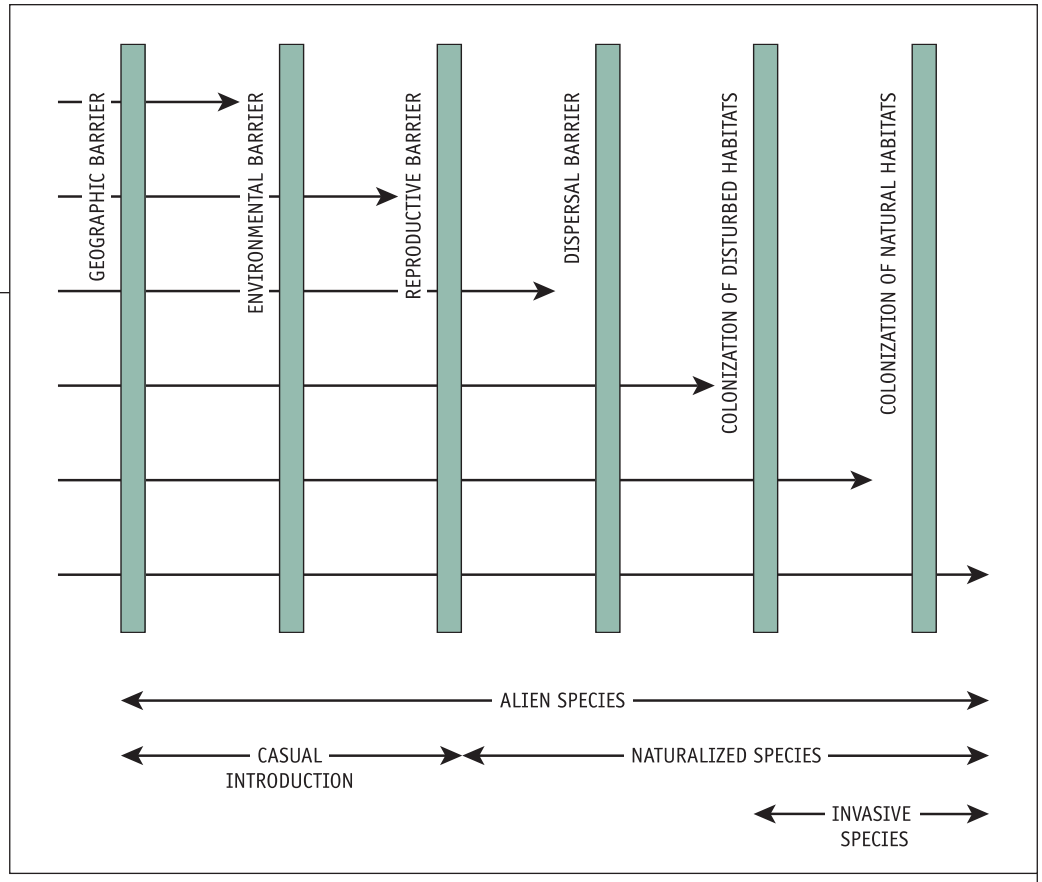


Figure 1: A small but significant number of introduced plants and animals are able to pass through reproductive and dispersal barriers to become invasive species.

dunes. All of these have expanded their range into native plant habitats.

An attractive and fast-growing green alga, *Caulerpa taxifolia*, was introduced to the saltwater aquarium trade in the late 1970s. Although native to warm tropical waters, strains of *Caulerpa* had been selected in Europe to tolerate cooler aquarium temperatures. Sometime around 1984 this alga was inadvertently released into the waters of the Mediterranean Sea near Monaco. This original introduction likely resulted from the simple act of flushing aquarium water down an open sewer into the sea. From a single small patch that grew to 2 acres in size by 1989, *Caulerpa* expanded its range such that by 1997 it had blanketed more than 11,000 acres of the northern Mediterranean coastline. Dubbed the "killer algae," it continues a relentless advance across the Mediterranean Sea today, causing ecological and economic devastation as it chokes out native species of algae and invertebrates with costly impacts on recreational diving and commercial fishing. Just three years ago populations of *Caulerpa*, genetically identical to the Mediterranean strain, appeared in a coastal lagoon at Carlsbad in San Diego and soon after in Huntington Harbor in Orange County. Millions of dollars are now being spent on eradication efforts at these sites.

Many other invasive species, new to Southern California, present potentially serious ecological and economic threats. The red imported fire ant, native to South America, has long been an unwelcome invader in the Southeastern United States where they are estimated to have economic costs in the hundreds of millions of dollars annually. This impact comes from direct harm to crops, damage to electrical equipment and irrigation lines, and medical and veterinary expenses involved with treating the fiery stings of this aggressive ant. Fire ant colonies were first discovered in the San Joaquin Valley of California in 1997, and have since appeared in Orange, Riverside, and Los Angeles Counties. Although these initial colonies have been destroyed, it is estimated that programs to continue the eradication of future invasions of these ants will cost tens of millions of dollars annually and may in the end be unsuccessful.

The fungal pathogen causing sudden oak death has recently become established in northern and central California where it has

Caulerpa taxifolia, the killer algae, is beginning to invade our coastal waters.

Developing aggressive control programs for invasive species requires a variety of measures, ranging from monitoring to aggressive eradication programs.

been responsible for the widespread death of native oaks. It has not yet appeared in Southern California but it may only be a matter of time until infections are unintentionally transported to our region through nursery stock or firewood from infected trees. New invasions of plants, animals and pathogens can be expected to continue in the future.

GOVERNMENT AND PUBLIC POLICIES

The international crisis of invasive alien species is beginning to be addressed by a number of multinational agreements such as the Convention on Biological Diversity, the Ramsar Convention for the protection of wetlands, the Convention on the Law of the Sea, the International Plant Protection Convention, and the General Agreement on Tariffs and Trade (GATT). This is a good start but much more needs to be done to convince international agencies that controlling invasive species is in the self-interest of all countries and individuals, and is a prerequisite for a satisfactory quality of life for everyone.

After years of relatively passive concern about the dangers of invasive species, both U.S. federal and state agencies are beginning to take this problem seriously. There exist a variety of federal laws and regulations related to noxious weeds, pest animals, aquatic invasives, and ballast water management, many of these dating back decades http://www.invasivespecies.gov/laws/main.shtml. California laws and regulations related to invasive species are largely included in the California Fish and Game, Food and Agriculture, Harbors and Navigation, and Public Resources Codes http://www.invasivespecies.gov/laws/state/ca.shtml.

Much more needs to be done at all levels, however. While the State of California, for example, has taken the welcome step of declaring a list of highly invasive plant species that may not be sold in the state, forceful political lobbying by the nursery industry has kept problem species from being listed as they should. Although pet shops have become increasingly educated to issues of invasive animals, many still carry a number of vertebrates that have potential for becoming naturalized in Southern California.

A much more aggressive approach at controlling invasive species has been adopted in South Africa. There, laws patterned after regulations on hazardous wastes place an economic responsibility on property owners to control invasive plant species on their lands. Any species on a priority list of aliens must be eradicated at the owner's expense. There are two additional categories covering respectively commercially significant but potentially invasive plants, and ornamental invasive plants. The former group can be grown only by permit, with the permittee accepting full responsibility for control should they invade beyond the subject property. The ornamental species of declared invasives are allowed in existing gardens but may no longer be propagated, planted, or sold. Again, the landowner of existing plantings is responsible for preventing spread of the species. The California Exotic Pest Plant

Well-meaning but ill-informed public groups have greatly complicated control policies by litigating removal plans for invasive species out of misplaced concerns.

Council (CalEPPC) is now working to establish a similar series of categories for invasive plants in our state, but this listing has no regulatory status. The CalEPPC web site contains links to extensive information on invasive plant species http://caleppc.org/.

Developing aggressive control programs for invasive species requires a variety of measures. For existing invasive species, a triage approach is necessary to separate three categories of problems. One group, as exemplified by the alien annual grasses, is so entrenched that there is little likelihood of control. At the other extreme are naturalized species not yet showing any indications of invading natural communities or rapidly expanding their ranges. Regular monitoring of these species may be justified over active control efforts. The most significant groups in the triage are those species beginning to invade aggressively but where mechanical, chemical, or biological control is possible. The invasions of giant reed along our riparian streams and new invasions of the algae *Caulerpa* along the Southern California coast fall into this category where active control is still possible and critically important.

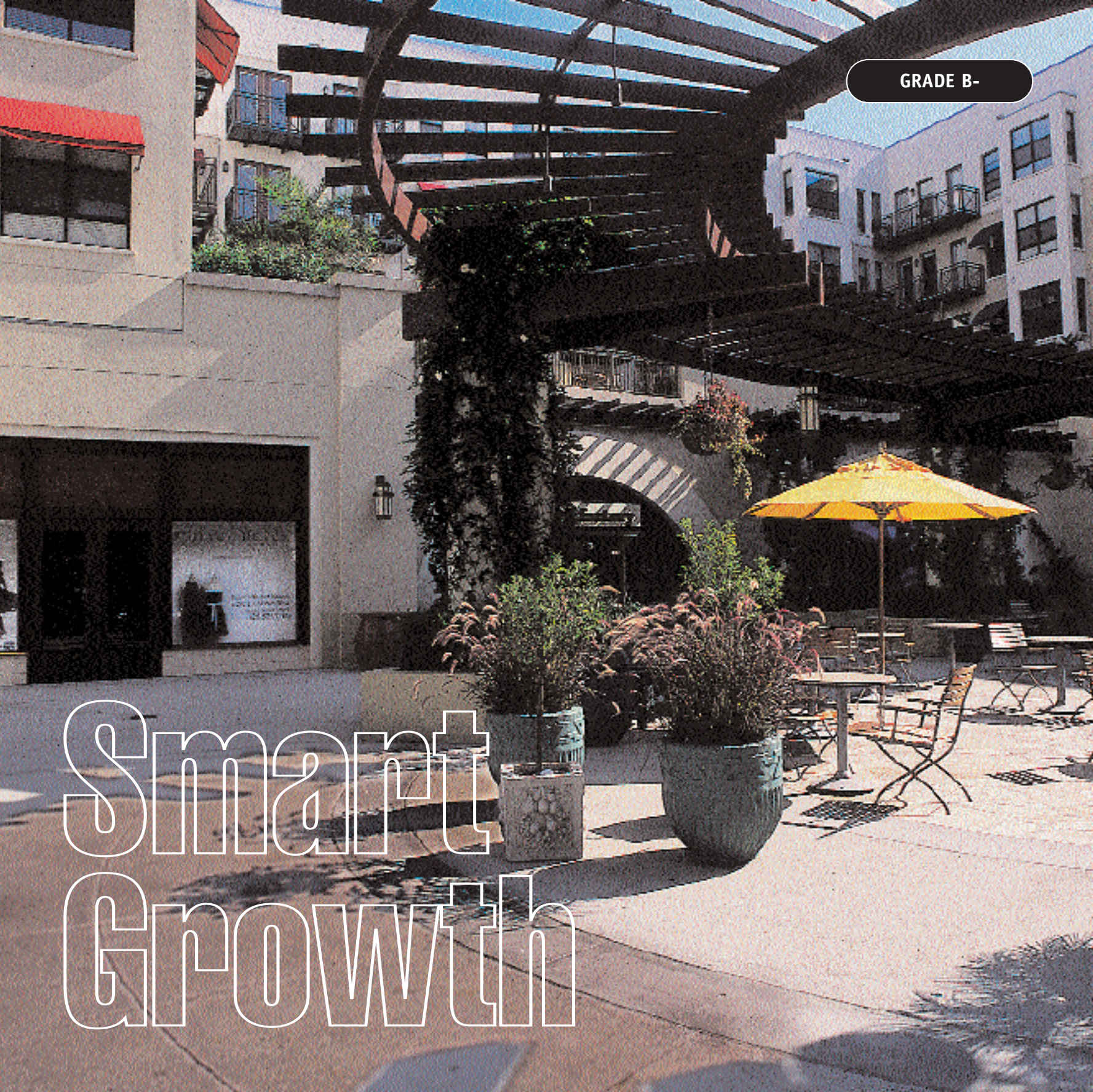
OVERVIEW: A GRADE FOR SOUTHERN CALIFORNIA

Despite a slowly increasing awareness by the public of the potential ecological and economic impacts of invasive species in Southern California, there has been relatively little pressure on government agencies to take effective action. Even when federal, state, and local agencies have initiated control programs, taking action has often been difficult. Well-meaning but ill-informed public groups have greatly complicated control policies by litigating removal plans for invasive species out of misplaced concerns for animal welfare or use of non-toxic chemicals. Political pressure from these groups delays government actions and contributes to a continuing cascade of ecological damage and economic cost.

GRADE

A **Grade of D**, or barely passing, is given to Southern California for controlling existing invasive species and the prevention of new invasions.

Philip Rundel is professor of Biology in the Department of Organismic Biology, Ecology and Evolution at UCLA and manager of the UCLA Stunt Ranch Reserve, a field station for education and research in the Santa Monica Mountains. He has been a faculty member at the University of California since completing his Ph.D. degree at Duke University in 1969. His research centers on the ecophysiological adaptations of plants and plant communities to environmental stress, particularly in the five Mediterranean climate regions of the world. This research has involved active field studies in chaparral, oak woodlands and warm desert regions of California, as well as in comparable areas of Mediterranean-type shrublands in central Chile and the Cape Region of South Africa. Dr. Rundel has become increasingly involved in programs related to the ecology, biodiversity, and conservation biology of tropical regions around the world. His ecological field studies have been carried out in Costa Rica, Panama, Brazil, Zimbabwe, Thailand, Cambodia, and the high Altiplano region of the Andes in Peru and northern Chile. He has worked in recent years with WWF on issues of conservation priorities for Cambodia, Laos and Vietnam.



GRADE B-

Smart Growth

by Jonathan Zasloff, J.D., Ph.D.

Professor of Law, UCLA School of Law

Southern California will soon find itself slammed between two competing yet equally pressing public policy dilemmas. On the one hand, development is quickly consuming the region's remaining open space, not only depriving residents of precious recreational opportunities, but also snarling traffic and degrading air quality. By the year 2020, if present trends continue, southern Californians will drive 50% more miles in 5 million more automobiles. Average peak-hour traffic speeds on the region's freeways, now roughly 37 mph, will slow to just over 19 mph. Meanwhile, although recent bond issues have helped ameliorate the situation, the Los Angeles region remains one of the nation's lowest in per capita availability of open space.

Yet the traditional response of the environmental movement—slower growth and fighting development—is the reaction of the ostrich. In the next two decades, southern California will add the population equivalent of two cities the size of Chicago, mostly due to natural increase and migration from other areas of the United States. It is no answer just to tell them not to come or not to be born. They will arrive in a region already plagued by an acute housing shortage: in 1998 the average Southern California household spent 37% of pre-tax wages on housing—one of the highest figures in the nation. The regional home ownership rate (49 percent) is lower than any U.S. metro area except New York and well below California and U.S. averages. Less than a quarter of households in southern California are able to purchase a median-priced home. In lower-income areas, affordability problems are even more severe. Simply blocking development in this environment is not only wildly unrealistic, but threatens to divide the region even more deeply by class and race.

In an effort to square the circle, planners and policy thinkers have developed the idea of "Smart Growth," which seeks to achieve the benefits of growth in a way that preserves environmental values. While Smart Growth comprises a wide variety of policies, in general its advocates seek to promote more compact development, closer to urban centers, and to concentrate housing close to transit nodes. These principles, they believe, will carry three primary environmental benefits:

1. Reduce dependence on the automobile, with obvious benefits in terms of air quality, energy consumption, and traffic congestion. Greater housing density serves as a central pillar of the Smart Growth philosophy because it is necessary to make public transit economically viable.
2. Allow for open space preservation. Instead of building new suburbs at greater distances from the city, Smart Growth seeks to preserve these "greenfield" areas, potentially saving hundreds of thousands of acres of critical habitat and wildlife corridors.
3. Promote more environmentally sensitive design. Multifamily units, for example, use less energy per capita than single-family detached residences.

Smart Growth's overall idea, then, is to promote environmental sustainability while planning effectively for inevitable population expansion. Appropriately tailored Smart Growth measures appear to be part of the solution for the twin threats described above. How has the City of Los Angeles[1] responded?

"Smart growth development" refers to a small but very important slice of the Smart Growth puzzle: land-use controls over housing. The private sector constructs and markets the vast majority of units available for purchase and rental. Developers cannot build, however, unless local land use regulations allow them to do so. Municipal governments and other local land use authorities have routinely used these regulations to block development, particularly multifamily structures and affordable housing. This policy often derives from crude

The Grove shopping center with Park La Brea and apartment complexes in the background, a recent example of mixed use development.

racism and classicism, i.e. "we don't want those people living in our town." But just as powerful are the fiscal benefits of exclusionary zoning: multifamily units (particularly affordable ones) erode the municipal tax base and often contain numerous school-age children (thus putting fiscal pressure on the school district).

Yet such structures are crucial for Smart Growth development in the southern California region. Los Angeles is substantially built out: we will no longer see vast new subdivisions within the city limits.[2] If Los Angeles is to foster more compact growth, and thus do its regional share in reducing the need for consuming undeveloped outlying land, it must plan for "infill development"—multifamily structures, often containing affordable housing, where working families can live. Otherwise, such families will seek housing on the region's fringe, spurring the growth of sprawl and the consumption of open space. This prospect is not speculative: in May 2003, the median price of a house in Los Angeles County climbed far past $320,000, well beyond the range of most middle-class and working families. They will live elsewhere unless Los Angeles gives them affordable options, yet many will work in Los Angeles and make long commutes.

Southern Californians can expect little help from the federal government, which has cut funding for affordable housing, proposed severe restrictions in low-income rental assistance, and made clear that the federal government will offer no assistance in building affordable rental units. The burden for affordable housing, then, is on state and local governments. How has Los Angeles used its *regulatory* power to allow for smart growth development? The question turns not on *whether* development will occur but rather *what kind* will occur. In order to protect environmental values, Los Angeles must energetically increase certain kinds of development—multifamily structures, affordable housing, development near transit nodes. Has it done so?

THE LEGAL FRAMEWORK

State law mandates that each local land use authority must adopt a "general plan," which will guide development and control the pace and nature of development. The General Plan is the "constitution of local development:" generally speaking, any land use regulation inconsistent with the General Plan is legally invalid. This general plan must include several "elements." For our purposes, in Los Angeles three elements are critical:

- The *General Plan Framework*, which gives overall direction to the disparate elements of the plan, and provides major policy direction;
- The *Land Use Element*, which deals with such matters as population density, building intensity, and the distribution of land uses within a city. Because Los Angeles is so large, it has 35 separate

Smart Growth will not become a reality without strong leadership from the mayor and city council.

Pasadena Gold Line—light rail can be an efficient form of mass transit.

"community plans" that do the work of the land use element; and

- The *Housing Element*, which must assess the need for housing for all income groups and lay out a program to meet those needs.

After these elements are prepared, the city must then enact appropriate zoning and building regulations to implement them. This article considers the key elements of the Los Angeles General Plan, the ordinances enacted to implement them, and the degree to which these laws have been effective.

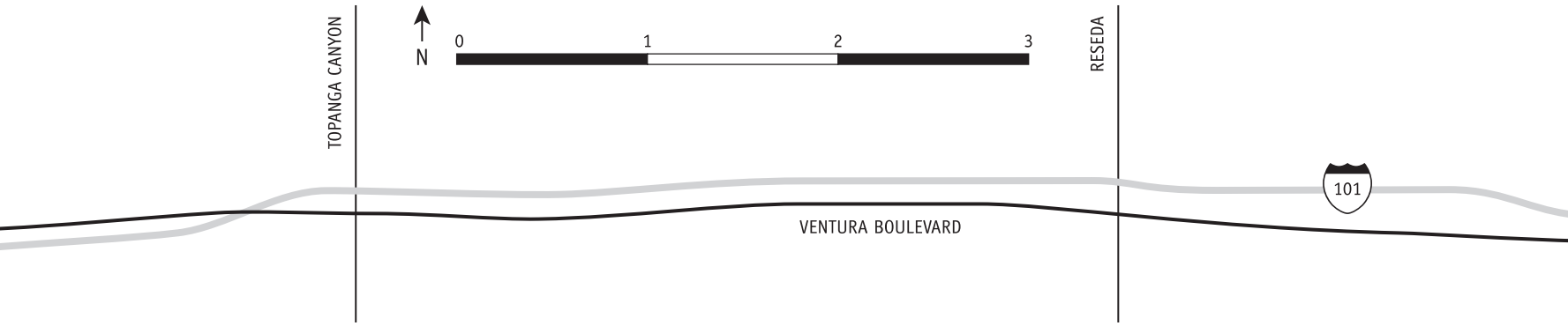
ANALYSIS

In simplest terms, LA's record is decidedly mixed. On the positive side, the Framework Element recognizes that housing remains a critical need, which represents a step forward: for years, the city seemed oblivious to the growing housing crisis in its midst. In January 2002, the Housing Element received recognition of compliance from the state department of Housing and Community Development.

Moreover, the Housing Element mandates a series of new laws and policies designed to alleviate the city's housing shortage and enable smart growth development. The new "Residential/Accessory Services (RAS) Zone" ordinance, for example, permits a broad range of retail uses on the ground floors of multifamily projects (something the city previously largely disallowed), thereby promoting greater public acceptance of multifamily units. And Los Angeles has also sought to expand affordability in these units by increasing the "density bonus" for low- and very-low income developments above the levels mandated by state law. Such a bonus enables the developer to build more total units than regularly permitted, thus allowing a greater margin for profit and making affordable housing construction more attractive to the private sector.

Los Angeles has also moved aggressively in fostering the adaptive re-use of older structures. This policy has seen its greatest effect downtown: a recent study by the Los Angeles Conservancy found that since the adoption of an Adaptive Re-use Ordinance in 1999, "interest in converting older and historic office buildings to housing in downtown has skyrocketed." All told, 4,255 downtown units are currently in development. Los Angeles has adopted adaptive re-use areas for several older sections such as Chinatown, Lincoln Heights, Hollywood, Wilshire Center/Koreatown, and South Los Angeles, and is currently considering an ordinance that would give zoning administrators discretion to extend the ordinance's provisions throughout the city.

The Framework and Housing Elements also contain several innovative (at least for southern California) ideas to increase mixed use areas. The Framework establishes a Mixed Use District, and specifies particular areas of the city, located along commercial corridors, where more intensive development



including multifamily units, may occur. It also encourages the greater use of "specific plans" (essentially unique zoning patterns) in selected areas of the city that would better integrate higher density development and retail. The Housing Element proposes a series of intriguing ideas, including the suggestion to construct affordable housing above dozens of the parking lots that dot this car-dependent city, a strategy that could yield thousands of new units.

In addition, the Framework adds a useful and potentially important chapter concerning urban design guidelines. It notes that higher-density developments are sometimes opposed because of poor design, and sets forth criteria for better design that will not add cost. Its most important innovation might be its recognition that changing street design could help foster pedestrian oriented districts where mixed use development would be welcomed. This is an important change from a city where in the past, many have viewed pedestrians as obstacles to the free flow of traffic.

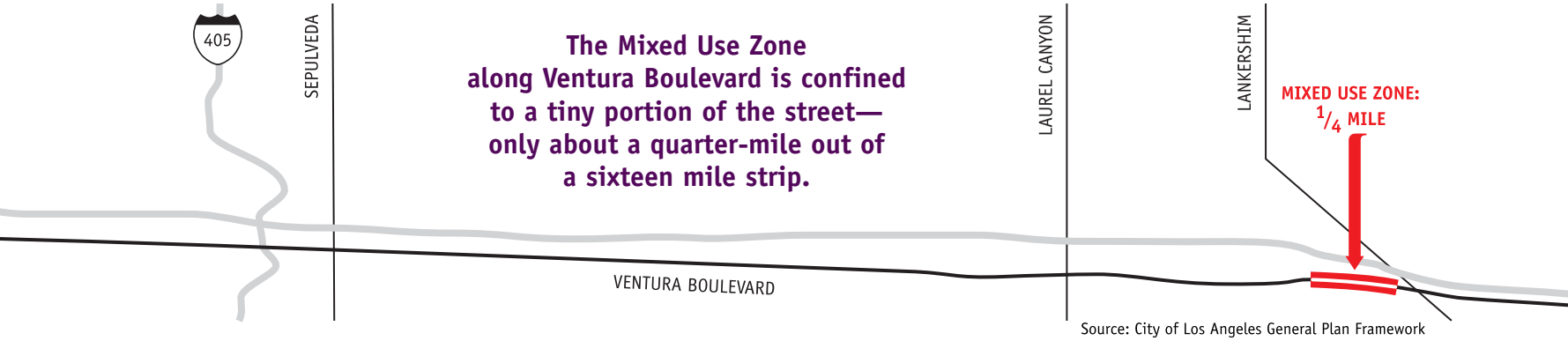
At its broadest level, the Framework, related elements and selected zoning ordinances make a clear and important point necessary for consideration of future development: Los Angeles is going to grow whether Angelenos want it to or not. We can either manage the growth effectively, or pretend that it won't happen and suffer the consequences.

GIVING WITH ONE HAND...

A closer look, however, reveals that there is less innovation to the city's housing policy than meets the eye. First, virtually all of the city's land use policies rely on obsolete data, which seriously undermines their effectiveness. The City Council adopted the Housing Element in January 2002, but the document is based on 1990 Census data, making the projections of future housing practically worthless. The Framework has not been updated in nearly eight years, meaning that it has missed the rapid and unprecedented expansion of the late 90's—and thus it has also missed the sharp increase in housing demand during that period. The Census Bureau estimates that Los Angeles City added more than 200,000 new people during the 1990's—an estimate that is probably low due to the difficulty in counting new immigrants. Broader economic figures tell the same story: for LA County as a whole, total sales ballooned by more than 26% during the decade, creating further economic pressure on housing, and leading to the bleak numbers reported at the beginning of this article.

The city is not solely to blame for the old data: delays in the 2000 Census reports means that no city in California has up-to-date statistics. But instead of seeing the old numbers as a problem to be ameliorated, Los Angeles has seen it as an opportunity to avoid grappling with the housing policy challenge. The Housing Element repeatedly refers to the depressed demand for housing brought about the early 90's recession—even though that recession was a distant memory by the time the Element was adopted.

Emphasizing the recession allowed the city to accept, without questioning, a thoroughly implausible estimate that only 60,000 new units of housing need to be constructed by 2005. And this acceptance, in turn, meant that the city did not have to be truly serious about developing and implementing programs to build more housing. For example,



The Mixed Use Zone along Ventura Boulevard is confined to a tiny portion of the street—only about a quarter-mile out of a sixteen mile strip.

Source: City of Los Angeles General Plan Framework

the Housing Element places great emphasis on a new zoning category—the "Mixed Use District"—that would expand the number of residential units and reduce vehicle trips due to their location close to commercial areas. But although the City Council duly enacted the enabling ordinance, Mixed Use Districts are few and far between.

The city is leaving it up to developers to petition for zone changes instead of taking affirmative steps to ensure that such rezoning takes place. It is laudable to allow private sector realities to drive concrete zoning decisions, but it will also undermine numerous worthy projects, as local homeowner group agitation often holds up rezoning, and local political figures use the rezoning requests to extract campaign contributions. It took the city nearly two years just to write the ordinance without implementation: refusing to take its own implementation steps means that it could be several years before a significant number of new units are permitted.

In areas such as the San Fernando Valley—a residential area based on single-family homes that suffers from an acute housing shortage—Mixed Use Zones are practically nonexistent even on streets for which they would seem tailor-made. One of the Valley's chief thoroughfares, Ventura Boulevard, is dominated by neighborhood commercial establishments and could serve as a base for mixed use development. But the Mixed Use Zone is confined to a tiny portion of the street—only about a quarter-mile out of a sixteen mile strip. Such an absence derives in large part because a "Specific Plan," negotiated throughout the 80's and 90's, controls Ventura Boulevard's development, and is incorporated explicitly within the city's General Plan. But this means that the entire process has operated backwards: state law provides that the General Plan controls the specifics, not vice-versa. The upshot is that outdated plans control future priorities.

Lack of creativity—or political support—has blinded the city to other possibilities. Consider the example of the state-mandated "density bonus" for affordable housing. Federal regulations create three categories for affordable units—those accessible by "moderate," "low," and "very low" incomes. These categories are based on families' relationship to the regional median income. In Los Angeles County, for a family of four, the threshold for "very low" income is less than $27,550 a year; for "low" income is $44,100 a year; and "moderate" is $66,100. State law requires cities to allow developers greater density if they build residential units for "low" or "very low" income renters, and the Housing Element observes that when the state removed the "moderate" category from its density bonus law, developers' applications for such bonuses declined sharply. Aside from the questionable statistics used to make this conclusion, the Element then blandly concludes that the state law is not effective in spurring the growth of affordable units.

But it never considered the possibility that Los Angeles on its own volition could adopt its own program for moderate income units. Neighborhood opposition to "affordable" housing often stems from the inaccurate belief that such housing brings with it crime and disorder. Emphasizing the development of moderate income units could ease the housing shortage and overcome some (although not all) neighborhood opposition. After all, the occupiers of such units are service providers, including nurses, police officers,

The Promenade Plaza condominiums at Hope and First Streets in downtown Los Angeles.

Emphasizing the development of moderate income units could ease the housing shortage and overcome some neighborhood opposition.

teachers, fire fighters, and secretaries—the core of any city's working class. None of the General Plan's elements, however, ever considers the development of moderate income housing as a high priority.

Little wonder, then, that even where the General Plan theoretically advocates Smart Growth development, the concept suffers from a noticeable lack of implementation. Three years ago, the Metropolitan Transit Authority finally completed construction of the Red Line subway system. Subway stops form the backbone of Smart Growth because they enable the development of higher-density residences that can use transit instead of the automobile. But while the Framework calls for higher-density residential development next to transit nodes, MTA subway stops remain essentially indistinct from the rest of the city. Many Red Line stops are surrounded only by parking lots. Recently, the city has moved to redevelop some of these areas—several years after the introduction of the Red Line. And at this stage, the emphasis has been on retail development—not housing.

This implementation failure seems endemic. At the end of 2000, the City Planning Commission proposed a series of 28 recommendations to increase the supply of affordable housing. Belying the Housing Element's bland acceptance of 60,000 unit need, the Planning Commission stated that the city has a housing crisis that requires infill development. Nearly three years later, however, most of these recommendations remain just that. For example, as noted above, the city's recommendations for new mixed use zones will remain meaningless unless existing parts of the city are rezoned.

If anything, the situation has worsened. The General Plan acknowledges that the community plans actually arrange for less intense residential uses, threatening to undermine already existing multifamily units. And even those community plans less hostile to smart growth do not provide much encouragement. The Studio City-Sherman Oaks Community Plan, for example, mandates that 68% of all residential units in the area units be reserved for single-family dwellings. If this mandate is followed—and legally it must be—then it ensures that virtually no multifamily units will be built because the area is already substantially built out for single family residences.

POLITICAL FORCES

In general, the picture that emerges is that of a city earnestly attempting to foster smart growth development within its borders—but only where political opposition is limited, and lacking strong political leadership to impose real change. Planners must function within a political context, and in Los Angeles homeowners' associations (especially in more affluent neighborhoods) aggressively fight even the most benign plans to build affordable units, such as senior housing. Smart growth will not become a reality without strong, forceful leadership from the mayor and city council. The Housing Element itself tells the story: the document states that in order to get public input, the Planning Department conducted all of five public meetings—the last of which was held four

Unless the city moves more aggressively to allow multifamily development, and takes the necessary political risks, it is sowing the seeds of severe environmental and social problems down the road.

years before the final document was prepared.

To be sure, Los Angeles has made significant strides in affordable housing. For example, it has promised to build a $100 million Affordable Housing Trust Fund and has hired several capable and dedicated staff to see the project through. LA has also responded to the problem of "expiring" affordable housing. Thousands of units made affordable by federal subsidies will disappear in the next decades because their owners will no longer be legally required to keep them affordable. To meet this challenge, the city has enacted an aggressive new program to assist owners and purchasers who wish to maintain affordability.

But these approaches, relying largely on public subsidies and minor adjustments, will address only a small part of the problem. They do not grapple with the searing problem of moderate-income housing. Even with its new commitment to affordable housing preservation, Los Angeles lacks the funds to prevent large-scale conversions of affordable units to market rate, and cannot begin to fund any large-scale construction of new units. The state, in the throes of a budget crisis, will be unable to assist and indeed is looking to local governments to pick up the fiscal slack. Unless the city moves more aggressively to allow multifamily development and takes the necessary political risks, it is sowing the seeds of severe environmental and social problems in the future.

GRADE

A **Grade of B-** for Los Angeles.

NOTES

1. Unless otherwise mentioned, all references to "Los Angeles" in this Article are to the City of Los Angeles.

2. The exception to this, of course, is the Playa Vista project, perhaps the last remaining large undeveloped piece of land in the city. Playa Vista was analyzed in the 2002 Report Card.

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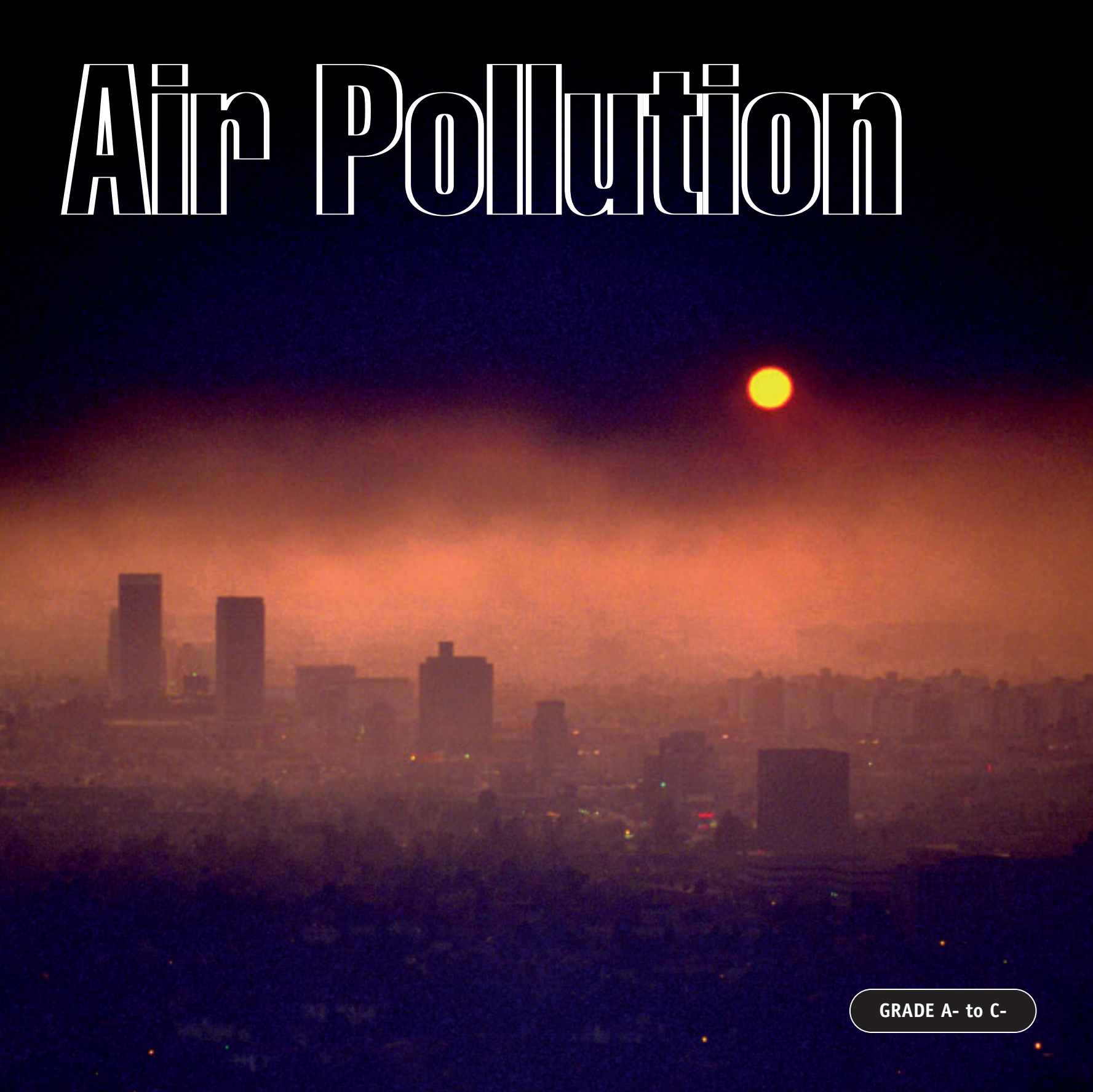
Before joining the UCLA faculty, Zasloff worked for a public interest law firm and specialized in environmental and land use issues, representing both developers and environmental organizations regarding environmental impact reports, general plan conformity and other planning law matters. He currently serves as the California Assembly Speaker's appointee to the Santa Monica Mountains Conservancy, and was a consultant to the state Assembly on urban planning, regional development, and transportation issues. Professor Zasloff holds a B.A. summa cum laude and a J.D. from Yale University, an M.Phil. from Cambridge University, and a Ph.D. from Harvard University.

Air Pollution



GRADE A- to C-

Suzanne E. Paulson, Ph.D.

Department of Atmospheric Sciences

INTRODUCTION

The 1998 Report Card reviewed the past effectiveness and future prospects of air pollution policy in the region. Policies up to that time, which resulted in spectacular improvements in air quality, were awarded a grade of A. Looking forward, a grade of C reflected the lack of effective control strategies in the pipeline, and was accompanied by the prediction that air quality would cease to improve, and indeed might start to deteriorate again. In RC 2000 we reviewed the status of air toxics in Southern California, and in RC 2001 the role of particulate matter in the region was described. Here, we revisit what remains one of the most serious environmental quality issues facing Southern California. We review how the quality of the air we breathe has changed since 1998, including the current status of air pollution, the effectiveness of long term emissions control programs, and prospects for future air quality in the region.

OZONE, PARTICULATE MATTER, CARBON MONOXIDE AND AIR TOXICS

Southern California has long been famous for smog. By the end of World War II, the clean air and views of the mountains that drew millions to Southern California were replaced by a noxious haze that we now refer to as photochemical "smog." This aspect of Southern California living has been the target of the nation's jabs for decades, but in recent years the tremendous progress in cleaning up the air seemed to be turning the region's image around. Houston registered more days above the ozone standard than Los Angeles for two years running in 1999 and 2000, and the Central Valley of California appeared on the verge of joining Southern California by becoming the second region in the nation with an air quality problem designated by the US EPA as "extreme." In 2001, however, the Los Angeles area regained the ozone title, and in 2003 the ozone levels became strikingly worse than in the preceding four years. Instead of creeping down toward the federal standards for ozone, levels appear to have bottomed out and threaten to increase.

The seriousness of the air pollution problem in the South Coast Air Basin (SoCAB, consisting of Los Angeles, Orange and parts of Riverside and San Bernardino counties) was the primary force behind the granting in the early 1970's of special regulatory status to the state of California to control sources of air pollution. California has used this special status with great success to demand tighter emissions standards from automobile manufacturers than those required by the federal government, as well as numerous other special formulations, from lower volatility paints to less toxic gasoline. The results of the regulations made at the state, local, and national levels have been nothing short of spectacular. For example, the peak ozone concentration in the SoCAB decreased from a high of 680 parts-per-billion (ppb) in 1955 to a low of 169 ppb in 2002 (but then increased to 216 ppb in 2003).

Air pollution has many components. The best known is ozone, a colorless gas that restricts breathing, exacerbates asthma, and limits plant growth. The other prominent components are particulate matter and air toxics, which may promote respiratory disease, cancer, birth or developmental defects or mortality. Particulates are tiny liquid or solid particles 10 microns or smaller—about a thousand 10-micron particles would fit in a grain of fine sand. Air toxics are airborne chemicals, such as dioxins, mercury and perchloroetheylene, which are individually likely to induce specific diseases. In earlier years, several additional air pollutants also posed a significant threat to public health, but these have been successfully controlled in the region. In the last few years, carbon

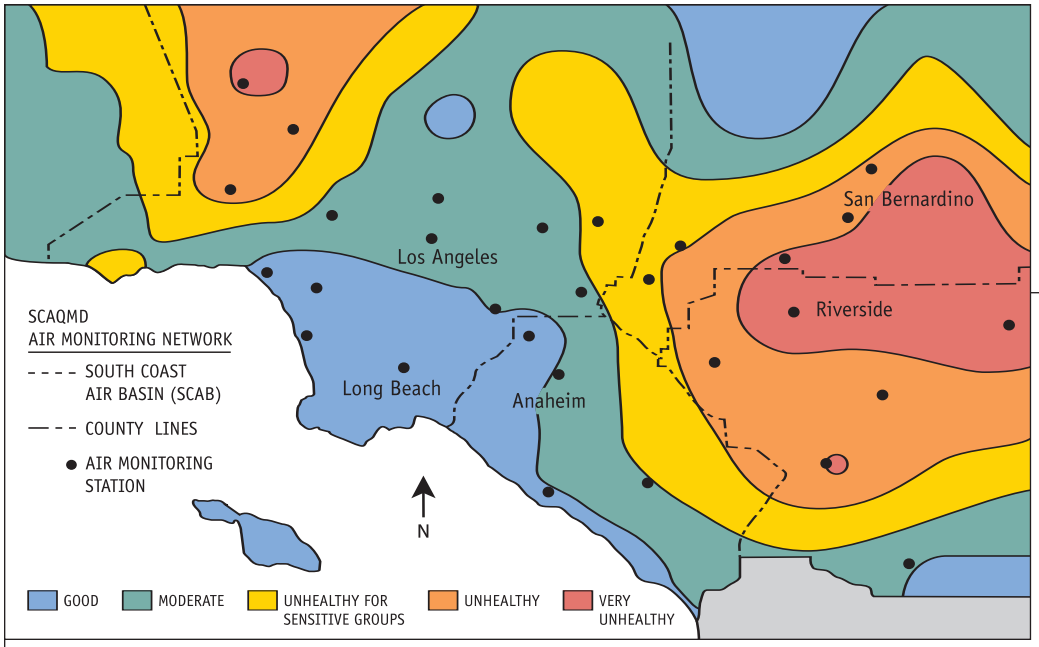


Figure 1: The geographical distribution of ozone levels on July 10, 2003, a typical high ozone day in Southern California. These levels were recorded at 4:40 in the afternoon, about when ozone reached its maximum levels that day.

monoxide has been reduced sufficiently to meet the federal standard, joining the ranks of sulfur dioxide, nitrogen dioxide, and lead: air pollution problems that have been solved in Southern California.

Most air toxics and carbon monoxide are released directly from sources, while much of the particulate matter and essentially all ozone form in the atmosphere from the reactions of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x), in the presence of bright sunlight. Air pollution is almost inevitable in the Los Angeles area because the local topography, persistent sea breezes, and the high-pressure system that resides in the area so much of the year work together to trap pollutants that react photochemically with sunlight to make smog.

Ozone Concern about air pollution by many long-term residents of Southern California has dropped over recent decades. Over the long term, peak concentrations of ozone and related gaseous pollutants have subsided, along with the most noticeable short-term health effects of air pollution. Gone are the days of coughing, shortness of breath, and stinging eyes that once accompanied smog alerts. The federal 1-hour standard for ozone is now exceeded 35-60 days each year, down from over 200 days in the 1970s. However, in the summer of 2003, O_3 made headlines again as the air quality noticeably declined and the SoCAB experienced its first stage 1 smog alert since 1998.

Very high ozone levels form mostly in the central and eastern parts of SoCAB, and in the Santa Clarita and San Fernando valleys (Figure 1). Ozone requires NO_x, VOCs, and the right weather to form. Since overall emissions of NO_x and VOCs trend over periods of a few years to decades, much of the short term variability in ozone is due to weather: some years are hotter and sunnier, with more stagnant air conditions that tend to trap air near the surface. Of recent years, the weather has been particularly conducive to forming ozone in 1998 and 2003, while 1999, 2000 and 2001 provided cleaner than average conditions. 2002 was closer to average, but it also fell on the clean side. This trend is borne out in Figure 2, which shows the maximum 1-hour averaged ozone concentration for each year. Ozone was basically flat for 1999-2001, up slightly in 2002, and much higher in 2003. If we correct for the meteorology in those years, the overall trend in the ozone is approximately flat for the last 5 years.

As the air quality improved through the 1990s, so did our understanding of what makes people ill. Health effects research in the 1980's and early 1990's led to a new ozone standard averaged over a longer time period (8 hours), but at a lower concentration. The eight-hour standard was put in place in 1997, but was challenged in court and not made into a regulation until 2002.

Particulate matter standards are exceeded throughout the year, and throughout the basin, from the coastal cities to the mountain slopes, and the current annually averaged PM2.5 loading in the region is about 40% higher than the federal standard.

Healthy individuals typically do not notice being exposed to lower concentrations of ozone over longer time periods, but such exposure is a better indicator of adverse health impacts.

Nearly every day in summer, or about 110 days per year, a portion of the South Coast Air Basin exceeds the new 8-hour standard (Figure 3). The Los Angeles area is not required to meet the 8-hour standard until it has met the 1-hour standard, for which the current regulatory target is 2010. In general it is much easier to reduce peak concentrations than it is to reduce concentrations over longer time periods, evidence for which can be seen by comparing Figures 2 and 3. While we may one day meet the federal 1-hour standard (although not by 2010) meeting the 8-hour standard will be far more difficult.

Particles During the summer smog season, and even during winter, most residents can still see air pollution, as they look across distances of a few miles or more. The tiny particles that affect health also scatter light, obscuring vistas and giving the air a whitish or grayish hazy appearance. Particles are believed to adversely affect health in several ways. Some particles deposit largely in the upper respiratory tract and promote inflammation that exacerbates asthma and other acute respiratory illnesses. Other particles deposit deep in the lung, where the chemicals they carry can initiate cancers or enter the blood stream and promote inflammation of the circulatory system, increasing incidences of stroke and heart attack. Thus, particles not only affect respiratory health but can also induce mortality.

Like ozone, the federal standard for particulate matter has been changed recently, shifting the focus from particles 10 microns and smaller to particles 2.5 microns and smaller (PM2.5). PM2.5 requires different strategies to control because while much of PM10 is generated by mechanical grinding (e.g., as cars move over roadways), PM2.5 comes primarily from combustion sources (including gasoline and diesel engines) and from reactions in the atmosphere that convert NO_x and VOCs to particulate matter. As in the case of the ozone standard, the SoCAB is required to meet the older PM10 standard first, by 2006, and the new PM2.5 standard after that date. PM10 has been essentially flat over the last decade. Widespread routine PM2.5 data collection only began in 1999. Like ozone and PM10, during 1999-2002 there is no discernable trend in PM2.5, either up or down, when we correct for meteorology. The PM2.5 standard is exceeded throughout the year, and throughout the basin, from the coastal cities to the mountain slopes, and the current annually averaged PM2.5 loading in SoCAB is about 40% higher than the federal standard (Figure 4).

Air Toxics The air toxic of greatest concern is diesel exhaust, which is a mixture of toxic gases and particles. Reductions in exposure to diesel exhaust have been slow, decreasing by at most 30% from 1990 to 2000. Benzene and butadiene, released by cars and trucks, follow diesel exhaust in toxicity ranking. These were decreased substantially in the early to mid-1990s primarily with the introduction of Phase II reformulated gasoline, but lost their downward momentum in the latter half of the decade. Other airborne toxics such as hexavalent chromium are serious problems local to their specialized sources, but present little threat to the health of the SoCAB population overall.

AIR POLLUTION AND HEALTH

While healthy individuals are now able to more or less ignore air pollution, sensitive residents of Southern California still suffer from the worst air in the nation. Children who

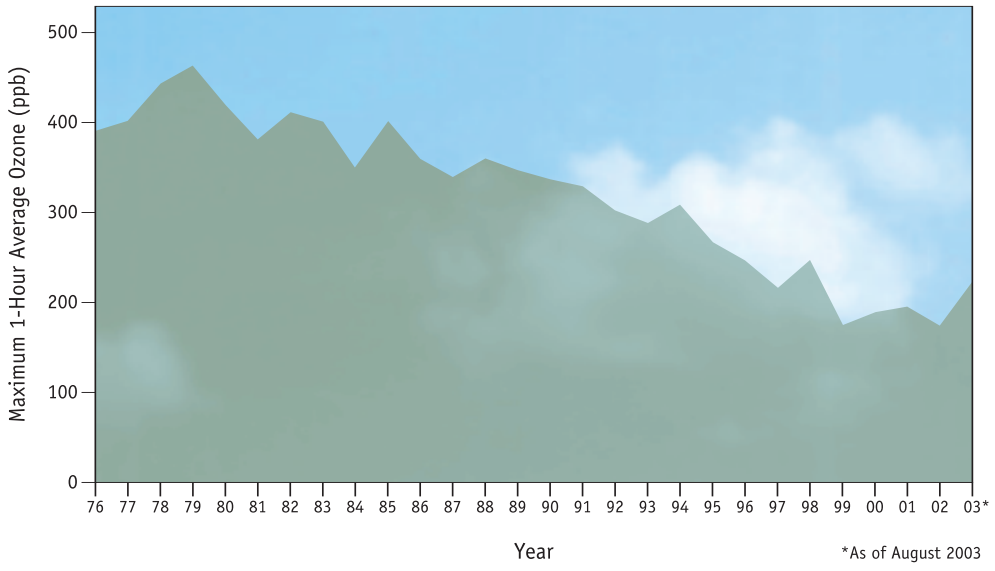


Figure 2: Maximum 1-hr average ozone concentrations in the southern California air basin from 1976-2003, in parts per billion (ppb). The 2003 data includes measurements up to August 31, only about two-thirds of the way through the smog season.

grow up in the more polluted parts of Southern California have lower lung function and more severe asthma. Estimates of premature deaths from air pollution in the SoCAB range from 1500 to 9000 per year, and air toxics are expected to generate several thousand additional excess cancers. While ozone impacts much of the air basin, it is worst in the eastern portions and inland valleys. Particle levels are elevated throughout SoCAB, and toxic diesel exhaust is particularly high near air and shipping ports, and along freeways and heavily traveled surface streets. Air pollution affects everyone, but lower income residents often have higher exposures by virtue of where they live, work, study or play.

CONTROLLING THE SOURCES OF AIR POLLUTION

Air quality is improved by controlling the sources of pollution. Most human activities result in emissions of some magnitude and type, whether VOCs, NO_x, particles, or toxics. Here we will address several of the major sources of air pollution, including gasoline and diesel powered vehicles and consumer products. The regulatory authority for the various sources of pollutants is divided as follows: The USEPA covers interstate transportation sources such as airplanes, trains and ships; the state of California has jurisdiction over autos, light trucks, buses and consumer products; and the South Coast Air Quality Management District (SCAQMD) regulates

Dramatic reductions of VOC and NO_x emissions through 1998 rank as one of our great environmental achievements...

stationary sources such as local industries and power plants and other sources such as construction activities. Finally, city and county governments have primary influence on air pollution through the transportation, land-use and development policies they establish. Policies regarding sprawl, traffic congestion, and alternative transportation such as light rail largely predetermine the quantity of vehicle use, the largest source of pollutants.

In order to control air pollution, it is necessary to know how much of which pollutants are emitted from which sources, and to a lesser degree, when. This information is compiled into an emissions inventory, which is a crucial, but by its nature flawed, tool for planners. Compiling emissions inventories is very difficult and labor intensive due to the sheer number of sources and tremendous variability within classes of, or even single, emission sources. For example, emissions from paint cans and household solvents can vary by more than a factor of 10 depending on how tightly they are capped and the temperature at which they are stored. The emissions inventory in use by the SCAQMD has other types of errors as well; for example the driving cycle typically used to predict automobile emissions, which are notoriously difficult to quantify, assumes cars never exceed the speed limit.

...but from 1999 combined NO_x and VOC emissions may have dropped by only half or less of that reported.

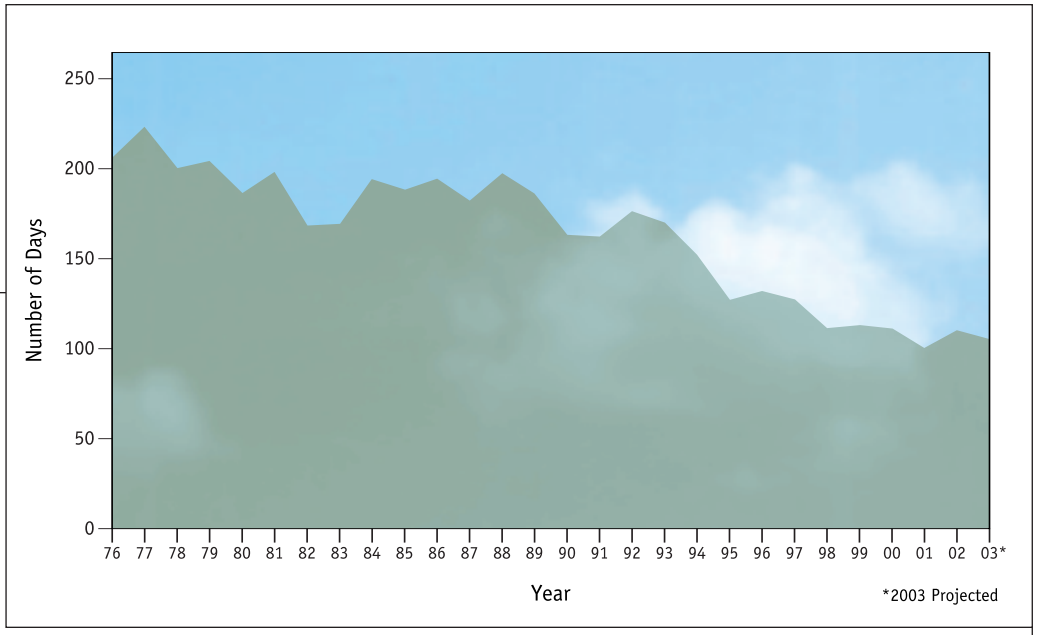


Figure 3: The number of days exceeding the 8-hour ozone standard in the SoCAB. Improvements in this health-based metric are less pronounced than they are for the exceedences of the older federal standard for maximum 1-hour ozone concentrations.

Measured concentrations of pollutants in the atmosphere provide an alternative method to track progress in reducing pollutant emissions, and several types of pollutants are monitored routinely at sites around SoCAB. Measured concentrations, when collected from many sites, chosen to be representative and not unduly influenced by polluters in the immediate neighborhood, show what is really happening to collective emissions of smog precursors and air toxics. Unfortunately atmospheric measurements have a limited ability to reveal progress in mitigating *individual* pollutant sources.

The SCAQMD's emissions inventory estimated combined emissions of VOCs and NO_x in the Los Angeles basin were at 3600 tons/day in 1987. By 1998, these had reportedly been reduced to about 2350 tons/day. Up until 1998 or so, these dramatic reductions (although not necessarily the absolute amounts) were corroborated by atmospheric measurements of ozone, NO_x and VOCs, all of which dropped substantially. This, together with earlier reductions, ranks as one of the great environmental achievements of the last 50 years, given the enormous growth in population and vehicles in the SoCAB during that period.

Between 1999 and 2003, the SCAQMD's inventory indicates that combined VOC and NO_x emissions declined to around 1800 tons/day, about 23%. During this time the ambient ozone levels, when corrected for meteorology, have stayed very roughly flat (as discussed earlier). The NO_2 measurement data indicates a decline in NO_x emissions, but somewhat less than that reported in the inventory. Because atmospheric measurements of VOCs are much more expensive than NO_x measurements, VOCs are measured at fewer stations and with lower frequency. Within this more limited data set, VOCs do not appear to have declined much during the four years from 1999 through 2002, indicating that combined NO_x and VOC emissions have dropped perhaps by only one-third to half of that planned in the emissions inventory. Unfortunately it is not possible to tell from these data which pollutant sources have not been diminished as anticipated.

To meet the 1-hour ozone standard, and make substantial progress on the PM2.5 and 8-hour ozone standards, combined VOC and NO_x emissions need to decrease at least to 800 tons/day, around a third of what they were in 1998. These reductions must be made in the face of continued growth in the economy, population, and vehicle miles traveled, and at a time when most of the easy and inexpensive controls have already been made.

Passenger Vehicles In Southern California, the emissions inventory suggests approximately 30% of NO_x and VOCs come from

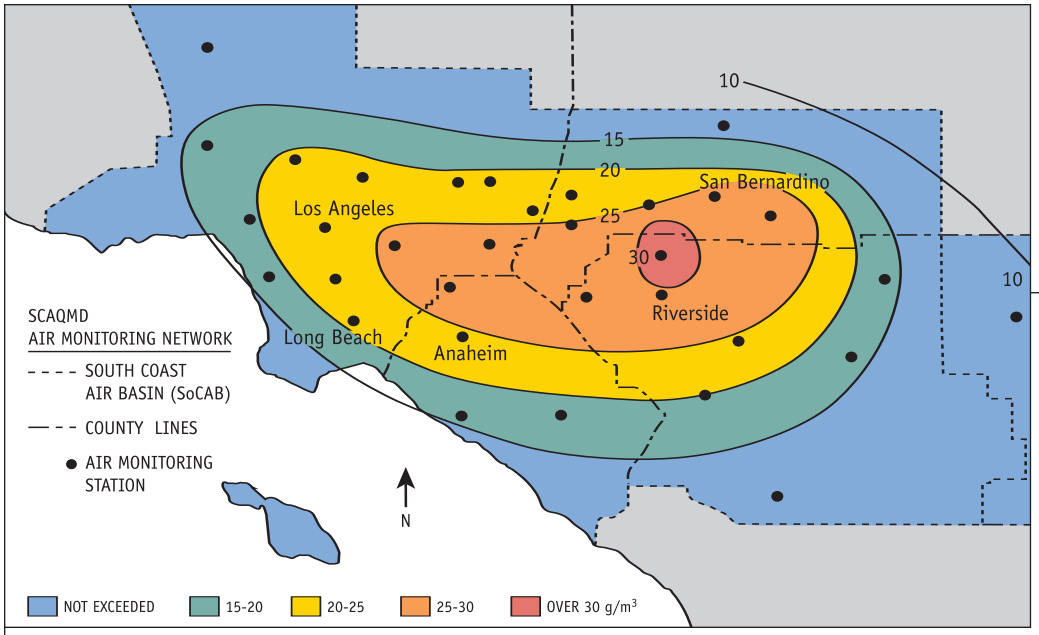


Figure 4: The geographical distribution of particulate matter with diameter less than 2.5 microns, annually averaged. The numbers on the contours indicate the particulate matter mass, in micrograms per cubic meter. The health-based federal and state ambient air quality standards, in micrograms per cubic meter, are 15 and 12, respectively.

passenger vehicles, including SUVs (down from about 40% in 1995). Today, new passenger cars roll off the assembly line with quite low emissions, but as they age their emissions can increase substantially. Cars emit both NO_x and VOCs while they are running, and in addition a substantial amount of VOCs are emitted as gasoline evaporates and escapes from leaky gas caps and fuel lines, and during re-fueling. Some cars eventually become so-called "super emitters" as a result of emissions system failure. These 10% of vehicles release about 60% of all vehicle emissions. The California Smog Check Program is intended to detect and repair (or remove) the super-emitters, but to date the program has had limited success (see below).

Emissions control devices are increasingly durable, so that cars that are 10 or 15 years old now are cleaner than cars of the same age 10 years ago. Similarly, we can expect that passenger car emissions will continue to decrease as the vehicle fleet turns over. There are some caveats, however. On the down side, SUVs and light trucks represent 50% of all new vehicles sold in California, and have much higher emissions allowances (and lower fuel economy standards) than passenger cars. Requirements to bring emissions of new SUVs down to the levels of other passenger cars are just being phased in, but as the current SUV fleet ages it will diminish improvements in air quality. On the positive side, the widespread adoption of hybrid vehicles like the Toyota Prius, Honda Civic, and others could improve matters significantly. Design improvements aside, since emissions for aging cars are roughly related to the quantity of fuel consumed, future emissions of hybrids will be smaller. While the recently scrapped zero emission vehicle program had its limitations, zero emission vehicles have value because they don't burn gasoline and thus never become super emitters.

During the 19-year period between 1965 and 1984, a series of engine design changes and addition of catalysts and on-board computers reduced emissions from new cars by more than 10 fold. Emissions from in-use cars and trucks have been reduced by nearly another factor of 10 since the early 1980's using a three-pronged approach: reformulating gasoline, redesigning refueling equipment, and implementing inspection and maintenance programs.

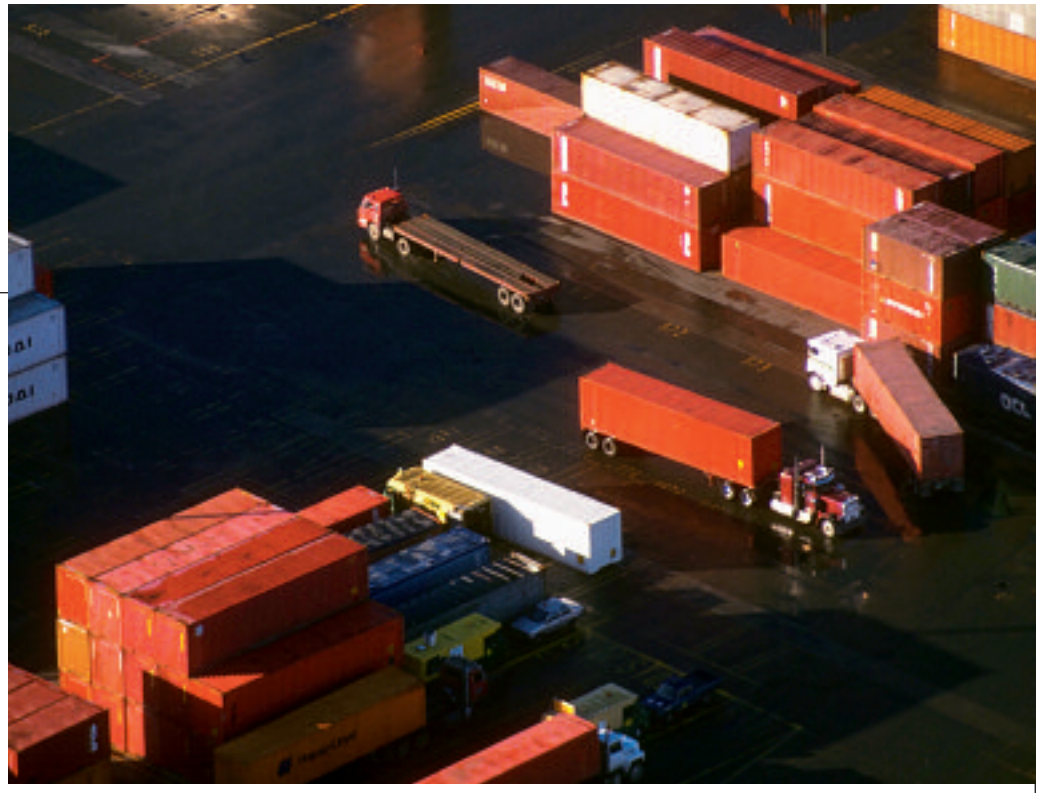
Reformulated gasoline was introduced in the South Coast Air Basin in two phases, in 1992 and 1996. Reformulation changes the makeup of gasoline to reduce its rate of evaporation, reactivity (or smog-forming potential), levels of air toxics such as benzene and butadiene, while increasing oxygenates. A higher oxygenate content in fuel reduces carbon monoxide emissions. Tighter vehicle

emissions standards contributed to the tremendous improvements in air quality during the 1990s, but much of it was due to gasoline reformulation. Unfortunately, at this point most of the improvements from gasoline reformulation have now been realized. A phase III gasoline is currently being introduced, but this mostly replaces the oxygenate MTBE, which causes water pollution, with ethanol. Little or no benefit to air quality is anticipated from this substitution.

Transfer, storage and vehicle refueling all result in significant VOC emissions. The introduction of devices to capture the gasoline vapor in a gas tank as it is replaced by liquid fuel during fill-up was a highly effective control measure when it was implemented 20 years ago. Today, fixing faulty vapor recovery devices and selling better portable gas containers may deliver more improvements. Consumer behaviors such as topping off during refueling, and accidental gasoline spillage at gas stations, at home and in marinas, all add up to a significant VOC source as well. Unfortunately, changing these behaviors has proved difficult.

Inspection and maintenance (I/M) programs (called 'Smog Check' in California) attempt to keep emissions low throughout the life of a car by catching and repairing high emitting vehicles. While I/M programs have certainly helped, both the older gas station test and the new central test facility I/M program have reduced emissions less than planners hoped. There are several reasons for this, including tampering by drivers, fraud by repair shops, and, in the case of the gas station test, a limited ability to simulate real-world driving. I/M programs are most easily improved by extending the warranties of emissions systems, thereby improving the repair rate for high emitters.

Alternatives to the I/M program include buyout programs whereby high emitting vehicles are purchased for several hundred dollars and crushed for scrap. These programs work, but are expensive. Remote sensing systems exist that can catch high polluting vehicles on the road. While there is resistance to these programs due to the "big brother" aura associated with them, they have been successfully implemented in other states.



Progress controlling toxic emissions from diesels has been slow. Exposures to diesel emissions is elevated near air and shipping ports, and along heavily travelled freeways and surface streets.

Diesel Emissions Diesels are large emitters of NO_x and toxic particles and gases. They emit only low levels of VOCs in part because diesel fuel does not evaporate easily. While progress in controlling gasoline vehicle

Black smoke from a heavy-duty diesel truck.

emissions has been tremendous, progress in controlling diesel emissions has been hindered by several factors unique to this source. Diesel engines are built to last for 500,000 miles or more, and have a useful life of up to 30 years. Fleet turnover is slow. While limited regulations to clean up diesels have been in place since the early 1990s, most diesels sold before 1998 had engine controllers that performed well during emissions testing, but not in actual use, resulting in minimal improvements for diesels during this time.

Cleaner post-1998 vehicles make up a small fraction of the current vehicle fleet. This presents the difficult problem of cleaning up the pre-1998 diesels. Some emissions reductions can be achieved by reprogramming on-board computers, and by other changes such as turning off engines at longer stops and providing electricity at ports and truck stops to eliminate the need to run the engine to generate electricity (e.g., for refrigeration or cabin use). Technology to retrofit older diesels is mostly still in the development stage. Controlling diesel emissions from mobile sources remains a high priority, and more regulations are slated to phase in later in this decade.

Consumer Products Emissions controls over the past several decades have focused on vehicles, historically the major sources of pollutants, and on industrial and commercial sources. Over time, however, as motor vehicle and industrial emissions are ratcheted down, other sources become more important. Currently residential sources comprise the second largest source category for VOC emissions. Consumer products include paints and strippers, personal care products like hair spray and rubbing alcohol, cleaning products, pesticides, lighter fluid and the like. It is perhaps remarkable that a single bottle of turpentine, a poorly sealed gallon of paint in the garage, or even nail polish remover can make a difference in air pollution. However, in the households of 16 million residents in South Coast Air Basin, they add up. So far, progress has been minimal at controlling most of these sources. State laws prohibiting banning any product category contribute to the problem; for example, even though pump hair spray can replace aerosol cans, the aerosol version is protected. Efforts are underway to reformulate many products to make them less volatile or reactive, as was done for gasoline. Nevertheless, improvements are expected only to keep pace with the growth of sources.

Without significant shifts in development practices, innovative control strategies and aggressive technology forcing, guided by a higher quality emissions inventory, air quality may not improve much. It may even get worse.

GRADES

Current air quality is the result of policies put in place over the last several decades. While the improvements over the past three decades, and especially during the early and mid-1990s, were stunning, progress has slowed. More great leaps forward such as those afforded by automobile catalysts and reformulated gasoline are not on the horizon, and the ozone and particle problems in Southern California remain a major challenge. While the current approach of making improvements to existing regulatory approaches may be able to roughly balance substantial growth in population, vehicle miles traveled, and economic activity over the next several years, the past five years of data from the atmosphere have shown that this type of approach will not lead SoCAB to the clean air we need.

Improvements in air quality from hybrid vehicles if they are widely accepted soon will not arrive for nearly a decade, and meaningful fuel cell benefits will follow many years after that. Without significant shifts in development practices, innovative control strategies and aggressive technology forcing, guided by a higher quality emissions inventory, air quality may not improve much. It may even get worse.

Our last assessment gave an A for policies up to that time, and C looking into the future. Based on the present analysis, our overall assessment of progress over the past decades is therefore lowered to an **A-**. Looking into the future, there are many new policies being phased in or in the planning stages, but recent experience indicates they are not aggressive enough. Moreover, the new standards will be harder to meet, and all indications are that we will not meet them anytime soon. Additional policies to phase out or replace highly polluting diesel busses and trucks are overdue. For the future, we give a **Grade of C-**.

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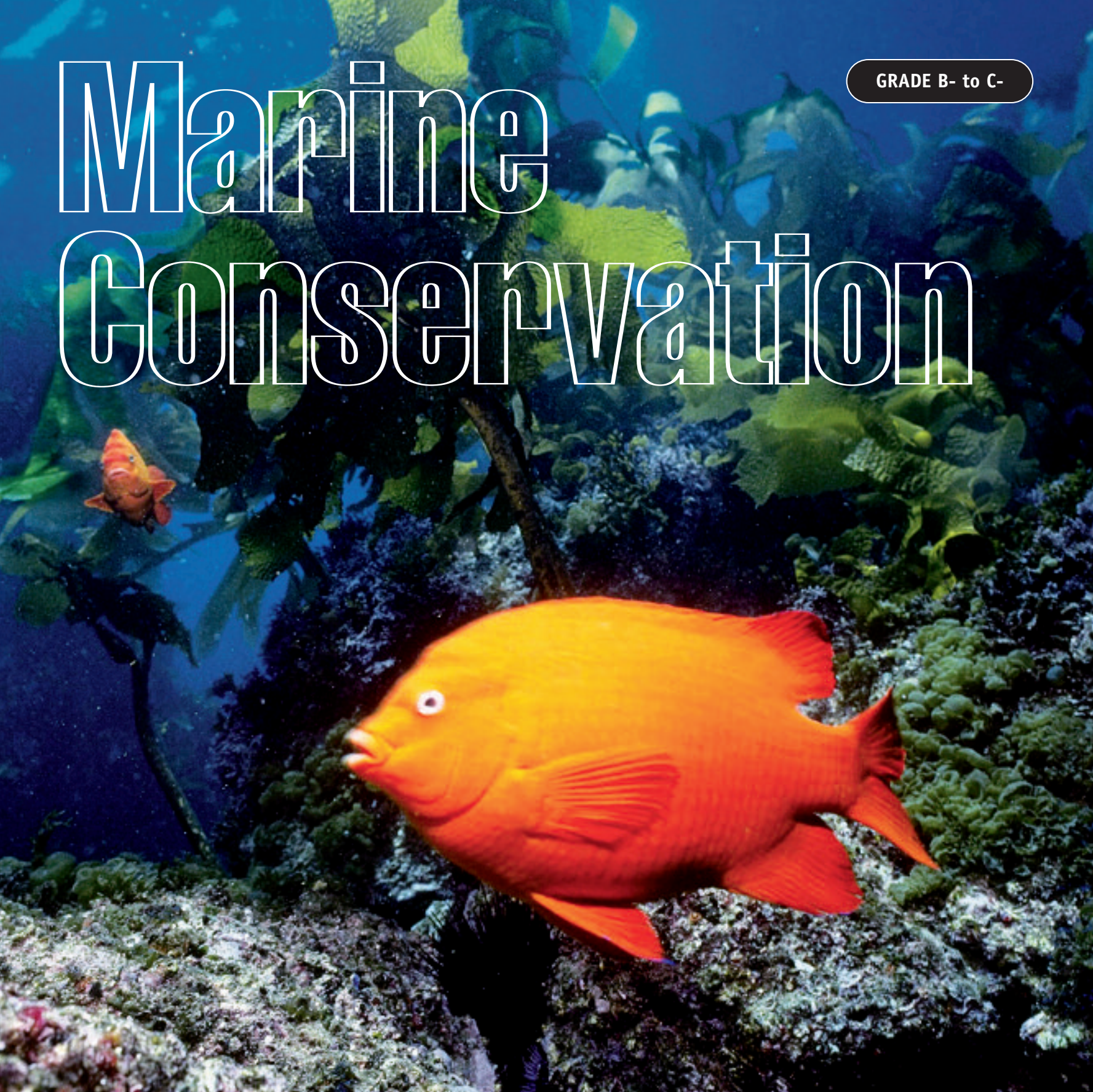
Marine Conservation

GRADE B- to C-



Gregor Hodgson, Ph.D.

Professor, UCLA Institute of the Environment's Coastal Center

COASTAL CONFLICTS

Whale-watching tours are fun and good business—but not long ago many scientists thought that whales were on their way to extinction. And for those of us who grew up in Southern California hearing tales of huge abalone being caught and sauteed in butter, the closure of this fishery has been shocking.

The coast is where the shore and rivers meet the sea, and where people are most inclined to build, manufacture, and play. It is also where development conflicts are greatest. The coast includes the planet's most productive marine ecosystems, providing habitat and essential spawning and nursery areas for most commercially and recreationally important fisheries. Coastal wetlands filter land-based contaminants, buffer storm surges and help retard coastal erosion.

Measuring over 1000 miles in length, California's coastline generates huge commercial, recreational, environmental and aesthetic profits. Recent estimates of the economic value of the state's coastal industries total $60 billion annually. Much of this activity is concentrated in Southern California where coastal uses are maximized and conflicts are most intense. California's population has burgeoned over the past century and an additional five million people are expected to be born or migrate here in the next ten years.

None of this is news to long-time residents of southern California who have watched the highly visible terrestrial changes—vast areas of agricultural land transformed into endless tracts of homes. What most citizens are unaware of, however, is how this growth has affected the marine environment. Development pressures on the coast present a significant challenge to government agencies whose goal is sustainable development, including marine conservation. A fundamental challenge for marine conservation is that many Californians have not had any personal experience with the sea other than enjoying the view from the beach. Only a small percentage have dived underwater, and can appreciate or evaluate changes in the marine environment.

WHAT IS MARINE CONSERVATION?

Marine conservation involves planning and regulating uses of the ocean environment in a way that allows the ecosystem to function normally, despite human impacts, and with special attention to living components such as fish, seabirds, whales and sea otters. A primary tool of marine conservation is creating marine protected areas (parks, reserves, special areas, etc.) where commercial, scientific and recreational uses are regulated and in some cases completely banned.

In 1972, the people of California passed Proposition 20, creating the California Coastal Commission to oversee the planning and development of the coast. In 1976, the legislature made the Coastal Commission a permanent body by enacting the Coastal Management Act. Through this process, California created the concept of integrated coastal management, of which marine conservation is one key component. The concept of coastal management is that the government will create a balanced, long-term plan for using coastal and marine resources that takes into account the needs of all stakeholders—including those who wish to conserve some areas forever in their natural state.

California has had significant success in protecting and even restoring certain marine species endangered by human activity. Yet the state has also experienced some dramatic setbacks. This article reviews case studies of individual species as well as habitat protection to address the question: How has California performed in meeting the goals of marine conservation?

Twenty-five years ago, most marine biologists believed it would be difficult for the abalone to go extinct.

Black Abalone were once very abundant in the intertidal zone.

PROTECTING MARINE SPECIES

The central goal of marine conservation is to protect populations of marine species at sufficient levels to ensure their long-term viability. Two strategies used include restricting exploitation of a species and protecting large areas of habitat to promote the overall health of the marine environment. Southern California has had successes and failures with each approach.

INDIVIDUAL SPECIES PROTECTION

Extinction of the Abalone Twenty-five years ago, most marine biologists believed that it would be difficult if not impossible to cause a shellfish species such as the abalone to become extinct. This belief was based on the fact that most shellfish can spawn millions of eggs each month. Abalone were still plentiful—"blacks" covered the rocks in the intertidal zone and reds, greens and pinks could be found in crevices in shallow waters, while white abalone lived in water between 85 to 150 feet deep. It seemed reasonable to assume that even if only a small percentage of abalone eggs were fertilized and survived, more than enough young would replace the adults harvested in a fishery.

Unfortunately, these ideas were wrong, and one formerly abundant species, the white abalone, is now critically endangered and nearly ecologically extinct despite its deep dwelling habits. In 1987, the commercial catch of white abalone decreased to near zero, yet the fishery remained open as fishermen argued that still abundant stocks existed in deeper water. During the early 1990s, biologists used both scuba divers and submarines to survey hundreds of acres of former habitat and were able to find only a handful of white "abs." The fishery was finally closed in 1996—too late to save the white abalone. The species was eventually placed on the Federal Endangered Species list in June 2001, fourteen years after the fishery had already collapsed. In fact, the commercial fisheries for all species of California abalone were nearing collapse when they were closed in 1997. Sadly, many California fisheries, from sharks to rockfish, have followed this worldwide pattern of overfishing, collapse and closure. In this respect, the marine environment in California is no different from that found in a typical third-world country where this pattern of serial depletion is common.

SAVE THE WHALES—A SUCCESS STORY

The "Save the Whales" campaign is a nice example of how marine conservation can be successful. While this was an international campaign, many battles and the ultimate success have involved southern California. The success is of particular interest in the marine conservation context because most people have never personally seen a whale and yet they feel compassion towards these amazing animals.

During the 1970s, many Americans became concerned about the plight of the great whales that were being hunted commercially for food by several nations. In those days, passengers on trips to Southern California's Channel Islands would commonly see gray and pilot whales, but other species were rare. Passengers almost never observed the blue whale—the largest animal on earth at 85 feet long and 100 tons—and the species was considered on the verge of extinction. According to the Oceanic Society, hunters killed at least 30,000 blue whales annually from the early 1900's to 1967 and the blue whale population declined to 5% of its original size. The federal government enacted the Marine Mammal Protection Act in 1972 to limit hunting of threatened species—including grays and blues. Environmental groups initiated the "Save the Whales" campaign and ultimately succeeded. The gray whale was declared "recovered" in 1994. An estimated 2000 blue whales now roam southern California waters, and pods are frequently observed in the Santa Barbara Channel.

It is worth considering why this campaign was successful. There appear to be three key factors. First, a young, energetic organization, Greenpeace, used brilliant David-versus-Goliath public relations to sell their clear, simple message. Second, only a handful of countries were still using whales commercially and sufficient time had passed so that American supporters could conveniently ignore our long history of commercial whaling. Third, whales are fascinating creatures in terms of size and behavior—some species' songs indicate an overlooked intelligence and human-like qualities.

The success of the Save the Whales campaign is a model for marketing single-species marine conservation to the public. However, this simple analysis implies that it may be more difficult to raise public or legislative support for an entire underwater ecosystem that most people have never seen or for a species of rockfish that is small, dull gray and spiny.

Why do policy makers often wait until a species is too far gone before protecting it? The long-term survival of any fishery species should be of central concern to those whose economic livelihood depends on its existence. Unfortunately, even when good scientific advice is available, the short-term economic interests of fishermen are manifested in political pressure to avoid restricting access to fisheries.

Saving an Orange Icon Although marine conservation failures have been numerous, the region has seen a few successes. One largely overlooked success story involves the California state fish, a brilliant orange damselfish known as the garibaldi which inhabits rocky reefs of southern California. This enigmatic fish does not grow very large and is not particularly desirable as a food fish. It was spared the attention of commercial fishers and recreational fishermen were long banned from catching them. However, juvenile garibaldi a few inches long are attractively colored orange with blue spots. In the early 1990s, a commercial fishery developed to supply home aquarium owners, depleting populations around Catalina Island. Concern over this issue led to enactment of a state law banning commercial collection of garibaldi in 1995. Despite their relatively low reproductive rate, garibaldi populations quickly recovered and are now in good health. This

Most southern Californians have no idea that sea otters were a common native animal.

success shows that with proper care, fish species can be sustainably managed in southern California—particularly when they do not appear on restaurant menus.

The Case of the Sea Otter Few visitors relaxing in the quaint restaurants of Avalon on Santa Catalina Island off Los Angeles are aware that the island was originally settled by Spanish and Russian fur traders drawn by the seemingly inexhaustible population of otters. In the late 1700s, the original distribution of otters extended from Japan through Alaska to Mexico with an estimated population of 300,000. Otter pelts are luxuriously soft and very warm with up to one million hairs per square inch, and thus were highly sought after in China. The hunt was rapacious. For example, in 1806, a single American ship using a Russian manager to lead Aleut hunters speared 4,819 otters including 549 pups. The ship sailed to Hong Kong where the pelts were sold for $300 each—an enormous sum at that time. By 1911, as few as 1000 otters were left in America and all sea otter hunting was banned.

From an original California population of about 20,000, the species nearly died out, with just a handful of otters surviving near Monterey, slowly reproducing until reaching 1,800 by 1972. At that time a near-shore gillnet fishery was implicated in otter drowning cases and so the state restricted deployment of nets to further offshore. The otters rebounded again until the past four years, when numbers began slowly declining due to disease.

Is the sea otter story a success story for California marine conservation? What is the yardstick of success? Sea otters have been saved from extinction. But we must temper our delight at observing sea otters using rocks as tools to break open shellfish on their bellies at Point Lobos with the knowledge that the original, much larger population was distributed over a geographic range orders of magnitude larger than present. Most southern Californians have no idea that sea otters were a common native animal. Since sea otters can swim long distances, one may wonder why we can't see our furry friends basking in the sun in their original habitat off Avalon?

A surprising aspect of California's sea otter recovery program is that sea otters have been physically excluded from Southern California by a catch and release program worked out as a compromise with fishermen in the 1980s. Fishermen were concerned that if otters were allowed to return south of Point Conception, the then valuable shellfish catch would decline. Sea otters lack the thick layers of body fat that keep seals well insulated from cold California waters, hence a full-grown 65 lb otter eats about 15 lbs of fish and shellfish per day. In 1986, the US Fish and Wildlife Service set up a "no-otter zone" south of Point Conception in exchange for

Large-scale marine habitat protection has not been a feature of California coastal management.

Santa Cruz Island, part of the Channel Islands National Marine Sanctuary.

establishing a colony on San Nicolas Island. The state trapped and moved all otters observed south of Pt. Conception at a cost of about $10,000 per animal. Ironically, the San Nicolas population experiment failed, and recently the USFWS has decided to allow otters to move south, after the fisheries protected from sea otters failed due to overfishing.

HABITAT PROTECTION

Marine Protected Areas Large-scale marine habitat protection has not been a feature of California coastal management. Although Southern California coastal waters contain such notable locations as Channel Islands National Marine Sanctuary and Point Lobos State Reserve, until now, only 14 of 220,000 square miles, or far less than 1% of official California waters have been designated as reserves—completely off limits to fishing. All other subtidal waters, whether inside or outside of "parks," have remained open to most forms of fishing. In comparison to terrestrial parks where commercial hunting of wild animals is banned, commercial fishing of marine animals (fish) has been a long accepted practice.

Two recent laws represent a long-overdue change in policy: the 1999 Marine Life Management Act, which requires that the Fish and Game Department prepare management plans for designated fisheries; and the 1999 Marine Life Protection Act (MLPA), which mandates the establishment of a network of Marine-Protected Areas "MPAs," including no-take reserves. The MLPA provided the basis for the State to make a very controversial 2002 decision to increase the size of no-take areas within the Channel Islands.

Channel Islands No-Take Area MPAs are one of the most valuable tools in implementing marine conservation. Recent research has clearly documented that in ecosystems ranging from coral reefs to kelp beds, marine protected areas result in increased biodiversity, increased body size and numbers of species targeted by fisheries. In April 2003, after four years of public consultation, the California Fish and Game Commission voted to create a 132 square-mile network of marine reserves, covering about 19% of the waters around the five Channel Islands in the National Park. Since the "marine reserve" designation prohibits all types of collection and fishing, this is the single most important success in California marine conservation in the last 100 years. This decision is based on solid science that demonstrates both that the individual size of an MPA and its relationship to neighboring MPAs can contribute to an MPA's success.

One of the well-known limitations of fisheries management has been a single-species approach, whereas most fisheries include multiple species. Conservation science now recognizes that to be successful,

The "no-take" reserves approved for southern California's Channel Islands in late 2002 represent a giant leap forward for marine conservation in the state.

marine reserves need to be large enough to include a significant percentage of a given ecosystem. Thus the MLPA provides the framework for increasing the scope of protection to the ecosystem level.

The "no-take" reserves approved for southern California's Channel Islands in late 2002 represent a giant leap forward for marine conservation in the state. Yet the designation process was controversial and some stakeholders fought it every step of the way. In December 2002, a coalition including United Anglers of Southern California and a variety of commercial fishermen's groups filed suit against the proposed Channel Islands reserves. Reserve proponents have clearly failed to educate those who should be most supportive of marine conservation that no-take areas are in everyone's interest if only to reseed surrounding waters. Public education and community-based monitoring of our coastal resources, including the involvement of fishermen in data collection and analysis, will all be necessary to move forward in protecting and conserving California's precious marine environment.

GRADES

Grades for the government and public:
Past (1849-1999) **C-**
Present (1999-2003) **B-**

Gregor Hodgson is a Visiting Professor at the UCLA Institute of the Environment's Coastal Center. He teaches courses in Integrated Coastal Management and Marine Conservation. Hodgson earned a B.S. degree in biology in 1979 at UCSB, where he worked for the Santa Barbara Underseas Foundation and carried out a study of the sea lion haulout on the west end of Santa Cruz Island. Hodgson then spent three years as a US Peace Corps volunteer in the Philippines where he carried out intensive coral reef surveys. Hodgson was an East-West Center scholar and completed his PhD in zoology at the University of Hawaii, where he also carried out ecological economics study of coral reefs. He returned to Asia to manage the environmental department for a multinational design engineering firm to implement coastal management projects for the UN. He designed an innovative global coral reef monitoring program called Reef Check, which brings together scientists with volunteer divers to assess the health of the world's coral reefs. The program was the first to document the global coral reef crisis and is now active in over 60 countries. Since joining UCLA in 2000, Hodgson has focused his research on marine conservation in coral reef communities and California.

About the UCLA Institute of the Environment

MISSION—BUILDING KNOWLEDGE AND SOLUTIONS FOR PLANET EARTH

The Institute of the Environment (IoE) is generating knowledge and providing solutions for regional and global environmental problems, and educating the next generation of professionals, leaders and citizens committed to the health of our planet. Through its local, national and international programs, the IoE employs innovative cross-disciplinary approaches to address critical environmental challenges—including those related to water quality, air pollution, biodiversity, and climate change—with the goal of achieving sustainable human coexistence with natural systems.

GOALS

The Institute of the Environment seeks to:

- Develop a world-class, broadly interdisciplinary environmental research and teaching program that links science and policy creatively and in-depth.
- Support and expand environment-oriented activities at UCLA, and in the regional community, by providing access to expert advisors, resources and infrastructure.

- Provide unparalleled leadership in environmental problem solving that is based on science and technology with social consciousness and sensitivity.

TEACHING

The IoE enhances undergraduate and graduate student training by presenting environmental issues within a broad yet integrated framework. Classroom activities are enhanced by student contact with the Institute's research programs, including fieldwork at remote facilities such as the Stunt Ranch Natural Reserve in the Santa Monica Mountains, and the Ocean Discovery Center on Santa Monica Bay. Graduate students participate directly in a wide range of projects, both in the field—at Point Mugu Lagoon, for example—and in the laboratory—including "wet" experimentation, computer modeling, and geographic information systems analysis.

This year, the Institute introduced a new minor in *Environmental Systems and Society*. The curriculum, which involves a collaboration between nearly a dozen campus departments, probes the relationships between science, history, political science, policy, and technology to broaden environmental knowledge and understanding, and to delineate new professional horizons.

The Institute is also launching a unique Ph.D. degree program that takes graduate-level environmental education beyond existing boundaries. Students are first required to establish a strong foundation in a primary field of study. Subsequently, as they pursue their dissertation research, students are immersed in a multidisciplinary learning environment. This novel approach is expected to yield discoveries that extend knowledge into unforeseen frontiers.

RESEARCH

IoE faculty, professional staff and students conduct interdisciplinary research that is often focused on the Los Angeles area. Such activities are presently organized through five centers. The *Coastal and Marine Research Center*, which deploys a 75-foot sea-going vessel—the Sea World UCLA—addresses

problems related to the coastal ocean and land margin bordering Southern California, including wetlands and watersheds. The center is also home to the world-renowned Reef Check coral reef monitoring program.

The Institute's *Center for Tropical Research* considers biological processes that underlie and maintain the diversity of life worldwide, especially in the tropics, and utilizes this knowledge to address threats to global biodiversity. The center has established a network of scientists, many from developing countries, studying the origins of diversity in tropical rainforests, and rainforest restoration in human-dominated landscapes. Closer to home, the center is examining the loss of Mediterranean woodland habitats in the nearby Santa Monica Mountains.

The *Center for Air Pollution and Exposure* is investigating the causes of poor air quality and its effects on the population of Southern California. The center integrates studies of regional weather, air toxics, and human exposure to smog, assessing potential health impacts and addressing questions of environmental equity, with the aim of guiding policy. A related activity—the *Southern California Particle Center and Supersite*—is a UCLA-led consortium of five major universities studying the origin of respiratory disease associated with exposure to airborne particulates, especially those generated by traffic.

The Institute's new *Center for Urban Sustainability and Predictability* was launched this past summer. Its mission derives from the proposition that society must achieve a sustainable relationship with the natural world to ensure a century of sustainable development in Southern California. Research themes address issues related to land use, transportation systems, energy consumption, water resources, and green design.

OUTREACH

The IoE reaches out to the local community. The *Southern California Environmental Report Card*, for example, offers an annual assessment of the state of the regional environment that is widely used by the public and private sectors. Through its *GLOBE in the City* program, the Institute brings environmental science directly to K-12 classrooms across Los Angeles. The *GLOBE* project collaborates with the Los Angeles Unified School District and the California Air Resources Board to set up air quality learning sites at local schools. As in the past, IoE-sponsored seminars and colloquia continue to explore timely subjects of interest to the public. And the Institute has launched a series of *Eco Salons* that bring together community leaders and UCLA faculty to discuss the latest discoveries in environmental research.

LOOKING AHEAD

With the introduction of a graduate degree, the Institute of the Environment has achieved a critical milestone in the development of a fully articulated academic program. A high priority at this point is the recruitment of new faculty with environmental interests. The IoE recently appointed ten campus faculty members to its roster, joining the six current permanent faculty of the Institute. Several searches are also underway. The consolidation of a full complement of faculty, students and staff into a permanent home on the central UCLA campus will mark the beginning of an exciting and productive era for the IoE.

RC 2002 Revisited

RESPONSE RECEIVED FROM SOUTHERN CALIFORNIA EDISON

I once again enjoyed reading the *Institute of the Environments Southern California Environmental Report Card*. You and your colleagues are to be commended for your efforts to communicate to the leaders and interested public of the region on some of its more important environmental issues and their public policy implications.

However, I take exception to a couple of inferences made in two of the Report Card articles. The first concerns the figures on Pages 8 and 9 in Dr. Rundel's article on Biodiversity showing current vegetation and land cover in the Santa Monica Mountains compared to future land cover, predicted by a simple model that assumes development at a constant rate equivalent to that observed between 1983 and 1990. A more precise model could have been employed here: one that incorporates present and future ownership, regulatory and political constraints, and other factors.

I would guess that a great deal of the land "whited out" as future development in Figure B is in fact either owned by the Santa Monica Mountains Conservancy or some other

public entity, or is slated for acquisition using some of the billions of bond dollars granted by voters in the past 4 years for the acquisition of lands for watershed and open space preservation, and therefore will most likely remain undeveloped. Other whited out property is located in the coastal zone regulated by the California Coastal Commission, not known for a development-friendly attitude.

The figures improperly convey to the lay reader the impression that development is inevitable and conservation efforts are hopeless, rather than conveying the truth that public land acquisition and environmental scrutiny of development are indeed working and will stem the development tide, albeit at significant cost. A C+ grade does not, in my opinion, fairly reflect the efforts presently put forth by public and government to preserve habitat.

Second, I would argue that certain facts stated in the first full paragraph on Page 36 in Mr. Schoen's article on "Sustainable Building" are simply untrue. The author states the Playa Vista development will provide badly needed housing, but "at the cost of precious wetlands." To imply that the current development is either impacting jurisdictional wetland or preventing practicable restoration is fallacy. The developer recently abandoned plans for any proposed development west of Lincoln Blvd, and the Playa Vista project will now be limited to about 5,300 residences (down from over 11,000 once proposed) rendering obsolete Mr. Schoen's statement that "it appears certain the load put on surrounding streets will lead to near grid-lock traffic conditions." Gridlock is not a likely outcome, partly owing to road improvement mitigation that will inevitably be imposed but mostly because of the reduced project size, thanks to persistent public activism, bond funding and regulatory scrutiny reflective of public sentiment.

David W. Kay, D. Env.
Project Manager, Marine Mitigation
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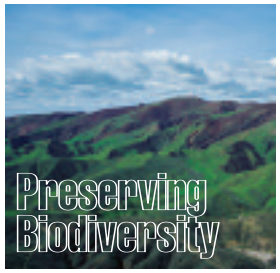
continued

ERC RESPONSE TO LETTER OF DAVID KAY



The points raised by David Kay of Southern California Edison in his letter focus on the question, "What will the Santa Monica Mountains look like in 50 years?" The potential future development scenario presented in my article "Preserving Biodiversity" in the RC 2002 is an entirely possible one based on conditions when the model employed was developed. We can all hope that such a level of development will never occur, and we have some reasons for cautious optimism. Successful state bond issues for the purchase of conservation lands, active programs of land acquisition by the Santa Monica Mountains Conservancy and other land trust organizations, and favorable tax laws for land donations have all had a positive influence in protecting our unique biodiversity in Southern California. However, a variety of economic and demographic forces related to spiraling land values, government deficits, and strong pro-growth pressures are working against an expansion of protected areas in the future. For example, a substantial portion of recent bond funds earmarked for open space acquisition have been appropriated by the legislature and Governor Davis for other uses to reduce the enormous state budget deficit.

We will not be able maintain effective efforts in preserving biodiversity without continued grass-root public concern and increased levels of proactive planning by public/private partnerships. The needs are greater than ever at a time with diminishing public resources. The future of the Santa Monica Mountains and other wildlands in Southern California may well depend on political decisions being made today as our elected officials prioritize conservation and the preservation of biodiversity against competing public expenditures, population pressures, and looming deficits at all levels of government.

Philip W. Rundel, Ph.D
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SECOND RESPONSE TO DAVID KAY LETTER

David Kay questions Prof. Schoen's statement, in his article "Sustainable Building" (RC 2002), that building 5300 additional residences in Playa Vista will lead to near grid lock conditions on surrounding streets. He asserts the impact of the accompanying vehicles will be mitigated by road improvements. Of course this is the argument made for all such projects and a fundamental fallacy of the CEQA process. If the traffic impacts of every project can be fully mitigated, as pro-development forces invariably assert, then why is traffic congestion worsening, and average commute times increasing, year by year, in Los Angeles? By most metrics, the area under discussion in West Los Angeles, including the 405 Freeway, is already approaching near gridlock conditions for large periods of each day. Building 5300 new homes will only exacerbate that reality.

Arthur Winer, Ph.D
Editor, RC 2002

Southern California
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RC 2003

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