Oak Woodland Wildlife

The Effects of Development on Oak Woodland Wildlife: Fragmentation of Woodland Habitats

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Introduction

By unfortunate coincidence, California's oak woodlands occur in some of the fastest growing urban and suburban areas in the state. Accelerated rates of woodland conversion were initially viewed as an indication of regional revitalization and a source of new tax revenue. However, rates of conversion in many areas are reaching a threshold of public tolerance; recent land developments in woodlands have engendered a sense of loss in public amenities and quality. Wildlife issues focus this vague sense of lost amenities more than any other resource problem and have become one of the most critical parts of the Integrated Hardwood Range Management Program.

Unlike land conversion, fragmentation of oak woodlands alters wildlife resources without completely consuming their habitats. Although the consequences of fragmentation are often equivalent to complete conversion, the process is typically gradual and often goes undetected because fragments may exist long after they have lost their utility to wildlife.

The issue is compounded by our historical perspective on wildlands. In the

1800's, wildlands were perceived as boundless, resilient, and capable of absorbing the refuse and expansion of frontier California. Gradual conversions of western landscapes were imperceptible, and the change from wild landscapes with urban islands to an urban environments with fragments of wildlands often went unnoticed. That is, until fragmentation began to reach a critical point where specific amenities, such as wildlife species, were lost.

California's urbanizing landscape now bears a striking resemblance to the illustrations of the famous German artist, M.C. Escher. His paintings blended geometric patterns of wildlife species, and he usually challenged observers to find the point where a pattern stopped depicting one species and started depicting another. So it is with our urbanization, we often fail to see our landscape patterns shift from scattered urban islands in oak wildlands to an urban landscape until the change is nearly complete.

Wildlife dominated M.C. Escher's pictures; he typically substituted one species of wildlife for another across a canvas - white birds against a black background would subtly shift to black fish against a white background. Wildlife substitutions across our urbanizing landscapes, however, have been far less equitable; fewer than 25% of our woodland wildlife have adapted to urban environments. The remaining species are unlikely to survive the transition from wildland to urban area, and will disappear as contagious woodlands are fragmented into smaller and smaller stands.

The Process of Fragmentation

For the sake of discussion, the processes contributing to oak woodland fragmentation can be grouped into three categories: (1) large-scale conversion of woodlands, which may isolate a number of habitat islands within a short time; (2) patchwork conversion of woodlands, which has the cumulative effect of isolating progressively smaller patches of woodlands over a longer preiods; and (3) rural development, which alters the integrity of habitat areas without actually converting large acreages.

Although large-scale removal of oak woodlands can result from woodcutting or other reversible uses, it is primarily the product of urbanization. Islands of habitat may persist within these urban landscapes for many intentional or unintentional reasons, such as planned wildlife easements or slopes too steep to build. In general, development projects that are large enough (some over 10,000 acres) to encircle woodland habitat islands are a relatively new phenomenon. They were part of the land-booms of the 1960's, 70's and 80's in southern California and the 1980's in northern California. In many cases these mega-projects were over 10,000 acres and could be seen on LANDSAT imagery.

Despite the magnitude of large scale projects, the major forces fragmenting oak woodlands are piecemeal conversions and rural development. Conversion typically starts as a number of relatively small, unrelated projects across a relatively large woodland area. New areas are developed and old areas expand;

as these converted areas grow together, woodlands are divided into progressively smaller islands and corridors of habitat. The rate at which these islands are surrounded by converted lands is a function of the original configuration of the woodlands as well as the positioning of the land developments.

Rural development often creates qualitative changes to woodlands which alter landscape dynamics in a fashion similar to the quantitative changes brought by patchwork development. However, habitat characteristics are often altered without major changes in vegetation. Habitat quality may be corrupted for some distance around rural developments because these areas act as innoculates of exotic and feral wildlife.

The same kind of alteration occurs at the interface between urban and woodland areas; however, the magnitude and intensity are far greater than in rural areas. Human intrusions across the urban/woodland interface range from foot traffic to off-road vehicle activity and refuse dumping. Surface-runoff from urban areas increases water flow into oak woodland habitats, increasing rates of sedimentation and non-point source pollution.

Fragmentation and Wildlife

All three categories of processes create barriers to the movement of individuals and populations across the landscape. As fragments narrow and wildlife resources decline, the remaining habitats begin to filter the movements and migrations of wildlife. At this point, species which are extirpated from a specific area may not be able to re-invade that area and the process of regional extirpation begins.

Wildlife biologists have always viewed land-use and management from the perspective of wildlife habitats. In the 1960's, habitat was typically associated with the bare essentials for individual survival: food, water, and cover. Over the past twenty years, however, it has become increasing obvious that the concept of habitat includes other environmental features, such as breeding locations, sufficient home range areas to maintaining population demographics and social structures, and avenues for dispersion, migration and gene flow. The common thread across these new concerns is that the amount and distribution of habitats across space and time must be sufficient to sustain wildlife populations. Fragmentation isolates populations; it can reduce the size of a population to a point where extinction become a high probability. The interspersion of urban settlements interferes with the movement and dispersion of wildlife across oak woodland habitats; this alters rates of re-colonizing after extirpation, the dispersion of populations, and genetic composition of populations.

As a woodland area becomes more and more fragmented, management of the spatial distribution of habitat becomes more critical. If the remaining fragments are to continue to support wildlife species, then they need to provide habitat for both the proper patterns of population dispersion and the movements of individuals.

Despite evidence to the contrary, wildlife biologists have typically treated the dispersion of wildlife across landscapes as static and often uniform. This is primarily because it is usually not necessary to manage the complex fluctuations of species over time and space in ecosystems which are large and intact. Many ecologists now subscribe to the concept that some regions of a wildlife population may be the source of most of the offspring, while other areas produce few offspring and may have higher mortality. Conventional wisdom is that these sources and sinks of wildlife population may be fixed by habitat resources; however, a growing body of research suggests that population sources and sinks fluctuate over time across habitats. Because these shifts are not necessarily predictable from direct habitat observation, wildlife biologists have begun to develop models which predict when a population reaches a point where chance events may cause extinctions.

Wildlife needs and habitat quality can shift over periods of years, seasons, days, or even hours. Some natural changes in habitat quality are irreversible; extirpation can only be avoided if enough habitat patches exist to allow species to follow the changing patterns of suitable habitat. Fragmentation of habitat can remove transitional parts of the landscape, creating gaps in the number of suitable habitats available. Interspersed urbanization can create barriers to species attempting to follow habitat changes.

The social structures and demographics of wildlife populations adds another layer of complexity to habitat fragmentation. In many species, individuals migrate to locate mates or sites for reproduction. Fragmenting habitats can interfere with these movements, disrupting the ratio of males to females or patterns of mate selection. This interference can lead to inbreeding and the concomitant loss of genetic material. It has been suggested that this loss of genetic variability may leave species with less ability to adapt to future changes, thereby hastening extinction.

In many cases, the manner in which individuals are able to move in and out of an area defines the functional size of a wildlife population. If a species is able to cross unsuitable areas while moving between habitats, the need for contiguous suitable habitat is relaxed. However, if the unsuitable habitat represents a barrier, as is the case with many urban areas, then some corridor through this barrier is necessary to maintain movement. In addition, if the individuals of a species are relatively immobile or depend on certain habitat features for movement, then contiguous habitat and habitat corridors may be the only way to maintain populations.

Movements along habitat corridors can take a wide variety of forms. Mobile individuals simply cross altered habitats or move through corridors. Corridors for mobile species need only provide secure passage. Less mobile species may take generations to cross corridors, or may cross corridors only during periods of eruptive population growth. In this case, corridors are living connections among populations and must provide all the necessary resources for species survival.

Over 300 vertebrate species use oak woodlands habitats. The majority of these species are at least seasonally if not completely dependent on oak woodlands. Immobile species, such as Arboreal Salamanders, are not able to move out of oak woodland habitats. Many large mammals, including the mule deer, mountain lion, coyote, and grey fox, are able to cross between woodland fragments as long as the intervening habitats do not become too urbanized. We know

very little, however, about the migratory abilities of the majority of wildlife species which fall between these two extremes. A large number of bird and bat species though free ranging, are unable to leave specific areas or habitats for behavioral reasons.

Avoiding Extirpation by Fragmentation

At present, we lack a prescription for both the optimum size of oak woodland habitats and the optimum width of movement corridors. For many reasons, general formulas for the dimensions of these woodlands areas will remain simplistic and, therefore, error-laden. Each wildlife species in oak woodlands has specific habitat needs, demographics, and abilities to move or adjust to habitat loss and alteration. Patterns of habitat use vary across the distributional range of many species. Differences in weather, soils, substrates, topography, and biogeography alter the patterns of habitat distribution and quality and, therefore, patterns of habitat use. Long-term environmental changes may create uneven changes among habitats.

Under these circumstances, the most conservative strategy is to minimize the fragmentation of remaining woodland habitats. The management model which has the greatest degree of economic and ecological reality is UNESCO's Man in the Biosphere program. Under this system, landscapes are divided into three major uses: (1) land designated for development, (2) land with habitat areas designated for conservation of wildlife, and (3) intervening buffer zones of rural and agricultural use. Ideally, the boundaries of woodland conservation areas would not be violated by urban or rural uses, the buffer zone would be sufficiently large to maintain traditional forms of ranching and agriculture, and urban and suburban land-uses would be concentrated in the most efficient patterns of infrastructure and capital facilities development.

Avoiding Crisis Management of Woodlands

Unfortunately, twenty years of zoning, county general plans, environmental assessments, and environmental impact reports have failed to separate wildlands from developed lands in many urbanizing areas. As an example, there are over 300 separate areas of urbanization in western Riverside County, each averaging 500 acres. If growth had been contiguous to the six cities of the region, the total urban area would have produced approximately 100 miles of urban-wildland boundaries. Instead, these discontinuous urban patches, covering an area of less than 30 square miles, have over 1000 miles of interface with adjacent wildlands - the distance from San Diego to Denver. This ten-fold increase in perimeter translates into ten times the management problems in the region's hardwood rangelands.

Land developers have received ambiguous signals from land-use planners on conservation issues involving cumulative impacts and habitat fragmentation. Projects are initially allowed to go forward with little restrictions in woodland habitats. However, at some subsequent point in time, similar projects are denied or radically altered because cumulative effects begin to appear. This first-proposed-first-approved environment encourages developments which start the process of fragmentation. Developers need to know where land development will endanger wildlife or critical habitats so that they can make educated decisions about their actions.

Management problems can be reduced by working at a number of different scales of land-use. Early recognition of wildlife resources and needs by local, state, and federal agencies can identify potential areas of conflict. For example, special districts and special plans can contain conservation easements as part of development. Specific development and subdivisions plans can reduce the fragmentation of woodlands by clustering housing units. All these conservation actions will require vision and creativity to maintain both the economic viability of projects and ecosystems of developing landscapes. However, the incentives for such actions include expedited project reviews, increased revenue from increased amenity values, and the acquisition of projects benefits without the loss of community values.

Management actions by rural landowners can help protect woodlands from fragmentation. Woodlands typically extend over more than one property and are subject to many different kinds of management. Although a specific management action on one property may seem benign, it can have broader damage because of actions of adjacent property owners. In this regard, a conservation district or home owners association can help coordinate the activities of property owners to benefit both community and individual goals for woodland management.

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