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Habitat Protection Planning

Where the Wild Things Are

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Habitat Protection Planning:
Where the Wild Things Are

CHRISTOPHER J. DUERKSEN; DONALD A. ELLIOTT, AICP;
N. THOMPSON HOBBS; ERIN JOHNSON, AICP; JAMES R. MILLER

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Chapter 1. The Many Reasons to Protect Habitat

Early European colonists had an abundance of wildlife to serve subsistence needs. Seemingly endless flocks of ducks, geese, and swans; and abundance of wild turkeys, deer, and bison; green clouds of Carolina parakeets and millions of passenger pigeons; and a bounty of fish and shellfish. This abundance quickly established a viewpoint that the New World's wildlife resources were inexhaustible.

MILTON FRIEND, *INVENTORY AND MONITORING OF WILDLIFE HABITAT*

Demographers project that, by the year 2000, 90 percent of all United States citizens will live in urban areas. Urban growth results in the fragmentation and loss of natural wildlife habitat, and the process of urbanization will continue to alter the biological and physical components of existing ecosystems as development reaches into more and more natural areas. Even agricultural areas have contributed significantly to loss of wildlife habitat. Habitat diversity in agricultural ecosystems has declined drastically since World War II as hay and pasture requirements for animals have declined. In addition, agricultural activities to drain wetlands, consolidate fields, eliminate fence rows, eliminate idle fields, merge farms, and disturb or fragment grasslands have significantly reduced habitat and the resulting diversity of wildlife

The cumulative impact of land development has a devastating impact on natural ecosystems, and that impact extends far beyond the boundaries of developed areas. Although ecosystems adapt to naturally occurring changes, new conditions caused by residential and commercial construction may produce an imbalance that lasts for decades. In addition to destroying wildlife habitat, buildings, roads, fences, and other obstructions restrict natural wildlife migration. Some species are particularly vulnerable to such obstructions. If a fence blocks the movement of pronghorn, for example, the animals will generally not seek an alternative route but will instead remain at the fence until they starve. Impermeable surfaces also create heavy runoff that can erode riparian areas. Increasing development to accommodate people generally results in a decline in air and water quality, and we are only now discovering the full extent of the environmental contamination that has occurred over past decades. All of these factors affect the quality and quantity of wildlife habitat in developed areas.

Del Weniger, U.S. Fish & Wildlife Service

Bunched cory cactus is being threatened in Texas by grazing livestock and plant collectors

There is an increasing understanding of the necessity to protect the country's remaining areas of wildlife habitat. In addition, there is a growing need to discover and use new tools that can successfully balance competing needs for wildlife habitat areas. Land-use planners have an important responsibility to foresee harmful effects of human activity on the environment and to take action to prevent or mitigate further damage and to protect existing resources. In densely developed areas, it is important that protective measures stabilize wildlife habitats while allowing public enjoyment and appropriate uses of resources.

QUALITY OF LIFE

Most people realize that the presence and protection of wildlife improves the quality of their lives. There is an obvious value to wildlife habitat in areas where people live, even though it is difficult to assign actual values to that habitat. A look at the real estate section of almost any metropolitan newspaper reveals that people want a natural environment and wildlife habitat near their home, work, school, and recreational areas. And this is true even if they never actually see the protected wildlife. The mere knowledge that

wildlife is nearby and that we have contributed to its protection often improves the quality of our lives. Unfortunately, for many Americans, the concept of wildlife habitat is defined by an urban perspective. For the growing percentage of our population residing in cities and towns, wildlife is "out there," beyond where the sidewalk ends. Although many citizens are able to enjoy a variety of birds and small mammals, the general concept of our surroundings is based on the built environment rather than the larger natural environment. In addressing the multitude of sometimes competing interests between economic growth and environmental protection, tough and sometimes expensive decisions must be made. Even though our land-use patterns tend to diminish wildlife habitat, paying attention to both man and nature should be mutually beneficial, not mutually exclusive. Development and environmental protection can and do coexist well if planning is applied in harmony with the environment rather than dominating it.

ETHICAL AND MORAL CONSIDERATIONS

Many people feel an ethical and moral imperative to protect wildlife and its habitat from the growing impacts of human development. For them, the words of Edward LaRoe (1995) of the National Biological Service ring true:

> Certainly extinction is natural; it naturally occurs as newer forms of life evolve. But under the forces of population growth, technology, and special interests, humans have driven the rate of extinction today to about 100 times — two orders of magnitude — the natural rate. Even worse, the rate of extinction is still increasing and will be 100 to 1000 times faster yet in the next 55 years; scientists predict that between now and 2030, half the expected lifetime of a child born today, the earth will lose between a quarter and a third of all existing species. And this is in the absence of new forms of life to replace them. The last time Earth lost this large a share of its life was 65 million years ago, when it may have collided with an asteroid; the impact of humans on our planet today may have been last equaled by the collision of two heavenly bodies.

RECREATIONAL

The protection of wildlife also contributes substantially to the recreational opportunities available to people. Birdwatching, wildlife hikes, fishing, and hunting are only a few of the many recreational activities that depend on the availability of wildlife. To take just one state as an example, in 1995, the Colorado Division of Wildlife issued more than 1 million resident and nonresident licenses for recreational hunting and fishing. (See Table 1-1.)

Table 1-1. Licenses Issued by Colorado Division of Wildlife (1995)

Type of Activity	Resident	Nonresident
Deer	116,629	73,501
Elk	128,859	97,428
Other big game	20,615	1,551
Small game	45,127	3,082
Fishing	417,928	224,267
Total	**729,158**	**399,829**

Source: Colorado Division of Wildlife

Table 1-2. Colorado Sportspersons and Activities (1995)

Type of Activity	Urban	Small City	Rural
Big Game Hunting	3.3%	5.8%	13.9%
Small Game Hunting	3.7	6.4	9.4
Fishing	20.0	30.0	37.0

Source: Colorado Division of Wildlife

During the same year, a significant percentage of Colorado's adult population participated in hunting and fishing activities. (See Table 1-2.)

ECONOMIC IMPORTANCE/TOURISM

The protection and preservation of wildlife also contributes to the economic health of a state through tourism and otherwise. Again, to take Colorado as an example, in 1990, an economic impact model developed by the Colorado Chapter of the Wildlife Society estimated that direct spending on hunting and fishing totaled over $570 million (excluding spending by the Colorado Division of Wildlife itself) within the state. When all direct and secondary spending was counted, the figure rose to over $1.3 billion, and this figure did not include the fact that the opportunity to view wildlife is considered to account for about 20 percent of all general tourism to Colorado. In 1995, total expenditures by anglers and hunters within the state totaled almost $1.7 million.

AVOIDING POTENTIAL FEDERAL INTRUSIONS

Some communities feel that adequate protection of wildlife habitat will help minimize the likelihood of federal intrusion into local decision making. Ever since its inception, the Endangered Species Act has provided strict control procedures that will be invoked when a species is listed as "threatened" or "endangered." Under the provisions of Sections 7 and 9 of the Act, the listing of a threatened or endangered species shifts decision making about habitat for that species to the federal level. There is, therefore, an incentive for local communities and state governments to find ways to protect and enhance habitat for different species in order to sustain the numbers of that species and defer or prevent their listing as either threatened or endangered.

Although Section 10(d) of the Act now allows states and localities more voice in how certain habitats will be managed, it still requires substantial coordination with the federal government. Active habitat management on the local level before the Endangered Species Act is invoked can pay rich dividends in protecting flexibility for local solutions.

INCREASED RELIANCE ON LOCAL INITIATIVES

Over the past 10 years, local governments have begun to emerge as a prime partner and implementer of effective wildlife preservation programs. This trend is the result of two important factors. First, it reflects the fact that citizens are increasingly vocal and involved with habitat conservation issues at the local level. Second, it reflects a significant restructuring of the federal government's involvement with wildlife issues.

State and Local Governments Step Forward

Because the preservation of wildlife contributes to the perceived quality of life for many residents, generates significant revenue through sports and passive tourism, and fulfills a growing sense of a moral obligation to protect wildlife, state and local governments have stepped into the field of habitat protection. Instead of relying on federal wildlife programs, local citizens and state legislators have often agreed to pursue the same aims at the local level. Their approach has often involved less money, less bureaucracy, more flexibility, and more local control than the programs they replace. Examples of this trend include the growing inclusion of wildlife components into community comprehensive plans and the growing number of sensitive lands ordinances that include wildlife habitat lands.

Of particular note is the March 1997 passage of the Multiple Species Conservation Program (see Appendix B) in San Diego, California, which is being hailed as a watershed moment in the history of local and regional planning for habitat preservation. MSCP promotes flexibility and certainty in dealing with extremely intense development pressures. The program will be watched closely during its implementation to judge whether it can provide a useful model for other local and regional habitat conservation plans. The Clinton administration is squarely behind the program for its creation of voluntary conservation partnerships on private lands.

Declining Role of the Federal Government

The importance of state and local efforts has been further highlighted by the retrenchment and restructuring of federal wildlife programs. Ever since its enactment in 1966, the strongest statement of the importance of wildlife and biological diversity to Americans has been the Endangered Species Act (ESA). Although originally aimed at curbing the poaching and smuggling of rare animals, ESA has evolved considerably since then. The act was amended in 1969, and a thorough revision in 1973 forms the core of the current act. Section 9 of the act prohibits the "taking" of an endangered species, which is defined to include hunting, killing, harming, harassing, or otherwise acting in ways that indirectly affect a species. The act has a broad scope and prohibits takings by private citizens, state and local governmental entities, and also authorizes citizen suits.

During the past 10 years, however, the federal government's role in the protection of species and habitat has been declining. As early as 1982, amendments to ESA allowing "incidental takes" of protected species showed the pressures to reduce federal protections for wildlife. Those pressures have been reinforced by the need to balance the federal budget, which has led to questioning of funding for environmental protection in general, and particularly those programs that could slow down or stymie private development projects. Following the congressional election of 1994, both ESA and the Army Corps of Engineers' Section 404 wetlands permitting procedures have been under intense attack by both Congress and property rights advocates who argue that their effect on small landowners is often oppressive. Fortunately, many of these efforts to roll back federal protections have resulted in strong public opposition and only limited changes. The pressure remains, however, and it is probably wise to expect that the federal government will not be on the leading edge of wildlife protection in the foreseeable future.

Bob Stevens, U.S. Fish & Wildlife Service

Logging, recreational use of habitat, and poaching have restricted the grizzly to isolated mountain regions.

Most Land-Use Decisions Are Made Locally

In most states, many decisions regarding the use of land are made at the local level. Many state courts have long held that zoning and subdivision powers are matters of "local concern" that prevail over state concerns unless the state legislature adopts specific legislation overriding or sharing those powers. Even so-called state land-use acts are aimed at enhancing the powers of local governments and are generally triggered by local authorities rather than state authorities. As a result, some of the most powerful tools that can threaten or protect wildlife habitat are in the hands of county commissioners, city councils, and town boards. The members of those commissions and councils are often very familiar with the types of wildlife found in their communities. It is important that they also understand how their planning, zoning, subdivision, and other land-use decisions will affect that wildlife. Thoughtful actions to protect wildlife habitat at the local level can often protect specific habitats better and cheaper than even the best-intentioned state or federal protection scheme.

Many communities are now taking the initiative to insert wildlife protection goals into their major planning efforts, and this is true in urban as well as rural areas. In addition, there is evidence that

local voters have more tolerance for programs and regulations designed and implemented at the local level. As the authors of a previous wildlife manual stated:

> We believe that programs of land use control, even if fairly radical in nature, will succeed if they are viewed as local programs, administered by people living close to the land. For example, Weld, Saguache and Baca Counties are all very rural, agricultural counties in Colorado. All have implemented local soil conservation programs that prohibit, in some cases, the plowing of fragile grasslands. Despite the seemingly controversial nature of these ordinances, none have been seriously tested in the several years they have been in place because, local authorities believe, the rules are designed and directed by local residents. Similar programs directed at the conservation of natural resources, such as wildlife, probably will succeed if they remain under the jurisdiction of local government (Bissell et al. 1986).

PURPOSE/GOALS OF THIS REPORT

This report attempts to do four different things. First, it promotes an interdisciplinary approach to wildlife habitat protection. To do so, it presents a framework for thinking about wildlife that integrates sound science, planning, and legal considerations. Second, it establishes a set of biological principles that define a new way of thinking about wildlife habitat protection during local planning and development review. Third, it presents a compendium of protection approaches and a legal analysis of the strengths, weaknesses, and constitutional limitations of different habitat protection techniques and strategies. Finally, this report will serve as a resource book regarding innovative habitat protection programs throughout the United States.

Chapter 2. A Practical Framework for Making Local Habitat Protection Decisions

Citizens often voice their intent to preserve environmental values as communities develop and grow. However, these intentions are frequently difficult to realize, in part because achieving environmental protection may pose challenging compromises among needs to preserve the environment, to invigorate the economy, and to protect private property rights. Rising to these challenges requires a scientifically sound, utilitarian approach to protection, an approach that is legally and politically tenable. This report describes practical methods for protecting wildlife habitat. These methods can be applied broadly across a range of landscape types and a variety of political jurisdictions in response to many types of development.

The usefulness of the methods described in this handbook depends on a few key concepts and assumptions about the ways that people and wildlife share the land. In the first part of this chapter, we outline these assumptions and concepts. In particular, we make three points.

- We develop the idea that there are two fundamentally different categories of human effects on wildlife, categories that operate at different scales in the environment.
- We discuss how these different categories of impact require different approaches to management.
- We show that the opportunities for success in managing human impacts on wildlife depend on the current state of land development in the area of interest (i.e., the extent to which the area is rural or urban in character).

Later in the chapter, we use this framework to offer practical guidance for what to do on the ground to protect wildlife populations and habitats.

DEFINITIONS

Communicating ideas about human impacts on wildlife habitat requires us to think clearly about ecological concepts, ideas that may not be familiar to all readers. Such thinking requires a clear vocabulary. Several biological terms will be used frequently in this chapter. These are defined in Table 2-1 (page 6).

SCALE, HUMAN IMPACTS, AND WILDLIFE PROTECTION

Equipped with these definitions, we begin with the idea that residential development influences wildlife at two fundamentally different scales—the broad "landscape" scale and the more focussed "site" scale. At the landscape scale, development influences the distribution, survival, and persistence of wildlife populations and communities. At the site scale, development influences the behavior, survival, and reproduction of individual animals. Effects at the landscape scale can be mitigated by landscape management; effects of development at the site scale can be mitigated using site management. These two key concepts of scale are illustrated in Table 2-2 (page 6).

Scale, in turn, determines the usefulness of actions chosen to modify the impacts of development. To illustrate this idea, it might be useful to think of a rural landscape, a large area that is predominantly undeveloped, but that contains a few spatially separate subdivisions. The impacts of people within those subdivisions occur at fine scales. At these scales, we will refer to human impacts on wildlife as

U.S. Fish & Wildlife Service

Ferrets have declined with the loss of prairie habitat and the extensive killing of prairie dogs.

Table 2-1. Definitions of Ecological Terms

- **Landscape** is a large land area (i.e., multiple square miles) that contains habitat for wildlife. A watershed offers an excellent example of what we mean by a landscape. Within a landscape there are usually different types of vegetation arranged in a mosaic, much like a patchwork quilt.
- **Patch** of habitat is what you would think it is—a spatially separate instance of a given type of habitat. For example, a stand of aspens surrounded by conifers is a habitat patch for some species of cavity-nesting birds.
- **Vegetation type** is a classification given to plants that are found in the same place on a landscape. For example, stands of trees that are predominantly aspen would be classified as the aspen vegetation type, while areas that are covered with grasses and no trees would be classified as the grassland vegetation type. Different wildlife species have different affinities for vegetation types.
- **Population** is a group of individuals of the same wildlife species that reside in areas small enough that members of the group are reasonably likely to breed with one another. Thus, a herd of mule deer that uses a creek drainage in the Colorado mountains is, most likely, a single population. However, herds of deer that use drainage separated by peaks are likely to be distinct populations.
- **Community** is a group of different wildlife species that are linked by ecological processes (e.g., predation, pollination, competition) at a given location. Often, communities are associated with a particular type of vegetation. Thus, the aspen wildlife community refers to all of the wildlife species (birds, mammals, amphibians, reptiles) that live in stands of aspen.
- **Biodiversity** is the variety of all lifeforms considered at all levels of organization, from the genetic level through the species and higher levels of taxonomic organization, and including the variety of habitats and ecosystems.
- **Fragmentation** is the breaking up of continuous areas of habitat into smaller parcels. For example, a forest becomes fragmented when sections are cleared for agriculture or when trees are cleared to build roads.
- **Habitat** consists of the physical features (e.g., topography, aspect, stream flow) and biological characteristics (e.g., vegetative cover, other animal species) needed to provide food and shelter for wildlife.
- **Species diversity** is the number of different species of wildlife, or species richness, and their relative abundance in a given location. As species die out in that location, species diversity declines.
- **Scale** is the relative size of an area of interest. If we focus on relatively small areas (say, the area around a house or a single subdivision), our focus is *fine scale*. If we pay attention to much a larger area (i.e., a county or watershed), we are looking at *coarse scales*.

"site effects." Such effects include the influences of dwellings, roads, and human behavior on the behavior, reproduction, and survival of individual animals. Examples of site effects include avoidance of structures and roads by wildlife, changes in mortality rates (e.g., highway deaths or cats preying on songbirds), and increases in human/wildlife conflict (e.g., bears picking through trash cans). Taken together, these site effects

Table 2-2. The Landscape Scale and the Site Scale

Scale of Effects of Development	Examples of Effects of Development	Type of Protection	Examples of Protection Tools
Landscape Scale	Conversion of habitat patches to residential development. Fragmentation of habitat patches by roads.	Landscape Management	Zoning Clustering Transportation planning Transfer of development rights Conservation easements
Site Scale	Increased predation by domestic pets. Increased disturbance from human activity. Reduced cover of native vegetation.	Site Management	Control of pets Buffer requirements Maintenance of native plants in landscaping Sensitive lands overlays

produce what we will call a "disturbance zone" around a house or a subdivision. (See Figure 2-1.)

We define a "disturbance zone" as the area surrounding a house, road, or a subdivision in which

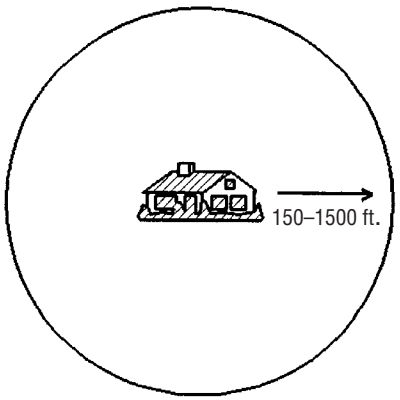


Figure 2-1. Disturbance Zone

the value of habitat for wildlife is meaningfully reduced by human activity and/or structures. A meaningful reduction in value occurs whenever an area is avoided by native wildlife or when the ability of individual animals to survive and/or reproduce declines in the area.

Although site effects of a given development are important at that location, such effects are not the only way that development influences wildlife. At larger scales, such as a valley containing several subdivisions, site effects accumulate and disturbance zones add together to cause what we will call "landscape effects." Landscape effects cause changes in the behavior, reproduction, and survival of populations, which, in turn, influence the composition and persistence of communities of wildlife. Landscape effects include reductions in habitat area (which results in diminished animal numbers) and increases in habitat isolation (which constrains the movement of animals among patches of habitat or seasonal ranges).

Differentiating between the scales of human effects is important because scale determines the kinds of approaches a community can use to manage the ways that development influences wildlife.

At the scale of a specific subdivision, site effects can be mitigated by "site management," which includes all of the actions that can be taken by people to moderate their effects on the behavior and survival of individual wildlife. Examples of such management include buffering of roads and structures, avoiding critical habitat by site design, management of vegetation, and control of pets. The primary goal of site management is to reduce the size of the zone of disturbance.

In contrast to site management, the goal of landscape management is to reduce harmful effects of increases in the density and distribution of the human population on populations and communities of wildlife, as opposed to individual animals. In general, this means managing the type and intensity of development and its spatial location in a broader area (e.g., a county or a basin as opposed to a subdivision). In so doing it is possible to maintain the variety and extent of valuable habitats and to preserve opportunities for animal movement among those habitats by using techniques that steer development away from areas that have high value for wildlife and towards areas that have low value.

THE RURAL-URBAN CONTINUUM

The opportunity to use site-level and landscape management depends on the history of development in a given area. We can think of the extent of development as a continuum extending from relatively undeveloped, rural areas to areas that are predominantly urban (Figure 2-2). The emphasis in a plan for wildlife protection depends on the position of an area of interest along this continuum. Landscape management may be most effective in rural areas, whereas site management is likely to be most effective in urban areas.

At the rural end of the development gradient, there is large opportunity for landscape-level management, simply because there is abundant wildlife habitat. As a result, it is possible to plan for development by identifying the areas of high wildlife value and encouraging development elsewhere. Because undeveloped areas predominate the landscape, the fragmentation of the landscape by new development still leaves large undisturbed areas. This means that there is ample opportunity for movement of wildlife among habitat patches. County governments and private landowners will have primary responsibility for protection programs in rural areas.

In contrast, municipal governments play a much more important role in habitat protection in urban areas. Because much of the landscape has been fragmented by development, opportunities for effective landscape management are not as great as in rural areas. Thus, site-level management becomes much more important at the urban end of the gradient.

This rural-urban continuum is useful for organizing our thinking about protecting habitat, but it should not be used as a fixed recipe for management. All areas contain some blend of the attributes described above, and, as a result, all habitat protection programs should contain elements of landscape-level and site-level management. In the following sections, we offer some general guidelines for managing people and development to achieve habitat protection.

GETTING THE JOB DONE

A conservation plan contains an analysis of priorities for the protection of wildlife, plants, and natural communities. Such plans also describe the specific actions to be taken to achieve that protection (Beatley 1994). The two fundamental questions of wildlife conservation planning are:

- What areas of a landscape should be protected to preserve wildlife populations?
- What should we do now and in the future to protect those areas?

In the following sections, we assemble what we believe to be the most important findings of the science of conservation biology to provide some rules of thumb for conservation planning. First, we describe some "operational principles" for working with scientists to design effective, practical conservation plans. Subsequently, we review "biological principles" for managing human density at the landscape scale. We then turn to what is known about the biological basis for managing effects of development at the site scale. We will briefly describe how to apply each principle, and then we will review current scientific understanding to offer a rational basis for applying it.

SEVEN OPERATIONAL PRINCIPLES FOR HABITAT PROTECTION

Conservation planning requires combining scientific knowledge with techniques of planning, law, and politics to develop a strategy for protecting wildlife, plants, and natural communities. Here we describe some operational considerations for achieving effective conservation planning. We emphasize from the outset that conservation planning needs to be a collaborative and flexible process. It should be collaborative by involving a broad range of expertise and viewpoints, and it should be flexible in drawing on a variety of actions for implementation. Those actions should be chosen with regard to local values, capabilities, and preferences while also respecting regional, state, and national needs for conservation.

Collaboration is the very essence of conservation planning. A diversity of expertise and viewpoints is needed simply because conservation plans deal with unusually complicated problems—the interaction of human and natural systems with all their attendant political, biological, and cultural complexity. It is, therefore, not surprising that success depends on people with different backgrounds working together successfully. The following groups have played an important role in conservation planning efforts in the past and will continue to do so in the future.

- Citizens, including landowners, developers, and environmental advocates, who communicate goals as well as needs and preferences for implementation
- Ecologists, who identify areas for protection based on biological attributes that provide a rational basis for regulation and investment
- Attorneys, who develop regulations and standards for wildlife protection
- Land trust representatives, who mobilize private resources for protection efforts
- Planners, who integrate priorities for wildlife with other needs of community, such as housing, transportation, recreation, infrastructure, and services
- Decision makers, who approve plans that achieve community goals in an equitable way

Table 2-3 summarizes some principles that will enhance the collaborative approach to conservation planning. In particular, we describe how citizens and planners can interact effectively with ecologists in developing practical and scientifically sound approaches to habitat and species protection.

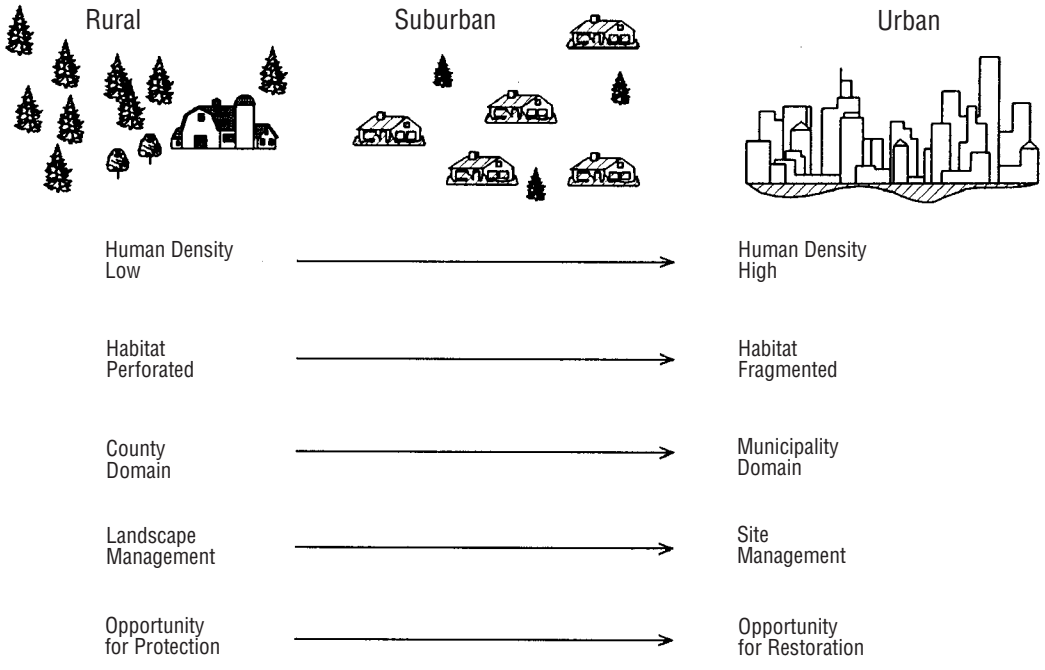


Figure 2-2. The Rural-Urban Continuum

Table 2-3. Seven Operational Principles of Habitat Protection	
Principle 1	Be willing to use rules of thumb based on scientific findings that may someday prove to be false.
Principle 2	Understand that complex environmental problems do not have a single, scientific solution founded on "truth."
Principle 3	Begin all conservation plans with clearly stated, specific goals for wildlife protection.
Principle 4	Insist that the analysis used for setting conservation priorities can be understood by everyone who is affected by it.
Principle 5	Realize that all models are wrong, but some are useful.
Principle 6	Make plans adaptive by evaluating the consequences of actions. Learn by doing.
Principle 7	Seize opportunities to enhance wildlife habitat by intelligent design of developments.

Principle 1. Be Willing to Use Rules of Thumb and "Truths" That May Someday Prove to Be False.

It is not uncommon to hear ecologists express concern that the current state of knowledge is inadequate to make recommendations for managing complex ecological systems, particularly human systems. Of course, knowledge is imperfect—any science has some uncertainties, and ecology is no exception. But at any given time in the maturation of a science, there is a prevailing wisdom or opinion that is useful at that time. You should insist that such wisdom is used to support current decisions, while appreciating that scientific understanding will be revised as knowledge improves. Thus, the ecological principles of habitat protection that we offer below are our best effort to assemble current scientific knowledge relevant to conservation planning. Apply the principles we offer with confidence until someone offers you something better.

Principle 2. Understand That Complex Environmental Problems Do Not Have a Single, Scientific Solution Founded on "Truth."

This is a corollary to the first operational principle above. Deciding what areas of landscapes should be protected for wildlife is a highly complex environmental problem, and, if you expect an ecologist to deliver a crisp solution similar to a specific flow rate of water in a pipe delivered from a reservoir, you are bound to be disappointed. There are many examples in the physical sciences where precisely stated problems can be solved unambiguously, but ambiguity is inherent in most ecological problems.

However, such uncertainty is permissible in most applications. For example, it is usually the case that the standards of "proof" legally required to support regulations with science are often not as rigorous as the standards that scientists apply to themselves. That is, in a court of law, it may be sufficient to simply present a reasonable, credible argument based on a range of scientific interpretations. It is often unnecessary to state a precise, mathematically expressed level of confidence in that interpretation.

The main point here is that conservation plans can be developed using a variety of approaches to analyze the problem of what to protect, a variety of data relevant to that problem, and a range of scientific viewpoints defining its solution. The data, analysis, and viewpoints that are most appropriate for a given conservation plan depend on two things: (1) the goals of the plan, and (2) the ability of an ecologist to make his or her approach to the plan understandable and credible to the people who will be affected by it.

Principle 3. Begin All Conservation Plans with Clearly Stated, Specific Goals for Wildlife Protection.

It follows that one of the more important steps in developing a conservation plan is establishing clear and specific goals. The operative words here are clear and specific. As an example of a goal that lacks these operative features, consider the following:

> Land uses should be designed to be harmonious with wildlife habitat in the county.

This goal sounds laudable, but it is so broad that no one could disagree with it. From a legal point of view, it is so vague that it may even be unenforceable. For example, it is arguable that downtown Denver is "harmonious habitat" for Peregrine falcons because it offers nesting habitat and plenty of pigeons. Because goals are needed to choose an appropriate analytical approach for setting conservation priorities, goals that are excessively broad, like this one, make all approaches equally worthwhile.

In contrast, consider the following:

> The county will strive to ensure the persistence of populations of all of the native vertebrates in the county. We will do this by preserving habitats sufficient to support viable populations of all species and by preserving the ecological processes needed to support those species. In addition, the county will minimize human impacts that harm the abundance and distribution of sensitive and economically important species, including native ungulates, sport fish, and watchable wildlife.

The second goal gives us something concrete to talk about—it specifies what we are trying to achieve by identifying three crucial elements: (1) a focus on habitat, (2) an identification of the species we are concerned about (native vertebrates), and (3) a criterion for success (viability). These three elements should be found in all goals for conservation plans.

Principle 4. Insist that the Analysis Used for Setting Conservation Priorities Can Be Understood by Everyone Who Is Affected by Decisions Based on that Analysis.

This is the "emperor must wear clothes" principle. "State of the art science," which is thought to be tech-

nically elegant by ecologists but which is opaque to citizens, should be dispensed with in favor of science that can be understood and believed by the people who will use it. This is a controversial statement, but we are convinced of its wisdom. The reason is that, in a democracy, all government decisions must be explainable to be credible. If a planner must support decisions with the technical blessing of an ecologist, that planner is not likely to be credible with the citizens he or she serves. We contend that it is part of our culture to be skeptical of highly technical or obtuse analyses, particularly when they affect our lives. Conservation biology is not rocket science, and if the analysis offered up by an ecologist is not clear to you, ask that it be made clear.

Principle 5. Realize that All Models Are Wrong, but Some Are Useful.

Setting conservation priorities will almost always involve some sort of an ecological model. It is important to understand that the predictions of all models are wrong simply because a model, by definition, is an abstraction of the real world. A corollary to this idea is the statement of Mark Twain that "prediction is difficult, particularly when it involves the future." The important point is that the value and utility of an ecological model should be measured in terms of your ability to use that model to make a better decision or to communicate the basis for that decision. The success of a model should not be measured against some absolute standard of accuracy because a*ll* models make inaccurate predictions.

Principle 6. Make Plans Adaptive by Evaluating the Consequences of Actions. Learn by Doing.

It has been said that the planning process is analogous to the scientific method. This analogy holds true if we evaluate how plans are implemented and then use what we learn from those evaluations as input to the next planning cycle, as illustrated in Figure 2-3. Using management actions to learn about the workings of ecological systems is known as "adaptive management" (Walters 1986; Walters and Holling 1990). Ecologists can be a tremendous resource in designing adaptive management plans because human actions disturb natural systems, and ecologists are trained to understand the effects of such disturbance in a rigorous way. For example, there are many unanswered questions about the effects of people on wildlife habitat that could be answered by managing development at the site or the landscape scale. How does housing density affect wildlife communities? What kind of setback from riparian areas is best for maintaining diversity of riparian species? How does infrastructure affect the movement of animals across landscapes? What is the impact of trail use on the nesting success of forest birds? If we commit ourselves in planning efforts to answering just one or two unanswered questions like these, we constantly improve our ability to develop and implement strategies and tactics for conservation.

Principle 7. Seize Opportunities to Enhance Wildlife Habitat by Intelligent Design of Developments.

The very notion of habitat "protection"—of locking up nature in order to save it—runs contrary to the idea that human systems can interact with natural ones in a favorable way and plan landscapes that enhance environmental values like wildlife habitat. An emerging view among contemporary ecologists is that we must manage the relationships between man and nature so as to achieve specific objectives for natural systems (Botkin 1990; Pickett et al. 1992; Jordon 1994; Turner 1994; Kane 1994). We urge you to reject the notion that all human actions degrade natural environments—the challenge we face is discovering a way that the human population can live in harmony with natural systems. If we take the view that all human actions lead to disharmony, we have admitted defeat in this fundamentally important endeavor.

For example, development can be used as a tool to enhance wildlife habitat in agricultural counties like those along the eastern edge of the Rocky Mountains. These counties contain substantial land committed to irrigated agriculture that is being developed as subdivisions. Before they were plowed, these lands contained very small streams that are now absent from the landscape as a result of cultivation. Intelligent design can restore these streams and perhaps create associated wetlands. Doing so can enhance wildlife habitat by rejuvenating a riparian zone. If such restoration is done in an intelligent, deliberate way over large areas, the streams and vegetation that emerge can create a network of corridors that offer habitat values at site and landscape scales.

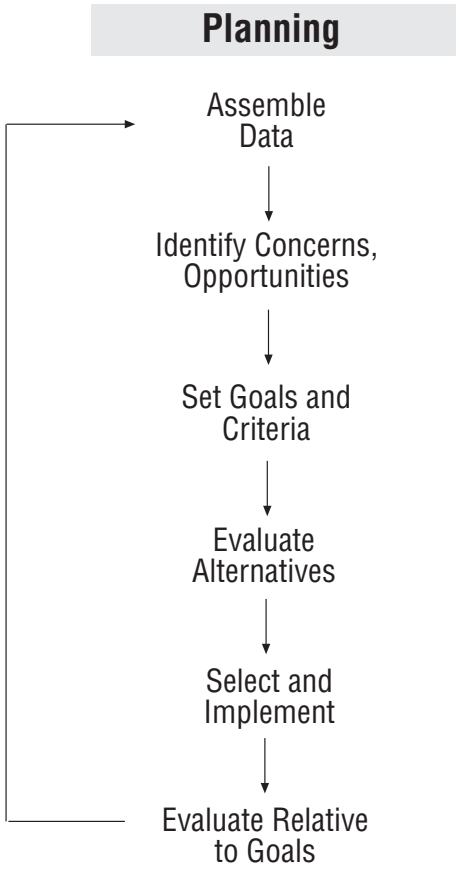


Figure 2-3. The Planning Process

SEVEN BIOLOGICAL PRINCIPLES FOR HABITAT PROTECTION AT THE LANDSCAPE SCALE

One thrust of the seven operational principles listed above is that effective conservation planning requires us to apply current knowledge to the design of protection strategies while knowing full well that such knowledge may be imperfect. The next step is to outline what we believe are the findings of conservation biology—or "biological principles"—that are most relevant to habitat protection in rapidly developing areas. We first address principles that apply to landscape management, and we then offer principles for site management. The seven key biological principles applicable at the landscape scale are summarized in Table 2-4.

Table 2-4. Seven Biological Principles for Habitat Protection at the Landscape Scales

Principle 1	Maintain large, intact patches of native vegetation by preventing fragmentation of those patches by development.
Principle 2	Establish priorities for species protection and protect habitats that constrain the distribution and abundance of those species.
Principle 3	Protect rare landscape elements. Guide development toward areas of landscape containing "common" features.
Principle 4	Maintain connections among wildlife habitats by identifying and protecting corridors for movement.
Principle 5	Maintain significant ecological processes in protected areas.
Principle 6	Contribute to the regional persistence of rare species by protecting some of their habitat locally.
Principle 7	Balance the opportunity for recreation by the public with the habitat needs of wildlife.

Principle 1. Maintain Large, Intact Patches of Native Vegetation by Preventing Fragmentation of those Patches by Development.

Action Needed to Implement Principle 1

*V*egetation should be mapped across the landscape to identify natural areas that are not currently fragmented by roads or residential development. If all other values of habitat are equal, larger patches of habitat should be protected in preference to smaller ones. Try to strive to minimize development within these areas and avoid fragmenting them with roads.

Scientific Rationale for Principle 1

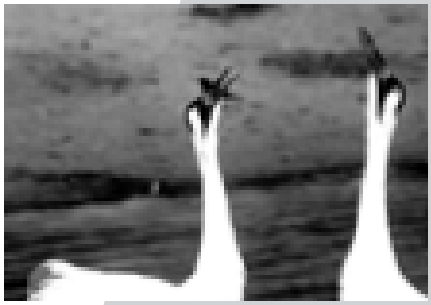
Large intact patches of native vegetation are valuable for wildlife because such patches support large, persistent populations and provide habitat for a greater diversity of species than small patches do. Here, we review the relationships between patch area and wildlife abundance, persistence, and diversity.

Effects of patch area on wildlife abundance. The primary reason to preserve large, intact patches of habitat is that long-term trends in population size of wildlife species are directly related to the area of habitat available to them (Harris 1984; Hoover and Wils 1984). Many wildlife species are territorial and "defend their space" against members of the same species. As a result of this defense, the number of individuals using a given patch is limited by the average territory size. For other species, abundance is ultimately controlled by the resources available in the patch—such as the amount of food or the number of nest sites (Sinclair 1989). It is often a safe prediction that the number of individuals of a given species within a patch of habitat will increase in direct relation to the area of the patch.

The characteristics of individual wildlife species determine the way that habitat area and quality affect the abundance of that species. The most obvious influence of species characteristics on animal abundance is body size—an acre of willows will support far more mice than moose (Peters 1983; Pennycuick 1992). This occurs because territory size increases as body size increases and because large animals require more food than small ones do. Hence, they require a greater area of habitat to meet their nutritional requirements. As a result, the number of animals per unit area increases as animal size declines, but this relationship is not directly proportionate to size.

The effect of habitat area on animal abundance is also influenced by the feeding habitats of wildlife. For example, predators require much more area than herbivores do, and, as a result, a given habitat patch will support far fewer predators, like bear or mountain lion or bald eagles, than herbivores, like mule deer or prairie dogs (Colinvaux 1978). Why this is true is easy to see by example. If a mountain lion eats 100 deer in a year, then a single lion must range over an area that supports more than 100 deer.

The abundance and diversity of wildlife in a habitat patch are also influenced by the types of patches that surround it and the land uses that occur in them. Of particular concern are so-called "edge effects" that occur in a zone of influence centered on the boundary between two patches. Historically, many wildlife biologists sought to maximize "edge" between two contrasting and adjacent habitat patches in the belief that this enhanced the landscape for wildlife. This was based on Aldo Leopold's (1933) "law of interspersion," which stated that the density of wildlife species requiring two or more habitat types is proportional to the amount of edge between or among those habitat types.



Luther Goldman, U.S. Fish & Wildlife Service

Collision with urban power lines is endangering the whooping crane.

Within the past 20 years, however, a number of ecologists have suggested potentially detrimental effects of such practices for some species, based on a number of studies conducted primarily in the eastern U.S. and focusing on songbirds (Gates and Gysel 1978; Whitcomb et al. 1981; Lynch and Whigham 1984). These investigators and others have suggested that some species require large, intact forest patches, and that such patches have become increasingly rare as wildlife habitat has been converted to urban or agricultural uses. Such conversions may be responsible for the decline of some species, notably migratory songbirds (Hagan and Johnston 1992).

Gates and Gysel (1978) referred to decreased nesting success near edges as the "ecological trap hypothesis." According to this hypothesis, birds that nest near edges suffer high rates of nest loss due to predation (Whitcomb et al. 1981; Yahner and Wright 1985; Andren and Angelstam 1988) or parasitism (Brittingham and Temple 1983). Based on a review of such studies, Paton (1994) surmised that these detrimental effects are most acute within 150 feet of the edge of a patch. Thus, the effective area of a habitat patch may be substantially less than the apparent area for species that are sensitive to edge effects.

Adjacent patches need not be large for edge effects to occur. For example, Small and Hunter (1988) documented higher predation rates for birds nesting in forested patches near roads or power line corridors. Roads also disrupt or prevent wildlife movement, act as conduits for exotic species and predators, and serve as sources of pollution and habitat disturbance such as fire (Schonewald-Cox and Buechner 1990; Bennett 1991).

Effects of patch area on species persistence. **T**he reason that the effect of habitat area on animal abundance is so important is because, in the long term, the p*ersistence* of populations depends on population size. A persistent population is one that does not go extinct, and p*ersistence time* is the average time that a species is likely to exist before the species becomes extinct from the local area. Many studies have shown that the best predictor of persistence time is population size—large populations are much more likely to persist for a long time than are small populations (Wilcox and Murphy 1985; Wilcove et al. 1986; Simberloff 1988; Pimm and Gilpin 1989; Pimm et al. 1988; Ryan and Siegfried 1993; Fahrig and Merriam 1994).

This is the case for several reasons. First, small populations are more susceptible to "bad luck" in births and deaths (Raup 1991; Lande 1993; Caughley 1994). To illustrate the effects of such luck, think of an imaginary population that is regulated by the flips of a coin. Each year you flip the coin once for each animal in the population—heads it lives, tails it dies. If there are only 10 animals in the population, a run of bad luck could easily drive the population to extinction within a few years. On the other hand, if there are 1,000 animals in the population, the chance of getting enough tails to kill them all off is almost nil.

Another source of bad luck is the environment itself (Goodman 1987; Lande 1993). For instance, mortality rates for wildlife tend to increase dramatically during very harsh winters. Large populations are able to bounce back after such mortality, but small ones often cannot.

Finally, population size is important to persistence as a result of genetic effects (Lande and Barrowclough 1987; Lande 1988). Small populations tend to become i*nbred* as a result of mating among close relatives. Inbreeding allows deleterious genes to accumulate in the population. This accumulation of "bad genes" diminishes reproductive success and survival, which makes it more likely that the population will decline to extinction (Beardmore 1983; Charlesworth and Charlesworth 1987; Pimm and Gilpin 1989; Hass 1989).

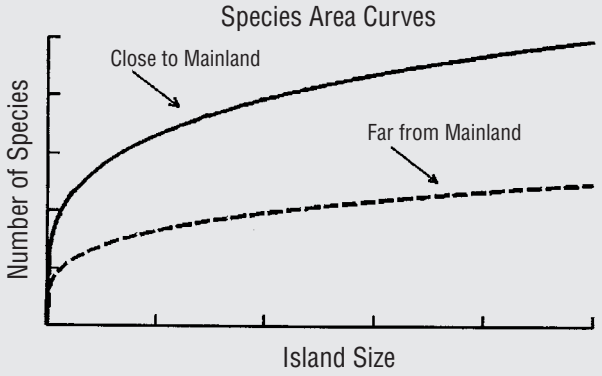
So, persistence of populations declines as abundance declines, but persistence is not directly proportionate to abundance. Populations that reach a level of abundance where chance extinction is highly improbable are said to be v*iable populations* (Boyce 1992; Remmert 1993). For a population to be viable, it must have an adequate amount of habitat, because as we described above, abundance is roughly proportionate to habitat area. So, reductions in habitat area resulting from development can be reasonably assumed to reduce the average persistence time of populations and to reduce their viability (Ryan and Siegfried 1993; Fahrig and Merriam 1994).

Effects of patch area on species diversity. Large intact patches of habitat tend to support a greater diversity of species than small, fragmented patches do. Many ideas on habitat fragmentation and species diversity can be traced to studies of species diversity on islands. During the 1960s, Robert MacArthur and Edward O. Wilson (1967) developed and tested a theory predicting why islands contained different numbers of species. Their work and work of others has generally shown that species diversity increased asymptotically with island area (Deshaye and Morisset 1989; Gilpin and Diamond 1980; Seagle 1986; Simberloff and Abele 1982). (See Figure 2-4.) In addition to island area, an important influence on species diversity was distance to the mainland or other large land mass. All other things being equal, islands that were a long way from a continent tended to have fewer species than those that were close to continents (MacArthur 1972).

The relationship between island size and diversity is known as a *species area curve.* In addition to real islands (that is, land surrounded by water), species area curves have been documented for many "island-like" patches

of habitat (e.g., mountain tops surrounded by lowlands) (Harris 1984; Brown 1971). (See Figure 2-5.) The generality of this relationship is believed to result from the balance between immigration rates (the number of species arriving at an "island" per unit time) and extinction rates (the number of species going extinct) (MacArthur 1972). As island areas decline, persistence time declines and extinction rates increase. As distance from other land masses or other sources of immigrants increase, colonization rates (the rates at which animals from other areas find their way to the island) decline. The number of species found on an island is the number present when extinction rates and colonization rates are equal.Thus, based on this theory and many subsequent empirical studies, it is reasonable to predict that large intact patches of habitat are likely to support a larger number of species than small patches will.

Figure 2-4. Island Size and Species Diversity



Summary. The value of protecting large, intact habitat patches of habitat is supported by many studies documenting that the area of a habitat patch exerts a strong influence on wildlife population size. Population size, in turn, influences the persistence time of populations such that populations with large habitat patches tend to persist longer than those that make a living in small ones. Finally, species diversity tends to increase asymptotically with increased patch area.

Principle 2. Establish Priorities for Species Protection and Protect Habitats that Promote the Distribution and Abundance of those Species.

Action Required to Implement Principle 2

Applying ranking systems to identify species that will receive priority for protection and for investment in conservation. Learn about the habitat requirements for those species and devise protection and management plans to ensure that habitat requirements are met.

Scientific Rationale for Principle 2

Principle 2 is based on the frequent observation that a relatively small number of features of habitat are likely to be particularly important in determining the survival and reproduction of individual species. For example, Abert's squirrels require mature ponderosa pine for nesting, willow flycatchers require dense shrubs in riparian areas, and bighorn sheep require meadows in close proximity to rocky outcrops. Principle 2 can be thought of as the "devil is in the details" rule—managing to ensure persistence of species requires a detailed understanding of their life histories and habitat requirements. It is unreasonable to expect that such understanding could be accrued for all of the wildlife species in a given location. Consequently, it is important to "narrow the field" by setting some priorities for protection.

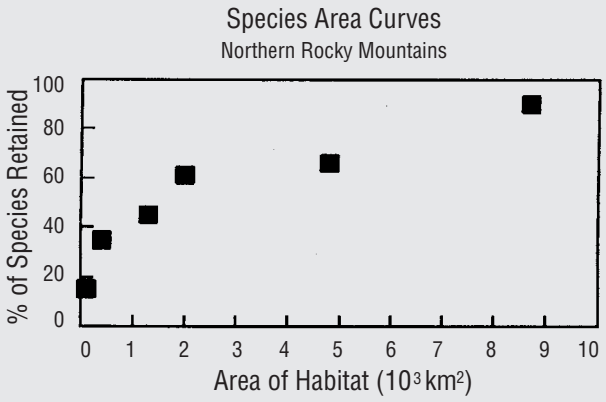
There are a variety of systems for such prioritization. Some emphasize the need to preserve a wide variety of species, while others focus on threats to persistence, the economic and aesthetic value of the wildlife, or other factors (Milsap et al. 1990; Master 1991; Given and Norton 1993; Gross et al. 1995). These systems can be used in combination with an understanding of local values to select a set of species that will receive particular attention in conservation efforts.

Principle 3. Protect Rare Landscape Elements. Guide Development Toward Areas with More Common Landscape Elements.

Actions Required to Implement Principle 3:

Principle 3 requires an inventory of wildlife habitats and vegetation within the landscape of interest. Such inventories can be used to identify landscapes, such as wetlands, riparian zones, cliffs, or old growth forest, that are uncommon or are necessary to support rare or threatened species. Development can be encouraged in other areas with a more predominant vegetation type.

Figure 2-5. Rocky Mountain Species Area Curve



Scientific Rationale for Principle 3:

Implementing Principle 3 is fundamentally important to all wildlife protection efforts because the diversity of wildlife species found on a landscape depends on the diversity of habitats available to them (Forman and Godron 1981; Marcot and Meretsky 1983; Fox

1983; Forman 1995). Habitat diversity in turn, can be markedly reduced if "uncommon" parts or features of habitats are lost.

To illustrate why habitat diversity is so important, think of a richly sewn patchwork quilt of many colors and fabrics and compare it to a simple wool blanket. The patchwork quilt has much greater diversity in its pattern than the blanket does. Just like the quilt, most landscapes contain several different habitat types juxtaposed in complex patterns—sagebrush is interspersed with grassland and riparian zones, stands of aspens are mixed with oakbrush, conifer forests are dotted with meadows. Increased mingling of different patches of vegetation creates a greater variety of "places to live" for wildlife species (Forman 1995).

This is the case because dissimilar habitats provide for the nutritional and reproductive requirements of different species. Whenever those dissimilar types occur together on the landscape, a greater variety of species can make a living there. The best example of this variety is seen in riparian zones, where water and land come together. This coming together allows for a much greater variety of species than would be found on land or in water alone.

This is important because habitat types are almost never distributed equally across a landscape. Some are rare, and some are common. It follows that rare habitats can contribute a disproportionate share of the diversity of wildlife that are found in a given place. For example, imagine that a hypothetical landscape is 95 percent grassland and 5 percent riparian. There are 200 species on the entire landscape, 100 of them depend on the riparian zone. Loss of 5 percent of the habitat area can lead to a 50 percent decline in species if that loss comes from the riparian zone. Thus, if these rare elements of landscapes are converted to human uses, particularly to residential development, a precipitous decline in wildlife diversity may follow. In contrast, wildlife diversity may be relatively insensitive to development that occurs in the more common habitat types. This creates opportunity for compromise in planning for development. The needs of people can be accommodated alongside the needs of wildlife if people are willing to adjust their distribution to avoid habitats for wildlife that are in short supply on the landscape.

Principle 4. Maintain Connections among Wildlife Habitats by Identifying and Protecting Corridors for Movement.

Action Required to Implement Principle 4

Whenever possible, map routes of movement among seasonal ranges of important wildlife species. In addition, try to identify small patches of vegetation that provide "stepping stones" among large, core patches described above. Protect these movement routes and stepping stones.

Scientific Rationale for Principle 4

We acknowledge from the outset that the importance of corridors in achieving habitat protection is scientifically controversial (Simberloff 1988; Hobbs 1992; Mann and Plummer 1995). In addition to creating the beneficial affects described below, some researchers conclude that connections among habitat areas could promote the transmission of disease and could concentrate animals within a given space, making them more vulnerable to predators. However, our view is that protecting corridors probably does no harm (but see Hess 1994) and is likely to offer substantial benefits to wildlife for the reasons described below.

Corridors are areas of the landscape that are more likely to be used for movement among habitat patches than other areas (Forman 1995). When we think about protecting corridors, there are two ways we can approach the problem. First, we can determine and map the routes that are used by wildlife to move among habitats by simply observing such movements with radiotelemetry or other techniques. Such routes are what most people think of when they talk about movement corridors.

Although that approach provides an intuitive way to identify corridors, it is very expensive. As a result, it tends to be used only for a few economically important species like elk or moose. What can be done to identify corridors for the many other species of wildlife?

One possibility is to identify stepping stones among major habitat types (Figure 2-6). In many cases, there are small patches of vegetation that tend to bridge the gaps between large ones in the same way that rocks in a stream bridge the gap between its banks. Most geographic information systems include analytical tools that can help identify these patches. In the absence of empirical studies of animal movements, we must simply presume that protecting these patches will facilitate movement among large, intact habitat patches.

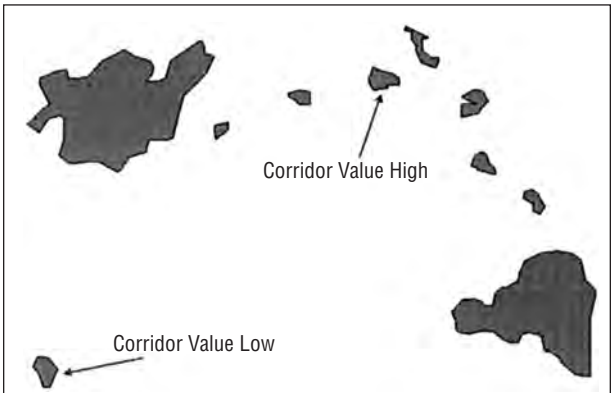


Figure 2-6. Stepping Stones

By making this presumption, we can protect corridors for entire communities of species using those patches.

Corridors are important because, by definition, they are areas of the landscape that facilitate movement among populations. Such movement is valuable for three reasons.

First, many species must move among seasonal ranges in order to meet their requirements for food and cover at different times of the year (Edwards and Ritcey 1956; Taber and Dasmann 1957; Herbert 1973;

Risenhoover and Bailey 1985; Wilcove 1985; Shaw and Carter 1990; Kozakiewicz 1993; Boyce 1991). Eliminating movement routes for these migratory species can prevent them from meeting their seasonal needs for feeding and/or reproduction. For example, deer and elk typically use high-elevation ranges during the summer and lowlands in the winter. Often, migration occurs along drainage corridors connecting these areas. If migration routes among seasonal ranges are cut off, large areas of habitat can be rendered inaccessible. Such reductions in habitat area will compel reductions in population size as described above.

Second, populations that are connected to each other by the process of dispersal are more likely to persist than isolated populations (Wiens 1990; Stacey and Taper 1992; Wissel et al. 1993; Verboom et al. 1993). Successful dispersal among populations enhances persistence because a large population can "rescue" a small one from extinction by providing a source of immigrants—like "reinforcements" to an imperiled garrison. If immigrants arrive in a small population that is on the verge of extinction, they can help the imperilled population recover from a run of bad luck to achieve viable size.

Third, successful dispersal among populations prevents inbreeding and helps to maintain genetic variability within populations (Simberloff 1988; Lande and Barrowclough 1987). Such variability is associated with enhanced vigor, survival, and reproduction (Deforge et al. 1979; Beardmore 1983; Sausman 1984; Charlesworth and Charlesworth 1987; Hass 1989).

In contrast, blocking corridors or allowing development in locations that isolate wildlife populations can:

- reduce the area of habitat available to species;
- increase the likelihood of population extinction by reducing immigration; and
- exacerbate genetic problems that result from inbreeding

Principle 5. Maintain Significant Ecological Processes such as Fires and Floods in Protected Areas.

Action Needed to Implement Principle 5

Many natural ecological processes are necessary to maintain plant and animal communities within the landscape. Examples of ecological processes include periodic fires, floods, and distribution of habitat materials thrown by the wind. Local communities should consult with private and public land managers and ecologists to identify which ecological processes are most important to the community's priority wildlife species, and to ensure that those processes are sustained.

Scientific Rationale for Principle 5

Habitat protection has traditionally been viewed as an essentially passive process (Botkin 1990). In this process, we prevent development or resource extraction from an area of land. Preventing development, by itself, is thought to be sufficient to sustain the value of habitat. We have assumed that, if we leave nature alone, we will protect wildlife and its habitat. This intuitively appealing approach has been strongly challenged in recent years because ecologists have realized that "disturbance" of landscapes by events like fire, grazing, and flood is fundamentally important to maintain the plants and animals native to those landscapes (Pickett and Thompson 1978; Pickett et al. 1992). Thus, "leaving nature alone" will often fail to protect habitat if sources of disturbance are not maintained.

W.N. Duncan, U.S. Fish & Wildlife Service

Supression of fire is a main factor endangering the hairy rattleweed, a perennial legume.

For example, the Colorado Division of Wildlife recently studied historical changes in the structure of a riparian landscape along the North Platte river. The area was purchased to protect wildlife habitat during the 1920s. The division mapped and analyzed the spatial distribution of patches of cottonwood forest using aerial photographs taken in 1937 and 1990. During that time interval, there were many impoundments built along the river, and the division's analysis showed that the cottonwood community that was ostensibly protected by a conservation purchase was in fact being lost because of the absence of annual flooding. Although conservationists bought the parcel, they ignored the process, and as a result lost much of the conservation value of the area. This work reveals that all facets of the landscapes are embedded in a larger context and the processes that operate in that larger context are critical to conservation.

There are many other examples. Periodic burning and grazing is needed to maintain native species in tallgrass prairie, and ground fires are needed to ensure regeneration of oak forests. In the absence of these sources of disturbance, wildlife habitat can be lost through natural processes of succession no matter how well it is "protected" from human use.

Maintaining appropriate levels of disturbance will frequently require active management of the land rather than passive protection. Often, it is necessary to substitute management actions for natural disturbance events. For example, prescribed burns might take the place of uncontrolled natural fires, logging might be used to simulate natural canopy gaps, livestock could serve as a surrogate for absent native herbivores, and

releases of water from impoundments can be timed to mimic natural runoff.

As an example of active management to preserve disturbance, we now consider how intelligent planning for development can actually enhance the persistence of threatened species relative to passive protection alone. Consider the first Habitat Conservation Plan developed as part of the implementation of the Endangered Species Act in San Bruno Mountain, California during the 1970s. Habitat Conservation Plans are what they sound like—comprehensive plans for the conservation of habitat for threatened or endangered species. They allow for development in the habitats of such species, provided that active measures are taken to preserve and enhance habitat adequate to ensure viable populations of the species in questions. In the San Bruno Mountain case, habitat for the endangered mission blue butterfly was threatened by proposed development. However, it was also threatened by loss of habitat due to natural processes occurring in the absence of development. The mission blue butterfly is dependent on a species of flower only found in the native grassland, which was rapidly being converted to non-native species. Maintenance of native plants in the area required active management, which required steady funding. By implementing a conservation plan, developers provided the funding for management and restoration required to maintain the butterfly's habitat. In return, they were allowed to develop areas of habitat that would have been off limits if a conservation plan had not been put into place. Habitat Conservation Plans are discussed in much more detail in Chapter 6 and Appendix B.

Principle 6. Contribute to the Regional Persistence of Rare Species by Protecting Some of their Habitat Locally.

Action Needed to Implement Principle 6

Map wildlife habitat at state or regional scales and identify habitats that are rare or are home to sensitive wildlife species. Protect and manage some of those rare habitats in local conservation plans, especially if the local area contains a large proportion of the total habitat in the region. In other words, local communities need to think regionally and act locally.

Scientific Rationale for Principle 6

John Wesley Powell, a geologist who explored the American West following the Civil War, argued many years ago that the political boundaries of the West should respect the important environmental boundaries—particularly the limits of watersheds. Unfortunately for conservation, his arguments were never implemented, and, as a result, the existing political boundaries can cause serious gaps in species protection. This is because habitats and populations that are abundant within a political jurisdiction may be regionally rare, while regionally abundant species may be rare locally. In either case, knowledge of the status of species beyond the political boundaries is a prerequisite for intelligent conservation planning at the local level. Without looking beyond the political boundaries of municipalities or counties, it is possible that effort will be wasted in protecting species that are regionally abundant or that opportunities will be forgone to protect species that are regionally rare.

Principle 7. Balance the Opportunity for Public Recreation with the Habitat Needs of Wildlife.

Action Needed to Implement Principle 7

Ensure that some protected areas remain in private ownership not open to the public in order to reduce intensity of use by recreationists. Regulate recreational use of protected habitat on public land to minimize impacts on sensitive species.

Scientific Rationale for Principle 7

There is some evidence that human recreational activity can disturb wildlife populations to the extent that they will fail to thrive in heavily used areas. It follows that a comprehensive conservation plan would be wise to include some protected areas where recreational use can be limited to levels that are appropriate for wildlife protection.

FIVE BIOLOGICAL PRINCIPLES FOR HABITAT PROTECTION AT THE SITE SCALE

The smaller scale of wildlife habitat protection is the site scale. For our purposes, the site scale ranges from individual lots and neighborhoods to entire residential or commercial developments. We focus on species and habitat threatened by human activities. Again, the relevant question is How do we maintain the integrity of wildlife habitat to the greatest extent possible in the immediate vicinity of areas developed for human use? Thus, the overall goal is to sustain wildlife populations and in so doing to enhance the quality of the present and future human environment.

Although ecological investigations about wildlife are legion, relatively few studies have been conducted specifically in an urbanizing context. As a result, we must often extrapolate from studies conducted in nonurban settings and apply the results to areas where people live. Many investigations of the impacts of human activity on wildlife have focused on game animals, and we must thus cautiously extrapolate results to nongame species. Finally, most wildlife studies are of relatively short duration—three years or less. It is quite possible that the full effects of urbanization on wildlife may not become apparent for longer periods of time (Aldrich and Coffin 1980). For example, researchers in San Diego found that the number of years since canyons were isolated from larger tracts by residential development was an important factor in predicting extinction rates for bird species found there (Soule et al. 1988; Soule et al. 1992).

With these caveats in mind, our goal is to recommend ways to achieve a reasonable balance between the needs of people living in a community and the needs of wildlife—based on ecological principles and the best scientific information available. Where information is not available, we advocate a conservative approach in the hope of keeping options open. It is easier to retain habitat and protect species now than it is to replace them once they are gone.

Table 2-5 summarizes a number of fundamental principles for the conservation of wildlife at the site scale. These principles are by no means exhaustive and can be modified or built upon as information from relevant ecological studies accumulates.

Principle 1. Maintain Buffers Between Areas Dominated by Human Activities and Core Areas of Wildlife Habitat.

Action Required to Implement Principle 1

Designate habitat patches as core areas on the basis of their importance to wildlife. Relegate human activities to one or more buffer zones surrounding a core area, with more intense activities restricted to more distant zones. Visual buffers, such as a row of trees or shrubs, may also prove effective in mitigating human disturbance. If people must pass through the core area on foot or bicycle, limit them to a well-defined trail.

Table 2-5. Five Biological Principles for Wildlife Conservation at the Site Scale

Principle 1	Maintain buffers between areas dominated by human activities and core areas of wildlife habitat.
Principle 2	Facilitate wildlife movement across areas dominated by human activities.
Principle 3	Minimize human contact with large native predators.
Principle 4	Control numbers of midsize predators, such as some pets and other species associated with human-dominated areas.
Principle 5	Mimic features of the natural local landscape in developed areas.

Scientific Rationale for Principle 1

Human activities in or near wildlife habitat may cause some animals to alter their activity and feeding patterns. Although such alterations may seem relatively harmless at the time to the casual observer, they may have serious consequences for the animal. For example, stress that results from human disturbance may lead to increased susceptibility to disease, reduced reproductive output in some species, or abandonment of the area temporarily or permanently.

In order to mitigate the effects of human activity, we must first have an appreciation for the range of potential impacts on wildlife. Flushing distance (i.e., the distance from disturbance at which an animal flees) depends on the type of disturbance and the species. Information on flushing distances is available for a number of species, and these data may provide some guidelines regarding appropriate buffer sizes.

Effects of traffic on wildlife. Some wildlife species appear to alter their habitat use as a result of traffic, associated noise, or a combination of the two (Singer 1978; Rost and Bailey 1979; van der Zande et al. 1980; Reijnen et al. 1987). In the foothills of the Canadian Rockies, for instance, habitat use by elk is strongly related to the proximity of roads. Elk used grassy areas near roads only in the early morning and late evening, when traffic volume is lower. They are, however, found in similar areas when there is a visual buffer between the grassy area and the road (Morgantini and Hudson 1989).

Distance from roads and traffic intensity on the roads influence the response of some species (MacArthur et al. 1982). In the Netherlands, breeding grassland bird densities were diminished for up to 1.2 miles from a busy highway, while a quiet rural road had similar effects on birds only within 0.3 miles (van der Zande et al. 1980). Some studies show that disturbance in open terrain, such as traffic or noise, may be more severe than in woodlands for birds as well as some other animals (van der Zande et al. 1980; Gabrielson and Smith 1995).

Effects of hikers on wildlife. It is possible that people walking along a road or trail have an even greater effect on wildlife activity patterns than vehicular traffic. This is because people on foot pass through an area much more slowly (Gabrielson and Smith 1995). Deer and elk, for example, have been known to alter habitat use as a response to hikers on trails (Rost and Bailey 1979). Still, if people must pass through a core habitat area, it is probably preferable to have them walking on a well-defined path. People following a well-used trail become predictable, as does motorized traffic on busy roads. The activities are channeled or constrained to occur in the same place, and often at certain times of the day. Some wildlife species appear to habituate to predictable human activity if the disturbances are perceived as non-threatening (MacArthur et al. 1982). For wildlife, habituation is defined as the gradual disappearance of behavioral or physiological responses to repeated stimulation. Habituation is unlikely when disturbance occurs at irregular times and places. For this reason, humans moving unpredictably through an area seem to provoke a stronger response than does motorized traffic on roads or people on trails (Gabrielson and Smith 1995).

Physiological responses of wildlife to stress. When surprised or threatened, wildlife react in a number of ways, occasionally "playing possum" or assuming a defensive posture, but more often fleeing. Active responses to human disturbance are typified by the animal's running or taking flight in order to escape. This sort of response is associated with a number of profound physiological adjustments, such as increased heart and respiration rates, elevated blood sugar, increased blood flow, and increased body temperature—in other words, stress (Gabrielson and Smith 1995). Energy costs associated with an active response to human disturbance may have serious

consequences for animals. This is especially true during critical times of the year, such as the postnatal period for mammals or the breeding period for birds, when an animal's energy reserves are already depleted and further stress may result in diminished reproductive output. For birds, disturbance may result in slower growth or premature fledgling for nestlings, and in nest evacuation or abandonment by the parents. Even if the parents eventually return to the nest, the eggs or young may be lost to predators in their absence.

Core area/buffer concept. What might be done to mitigate the effects of vehicular and pedestrian traffic? One approach involves the use of buffer zones, which are analogous to minimum impact areas at the landscape scale. One of the first expressions of this concept in a conservation context focused on old-growth ecosystems in the Pacific Northwest and involved "multiple-use modules" (Harris 1984). The basic idea was to establish a core area of sensitive habitat surrounded by buffer zones, with human use of increasing intensity permitted in the buffers as one moved away from the core (Harris 1984; Noss and Harris 1986). The notion of the core/buffer concept could also be applied in a suburban or rural setting. (See Figure 2-7.)

The first step is to identify sensitive or important habitat. Top priority should be assigned to habitat for

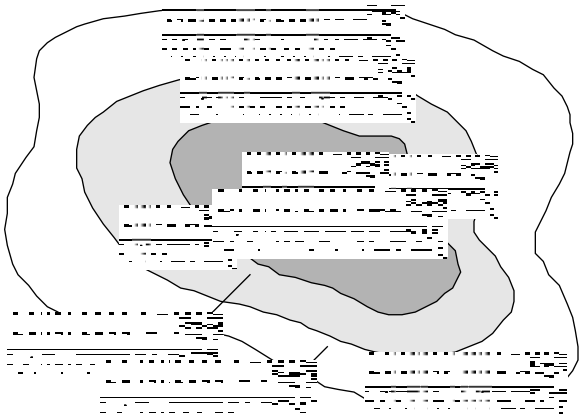


Figure 2-7. The Core/Buffer Concept

threatened or endangered species, species that are particularly sensitive to human activity, habitat that is regionally unique, and areas that support large numbers of native species. Consideration should also be given to habitat that is rare locally or may have educational value, such as wetlands, riparian areas, large meadows, or woodlots. Roads and motorized traffic should be disallowed in the core area, but could occur in one or more of the buffers. Ideally, nonmotorized traffic and hikers would also be relegated to a buffer zone. The next best option is to limit this type of activity to the periphery of the core area. If hikers or bikers must be allowed to pass through a core habitat area, it would be best to limit their activities to marked trails. This might be accomplished by constructing short, natural-looking fences (split-rail, perhaps) along the trail that would direct the flow of human traffic, maintain a rustic visual impression, but still permit wildlife movement. In this way, wildlife may habituate to human intrusion by making its location predictable, with the added benefit of reducing "braided" trail systems. A braided trail system is one in which the hiker has different options for side trails that eventually rejoin the main trail—but result in disturbances over a wider area.

Alternative or complementary approaches to spatial buffers include visual barriers and temporal buffers. Visual barriers might take the form of a row of trees or shrubs along a road or hiking trail. Again, such barriers appear to be effective for some large mammals in mitigating human disturbance (Morgantini and Hudson 1980). Visual barriers can also serve the dual purpose of keeping people on designated trails. Temporal buffers would simply involve the limitation or exclusion of human activity in or near sensitive areas during critical times of the year, such as the nesting period in birds or the immediate postnatal period in mammals (Gabrielson and Smith 1995). Although these are perhaps the most critical times for some species, disturbance at other times of the year may also have important consequences. For example, winter is a time of food limitation for many species, a time when energy budgets are already strained (Hobbs 1989).

How far from a core area should a road or hiking trail be? The answer depends on which species are likely to be found there or which species are the targets of conservation efforts. For a few species, rough guidelines are available in the form of reported "flushing" distances (i.e., the distance from a disturbance at which an animal flees to a new location). (See Table 2-6.) This distance is variable, and depends upon a number of factors, including the nature of the disturbance, the individual animal, the degree to which it has been habituated to the disturbance, the habitat type, and the season. A distance of approximately 600 feet is recommended for mule deer to avoid most flight (Freddy et al. 1986; Ward et al. 1980), while distance reported for elk range from 50 to 1,300 feet (Schultz and Bailey 1978; Cassirer et al. 1992), depending on the type of disturbance and prior habituation.

Some researchers have recommended distances from 250 to 1,000 feet in order to avoid 90 percent of flushing in reaction to a person on foot for a variety of wintering grassland raptor species, including the American Kestrel, Merlin, Prairie Falcon, Rough-legged Hawk, Ferruginous Hawk, and Golden Eagle (Holmes et al. 1993). The mean flush distance for wintering adult Bald Eagles along the Nooksack River was 650 feet in response to pedestrians (Stalmaster and Newman 1978).

When relevant estimates of flushing distances are available, we advocate a conservative approach in determining buffer sizes because no study can exhaustively account for the many factors involved in determining the distance at which an animal flushes. An example of a conservative approach for establishing setback distances for colonial water birds involves using the mean flushing distance, plus one-half the mean, plus 130 feet as the width of a buffer zone

Table 2-6. Approximate Average Flushing Distances Based on Published Studies

Species	Disturbance Factor	Flushing Distance (in feet)	Source
Double-crested cormorant	People walking directly toward nest	92	Rodgers and Smith 1995
Great blue heron	"	105	"
Black-crowned night heron	"	98	"
American kestrel	Person walking toward perched bird in winter	144	Holmes et. al. 1993
Merlin	"	250	"
Prairie falcon	"	300	"
Rough-legged hawk	"	580	"
Ferruginous hawk	"	207	"
Golden eagle	"	738	"
Bald eagle	Person walking during breeding season	1562	Fraser et. al. 1985
Bald eagle	Land activity near roost	820	Stalmaster 1980
Mule deer	Person walking in winter	656	Freddy et al. 1986
Mule deer	Person walking in winter	282	Ward et al. 1980
Elk	Person walking in winter	282	Schultz and Bailey 1978
Elk	Cross country skiers in low use area	1312	Cassirer et al. 1992
Elk	Cross country skiers in high use area	29	"

Source: Miller 1995

(Rodgers and Smith 1995). In some cases, the flushing distance can be affected by the amount of cover in the area. If more cover is available around the animal, it may feel less threatened by a given disturbance or may need to move a shorter distance in order to feel safe. There is an urgent need for information covering a wider variety of situations for more species and in more settings.

Principle 2. Facilitate Wildlife Movement Across Areas Dominated by Human Activities.

Action Required to Implement Principle 2

Provide for parcels of open space that are as large and continuous as possible within the constraints of site-scale planning. Maintain connectivity between these parcels. Locate roads and recreational trails away from natural travel corridors used by wildlife, such as riparian areas. Provide alternatives to crossing busy roads, such as underpasses, especially during road construction. Minimize fencing types that inhibit the movement of wildlife species that are likely to occur in the area. Minimize the visual contrast between human-dominated areas, including individual lots, and less disturbed terrain in the surrounding area.

Scientific Rationale for Principle 2

As mentioned earlier, the probability of extinction is inversely proportional to population size. That principle is just as true at the site scale as at the landscape scale. This suggests that local extinction—especially in an urban area that is highly fragmented and permeated by relatively intense human activity—is best avoided by maintaining large parcels of open space because larger areas generally support more individuals of a given species. The success of this strategy is enhanced if the parcels are contiguous or nearly so. For habitat patches that are not connected, corridors may facilitate dispersal as well as daily and seasonal movements (Soule 1991a; Noss 1993).

Although the corridor concept has been incorporated into many management plans, probably due to its intuitive appeal, the utility of corridors has been the subject of much debate (Simberloff and Cox 1987; Noss 1987). Much has been written on the topic, but overall there is little evidence, pro or con. A few studies indicate that some species seem to prefer corridors when they are available (Wegner and Merriam 1979; Dmowski and Kozakiewicz 1990; Merriam and Lonoue 1990), and there is an accumulation of observational data suggesting that animals use corridors (Bennett 1990; Saunders and Hobbs 1991). Experimental studies and manipulations are a prerequisite for more conclusive evidence, and such studies are both difficult and expensive to conduct. Still, it is likely that corridors increase the probability of movement between larger areas and may be especially important for species that are sensitive to barriers in an urban context. There is little doubt that it is more cost-effective to maintain existing connections than to recreate them (Hobbs 1992). Corridors should be considered in the context of local and regional conservation strategies and options (Simberloff et al. 1992), as well as site context and the ecology of target species, including home range, dispersal abilities, social structure, and foraging patterns (Lindenmayer and Nix 1993).

Roads as barriers to wildlife movement. The term "corridor" has also been applied to underpasses and tunnels connecting habitat on either side of a busy road

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Road kills and free-ranging dogs have added to the mortality of the deer population.

or highway (Simberloff et al. 1992). Road kills of animals by vehicles are the most obvious impact on wildlife. Lalo (1987) estimated that 1 million vertebrates per day are killed on roads in the U.S. Populations of most small vertebrates tend to recovery rather rapidly from such losses (Bennett 1991), but the impact on populations of larger animals or rare species may be substantial. In Florida, for example, road kill is the leading source of mortality for all remaining large mammals except the white-tailed deer, including most of the large endangered species (Harris and Gallagher 1989). Roads also serve as barriers to dispersal for a variety of animals that are reluctant to cross them (Oxley et al. 1974; Wilkins 1982; Swihart and Slade 1984; Brody and Pelton 1989). One researcher asserts that roads may be "the single most destructive element of the habitat fragmentation process" (Noss 1993, 60).

There have been a number of attempts to reduce road kill and facilitate animal movement across roads, and these efforts have met with mixed success. Methods involving reflectors, fences, one-way gates, and wildlife crossing signs have for the most part been relatively unsuccessful (Forman 1995). Tunnels or underpasses, on the other hand, have been proven effective for a variety of species (Reed et al 1975; Singer et al 1985; Langton 1989; Mansergh and Scotts 1989). For existing roads, retrofitting underpasses is often prohibitively expensive. The opportunity to incorporate underpasses or tunnels into the construction of new roads is much more cost-effective and should be a consideration (Soule 1991b). One approach is to identify at least two species from the local or regional pool: the largest animal expected to use the underpass and the species for whom the road is likely to be the greatest barrier. Then design the structure with them in mind (Forman 1995). The assumption is that success for these two species should translate into success for a variety of other animals.

Fences as barriers to wildlife movement. **I**n addition to roads, fences also inhibit movement for some species, and both barriers tend to increase with residential development. Fences that restrict movement are desirable in some instances, such as pet control. When privacy or aesthetics are the issue, however, barrier effects can be reduced by minimizing fencing, or at least fence types that are unfriendly to wildlife. Chain link fences, for example, would prevent movement by many mammal species, whereas split rail fences may not. Another alternative involves the use of fence substitutes, or "living" fences (e.g., shrubs), that serve some of the functions of fences but still allow wildlife to move through them. Furthermore, dense clumps of shrubs, perhaps in combination with a row of trees, may also provide nest sites, food, or cover for wildlife while serving as a visual screen or barrier to movement of humans. Back lot lines are commonly the least manicured area on a lot and, as a result, are likely to support native plants and animals while maintaining connectivity in a suburban neighborhood (Forman 1995).

Principle 3. Minimize Human Contact with Large Native Predators.

Action Required to Implement Principle 3

Prevent wildlife from associating food with humans by exercising tight control over potential sources of nourishment, such as garbage or food for domestic animals. Prevent pets from roaming freely in areas known to be inhabited by large predators (e.g., black bear, mountain lions, alligators).

Scientific Rationale for Principle 3

Perhaps nowhere is the need to minimize human contact with animals greater than with predators, particularly large predators. When people choose to live in close proximity to these species, there are attendant risks and responsibilities. The risk is that they may come into contact with a large predator, potentially resulting in harm or death. Our responsibility involves minimizing opportunities for predators to be rewarded by coming into contact with us. We have proven ourselves extremely efficient at eliminating these animals when we choose (Lopez 1978; but see Wilkinson 1995) but much less capable of coexistence.

To understand the basis for this conflict, imagine a pyramid with the various levels occupied by organisms that feed on the same general type of food (i.e., a trophic pyramid) (Elton 1927). The bottom tier is occupied by the most numerous organisms, such as plants. The next level is occupied by herbivores (species that eat plants and are therefore less numerous because it takes many plants to sustain an herbivore over its lifetime). Carnivores occupy the highest levels, with smaller carnivores consuming smaller herbivores, and larger predators feeding on herbivores in addition to preying upon some of the smaller carnivores. Again, there are necessarily fewer animals at the top of the pyramid because it takes a number of prey to support one predator.

This metaphor is admittedly oversimplified but is meant to illustrate two points. First, large predators exert a certain measure of control over the lower levels, at least in some cases. Second, a consequence of being at the top of the trophic pyramid is that, in a sense, it places these animals in direct competition and conflict with the most prolific consumer of all—man.

Habituation of predators to human food sources. For many predator species, habituation to people and their activities is not desirable. When large predators learn to associate humans or their residences with food, it probably means trouble for the humans and almost certainly eventual death for the animal. As we encroach

upon the habitat of these species, we must make every effort to exert tight control over potential food sources. Garbage is irresistible to many large predators and other wildlife, and should be secured in animal-proof containers. The same can be said of food for domestic animals, barbeque grills, and compost piles. Wildlife need to associate either people or their environs with food only once. Once learned, the association is virtually indelible and will determine the animal's behavior.

The role of large predators in maintaining prey populations. Although top predators have often been persecuted as a result of negative impacts on their prey, they actually may play a role in maintaining populations of some species. As mentioned above, it has been suggested that large predators exert considerable control on populations of smaller predators (Soule et al. 1988; Harris 1989). In the absence of large predators, smaller predators may experience population explosions, in some instances increasing by several orders of magnitude (Terborgh and Winter 1980; Emmons 1984). This phenomenon has been termed "mesopredator release" (Soule et al. 1988). As the density of mesopredators increases, so does their impact on their prey—birds, nestlings, small mammals, amphibians, and reptiles. This may in turn affect other species, such as birds of prey, that rely upon the same prey base (George 1974).

Mesopredator release is difficult to prove, but there is a growing body of evidence supporting this phenomenon. Soule et al. (1988) provide both statistical and circumstantial evidence that the disappearance of coyotes from habitat islands in San Diego resulted in increases in smaller predators, such as gray foxes and domestic cats, which in turn increased predation pressure on birds. On Barro Colorado Island in Panama, an increase in the number of smaller predators appeared to be related to the extinction of the puma (Glanz 1982). Lindstrom et al. (1994) reported that red foxes in Sweden played a key role in suppressing a number of species of small game. Numbers of red fox have increased because forest clear-cutting created high-quality habitat for this midsized predator while humans have eliminated its natural enemies, such as wolves. In Spain, Palomares et al. (1995) report that Iberian lynx appear to control mongooses, resulting in increased densities of the latter's staple prey, the European rabbit. Pet owners especially should note that smaller predators sometimes function as prey items for larger carnivores. Domestic pets should not be allowed to roam freely in areas likely to be inhabited by large predators.

Principle 4. Control Numbers of Midsize Predators, such as Pets and Other Species Associated with Human-Dominated Areas.

Action Required to Implement Principle 4

Prevent domestic pets, especially dogs and cats, from roaming freely. As an alternative, provide designated areas where people can exercise or "run" their pets. Control potential food sources, such as garbage, for small to midsize predators that thrive in human-dominated environments.

Scientific Rationale for Principle 4:

In human-dominated environments, small to midsize predators often exist at high densities. For domestic pets, such as dogs and cats, the reason is obvious. Some wild animals, such as raccoons and striped skunks, also reach much higher densities in urban as opposed to rural areas (Hoffman and Gottschang 1977; Rosatte et al. 1991).

Impacts of midsize predators on other species. These species prey upon small mammals, amphibians, reptiles, and songbirds, including eggs and nestlings (Churcher and Lawton 1987; Harris and Silva-Lopez 1992). The mortality attributed to these predators is staggering. Churcher and Lawton (1989) estimate that domestic cats in Britain kill nearly 70 million birds and small mammals per year. An illustrative example is provided by Stallcup (1991), who suggests that with 55 million cats in the U.S. (a conservative estimate of the Pet Food Institute) and excluding 20 percent that are old or do not leave the house, and assuming that 1 in 10 cats eats a songbird per day, the daily death toll would be 4.4 million birds. Even if these estimates are off by an order of magnitude, the impacts are substantial. Human-dominated areas are degraded by the reduction or elimination of songbirds and other desirable species. Animals that nest on or near the ground may be particularly vulnerable (Emlen 1974; Guthrie 1974; Weber 1975; Vale and Vale 1976).

Supplemental food sources. In addition to pets being kept by people, there are two basic reasons that feral cats and dogs, as well as other species, such as raccoons, reach such high densities in urban areas. First, there is a variety of structures to serve as shelter for these species, such as abandoned buildings, the crawlspace of a house, sewers, etc. Second, there is an abundance of feeding opportunities (Hoffman and Gottschang 1977; Haspel and Calhoon 1989). A primary source of supplemental food is garbage. One study showed that an urban neighborhood with poorly contained refuse supported nearly twice the number of free-ranging cats compared to an area where most refuse containers were covered (Calhoon and Haspel 1989). It follows that one simple step which homeowners can take in an effort to

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Urban conversion of coastal habitat puts humans in close contact with dangerous predators, such as the American crocodile.

maintain lower densities of wild or semiwild predators is to secure their garbage and food for pets.

Prevent pets from roaming freely. The death rates of small animals mentioned above were caused not only by wild species but also by domestic pets. How is it possible that well-fed pets could be responsible for exacting such a heavy toll? Laboratory studies indicate that, at least for cats, hunger and hunting are controlled by separate areas of the brain (Polsley 1975; Adamec 1976). In other words, some species continue to kill after their hunger has been satiated. This tendency may serve a purpose in the wild, where feeding opportunities are limited and prey capture is difficult (Adamec 1976), but it also enables well-fed pets to be very efficient predators. Furthermore, as Soule et al. (1988) have pointed out, animals that receive supplemental food from people can continue to take wildlife long after the prey base can no longer sustain a predator that relies on wildlife alone for food.

Principle 5. Mimic Features of the Local Natural Landscape in Developed Areas.

Action Required to Implement Principle 5

Retain as much predevelopment, high-quality habitat as possible, including some large patches. Keep levels of disturbance to trees, the understory, and other structural features to a minimum during construction. Design house lots in a fashion consistent with local natural habitats (e.g., by using native vegetation). Enhance the habitat value of degraded predevelopment landscapes with selective plantings.

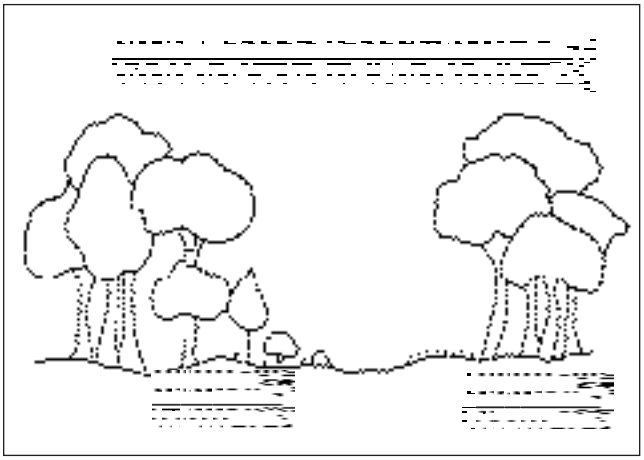
Scientific Rationale for Principle 5

The most effective way to maintain the quality of habitat during residential or commercial development—and thereby enable native species to continue to persist after its completion—is to minimize habitat alteration during construction. Urban areas that have been designed with little regard for wildlife generally reflect this lack of planning in the assemblages of animals that live there. These faunas typically consist of species that are omnipresent in human-dominated environments and often become pests, including, for example, non-native birds, such as the House Sparrow, European Starling, and Rock Dove. With some planning and attention to landscaping, the presence of more desirable species can be maintained or increased.

Rather than design a new and artificial landscape, one should attempt to blend human developments in with the natural landscape. If the landscape was already highly degraded before development, with careful planning it may be possible to enhance its habitat value for some species. This is particularly true for a variety of bird species as well as some small mammals. In human-dominated areas, vegetation is a critical component of wildlife habitat, providing both food and cover. Fortunately, it is an element that can often be managed relatively easily.

Maintaining or enhancing habitat quality by managing vegetation. Most studies of the relationship between vegetation and wildlife conducted in an urban or suburban context have focused on birds. Adams (1994) suggested that the key to maintaining a diverse assemblage of birds in such areas is to have several layers of vegetation, such as ground covers, shrubs, and trees. (This idea has its genesis in the work of an eminent ecologist, the late Robert MacArthur, who quantified the relationship between increases in bird species diversity concurrent with vertical layering in vegetation, called foliage height diversity, over a range of habitats (MacArthur et al. 1961).) Some subsequent studies seemed to confirm this relationship (Karr and Roth 1971; Wilson 1974), while others asserted that the horizontal patchiness of vegetation was a better predictor of bird species diversity than was vertical layering (Roth 1976).

Generally, these relationships were explained in terms of food limitation and competition; more foliage means more food and more foraging sites (MacArthur et al. 1962). As an alternative explanation, Martin (1988) asserted that greater densities of plants provide a greater number of nesting sites and reduce the risk of predation. Finally, there is evidence to support the notion that, in addition to plant diversity, the composition of the vegetation is also important (James and Wamer 1982; Rice et al. 1983; Anderson et al. 1983), and this may be related to the food resources that different species of plants provide (Rotenberry 1985). It seems likely that all of these factors—vertical and horizontal plant diversity, as well as plant composition—play important roles in determining which species are found in human-dominated areas.



Source: L. W. Adams, *Urban Wildlife Habitats—A Landscaped Perspective* (Minneapois: University of Minnesota Press, 1994), 108.

Many studies have shown that bird assemblages in urban areas are characterized by fewer species but higher overall densities (Batten 1972; Geis 1974; Aldrich and Coffin 1980). These groups tend to be dominated by ground-foraging seed eaters and omnivores that nest on tree branches or buildings (Emlen 1974; DeGraaf and Wentworth 1981; Beissinger and Osborne 1982). Species that feed on insects, including those that winter in the tropics but breed in North America (e.g., Warbling Vireo, Common Yellowthroat, Black-headed Grosbeak), as well as birds that nest on the ground (e.g., Rufous-sided Towhee), in shrubs (e.g., Yellow-breasted Chat, Veery), or in tree cavities (e.g., Downy

Woodpecker) are either absent or occur at very low densities in urban areas (DeGraaf and Wentworth 1981). Suburban areas have a relatively greater diversity of birds, although the same species that dominate urban sites are still abundant in many suburbs. What features might account for these differences?

A number of researchers have suggested that the diversity of native bird species in urban areas depends on the amount of native vegetation that is present (Geis 1974; Mills et al. 1989; Sears and Anderson 1991). Urban areas are generally associated with fewer trees, shrubs, and areas of weedy growth than are suburbs (DeGraaf 1987). Thus, species that are able to use buildings and tree branches for nest sites are at an advantage in urban areas but are still able to benefit from this ability in suburban areas. The presence of bluegrass lawns provides feeding opportunities to ground-gleaning omnivores in both environments, and non-native ornamental trees and shrubs provide alternate sources of food for seed-eaters and omnivores but often have few insects (Beissinger and Osborne 1982). One explanation for this relationship, at least for birds that feed on invertebrates, is based on evidence that native vegetation may be associated with a greater number of insect species (Southwood 1961). DeGraaf (1987) further asserts that planted trees and shrubs, no matter how mature, do not suffice as breeding habitat for insectivorous songbirds, at least in the northeastern U.S.

Through planning and active management of vegetation, the possibility of retaining or enhancing predevelopment faunas is increased greatly. For instance, Goldstein et al. (1986) compiled a list of bird species that respond positively to the presence of predevelopment habitat features in suburban areas. The retention of fields and patches of trees and shrubs during development offer the best prospects for enhancing suburban bird assemblages (DeGraaf 1986). Where plantings are necessary, native trees and shrubs that provide cover, persistent fruits, seeds, and secure nesting sites offer good alternatives to non-native ornamentals (DeGraaf 1987). State wildlife agencies as well as local natural resources departments are good sources of information on locally occurring wildlife species and habitat-enhancing trees or shrubs.

Aside from arboreal mammals, such as squirrels, birds are probably more closely associated with vegetation structure than are mammals (D.M. Armstrong, personal communication). Still, concentrated areas of trees and shrubs, as well as weedy areas potentially serve as cover for many small mammals and are preferable to scattered trees and mowed lawns.

Minimizing edge effects. When we address edge effects at the local scale, we are usually referring to situations in which two fairly sizeable habitat patches meet, such as a residential area and a large field or woodlot. It makes little sense to attempt to minimize edge effects on a small individual house lot because, there, vegetation generally exists in strips or clumps rather than in large patches.

In our discussion of landscape-scale techniques, we have described a variety of edge effects and enumerated some potential consequences of edge for wildlife. There are several ways to minimize edge effects at the local scale. Habitat fragmentation may be reduced by consolidating artificial edges (Miller 1995). For example, instead of locating a trail through the middle of an intact habitat patch, place it alongside a road or along the perimeter of a subdivision. In addition to consolidating artificial edges, attempt to mimic naturally occurring edges. "Soft" edges (e.g., a variety of smaller shrubs that grade into larger shrubs and small trees at the edge of a wooded patch) provide more wildlife habitat than an abrupt or geometrically straight "hard" edge. Furthermore, soft edges are more aesthetically pleasing and require less effort to maintain.

Chapter 3. Linking Specific Problems with Appropriate Tools

Although protecting wildlife is a popular goal, implementing that goal is often difficult. As the old saying goes, "to plan is heavenly, but to implement is divine." Even if local residents and officials understand the basic framework and the workable principles of habitat protection described in Chapter 2, it is often unclear how to translate them into an effective set of wildlife protection programs. The problems are compounded by the fact that wildlife protection is never the only important goal of the community—it needs to be balanced and integrated with other objectives. Sometimes, that means finding the least intrusive way to implement wildlife protection goals. In addition, wildlife protection almost always involves a discussion about the use of real estate and the need to protect private property rights. In order to respect competing goals and rights, it is important that the community understand the different tools that are available to achieve habitat protection.

DISTINCTIONS IN SCALE AND LOCATION

The previous chapter distinguished between wildlife protection principles that apply at the landscape scale (such as a valley, a basin, or a major development site) and those that occur at the site scale (such as a single lot or a small development area). It is important to understand that the concepts of landscape-scale and site-scale planning have different implications depending on where the planning site is on the rural-urban continuum. That is because the planning concepts of "scale" and "location" are different.

- Distinctions in Scale, such as "Landscape Scale" and "Site Scale" relate to the question, How big is our planning area?
- Distinctions in Location, such as "Rural, Suburban, and Urban" relate to the question, Where is our planning site located?

In order to develop an effective plan for wildlife habitat protection at the local level, the community needs to take into account both the scale and location of their planning area. Each possible combination of scale and location produces its own distinct mix of opportunities and challenges.

Opportunities include situations where the scale of the planning effort or the location of the land make it relatively easily to achieve one or more of the biological principles discussed in Chapter 2. Communities should focus on those opportunities and should ensure that the planning effort does not compromise a principle that is relatively easy to achieve. Just because a principle is relatively easy to achieve in a given situation does not mean that it is not important. Sometimes very basic protections (e.g., the preservation of large patches of vegetation and effective buffering of those areas) can be very important to wildlife. In general, the broadest range of opportunities occurs when the community can design a habitat protection scheme based on landscape-scale planning for a rural area. In contrast, the list of opportunities is much shorter when the opportunity is for site-scale planning in a heavily developed urban area.

Challenges, on the other hand, are situations where either the small size of the planning area or the location of the land make it difficult to achieve one or more of the principles. This does not mean that the challenge is impossible; rather, it means that it may require careful attention or creative thinking to solve the problem. In general, the list of challenges increases as the scale of the planning decreases and the land becomes more urban. When planning is limited to a smaller-scale site in a developed urban area, it may be a challenge to implement any of the listed principles. In solving their particular challenges to wildlife habitat protection, communities should be careful not to compromise or forfeit those principles that are natural opportunities for the site and that may be easier to sustain over the long run.

THE OPPORTUNITY/CHALLENGE MATRIX

In Chapter 2, Tables 2-4 and 2-5 listed important biological principles that can help preserve wildlife habitat. Table 3-1 builds on those principles and summarizes a general set of opportunities and challenges that may present themselves in a wildlife protection effort. Obviously, this breakdown of

opportunities and challenges will differ for each community and will change depending on which species of wildlife are targeted for protection. In particular, opportunities and challenges may shift depending on whether large or small species are being targeted, and depending on whether the community is trying to preserve a relatively rare or a relatively common set of species.

Planning in rural areas can be done at either the landscape scale or at the site scale, depending on whether the community is engaged in an areawide planning effort or is drafting specific design standards for lots and subdivisions. Where the habitat lands have not been badly fragmented, it is important to do both.

In addition, Table 3-1 shows that planning for suburban areas can also be done at both the landscape scale and the site scale. Often, a community can predict that development will continue to trend outward from developed areas and can engage in an areawide protection effort for habitat in growth areas. Just because development has begun to move into an area does not mean that protection efforts are limited to site-scale principles. Although the inner edge of a growth area may have so much existing construction and population that site-scale principles are appropriate, the outer edge of the area may be so undeveloped that landscape principles can be effective. This is very important because suburban areas are the fastest- growing areas in the U.S. It is also the area in which potential habitat land is being lost at the fastest rate. Failure to use all of the tools available to protect habitat in suburban areas may have the largest impact on wildlife within a typical planning horizon of 20 years. Planning for wildlife habitat protection in suburban areas may also require the most careful thought simply because it is neither urban nor rural. This "in-between" status may make it difficult to determine which landscape- and site-scale principles will be effective, but it is essential that the community think through all of the potential principles that may apply.

In urban areas, the opportunities are more limited. This is simply because large patches of native vegetation seldom exist, corridors have already been blocked, and it is unreasonable to expect that natural events, such as floods and fires, can be allowed to occur where large numbers of people live nearby. Table 3-1 suggests that landscape-scale principles are largely inapplicable to urban areas, and that planning for urban infill projects should focus on site-scale principles. In those rare cases where very large areas are available for planning or redevelopment in urban areas (e.g., sites larger than 1,000 or 2,000 acres), and potential wildlife connections to other areas have not been irretrievably lost, communities should think of the site in suburban terms and should also attempt to apply landscape principles.

THE SCALE/TOOL MATRIX

A second way to approach wildlife habitat is to think about which specific habitat protection tools may be

Table 3-1. The Opportunity/Challenge Matrix

	Landscape Scale (Valley or Large Development Site)		Site Scale (Infill or Small Development Site)	
	Opportunities	Challenges	Opportunities	Challenges
Rural Area	Maintain large patches Prioritize species Protect rare landscapes Maintain habitat connections Protect regionally rare species Allow fire, flood, and wind Keep some areas off limits		Maintain buffers Facilitate wildlife movement Mimic natural features	Minimize contact with large predators Control pet-sized predators
Suburban Area	Prioritize species Protect rare landscapes Maintain habitat connections	Maintain large patches Protect regionally rare species Allow fire, flood, and wind Keep some areas off limits	Maintain buffers Minimize contact with large predators	Facilitate wildlife movement Control pet-sized predators Mimic natural features
Urban Area	N/A	N/A		Maintain buffers Facilitate wildlife movement Minimize contact with large predators Control pet-sized predators Mimic natural features

applicable at the scale for which planning is taking place. Some tools, such as land purchases or transferable developments rights programs, may be more effective when used at the landscape scale to protect relatively large areas of potential habitat. Other tools, such as clustering or the targeting of required land dedications, may be more effective when used at the site scale. Finally, some tools such as zoning and subdivision review standards can be effective at both scales. Table 3-2 (page 28) sets forth a general outline of potential tools and the scale at which they are traditionally used. It is important to realize, however, that almost all of the listed tools can be used effectively at any scale with a little creative thinking. Each of the tools listed in Table 3-2 is described in more detail with examples in Chapter 4.

Tools for the Landscape Level

In general, the tools that will be effective in implementing the landscape-scale principles described in Chapter 2 are those that can address the general location of development areas within an entire valley or basin. When wildlife protection is addressed at this level, it may require that new development or significant human activity be excluded from an area. If that area includes all or part of a private landowner's parcel, tools that provide compensation to the owner in terms of either money or the ability to develop elsewhere may be appropriate. Potential tools include habitat purchase, transferable development rights (TDRs), preferential taxation, and limited conservation development. Protection of large patches of native vegetation and corridors may also require the creation of new large-scale zones or overlay districts, or the use of new subdivision review standards**.** Finally, an effective approach to wildlife protection at the landscape scale may require the cooperation of several different governments in the valley or watershed or range area through the use of intergovernmental agreements. All of these tools attempt to steer new development activity away from sensitive areas through constitutional means. They do not attempt to address what the new development will look like, just where it will take place. The effective use of any of these tools should be based on accurate information about vegetation and the known range of the targeted species, both of which are sometimes available from a state's division of wildlife. If accurate information is not available from other sources, such information should be obtained from local knowledge of wildlife behavior patterns and locations.

Tools for the Site Level

Appropriate tools for site scale also address where development occurs, but on a much smaller scale. Instead of answering the question, Where are there sensitive patches of vegetation or wildlife corridors in this valley?, they answer the question, Where are there opportunities to buffer or connect wildlife-supporting vegetation on this particular property? Site-scale tools also address the question, How can the development be designed and human activity controlled within this area to minimize disturbance to the chosen species?

Appropriate tools to address these issues include the language of the zoning ordinance, which controls permissible uses of the land and the size and location of structures on their sites, and the subdivision standards, which control the layout of building sites and the amount and location of land parcels that must be set aside for parks within the development. Zoning and subdivision controls can also set standards for vegetation, buffering, noise, glare, and the number of domestic pets, all of which can affect nearby wildlife. Another appropriate tool is clustering, which allows a landowner to move permitted development density from one portion of the site to another in order to protect sensitive lands. Development density bonuses are also sometimes included to encourage such clustering. In contrast to landscape-level tools, site-level tools rarely attempt to prevent development or human activity on all of an owner's land, and so TDR or land purchase tools are seldom required. Instead, easements or limited conservation development plans may be more appropriate.

EXAMPLES OF PROTECTION PROGRAMS

The use of landscape- and site-scale tools should not be treated as an "either/or" choice. In many rural and suburban communities, an effective wildlife habitat protection program will include both types of tools. Set forth below are examples of possible wildlife habitat protection programs for three types of communities. These examples are not suggested as models because the tools appropriate for each community will always be determined by that city or county's specific wildlife protection goals. Instead, they are presented to show how local communities may need to pull different landscape-scale and site-scale tools from Table 3-2 in order to achieve their goals. All of the tools listed in these examples are described in more detail in Chapter 4.

The Jackelope Valley—a Rural Program

The citizens of Jackelope Valley moved there because they enjoyed watching large game animals and fishing on the gold medal trout stream that runs through the valley. They have also learned that the valley contains substantial areas with good habitat for two species of fox that are common in the valley but relatively rare in their portion of the state. After a thorough planning process, they decided to adopt a valleywide habitat protection program to preserve the abundance and increase the distribution of these species. Their program included the following elements.

Landscape-Scale Elements

1) A wildlife preservation overlay district requiring that development be kept 500 feet away from identified corridors connecting different areas of large game habitat and from identified corridors connecting different areas of fox habitat

2) A transferrable development rights (TDR) program allowing landowners whose entire property was designated as prime habitat to transfer their development rights to designated growth areas adjacent to the towns in the valley and giving them a density bonus for doing so

Table 3-2. The Scale/Tool Matrix			
		Landscape-scale Tools	Site-Scale Tools
Regulatory Tools	Zoning Texts and Maps	X	X
	Special Overlay Districts	X	X
	Agricultural and Open Space Zoning	X	
	Performance Zoning		X
	Phasing of Development		X
	Subdivision Review Standards	X	X
	Sanctuary Regulations	X	
	Urban Growth Boundaries	X	
	Targeted Growth Strategies	X	
Incentive Tools	Density Bonuses	X	X
	Clustering		X
	Transferrable Development Rights	X	
	Preferential Tax Treatment	X	
Acquisition Programs	Fee Simple Purchase	X	X
	Sellbacks and Leasebacks	X	X
	Options and Rights of First Refusal	X	X
	Easements and Purchases of Development Rights	X	X
	Land Dedications and Impact Fees	X	X
Development Agreements			X
Control of Public Investments		X	X
Taxing and Assessment Districts		X	X
Private-Sector Initiatives	Land Trusts		X
	Limited Conservation Development		X
	Industrial Restoration Showcase Projects		X
Intergovernmental Agreements		X	
Education, Citizen Involvement, and Technical Assistance		X	X

Site-Scale Elements

1) New subdivision standards requiring that developed portions of lots be more than 200 feet away from the trout stream and requiring that the land within 200 feet of the stream be kept in natural vegetation to help clean runoff water

2) An educational program to encourage large ranchers whose property contained some prime habitat areas to cluster development, to work with private land trusts to develop the least sensitive areas of their property, and to donate easements over the sensitive areas in return for tax deductions

Hidden Valley Ranch Estates—a Suburban Example

Spruceland is a growing suburb located on land that was formerly agricultural. There are scattered stands of spruce and other trees, several small streams that were plowed over by the farmers, and an area of rising terrain leading to a unique "cragrock" formation. Leapfrog development has resulted in an irregular mixture of developed and undeveloped parcels. The citizens of

Hidden Valley Ranch Estates became concerned that they no longer saw deer on the undeveloped land or heard songbirds in the morning, and they decided to target those species for protection. They also noticed that they saw fewer types of small animals around the cragrock area. After reviewing information about predicted growth for the city and remaining areas of vegetation, they decided that their goal was to increase the abundance and distribution of mule deer and to preserve a viable population of songbirds. Their program has the following elements.

Landscape-Scale Elements

1) A habitat purchase program funded by a portion of their sales tax proceeds to purchase the cragrock area in order to preserve that rare landscape element.

2) A zoning text amendment requiring that all mature stands of more than five trees and their associated understory be preserved and integrated into new development, and that construction activities avoid disturbing the area within 25 feet of those trees.

Site-Scale Elements

1) A new subdivision regulation requiring that developers of land containing the old plowed-over streams grade and vegetate their land so as to recreate those old streams as possible mule deer migration corridors.

2) A clustering ordinance giving developers a development density bonus if they cluster development at least 500 feet away from the restored streams, which is approximately the flushing distance for mule deer.

Fort Palmer—an Urban Example

Fort Palmer is one of the larger cities in the state and is largely built out. There are still a few significant development parcels on the periphery, however, and continuous infill and redevelopment activity. Citizens still notice significant numbers of small animals like coyotes and rabbits in the drainageways and along the city's hike/bike trails. There are also significant numbers of ducks and geese that use the city's parks and undeveloped lands as winter habitat. After studying potential wildlife corridors and vegetation, the citizens decided to target these species and to aim at preserving their current numbers. Fort Palmer decided to pursue a site-scale strategy and adopted a wildlife habitat protection plan with the following elements.

Site-Scale Elements

1) A zoning text amendment requiring that native vegetation that serves as cover and food for ducks and geese be planted as part of the development or redevelopment of parcels larger than two acres, and that construction on those parcels not occur during nesting seasons.

2) A performance zoning system requiring that all new development near the drainageways or wooded areas earn a given number of points through wildlife-sensitive design (e.g., designating and buffering significant habitat areas, preserving existing vegetation, or preventing nighttime glare onto stands of trees or buffer areas) in order to proceed with development, and offering density bonuses to those who earn more than the minimum number of points.

3) A program to construct low-rise fencing along unpaved trails in the drainageways to make the disturbance from hikers more predictable and more limited in area.

The examples of Jackelope Valley, Hidden Valley Ranch Estates, and Fort Palmer illustrate several points. First, they show the importance of wildlife planning for the community. None of the three communities would have been able to craft an appropriate plan without first studying the land, the existing wildlife, the regional context, and the opinions of their residents. Second, they show how each community's habitat protection plan is likely to be different. Not only are different species important to different communities, but the preservation goals also differ. Some communities will want to expand the numbers of wildlife, others will focus on increasing the variety of wildlife, and yet others will be satisfied with preserving the types and kinds of wildlife that are already present. Third, the examples show the wide variety of wildlife habitat protection tools that can be used to achieve specific goals. Each of the tools mentioned above—and many more—are discussed in Chapters 4 and 5. Once again, the package of tools will have to be assembled and tailored to match the specific goals of the community.

Chapter 4. Crafting an Effective Implementation Program

This chapter discusses several wildlife habitat protection techniques in greater detail. Because each community has its own topography, ecology, political climate, and goals for wildlife, it is unlikely that one community's wildlife protection program can simply be transplanted to a new location. In addition, the process of debating which alternative goals and tools may be appropriate for a city or county makes it much more likely that the resulting program will be successful. Finally, it is important to remember that wildlife does not respect jurisdictional boundaries. Because of the interjurisdictional nature of wildlife and natural resource projects, it is also important to coordinate activities with other local governments on the basis of biological or geographical boundaries rather than on purely political ones.

Within each community, a committee or task force should be established to create workable systems out of the policy directives created in ordinances and intergovernmental agreements. However, local governments should generally try to avoid establishing new administrative structures simply to deal with wildlife, since this will be a source of criticism that distracts attention from wildlife issues. Local committees implementing habitat protection programs should strive to get representation from the top levels of relevant boards since that is where many decisions are made. At the same time, every effort should be made to design public outreach programs and citizen participation efforts to ensure that genuine community values are reflected in the program. This is particularly true when considering new regulations and acquisition programs.

Although a variety of different tools are available to protect wildlife habitat, all of them must conform to basic principles of constitutional law and to the requirements of the state statutes. Those restrictions are discussed in Chapter 5, which should be read in conjunction with this chapter.

REGULATORY APPROACHES

America's local communities have engaged in land-use regulation and growth management since the early 1900s when comprehensive planning first became popular. In the 1920s, the United States Department of Commerce began encouraging the individual states to adopt a standard zoning enabling act. In 1927, the United States Supreme Court ruled in *Village of Euclid v. Ambler Realty Company*, 272 U.S. 365 (1926), that zoning was a valid exercise of the police power inherent in local governments. Since that time, thousands of cities, towns, and counties throughout the country have adopted comprehensive land-use plans and have zoned their communities based on those plans. While comprehensive planning and zoning have become the basic tools of development and growth management in most places, there is increasing recognition that these traditional approaches have shortcomings and may need to be supplemented with other tools.

Modernizing land-use regulations is the most direct method of providing wildlife habitat protection. This can be accomplished by incorporating and combining wildlife habitat needs with traditional land-use controls. In a planning analysis, areas of conflict between human and wildlife needs will arise. For example, a desired recreational trail along a river could be found to disturb sensitive riparian habitat. By moving most of the trail out of the floodplain area and including rest stops near the river, both objectives can be met. Another example might be using wetland areas for stormwater control and enhancing wildlife habitat. Although many regulatory tools are available to promote wildlife habitat conservation, existing regulations need to be evaluated before any new regulations are adopted. This section describes some of the more common regulatory methods of protecting and enhancing wildlife habitat.

Application Requirements

In their simplest form, local regulations should provide that:

1. an applicant is provided with wildlife information and maps that the jurisdiction has on hand and/or a checklist of standards that will be used in reviewing applications;
2. the applicant has to submit an analysis of the impacts of the development on wildlife; and

3. the application will be reviewed by an agency (e.g., a state department of wildlife) or individual with the expertise to carry out the review.

Application requirements should make absolutely clear whether developments can be denied if, after the application is reviewed, it is determined that the impact on wildlife habitat is unacceptable.

Local governments may want to review the application standards being applied in habitat protection ordinances for tools to help make traditional land-use controls more responsive to community goals for habitat protection. For instance, a development application in Lee County, Florida, under its protected species ordinance, requires an applicant to submit a survey of the proposed development site if certain species are likely to be found on the site.

The determination of the likelihood of the presence of a species is made by an evaluation of the vegetative communities found on the site. These vegetation communities are mapped by the county. A matrix showing the listed species found in Lee County, the vegetative communities that they use, seasonal restrictions, recommended buffer guidelines, and a list of what is to be included in the survey is given to the applicant. Both the species matrix and the prescribed survey method were placed into the county's administrative code, rather than the protected species ordinance, to ensure flexibility and to make it unnecessary to amend the ordinance whenever new findings from the scientific community become available.

Practice has shown that the surveys required by this application process are far more effective in identifying the species that occupy a site than were surveys required under the previous zoning ordinance language. The result has been more certainty for the developer and the county that there will be no surpises as the development proceeds. If the survey identifies a protected species on the site, the applicant must submit a management plan for the development area with the application. It should be noted that these application procedures were developed in conjunction with county developers, environmental groups, and the county economic development coalition.

Zoning Texts and Maps

Enacting new zoning regulations or revising existing regulations is often one of the most effective ways of using local powers to protect important habitat. Those communities that have not yet enacted zoning controls are forfeiting a highly effective and versatile method of protecting wildlife habitat (Bissell et al. 1986). Because each ordinance is tailored to the circumstances of the local government, zoning can address specific local issues that may be important for wildlife habitat protection.

In general, zoning ordinances are implemented through the use of both regulatory text and maps. Zoning regulations can therefore often be updated or amended by addressing the specific requirements in the ordinance text, or by adopting new maps that apply regulations to new areas, or a combination of both. For example, if a community wanted to protect existing trees because of their wildlife value:

- one option would be for the town or county to enact a new subsection of text addressing tree protection and to make those requirements applicable to all zone districts;
- a second option would be to draft similar protection language but to add the new requirements to only specific zone districts through amendments to those chapters of the code;
- a third option would be to create a new chapter or subsection creating a "habitat protection zone" and then amend the zoning map to apply that zone where it is appropriate; and
- a fourth option would be to draft the protections into the text of an "overlay zone" and then amend the zoning maps to add the overlay district on the existing zoning districts.

Map amendments and broad text amendments are landscape-level tools, while text amendments related to only as few districts or small areas are considered to be site-level tools.

As the fourth option suggests, many of the protections described in this section as "specialized zoning controls" could also be imposed through the use of the "special overlay districts" (described in more detail below) and vice versa. In each case, the key question is whether the regulation is intended to apply across an area that does not conform to existing zone district boundaries. If it does, an overlay map district should probably be used. Regardless of whether a text, map, or overlay district approach is used, it is usually wise to consider whether variances or exceptions should be available where strict application of the regulations would create an unusual hardship or where unique circumstances make it unlikely that the regulation will in fact produce habitat protection benefits.

Use restrictions. Often, the most dramatic way to protect wildlife habitat is to control the permitted uses on habitat lands and surrounding areas. Through its listing of uses by right, conditional uses, and the criteria for approval of conditional uses, a zoning ordinance can prevent traffic-intensive or people-intensive activities from occurring close to prime habitat areas, migration corridors, calving areas, and similar lands. In some cases, it may be wise to amend existing zoning ordinances to convert current uses by right into conditional uses subject to criteria designed to measure the impact of the activity on wildlife. This approach would allow applicants for those uses to move forward with their projects if they could design the site and manage their operations in wildlife-sensitive ways.

Density restrictions. A second effective way to reduce impacts on wildlife is to control the density of development in and around habitat areas. At the landscape level, minimum lot size requirements or maximum residential densities can be amended to reduce the number of people on sensitive land and the frequency of human-animal interaction. At the

site level, projects can be designed with a gradient of density away from the habitat sites. Areas near the habitat could have very low densities, and development further back could have correspondingly higher densities. Through the use of gradients and clustering of development away from prime habitat, wildlife impacts can be dramatically reduced while maintaining the overall number of residential units on the land.

Tree protection and vegetation management. One effective way to protect wildlife habitat is to regulate the cutting of trees or vegetation that the target species use for cover or food, and the use of this tool has been increasing dramatically. In 1984, a national study published by the University of Pennsylvania identified fewer than 100 tree protection ordinances in use in the U.S., with most of the ordinances coming from Florida or California (Coughlin, Mendes, and Strong 1984). By 1989, however, a survey of all incorporated cities in California showed 159 city tree ordinances, and more than 50 percent of those contained protections against removal of trees. Perhaps more importantly, tree protection laws are no longer confined to densely populated and rapidly growing states like Florida and California; they are being adopted everywhere. Some communities, such as Austin, Texas, and Thousand Oaks, California, prohibit the removal of any trees larger than a specified size.

Another important form of special regulation is vegetation management. Controlling the types of vegetation planted in, or removed from, an area is an effective way to attract desired species or discourage unwanted ones. Many approaches are available, but the more comprehensive and integrated ones will be more effective. For example, local regulations can specify the types of vegetation that must be maintained in designated greenways and wildlife corridors. Often, the vegetation requirements will differ from those in standard landscaping ordinances. Vegetation management can also be used to create a transition from undeveloped land to developed areas. In general, woodland and riparian areas are critically important for wildlife habitat, and such vegetation should be protected if possible. Wetlands should also be preserved to add biological diversity, filter runoff, and recharge groundwater systems (Aurelia 1986). Some communities, like Lake County, Illinois, and Fairfax County, Virginia, require that a certain percentage of tree or vegetation cover remain on a site.

Whenever tree preservation or vegetation protection management ordinances are adopted, regulations should also clarify that trees and vegetation adequately protected by the developer will count towards the satisfaction of applicable minimum landscaping requirements in the zoning code. The effectiveness of vegetation protection programs often depends on the identification of what specific species of trees or vegetation will actually benefit a given species of wildlife in a given location. Tree and vegetation protections are, therefore, generally considered as site-level tools.

River corridor protection standards. Zoning can also promote healthy wildlife populations by protecting river corridors. Several good examples of river corridor protection are available. Park City, Utah, and several other communities have adopted standards requiring that development be set back at least 100 feet from rivers and streams and be buffered from view. Near Atlanta, Georgia, Fulton County has passed the Chattahoochee River Corridor Tributary Act that creates a 35-foot buffer zone along all banks of tributaries of the Chattahoochee, a National Wild and Scenic River. Similar regulations were upheld by the Montana Supreme Court in a recent case. In the Denver Gateway area, development must be set back from First Creek a minimum of 200 feet, and other buffering controls apply.

Gaylan Rathburn, U.S. Fish & Wildlife Service

Death from speedboat propellers is an escalating threat to the West Indian manatee.

Requirements for vegetative barriers or buffer areas. Vegetative barriers can be used to increase the perceived separation between developed and natural areas. They can also be used to either attract or repel different species of wildlife. For example, in areas where big game is not wanted, zoning and landscaping standards can require the planting of vegetation that large game animals do not like. On the other hand, the same code might require the planting of species that attract songbirds. Similarly, buffer zones can be used to decrease "line of sight" distances for wildlife and humans, reduce noise disturbances, protect critical habitat, and protect bodies of water. In many cases, careful research will be needed to determine exactly how much buffer will be required in order to adequately protect the target species (Sikorski, Bissell, and Jones 1986). Barrier and buffer requirements are usually site-level tools.

Controls on fencing. Where local wildlife goals call for keeping humans and large animals apart, zoning regulations might require perimeter fencing that is impassable to certain species. On the other hand, if a new development threatens to cut off a historic migration route or to separate related feeding areas, the code might put a limit on the heights of fencing to ensure that the fences are passable to wildlife. In still other cases, the goal may be to make sure that wildlife see the fences as they approach them so that they can avoid entanglement. In general, fences lower than 40 inches tall will not be a barrier or a source of entanglement to large game animals. Fencing controls are usually site-level tools because their effectiveness often depends on the specific location and layout of the land.

Controls on public or vehicular access. Another important category of zoning control is access. The issue of access is often an area of shared responsibility between the planning department and the public works or transportation department, and effective controls will require the joint efforts of both groups. In order to protect wildlife, it is often necessary to restrict human or vehicular access to areas that wildlife use or routes along which animals migrate. Access restrictions could include permanent road closures, locked or manned gates, or signs. In some cases, merely requiring that the point of access be hidden from the public may be adequate and may still leave a road or trail open for use by emergency vehicles and others. Where vehicular access is the problem and pedestrian access is acceptable, the zoning code or public works standards might require that minor roads be converted into trails (Sikorowski, Bissell, and Jones 1986, x28-x29). Again, because the appropriate level of access depends on the location and layout of development, it is usually a site-level tool.

Other development standards. Special zoning regulations can be drafted to address numerous other development factors that affect wildlife. For example, window-well covers might be required at ground level in order to prevent small animals from falling into areas from which they cannot escape.

Developments in rural areas might be required to implement garbage management standards so that the introduction of people into an area does not result in added opportunities for wildlife to scavenge for the food that humans throw away. Examples of garbage management techniques include requirements that no garbage be placed outside a primary or accessory structure or that all garbage be disposed of in a single, well-secured, odor-proof building serving an entire development and located far from habitat areas.

Finally, it may be necessary to adopt special standards restricting noise or nighttime noise in sensitive habitat areas. Sage grouse, which are periodically considered for listing as a threatened species, are particularly sensitive to noise. Noise standards can be adopted as a performance standard (such as "no more than X decibels as measured at the edge of the habitat area") or by explicitly prohibiting the activities that create unacceptable levels of noise (such as all-terrain vehicle use, hunting, or wood cutting).

Phasing of development. In some cases significant wildlife benefits can be gained by requiring new development to be constructed in specific phases. If the species to be protected can adjust to the presence of humans nearby, a phasing strategy might require that the first stages of development occur far from the prime habitat area, so that the animals are not presented with a dramatic disruption of their habitat. Instead, construction can begin far away and proceed towards the habitat area with development densities declining as construction gets nearer to the buffer area or habitat. If the species to be protected is unable to adjust to nearby development, it may still make sense to require construction to begin far away from the prime habitat and corridor areas in order to allow the animals time to find alternative habitat areas on their own.

Controls on construction activity. Any zoning regulation that involves the need to treat sensitive areas carefully should address not only the desired outcome, but also the rules that must be followed during construction activity. Even when carefully crafted standards are being implemented by a cooperative landowner or developer, a few careless activities during the construction phase can destroy the habitat that was to be protected. Construction controls may need to address:

1. prevention of accidental cutting of trees or vegetation;
2. restrictions on excavation near roots or root masses;
3. limitations on severe grade changes near the vegetation or in mating or calving areas;
4. restrictions on dumping of construction materials or toxic materials near important vegetation or other cover;
5. limitations on the use of fires to clear vegetation prior to construction;
6. limitations on the duration or hours of construction;
7. limitations on timing of construction to avoid critical times for the wildlife, such as calving periods;
8. limitations on the number of project personnel or construction vehicles on site at any one time through the use of transportation pools or staggered shifts;
9. restrictions on construction personnel access to wildlife areas; and
10. speed restrictions on access roads (Sikorowski, Bissell, and Jones 1986, x22-x24).

Integrated approaches. When considering a zoning approach to habitat issues, it is useful to use an integrated approach and to ensure that other regulations reinforce the new zoning provisions. For example, design standards for development need to be modified to include wildlife considerations. Stormwater management ordinances may need to reflect water-quality controls in natural areas that support wildlife. Other sensitive lands regulations may be needed to implement or reinforce a wildlife protection plan, such as scenic highway controls, river corridor protection, and steep slope protection.

In addition, when drafting new zoning regulations, it is always important to keep in mind the ability of the community to enforce the regulation and the cost and complexity of doing so. A sophisticated ordinance carefully targeted to achieve subtle goals is meaningless if the city or county does not have personnel who can and will enforce it or the budget to pay for the extra effort involved. Often, a simple zoning requirement can be as effective as a complicated clause and will require much less effort.

Special Overlay Districts

Overlay zones are special zone districts that supplement, but do not replace, the basic zoning regulations applicable to a property. They are a useful tool when an area containing hazards, sensitive lands, or unique opportunities crosses several different standard zoning districts. Overlay zones are becoming a popular and effective method of protecting wildlife habitat and natural resource features for larger areas that include several underlying zoning districts. An overlay zone effectively eliminates the need to revise the regulations for each zoning district. Instead, it superimposes additional regulations specifically targeted to protect important physical characteristics of the land.

The most common example of overlay zones involves floodplains. Many local governments adopt floodplain overlay zones that map those areas of the community subject to flooding and require that development in such areas meet certain standards over and above the standards imposed by the basic commercial, industrial, or residential zone district that already apply to the property.

Overlay zones that have particular importance for habitat protection are those that include provisions regulating:

- protection of vegetative cover, including trees;
- setbacks from sensitive areas such as wetlands and streams;
- percentage requirements for open space preservation; and
- avoidance of prime calving, nesting, and other critical areas.

As a wildlife habitat tool, overlay districts have several advantages. They allow local governments to tailor regulations to specific issues that are relevant to a discrete, mappable area. Since they do not affect the underlying zoning governing permissible densities and uses, they avoid the need to reopen old debates in those areas. The can also be drafted to reflect a balance of different goals, such as environmentally compatible development and open space protection. At the same time, overlay zoning has some drawbacks. If the terms of the zone are complicated, it may require skilled staff to implement and enforce them. Some residents will see them as adding a layer of complexity to development approval processes. In general, overlay zones are used to address land characteristics that extend across a wide area or a variety of properties and are therefore usually considered a landscape-level tool.

Sensitive lands. An increasing number of cities and counties are adopting special overlay regulations to protect sensitive environmental areas. For example, Park City, Utah, recently adopted overlay regulations to protect a broad range of environmentally sensitive features including wetlands, stream corridors, steep slopes, ridge lines, and view corridors. In 1994, Summit County, Colorado, adopted a special overlay district and regulations stating that the county "seeks to fully protect wildlife habitats within the wildlife overlay zone from the significant adverse affects of development." The ordinance includes detailed definitions of what constitutes "significant adverse

Environmental Resource Overlay Zone: Tucson, Arizona, Mountain Plan

One good example of the effective use of overlay districts for wildlife corridors comes from Tucson, Arizona, where natural resources are both limited and fragile because of the arid climate (Evans 1990). The Tucson area has lost 90 percent of its riparian vegetation through grading, bank protection, channelization of washes, and other flood control measures. Natural drainage corridors provide wildlife migration corridors between the Tucson area and the nearby Saguaro National Monument. In drought periods, wildlife wander up the drainages in search of food and water and encounter problems because of interactions with the urban environment. Problems stem from direct human impact, such as noise and pets, and from the loss of biodiversity and gene pool interaction because migration routes have been cut. Tucson recognized the need to protect the wildlife and in 1979 created the Tucson Mountain Plan that established a buffer area around a portion of the national monument, even though the city boundaries did not reach the monument.

Tucson adopted an environmental resource overlay zone ordinance in 1990 that was designed to protect the natural vegetation along washes originating in the national monument and mountain park areas. An important element was to maintain the natural vegetation in place because revegetation does not compensate for the ecosystem loss, especially in the arid desert climate. The ordinance includes tough restrictions but is geared to allow development that is compatible with the presence of wildlife, such as the strict protection of areas near washes. It allows revegetation if temporary encroachments are necessary. The approach is generally to encourage working with the natural resources so that wildlife is not driven away as development occurs in sensitive areas. The ordinance applies to all lot sizes and all types of construction permit applications.

Another feature that makes the ordinance effective is an option for developers that eliminates the requirement of a study of riparian resources if all development is outside of the 100-year floodplain. In Arizona, the 100-year contour can be quite wide, but simply leaving it alone substantially complies with the objectives of the ordinance. The ordinance has also been effective because it applies to both public and private projects. The city has also discontinued drilling wells for groundwater near the designated washes. The overall success of the ordinance can also be attributed to the project size because the protected washes represent an area large enough to effectively function as wildlife habitat. The Tucson resource overlay zone ordinance provides a good example of a landscape-scale protection tool.

effects" of development and contains detailed provisions allowing the county to require a wildlife impact report from the developer either at the start of the application process or later if available information is not adequate to make a decision. The Summit County ordinance is comprehensive, flexible, and relatively short, all of which increase its utility and clarity.

Wildlife corridors. A second popular use of overlay districts is to designate and protect corridors that serve as migration routes and provide continuous strips of habitat. They can also provide important aesthetic and recreational benefits to the community (Lyle and Quinn 1990). Because of this important overlap of wildlife and human benefits, the community may be able to support wildlife corridors without understanding the full ecological importance of open space preservation. Care should be taken not to plan for recreational access or trails, however, in areas where that will compromise wildlife goals. Not every corridor needs to be a hiking or biking trail. Because wildlife corridors need to be relatively continuous between patches of habitat in order to be effective, they are a good landscape-scale protection tool.

Voters often think of greenways and corridors as parks and trails, but, for wildlife, a corridor can also be an undeveloped parcel, a drainageway, or a utility right-of-way. A carefully designed overlay can protect existing and natural features that promote species richness and diversity. They can also facilitate cooperative planning with other local government functions, such as designing drainage and flood control systems. The important underlying objective is to minimize habitat fragmentation by creating or enhancing ecological connections between larger wildlife habitat areas. The protection of wildlife corridors and greenways can produce measurable results in a short time with a minimum of inventory and other staff-intensive procedures. Those initial positive results may also encourage local officials to pursue additional protection measures.

Often, the overlay zone requires minimum setbacks from known wildlife movement areas or riparian areas. Wildlife corridors can also be accomplished in conjunction with other projects. For example, a utility corridor through a forest area could be cut to provide a transition ecosystem and be more aesthetically pleasing than the traditional clear-cut swath. Flood and drainage control projects can use existing vegetation instead of replacing it with concrete. Stormwater management can be planned to support wetlands and riparian vegetation. Many other overlapping objectives exist within any local government system and can be developed through interagency communication. In addition, certain uses can be prohibited or converted into conditional uses in an overlay area.

A greenway overlay district needs to be tailored to prioritize wildlife habitat needs while accomplishing other purposes (Salwasser 1986). The more general objective underlying greenway and corridor development is creating species diversity. While this is usually a positive goal, under certain circumstances, it may not be totally desirable. For example, an ecosystem for a disturbed species could be further harmed by a corridor that would allow natural predators to have ready access to the area. Special considerations need to be made in some instances to protect species richness rather than diversity. These and other potential issues can be resolved through the principles outlined in Chapter 2.

Agricultural and Open Space Zoning

Zoning and subdivision ordinances commonly require minimum lot sizes. In suburban single-family residential areas, minimum lot sizes typically range from one-quarter to two acres. To preserve agricultural areas, forests, wetlands, floodplains, and other types of wildlife habitat, some communities have adopted a variety of special agricultural land and large-lot zoning programs that require larger minimum lot sizes. In addition, many of these ordinances increase the requirement that a specific percentage of each parcel must remain in open space. Lot-size controls are generally considered to be site-level controls.

A few communities have adopted exclusive agricultural zoning, which has proven to be quite effective in protecting farmland. To the degree that the community wants to protect types of wildlife habitat that are found in and around farming operations, this can be an effective wildlife tool. Generally, such zoning includes a large minimum parcel size (often 160 acres or greater), the exclusion of all nonfarm land uses, and other restrictions, such as limits on the number of building permits in the zone. Again, because they are usually aimed at large areas of farm or ranchland, agricultural zoning is a landscape-scale tool.

In many cases, however, wildlife habitat does not overlap with agricultural areas, and agricultural zoning will not be appropriate. In such cases, large-lot zoning may be a more direct tool for protecting habitat. In this approach, communities establish a large minimum lot size. For example, many Midwestern jurisdictions in Illinois, Michigan, Minnesota, and Wisconsin have required minimum lot sizes of 160 acres and more. In Weld County, Colorado, agricultural districts require minimum lot sizes of 80 acres per dwelling unit.

Large-lot zoning provisions may come in a variety of forms. So-called "quarter-quarter" zoning allows each landowner one buildable lot per 40 acres of farmland. Once the allowable number of lots have been developed anywhere on the property, no more construction is allowed. This approach works best in rural areas with only moderate growth pressure and larger farms, and is used extensively in the rural areas around Minneapolis/St. Paul.

In contrast, sliding-scale zoning decreases the number of residences allowed per acre as the parcel size increases. Thus a 10-acre parcel may be allowed one residence, a 40-acre parcel only two, and a 160-acre tract only three units. Sliding-scale zoning has shown to be effective in agricultural areas that are under development pressure. It allows some development to occur but still preserves some farmland, particularly larger parcels. Adequate buffers must be established between agricultural and residential uses.

Large-lot zoning has several features that work well to protect habitat. It prevents the development of

large tracts of open spaces and agricultural areas. In addition, it may reduce inflationary land speculation by reducing the prospects for easy conversions to higher-intensity, nonagricultural uses. It is also relatively simple to administer and involves little cost to government. On the other hand, large-lot zoning can be harmful to wildlife habitat protection if it encourages valley floors or watersheds to be broken up into checkerboards of individual lots that ignore habitat values. Communities that use large-lot zoning techniques to reduce overall densities should generally offer the alternative of clustering the same number of homesites in portions of the area without high habitat value and should consider offering a density bonus for such clustering. It will often be more economical and marketable for a large landowner to create 10 smaller homesites near existing roads and utility systems than to create 10 large lots scattered across a valley. This type of development will also have less impact on wildlife. In addition, communities that pursue large-lot zoning should ensure that the standards they adopt allow for some economic use of each parcel of land.

Performance Zoning

One alternative to traditional zoning is performance zoning, which regulates development primarily by limiting development impacts rather than densities or uses. Such ordinances may target either a single type of impact or a broad range of impacts (e.g., traffic generation, pollutant emissions, stormwater runoff, and development of open space). Developments that meet these standards are allowed regardless of the whether they are residential, commercial, industrial, or institutional, but even low-density developments that fail to meet the standards are prohibited. While performance zoning regulations have been used since the 1950s, they have become increasingly popular as local governments have realized that the impacts of development are relatively unrelated to the category of land use in question.

In the area of wildlife protection, performance standards may be expressed in terms of minimum open space ratios, maximum vegetation disturbance limits, maximum noise or glare limits, minimum contiguous landscaping standards, or similar standards. Since habitat protection focuses on the impact of development on critical areas, performance zoning is basically well suited to wildlife protection.

Sophisticated performance zoning ordinances targeting multiple impacts may incorporate point systems. Development proposals are assigned point values for their ability to minimize a variety of impacts, and all development proposals must achieve specified minimum scores. Breckenridge and Boulder, Colorado, are examples of communities that have embraced point systems, with emphasis on protection of environmentally sensitive areas and promotion of high-quality development. Performance zoning may either supplement or replace traditional zoning regulations. Thus, an overlay zone district might incorporate performance standards rather than specific development requirements. Communities that choose the performance approach, however, should make a commitment to careful measurement of individual impacts of development.

Performance standards have several distinct advantages over traditional zoning in some circumstances. They provide opportunities for developers to design innovative layouts that can accommodate development while attaining wildlife goals. Performance systems do not presume that the solution contained in a set of physical zoning regulations is the only way to achieve the community's goal.

In other circumstances, however, performance zoning can have disadvantages. It cannot prevent improper location of development when the problem is caused by a subjective factor that cannot be measured. Moreover, performance zoning systems often require sophisticated skills to measure different impacts on wildlife protection and may require additional staffing or consulting services in order to work properly. In addition, the impacts of development on wildlife are often incremental. Under detailed performance zoning ordinances, planners must be able to understand and evaluate complex studies containing technical analyses and projected impacts so as to exercise informed discretion in allocating points and requiring impact mitigation measures. Often, local staff need to know as much about a technical field of planning as the consultants who prepare the studies measuring anticipated impacts. In cases where the incremental impact of each development is small, but the collective impact of all developments is large, performance zoning may be poorly suited to wildlife protection. Instead, it may be simpler for the community to adopt an objective development standard (e.g., a setback or spacing requirement) to minimize the incremental impacts of each construction project. Since the philosophy and results of performance zoning emphasize impacts on a specific species on a specific site, it can be considered as a site-level control.

Subdivision Review Standards

In contrast to zoning regulations, subdivision approval standards address primarily the size and shape of lots that can be made available for development and the amount of infrastructure that must be installed before development can proceed. Although originally designed to protect consumers from the sale of substandard or undevelopable lots and to protect the public from low-quality development, subdivision standards have expanded to include many restrictions aimed at controlling the impacts of development. Many controls that could be included in zoning regulations can also be addressed in subdivision controls, and vice versa.

In order to protect wildlife habitat, for example, subdivision standards could require the use of large lots to limit the number of people living in the area or could prohibit the creation of lots in sensitive areas. In addition, many modern subdivision ordinances impose strict buffering requirements in an attempt to protect undeveloped areas. Subdivision regulations could also include standards requiring that storm drainage be managed to promote riparian vegetation where

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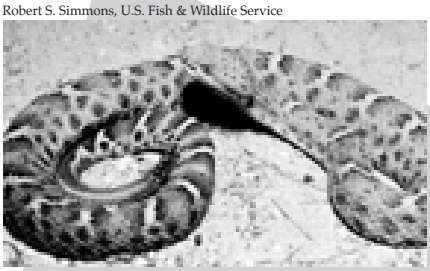


Many snakes are collected for live specimens and food, upsetting the ecosystem by removing these key predators.

that is desired or to avoid disturbing desert vegetation when that is important to the species.

Similarly, lot size and shape regulations could be structured so as to minimize the number of different lots that are laid out along an important drainage or migration corridor because human activity is often proportionate to the number of houses in the area.

While a public policy to restrict land subdivisions in an entire valley or watershed would be a landscape-level tool, the drafting of specific subdivision standards to protect habitat values is a site-level control.

Some state statutes explicitly authorize county governments to require landowners to dedicate a portion of their land as future school and park sites as a condition of development. The U.S. Supreme Court has required that these dedications be roughly proportional to the impacts of the proposed development. Local governments have considerable latitude to designate which land should be designated for future parks and to decide whether the appropriate park for that area should be an active or passive area. Accordingly, cities, towns, and counties can use their subdivision powers to require the dedication of habitat areas as open space to be used for passive activities. This topic and the landmark case of *Dolan v. City of Tigard*, 114 S.Ct. 2309 (1994), which sets constitutional standards for land dedications, are discussed in more detail in Chapter 5.

Sanctuary Regulations

In addition to zoning and subdivision-type controls, many local governments have discovered new and unique tools that will help to protect wildlife habitat. Although most of these solutions could be included in a zoning or subdivision ordinance, they are sometime adopted as a special permit requirement or a general policy of the government.

One increasingly popular tool is the creation of legislatively adopted "sanctuaries" for existing types of land use. Many agricultural areas encounter difficulties when new development locates nearby. The problems begin when relatively low land values attract residential or commercial development. After construction, new residents find that the preexisting agricultural uses emit odors and stir up dust. These issues lead to conflict, often involving expensive litigation, and in many cases the initial users leave the area to seek new locations to avoid such conflicts and expenses. When the original agricultural area served as wildlife habitat, this leaves the habitat open to development. Where local governments wish to retain agricultural and wildlife uses, they can create sanctuaries that prevent the encroachment of incompatible uses. "Right to operate" provisions in such sanctuary zones immunize local farmers or ranchers against nuisance claims, rezonings, or other pressures to require changes in operations that would be detrimental to the farm or ranch, and they might lead it to stop operations.

The Colorado General Assembly has adopted a variation of this protection against nuisance claims by specifying that an agricultural operation cannot be defined as a nuisance. More specifically, "an agricultural operation is not, nor shall it become, a private or public nuisance by any changed conditions in or about the locality of such operation after it has been in operation for more than one year." Local ordinances that define agricultural operations a nuisance or provide for their abatement as a nuisance are void (C.R.S., Sec. 35-3.5-102).

Care should be taken in drafting sanctuary protections, however, to avoid making them so tight that they exclude all other uses. If alternative uses are prohibited, there may be increased pressure to rezone for development rather than move to alternate, less-intensive, permitted uses when market forces render the farming or ranching operation infeasible. Because they are generally adopted as a policy applicable to an entire county or a large area, sanctuary regulations are a good example of a landscape-level tool.

An Overall Growth Management System

Protections for wildlife habitat can also be integrated into overall growth management systems through the use of urban growth boundaries, targeted growth strategies, and capital improvement programs. Again, because these tools generally address growth patterns in an entire jurisdiction, they are good examples of landscape-scale protection tools.

Urban growth boundaries. The use of growth boundaries allows cities to guide new development patterns by directing urban services to such areas and withholding them from others. In particular, communities with urban growth boundaries can ensure that those boundaries do not include sensitive habitat areas. If they do, the city or town may want to rethink where it wants to install infrastructure so as to avoid habitat areas that it wants to protect.

The regional government for the Portland, Oregon, metropolitan area has delineated an urban growth boundary administered by local governments in compliance with state legislation. This program has proven generally successful in confining growth to the areas within the boundary. Within the boundary, development has often bypassed previously "urbanized" areas and located in outlying "urbanizable" areas (defined as available and suitable for urban development upon the extension of urban services), but the program has been fairly effective at containing leapfrog development, preserving more outlying areas for agricultural and other less-intensive uses, and

maintaining order in metropolitan growth patterns.

Some communities have established urban growth boundaries even without a statewide mandate. The best known example in Colorado is Boulder, which has delineated boundaries for the extension of urban services and has worked with Boulder County to channel growth to areas adjacent to already developed areas, thus precluding development and costly service extensions in the mountainous areas bordering the city. A number of cities in Larimer County, Colorado, including Loveland and Fort Collins, have drawn urban growth area boundaries.

Targeted growth strategies. Another similar approach is that of designating development areas to which new growth is targeted within a region. Again, a targeted growth system could reduce development in large areas of a county or region where sensitive habitat areas exist. One recent example comes out of the MetroVision 2020 Task Force of the Denver Regional Council of Governments. As an alternative to dispersed development patterns that may result as the region adds a predicted 900,000 people over the next 25 years, the MetroVision 2020 Task Force has recommended consideration of development of satellite cities where growth would be channeled. These satellite cities, which could be existing communities or new planned communities, would be physically separated from the central urban area by open space or undeveloped land. Most of the new growth would be directed to existing satellite communities with the capacity for growth, including Castle Rock, Bennett, Evergreen, Brighton, Erie, Longmont, and Idaho Springs. Other urban growth would be limited to existing cities and already approved master planned communities. In some cases, this would tend to preserve contiguous areas of habitat and/or wildlife corridors between the settlement centers.

Several western U.S. counties have adopted the targeted development approach as part of their overall land-use management system. For example, Larimer County, Colorado, has entered into several intergovernmental agreements with some of its constituent cities that target new development to already built-up areas, such as Fort Collins and Loveland. However, not all municipalities in the county have signed such agreements, and thus some growth has occurred in several smaller, outlying communities with limited infrastructure and services. Even where targeted growth agreements have been signed, they often do not take into account wildlife concerns.

In general, targeted growth arrangements cannot be effective as habitat protection tools unless they involve the cooperation of at least the county government or a regional planning area. Although individual cities and towns can protect limited areas within their borders, efforts to protect nearby areas will always be subject to development permitted by the county or an adjacent city or town.

Capital Improvements Programming. In addition to urban growth boundaries and targeted growth schemes, local governments can incorporate wildlife protection goals into their capital improvements programs and budgets. In many jurisdictions around the country, a strong relationship has been shown between the presence of infrastructure and development of the land. Local governments can effectively discourage the development of habitat areas by not planning for or budgeting for water or sewer lines or roads in the area, and by discouraging the creation of special districts to finance those elements of infrastructure. Since the creation of all water, wastewater, and metropolitan districts is subject to the approval of either the county or city government in which it is located, local governments can prevent the creation of infrastructure financing districts by withholding that approval.

A Density Bonus Program: The Routt County, Colorado, Land Preservation Subdivision Process

In 1995, Routt County, Colorado, enacted a density bonus intended to encourage landowners to submit their property to the county's subdivision procedures instead of opting for an exempt 35-acre tract division. After extended negotiations between county staff, environmental interests, and ranchers, a compromise was reached in which the county created an expedited review procedure for large tract subdivisions. Under the Land Preservation Subdivision process, a landowner voluntarily agrees to submit a proposed subdivision to the county government for review on six issues: preservation of agricultural lands, visual resources, setbacks from natural features, infrastructure, geological hazards, and wildlife habitat. Areas not designated for development must be preserved as open space through development agreements or other techniques, and the landowner is offered an incentive of one additional buildable lot per 100 acres of land preserved from development. In addition, the procedure calls for the county government to complete its review within 12 weeks. The procedure remains optional, however, and those landowners who still wish to pursue 35-acre subdivisions may do so without county involvement.

Coordination with Other Land Development Codes

Wildlife habitat protection does not exist in a vacuum. It must be consistent with, and reflected in, the other local government land-use control systems. In addition to the types of zoning, subdivision, and growth management controls described above, wildlife protection standards must be coordinated with street and access codes, annexation policies, and environmental control systems. Street design codes should be drafted to allow smaller and less

disruptive streets near wildlife areas, and to allow alternative access patterns directing traffic movements to less-sensitive areas. Local annexation policies should reinforce habitat protection by providing that annexation or development agreements must be consistent with wildlife protection plans and regulations, and to discourage the extension of utilities into sensitive areas. Unless all of a city's or county's land-use controls work together to treat habitat areas in a consistent way, they will probably not be effective.

INCENTIVES

Incentives are a second important set of tools for implementing habitat protection. Many local governments that are reluctant to adopt land-use regulations are more willing to adopt incentives. With careful attention, incentives can sometimes be as effective or even more effective than regulations. When crafting an incentive approach to protecting wildlife habitat, however, it is important to ensure that the incentives offered to enhance wildlife do not undermine other important community goals. Once again, habitat protection does not exist in a vacuum, and local government incentive programs need to be integrated as carefully as its regulatory programs.

Density Bonuses

Perhaps the most common form of incentive is development density bonuses. In these programs, the local government offers landowners a chance to construct more residential or commercial development on their land if they will take certain actions to promote wildlife. The required actions can include locating development outside of prime habitat areas, implementing groundwater runoff controls to avoid erosion into streams used by wildlife, planting specific types of vegetative cover that attract (or repel) wildlife, or avoiding glare and traffic movements near wildlife areas or corridors. The amount of additional development density allowed should vary depending on the importance and difficulty of the landowner's actions to promote wildlife, but bonuses are commonly in the range of a 25 to 50 percent. Larger bonuses may create fairly significant development impacts and may raise questions about the rationale behind the base zoning density. Care should be taken to avoid granting incentives that result in additional wildlife impacts that are greater than the benefit gained by the landowner's habitat protection measures.

Clustering

A second form of incentive is cluster zoning, which provides flexibility for developers to construct buildings in clusters while remaining within the constraints of overall average density restrictions. Under cluster zoning, maximum densities are calculated not for individual lots, but for overall development areas. Rather than requiring uniform intervals between building sites, such ordinances often waive minimum lot size and dimension requirements to allow tight clusters of buildings in some areas, with other portions of the parcel set aside for open space or habitat use. Often, the local government imposes a requirement that clustering cannot occur unless most or all of the land that is left undeveloped is protected from future development through the use of a conservation easement or deed restriction. In other cases, the government reserves site plan review authority over the clustered development to ensure that the layout, visibility, and design do not create negative impacts on the area. Cluster zoning concepts are widely used to permit development while setting aside areas for the preservation of sensitive areas, such as forested areas, wildlife habitat, wetlands, agricultural areas, and other such resources. While some cities and counties allow clustering throughout their jurisdiction, others target the tool where it is particularly important to protect sensitive land or habitat.

Cluster provisions have several advantages to both wildlife planners and the public. They provide flexibility for planners and developers to design innovative development layouts that can accommodate development as well as environmental or land preservation objectives. They can also preserve significant tracts of wildlife habitat while still protecting land values. On the down side, the successful administration of cluster ordinances requires a sophisticated planning staff that is able to exercise discretion in determining appropriate and feasible development layouts. In addition, clustering may not be an appropriate tool if all of the parcel is in a sensitive habitat area or if the community needs to encourage shifts of development density between different ownerships, rather than within an ownership. In such cases, a transferable development rights (TDR) system (see below) may be a better approach. Finally, if a substantial number of cluster developments are approved in close proximity to one another, the resulting development may have the same impacts as suburban sprawl and may significantly change the character of an area.

Cluster Development Provisions: The Montgomery County, Pennsylvania, Land Preservation District

One good example of cluster development comes from Montgomery County, Pennsylvania. The intent of the Land Preservation District in Montgomery County is to preserve open space and natural lands on development parcels of 10 acres or more. The regulations permit development of compact residential areas that are carefully located, designed to reduce their intensity, and preserve agricultural lands, so long as a minimum of 75 percent of the site is protected as private open space.

Transferable Development Rights (TDRs)

A third form of development incentive for habitat protection is density transfers, which are usually

implemented through a transferable development rights (TDR) program. Density transfers involve the shifting of permissible development densities from unsuitable development areas to more appropriate sites—in this case from important habitat areas to less important areas. Under this concept, the local government studies and designates appropriate "sending" and "receiving" areas on a map. A participating landowner in a sending area transfers development rights to another landowner in a receiving area, who increases his or her development rights in that area beyond what would otherwise be possible. In general, the price of development rights being transferred is left to the private market, and the local government does not try to affect that price one way or another.

Grants and Loans

A fourth form of local government incentive to promote the protection of important habitat is the use of grants and loans. Local governments can make grants or loans to support the acquisition or management of important wildlife areas, to promote wildlife education, and complete wildlife inventories. Or the local government can apply to the state and federal governments or to nonprofit foundations and associations for money to fund such grants.

In addition, grant and loan programs can sometimes be used to supplement regulatory tools. At the same time that some communities change their regulations regarding land development, they make financial resources available to help landowners cover the added cost of complying with those regulations.

Transferable Development Rights in Montgomery County, Maryland, and the New Jersey Pinelands National Reserve

The Transferable Development Rights (TDR) concept has been applied in a number of jurisdictions. Montgomery County, Maryland, has used a TDR program to protect agricultural lands against strong urban growth pressures. The Montgomery program involves three elements: (1) the identification of a "sending area" that includes the county's best agricultural lands; (2) downzoning in the sending area from five-acre minimum lots to 25-acre minimum lots, with landowners retaining TDRs equal to their original five-acre-lot development rights; and (3) the identification of a "receiving area," in which landowners may augment their development rights with additional rights purchased from the sending area.

One of the most successful TDR programs for natural area protection has been employed in the Pinelands National Reserve in New Jersey. To date, more than 10,000 acres have been preserved, and the TDR market provided by the program was recently held to be an important consideration in rejecting a takings challenge to the Pinelands' strong system of regulatory controls designed to protect existing agricultural lands and open space.

TDR programs can be designed to be voluntary in the sending and receiving areas, mandatory in both areas, or voluntary in one area and mandatory in the other. The effects of the tool will depend greatly on which option is chosen. In addition, the success of the program in protecting wildlife habitat will depend in large part in the careful balancing of opportunities in sending and receiving areas, so that excessive sending areas do not flood the market and restrictive receiving areas do not limit the usability of the credits for sale. Importantly, TDR programs seldom work if the underlying zoning is too generous with development density because neither potential buyers nor potential buyers of transferable rights have any incentive to participate.

TDR systems have several important advantages as land regulation tools to promote wildlife. They help alleviate pressures and incentives to subdivide or develop land by offering some means for landowners to recoup property values while maintaining low-density land uses. In addition, where land-use regulations impose low-density restrictions on development rights, TDRs restore the value of those rights to the landowners, thus providing a shield against takings claims. Because TDR programs usually aim to move densities from one large area of the community to another, they are best considered as a landscape-scale tool.

Grants and loans have several advantages as a habitat protection tool. Their effect can be direct and immediate. Development proposals can be changed, information can be collected, and education efforts can begin. In addition, public loans and grants can often be used as matching funds to obtain additional private investment or financing. A little seed money can go a long way towards a long-term financing solution. They can also make the adoption of new regulations more politically acceptable by giving the public an easy means to comply with them. Revolving loan funds can go further by allowing a fixed amount of government seed money to be used over and over again as the recipients repay the loans.

But there are disadvantages, too. Grant programs can be expensive and must compete for attention with other local government priorities. Loan funds can be less expensive in the long run, but take staff time to administer and enforce. In addition, if they are not defined carefully, grant and loan funds can encourage dependency. Worthy programs can begin to expect regular financial help from the local government, rather than working on a more sustainable system of long-term financing.

Preferential Tax Treatment

A fifth form of incentives to preserve habitat is preferential tax treatment.

Use assessments. Where potential profits motivate landowners to convert low-density land uses to higher intensities or to convert important habitat areas into intensive development areas, preferential tax programs can counter these motives by providing incentives to maintain existing low-intensity uses. One of the most important forms of preferential taxation is current use assessments. Local governments levy real property taxes against the assessed value of property. Under standard practice, tax assessors determine value based upon the "highest and best use" of a property, which reflects the highest potential use of such property.

Current use assessments alter assessment practices by requiring assessments to reflect actual current uses rather than prospective potential uses. Where development pressures create higher property values and tax burdens, current use assessments provide tax relief to landowners who choose to continue agricultural, forestry, rangeland, or other low-density uses that are consistent with continued habitat value.

Another application of the current use assessment concept allows private landowners to contract with government agencies to restrict the use of their properties. Such agreements limit the range of potential highest and best uses, thereby decreasing the assessed value of the properties and providing tax relief to landowners who agree to such restrictions. Often, this can be done through a conservation easement or deed restriction as well as through a development agreement. Because use assessments are granted based on the use of a specific parcel of land, they work as site-level habitat protection.

Tax credits. Another tax incentive approach that has proven to be successful in preserving open space involves offering income tax credits for the value of approved conservation easements. Federal tax deductions are available for donations of qualifying open space or open space easements to nonprofit organizations. This tool is frequently used by private land trusts and is discussed in more detail below.

In general, preferential tax systems present an equitable way to encourage open space or low-density uses by requiring tax assessments to reflect current rather than prospective values. They also help accomplish land conservation goals without the use of regulations. On the other hand, most preferential tax systems cannot delay development pressure indefinitely. Potential profits from the development of habitat land can easily outweigh the benefits of a property tax break. Where there is no recapture provision, preferential taxes may reward land speculators and developers by lowering holding costs until the development market creates sufficient profit incentives for conversion to nonagricultural uses. Finally, such tax systems do create indirect public costs in the form of foregone tax revenues.

Since tax credits for easements depend on the specific parcel of land involved, they are primarily a site-level tool.

ACQUISITION PROGRAMS

One of the most effective ways of preserving wildlife habitat is to buy it. Local ownership often simplifies management decisions and provides a relatively permanent way to protect the habitat. Government acquisition strategies can be used effectively as a supplement to regulations, especially where control of the land is necessary to prohibit essentially all development in sensitive environmental areas or to prohibit general public access for recreational and other purposes. While regulatory protection programs must leave an economic use of the land for the owner, government ownership removes that obstacle because the government is essentially agreeing to use the land for noneconomic purposes. Thus, when communities believe that the only way to protect habitat is to prevent virtually all use of the area, they should seriously consider fee or development rights acquisition programs.

Ownership programs generally fall into two categories. First, some programs seek to buy the land itself. These are often called "fee ownership" programs. The second type of program seeks to buy the rights to develop the land into uses consistent with its role as wildlife habitat and are often called "sellback," "leaseback," or "development rights" programs. Local communities interested in obtaining land or development rights for habitat preservation should also think about incentives that may be available to induce the landowner to donate the land to the community or to a third party who will manage it. Often, such donations can be a way for wealthy landowners to obtain a valuable tax deduction. Among other things, the local government can also agree to name the protected habitat area in honor of the landowner making the donation.

Because acquisition programs focus on the need to acquire specific areas of land and the value of that land, they are often thought of as site-level tools. However, if the community pursues a consistent strategy to acquire lots of land or development rights in a defined habitat area, the result can be very effective landscape-level protection.

Fee Simple Purchase

Ownership of land includes rights of possession, access, exclusion, disposition, and rights to specified uses such as mining, hunting, or development. Where one party owns the entire bundle of these rights, that party owns the land "in fee simple." Acquisition of land in fee simple gives the purchaser full title to and possession of all rights associated with the purchased property, subject only to the constraints imposed by nuisance laws and valid public regulations, including zoning and subdivision. Fee simple ownership provides the simplest and most effective means of implementing habitat control because the government owns the land and controls its development, redevelopment, preservation, and access. Once the government entity assumes fee simple ownership, it has a broad range of options. It may reconvey selected interests in the land, restrict future uses of the land, lease the land, or otherwise control the bundle of property rights in a manner consistent with its habitat objectives.

The late 1980s and early 1990s were good times for local governments to be purchasing open space

because the downturn in the economy in many places led to a buyer's market for undeveloped and partially developed land. The Federal Deposit Insurance Corporation and the Resolution Trust Corporation were actively selling inventories of land obtained through savings and loan foreclosures and collapses. In addition, those banks and saving and loan associations that remained in business were often very interested in selling their inventory of "real estate owned" properties obtained through foreclosures. Although the upswing in the economy in the mid-1990s has dramatically reduced the number of below market sellers, local governments should continue to monitor the activities of banks and the federal government as land sellers and should be ready to take advantage of opportunities to acquire prime habitat parcels.

One drawback of fee purchase programs is that they tend to be expensive. Land itself is often expensive to buy. In addition, the city or county needs to take into account interest on any debt that was issued for the purchase, foregone interest on alternative investments, foregone taxes, and maintenance costs for the land. Managing, maintaining, securing, and enforcing public access restrictions on fee ownership land can be a very expensive proposition. Over a period of years, management costs may actually exceed the original purchase cost of the land. For that reason alone, many jurisdictions decide not to purchase land in fee simple and instead concentrate on controlling the development potential of the land.

A second drawback of fee simple purchase is that it may make it more difficult to prevent public access to the land. Once land is owned by the local government, many citizens assume that it is available for their use as needed. Since public use may seriously compromise the value of wildlife habitat areas, the right of the public to use some areas must be restricted if the land is to serve its purpose. If the nature of the species and habitat involved are such that human presence must be kept to a minimum, it may be more useful to consider the acquisition of easements or development rights to achieve wildlife goals. Such techniques can help control the owner's use of the land in order to protect its habitat value while leaving the basic ownership of the land in the hands of a private party who can exclude the public from the land.

A number of state and local sources may be able to fund acquisitions of land to be used for park or other open space purposes. A second source of purchase capital is local tax revenues.

Five Effective Land Purchase Programs in Colorado

The City of Boulder has the oldest open space program in Colorado and has used a specially earmarked .73 percent sales tax to raise $100 million and buy 25,500 acres of dedicated open space in a greenbelt around the city. The sales tax revenue stream now produces about $15 million each year. Another 8,000 acres of mountain parks in the Boulder foothills have been separately set aside through the parks and recreation department. Some of the Boulder open space land is leased to farmers to maintain the agricultural uses. Other parcels are maintained as natural areas, allowing passive recreational uses, such as walking, bicycling, and horseback riding.

Boulder County implemented a land purchase program in 1975. The program was originally funded through the county general fund and the state lottery funds, and has resulted in the purchase of 16,000 acres of land. Beginning with a budget of about $1 million, the appropriated funds grew to a $2.5 million acquisition budget and a $1 million operating budget in 1993. A new quarter-cent sales tax was approved in 1993 and has been used to fund a $34 million bond issue, two-thirds of which is already committed. Approximately 30,000 acres have been purchased through the Boulder County program. The current strategy is to purchase as many of the identified priority parcels as possible with the bond funds, then gradually move into more of a stewardship and maintenance role.

Jefferson County has had an open space acquisition program in place since 1972. Funded by a one-half percent sales tax that generates $22 million in annual revenue, the county has spent approximately $123 million to acquire 29,500 acres of land. The lands are used for a variety of purposes, including natural areas, buffers, and trail corridors. Open space funds are also distributed to eight cities in the county, with Lakewood receiving more than $13 million and Arvada receiving more than $11 million since 1972.

Douglas County initiated its open space program in November 1994 when it approved a one-sixth percent sales and use tax, part of which is shared with the municipalities within the county. During its first full year of operation, the program raised about $2 million. A nine-member Douglas County Open Space Advisory Committee makes recommendations on expenditures of the open space funds to the county commissioners. Recommendations to date have included a wide variety of projects, including both fee purchases and easement purchases, and have resulted in eight separate transactions protecting about 780 acres of prime open space. Half of the tax revenues are spent on administration, about 12 percent on parks and recreation facilities, and the remainder for open space and trails.

In November 1995, Larimer County voters approved an eight-year, one-quarter percent sales tax for open space acquisition and designated that 55 percent of the resulting revenues go to the cities and the remainder to the county. The sales tax is expected to produce about $6 million per year.

Integration into Park and Open Space Purchase Programs

Many communities already have a program in place for the acquisition of open space for parks and trails. Most often, such programs are included in the city, town, or county's regular capital improvements programming, where they must compete with other pressing needs for public investment. In other cases,

voters have approved a separate tax to fund a free-standing open space acquisition program that does not need to compete for scarce public monies. Where such programs exist, it may be possible to expand them to include the acquisition of important habitat lands merely by amending the list of eligible types of land and criteria for the selection of habitat lands. In many cases, this expansion would be consistent with the intent of the existing program and would not require the creation and funding of an open space program specifically designed for wildlife. In cases where open space purchase programs have been approved through voter referendums, however, great care should be taken to ensure that an expansion of the program is clearly consistent with the referendum approved by the voters.

enforce the terms of a sellback transaction is to include a reverter clause in the deed providing that title will revert to the government in the event significant provisions are violated.

Boulder County, Colorado, for example, owns more than 1,000 acres of land that is leased back to farmers. Several of the landowners with whom Boulder County is currently negotiating purchases are requesting purchase and leaseback arrangements. Denver has leased much of the land purchased for Denver International Airport back to farmers to keep it in agricultural uses until it is needed for runway or airfield expansions. To the degree that continued agricultural usage is compatible with protection of the desired wildlife species, sellbacks and leasebacks can be effective site-level tools to reduce the costs of habitat acquisition programs.

Purchase and Sellback/Purchase and Leaseback: Some California Examples

The California Coastal Conservancy is charged with assisting in the protection of undeveloped coastal lands. It has a successful program that provides grants to land trust organizations to purchase agricultural and other land and then resell the land with conservation restrictions. Funded by the state, the experience of the program is that agricultural lands purchased at full market value can be resold with conservation restrictions that allow for agricultural and other open space uses at nearly the original purchase price. The cost of the program is thus minimized, and land is kept in productive use.

The California State Parks Department also has a successful purchase and leaseback program for agricultural lands in various areas of the state. In Santa Cruz County, an area with stringent land-use controls, the 2,300-acre Wilder Ranch was purchased by the state. Of the total ranch, 635 acres are leased to 11 farmers for agricultural purposes. The state maintains the remainder of the ranch for a variety of open space and recreational uses. The state parks department believes that the success of this and other similar projects helps dispel the myth of incompatible agricultural and recreational uses.

Sellbacks and Leasebacks

Once the government owns the land, it does not need to retain ownership of all of the "bundle of sticks" in order to protect wildlife habitat. It can use its position as the owner of the land to facilitate the rezoning of the land or to impose negative easements, deed restrictions, or development agreements, and then resell the land to a third party. This is known as a "purchase and sellback" transaction. Alternatively, a city or county government could purchase the property and then lease it to a third party subject to conditions and restrictions as provided in the lease. This is known as a "purchase and leaseback."

Negative easements impose restrictions upon the landowner's property rights but do not grant affirmative rights. The "purchaser" of a negative easement simply imposes a restriction on the land. For example, in the area of wildlife habitat protection, a negative easement retained by a local government when it resells the land might state that the new owner may not develop property, disturb vegetation, or increase or change stormwater flows in any way within a specified distance of a riparian corridor. The government must still monitor the land use, however, to make sure that the restrictions are being observed, or those restrictions could conceivably lose their legal enforceability through neglect. One way to help

Purchase "Triggers": Options and Rights of First Refusal

Just as the local government may not need to keep ownership of the entire fee interest in land to achieve its goals, it may not need to purchase the property at all until an alternative use or sale of the land is contemplated. Purchase "triggers" apply the basic concept of purchase options in real estate transactions—they provide a means for a potential purchaser to "tie up" a property without actually buying it. By purchasing an option on property, a potential purchaser reserves the exclusive right to purchase the property within a specified time period or in the event that certain events happen. A related tool is a "right of first refusal," under which the local government entity pays for a first right to purchase a property if the property is to be sold. The buyer of a right of first refusal often does not need to negotiate a price in advance but is obligated to match a bone fide offer submitted by another potential purchaser. This avoids the difficulty of valuing habitat land now but does protect the seller against having to sell at a bargain price when there is a better offer from another potential buyer. Because right of first refusal programs leave the potential purchase price for the land to be determined by a third party, they may create problems for local governments that need predictable costs in

order to meet their budget constraints and funding cycles. To avoid this problem, local governments that want to tie down the price of a future purchase now should instead buy an option or execute a right of first refusal with a clear statement of the agreed price.

A third variation has been employed to protect federal reserve areas and national recreation areas from adverse development on private property inholdings. This is sometimes called a "Sword of Damocles" provision. This system has been used in Idaho's Sawtooth National Recreation Area, where regulations and design controls were imposed on private properties to preserve the natural setting of the area. Under this approach, the government agency devises a comprehensive land-use plan for the area and designates various zones for different uses and developments. As long as the landowner voluntarily agrees to comply with the plan and restrictions, the government's power to condemn is suspended. In Sawtooth, both the local government and U.S. Forest Service are involved in making the system work. However, if a use that is inconsistent with the plan is proposed or undertaken, the power to condemn is triggered, and the land can be brought into public ownership to prevent the incompatible development.

A Sword of Damocles provision could also be implemented under a local government's power to condemn land. If the proposed use of lands for habitat or buffer zones meets the definition of a "public purpose," the local government has the power to purchase the land through the eminent domain process. The government also has authority to agree not to use those powers as long as certain conditions are maintained.

One drawback with purchase triggers involves cost. While purchase in fee simple is costly by itself, the option or right of first refusal adds an additional cost. A local government could wind up paying first for the cost of the option and then again for the full purchase price of the land. Another drawback involves the cost of delay. The triggering events may not occur until development pressures increase, and by then land costs will also have increased commensurately.

Sword of Damocles provisions have similar advantages and drawbacks. They may also lower the market value of a property by discouraging purchasers and create opposition from present property owners. In addition, Sword of Damocles provisions are only as effective as the resolve of the relevant agency to exercise its condemnation powers and the availability of money that resolve to pay compensation awards—may waiver or the funding may fall short due to political or fiscal pressures.

Life Estates

In some cases, a town, city, or county may be able to achieve its wildlife habitat goals through the acquisition of life estates in important lands. Not infrequently, the owners of agricultural or ranch lands would prefer not to develop their lands and would like to see the farm or ranch remain intact as long as possible. However, many of these same owners would like to be able to pass their land on to their children for them to do with as they wish. For that reason, they are unwilling to grant easements or impose deed restrictions or covenants that would bind their children's use and disposition of the land. In those circumstances, and if prime habitat areas or corridors are involved, the local government may want to purchase a life estate in the land and lease the property back to the current owner at roughly the same cost. The terms of the transaction allow the government to control the use of the land during the owner's lifetime but terminate that control at the time of the owner's death. Even though the land could be put to incompatible use some time in the future, the purchase of a life estate can buy time for the local community to consider follow-up steps and/or to raise money for the eventual purchase of the property. Since life estates are negotiated for specific parcels of land, the purchase of a life estate is considered a site-level protection tool.

Easements and Purchases of Development Rights

Easements can be viewed as just a few of the bundle of rights that are included in fee simple ownership. They constitute severable interests in land. The severable nature of easements allows a landowner to convey or reserve specific rights associated with a property apart from the right to posses and use the land in general. By applying the law of easements, local governments can control land development without buying the fee simple interest in the habitat land itself. Easements and development rights programs are essentially programs enabling the local governments to pay landowners to forgo certain land development rights, and documenting the transfer of those development rights to the government.

There are two distinct types of easements. Positive easements grant someone else an affirmative right to use property in a specific manner or to interfere with the owner's otherwise enforceable property rights. A right of access across a neighboring property is a common example of a positive easement. In contrast, negative easements create restrictions upon the landowner's property rights. Negative easements do not grant affirmative rights to someone else, they instead restrict the actions of the owner. Particular restrictions vary according to their objective. In the field of wildlife habitat protection, they generally prevent the owner from doing those things that would disturb the wildlife or their environment. Whenever possible, easement donors should make habitat goals clear in the easement documentation so that the terms of the easement can be enforced if the landowner begins using remaining rights in the property in ways that undermine those habitat goals.

Timing plays a key role in the success of an easement or development rights program. Such programs should begin when development pressures are not so strong as to inflate the values of development rights and when the residual uses of the land remain profitable. Essentially, government should "buy low" so as to maximize its cost savings. Since the governments that purchase development rights usually have no plan to resell them in the future, most of these programs do not create development rights "banks" or TDR programs. The government simply retires the rights to prevent their future use.

Even though this acquisition option seems eminently logical, efforts to purchase easements or development rights face several obstacles that demand careful thought. First, development rights acquisition programs work only when the local government can identify which particular rights need to be purchased to protect the habitat value of the area. When the true need is to prevent all use of the land or to purchase virtually all of the rights to the land, the government should instead consider a fee simple purchase. Purchase of development rights will only be less expensive than a fee simple purchase if the landowner retains a meaningful economic use of the property. A second complication involves the effect of zoning upon valuation. The local government needs to decide whether it is willing to pay for the potential development value of the land even if the property is zoned for agriculture. To refuse to acknowledge the development potential of the land may result in the government offering purchase prices too low to interest sellers. To acknowledge development potential invites criticism that the government should not be paying for speculative values that could only be realized if the government was willing to change its current zoning.

In spite of these drawbacks, however, easements and development rights purchase programs are popular because the land remains in private ownership and subject to local property taxes, and because the costs of the program may be lower than fee purchase programs.

Common terms of conservation easements include bans on subdivision of the land, timbering, destroying vegetation, grazing, construction roads, mining, using insecticides or herbicides, excavation, or altering specific features, and limitations on human access (Sikorowski, Bissel, and Jones 1986).

Land Dedications and Impact Fees

Land dedications are conveyances of land from a private owner to a local government, either voluntarily or to offset the anticipated impacts of a proposed development. An increasing number of local governments are imposing land dedication requirements or fees in lieu of dedication as conditions for permit approvals. Many state statutes explicitly authorize governments to impose land dedication requirements or fees-in-lieu for parks and schools, and a large number of home rule municipalities impose similar requirements.

Where new development creates needs for increased public services and infrastructure (schools, roads, recreational facilities, etc.), this practice is intended to ensure that new development "pays its own way" by assuming these costs. Thus, where new development threatens to strain a community's recreational facilities, developers might be required to dedicate a specified number of acres for every 1,000 residents of a residential project. Since increasing development may put increasing pressure on existing habitat in the vicinity, it may also be appropriate to create a land dedication requirement to protect those areas. In the alternative, developers might pay a fee into a dedicated open space fund that would be used to purchase passive open space land and habitat open space land in the general vicinity of the project. Many statutes also give county governments the ability to approve the location of required park land dedications, and many home rule cities have similar provisions.

Taken together, these two powers may allow some communities to implement the acquisition of important habitat areas through dedications or fees in lieu of dedication at the time that land is subdivided or building permits are issued. While courts have generally been sympathetic towards exactions, these programs raise legal issues that are discussed in detail in Chapter 5.

Dedication requirements and fees-in-lieu often are strongly opposed by the development community, which prefers the use of general property taxes, public bond issues, and other traditional government revenue sources to fund infrastructure. Opposition may be particularly strong when the purpose of the requirement is to mitigate an impact on wildlife rather than to construct physical infrastructure to be used by people. The crafting and implementation of these

Purchasing Development Rights in Light of Growth Pressures: King County, Washington

In the Seattle metropolitan area, King County, Washington, has administered a successful purchase of development rights program to preserve agricultural land in the face of metropolitan growth pressures. Drawing upon a $50 million bond issue, the program funds the county's purchase of development rights for properties facing development pressures with priority rankings determined in accordance with the intensity of such pressures. Participation in the program is voluntary for eligible landowners. Purchase prices are calculated as the difference between appraised value at the land's "highest and best use" and the appraised values as farmland. That formula reflects the development potential of the land, regardless of its current zoning. After purchasing the development rights, the county records restrictive covenants on the properties in the land records and limits development rights to 5 percent of the property's nontillable area.

types of exaction programs also require substantial staff resources. In the initial development of the program, the government entity will have to address potential legal issues by devoting substantial resources to background studies so as to establish a firm legal basis for its program. Even when carefully calculated, impact fees may not cover costs of needed improvements unless set at very high levels that may have adverse impacts on the economic competitiveness of the community and housing affordability, and may not be as cost-effective as tax-exempt forms of financing such as municipal bonds.

The U.S. Supreme Court's ruling in *Dolan v. City of Tigard*, 114 S.Ct. 2309 (1994), indicated that courts will look carefully at land dedication programs for fairness to the landowner. Communities interested in adopting land dedication requirements to promote habitat protection should read the discussion of this important case in Chapter 5.

Instead of imposing a requirement to dedicate land per se, some communities have created impact fee programs. These programs collect pro rata fees from different landowners, pool them, and then use them to purchase open space or habitat lands. Even though a local government may not have authority to require land dedications for purposes other than schools or parks at the subdivision stage, it may have authority to impose a carefully calibrated impact fee to collect funds to be used to purchase areas of habitat directly threatened by the new development. Impact fees are a broader tool than land dedications because they can address development impacts that cannot be addressed through land itself. In addition, since the use of impact fees reduces the need for tax increases to pay for similar services, they are often popular with citizens of the community. Great care should be taken to calculate impact fees so as to be proportional to the anticipated impacts of the development on wildlife habitat in particular.

Where impact fees are used, however, new issues arise. Most importantly, impact fees must be spent so as to benefit the payor within a reasonable period of time after the payment. In general, governments that collect impact fees are expected to use those fees to build facilities that provide some type of service or benefit to the payor. In the context of wildlife habitat protection, this raises some interesting issues, since the "users" of protected wildlife are largely the public who enjoy the many benefits of living in an area where the species is preserved. Although the nearby landowners may enjoy a special benefit by virtue of the fact that buyers will pay more for land near wildlife, it may be hard to show that the benefit is qualitatively different than that enjoyed by the public at large. In addition, impact fees are usually paid at the time the land is developed and often at a late stage in that process. By the time the fees are collected, nearby habitat areas will also be under development pressure, and the price of acquiring the habitat may be very high. For all of these reasons, cities and counties that want to adopt impact fees to pay for wildlife habitat acquisitions should be careful to lay a strong factual and legal foundation for their actions and should be very careful to meet the constitutional standards described in Chapter 5.

Land Trades

Finally, local governments should always consider whether the most cost-effective way to acquire habitat lands may be to trade other lands owned by the government and no longer needed for their original purposes. In the course of time, many towns and counties discover that they have an inventory of land parcels in or near developed areas that the government no longer needs. Instead of selling those parcels on the open market, the government may want to consider a trade for habitat lands further away. In cases where the current owner of the habitat lands is holding it for future development, a potential trade for land nearer to water and sewer lines and market demands may be very attractive.

DEVELOPMENT AGREEMENTS

Often, local governments may find opportunities to protect quality wildlife habitat through negotiations with individual landowners at the time when specific development proposals are brought forward. The most flexible technique for doing so is a development agreement. Some state statutes allow cities and counties to enter into development agreements obligating both the government and the landowner to carry out certain actions in order to "vest" a preferred development plan for a period of time. Development agreements can give the landowner more certainty that the government will not act to delay or deny the development activity for a period longer than is defined in the statute. In return, the local government can ask the landowner to design and operate the proposed development in ways that will protect or even enhance the existing wildlife habitat on the property. Because they are negotiated on a project-by-project basis, development agreements can be an effective site-scale tool for habitat protection.

For example, a development agreement might include provisions requiring the landowner to:

- avoid construction activities in certain areas;
- time construction so as to avoid mating, nesting, and other sensitive times for wildlife in the area;
- phase the development of the site so that earlier low-intensity development helps to buffer wildlife from later, more intensive, development;
- limit the number of vehicles or workers on the site at any one time;
- implement additional dust and noise control measures during construction;
- close access to specific trails or roads during specific times of the year; or
- incorporate vegetation with wildlife food value into site landscaping.

The strength of development agreements is that they can be tailored to the exact needs of the specific land and proposed development. In addition, since they are negotiated contracts, they are not subject to some of the strict constitutional requirements that limit the local government's power to adopt general regulations.

U.S. Fish & Wildlife Service

The pearly mussel is being endangered by pesticides and industrial pollutants.

CONTROL OF PUBLIC INVESTMENTS AND PROJECTS

Another way in which local governments can promote wildlife habitat protection is through careful direction, design, and control of public projects and investments. Local governments spend hundreds of millions of dollars each year on projects like parks, water lines, and highways that have a profound effect on land development and use patterns. Since the 1970s, there has been an increasing realization that the impacts of the governments' own projects on land must be thoroughly analyzed and coordinated with governmental priorities. In order to avoid unintended impacts on wildlife habitat areas, local governments must ensure that information about habitat areas is included in all decisions to construct roads, storm drainage facilities, water facilities, wastewater facilities, public buildings, and public storage yards. In general, the local government should follow the same principles that it imposes on private developers related to design and construction to minimize habitat impacts.

On the positive side, cities and counties should ensure that any available inventory of prime habitat areas is integrated into the decision-making process to purchase land for parks or for other public facilities. Buying a site for a public facility that includes important habitat and then designing, siting, and buffering the public facility to protect that habitat may be a very effective way to achieve two public goals at once. In addition to considering the impacts of its own infrastructure construction on habitat goals, local governments should ensure that special metropolitan districts and other districts within their boundaries are also acting consistently with those goals. In particular, in areas where the local government decides not to extend infrastructure in order to reduce development pressures, it should have clear policies in place prohibiting the creation or continuation of special district activities that would circumvent that goal.

TAXING AND ASSESSMENT DISTRICTS

In cases where the habitat to be protected—and the benefits from that protection—are limited to a specific area in the city or county, it may be appropriate to consider the use of a special taxing district to raise additional funds to buy land or development rights in that area. The state of Iowa has adopted legislation permitting the creation of special conservation districts to levy taxes to acquire land for wildlife reserves and parks.

Even without a specific statute for conservation districts, it may be possible to use existing legislation to achieve the same result. For instance, Colorado's legislation permits the creation of park and recreation districts to acquire and manage parks and open spaces. Park and recreation districts do, however, have some significant drawbacks as a habitat protection tool. They are subject to onerous reporting and control requirements from both state and local governments, and are controlled by a board of directors of property owners within their boundaries. In addition, unless they are carefully designed, they may inadvertently encourage land development within their boundaries. For both reasons, Colorado's local governments proceed cautiously when examining the alternative of tax districts for wildlife purposes. In many cases, it may be preferable to create a government-controlled district (e.g., a general improvement district or a local improvement district) to achieve the same result.

PRIVATE-SECTOR INITIATIVES

Increasingly, the private sector is playing a very important role in the preservation of quality wildlife habitat, and local governments would be well advised to work with the private sector in order to increase effectiveness and leverage resources. Frequently, private-sector partners are not subject to some of the time-consuming procedural requirements that slow down local government. In other cases, they are able to mobilize resources faster than local government. Those factors can make the difference between a successful or unsuccessful project to protect threatened areas (Endicott 1993). In addition, an increasing number of land developers have found that they can realize more profit by including a strong conservation element than with a development project that disregards the importance of the natural environment (Faraca 1986). This attitude also creates the possibility of effective conservation partnerships.

Land Trusts

Private land trusts are nonprofit land-owning and managing organizations, and they are playing an increasingly important role in land conservation throughout the United States. While land trusts have no powers to regulate land, they use a broad array of other preservation strategies and can be valuable partners. For example, where government budgets do not have enough money to acquire critical tracts in a given time frame, land trusts may be able to purchase and hold the property for future government acquisition. In addition, private land trusts can sometimes be good partners in wildlife habitat protection because they can work effectively with private landowners. This is true, in part, because the involvement of a land trust often creates possibilities for tax incentives and, in part, because landowners may be wary of working with the government itself.

Often, the pairing of governmental regulatory powers and land trust financial resources can be beneficial to both groups. Land trusts can also provide significant cost savings in land acquisition efforts.

As tax-exempt charitable organizations, land trusts may acquire lands through charitable donations or bargain sales, which may prove advantageous to the selling landowners because they obtain tax deductions. Landowners can reduce their income and estate tax burdens and keep their property intact to pass on to the next generation for agricultural and other open space purposes. If a land trust then resells such low-cost acquisitions to the government, the trust may be able to recoup its own costs while still helping the government realize considerable savings. In addition to purchases in fee simple, land trusts can also use the development rights acquisition or easement programs, and the sellback and leaseback techniques described above.

Relying on private land trusts to help achieve public habitat objectives does have some potential disadvantages, however. The objectives of the land trust may change over time and may come to differ from the city or county objectives before the government has had time to purchase the land in question. Some land trusts may not have adequate staff and resources to administer significant land holdings or may not manage them as the local government might wish. Finally, some land trusts may permit or deny public access to properties they own or manage when the local government would have preferred just the opposite for wildlife habitat reasons.

Limited Conservation Development

The outright purchase of habitat land or development rights is not the only way in which landowners and private entities can promote habitat protection. Increasingly, developers and nonprofit conservation organizations are promoting the limited development of land in ways that can still protect extensive tracts of open space and wildlife resources. Some of these limited developments have been undertaken by conservation organizations that recoup the cost of sensitive lands and open space they have purchased by allowing limited, carefully sited development on a small portion of a parcel.

Limited conservation development projects have several advantages as habitat protection tools. They can protect land without direct government regulatory involvement, although tax incentives are sometimes necessary. In addition, private land conservation organizations can sometimes react to growth pressures more quickly than governments, since there is no need to follow statutory procedures, hold hearings, or hold elections to raise acquisition funds. One disadvantage is that private cluster development initiatives may tend to protect land on a fragmented basis with no regional vision. For example, the land protected may be the most beautiful but not the most important wildlife habitat, or it may be located so that it is not contiguous with an adjacent habitat area. By working with the sponsoring land trust or nonprofit to include wildlife goals, however, this problem can often be solved.

Industrial Restoration Showcase Projects

The rise in environmental litigation backed by serious penalties under federal environmental protection laws has caught the attention of many large industrial companies and utilities. Some of those organizations are now implementing expensive reclamation and restoration projects, and are using large advertising budgets to let the public know about their efforts. They want America to know that they have restored former hazardous waste sites and other environmental disaster areas to the status of a healthy natural environment. In some cases, habitat protection or restoration has been explicitly emphasized. The creation of new, high-quality habitat is a win-win solution to a cleanup problem, since it also allows the industry to create a reuse that does not require clean up of the land to standards acceptable for human occupation. The reuse plan for the Rocky Mountain Arsenal near Denver took advantage of just such an opportunity. By agreeing to habitat use, the state government and those responsible for the pollution were able to move forward with cleanup efforts faster and enhance what is clearly a premier habitat area.

These industry efforts should be applauded by the public, and towns, cities, and counties should be aware of them and should look for opportunities to work with local industries on restoration of former sites into significant habitat areas. The companies that are participating in restoration projects are providing the technology and resources that help to correct the environmental damage of past decades. Because these efforts are being achieved with today's dollars, advertising is often needed to convince America that there is a justification for the significantly increased costs in utilities, services, and retail products. Local government assistance in spreading the word about these projects can be very valuable to the industries involved.

Projects that restore or enhance environmentally damaged areas enjoy widespread public support, whether they are court-imposed or are a voluntary effort to prevent fines or litigation. Many efforts focus

Power Plants and Striped Bass: Restocking Chesapeake Bay

A good illustration of a utility project that benefits wildlife is the use of heated water discharge from a power plant in the Baltimore area to raise striped bass for later stocking of the Chesapeake Bay (Kraeuter et al. 1986). The striped bass was selected for a pilot aquaculture facility because it is well-adapted to the conditions of the Chesapeake Bay, is an important food and sport fish in the area, and was suffering a severe decline in population. The striped bass is also the Maryland state fish and is looked upon as a symbol of the quality of life in the bay region. The sponsoring utility company received recognition for its efforts to improve the striped bass population, and the project emphasized the company's goals of putting waste resources to a good end and minimizing the impact of power production on the environment.

Limited Conservation Development: Four Success Stories

Mill Hollow is one of the first and most successful efforts at limited conservation development. The project was undertaken by the Philadelphia Natural Lands Trust. The owner of a 70-acre property known as Mill Hollow approached the Trust to assist with the conservation of his property. The land was a large estate with a historic home in an area subject to development pressure near Philadelphia. It contained 40 acres of undisturbed woodland in addition to the main home, several smaller houses, and a barn. The owner wanted to preserve the property, remain on the land, and meet certain financial goals. Working with the owner, the Trust came up with a conservation development plan that called for spinning off the 40-acre woodland and conveying it to the Trust. The remainder of property was then subdivided into six parcels ranging from 1.5 to 15.7 acres. The original plan called for the owner to retain the main residence and the 15.7-acre parcel. The rest of the land was offered as a single parcel for $1.4 million or individual lots with a total price exceeding the $1.4 million figure. In addition to the land donation, the stream valley on the property was subject to a conservation easement and architectural controls were placed on home/building construction. The donated parcel would be managed by the Trust with a percentage of each sale donated to the nonprofit to support property management. One parcel was sold early to cover expenses, and the remainder were then sold to a single buyer for $980,000.

The Evans Ranch is a scenic 3,243-acre parcel located nine miles west of Evergreen, Colorado, at the base of Mount Evans. The property is bordered by the Arapahoe National Forest, Mount Evans Wilderness Area, and the Colorado Elk Management Preserve. The Evans Ranch provides a natural habitat for a large elk herd, mountain lion, mountain goat, black bear and cougar, as well as for many smaller wildlife species. Large areas of the ranch are forested with Colorado blue spruce, Engleman spruce, Douglas fir, ponderosa pine, lodgepole pine, quaking aspen, cottonwood, and willow. The property contains five valleys, each with meadows and a trout stream, surrounded by forested, rocky slopes and ridge lines.

The Evans family heirs wanted to sell the property, which was zoned for two-acre residential lots under the county master plan, but wanted to preserve the ranch through limited development. Colorado Open Lands, a nonprofit conservation organization, purchased the ranch in 1984 for $4.5 million. To recoup the purchase price and preserve the property, the organization divided the ranch into five parcels ranging from 532 to 594 acres, each defined by a valley and the surrounding mountain slopes. A central parcel of 131 acres containing the original homestead was reserved for common use by all five property owners. Each ranch parcel has several restrictions, including a 40-acre homesite envelope and a one-unit development limitation. Each owner has a recreational easement over the other four ranches. In addition, the purchase of a parcel gave each owner a 20 percent interest in the 131-acre parcel (the ranch headquarters) that is organized as a corporation and used as the management entity and security checkpoint for the entire ranch. An annual assessment paid to the ranch headquarters corporation provides capital for the ranch operation and management. The five ranch parcels were priced at $1.6 million each. Three were sold within the first year for $1.5 million, and the other two parcels were sold shortly afterward.

on entire ecosystems and some projects have been instrumental in developing advancements in wildlife biology that can be applied in other situations. Because of this important role, the participation of industries and utility companies should not be overlooked in local and regional wildlife habitat programs (Liu 1990).

INTERGOVERNMENTAL AGREEMENTS

The boundaries of important wildlife habitat areas almost never coincide with the political boundaries of cities, counties, or towns. Effective protection of the habitat will therefore often require significant cooperation between jurisdictions. The most effective way to formalize that cooperation is through the use of intergovernmental agreements (IGAs). Although they are often time consuming to negotiate, execute, and manage, IGAs are usually well worth the effort because they result in a shared value system and a shared control system. The discussion that goes into the creation of those systems helps emphasize the importance of wildlife issues, and the resulting IGAs are often more resistant to change than the policy of a single government. Because they can address an entire county, valley, or transportation corridor, IGAs are usually considered to be a landscape-scale protection tool.

IGAs have several advantages as wildlife protection tools. They are negotiated voluntarily, so that local governments do not feel coerced into participating. Because they are freely negotiated and are only adopted when consensus has been reached, they may be easier to enforce than county or regional plans adopted without strong consensus. IGAs can specifically address a wide variety of growth management issues and can generally strengthen the working relationships between local governments. One disadvantage of IGAs is that they sometimes do not have effective enforcement mechanisms. Local governments are often reluctant to agree to the inclusion of specific enforcement tools that could be used against them and are also reluctant to use the courts to try to enforce the contract against another signatory government.

EDUCATION, CITIZEN INVOLVEMENT, AND TECHNICAL ASSISTANCE

Training and Information Programs

Educational and informational programs are often an overlooked element of successful wildlife habitat protection efforts. Many states have established technical assistance programs within their state agency structures.

Four Success Stories (continued)

Upper Elk River Valley is one of the most interesting and promising private conservation initiatives. The scenic Upper Elk River Valley is about 18 miles north of Steamboat Springs, Colorado. Here, a group of ranchers who own most of the valley have joined together with the assistance of the American Farmland Trust and have developed a compact that sets forth principles to protect the valley and its ranching way of life. The major goal of the compact is to protect the special rural character of this remarkable landscape while maintaining a viable agricultural economy. Rather than traditional patterns of suburban or large-lot 35-acre subdivisions, the compact envisions a very small amount of "protective development" that guides new growth away from the best of the valley's agricultural and forest lands. It allows for limited residential development that has minimal agricultural or visual impact, and offers landowners the ability to sell some land for homes for their families or vacation residences without adversely affecting agricultural and low-impact recreational opportunities.

To implement the plan, several of the valley's ranchers have donated conservation easements to the American Farmland Trust, taking income tax deductions in the process and reducing inheritance taxes in the future. These easements ensure that the ranches will forever stay in agricultural use. Instead of giving up all their rights to develop, they have reserved a few homesites that will be very valuable. When the landowner needs to send a child to college or pay for new equipment, he or she has homesite assets to sell instead of having to break up productive agricultural land.

Phantom Canyon Ranch exemplifies private cluster development initiatives. It is located in Colorado near the Wyoming border. This is a joint project with the Nature Conservancy to preserve the Phantom Canyon and provide homesite and working ranches surrounding the canyon with covenants and restrictions designed to preserve the unique values of the area. The project includes over 16,000 acres, of which 2,715 acres are in the Phantom Canyon Conservation Area. The original project design included four working ranches ranging from 800 to 1,200 acres and 11 subparcels that each include several homesites. The plan designated homesites according to specific criteria relating to privacy and physical characteristics, such as ridgelines, hills and woodlands, wildlife habitat, and other elements. Each designated building site consists of a 100,000-square-foot building envelope that is purchased in fee simple. Purchase of a homesite also includes an undivided acreage equivalent interest in the larger subparcel.

The Phantom Canyon Conservation Area consists of four separate parcels. The central canyon area is a Nature Conservancy Preserve including 1,120 acres. In addition, there is a Nature Conservancy easement on 480 acres preserved as private wild and scenic open space for the exclusive use of the owners of Phantom Canyon Ranches. This parcel provides superb trout fishing and natural beauty. The Canyon Common Land greenbelt area consists of 840 acres, and the Halligan Reservoir common area includes 275 acres.

For instance, Colorado, through its division of local affairs and other agencies, maintains eight regional offices and a core staff that offers local governments advice on issues of land-use and growth management. The division sponsors a series of regional summer workshops that often cover recent developments in land- use planning and law. While impressive in terms of scope and output, this technical assistance program has a very small budget and small staff.

Other institutions in a state, like university extension programs and the local chapter of the American Planning Association, also offer technical assistance, educational workshops, and publications geared to assisting local governments in land-use planning and open space/habitat protection. Nationally, APA's Planning Advisory Service offers ordinances, plans, and other information related to managing development for people and wildlife. Finally, the local chapters of the Urban Land Institute (ULI) and the National Association of Home Builders (NAHB) hold educational workshops and conferences on quality development techniques for their members.

In some jurisdictions, there is also a significant effort to keep private landowners informed of the range of land conservation incentives and other programs available to them to encourage habitat protection. For example, where a plan attempts to prevent undesirable development by maintaining existing agricultural uses, the landowners' understanding of tax relief programs, easement sale or donation options, and conservation reserve and wetlands reserve subsidies furthers the objectives of the plan. Successful public education programs have included manuals summarizing different programs that can help landowners to understand the rules, benefits, and relief offered to promote wildlife goals.

Educational programs are essential to a successful wildlife habitat protection program and can develop significant interest in participation. Programs should make a special effort to involve children and to design learning experiences that complement the development of a broad wildlife and natural resource perspective (Schicker 1986).

Citizen Participation

Another form of effective education is direct citizen involvement in the habitat protection program. Direct citizen involvement can also stretch scarce public funds through the use of volunteer help. Lack of funding and other resources to effectively implement a program is

Intergovernmental Agreements (IGAs): Colorado Examples

There are several good examples of the use of Intergovernmental Agreements (IGAs) to pursue joint planning goals in Colorado. Aspen and Pitkin County have used intergovernmental powers to form a joint planning agency. Similarly, the City of Boulder and Boulder County have used an IGA to preserve open spaces around the city. One of the key aspects of that agreement provides that new development will occur only in those areas where the city and county agree to provide urban services. This application of capital improvement policies in a regional IGA has effectively preserved open areas, including strategic vistas, recreational areas, and entrance corridors around Boulder while directing urban-scale development to the urbanized core of the city. The same tool could be used to protect wildlife habitat areas that are important to more than one government.

In addition, beginning in the early 1980s, the City of Durango and La Plata County executed a series of IGAs related to joint planning activities. The agreements provide for joint review of subdivision requests in designated areas and restrictions on annexation in some areas where joint land-use and development plans have been adopted. The Town of Berthoud and Larimer County in 1994 entered into an interim IGA in which the two jurisdictions agreed to develop a joint land-use plan for the area surrounding Berthoud. Applying some of the basic concepts of the Boulder agreement, Berthoud and Larimer have adopted joint policies seeking to direct the spread of Berthoud's growth to designated growth areas. While this interim agreement does not contain the substance of a joint land-use plan, the agreement designates a joint planning area including and surrounding the town. It also provides a procedural mechanism requiring the county to refer land-use decisions pending in the joint planning area to the town and to justify land-use decisions that are contrary to the town's recommendations. Finally, the agreement makes the IGA mutually enforceable in court.

A recently executed IGA involving Boulder County and the communities of Lafayette and Erie breaks new ground in the protection of open space. The agreement helped settle lawsuits that had been filed by Boulder County and Lafayette challenging the annexation by the Town of Erie of 2,000 acres of property adjacent to the northern border of Lafayette. The agreement establishes strict density limitations on parcels within a 7,000-acre rural preservation zone and basically prohibits density increases beyond current Boulder County zoning. Future annexation requests of any parcel within the rural preservation area must be referred to the other parties for review. Certain other lands are allowed higher densities but are subject to use and design standards.

These and other IGAs aimed at open space preservation could easily be targeted to sensitive habitat areas or wildlife corridors. In fact, since the essence of a wildlife corridor is its continuation over a relatively long distance, IGAs are often critical tools for the preservation of a corridor.

Another IGA is being discussed among communities in Larimer and Weld Counties. This project managed by the City of Fort Collins aims to produce a regional open space plan that will identify open space and natural areas of regional significance that should be protected, as well as trail linkages among communities. Another goal is to evaluate existing growth patterns and development policies in the participating communities and make recommendations for changes that will result in more compact, efficient development and revised delineations for urban growth areas. Participating jurisdictions include Fort Collins, Berthoud, Evans, Greeley, Loveland, Milliken, Wellington, Windsor, Larimer County, and Weld County.

a common shortcoming of an otherwise well-planned habitat or natural resource conservation effort. Data collection and analysis is a necessary element of many programs and is the backbone of successful habitat protection. Involving citizens in the process from the beginning can reduce the administrative and financial burden and increase the public acceptance of conservation planning. Effective citizen participation is necessary to accurately gauge public opinion regarding management and implementation policies and to reduce the gap between the public's interest in wildlife protection and its knowledge of appropriate conservation measures.

Citizen participation should be initiated at the outset of a wildlife habitat protection program. Public forums help to identify common objectives and interest groups that may be able to contribute time and resources later in the process. Forums and informational meetings also develop consensus because citizens become part of the policy development and decision-making process. Forums held early in the process also help to identify special local resources that can contribute to the project.

Implementation strategies and research priorities can also be designed around available community resources. With creative planning, a wide variety of volunteers can each contribute small portions of a large project that is coordinated by the local government. Students, youth groups, and nature groups can be organized to assist in a large-scale inventory of plant and animal communities. Other civic organizations can participate in joint fund-raising efforts, and senior citizens can contribute both time and invaluable experience to a community effort (Jackson 1990).

In designing a citizen participation program, it is important to carefully develop a community strategy and to define specific information needs. The program should be flexible, so that it can be successfully marketed to reach specific target audiences. The substance, length, and extent of a program needs to be tailored to the community structure and also needs to be continually adjusted to respond to differences in desired and actual results.

Resource Inventories

Inventory programs that identify critical environmental and wildlife resources can be invaluable in educating the public and landowners about where development should and should not occur. There are a number of good examples at all levels of government and in the private sector that demonstrate the value of resource inventories.

Many local governments around the nation are undertaking inventories as they prepare comprehensive plans and growth management regulations. In San Diego County, a consortium of 10 separate jurisdictions has undertaken a large Habitat Conservation Program that involves extensive inventory work including computerized mapping of habitat for about 100 of more than 300 species considered sensitive in southern California. Project coordination has involved establishing a common system for classifying vegetation and a consistent model for evaluating habitat to be used by all participating groups. The model classifies habitat as either very high quality, high quality, medium quality, or low quality based on vegetation types, sensitive species, connectivity, and other factors. The most important result of this inventory effort has been the production of a "gap" analysis that identifies gaps in regulatory protection of sensitive habitat. (See Appendix B.)

In Colorado, there is increasing use of inventories in the local land planning process. For example, Teller County has incorporated the Colorado Division of Wildlife maps in a natural resource zoning ordinance that identifies high, moderate, and low areas of potential wildlife impact. Summit County has also worked closely with the Division of Wildlife in a pilot program to produce more detailed wildlife and habitat inventory information upon which to base local development reviews.

The private sector has also been active in producing inventories. Developers are often asked to produce baseline natural resource information as part of the development review process.

Perhaps the most interesting and successful survey of natural resources is one initiated by the Nature Conservancy, a private nonprofit organization that stores and manages information on natural ecological diversity. In this effort, field workers gather data about rare plant and animal species, various types of native plant communities, and aquatic systems in a state. More than 25 states have adopted systems patterned after this program. Some communities have taken the inventories a step farther and have used them to identify sites that are off-limits to development.

ADMINISTRATIVE AND MANAGEMENT ISSUES

Local governments that initiate or expand programs for wildlife habitat protection should recognize that most programs require careful continuing management, enforcement, and monitoring. The very nature of habitat areas often means that they are far away from human activity where violations of the program or deterioration of the habitat will not be easily noticed. If a community is serious about protecting habitat, it must make a commitment to regular monitoring and careful management of the protected areas.

In addition, local governments that intend to initiate or expand a habitat protection program should have a clear understanding of the true costs of the program. Those costs usually fall into three categories: (1) planning, (2) habitat acquisition, and (3) administration, maintenance, and enforcement of habitat plans. Although actual habitat acquisition often accounts for the highest percentage of these costs, initial planning and continuing management are crucial to program success, and it would be unwise to ignore either element or its costs.

Enforcement and Monitoring

What type of enforcement and monitoring is needed will vary depending on what type of tools are included in a local protection program. Regulatory approaches can often be enforced by making sure that zoning permits, subdivision approvals, and building permits are not granted until project designs are appropriate. Even if these permit programs are working, however, they may provide little protection against careless clearing of the site at the start of development. It is very important that the local government adopt appropriate grading and construction controls, and conduct frequent site visits before and during the site preparation stage. Incentive programs can be monitored by obtaining annual reports from local government departments summarizing how many landowners use the incentives offered. Acquisition programs generally do not need specific enforcement tools, since most acquisitions are voluntary and negotiated. However, a local government that is relying on purchases to protect habitat should arrange for annual reports on the number, terms, and locations of purchases consummated. The same is true for partnerships with private-sector initiatives.

Monitoring of habitat protection programs falls into three categories. First, the local government should monitor the cumulative total of all actions taken during each year. That includes the amount and location of land protected during the year. Second, the local community should conduct at least annual site inspections of the protected areas to identify whether the

Berry Nehr, U.S. Forest Service

The red wolf became extinct in the wild before being reintroduced from captive populations.

R.J. Shallenburger, U.S. Fish & Wildlife Service

The silversword is imperiled by introduced grazers, insects, and low reproduction.

adopted design solutions, buffers, easements, and other safeguards are really protecting the quality of the area.

If a local program is successfully incorporating design solutions into new development, convincing landowners to use the incentives, and systematically acquiring critical pieces of land, but the quality of the habitat is still eroding, something must change. Third, the city or county should monitor whether the program is actually achieving its wildlife goals. If the goal was to increase the geographical range of certain species, is that happening? If the goal was to protect a rare species, are its numbers increasing or declining? This will require a close working relationship with state division of wildlife and may involve collecting wildlife and habitat information over time related to:

- how the wildlife are using different parts of the habitat;
- how certain land uses have affected individual wildlife species, individual plant species, individual habitat components of the wildlife community, and entire wildlife communities;
- how natural environmental conditions have caused species or habitat change; and
- how accurate the models used to predict wildlife and habitat models have proven to be (Jones 1995).

Habitat Management and Maintenance

There are two important types of change in wildlife habitat. The first type is the alteration of land that results from developing it for human uses (e.g., the construction of a residential subdivision). Many habitat protection efforts are aimed at modifying this source of change. While such efforts are often a necessary part of protecting habitat, they may not be sufficient because the second type of change in habitat occurs even when human influences are excluded. Even "protected" grasslands are invaded by shrubs. For example, stands of aspen trees gradually change to stands of conifers, and cottonwood groves age and fail to regenerate. If these sorts of "natural" changes degrade habitat for species that the community wants to protect, such changes must be opposed by active management to maintain the habitat.

For example, Waterton Canyon State Park in Colorado offers important year-round habitat for a population of bighorn sheep. The sheep rely on the canyon's grassy areas for feeding because the openness of these areas provides greater security to bighorns than the "closed-in" shrub lands. However, in the absence of fire, grass patches are taken over by shrubs, and eventually the entire canyon would become less suitable for the bighorn population. As a result, active management of the canyon by people is needed to preserve its value for wildlife. Such management includes prescribed burns and the cutting and removal of shrubs.

Planning for habitat protection must anticipate those actions needed to preserve the natural features that made an area desirable to protect in the first place. Local governments should consult with ecologists and wildlife biologists to develop and execute habitat management plans for protected areas. In addition, communities interested in protecting wildlife habitat should not forget to plan and budget for the costs of managing and maintaining habitat after it is acquired or protected.

Management Finance

Enforcement, monitoring, and management of habitat protection programs require staff time and money. Often, the total cost will be only a small fraction of a city or county budget, but it needs to be included in the total anticipated expense of the program. As a practical matter, it is difficult to isolate the cost of incorporating wildlife protection tools into most regulatory approaches because habitat protection issues are reviewed at the same time that roads, utilities, drainage, and other development requirements are reviewed as part of a subdivision or site plan. The same is true for incentive programs because they are often used as part of overall development approvals. On the other hand, it is fairly easy to isolate the ongoing costs of managing land that is acquired or protected.

Cities and counties typically have several sources of revenue available to cover the management costs of habitat protection programs. If the jurisdiction is not large, it may be possible to pay the expenses from the general fund. On the other hand, if the additional costs of reviewing development applications to verify required habitat protections can be isolated, it could be added to the city or county's development review fee structure. Where bond issues are planned to raise money for the purchase of habitat land or development rights or to conduct an educational campaign, the administrative and management costs of the program can be included into the amount of the bond issue. Similarly, if potential tax increases are on the ballot for open space, the administrative costs of the program can be included in the calculation of that tax increase. If donations of land are accepted and the donor receives a tax benefit, the donor can sometimes be required to grant a stewardship endowment to offset the costs of managing the land. Finally, some states have programs that offer funding and technical assistance for habitat improvement.

Chapter 5. Legal Issues

ENABLING AUTHORITY

Before beginning to draft local statutes or regulations to protect habitat areas, local governments must always consider whether they have been granted enabling authority to engage in specific activities by the state legislature. Authority for most local government programs comes from three possible sources:

1. General home rule powers;
2. Specific enabling statutes; or
3. Implied authority from general land-use planning, zoning, and subdivision laws.

In some cases, if the general intent to protect wildlife or natural resources is already present in an existing land-use control ordinance, it may be more effective to modify management and policy objectives than to adopt a completely new ordinance to address wildlife concerns. In some cases, it may be possible to amend administrative regulations to achieve the same result as a zoning change. If numerous zoning amendments would be too time consuming or difficult, another alternative might be to wait until the current ordinance is revised for other purposes and then incorporate specific language regarding wildlife protection at that time.

Home Rule Powers

One of the most important concepts in local government planning and regulatory powers is the difference between a "home rule" government and a "statutory" government. A local government's land-use authority within its jurisdictional limits may depend on whether it is: (1) a home rule city, (2) a home rule town, (3) a statutory city, (4) a statutory town, (5) a home rule county, or (6) a statutory county. In general, the larger the population of a city, town, or county, the more likely it is to adopt a home rule form of government if it is available.

As a rule, statutory governments have only those powers explicitly given to them by state law, and those grants of power are often narrowly construed. Cities, towns, and counties that choose to exercise home rule powers may create their own charter, ordinances, and laws on "matters of local concern." The powers of home rule counties are usually set forth in more detail than those for home rule cities, and they may exercise their powers only in unincorporated areas of the county.

Although home rule governments may typically acquire broader powers than statutory governments, there are two important limitations on home rule powers. The first is that a home rule city, town, or county generally has the power to supersede state law only where the matter in question is of local concern. The state's legislature and the courts typically divide governmental matters into three categories: (1) those of purely local concern, (2) those of statewide concern, and (3) those of mixed local and statewide concern. The lines between these categories are seldom clear. Whether a particular matter is of local, mixed, or statewide concern is often contested and is generally decided on a case-by-case basis. Both the state and local legislatures may regulate matters of mixed concern as long as there is no conflict between the enactments of the two levels of government. If there is a conflict, state legislation will supersede local legislation in these mixed areas.

The second limitation is that home rule governments are often bound by the provisions of the state statutes to the same extent as statutory municipalities unless and until they adopt charter or ordinance provisions creating different rules or procedures. If the home rule government has not adopted legislation on a particular matter, the state statutes on that topic may govern its powers.

Zoning is usually determined to be a matter of local concern except in specific circumstances where state statutes explicitly provide otherwise. For instance, in the area of wildlife protection, Colorado has clearly adopted a statewide system of protection administered by the Division of Wildlife, but it has also empowered local governments to address wildlife and habitat issues through other statutes. Therefore, protection of wildlife habitat would probably be held by the courts to be a "matter of mixed state and local concern" in which local regulations will be upheld as long as they are not inconsistent with state law. Enabling acts in other states often have similarly broad language. A small number of states specifically authorize planning and land-use regulation to protect wildlife habitat per se,

which gives a stronger foundation to such activities and broadens the possibility of implied powers. In contrast, states like California and Florida have created specific statutory schemes to address wildlife protection in the planning process. Even in these states, however, the state government seldom intends to preempt the entire field of wildlife protection, and local governments generally have the power to address habitat issues as long as they do not act inconsistently with state law.

Statutory Planning and Zoning Powers

Statutory cities, towns, and counties. Basic planning powers for statutory cities, towns, and counties are found in state enabling legislation. In Colorado, for instance, it is the duty of the planning commission to make and adopt a master plan for the physical development of the territory within the municipal boundaries. More particularly, the commission is directed to develop a master plan for the general purpose of "guiding and accomplishing a coordinated, adjusted and harmonious development of the territory within the municipality, which, in accordance with present and future needs, will best promote the public health, safety, morals, order, convenience, prosperity and general welfare [of the citizens] (C.R.S. Sec. 31-23-207).

Zoning can be a powerful habitat protection tool at both the landscape level and the site level. A minority of states have adopted modern zoning enabling acts that grant different levels of zoning control in different contexts. The majority of states still have zoning enabling acts based on the "model acts" of the 1920s.

Zoning is an aspect of a local government's "police power," which is the power to regulate activities in order to protect the public health, safety, and general welfare. Those terms are broad enough to encompass zoning to protect wildlife habitat. For example, the Colorado legislature has granted that state's cities and towns the authority to regulate and restrict the height, number of stories, and size of buildings and other structures, the percentage of a lot that may be occupied, the size of lots and open spaces, the density of population, the height and location of trees and other vegetation, the location and use of buildings, structures and land, and the uses allowed along any stormwater channel or basin designated and approved by the Colorado water conservation board. The provisions on regulating uses and structures, protecting trees and vegetation, and controlling uses along any flood channel can all be used as authority to regulate land for habitat protection. In many states, specific regulations can override more general zoning regulations. Therefore, special regulations aimed directly at wildlife protection can sometimes be used to create a higher level of protection for both animals and habitat, provided that the statutory government can find authority for those regulations.

Robert Reed, U.S. Fish & Wildlife Service

The northern wild monkshood is threatened by a restrictive habitat that requires cold, humid sites in deep shade.

State regulatory schemes. In searching for sources of authority to regulate land for habitat protection, local governments should give particular attention to state regulatory schemes that may, first, grant specific regulatory powers to protect wildlife or, secondly, impose restrictions on the scope of all land-use powers. For example, the Colorado general assembly has adopted two land regulatory schemes that could limit the ability to use zoning powers to protect habitat. First, the state oil and gas conservation commission has been granted authority to regulate the drilling of oil and gas wells in the state and to encourage the development of oil and gas resources. The Colorado Supreme Court has held that this means that local governments—even home rule cities—cannot prohibit all oil and gas drilling within their boundaries but may still regulate the location of drilling activities in ways that do not usurp the authority of the oil and gas commission.

Similarly, the Colorado Mined Land Reclamation Act governs the issuance of mining permits throughout the state but does not preempt local governments from all regulation in that field. The Colorado Supreme Court has held that an applicant who has successfully obtained a mining permit from the mined land reclamation board must still comply with local zoning regulations before mining can proceed. Land designated as potentially having commercial mineral deposits need not be rezoned to allow mining activities if site conditions or impacts make that use inappropriate, and a denial of rezoning in that situation has been upheld against a challenge that it would exclude a legal industry.

Statutory Subdivision Powers

Subdivision powers are a powerful tool available to most local governments to control the creation of buildable lots at the landscape level and design and character of those lots at the site level. When used in concert with appropriate zoning, subdivision powers can help direct development away from important habitat areas or require sensitive incorporation of habitat areas into development.

Although traditional subdivision enabling acts did not mention wildlife habitat protection as a purpose for regulation, more modern statutes may do so. Again, language authorizing the use of subdivision powers to protect "natural resources" or "sensitive lands" can often be used for wildlife habitat purposes.

In general, state enabling acts often describe both procedural and substantive requirements that must be met in order for statutory cities and towns to exercise subdivision control powers. These statutes often call for a three-stage process requiring the landowner to submit

Habitat Protection Planning and Areas of Critical State Concern

APA has undertaken a multiyear project, Growing Smart℠, that will lead to a set of model state statutes to modernize land-use planning and zoning so that all levels of government can better manage change and address quality-of-life issues. One of those statutes addresses areas of critical state concern (APA 1996, 5-23 to 5-43). The APA model incorporates a general enabling statute that could be applied on a statewide basis, but only after the state government adopted a "state land development plan" that contains goals, policies, and guidelines to provide a framework and priorities for the administration of the program. The following paragraphs explain in more detail how the statutes addressing areas of critical state concern would incorporate the goal of habitat protection.

State-administered critical areas programs:

- identify and designate all large tracts of land that are "critical" to the environmental health of the state, or represent some other critical resource, such as regions of the state that have special historic or archaeological significance or possess scenic beauty; and
- institute regulations to protect those designated areas from unnecessary exploitation (see Kusler 1980 for an excellent overview of land-use controls in environmentally sensitive areas, including a discussion of program design, definition of areas, formulation of development standards, and governmental roles).

The state intervenes to protect these areas because, in some cases, local governments may otherwise allow development to occur in order to increase their local tax base, in the process forgetting or ignoring the damage to the environment that results (Mandelker 1976, 66). Also, local governments—especially the smaller ones—may not have the technical capability or resources to manage such a program on their own. In other cases, it may be the local government itself that has initiated the designation process with the state; as biological communities are not based on political boundaries, the regulation of development in the tracts of land that constitute a critical area thus become an interjurisdictional issue that no one governmental unit can solve by itself.

A state that employs the critical areas concept typically carries out its program in one of two ways.

1. The state conducts a study and applies statutory criteria to a particular area to determine whether it satisfies the standards for designation. This mechanism, which involves the establishment of a comprehensive statewide system, is based on the American Law Institute's *A Model Land Development Code* (ALI 1976). Several states have employed this approach, including Colorado, Florida, Minnesota, Nevada, Oregon, and Wyoming.
2. The state establishes a special program directed at a certain area of the state (e.g., coastal zones). This has been characterized as an "ad hoc" approach and has been used in states that include California, Massachusetts, New Jersey (for the Pinelands area), New York (for the 6-million-acre Adirondack Park region), North Carolina, Virginia, and Maryland (for the Chesapeake Bay programs) (Malone 1994, Sec. 13.01).

Once the designation has been made under such programs, the state formulates a comprehensive management plan or specific set of controls to advance or protect state interests. Development in the area is then subject to the management plan and regulations based on the plan or the special set of controls. The state may regulate the development directly or it may delegate authority to local governments that have fulfilled certain requirements under the statute (e.g., such as obtaining certification from the state of local development regulations as meeting the objectives of designation). The program may also be accompanied by purchase of land and interests in land.

Section 5-203 of the model statutes permits the designation of habitat conservation areas as one type of critical area. Key provisions are shown in ***boldface italic***.

5-203 Criteria for Designation of Areas of Critical State Concern

An area of critical state concern may be designated only for the following:

(1) an area containing or having significant impact upon environmental or natural resources of local, regional, or statewide importance, including, but not limited to, federal or state parks, forests, wildlife refuges, wilderness areas, aquatic preserves, ***areas of critical habitat for federally and/or state-designated endangered or threatened species***, rivers, [frequently-flooded areas], lakes, estuaries, aquifer recharge areas, geologically hazardous areas, and other environmentally sensitive areas in the state, the uncontrolled private or public development of which would cause substantial deterioration or loss of such resources or a substantial threat to the public health and safety. Specific criteria that shall be considered in designating an area of critical state concern for such purposes shall include:

(a) whether the ecological value of the area, as determined by the biological and physical components of the environmental system, is of substantial regional or statewide significance;

(b) whether the area contains designated critical habitat of any state or federally designated threatened or endangered plant or animal species [or other species of special state concern];

(c) whether the area contains a unique, ecologically sensitive, or valuable ecosystem or combination of ecosystems;

(d) whether the area contains plant and animal communities whose loss or decline would negatively affect regional, state, or national biodiversity;

(e) whether the area is susceptible to significant natural hazards, including, but not limited to, fires, floods, earthquakes, landslides, erosion, and droughts that would affect existing or planned development within it;

(f) whether the area is susceptible to substantial development due to its geographic location or natural aesthetic qualities; and/or

(g) whether an existing or planned substantial development within the area will have a significant and deleterious impact on any or all of the environmental or natural resources of the area which may be of regional or statewide importance.

Stuart Meck, AICP, Principal Investigator, Growing Smart℠

E. LaVern Smith, U.S. Fish & Wildlife Service

Chapman's rhododendron, a Florida shrub, is being threatened by deforestation and collectors.

first a sketch plan, then a preliminary plat, and then a final plat. Different information and application materials are required at each stage. Applications are generally referred to related departments and agencies for comment, a public hearing is held before the planning commission and/or city council, and a decision is made to approve, disapprove, or approve the plat with modifications.

Enabling acts often allow local governments to establish local standards controlling some or all of the following: the physical characteristics of the site; soil and hazard conditions; lot areas, frontages, and layout; infrastructure design and quality; storm drainage design and quality; adequacy of water supply; street layouts and quality; land dedications or cash payments for park and school lands; and assurances that required site improvements will be completed. Many statutes are broad enough to allow local governments to add requirements and detail specific to local needs, and many habitat concerns can therefore be incorporated into subdivision standards.

From the point of view of habitat protection, the authority to require land dedications during the subdivision process is very important. Since there is often explicit authority for local governments to require land dedications for parks, it may be possible to designate wildlife habitat areas for dedication as part of the new development. Local governments should be aware, however, that there has been much recent litigation on the topic of land dedications, and that courts are increasingly requiring that local governments be able to defend their requirements in light of the anticipated impact of the proposed development. The test of appropriateness is whether the proposed development creates wildlife impacts that they should be required to mitigate—not whether their land contains wildlife habitat that the local government would like to protect. This complex topic is discussed in more detail in the section on takings below.

Even though zoning and subdivision statutes based on the "standard acts" of the 1920s can often be construed to allow habitat protection measures, local governments would be wise to search for other "special" acts that may grant more direct authority. The focus and coverage of these acts varies widely from state to state. Examples include acts addressing:

- environmental quality;
- areas and activities of statewide interest;
- developments of regional impact;
- watershed protection;
- protection for native vegetation;
- protection for sensitive lands;
- growth management techniques; or
- preservation of agricultural lands.

These and other acts should be carefully reviewed to see whether the additional planning or regulatory authority that they grant to local governments can be used to protect habitat.

Enabling Authority for IGAs

The authority to enter into binding agreements with other local governments is very important for habitat protection. Often, the only way to avoid destructive competition for tax base or the interruption of continuous wildlife corridors is for two or more governments to agree on their approach to such areas. As an example, the Colorado general assembly has adopted statutes both encouraging intergovernmental cooperation and providing a legal basis for intergovernmental agreements. Under the terms of those statutes, all local governmental entities in Colorado are encouraged "to make the most efficient and effective use of their powers and responsibilities by cooperating with and contracting with" other local governmental entities. Local governmental entities are empowered to contract with one another to provide any function, service, or facility that each entity is lawfully authorized to provide. Such contracts may provide for the joint exercise of power to provide the function, service, or facility or may establish a separate legal entity to do so.

Colorado's local governments also have a specific legal basis for intergovernmental agreements on land-use issues. More specifically, "local governments are authorized and encouraged to cooperate or contract with other units of government. . .for the purposes of planning or regulating the development of land including, but not limited to, the joint exercise of planning, zoning, subdivision, building, and related regulations." In addition, "local governments may provide through intergovernmental agreements for the joint adoption by the governing bodies, after notice and hearing, of mutually binding and enforceable comprehensive development plans for areas within their jurisdictions." Finally, "a comprehensive development plan may contain master plans, zoning plans, subdivision regulations, and building code, permit, and other land use standards, which, if set out in specific detail, may be in lieu of such regulations or ordinances of the local governments" (C.R.S. Secs. 29-20-105(2)(a) and (b)). Local governments in other states should learn whether similar statutes on cooperation exist and should make use of them if they do.

INTENT STATEMENTS

Regulations designed to protect habitat areas should include clear statements of the intent of the regulation. Where specific enabling statutes have not been enacted,

the validity of an ordinance sometimes turns on whether its stated purpose is one that is authorized under some general land-use law of the state. For statutory cities and counties, care should be taken to clearly articulate the purpose of the regulation and to tie it to specific language in the state planning, zoning, or subdivision statutes.

DUE PROCESS AND A RATIONAL BASIS

Local governments interested in adopting regulations to protect wildlife habitat areas should be careful that both the regulation and the process by which it is adopted comply with constitutional requirements for due process. In addition, they should make sure that there is a rational connection between the goal that they want to achieve and the techniques that they choose to pursue it.

Procedural and Substantive Due Process

The 14th Amendment to the U.S. Constitution states "nor shall any state deprive any person of life, liberty, or property, without due process of law." A similar standard of conduct applies to the federal government's actions because of language in the 5th Amendment. In practice, the concept of due process is sometimes divided into "procedural due process" and "substantive due process."

Procedural due process concerns the *mechanisms* by which the local government adopts the regulation in question. The three most important elements of procedural due process are (1) what kind of notice is required to the public, (2) what type of a hearing is required, if any, and (3) what principles shall guide the decision making to ensure that it is fair and informed (White and Edmonson 1994). Frequently, a state statute or the home rule charter of a city, town, or county will state what type of notice is required, whether a hearing is required, and if so, what type of hearing. For example, the state enabling acts for zoning and subdivisions of land require both notices and hearings before adoption of a new regulation applicable to land.

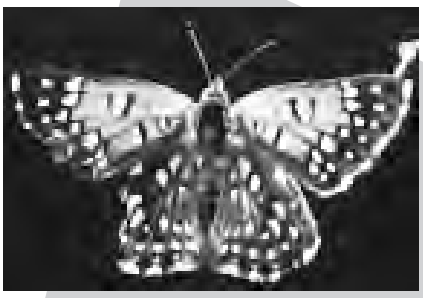
Local governments should be aware, however, that the procedural due process requirements may be higher when they are considering the rezoning, subdivision, or regulation of a specific parcel or parcels of land than when they are adopting a text or map applicable to the community in general. Actions related to specific pieces of land are often termed "quasi-judicial" acts of government, while the making of general laws is referred to as a "legislative" act. Governments are often held to higher standards regarding notice, hearings, record-keeping, official findings, and sometimes cross-examination and rebuttal, when they act quasi-judicially. Since many overlay districts, rezonings, subdivision approvals, and development agreements affect specific parcels of property, local governments should be particularly careful to abide by all required procedures when adopting or approving them. In recent years, one of the most common techniques used to challenge a new governmental regulation or land-use approval has been to find a procedural flaw in the adoption process.

In addition, local government officials should be careful to make fair and informed decisions on the regulations proposed for adoption. Members of planning commissions, county commissions, or town or city councils with any interest in the property that would be affected by a quasi-judicial action should be careful to let that be known at the start of the meeting and should generally leave the room and avoid taking part in the discussion or voting on the matter. In some instances, where the connection with the land in question is remote or indirect, merely disclosing the matter may be enough. A general rule is that any potential conflict of interest, no matter how remote, should be disclosed, and that the city or county attorney can then provide advice on whether to abstain from discussion and voting.

Another general rule is to avoid talking with either the proponents or opponents of a particular site-specific regulation before the hearing. One hallmark of fair decision making about a specific person's property is that the decision is based on testimony that is heard by all sides at the same time, so that there is an effective ability to question assumptions and misstatements made by either side. The prohibition on discussing the substance of proposed regulations has generally been held not to prohibit discussing the matter with city or county staff members, however. In addition, when discussing a general policy or a legislative act applicable to a wide class of properties or people, conversations between the public and decision makers are usually allowed.

A Rational Basis for Decisions

In contrast to procedural due process, substantive due process involves the *rationality* of the proposed decision and requires that the regulation be rationally related to the goal that the community wants to achieve. Constitutional principles of substantive due process are designed to weed out cases where the proposed regulation could not help to achieve the desired goal, even if the regulation was successful. While most local government actions meet this test, there are some well-known cases that have failed to meet it. In 1987, for example, the U.S. Supreme Court considered the case of a regulation requiring that a beachfront lot owner provide an easement along the beach in front of his house as a condition of enlarging his house. The court invalidated the requirement because it found that the easement would promote access *along* the beach, while the stated goal of the regulation was to mitigate the burden that the



Edward S. Ross, U.S. Fish & Wildlife Service

The metalmark butterfly depends on buckwheat, which is being diplaced by non-native plants.

U.S. Fish & Wildlife Service

The Florida panther is a remnant wild population, with only 30 to 50 surviving.

larger house would place on access *to* the beach. Even though access along the beach might be a good thing, it could not achieve the stated goal of the ordinance and therefore failed to meet the requirements of substantive due process (*Nollan v. California Coastal Commission*, 483 U.S. 825 (1987)). Careful drafting of proposed regulations and attention to those local land-use controls endorsed by the state legislature can almost always avoid a successful substantive due process challenge.

AVOIDING VAGUE REVIEW STANDARDS

A wildlife habitat protection ordinance must establish sufficient standards against which the zoning authority's action can be measured. An ordinance that lacks sufficient standards vests unreviewable discretion in those who must enforce the regulation and may be held invalid because it is so vague that it violates due process or because it improperly delegates legislative power. One general rule is that a land-use regulation must be sufficiently explicit so that a reasonable landowner can understand what is required to comply with the regulations and plan his or her land use accordingly. Local regulations should use clear and concise language, and should define terms so that the reader is left in little doubt as to what is required or intended.

One good example of a wildlife protection regulation with clear and defined standards comes from Summit County, Colorado. In October 1994, Summit County adopted its Wildlife Habitat Overlay District, which contains detailed language about what the planning commission and the board of county commissioners may or shall do in different circumstances. For example:

> The Planning Department *shall* incorporate the comments and recommendations received from the Division of Wildlife in the staff report to the Board of County Commissioners. The Board of County Commissioners *shall* give consideration to whether the proposal protects wildlife habitats and wildlife species from the significant adverse impacts of development. The Board of County Commissioners *may* give consideration to specific measures in the proposal that meaningfully mitigate adverse impacts on wildlife habitats and species. The Board of County Commissioners *shall* give special consideration to wildlife habitats which are determined by the Colorado Division of Wildlife to be of unique or critical value. The Board of County Commissioners *may* require special conditions or modifications of a proposal, or may deny a proposal in cases where the significant adverse impacts of a development cannot be adequately mitigated, resulting in significant adverse impact on wildlife habitat and/or wildlife species in the County (Sec. 4204.904, Summit County, Colorado, Land Use and Development Code, emphasis added).

The ordinance also defines a "significant adverse effect" on wildlife by using defined terms for "impacts on wildlife species," "impacts on wildlife habitat," "impacts on wildlife movement patterns/displacement and adaptation of wildlife populations," "uniqueness of habitat and species to Summit County," and "cumulative impacts." Each definition in turn requires consideration of up to seven different factors, each of which is defined in detail. For example:

> [T]he Planning Commission and Board of County Commissioners shall consider the following factors in determining whether or not a significant adverse impact on wildlife habitat or wildlife species in the County may occur as a result of a proposed development and the improvements necessary to serve it:
> . . .
>
> B. Impact on wildlife habitat: Elimination, reduction, and/or fragmentation of wildlife habitat to the point that the viability of an individual species is threatened in the County and the diversity of wildlife species occurring in the County is reduced. Assessment of significant adverse impact should be based on the following factors:
>
> 1. The amount of vegetation/habitat removal and/or alteration within the development site.
> 2. The amount of habitat of similar type and quality within the development site that remains contiguous.
> 3. The existing and proposed amount of lot coverage.
> 4. The existence of contiguous habitat of similar type and quality on adjoining land.
> 5. Mitigation efforts that directly address the negative effects of the proposed land use on wildlife habitat.

Other suggestions for drafting clear and defensible standards are to list the types of habitat or vegetation to be protected and to list the size of trees or vegetation that are big enough to provide effective food sources or cover.

The need for clear standards is well illustrated by experience in communities that have adopted tree and vegetation protection ordinances. Such ordinances have been upheld against claims that their standards were too vague in cases where terms like "significant adverse impact" are defined and tied to effects on water tables and noise (*Watson v. City of St. Petersburg*, 489 S.2d 138 (Fla. App. 2d.Dist. 1986)) and where limitations on tree removal were defined in terms of leaving behind a "well-distributed stand of trees" and "avoiding single openings greater than 7,500 square feet in the forest canopy" (*Town of Freeport v. Brickyard Cove Associates*, 594 A2d 556 (Me. 1991)).

On the other hand, a community that included a requirement for "harmonious" development without adopting criteria, standards, or definitions to guide the reader about what "harmonious" means in a particular context found that its regulations were overturned as

overly subjective and vague (*Morristown Road Associates v. Borough of Bernardsville*, 394 A2d 157 (N.J. Super 1978).

One good guide to drafting defensible designation and review criteria is to remember the purposes behind the constitutional protections against vagueness—to ensure that the person reading the ordinance can tell what it requires and to enable a court to review the record and see if the local government really enforced the standards adopted by the county commissioners or city council. Standards that are too vague to achieve these goals may fail judicial scrutiny.

THE TAKINGS ISSUE AND HOW TO AVOID IT

Another important concern for communities that intend to protect important wildlife habitat is the "takings" issue. The takings issue arises in response to either a development regulation or an exaction of land or money. "Regulatory" takings claims occur in response to regulations addressing permitted land uses, densities, heights, setbacks, or other development criteria. "Exaction" takings claims occur when the government has required that the landowner dedicate land or give money to the government as a condition of development approval (Duerksen and Roddewig 1994).

Regulatory Takings

In order to evaluate whether a proposed wildlife habitat protection ordinance might constitute a regulatory taking, the local government should try to answer the following three questions.

1. Does the regulation deprive the landowner of *all reasonable economic use* of the property?
2. Does the regulation interfere with the landowner's *reasonable investment-backed expectations*?
3. What is the *character* of the government action? (Duerksen and Roddewig 1994)

Reasonable economic use of the property. Land-use regulations must generally leave the owner of the land with a reasonable economic use of the property (with minor exceptions for situations where the only reasonable economic use is also a public nuisance). To carry out this test, the courts often measure the decrease in property value before and after the regulation is applied. Most courts have typically required an almost total wipeout of value before they find a taking. The mere fact that a habitat protection regulation will seriously reduce the value of the owner's property does not by itself create a taking (*William C. Haas and Co. v. City and County of San Francisco*, 605 F.2d 1117 (C.A. Cal. 1979)).

In addition, courts sometimes focus on whether the landowner is left with any "reasonable economic use" of the property. Zoning or subdivision controls that restrict the use of land in order to preserve habitat must still allow for some reasonable economic use of land. Often, the continued availability of the land for farming or ranching will fulfill this requirement, and several courts have upheld strict floodplain and wetlands regulations because an owner is able to pursue farming and recreational uses that could produce a reasonable economic return.

Regardless of whether the court focuses on the extent of the diminution in value or the existence of a remaining economic use of the land, there are no hard and fast numerical formulas to determine when a taking has occurred. It is a question that must be decided on a case-by-case basis depending on the facts of each situation.

The leading U.S. Supreme Court case involving economic use of the property is *Penn Central Transportation Co. v. City of New York*, 438 U.S. 194 (1978). In that case, the owner of Grand Central Station in New York wanted to build an office tower over the station, and such towers were prohibited by the city's designation of the station as a historic landmark. Although the city would allow some of the unused density on the site to be transferred for use on surrounding properties, the railroad challenged the restriction on the grounds that it denied them the economic use of the terminal site. The Court held for the city, noting that the constitutional protection of reasonable economic use does not mean maximum economic use. The Court pointed out that the railroad already had the reasonable economic use of the parcel as a train station, and that the transferability of unused density further expanded the economic use of the property. It concluded that, in order to be a compensable taking, a regulation would need to have "nearly the same effect as the complete destruction of the property rights."

The case of *Glisson v. Alachua County, Florida*, 558 So.2d 1030 (Fla. App. 1 Dist. 1990), shows how the principles of *Penn Central* have been applied in the case of environmental protections. In this case, the government had conducted an exhaustive study of an environmentally sensitive wetland area surrounding a state historic site and had then enacted a series of development regulations for the area. The regulations included protection of existing vegetation, a five-acre minimum lot size, a requirement that all but one acre of each lot remain undisturbed, and clustering provisions allowing for the transfer of unused density to development sites outside the area. Several landowners challenged the regulations on the basis that they had already expended substantial money to get development approvals, and that their development was being restricted to create a benefit for the public

U.S. Fish & Wildlife Service

The Eureka Valley evening primrose, a member of the dune's unique flora ecosystem, is being reduced by sand mining, dumping, and agriculture.

as a whole. The Florida courts found for the county government, stating that the regulations allowed for the continuation of existing uses, that variances and transfers were available, and that there had not been a denial of all economically viable uses of the property.

One example of a regulation that does violate constitutional protections would be a restriction prohibiting the construction of any permanent structure for commercial or residential purposes. In *Lucas v. South Carolina Coastal Council*, 112 S.Ct. 2886 (1992), the U.S. Supreme Court considered a parcel of oceanfront property where the state government had prohibited all permanent structures for living or working because of hurricane risks. The owner challenged the restriction, pointing to the fact that the lots on either side were developed with homes, and claiming that the effect of the regulation was the same as an outright condemnation of the property. The court agreed with the owner and required compensation. *Lucas* presents an unusual situation, however, since it is rare for land-use regulations to prohibit all permanent structures or uses.

In addition, some courts have focused attention on regulations that rigidly divide parcels into "development" and "no development" zones, and have invalidated those regulations when it appears that they deny those in "no development" zones the reasonable economic use of their property. This is true even in cases where the regulation allows the transfer of development rights from one area to another if it appears that the "no development" landowners may have practical difficulties in taking advantage of the transfer provisions (*Corrigan v. City of Scottsdale*, 720 P.2d 528 (Ariz. App. 1986), affirmed in part and reversed in part 720 P.2d 513 (Ariz. 1986)). Communities drafting habitat protection programs should be particularly careful to avoid inflexible designations of habitat areas that prohibit all development in those areas.

Reasonable, investment-backed expectations. Even if a land-use regulation does not create a very substantial reduction in the landowner's property values, and even if it leaves the landowner with reasonable economic uses of the land, it may be held to be a taking if it interferes with the landowner's reasonable investment-backed expectations. For example, if a landowner had received governmental permission to develop a private resort with trails through habitat areas and had actually built the resort and trails, and the local government later decided that trails should not be built through those habitat areas and refused to grant an occupancy permit for the building, the courts might well find the local government's actions to be unconstitutional. In order for a landowner to claim interference with reasonable, investment-backed expectations, however, the landowner must show that:

1. The expectations were reasonable—which generally means that it was a legal use of the property at the time the landowner made its investment—not just a speculative expectation that the zoning could be changed to permit the use. The reasonableness of expectations is measured from the point of view of an objective outsider, not the subjective point of view of the landowner.

2. The expectations were investment-backed—which generally means that the landowner had gone beyond just buying the land to constructing the project with all required permits.

3. The landowner did not know of the regulation prohibiting the project when the land was purchased and construction was started. Many courts have held that proceeding to buy and develop land with the knowledge that it may be in a special area where special permits are required is not a reasonable course of action.

The character of the government action. In considering the character of the governmental action, courts have tended to focus on government regulations that look like efforts to obtain public open space or require public access to property when there is no relationship between needs created by a project and the amount of land or access being demanded. For example, the Washington Supreme Court struck down a local greenbelt protection ordinance because it appeared that the city ran out of funds for greenbelt acquisition and then resorted to a regulatory program to accomplish the same ends (*Allingham v. City of Seattle*, 749 P.2d 160 (Wash. 1988); overruled in part by *Presbytery of Seattle v. King County*, 787 P.2d 907 (Wash. 1990)).

Government actions that aim at regulating development for valid reasons will generally receive greater deference than actions that look like indirect attempts by the government to acquire property without paying for it. Local governments should be particularly careful that any regulations they draft that limit development or activity in certain areas not look like attempts to acquire those areas as public open space. In order to avoid this pitfall, the community should always be able to answer these questions:

- What reasonable economic use is still allowed on this property, taken as a whole?;
- Does the landowner retain the right to exclude the public from the land?; and
- Does the regulation affect the value of the land so dramatically that it would be more fair to buy the land?

Barney Nehr, U.S. Fish & Wildlife Service

The peregrine falcon is being reintroduced, after virtually being wiped out in the 1970s by chlorinated pesticides.

Takings through Exactions

The law of exactions concerns the relationship between a proposed development, a requirement that land be dedicated or money be paid as a condition of development, and the use of that land or money. Many exactions are legal, and many statutes explicitly allow local governments to condition development approvals on the dedication of land or payments of money in many circumstances. However, an exaction may be ruled illegal if goes beyond the authority of the local government or fails other constitutional tests. While the law in this area continues to evolve, the general rule holds that there must be a reasonable relationship between the required land dedications or cash payments and an actual impact created by a project. Furthermore, the land dedication requirement needs to be roughly proportional to the need created by a development. Impact fees probably also need to meet that standard. When cash payments are in the form of impact fees, the revenues collected must be segregated and earmarked for land purchases or for the construction of facilities to serve new development, and must never be commingled with general tax funds.

The most recent exaction issue considered by the U.S. Supreme Court occurred in 1994, in the case of *Dolan v. City of Tigard*, 114 S.Ct. 2309 (1994). In *Dolan*, the owner of a hardware store wanted to expand the store, and the city government imposed a requirement that the store dedicate lands for a storm drainage ditch and a trail along that ditch. The Court decision explicitly upheld the value and legality of municipal planning to prevent floods and ensure adequate transportation, but held that when the exaction was part of a site-specific requirement—as opposed to a jurisdictionwide dedication standard—the city needed to make an "individualized determination" that the required land dedications were "roughly proportional" to the development's impact on storm drainage and transportation systems. The government could not impose the full burden of a trail land dedication upon the landowner just because its land happened to be in the city's preferred location for a trail. However, if the expansion of the store would directly or indirectly create additional road and trail traffic sufficient to justify construction of a trail to alleviate congestion, the exaction would be legal. Although the court did not require mathematical accuracy, it did require that the government be prepared to document the fairness of the required dedication. Similarly, local governments should be prepared to document the "rough proportionality" of required habitat exactions based on habitat impacts. Fees in lieu of dedications may be subject to the same requirements.

Administrative Relief Provisions

Before takings claims can be filed, the landowner is required to pursue local administrative remedies that could prevent or mitigate the degree of the hardship involved. In many cases, local government ordinances or regulations allow the landowner to apply for a variance, exception, exemption, rezoning, or cluster development approval as a way of preventing unnecessary hardship, and the courts expect that the landowner will take advantage of those avenues of administrative relief. This requirement for the "exhaustion of administrative remedies" was upheld by the U.S. Supreme Court in *Agins v. Tiburon*, 447 U.S. 255 (1980), and has resulted in the dismissal of many potential takings claims.

D.B. Means, U.S. Fish & Wildlife Service

The pine barrens tree frog is being endangered by the clearing of land.

In addition to standard zoning variance provisions, some cities and counties are responding to the takings issue by crafting administrative relief provisions tied to site-specific information and available resources. Such provisions allow a landowner to apply for an exemption or to suggest an alternative development pattern when, due to unusual circumstances, the strict application of the regulation would create a denial of all economic use, a very substantial hardship, or an interference with a reasonable investment-backed expectation. Application requirements can be drafted to elicit economic information about the parcel, including how much the owner paid for it, how much investment has been made in the land, the types of uses to which it has been put, any past offers to buy or lease the parcel, and similar items. This economic information can help the local government evaluate the degree of hardship to the landowner, what options the landowner has to mitigate those hardships, and how the case might appear to a judge if a lawsuit is filed. Administrative relief provisions allow the local government to evaluate a potential takings claim before it is filed in court and to grant local relief or an exemption from the regulation if it is warranted.

Chapter 6. The National Role in Wildlife Habitat Protection

In spite of the increasing role played by local and state governments in wildlife habitat protection, the federal government continues to play a significant role. Since 1992, efforts to remove the federal government from wildlife and environmental issues have met with mixed success, and several key pieces of federal legislation have been reauthorized. Key areas of federal involvement will include regulations, incentives, and land acquisition and management programs for the protection of endangered and threatened species, the preservation of wetland areas that serve as valuable habitat for numerous species, and the conservation of land in general. While federal regulation in those areas is not expected to expand in the future, existing programs and regulations will remain important. The continued influence of the federal government will be particularly important in states with vast tracts of federal land with prime habitat areas.

The future of habitat protection will therefore resemble an increasingly balanced partnership, with local, state, and federal governments each exercising unique protection powers. It is important that local elected officials and residents understand the range of federal tools and programs available to supplement local habitat protection efforts. This chapter identifies the more important federal programs and summarizes their most significant provisions.

THE ENDANGERED SPECIES ACT

The Endangered Species Act (ESA) was originally aimed at curbing poaching and smuggling of rare animals. It has evolved considerably since its first enactment in 1966 and was thoroughly rewritten in 1973 (Bosselman 1993). Section 9 of the act prohibits the "taking" of an endangered species. This term is defined broadly to include hunting, killing, and other actions that indirectly affect a species—such as harming or harassing the animals. The act has a broad scope and prohibits takings by private citizens or by state and local governments. It also authorizes citizen suits to enforce the act.

In early litigation under the act, environmental groups persuaded the 9th Circuit of the U.S. Court of Appeals that the destruction of the essential habitat of a threatened or endangered species constituted a taking of the species in violation of the act (*Palila v. Hawaii Dept. of Land and Natural Resources*, 639 F.2d 495 (9th Cir. 1981)). The Sierra Club Legal Defense Fund, making that argument, was also the first group to use the Section 9 provision as the basis for a citizen suit. Building on that foundation, the U.S. Fish and Wildlife Service began to use a definition of a "take" of an endangered species to include not only actions that "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in such conduct" but also any "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." The result of this definition was to significantly broaden the scope of the act beyond activities deliberately aimed at harming or injuring animals. Overruling a decision by a federal appellate court, the U.S. Supreme Court upheld this broad reading of the terms "harm" and "take" (*Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon*, 115 S.Ct. 2407 (1995)).

Section 7 of the act requires the mapping of the "critical habitat" areas that a species needs to survive and the establishment of "recovery plans" for each listed species. Although priority is to be given to species that may be in conflict with economic development, federal agencies have been largely unable to fulfill these directives in pace with the demands of the development community. While the absence of designated critical habitat or a recovery plan does not defeat the protection of a species, the enforcement of the act has resulted in severe penalties being placed on developers who had no way of knowing in advance that development activity would be determined to be a taking of a species.

Section 7 of the act includes a provision for authorizing "incidental takes" for federal activities. For federal projects, the agency must consult with the U.S. Fish and Wildlife Service to determine whether any listed species are present. If a threatened or endangered species is present, the agency must undertake a

U.S. Fish & Wildlife Service

The snail darter, which requires a specialized habitat of sand and gravel riffles, delayed the con-struction of Tellico Dam on the Little Tennessee River.

biological assessment to determine whether the activity would put the species in jeopardy. There is also a possibility of an exemption granted by the Endangered Species Committee, but the required showings are very difficult to achieve. In the case of the snail darter, an endangered fish, a Section 7 exemption was not granted and the construction of a large dam was precluded (*TVA v. Hill*, 437 U.S. 153 (1977)).

Habitat Conservation Plans

The rigidity of Sections 7 and 9 and the absence of a permitting provision for nonfederal activities has created the need to resolve endangered species land-use conflicts in the private sector. In an early example of private-sector initiative, a developer and local environmental interest groups formed a committee and prepared a workable habitat protection plan for a development that affected several butterfly species, which are an important indicator of the overall health of ecosystems (*San Bruno Mountain Friends of Endangered Species v. Jantzen*, 760 F.2d 976 (9th Cir. 1985); Arnold and Goins 1986). Under the San Bruno plan, the developer donated more than 80 percent of the critical habitat area to the county, development was allowed to proceed on 14 percent of a critical habitat, and an annual contribution of $60,000 was paid to the county government to offset management costs for the donated land. The U.S. Fish and Wildlife Service approved the plan even though it was somewhat experimental.

Based on the San Bruno plan, the Endangered Species Act was amended in 1982 to authorize the issuance of "incidental take" permits for private-sector land development activities. Section 10(a) now provides for the preparation and approval of a habitat conservation plan (HCP) as the basis of a permit (Beatley 1990). The process is more extensive than the process required to authorize incidental takings in connection with federal actions under Section 7. If the proposed HCP is authorized by the U.S. Fish and Wildlife Service, development activities following the terms of the plan are considered to be exempt from potential violations of the act. An HCP needs to address biological, economic, and political issues. Another important component of many successful plans is the ongoing management of protected habitat areas for both biological integrity and damaging human activities. Successful plans also attempt to enhance the survival of the threatened species.

An HCP can be for a single development project or for a multijurisdictional area. At a minimum, Section 10(a) requires an HCP to specify:

1. the impact that will result from the taking;
2. steps that will be taken to minimize and to mitigate the taking;
3. funding to implement the plan;
4. an analysis of possible alternative actions including why they were not chosen; and
5. other elements if found necessary or appropriate.

A permit may be issued if the following four standards are met:

1. the taking is found to be incidental to an otherwise lawful activity;
2. impacts will be minimized and mitigated to the maximum extent practicable;
3. implementation of the plan will be adequately funded; and
4. the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.

Most HCP plans are prepared by an independent consultant and involve a steering committee made up of major stakeholders and community representatives. The committee is frequently chaired by a neutral group or conservation entity. Specialists are hired by the consultant to perform background studies. Most HCPs set aside a certain amount of land in habitat preserves and typically include other long-term management techniques, such as habitat restoration and land-use controls.

As of May 1997, there were nearly 400 HCPs either completed or in the works. By September 1997, about 18.5 million acres of ecologically important lands will be covered by HCPs. The plans prepared to take advantage of Section 10(a) are sometimes called "special area management plans," "resource management plans," "watershed plans," or "natural community conservation plans." Regardless of their names, all of them use the same collaborative process of including both private and public stakeholders interested in a more flexible set of options than allowed by Sections 9 and 7 alone. Even though the HCP process adds considerable costs to a development project, the development community has responded positively.

As might be expected, the HCP process has been criticized by some and praised by others (Bosselman and Tarlock 1993). Critics believe that the plans undermine and erode the intent of the Endangered Species Act and that HCPs simply put a price on environmental destruction. Supporters argue that the plans are a much-needed vehicle for flexibility and the scientific analysis provides a sound method of addressing environmental issues at the appropriate point in the development process. They agree

that, although there are many compromises in the development of an HCP, the process provides a forum that can diffuse hostilities between polarized interest groups and the result is generally a net benefit regarding the core environmental issues.

Natural Communities Conservation Planning Program

While HCPs result in both positive and negative effects for environmental and economic issues, a more general criticism can be directed towards the underlying single-species approach of the Endangered Species Act itself. An HCP does address the habitat needs of the subject threatened or endangered species but is not required to analyze the larger biological patterns or effects on an entire ecosystem. This may result in incomplete studies and inadequate conservation measures, even after considerable sums have been spent on the development of the plan.

A multispecies approach to habitat conservation would magnify all the problems associated with environmental regulation and would essentially be beyond the scope of ESA. California has addressed this situation by initiating its own Natural Communities Conservation Planning Program (NCCP) that attempts to identify and resolve issues before the Endangered Species Act is applicable. (See Appendix B.) In essence, the NCCP uses local planning resources to find ways to protect substantial assemblages of habitat land before the area becomes so fragmented or compromised by development that the listing of individual species is likely under ESA.

Because of its species-specific approach, the ESA often attempts to protect small, disconnected parcels of land where significant numbers of the threatened species exist, but not the larger tracts that would allow the continued health of the entire ecosystem of which the threatened species is a part. NCCP takes the broader view. Partners in the program, which include several agencies of state government and developers, enroll in the program and agree to set aside critical habitat areas and to monitor the ecosystems within them. California believes that the NCCP program improves on standard ESA practice because it adds certainty to both the environmental and development communities; provides technical assistance to prevent rather than fix problems; avoids the need for single-species recovery plans; and allows limited interim development while an NCCP is being developed for the area. When a species is listed as threatened under ESA, the existence of an NCCP program can lead to a special rule under Section 4(d) of the act. Section 4(d) rules are a third alternative to rules under section 7 or 10(a) of the act and involve state and local governments as partners in the process.

Colorado's Memorandum of Understanding

Colorado has recently become the first state in the U.S. to execute an agreement with the U.S. Department of the Interior designed to give the state a greater role in the application of the Endangered Species Act. This agreement may have implications for the design of local habitat protections. In particular, as the Colorado Division of Wildlife (DOW) acts to prevent some species populations from declining, it may need the assistance and cooperation of Colorado's local governments. In some cases, the DOW may need to request that local programs be initiated or expanded to focus on habitat that is necessary to avoid application of ESA. On the positive side, if the state is successful in working with local governments to craft unique solutions within Colorado, local governments may reap the benefit of being able to plan for habitat protection without having to work around the rigid federal requirements and remedies of the ESA in some cases.

THE NATIONAL BIOLOGICAL SURVEY/BIOLOGIC DIVISION

For almost a century, there have been calls for the federal government to create a comprehensive biological inventory for the country. One hundred years ago, a division of biological survey was formed within the U.S. Department of Agriculture. In 1939, that function was transferred to the Department of the Interior, where it became the Fish and Wildlife Service. While many of the original goals of the agency were developed, the "survey" function gradually declined.

More recently, concerns over the loss of species, wildlife habitat, and other natural resources has created a myriad of environmental regulations at the local, state, and federal government levels. Across the country, these regulations have led to serious conflicts between environmental protection and economic growth. The Secretary of the Interior has termed these situations "economic and environmental train wrecks," because they sometimes lead to the derailing of major construction projects at the last minute because of an endangered species, wetlands, or late-emerging environmental issue. The increasing complexity of environmental regulation and the desire to minimize the number of future "train wrecks" has led to renewed calls for a comprehensive biological survey.

In 1994, in order to help balance the goals of ecosystem protection and economic progress, the U.S. Department of the Interior spearheaded the formation of the National Biological Survey (NBS). Essentially, NBS was created by

David Gocke, U.S. Fish & Wildlife Service

The nests of the ornate box turtle are being protected against predators and by beachfront lighting controls.

drawing research scientists from various divisions of the Department of the Interior into a single new agency. The charge of the NBS is to inventory, map, and monitor the nation's natural resources and to provide information about the environment to assist decision making by a variety of federal agencies. The NBS is envisioned as a combination of several existing programs and environmental specialists from several departments that would act as an independent science bureau. It would not advocate positions on resource management issues and would not have regulatory or land or water development authority. Instead, it would provide information to help:

- identify ways to preserve the nation's biological heritage;
- manage biological resources in a sustainable manner;
- maintain essential ecological services, such as water supply, flood and erosion control, and climate amelioration;
- understand the impact of human settlement patterns, including metropolitan growth, renewable land use, and nonrenewable resource extraction;
- maintain the contributions of our nation's biota to the aesthetic quality of life;
- understand the effects of climate change;
- derive new economic wealth from biological resources;
- restore degraded environments (National Resource Council 1993).

In 1995, NBS's Status and Trends Program produced an impressive first product, *Our Living Resources: A Report to the Nation on the Distribution, Abundance, and Health of U.S. Plants, Animals, and Ecosystems* (LaRoe et al. 1995), which is recommended as a reference work.

Although recent federal legislation has redefined NBS as the Biologic Division of the U.S. Geological Survey instead of a freestanding agency (effective September 1, 1996), its charge and role as a center for research science has not been altered. It is too early to tell whether the reorganization of the NBS into a subagency will lead to a dilution of its role or reduced funding in the future.

Bruce Eilerts, U.S. Fish & Wildlife Service

Less than 1,000 Hawaiian monk seals exist, due to hunting, shark predation, and recent habitat disturbance.

THE NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA), 49 U.S.C, Sec. 303, applies to actions undertaken, sponsored, and, in some cases, permitted by the federal government. The act is primarily a procedural mandate that requires all federal agencies to conduct an evaluation of any action that may be defined as a "major federal action" that may involve a "significant impact on the natural environment." While judicial interpretations of this threshold definition vary with the circumstances, NEPA generally imposes a requirement that the agency at least consider all environmental impacts of a given action, as well as the alternative actions and measures that may mitigate such impacts. Although NEPA does not affect an outright prohibition even on those federal projects that do involve adverse environmental impacts, it does operate to provide more information about the potential adverse impacts of such projects and opens them to public scrutiny. Among those factors that must be considered is the effect of the proposed project on wildlife populations.

Many state governments have emulated the National Environmental Policy Acts with "little NEPAs" that apply to state-permitted or -funded projects. As might be expected, while these state acts generally resemble NEPA language and intent, there are wide variations from state to state. Thus some do not apply to local governments, and others cover only discretionary decisions.

Ever since its inception, NEPA has been controversial. Its supporters call it a big step forward in requiring project sponsors to think about environmental issues that were previously ignored. There is little doubt that NEPA has helped provide additional information for decision makers, which should help them. In many instances, the required Environmental Impact Reviews and Statements have shown how projects could be altered in minor ways to avoid adverse impacts while still achieving the purpose of the project. On the other hand, NEPA critics who oppose environmental protection have called it a waste of time and money that can only slow down development. Even environmentalists and wildlife supporters have criticized its lack of mitigation requirements and the fact that it sometimes leads to only a cursory or perfunctory review of complex issues.

There is little doubt that NEPA studies and procedures can be costly and time consuming, particularly if the proponent must itself collect information about the environment that is not available from another source. There is also no doubt that a project sponsor intent on ignoring the environment will not be stopped by NEPA since there is no effective requirement that decision makers modify their projects to reflect environmental findings.

SECTION 404 WETLANDS PROTECTION

Section 404 of the Clean Water Act, 33 U.S.C., Sec. 1251 et seq., is relevant to wildlife habitat protection

Wetlands Mitigation Banks and Real Estate Speculation: "Only in America"

According to a story by Morris Newman in *California Planning and Development Reporter* (February 1997, 12), wetlands mitigation banking has led to real estate speculation that could turn out profits for developers who otherwise find such environmental restrictions their biggest fear. Newman tells the story of a developer in Santa Rosa, California, who, "by mistake," bought a 12-acre property that was dotted with vernal pools (tiny seasonal wetlands). Recognizing his mistake, he turned his hand to creating a viable wetlands site on the property that he could then sell in pieces to recoup his investment. It took the developer three years to get the necessary approvals for his project through California's Department of Fish and Game and the U.S. Army Corps of Engineers. Officials had to make sure that the site had the proper soil, and they supervised the introduction of at least three endangered plant species to the site. By one appraiser's estimate, the cost of creating a new wetlands is nearly $46,000 per acre. The developer has been authorized to sell up to 10 mitigation credits per year from this wetlands property. The developer has set the value of his wetlands at $200,000 per ace and is selling credits for $20,000 apiece. Newman reports that this figure is high compared to other mitigation banks, which were charging between $7,000 and $8,000 per credit.

The downside to this show of ingenuity is that the increasing value of wetlands is making it more difficult for public and nonprofit entities to afford their purchase. Newman cites the case of Sonoma County, where the Wildlife Conservation Board and the Sonoma County Open Space Authority had agreed to buy a 173-acre piece of property for open space and habitat preservation, as well as to create their own wetlands mitigation bank. The board was "galled" by an appraisal of the property that showed it to be worth $3.6 million ($20,689 per acre), given that its appraisal in 1975 estimated the property's value to be just over $585,000. The board ultimately ended up approving the purchase, hoping that it could recapture some of the cost by the sale of wetland mitigation credits.

Newman writes that, although he sympathizes with environmental officials who have limited resources to buy open space, he also had to confess to admiration for the ability of market capitalists to find a real estate advantage in environmental restrictions. As he points out, this tale does have an "Only in America" aspect to it. Despite potential purchase problems for public entities and nonprofits, there is a silver lining here. If market forces shift in a way to make environmental protection regulations less onerous economically for developers because they can turn their "mistakes" into profits, maybe everyone will benefit.

whenever desired habitat will involve wetland areas. This federal act is administered jointly by the U.S. Army Corps of Engineers and the Environmental Protection Agency, and provides significant opportunities for comment and involvement by the U.S. Fish and Wildlife Service. Section 404 creates a permit system that regulates disturbances of wetlands when that disturbance will affect more than one acre of the wetlands. Although President Clinton has discussed Executive Orders that would provide broad exceptions for single-family homeowners involved in improving their own property for their own use, the permit requirements for land developers or builders are still strict. Permits can be denied if a proposed activity, including any dredging, channelization, or development in a wetland will result in a "significant degradation" of wetlands. Significant degradation can include diminished recreational or aesthetic values as well as damage to aquatic systems. In addition, permits can be issued with conditions requiring mitigation of wetlands loss by restoring existing wetlands or creating new wetland areas.

Local governments should be aware that the need for a Section 404 permit may discourage development in wetlands and make it easier to steer development away from wetland habitats. If the existence of wetlands is documented as part of a local wildlife habitat inventory, that information should be passed on to both the state's Division of Wildlife (or comparable agency) and to the U.S. Fish and Wildlife Service so that it can be considered in future 404 permitting activities. In addition, when a developer proposes to build in a wetlands and then mitigate the impacts off-site, the developer may be looking for an existing wetlands to restore as part of the mitigation process. Local governments should therefore be prepared to suggest wildlife habitat areas where restoration or expansion of an existing wetland would promote the quality of the habitat itself.

In order to accommodate the need to mitigate wetlands off site, some states have recently begun creating wetlands mitigation banks. The mitigation bank idea arose from criticism that builders were sometimes mitigating their impacts on large wetlands by expanding small ones that were not sustainable or not large enough to achieve the goals of aquifer recharge, water-quality improvements, or wildlife habitat protection. The intent of the bank system is to designate large and healthy wetland areas—often those that support a wide variety of wildlife species—and encourage developers to expand and improve those areas. In some cases, private investors have actually purchased significant healthy wetland areas and then sold the rights to improve and restore the wetlands on an acre-by-acre basis. Potential buyers include builders looking for mitigation sites and an opportunity to get positive publicity by participating in a large and visible habitat area. To date, more than 46 wetlands mitigation banks are operating in the U.S., with most of those located in California and Florida. Oregon, Minnesota, New Jersey, Colorado, and other states have specifically endorsed the creation and operation of wetlands mitigation banks (Salvesen 1993).

FEDERAL LAND PRESERVATION INCENTIVES

Some federal laws offer financial incentives for land protection or impose disincentives by withholding

Steve Busack, U.S. Fish & Wildlife Service

The leopard lizard is being endangered by the cultivation of its grasslands habitat.

government subsidies for adverse land uses. In many instances, the types of land protected may have important wildlife habitat value. While the scope and funding of these programs are being scrutinized by Congress, programs such as the Wetlands Reserve Program and the Conservation Reserve Program still exist. In general, federal incentive programs are based on a simple and compelling argument that the government should not subsidize land uses that are harmful and contradict other established laws or policies. Such programs have proven to be very effective in the context of agricultural and wetlands protection.

Wetlands Reserve Program

The federal Food Security Act of 1985 and the Food, Agriculture, Conservation, and Trade Act of 1990, known as the "farm bills," established a number of programs designed to provide incentives for retaining wetlands. Perhaps the most significant such program was provided in the Swampbuster provisions of the Food Security Act. These established a Wetlands Reserve Program, 7 CFR 703, which offers incentives for preservation of up to 1 million acres of wetlands as well as disincentives for conversion.

Under this program, participating farmers prepare and implement wetlands conservation plans, and the federal government pays the farmer for the value of the use of the conserved lands as well as a portion of the costs of restoration and conservation. In addition, if the farmer chooses to convert wetlands to agricultural use, the farmer becomes ineligible for federal agricultural price supports, crop insurance, or any other federal agricultural subsidy programs. By thus maintaining a preservation incentive while eliminating competing incentives to convert wetlands, the federal government has provided a program that promotes the retention of wetlands and related habitat without causing financial harm to farmers. The 1992 pilot program involved nine states, 50,000 acres of land, and $47 million in funding. The 1996 reauthorization of the Farms Bills continued the Wetlands Reserve Program, but its scope is still modest.

Conservation Reserve Program

A Conservation Reserve Program was also included in the 1985 farm bill (7 CFR 704) and 1990 farm bill (7 CFR 1410). Under this program, the federal government offers payments and executes voluntary 10-year agreements with farmers who elect to remove highly erosive cropland from production, thereby reducing environmental damage from runoff and preserving wildlife habitat. This should help offset some of the strong negative effects of an increasingly monoculture agricultural industry on wildlife, effects that have steadily worsened since World War II. About 36.4 million acres have been removed from production for at least 10 years under the program so far and have been planted with tame or native grasses. One important additional benefit to wildlife has been to reduce pressure on 32 million acres of grass interspersed with lands remaining in production (Allen 1995). The Conservation Reserve Program has been continued under the 1996 reauthorizations of the Farms Bills, in no small part because it has been shown to be a very cost-effective way of reducing pollution that would otherwise have to be abated after the fact.

FOREST STEWARDSHIP INCENTIVES PROGRAM

The 1990 Farm Bill recognized the importance of stewardship of private forest land and land suitable for growing trees as a vital element in the conservation of the nation's natural resources. The bill created the Forest Stewardship Program (FSP) and the Stewardship Incentives Program (SIP), which are administered nationally and regionally by the U.S. Forest Service. State forest service agencies administer the program at the state level. The FSP provides education and technical assistance to private landowners. The SIP assists private landowners to implement the land stewardship activities recommended in their long-range forest plans and to manage their property for a variety of environmental benefits, including wildlife habitat. The program applies to landowners owning between two and 1,000 acres of land suitable for growing trees, provided they meet eligibility requirements and implement their plans according to applicable regulations for a minimum of 10 years. Under the SIP, cost sharing can be used to promote the development of forest stewardship programs, reforestation, agroforestry, forest improvement, riparian and wetland protection, and the enhancement of fisheries and wildlife habitat.

DEPARTMENT OF AGRICULTURE ENVIRONMENTAL-QUALITY INCENTIVES

The U.S. Department of Agriculture's Environmental Quality Incentives Program (EQIP) is a new cost-sharingprogram under the federal Agriculture Improvement and Reform Act, 110 Stat. 888, April 4, 1996, that combines the functions of several existing USDA cost-sharing programs, including the Great Plains Conservation Program and the Colorado River Basin Salinity Control Program. The overall benefit of the combined program is the collaborative efforts between the various agencies to ensure that the program runs successfully. The Natural Resources Conservation Service is responsible for policies, priorities, and guidelines. The Farm Services Agency is responsible for administering the program at the state and local levels. Under EQIP, five- to 10-year contracts will be available to landowners to provide cost-share

and incentive payments for up to 75 percent of the price of installing conservation practices. EQIP is intended to make the administration of programs and funds more efficient. Payments to any person are limited to $10,000 annually and $50,000 for the life of the contract.

FEDERAL LAND OWNERSHIP AND MANAGEMENT

About 50 percent of all threatened and endangered species listed under the ESA occur at least once on federal land. In addition, about 36 percent of the more than 24,000 occurrences of federally listed species are found on federal lands. In some cases, more than 50 percent of the population of a threatened or endangered species lives on federal lands. As a result, the federal government can have a dramatic impact on the preservation of certain species simply through its actions as a landowner—and apart from its role in land regulation. This is particularly true in a state like Colorado, where the federal government owns more than one-third of all the land in the state. The federal agency with the largest opportunity to protect endangered species is the U.S. Forest Service, because 16 percent of all occurrences of listed species occur on lands that it manages. Lands managed by the Bureau of Land Management house 8 percent of the occurrences. Lands controlled by the Department of Defense account for 4 percent of occurrences, and lands managed by the U.S. Fish and Wildlife Service and the National Park Service each account for 3 percent of occurrences (Stein 1995).

OTHER KEY FEDERAL PROBLEMS AND POLICIES

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFW) plays a key role in many wildlife habitat protection issues, but it is not responsible for all federal wildlife concerns (Blanchard 1990). The USFW mission is tied to national goals, which frequently involve migratory, endangered, interjurisdictional, and international wildlife issues. USFW activities are also primarily concerned with public lands and land set aside specifically to protect critical wildlife habitat. In addition to its primary charge, USFW also perceives the need to provide the public with opportunities for nonconsumptive wildlife activities. Most USFW programs also attempt to set an example to encourage responsible stewardship for the environment and promote citizen involvement in wildlife issues.

It is important to recognize that state governments have a much different role in protecting wildlife habitat based on their various responsibilities to fulfill broad public interests, and local governments have a different role because of urban characteristics and interests. Because relatively little federal land is located in urban areas, the scope of USFW activities in urban areas is limited.

U.S. Forest Service

The U.S. Forest Service (USFS), which is a division of the U.S. Department of Agriculture, promotes wildlife habitat protection through its land management practices on the land that it controls. All Forest Service lands are managed under the multiple-use philosophy, which attempts to balance wildlife habitat protection goals with public recreation goals. Many aspects of habitat management practices of the USFS provide excellent models for developing local programs and philosophies.

Bureau of Land Management

The Bureau of Land Management (BLM) is a division of the Department of the Interior that operates under a multiple-use mandate contained in the Federal Land Policy Management Act. A recent strategic plan for the Bureau of Land Management listed fish and wildlife protection as a top priority for the agency (Almand 1990). The plan represents a new ideology for the BLM and a very progressive attitude towards wildlife habitat protection. The new policies bring fish and wildlife issues, riparian restoration, and recreational priorities more in line with traditional BLM functions of mineral resource and rangeland management.

The implementation policies of the *Fish and Wildlife 2000* plan contain some key innovations. For example, the plan targets working cooperatively with state, local, and private interests to achieve common goals and promotes a cost-sharing program to help fund multijurisdictional projects. The plan represents a positive change from the BLM's historical tendency to be driven by issues and events. The agency hopes to establish a proactive attitude to influence and shape the proper management of valuable natural resources. As urbanizing areas continue to encroach on more and more natural resources, this new philosophy could become a valuable asset for future habitat planning efforts.

National Park Service

The core philosophies of the National Park Service—another agency of the Department of the Interior—present an interesting perspective for wildlife habitat protection. In the face of prevailing wisdom that significant compromises must take place to accommodate both human and wildlife needs, the National Park Service holds fast to the idea that a natural area must be preserved or restored to a completely natural state (Matthews et al. 1990). The basic philosophy

E. LaVern Smith, U.S. Fish & Wildlife Service

The mountain golden heather is threatened by shade from larger shrubs.

Allen Montgomery, U.S. Fish & Wildlife Service

Deforestation and tourism are threatening the roosts of the monarch butterfly.

that our national parks should be natural systems functioning under natural processes is often criticized as an unworkable approach to a complex issue but is increasingly being seen as an ecosystem approach that can help mitigate some of the major shortcomings of the Endangered Species Act.

For example, the National Park Service strives to eliminate any plant or animal introduced to the area with human help, even if the species may be considered desirable. The result is that the original integrity of the natural area is effectively protected without going through an extensive biological analysis required to draft a Habitat Conservation Plan under ESA. The changing desires of the American people continue to challenge the National Parks philosophy, however (Tanacredi 1986). As Americans take shorter but more frequent vacations, and travel shorter distances, National Park visits near urban areas have increased. This also increases the likelihood of damage to park resources as a result of the park's inability to handle larger numbers of visitors within its ecosystem approach.

Because of the recent development of several national recreation areas in cities, the National Park Service has become involved in the relatively new field of urban wildlife biology (Hester 1990). Through research, management, and interpretation of urban wildlife issues, the National Park Service has shown that wildlife populations can thrive even in highly disturbed areas. The Service's increased willingness to work in disturbed environments will become a valuable tool for habitat protection measures in urban areas.

Land and Water Conservation Fund

The federal Land and Water Conservation Fund, 16 U.S.C. Secs 4601-4 et seq., 36 CFR 59, was established in 1965 to support federal purchases of national park, recreation, and conservation areas, and to make grants to state and local governments to acquire, develop, and improve recreation areas. That purpose has been interpreted to include the acquisition of endangered species habitat. Revenue for the fund comes from leases of rights to resources along the Outer Continental Shelf, motor boat fuel taxes, recreational fees, and the sale of surplus federal property. The combined receipts from all those sources totals $3 billion or $4 billion annually, but the full amount of receipts has never been made available for spending. Congress authorized a maximum annual spending limit of $900 million, and the actual spending in any one year is usually closer to $200 or $300 million. As a result of spending less than is received, the unspent balance in the fund is now about $8 billion. Over the 30 years that the fund has been in existence, $5.3 billion has been spent for federal acquisitions of land, and $3.2 billion has been spent for state acquisitions. At present, 80 percent of the fund is allocated to federal acquisitions and the remaining 20 percent to the states.

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Appendix B. The Southern California Natural Community Conservation Planning Program: The Future of Habitat Protection?

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Habitat Conservation Plans (HCPs) have been controversial since the federal Endangered Species Act (ESA) was amended in 1982 to allow them. (See Chapter 6 in this report for a discussion of HCPs.) Environmental groups have complained that HCPs essentially undermine the protections afforded by the ESA. Developers and landowners are unhappy with the cost of the process and its uncertainty. Local communities object to the fact that the U.S. Fish and Wildlife Service (FWS) must approve the local HCP, giving FWS a determining role in local land-use planning.

According to O'Connell and Johnson (1997), most of these criticisms are true. They note that 85 percent of HCPs are for single landowners and single species and cover only small areas. There have been a few exceptions (the Balcones Canyonlands plan for Austin, Texas, and the Plum Creek Timber plan in Washington state that will cover more than 400,000 acres). Indeed, the typical HCP process is costly and uncertain and is unlikely to attain the standards and goals envisioned by the ESA and the environmental community.

A flaw in HCPs is also clear in the "assurances" that they offer to participating landowners. Drafting an HCP allows the property owner only an "incidental taking" permit (see Chapter 6 of this report) for endangered species listed by FWS. As of May 22, 1997, there were 446 animal species and 634 plant species on that list according to the FWS endangered species "box score" (which can be found at http://www.fws.gov). But there may be as many as 3,000 more "at-risk" species in the U.S. Consequently, as an HCP is prepared for the taking of a species that is currently on the list, another species may come on it, opening up the process once again.

Table B-1. The Problems with HCPs According to the Stakeholders

Environmental Community	Regulated Community
Little funding for plans and "no surprises"	Lack of certainty
"Jeopardy" too weak a standard	Unreasonable costs
Few public participation opportunities	Imbalanced allocation of costs
Ineffective management provisions	Agreements not reliable
Poor oversight of plan implementation	Science lacks rigor
Small ownerships lead to fragmentation	Planning process not predictable
Species focus too narrow	Implementing not streamlined
Lack of credible scientific input	Not enough public funding

Source: Michael A. O'Connell and Stephen P. Johnson, "Improving Habitat Conservation Planning: The California Natural Community Conservation Model," *Endangered Species Update* 14, nos. 1-2 (1997), Table 1.

In 1991, it became fairly clear to the State of California that intense development pressures in Southern California and the flaws in the ESA and HCPs would continue to lead to innumerable and costly fights between developers, environmentalists, and local governments. In response, the California Department of Fish and Game and the California Resources Agency worked together to draft the Natural Community Conservation Planning (NCCP) program. The legislature passed the NCCP Act of 1991.

The NCCP program goals differ fundamentally from ESA goals. The principal NCCP goal is to protect multiple habitat areas and multiple species. This approach has been called "bioregional planning" (Callahan 1993). The NCCP program uses a set of conservation guidelines drafted by a team of independent scientists, and the guidelines are made regulatory by federal rule. The California act identifies a conservation standard of "no net loss of habitat value" for completed plans, "a considerably higher benchmark than for losses allowed under the 'jeopardy' standard by which HCPs are ultimately judged" (O'Connell and Johnson 1997). The NCCP program also promotes public participation. Multiple stakeholders are involved in drafting the plans. Finally, it promotes the conservation of areas under diverse public ownership—a goal rarely achieved under the HCP provisions of the ESA.

The trade-off in the NCCP program is similar to that in HCPs—habitat and species protection for development certainty. Preserves are clearly mapped, and no development can occur there, while other spaces are opened up to development. In other words, the blueprint for the region is more clear. But the NCCP program offers some significant differences in the way that trade-off is carried out. For instance, there is a "no surprises" policy to respond to the problem of "assurances" that vexed developers working with traditional HCPs. The policy ensures developers who are holding permits and properly implementing their HCPs that they will not be held liable if changes in nature result in necessary changes in the plans. If those changes result in an agency seeking additional lands, land restrictions, or financial compensation, those obligations will be met by the public agency, meaning the additional costs caused by those changes are picked up by the public. Regulations from the state and federal ESAs are combined in one set of requirements. And participation in the program is voluntary for landowners, who may seek separate FWS or state permits if they wish. Critics of the program have said that it give developers carte blanche to develop whatever they wish on lands not designated as a preserve in an NCCP plan. But proponents of the program note that participating jurisdictions are not prohibited from continuing to protect hillsides and floodplains and establishing open space through other land-use regulations and programs.

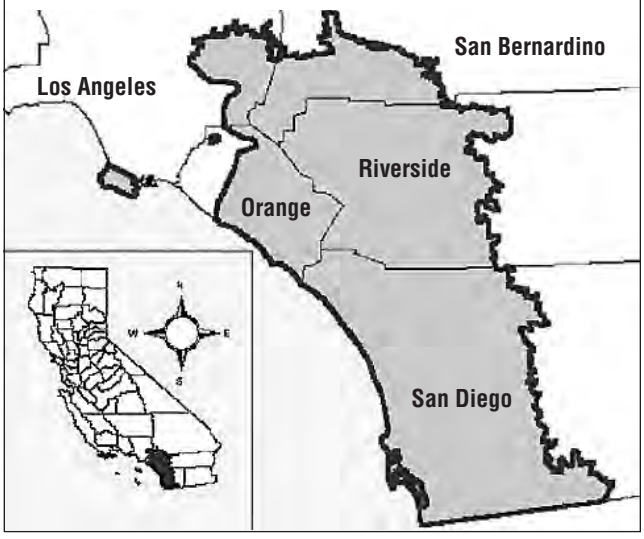
The act that probably was the greatest catalyst to implementation of the NCCP program was the federal government's listing of the California gnatcatcher as a threatened species in 1993. Since this bird's habitat is in coastal areas at the base of mesas and in canyon beds, where it is easy to site housing subdivisions or shopping centers, the nomination changed the development scenario dramatically. Furthermore, the bird requires large areas of the coastal brush to survive—the range being from six to 40 acres to give it an adequate food source of insects and sufficient protection from predators. The various players now had an area on which to test NCCP—the coastal sage scrub habitat. This area covers nearly 6,000 square miles, is home to 90 potentially threatened or endangered species besides the gnatcatcher, and contains some extremely valuable land for development purposes. The habitat is also highly fragmented and scattered over large parts of three counties—Orange, San Diego, and

Table B-2. Comparison of ESA Section 10(a) and NCCP Conservation Concepts		
Issue	**Section 10(a)**	**NCCP**
Planning Scope	Project-by-project	Biological Regions
Biological Scope	Single species or groups of listed species	Ecosystems and natural communities
Focus of Conservation	Highly imperiled species	Prelisting; Preventative
Scientific Input	Agencies and consultants	Independent Scientists
Institutional Involvement	Agencies and applicants	Local; State; Federal; Public; Private Landowners
Public Participation	Little or none	Work groups; Hearings; Public comment
Use of Agency Resources	Processing hundreds of individual permits	Servicing and enforcing several large-scale plans
Preserve Design	Fragmented set asides	Large habitat blocks
Duration	Short-term permits	Long-term or perpetual
Land Management	Relies on permittee	Independent; Adaptive; Required by agreement
Monitoring/Oversight	Passive; Relies on permittee	Active by agencies; Oversight by public
Landowner Assurances	Short-term, narrow	Predictable; broad
Conservation Standard	"Jeopardy"	No net loss habitat value; Contribution to recovery

Source: Michael A. O'Connell and Stephen P. Johnson, "Improving Habitat Conservation Planning: The California Natural Community Conservation Model," *Endangered Species Update* 14, nos. 1-2 (1997), Table 2.

Riverside—and smaller portions of two others—Los Angeles and San Bernardino. Fifty-nine local governments, numerous landowners, other private interests, federal wildlife authorities, and the environmental community are all active players in this program, and, so far, the results have been noteworthy.

Figure B-1. Southern Coastal Sage Scrub NCCP Region



Orange County

In Orange County, the Board of Supervisors approved the Central/Coastal Natural Community Conservation Plan on April 16, 1996. This plan is the first of three habitat conservation plans to be completed for Orange County as part of the state's NCCP program. The Central/Coastal plan guides environmental protection and land uses in a 209,000-acre area of developed land and open space in two noncontiguous parts of the county. The plan establishes a permanent preserve of nearly 38,000 acres of several types of habitat, including 19,000 acres of coastal sage scrub habitat, to help protect 42 different species, six of which are threatened or endangered. The plan makes it unnecessary to develop 42 separate conservation plans (one for each species) over the area.

Nearly 21,000 acres of the preserve were voluntarily dedicated by the largest private landowner in the area, the Irvine Company. Much of that land had been reserved for open space through a series of development agreements before institution of the plan. The agreement also calls for the Irvine Company to contribute funds to a management group, a nonprofit that includes representatives from the state's Department of Fish and Game. In all, the plan calls for a $10.6 million endowment from the Irvine Company, other developers, and county, state, and federal governments to provide management services. In return for its cooperation, the Irvine Company will be allowed to develop its remaining lands in the area, even in areas considered habitat for the gnatcatcher and other threatened species.

Not everyone is happy with the plan. A spokesperson for the Defenders of Wildlife told the *San Francisco Chronicle* (7/18/96) that "we're locking in land management and species protection policies for 50 to 75 years." There was also criticism that the government was giving away too much—limiting protected areas while giving developers a blank check to build elsewhere for decades to come.

Riverside County

Riverside County offers a perfect example of how local governments have benefitted under the NCCP program. Riverside County began an HCP process in 1988 to provide

protection for the habitat of the Stephens' kangaroo rat. While the plan was being completed, three other species in the county area for the HCP were placed on the endangered species list—the Riverside fairy shrimp, the California red-legged frog, and the California gnatcatcher. All of the work ended in frustration with the ESA process and what was seen as federal interference in local government and private land-use matters.

In May 1996, the original plan was supplanted by a new 30-year HCP that establishes five preserves in the county. The new HCP covers 43,761 acres, 15,000 of which are occupied by the Stephens' kangaroo rat. Eight cities in the county signed on to the plan.

Funding for management of the preserves will come from a commitment of $11.7 million from the eight cities and the county. The funding will come from development fees levied under the original HCP. The Bureau of Land Management will provide $3.6 million for land acquisition and management. Several areas within the preserves will be managed by the state's Department of Fish and Game (the San Jacinto Wildlife Area) and the Department of Parks and Recreation (Lake Perris State Recreation Area), saving the county $1.5 million in management costs.

San Diego

The Multiple Species Conservation Program (MSCP) was approved by the San Diego City Council on March 18, 1997. Passage by a conservative city of such a controversial plan was seen as key to getting the approval of neighboring jurisdictions that will be necessary to implement the program, and such approval is almost certain. After the vote, Interior Secretary Bruce Babbitt referred to the MSCP as "the jewel of habitat conservation plans" and predicted that it would have "important national implications . . . the latest and best example of a new era in American conservation."

Indeed, the scope of MSCP dwarfs any previous or planned effort at cooperation on a regional scale as regards habitat protection. It addresses more species, conserves a greater diversity of vegetation communities, and incorporates more local jurisdictions than any other plan currently approved or under development in the entire nation. It even has the blessing of both the San Diego Building Industry Association and San Diego County's Sierra Club.

The MSCP is the first of three such NCCP plans to be completed in San Diego County, which covers more than 1.3 million acres. The other two plans will cover northwestern San Diego County (the Multiple Species Habitat Plan) and eastern San Diego County (the Multiple Species and Open Space Plan).

Passage of MSCP was a crucial test for the NCCP process because critics expressed doubt that a program on this scale and facing the kind of development pressures that exist in San Diego County could get off the ground. They had noted that the Orange County HCP had been relatively easy to put together because much of the open space there had already been set aside and two large land owners controlled most of the property, meaning negotiations were simpler.

The specifics of the MSCP bear out its complexity and grand scale. The MSCP covers San Diego County from the San Dieguito River Valley south to Mexico and from the Pacific Ocean to national forest lands to the east. The heart of the program includes the establishment of a 171,917-acre preserve designed to protect 85 plant and animal species, including 14 threatened or endangered animal species and seven endangered plants. It has a 50-year time line. It links existing preserves like Los Penasquitos Canyon, the San Dieguito River Park, and the Torrey Pines State Reserve. Partners in the program include San Diego County and the cities of San Diego, Chula Vista, Coronado, Del Mar, El Cajon, La Mesa, Poway, and Santee. Several federal agencies and many landowners are also stakeholders in the plan. Approximately 63 percent of the preserve will be contributed by the public partners, and another 27,000 acres will be bought by them. Participating jurisdictions must establish a regional funding program to purchase and manage 13,500 acres (about 8 percent of the preserve) within three years. Initial funding of $41 million will come from a variety of sources, including developer fees, hotel tax receipts, and federal dollars. Other funding will be provided by management of some MSCP public lands by state and federal agencies, similar to that in the Riverside County plan.

The plan will be monitored closely by many because of its expense and complexity. A spokesperson for the local Sierra Club chapter said that it will be watching the implementation of the plan because "the devil is in the details." Others are concerned about funding. The executive director of the San Diego County Taxpayers Association told the *North County Times* (4/13/97) that there are "no dollars in a pot that says this money is going to be used for this specific purpose." In fact, the group gave the plan its Golden Fleece Award as an example of government waste. It is likely that a countywide ballot will need to be voted on in three years to secure a bond to help pay for the program. Costs are estimated to be between $13 and $39 per county household per year.

Other Subarea Plans and Program Accomplishments

The information in this section summarizes some other NCCP program accomplishments. These descriptions came from http://ceres.ca.gov/cra/NCCP, a site devoted to maintaining news about the progress of the NCCP program.

The Poway plan. This plan, when complete, will provide incidental-take coverage for 43 species of plants and animals. The City of Poway encompasses 25,000 acres and the HCP/NCCP plan establishes a 13,300-acre mitigation area where habitat conservation will be emphasized.

The San Diego Gas and Electric Company (SDGE) Plan. The NCCP Plan for SDGE, a linear NCCP, was the first plan approved in San Diego County. This subarea plan incorporates SDGE lands and easements, and future projects extending from southern Orange County south to the Mexican border. The project covers 110 plant and animal species and emphasizes avoidance of impacts. When impacts occur, the plan establishes mitigation requirements, which may include revegetation or use of up to 240 acres of mitigation credits set aside in several land parcels purchased by SDGE as mitigation banks. SDGE properties and easements play an important role in the NCCP region in providing habitat connectivity in areas where little natural habitat remains.

Conservation banks. Two new land banks were finalized. The Chiquita Canyon Conservation Bank encompasses 327 acres of critical coastal sage scrub and California gnatcatcher habitat in southern Orange County. The bank is owned and operated by the Transportation Corridor Agency, which has mitigation credits available to use for its own future projects or for sale to other parties. The San Vicente Conservation Bank, owned by the Boys and Girls Club of East County, was established in San Diego County and conserves 320 acres of coastal sage scrub and chaparral habitats. The proceeds from the sale of credits at this bank are used to support the activities of the Boys and Girls Club. The Boys and Girls Club is exploring placing adjacent lands into the bank as well. Several additional conservation banks are close to finalization.

Conclusion

The NCCP program is not perfect. Expense and funding are big issues. In the current political climate, habitat protection planning must take into account that private land owners will be expecting to be paid for any infringements on their valid

property rights. In areas like San Diego, where land values are extremely high, this presents a great challenge. Perhaps an editorial from *The Arizona Daily Star* (4/1/97) summed up the hope that the NCCP program brings to the development/habitat protection battle when the *Star* addressed the passage of the San Diego plan:

> For once, intricate, painstaking compromise appears set to move beyond the failed, tract-by-tract, species-by-species scrimmaging that has cost developers time and society scores of extinctions. Moreover, land use in conservative San Diego has now been based soundly on consensus and science rather than the whims of the real estate industry. As a result, an entire metropolitan area today has a fighting chance to save its landscape, rather than just argue about it.

That is why a sort of moral responsibility to stay on board falls on conservationists as well as builders just now.

The alternatives of inaction or gridlock are too dismal. Even scientists associated with groups like the Environmental Defense Fund agree business-as-usual under the Endangered Species Act won't do the job. Meanwhile, Western political alignments rarely permit wholesale land set-asides or unilateral government action to halt species decline.

It is imperative for conservationists, employing the leverage the act does provide, to work constructively to craft big-scale compromises like San Diego's, particularly in conservative regions of the sprawling West.

Such designs—if properly structured—remain the best deal available at a difficult moment. Likewise, they look like the best way to heal a world in pieces. Would that the fractured community of greater Tucson could draw itself together in a similar way.

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