

Urban Edge Effects

and their relationship with the natural environment



"Nowhere in the state are the challenges of future growth more apparent today than in places where cities encroach on adjacent open space. Along that ever-expanding edge are all the elements in a classic conflict over land use, transportation planning, water availability, and habitat preservation."

[Mary D. Nichols -- Secretary for Resources](#), State of California



PREFACE

By Gary Watts, State Park District Superintendent, Inland Empire District.

This web page was designed to broaden the understanding of urban edge effects, and to offer suggestions for softening these and other urban influences on all parks and preserved wildlands.



Gary Watts, State Park District Superintendent
Inland Empire District

There is a limited amount of land held for preservation purposes in perpetuity throughout the state. Once it is preserved, it needs to be managed smartly, and not compromised by the urban influence. The primary land management goal is to achieve a land use balance, one where mutual respect for nature and human development allows all creatures (raccoons, deer, bear, hawks and people) to optimally coexist.

As California's population rapidly increases, more and more development occurs to accommodate this increase. While development is needed and appropriate in some locations, oftentimes it occurs close to preserved wildlands adding to the land management challenge of avoiding and minimizing edge effects. Edge effects occur where development, including roads, takes place adjacent to wildlands. Edge effects threaten the ecological integrity, recreational experience, aesthetic quality, public investment, and safety operations of preserved wildland areas.

A special thank you goes to Enrique Arroyo, a masters student of Environmental Studies at the University of Southern California, who wrote the contents of this web site. Also, thank you to my staff for their editing efforts and continual educational efforts about urban edge effects.

PURPOSE

Education and interpretation are the focus of one of the State Parks' core program areas. Education is essential for the preservation of the State Park System. Through interpretive and educational programs, we gain appreciation and insight into California's natural and cultural riches.

This web page was developed to illustrate the consequences of edge effects on the natural environment and provide guidance for people living near wildlands and people who use wildlands for recreational purposes.

The material is separated into the following sections:

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Authored by Enrique Arroyo, Environmental Studies master of arts student at the University of Southern California. Comments can be sent to lldhq@parks.ca.gov

SECTION 1: INTRODUCTION

The Land of Opportunity

California has long been recognized as a land of opportunity. Its mild, year-round Mediterranean climate has attracted people from all over for decades. This continuous increase in population in the state yields an increasing demand for urbanization, often in wildland areas, which imperils the stability of the natural ecosystems. Increasing urban development in wildland areas also leads to risks and liabilities.

California is comprised of an assortment of natural and artificial landscapes that support a large number of people and a vast array of wildlife, including plants and animals. However, this landscape has changed dramatically since the advent of the automobile. Traditionally, most people lived near the central business district because of the abundance of services and employment opportunities. Their primary mode of transportation was either rail or carriage. Thus, living far from employment centers was not an option.

The proliferation of the car coupled with the construction of highways fueled the demise of rail use as public transportation in southern California. Consequently, automobiles allowed people to move out of the inner city and into new and affordable homes. Residential development spread rampant across the undeveloped landscape of many areas of California after World War II. Businesses were also lured away from the inner city with various incentives, such as reduced rents and newer buildings.

At the same time, a movement began to provide public parks as a form of promoting better health standards. Unsanitary and overcrowding conditions in the inner city prompted health officials to seek relief for the public. Parks were seen as a method of allowing people to get away from the hustle-and-bustle of the crowded inner city.

Today, much of California still struggles to provide sufficient land in outlying areas for new housing and commercial development. The remaining undeveloped land is often viewed for its development potential without regard for its inherent value. When undeveloped land is urbanized, however, we must carefully look at the relationship of the built environment with the remaining natural environment. People living near wildlands have an excellent opportunity to become stewards for the environment.

Habitat Fragmentation

Increasing development not only causes local effects on resident wildlife species, but also regional impacts on the entire system of native habitat. Urbanization does not always follow a logical pattern; in some cases, chunks of open space are cut away leaving behind disjointed pieces of native habitat. From a land-borne species perspective, these wildland remnants end up trapping some species with little or no available resources for survival, which can lead to [extirpation](#). The larger these natural reserves are, the more species they can sustain ([Diamond 1975](#)). Diamond's study indicates that increasing distance between "islands" of habitat could decrease the number of species in a given area. For example, a certain species will likely travel the shortest distance in fulfilling survival needs. The

longer the distance to the species' food or shelter source, the less likely the species will travel there unless a habitat linkage also contains its required resources.



Figure 1: Pockets of native habitat remain after urbanization fragments the natural landscape. In some cases, the pockets may be too small, or may be cut off from larger habitat reserves.

The best way to sustain wildlife and ecosystems is to minimize habitat fragmentation ([Soulé 1991](#)). The basis for this argument lies with scientific evidence in the forms of species-to-area relationships. First is the area effect that indicates destructive effects on natural systems of decreasing patch size. The rate of species extinction in an isolated patch of habitat is inversely related to its size, meaning that the smaller the habitat size, the greater the chance of extinction. This translates into a demand for larger habitats and accessibility between the smaller ones. Set-asides are often too small to prevent catastrophic rates of habitat disturbance and the loss of many species of animals ([Soulé 1991](#)).

The distance effect revealed the inverse relation between isolation and movement frequency, meaning that the more isolated a species is, the less likely it will be able to move, especially if movement corridors are not present. Adding to the problem, wildlife can become trapped in an urban environment, often resulting in their removal because of precautionary measures for public safety. It is important to remember that where wildlands have provided food and shelter for wildlife previously, they may attempt to return after people have claimed what was once their home, because that is the area they have always been accustomed to.

The age effect indicates that the older the isolated patch the more altered it should be. Pieces of natural land that have been separated from larger reserves for longer periods of time have an increased chance of experiencing loss of genetic makeup, competition with exotic species, and human disturbance. This can lead to fewer species being able to survive.



In areas adjacent to wildlands, the seemingly harmless process of urban development impacts natural ecosystems in many ways, including extirpation of important top predators. In order to curtail urban impacts to wildlands, the control of coyotes, bobcats, badgers and mountain lions should be opposed ([Soulé 1991](#)). Such animals help maintain healthy ecosystems and prevent the abnormally high population densities of smaller predators that are likely to prey on birds ([Soulé 1991](#)) ([Crooks & Soulé 1999](#)), changing the species diversity and upsetting the natural balance within the biological community.

Various organizations, such as [The Wildlands Project](#), seek to reverse fragmentation and prevent extinction by setting up a system of protected natural areas consisting of core wildlands, buffer zones, and zones of connectivity ([Soulé 2000](#)). It is important consider the possible extinction of local species within the next century due to delays inherent in planning and implementation of land transfers into preserves. [The Nature Conservancy](#) and [The Wildlands Conservancy](#) as well as various government agencies actively pursue land acquisitions for the protection of natural ecosystems.

SECTION 2: EDGE EFFECTS

Urbanization is comprised of residential, commercial, industrial, institutional and highway-related development. In short, urbanization is the built environment. At the perimeter, or edge, of the built environment is an area known as the urban/wildland interface. When development is configured in a manner that creates a high ratio of development edge to wildland, there is an increase in the potential impacts caused by human use (See Figures 1 and 2).

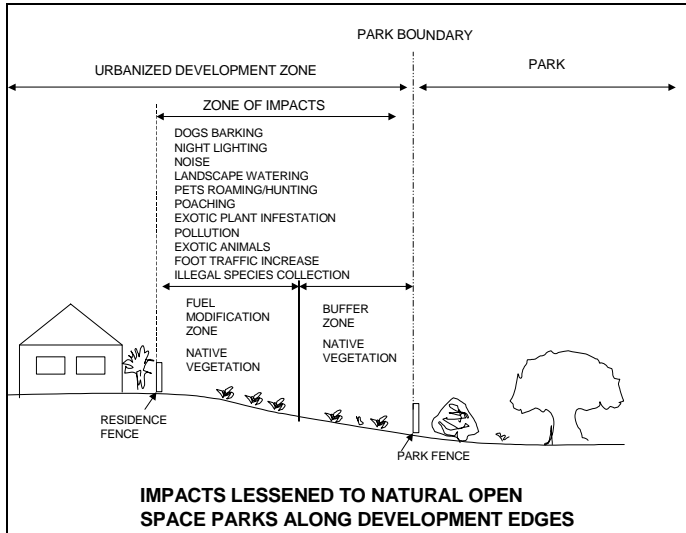


Figure 1.
Desired scenario.

Notice that the impacts remain in the development zone. A buffer zone can reduce impacts to natural communities and allow for an extended fuel modification zone for increased public safety.

Figure not drawn to scale.

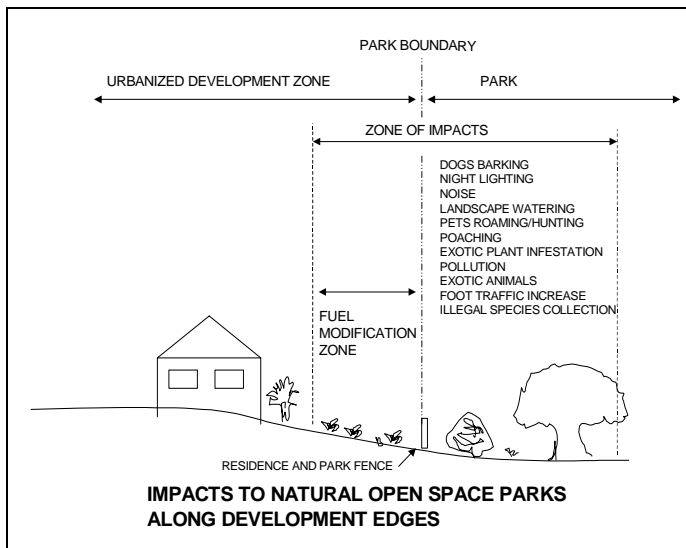


Figure 2.
Least desired scenario.

Notice that the zone of negative impacts extends into protected public park land.

Figure not drawn to scale.

Land managers have been relying on [island biogeographic theory](#) to plan for large natural open space reserves with connections to other reserves in order to preserve biodiversity. However, that is not enough. Because of adverse effects to these wildlands from surrounding developed areas, it is becoming clear that, in order to maintain healthy

ecosystems and maintain biodiversity, attention must be given to minimizing impacts to wildlands from surrounding urban areas. This has important implications for land managers since it involves a radically new way of viewing management and requires that neighboring land users, and hence neighboring land owners, interact in a positive way ([Saunders et al. 1991](#)). As neighbors to wildlands, residents have an opportunity to participate in promoting wildlife.

A few of these impacts, sometimes called urban edge effects, are as follows:

1. Introduction of [invasive exotic vegetation](#) inadvertently carried in from bikes, people, animals or spread from backyards or fuel modification zones adjacent to the park wildland,
2. [Higher frequency and severity of fire](#) (fires are a natural process but when too frequent can harm the environment),
3. [Companion animals \(pets\)](#) which can act as predators of and competitors with native wildlife, as well as vectors for disease,
4. [Use and creation of undesignated trails](#) can significantly degrade the natural environment,
5. [Introduction of exotic animals](#) which can compete with or prey on native animals.
6. [Influence on earth systems](#), such as [solar radiation](#), [soil richness and erosion](#), [wind damage](#), [hydrologic cycle](#), and [water pollution](#), can affect the natural and the built environment.
7. [Loss of foraging habitat](#).

Together, these effects can reduce the biological diversity in an entire ecosystem. Lessening these effects requires cooperation from adjacent landowners and additional resources for more intensive reserve management activities such as invasive plant removal and habitat restoration.

Edge Effect Category 1: Invasive exotic vegetation

Many animals make use of native vegetation for their survival. For example, the Chino Hills State Park is well represented by a variety of habitat types such as riparian woodlands, coastal sage scrub, native grasslands, and Southern California walnut woodlands. These plant communities provide a home for different wildlife species such as, mountain lion, bobcat, mule deer, greater roadrunner, California quail, migratory songbirds (California gnatcatcher, least Bell's vireo, etc.), raptors (golden eagles), reptiles, and amphibians.

Exotic plant species can take over existing native vegetation and eliminate food and shelter sources. Wildlife species become vulnerable due to a loss of native habitat. Their search for new homes may not always be successful due to restricted mobility, being in unfamiliar territory once relocated, or the animals will find that adjacent habitat is unavailable or unsuitable for them to survive. They may also become a victim of a wildlife/vehicle collision if they attempt to cross a highway. Loss of habitat also affects migratory species, such as swallows and least Bell's vireos because it eliminates vital breeding habitat that is critical in the species' survival.



The giant reed seen at the top of this photo and Cape ivy seen at the bottom are invasive exotics which take over native riparian plants, eliminating habitat for species such as the least Bell's vireo.

For guidelines see the discussion on [exotic vegetation](#) in Section 3: Suggestions for residents [living near wildlands](#)

Edge Effect Category 2: Higher Frequency and Severity of Fire

The warm climate in southern California provides an ideal environment for many people to enjoy a myriad of outdoor activities, such as hiking, bicycling, and horseback riding, just about any time of the year. However, with this warm weather comes the potential for drought, which in some cases can last years. Yet, much of the natural landscape in California is already well adjusted to long droughts. Such drought-tolerant vegetation is easily susceptible to fire because of its low water content. Much of California's vegetation is fire adapted, and needs fire in its life-cycle.

While the name might imply destruction, fire is actually a natural and vital element of California's ecosystems. Fires assist in the distribution and replenishment of vegetation in wildlands. In fact, some plant species cannot survive without fire. The seeds of some plants lie dormant until a fire breaks them open. Also, their roots are fire-resistant, which allows them to regenerate and spread rapidly among the ashes left from a wildfire ([CDF 1999](#)).

The natural cycle for wildland fires can range from a few years to several hundred years ([Stephenson & Calcarone 1999](#)). Human presence increases the frequency of fires in wildland areas, where they can start from cigarettes, open flame fires, and arson. Not only are people at higher risk, but the life cycle of plants and trees is affected.

When the frequency of fires becomes higher than what is natural for a vegetation community, it can undergo what is referred to as a "type change". A type change results in the replacement of a vegetation community with another vegetation community, such as non-native grassland replacing coastal sage scrub that has burned too frequently.



The severity of wildfires comes with the increased risk for public safety and the increased cost of repair following a fire. Public safety is pushed to the forefront when houses are located near wildlands. Once people are at risk, fire officials are prompted to seek solutions. One of the primary methods of reducing fire risk is by implementing a [fuel modification zone](#).

The actual cost of repair following a wildfire increases when the built environment is damaged. In addition, the natural environment suffers due to a loss of its replenishment cycle. For guidelines see the discussion on [wildfires](#) in Section 3: Suggestions for residents [living near wildlands](#)

Edge Effect Category 3: Companion Animals and Predation

Companion animals, such as dogs and cats, should not be allowed to wander freely in wildlands. They can hunt wild animals thereby disturbing food sources for other predators, and can disrupt the natural behavior of wild animals just by leaving their scent. Companion animals can also become the prey of coyotes, bobcats, and mountain lions. Also, domesticated animals may not be able to survive in the wild, as they may starve to death. For people who raise pigeons, they should be aware that in the wild, the pigeon population can reproduce explosively, thereby crowding out native species.

Domestic dogs

Dogs can chase, catch, kill or overheat and exhaust an animal that may be facing a low water supply. They can transmit an otherwise curable disease to wild animals that do not have the privilege to receive immunizations. In addition, dogs can receive snake bites and diseases from ticks. Fox tails and poisonous plants can also pose a threat.

Domestic cats as mesopredators

[Mesopredators](#) include domestic cats, foxes, raccoons, opossums, and striped skunks. Domestic cats have been known to prey recreationally on scrub-breeding bird species, bringing the carcasses home ([Crooks & Soulé 1999](#)). In fact, according to a study conducted in San Diego County 77% of cat owners in areas adjacent to wildlands allowed their cats outdoors and 84% of outdoor cats in this same area brought back kills to their residence ([Crooks & Soulé 1999](#)). At this study location the bird population cannot sustain habitat fragmentation coupled with predation by mesopredators ([Crooks & Soulé 1999](#)), as is most likely the case in other urban/wildland interface areas. Consistent with the [mesopredator release phenomenon](#) domestic cats and other mesopredator abundance have been curbed by the presence of medium and large mammalian carnivores, such as coyotes and bobcats who do not prey on scrub-breeding bird species helping to keep avian populations balanced.



Typically, the larger mammalian carnivores require large tracts of land in order to persist. However, today's society is allowing an increase in urban development that creates smaller fragments and a greater amount of urban edge. Consequently, there are a greater number of domestic cats at the urban edge. Protection of home ranges large enough for coyotes and bobcats can stabilize this relationship.

For guidelines see the discussion on [companion animals](#) in Section 3: Suggestions for residents [living near wildlands](#)

Edge Effect Category 4: Use and Creation of Undesignated Trails

Trails provide an opportunity for several types of outdoor recreational activities, including hiking, horseback riding, mountain biking, and wildlife viewing. Trails that originate from backyards, at the end of cul-de-sacs, or even along roadways jeopardize the health of the ecosystem as well as the safety of the park visitor. Urban development projects adjacent to publicly protected wildlands can be configured and designed so as to discourage the creation of undesignated trails.

Why use only designated trails



Trails are designed so that sensitive resources and public safety are taken into consideration. Also, designated trails are patrolled by park rangers and can be found on maps, decreasing response time in the event of an emergency.

Designated trails and roads provide a measure of environmental protection by keeping impacts localized. Trail maintenance is easier when all trails are identified because park managers can ensure that all trails are maintained.

Why not to use undesignated trails

When we venture off designated trails, we inflict certain impacts on the environment, and also put ourselves at risk of danger. Vegetation is reduced by increased usage. People can cause damage to native plant communities, which in turn can affect the creatures that rely on this vegetation for food and shelter. Furthermore, those species higher up in the food chain, such as the raptors and carnivores, may also be affected by the loss of the smaller, vegetation-dependent creatures. A reduction in the population of predators can further lead to mesopredator release, which can lead to a reduction in the migratory songbird population (See [Edge Effect Category 3](#)).

Some areas also have sensitive species, such as migratory songbirds, that do not have a tolerance for human disturbance. Also, people can unknowingly transport exotic plant seeds into the sensitive areas on their clothing or shoes, thereby increasing the severity of the impact on plant species. Eventually, this type of impact can affect native habitat communities compounding the effect on wildlife species.

In addition, soil erosion can result from continued use. Trail maintenance is primarily accomplished on designated trails, but difficult to perform on trails that are not identified, located in remote areas, or located in dangerous, out-of-reach places, such as steep hillsides.

In some areas, people wandering into restricted areas or undesignated trails may be fined. Only by having this regulatory power can park authorities have the ability to manage and maintain the precious resources, and keep them safe for everyone.

For guidelines see the discussion on [recreational effects](#) in Section 4: [Suggestions for park visitors](#)



Edge Effect Category 5: Introduction of Exotic Animals

Many species of native wildlife have been impacted by the introduction of animals that are not native to the areas (exotic animals). All groups of native wildlife are affected by this problem including insects, amphibians, reptiles, birds and mammals.

One example of this situation is the intentional or accidental introduction of predatory fish and amphibians such as bass and bullfrogs into freshwater ponds and streams. The eggs and young of native fish and amphibians become the prey of these unwelcome invaders. In most cases, native species of frogs, toads and fish decline drastically or become [extirpated](#) from that watershed as a result.

Nest Parasitism

Some migratory songbird species are continuously threatened by nest parasitism, chiefly by brown-headed cowbirds (*Molothrus ater*). Cowbirds search for established nests laying their eggs in the midst of the host birds' eggs. In cases where the nest may be full, cowbirds are known to remove one or more host eggs in order to lay their own. These host birds will unknowingly raise the cowbird hatchling as their own. The cowbird young can even dominate the host birds' young because it is usually larger in size.

Cowbirds feed on insects that target livestock and are notably abundant where riparian woodlands are in close proximity to grass or agricultural fields ([Stephenson & Calcarone 1999](#))(See [Rothstein et al. 1980](#) for further discussion). Agriculture, livestock grazing, and urbanization simplified the spread of cowbirds from their original home range in the Midwest ([Stephenson & Calcarone 1999](#))(See [Rothstein 1994](#) for further discussion). Among the birds affected by cowbirds are, the least Bell's vireo, southwestern willow flycatcher, and the California gnatcatcher ([Stephenson & Calcarone 1999](#)).

Edge Effect Category 6: Influence on Earth Systems

Habitat fragmentation can cause changes in physical and biological earth systems, such as solar radiation, wind strength, water quality, and nutrients in the affected area ([Saunders et al. 1991](#)). Such changes can result in consequences not only on wildlife but on people as well.

Solar Radiation

Fragmentation can result in changes to the [microclimate](#), in particular, solar radiation, wind, and hydrology of the fragmented landscape ([Saunders et al. 1991](#)). Removal of native vegetation can increase the solar radiation reaching the ground surface, resulting in a loss of ground moisture and changes in plant growth ([Saunders et al. 1991](#)). The fertility of the soil is then compromised, making it difficult, if not impossible, to revegetate these areas. There is also a higher frequency of habitat aridness and tree death ([Soulé 2000](#)). These changes to the landscape disturb the remaining native vegetation, especially along the urban-wildland interface ([Saunders et al. 1991](#)).

Soil Richness and Erosion

Soil is made of minerals, liquids, gases, and decomposed organic material and provides a home for a variety of creatures. Nutrients in the soil help keep drought tolerant plant species thriving. Altered temperatures can weaken the soil composition by modifying the nutrient content, which can advance onto adjacent areas. The increasing temperature can affect surrounding native habitats by reducing the amount of appropriate vegetation that can also negatively affect smaller mammals and reptiles dependent on that vegetation and soil richness.



Loss of root systems can result in soil erosion. Roots act similar to a web, holding soil together. When the roots become unstable or lose strength, the soil can disassemble, making it easier for it to wash away during storm events. Soil erosion can also result from an increase in soil aridity. Soil erosion means terrestrial species are without food and shelter. In essence, the natural value of the land is washed away.

"Urbanization, which usually results in the replacement of natural vegetation with pavement and other impervious surfaces, can create serious storm water runoff problems

as well as modifications to the microclimate" ([Beatley 1994, p. 102](#)). Other activities which can degrade the soil include off-road vehicle use, construction, overgrazing, and farming.

Wind Damage

Replacement of native vegetation with buildings, such as homes or offices, can alter the wind profile. Increasing winds, especially near edges, can damage the vegetation ([Saunders et al. 1991](#)). Trees and tall standing vegetation are particularly susceptible to damage by wind. Tree bark can be easily stripped away altering the livelihood of bark dwelling species. Also, litter fall from tree damage can harm the habitat below ([Saunders et al. 1991](#)). Wind can also transfer invasive plant seeds from areas close to but not necessarily adjacent to wildlands.

Hydrologic Cycle

Another physical effect is the modification of the hydrologic cycle. Urban development can alter the stream flow by introduction of hard, impermeable surfaces. Remaining vegetation effects the rate at which underground water tables get recharged during rain events. In addition, irrigation can also produce more water than the human environment can hold. The excess water then flows onto the wildlands and has the potential to disrupt the plant communities, such as coastal sage scrub, which do not require much water to thrive.

Another consequence of the effect on the hydrologic cycle is siltation into streambeds. Runoff from the built environment carries soil particles which can accumulate, alter the landscape, change the soil richness, and possibly obstruct tunnels that not only provide access for wildlife, but also allow the flow of water to the ocean.

Water Pollution

Water becomes polluted when there is a change in the chemical, physical, or biological quality which can produce harm to wildlife or make the water inadequate for the preferred uses. Various inorganic substances, such as gasoline, oil, pesticides, household detergents, radiator coolant, plastics, and many others, can pollute water. These agents can come from factories, service stations, farms, homes, roadways, litter, golf courses and other possible sources.

Soil erosion can result in clouds in the water, which in turn, prevent photosynthesis that can sustain aquatic species. Also, nutrients in the soil, such as nitrates and phosphates, can produce algae that take up dissolved oxygen when they die. Aquatic species dependent on this dissolved oxygen will soon die off as well. In addition, infants are also susceptible to death if they consume water with excessive levels of nitrates.

Edge Effect Category 7: Loss of Foraging Habitat

As more and more land is dedicated to development, suitable foraging areas for wildlife species are lost. Over time, the addition of more houses, roads, schools, shopping centers, etc. along the edges of wildland areas significantly impact the amount of area available for wildlife to forage and support reproductive activities. This also applies to adjacent disturbed areas such as agricultural fields and grazed fields.



A good example is the loss of foraging areas large enough for golden eagles. These large predatory birds have declined in urban open space areas in Southern California in recent history. An eagle pair uses the same territory each year for raising young. Areas where there is natural open space with buffers of agricultural use around it are able to support the continued reproductive success of these few remaining pairs. However, as more of these buffers are converted to development, their foraging areas shrink. At some point a foraging territory for an adult pair of golden eagles reaches a critical minimum size to successfully support them and their reproductive efforts. At that point, the pair is liable to disappear from that site. If a suitable alternative site is not found, the pair will not reproduce, threatening the overall population size. Planning for appropriate buffers adjacent to natural open space can help golden eagles to survive in Southern California and other areas.

SECTION 3: SUGGESTIONS FOR RESIDENTS LIVING NEAR WILDLANDS

Many people choose to live near wildlands. The motivation might be proximity to nature or distance from the inner city. Whatever the driving force may be, people living near wildlands should understand they have an important role when it comes to nature.

Wildlands have provided food and shelter for a variety of species for many years. Some of these species, such as mountain lions and coyotes, may not be favorable to humans because of the possible danger. However, animals may still recognize wildlands as their home even though it has been paved over. They may return to some areas where food was once abundant or shelter was ideal.

Residents whose properties are immediately adjacent to wildlands have an opportunity to protect native habitat and eliminate edge effects. At the same time, residents can provide for human safety, while still being sensitive to wildlife. Such knowledge may enhance the living experience and may provide opportunities for a symbiotic relationship between people and wildlife.

The following illustrates opportunities for people to soften the urban edge. The topics covered are [exotic vegetation](#), [wildfires](#), [companion animals](#), [residential lighting](#), [noise](#), and [household trash](#).

Exotic Vegetation

Use of exotic plant species on properties near wildlands should be avoided because they can overcome important native plants. Spreading can occur from bikes, pedestrians, and animals, either domestic or wild. Therefore, care in planting native vegetation is not limited to properties immediately adjacent to wildlands.

The following list includes plants that are a problem in wildland areas:

50 INVASIVE EXOTIC PLANTS IMPACTING CALIFORNIA WILDLANDS	
<i>Scientific name</i>	Common name
<i>Ailanthus altissima</i>	tree of heaven
<i>Ammophila arenaria</i>	European beach grass
<i>Aptenia cordifolia</i>	red apple
<i>Arcotheca calendula</i>	capeweed
<i>Arundo donax</i>	giant reed
<i>Atriplex semibaccata</i>	Australian saltbush
<i>Brassica nigra</i>	black mustard
<i>Bromus madritensis ssp. rubens</i>	red brome
<i>Carduus pycnocephalus</i>	Italian thistle
<i>Carpobrotus chilensis</i>	sea fig
<i>Carpobrotus edulis</i>	iceplant
<i>Centaurea melitensis</i>	toçalote
<i>Centaurea solstitialis</i>	yellow starthistle
<i>Conium maculatum</i>	poison hemlock
<i>Cotoneaster pannosus</i>	cotoneaster
<i>Cortaderia selloana</i>	Pampas grass
<i>Cynara cardunculus</i>	Artichoke thistle
<i>Cytisus scoparius</i>	Scotch broom
<i>Ehrharta calycina</i>	veldt grass
<i>Euphorbia esula</i>	leafy spurge
<i>Festuca arundinacea</i>	tall fescue
<i>Foeniculum vulgare</i>	fennel
<i>Eucalyptus globules</i>	Tasmanian blue gum
<i>Genista monspessulana</i>	French broom
<i>Halogeton glomeratus</i>	halogeton
<i>Hedera helix</i>	English ivy
<i>Hydrilla verticillata</i>	hydrilla
<i>Lepidium latifolium</i>	perennial pepperweed
<i>Lupinus arboreus</i>	bush lupine
<i>Lythrum salicaria</i>	purple loosestrife
<i>Malephora crocea</i>	ice plant
<i>Medicago polymorpha</i>	bur clover
<i>Nicotiana glauca</i>	tree tobacco

<i>Pennisetum setaceum</i>	fountain grass
<i>Raphanus sativus</i>	wild radish
<i>Ricinus communis</i>	castor bean
<i>Salsola tragus</i>	Russian thistle (= tumbleweed)
<i>Schinus terebinthifolius</i>	Brazilian pepper
<i>Schismus barbatus</i>	Mediterranean grass
<i>Senecio jacobaea</i>	Spanish broom
<i>Senecio mikanioides</i>	Cape ivy (= German ivy)
<i>Silybum marianum</i>	milk thistle
<i>Tamarix chinensis</i>	tamarisk (= salt cedar)
<i>Tanacetum vulgare</i>	tansy
<i>Ulex europaeus</i>	gorse
<i>Vinca major</i>	periwinkle
<i>Xanthium spinosum</i>	spiny cocklebur

The [California Native Plant Society](http://www.cnps.org) (916/447-2677, www.cnps.org) can help identify native plants.

The [CalFlora website](http://www.calflora.org), <http://www.calflora.org>, is a database that can identify both native and non-native plant species.

The [California Exotic Pest Plant Council](http://www.caleppc.org) (949/487-5473, www.caleppc.org) can help identify exotic species and their web site also categorizes exotic pest plants based on the severity of invasiveness <http://www.caleppc.org/info/plantlist.html>

Wildfires

Those who enjoy living near wildlands must deal with wildfires. People moving into areas near wildlands should be aware of the inherent danger of living near fire-prone areas. There is a certain amount of risk involved. Public agencies, such as fire departments, planning departments, resource agencies, and others, must also deal with fires, especially when they come close to urban developments.

In urbanized areas adjacent to wildlands, fire authorities have developed guidelines for fuel modification and maintenance. For example, the [Orange County Fire Authority \(OCFA\)](http://www.ocfa.net) defines a fuel modification zone as "a strip of land where combustible vegetation has been removed and/or modified and partially or totally replaced with drought-tolerant, fire-resistive plants to provide an acceptable level of risk from wildland fires" ([Guideline C-05, 2000](#)). The guideline includes a description of zones established for fuel modification. In all cases, an OCFA representative will assist in determining the distances for the fuel modification zones.

Irrigated Zone (Zone B) indicates that the next fifty (50) feet of fuel modification will consist of irrigated landscaping. This zone should include appropriate plant material, an irrigation system, and erosion control measures. Also, a minimum of twenty (20) feet is required from the drip line to any *Quercus* (oak) species. As in Zone A, combustible construction is not allowed.

Thinning Zone(s) (Zones C and D) should reduce the fuel load of privately owned wildland areas adjacent to urban developments. This area can extend one hundred (100) feet or more into the privately owned wildland areas.

Finally, **off-site fuel modification** zones in preserved natural areas are not recommended because of potential disputes regarding maintenance responsibility, and are not compatible with land conservation values. In fact, California State Parks' policy prohibits fuel modification on its land. Already, some urban development occurs right up to the property line of some state parks, whose staff must then deal with maintaining the public property and protecting it from edge effects. Such work does require some unscheduled tax dollars.

The State of California [Department of Forestry and Fire Protection \(CDF\)](#) also address fire protection for homes located near wildland areas and their website includes a detailed diagram.

A method of reducing impacts to native habitat and to fire management areas, is to use native plants. The following native plants, which may contribute to native habitat value and to fuel modification, are found in Chino Hills State Park, an area mostly of coastal sage scrub, chaparral, grasslands and riparian woodlands. **Keep in mind that these plants may not be suitable for all areas.**

10 NATIVE PLANTS SUITABLE FOR PLANTING IN FUEL MODIFICATION ZONES IN SOME SOUTHERN CALIFORNIA COUNTIES	
Scientific name	Common name
<i>Baccharis pilularis</i>	Coyote brush
<i>Encelia californica</i>	California encelia
<i>Lupinus bicolor</i>	miniature lupine
<i>Lupinus succulentus</i>	arroyo lupine
<i>Mimulus aurantiacus</i>	monkeyflower
<i>Nasella pulchra</i>	purple needlegrass
<i>Opuntia littoralis</i>	prickly-pear
<i>Platanus racemosa</i>	Western sycamore
<i>Quercus agrifolia</i>	coast live oak
<i>Ribes speciosum</i>	fuschia-flowered gooseberry

Please consult your local fire authority for regulations in your area. And please contact the natural park manager in your area for a list of fuel modification plants suitable for your area.

Companion Animals

Companion animals (pets), such as cats, can have a negative impact on scrub breeding bird communities. As previously stated, cats recreationally prey on birds ([Crooks & Soulé 1999](#)). Already in jeopardy of extinction due to habitat loss, some scrub breeding bird species, like the California Gnatcatcher, face a faster demise.

Wildlands are not safe for domesticated animals. Please keep a watchful eye out for their safety. Do not release or abandon them in wildland areas, as their chances for survival are slim.



Also, do not leave pet food outdoors, as it will attract wildlife such as skunks. Companion animals should be fed in secure places, where neither their food nor themselves will be susceptible to wildlife. A pet's water bowl should not be left outdoors as it also attracts wildlife.

Residential Lighting

Light should not be directed toward habitat areas; it should remain on the owner's property. Some species can be nocturnal, such as bobcat, and light sources can disturb their natural processes. Areas that are avoided by medium to large sized carnivores can have an increase in the number of [mesopredators](#), which can have a negative effect on avian species of scrub communities.

Noise

A reduction in noise levels should be observed between the months of March and September, as this is nesting and breeding season for many species. Loud, unusual noise can frighten adult species who may abandon their young ([Living on the Edge](#)). These orphans may not have a chance to survive. By extending a courtesy, species will be less occupied with their surroundings and more occupied with their natural life cycles.

Household Trash

Properly managing solid waste is also vitally important. Some animals, like foxes and raccoons, will search through trash cans for food. To avoid finding waste littered around the yard or attracting unwanted guests, lids should be securely fastened and if possible, trashcans should be kept indoors. If kept outdoors, metal cans should be used because some animals puncture through the plastic trash cans in their quest for food.

SECTION 4: SUGGESTIONS FOR PARK VISITORS

Recreational Effects

Trails are established to provide opportunities for hiking, horse back riding, mountain biking, and wildlife viewing. In some areas, trails are open to a variety of activities, ranging from walking to mountain biking, while in other areas, more intense uses, such as mountain biking are not permitted. The following guidelines can help ensure the safety of everyone and the maintenance of biodiversity.

Tips for all visitors

- Visitors are responsible for knowing and obeying rules and regulations.
- Dogs are allowed only in designated areas as posted and must be controlled on a leash at all times.
- Fires, smoking and open flames are restricted to designated areas.
- Weapons of any kind are usually prohibited.
- Please leave plants and animals undisturbed. This not only protects the natural environment but is also ensures public safety.
- All wildlife is protected -- please do not disturb any animals you may see. If you are fortunate enough to encounter wildlife during your visit, do not approach or startle the animal. Although wild animals are generally fearful of humans and will run away, some wildlife can be dangerous.
- Rattlesnakes are native wildlife and are especially active in warm weather.
- Learn to identify and avoid Poison Oak.
- Be aware that ticks are active in some areas and may carry diseases. Stay on designated trails and check yourself frequently for ticks.
- Mountain lions are occasionally sighted in some areas.
- Avoid hiking dusk to dawn to give animals time for their activities free from human influence.

Tips for trail users

- Courtesy should be extended to other trail users.
- Ride on designated trails only (indicated on signs and maps).
- Always yield to equestrians.
- Please observe the trail speed limit.
- Allow other trail users to pass. When in a group, avoid blocking the trail.
- Horses and slower moving individuals may be startled by faster moving trail users.
- Announce yourself when approaching another visitor, especially from behind.
- Prevent injury to yourself and damage to natural resources by staying on designated trails.

Cumulative

An increase in public services is required in order to maintain the lands impacted by urban edge effects. Maintaining the land requires financial subsidy. Park rangers and

ecologists work to improve the affected land by restoring native habitat and eliminating invasive exotic plant species. Other tasks include patrolling for illegal activities such as vandals and poachers.

Highways and Roads

Roads present a formidable barrier to wildlife movement. Also, they facilitate the movement of weeds and pests, cause erosion, stream sedimentation, pollution, further fragmentation, and increases in mortality rates of wildlife from collisions and hunting.

For motorists, one of the greatest challenges is to drive carefully through natural areas while staying alert to avoid wildlife attempting to cross the roadway. Wildlife/vehicle collisions can be distressing to motorists, can cause injuries to people and damage to vehicles, not to mention injury to and reduction of wildlife species. Many efforts are underway to provide opportunities for wildlife to cross highways, reduce the number of wildlife fatalities, and increase public safety. Such efforts include clearing and/or widening culverts to provide access for wildlife, improving fences and vegetation around culverts to increase usage by wildlife, and implementing adaptive management programs to monitor the effectiveness of these efforts.

SECTION 5: CONCLUSION

The Value of Wildlands

Wildlands can be considered a source of wealth for outdoor nature enthusiasts who see natural areas as an outdoor learning laboratory, while others may see wildlands for their economic potential. Still, economically, biodiversity has the value it brings from tourism and research and increased property values. "Ethically, maintenance of biological diversity is important because nonhuman species have their own intrinsic value independent of any practical value for human beings" ([Kaiser et al. 1995](#), p.123). Land use planners must be able to find a balance between the two sides.

Land use designation is to continually strive for land use designations that consider environmental protection, fiscal efficiency, neighborhood compatibility, limitation of sprawl, and aesthetic appeal. Land use tools, including impact fees, urban limit lines, design guidelines, should factor in public demand and development demand, and find a comfortable relationship for both. The challenge development agreements, capital improvement programs, and adequate public facility ordinances-as well as traditional zoning and subdivision controls, can be used to help guide land use and development ([Kaiser et al. 1995](#)).

Nature provides humans with psychological well-being and spiritual renewal. As Joseph Sax argues, national parks "...are especially suited to promoting contemplative and reflective forms of recreation, increasingly important in a technologically dominated society and landscape" (qtd. in [Beatley 1994, p. 105](#)). Such are the priceless qualities that are held in trust for all to enjoy. And it is the responsibility of the park staff, whether local, state, or national, to preserve the financial equity already invested in maintaining these areas. Public funds are used to maintain the public park system; development adjacent to public lands should be carefully planned with the inherent value of nature in mind.

Much of the reasoning behind support for urban development focuses on anthropocentric and utilitarian arguments. Leopold wrote, "The land relation is still strictly economic, entailing privilege not obligation" ([Leopold 1949, p. 203](#)). Even though Leopold tried to convey the same message more than 50 years ago, the struggle continues today to instill a non-anthropocentric view of our existence.

"We do not increase our enjoyment of an alpine meadow by picking its flowers, but by leaving them where they are."

[Joseph Sax 1990, p.112](#)

SECTION 6: LINKS

California

[California Resources Agency](#)
[Department of Parks and Recreation](#)
[Department of Forestry and Fire Protection](#)
[Department of Fish and Game](#)
[Department of Conservation](#)
[California Environmental Resources Evaluation System CERES](#)
[Land Use Planning Information Network LUPIN](#)
[California Environmental Quality Act CEQA](#)
[Governor's Office of Planning and Research](#)
[California EPA](#)
[State Water Resources Control Board](#)
[California Coastal Conservancy](#)
[California Office of Historic Preservation](#)

Federal Agencies

[Council on Environmental Quality CEQ](#)
[U.S. Fish and Wildlife Service](#)
[U.S. Army Corps of Engineers, Sacramento District](#)
[U.S. Army Corps of Engineers, San Francisco District](#)
[U.S. Army Corps of Engineers, Los Angeles District](#)
[U.S. Geological Survey](#)
[U.S. Environmental Protection Agency](#)
[National Marine Fisheries Service](#)

Environmental and Planning Organizations

[California American Planning Association](#)
[Los Angeles American Planning Association](#)
[National American Planning Association](#)
[Urban Land Institute](#)
[Association of Environmental Professionals](#)
[California Native Plant Society](#)
[California Exotic Pest Plant Council](#)
[Society for Ecological Restoration](#)
[The Nature Conservancy](#)
[The Wildlands Project](#)
[The Wildlands Conservancy](#)

Pollution Prevention

[Department of Toxic Substances Control](#)
[California Integrated Waste Management Board](#)
[State Water Resources Control Board](#)
[California Air Resources Board](#)

SECTION 7: GLOSSARY

Extirpation: to wipe out, or remove completely; to cause extinction, at least locally.

Island biogeographic theory: "the number of species found on an island is determined by a balance between two factors: the immigration rate of a species to the island from other inhabited areas, and the extinction rate of species established on the island. The model predicts that at some point the rates of immigration and extinction will reach an equilibrium point, which determines the island's average number of different species" ([Miller 1999](#)).

Mesopredator: a small sized land-borne vertebrate predator, such as domestic cats, raccoons, foxes, opossums, and striped skunks.

Mesopredator release phenomenon: "...large predators help to maintain the diversity of small-sized species within an ecosystem. This effect occurs because large predators often suppress the numbers of middle-size (meso) predators. In the absence of large predators, the smaller ones can be "released" ecologically, becoming both more abundant and more bold, a phenomenon called mesopredator release" ([Soulé 2000](#)).

Microclimate: The climate of a small specific place within an area.

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