24 Regulatory and Legal Considerations

One way of influencing change in the way forestry is practiced to benefit habitat for animals, or conservation of biodiversity, is through incentive programs such as certification (see previous chapter), tax relief, or compensation for ecosystem services through the form of easements, land purchases, purchases of carbon credits, or habitat banking (Pagiola et al. 2002). More typically, certain practices are prescribed by law. In the United States, laws are policies enacted by legislature and signed into law by an executive branch and enforced through a judicial branch of government. There are certain things that society values strongly enough to prescribe it. Keep species. Manage forests for sustained yield. Do not participate in trade of globally endangered species.

Some policies are set at local levels, such as counties, towns, and even neighborhoods. Zoning laws, building permits, and noise limitations are all set locally and enforced locally. The layers of policies, laws, regulatory agencies, and responsibilities regarding forest management and wildlife conservation, are at times overwhelming, especially to private forest land managers, and that is where the crux of the habitat management problem often lies. Wildlife are public resources whose habitat is most often controlled by private landowners with private property rights. It is relatively easy to envision an ecosystem management plan for a public property, whereby the outcomes of implementing the plan are a set of ecosystem services valued by society, using public land for the public good (Thomas et al. 2006). Private property owners have property rights, and, in some places, they may also have water and mineral rights, restricting what society can demand from their land (Bliss et al. 1997). So although society may say it wants active habitat management for a rare species on private lands, unless the land is deemed critical habitat for an endangered species, society cannot make the landowner do anything—unless there are laws.

INTERNATIONAL LAWS AND AGREEMENTS

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement among governments designed to protect species worldwide. Its aim is to ensure that international trade in wild animals and plants does not threaten their survival (Mace and Lande 1991). CITES was drafted as a result of a resolution adopted in 1963 at a meeting of members of The World Conservation Union (IUCN) and signed in Washington DC in 1973 (Hutton and Dickson 2000). There are now 169 signatories. Today, it provides varying degrees of protection to more than 30,000 species of animals and plants, whether they are sold alive or sold as animal or plant parts (e.g., ivory). This resolution has no habitat provisions; however, several legislations in the United States authorize Congress to appropriate funds to aid in international efforts at habitat conservation. The International Environment Protection Act of 1983 and the Neotropical Migratory Bird Conservation Act of 2000 provide funds to other countries to benefit species of animals, particularly those which cross international boundaries (Elliott et al. 2005).

Each country has its own set of laws regarding conservation of wildlife, forests, and habitat. Laws in some countries are extensive and enforced rigorously. In some countries laws exist but are not consistently enforced. In all cases, political pressures can lead to variable interpretation of the laws.

Countries often take an issue-by-issue approach in their contributions to global environmental issues, each contributing to global governances, such as the management of tropical forests, or to address climate change (Long 2010). Private networks (e.g., in certification) are becoming

more important in global governance because they span international boundaries and bring consistent standards and guidelines to international issues (Long 2010). The Reduced Emissions of carbon dioxide caused by Deforestation and Degradation (REDD+) program is one private network approach to reducing greenhouse gas emissions from forest loss or certain types of management, while also promoting public values associated with biodiversity and human well-being (Long 2010). Consequently, we are seeing layers of laws and policies in which political boundaries are spanned by private networks such as forest certification and REDD+ (Phelps et al. 2010; Nguon and Kulakowski 2013). Understanding the laws and private network governance effects on landscape change, and the ability for landscapes to meet desired future conditions, is critical to development of a forest management plan. I use examples of the hierarchical layers of laws in the United States to illustrate the complexities facing habitat and forest managers, but similar layers and problems are found in other countries.

NATIONAL LAWS

Since the beginning of the conservation debates in the United States between Gifford Pinchot and John Muir, legislation has been proposed that would influence how public and private lands are managed to provide public goods and services (Table 24.1). Many of the earliest legislative acts that affected private landowners had more to do with influencing harvest rates of commercially important species of trees and animals than with governing management on their lands (Bean and Rowland 1997). But as early as 1937, the Federal Aid in Wildlife Restoration Act (also known as the Pittman–Robertson Act) matched federal funds, collected from a tax on firearms, with state funds, to allow management of habitat to benefit many wildlife species (Oehler 2003). Although the original focus of these purchases was for game species, many nongame species benefited indirectly. Use of these funds for habitat management is now viewed more broadly to benefit hunted and nonhunted species in many states (Oehler 2003).

During the 1960s and 1970s, a suite of environmental laws emerged reflecting concern over sustained production of goods and services from public lands. The Multiple Use Sustained Yield Act, Endangered Species Act, National Environmental Policy Act, and National Forest Management Act represent pieces of legislation that continue to shape the way that federal lands are managed and continue to fuel the debates regarding priorities for federal lands (Hibbard and Madsen 2003). One of these, the Endangered Species Act, also has far-reaching influence on private lands. When a species is listed as threatened or endangered by the appropriate federal agency (usually the U.S. Fish and Wildlife Service), "taking" of individuals of protected species by a private citizen constitutes a violation of federal law (Sagoff 1997). The Endangered Species Act (ESA) requires the federal government to designate "critical habitat" for any species it lists under the ESA. Once designated, then any alteration of critical habitat that imperils one or more individuals of any protected species constitutes a violation of the law (Sagoff 1997), and the landowner can be prosecuted unless she (or he) has an incidental "take" permit (Smallwood 2000). The Habitat Conservation Plans (HCPs) are designed to provide no-net-loss of a species, while allowing private landowners the opportunity to continue managing their lands (see Chapter 18). The issue of controlling private property rights through federal law has met with considerable resistance, but because most habitat for many protected species occurs on private, not public, lands, the provision continues to represent a powerful tool for habitat protection and recovery. Unfortunately, there are no provisions for fair compensation of the property owner when ESA restricts harvest of trees for commercial gain (Innes et al. 1998). A federal compensation program, similar to what is used under the Conservation Reserve Program or Wildlife Habitat Incentives Program in the Farm Bill, would probably considerably ease the tension between private forest landowners and federal regulatory agencies.

The Endangered Species Act has been criticized on a variety of fronts. Some say that listing usually occurs too late to effectively recover many species (Neel et al. 2012). Others claim that the rigid framework of no-loss of species is inconsistent with the dynamic nature of ecosystems (Benson

TABLE 24.1

Examples of US Laws That Influence the Ability of Public and Private Forest Land Managers to Provide Habitat for Animals or to Conserve Biodiversity

Timber Protection Act of 1922	Protects timber on federal lands from fire, disease, and insects
Migratory Bird Conservation Act of 1929	Established procedures for acquisition, by purchase, rental or gift, of areas for migratory birds
Federal Aid in Wildlife Restoration Act of 1937	Provides federal aid to states for management and restoration of wildlife, including acquisition and improvement of wildlife habitat
Taylor Grazing Act of 1934	Governs grazing on public lands
Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948	Real property that is no longer needed by a federal agency can be transferred to the Secretary of the Interior if the land has particular value for migratory birds, or to a state agency for other wildlife conservation purposes
Multiple Use Sustained Yield Act of 1960	Established purposes for the National Forest System, including outdoor recreation, range, timber, watershed, and fish and wildlife
Sikes Act of 1960	Provides for planning, development, and maintenance of fish and wildlife resources on military reservations
McIntire-Stennis Act of 1962	Authorized a formula fund for forest research in all states
Wilderness Act of 1964	Considers all interior roadless lands >5000 acres for inclusion into the National Wilderness Preservation System
National Environmental Policy Act of 1969	Ensures that environmental values are given appropriate consideration, along with economic and technical considerations
Alaska Native Claims Settlement Act of 1971	Authorized Alaska Natives to select and receive title to 44 million acres of public land in Alaska
Endangered Species Act of 1973	Provided for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, and implemented the CITES agreement
Federal Land Policy and Management Act of 1976	Constitutes the "organic act" for the Bureau of Land Management and governs most uses of the public lands
National Forest Management Act of 1976	Constitutes the "organic act" for the Forest Service
Public Rangeland Improvement Act of 1978	Improved conditions of public rangelands for grazing, wildlife habitat, and other uses
Cooperative Forestry Assistance Act of 1978	Provides for cooperation on forest management issues with non-Federal forest landowners
Renewable Resources Extension Act of 1978	Increased extension emphasis in renewable resources, including fish, wildlife, and water resources, on private forest and range lands
Alaska National Interest Lands Conservation Act of 1980	Provided 79.54 million acres of refuge land in Alaska
Fish and Wildlife Conservation Act 1980	Provides financial and technical assistance to the states for the development, revision, and implementation of conservation plans and programs for nongame fish and wildlife
Tax Deductions for Conservation Easements of 1980	Stipulates that a taxpayer may take a deduction for a "qualified real property interest" contributed to a charitable organization exclusively for conservation purposes protected in perpetuity
International Environment Protection Act of 1983	Assists other countries in wildlife and plant protection efforts in order to preserve biological diversity
Food Security Act of 1985	Contains several provisions that contribute to wetland conservation including the Swampbuster Provision, the Conservation Reserve Program (CRP) and the Wetland Reserve Program (WRP)
Cave Resources Protection Act of 1988	Provides for management and protection of caves and their resources on federal lands

(Continued)

TABLE 24.1   (*Continued*)

Examples of US Laws That Influence the Ability of Public and Private Forest Land Managers to Provide Habitat for Animals or to Conserve Biodiversity

Emergency Wetlands Resources Act of 1986	Authorized the purchase of wetlands with Land and Water Conservation Fund monies
Land Remote Sensing Policy Act of 1992	Directs that Landsat 7 acquire high priority land remote-sensing data in order to meet the needs of the U.S. Global Change Research Program
Hawaii Tropical Forest Recovery Act of 1992	Provides grants, contracts, and cooperative agreements to promote sound management and conservation of tropical forests in the United States
Partnerships for Wildlife Act of 1992	Authorizes grants to the states for programs and projects to conserve nongame species
National Wildlife Refuge Acts	Various acts to establish specific refuges
Neotropical Migratory Bird Conservation Act of 2000	Provides grants to countries in Latin America and the Caribbean, and within the United States, for the conservation of neotropical migratory birds that winter south of the border and summer in North America
State Wildlife Grants program of 2001	Supports cost-effective conservation aimed at preventing wildlife from becoming endangered
Healthy Forests Restoration Act of 2003	Reduces the risk of catastrophic fire to communities, helps save the lives of firefighters and citizens, and protects threatened and endangered species

Source: Extracted from the US Fish and Wildlife Service Laws Digest, Washington, DC.

2012). Add, on top of these concerns, the effects of climate change (Povilitis and Suckling 2010), and it is no wonder that ESA continues to be questioned. Nonetheless, it is the strongest law we have currently in the United States to minimize risk of loss of species.

Another powerful federal law, the National Environmental Policy Act (NEPA), is designed to document and prevent unwanted adverse environmental effects of federal actions. Responsibilities of federal agencies, under the National Environmental Policy Act, include scoping of the management action, scientific analysis, social and economic analysis, securing public input, media relations, regulatory analysis, and litigation (Auer et al. 2011). There are instances where this Act can also influence management actions, not only on federal lands, but on nonfederal lands as well (Moser 2000). For instance, if federal funds are used in a habitat improvement project on state or private lands, then NEPA processes would have to be followed (Figure 24.1). It is during this process that environmental impact statements are developed to compare the environmental consequences of proposed and alternative land management actions. The process allows for public involvement and participation, creating a more transparent mechanism for ensuring that public concerns are addressed. The process is also costly, both financially and in timing, often taking a year or more before a record of decision is made. Those involved with NEPA processes can view the process differently. Stern et al. (2010) found that in the U.S. Forest Service, members of interdisciplinary teams conducting NEPA analyses emphasized minimizing negative environmental and social impacts, satisfying stakeholders, and avoiding litigation. Forest Service employees who make decisions based on NEPA processes placed more emphasis on efficiency and less on minimizing impacts (Stern et al. 2010). Advisory employees emphasized transparency in the process (Stern et al. 2010). Consequently, there have been efforts to change or "streamline" NEPA and more rapidly allow management actions to proceed where timing is critical (Smythe and Isber 2003). For instance, the Healthy Forests Restoration Act included provisions to this effect, enabling a more rapid response with regards to salvage logging to reduce risks associated with reburning of forests. Such provisions meet opposition, however, when streamlined procedures are perceived to increase risk of environmental degradation.
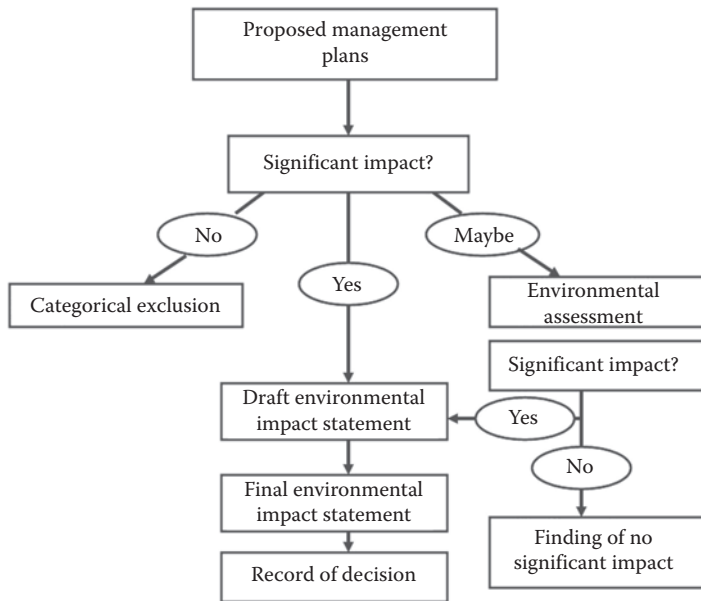
FIGURE 24.1 Flow chart of the NEPA process required of federal land managers and land managers using federal funds in the United States.

Cumulative effects analysis (CEA) is also required as a part of NEPA. Agencies charged with conducting a CEA often encounter challenges in defining the appropriate spatial and temporal scales of analysis, lack of understanding regarding the purpose of a CEA, lack of data, and communicating the results of the analysis (Schultz 2012). Agencies working with other land managers, public and private, could facilitate the effectiveness of CEAs.

A recent federal program has provided new opportunities for biodiversity conservation among the states in the United States. The State Wildlife Grants program of 2001 provides federal dollars to every state and territory to support cost-effective conservation aimed at preventing wildlife from becoming endangered. Funds are allocated to every state according to a formula based on each state's size and population. Each state and territory is responsible for developing a statewide wildlife action plan to identify species, and their habitats, of greatest conservation need, and outline the steps that would be needed to conserve all species and natural areas. This program is supported by a coalition of more than 3000 organizations that are members of Teaming with Wildlife. Such broad-based grassroots support for this initiative has helped to ensure its success. Once in place, a national support program may facilitate cross-boundary conservation needs and enhance collaborative efforts among states (Meretsky et al. 2012).

Federal funding is provided to land management agencies specifically to support habitat acquisition and management. National Wildlife Refuges represent the best example of a federal program of habitat management, but programs within NRCS, such as the Wildlife Habitat Incentives Program (WHIP), provide cost-share habitat improvement support for private landowners as well. Habitat management is also an integral part of land management plans developed in the Forest Service, Bureau of Land Management, National Park Service, and military installations. All tolled, many millions of federal dollars are spent annually on habitat management projects on public and private lands.

Under the 2008 Farm Bill, before state forestry agencies can receive federal funding, an assessment of state and private forest lands must be conducted, including priorities for "enhancing … biological diversity … wildlife, wildlife corridors, and wildlife habitat" (Kostyack et al. 2011). Further,

these assessments and strategies are expected to address how forests are to be managed to "adapt to global climate change" (Kostyack et al. 2011).

Federal funding also has been provided to support research and outreach activities to states. The McIntire–Stennis Act and the Renewable Resources Extension Act provide formula funds to land-grant universities, to support forest research and outreach activities, respectively (Thompson and Bullard 2004). These funds are often used to support research and outreach dealing with forest management, wildlife habitat management, and forest biodiversity conservation. This effort supplements efforts within the research programs of the various federal agencies (U.S. Fish and Wildlife Service, U.S.G.S. Biological Resources Division, U.S. EPA Office of Research and Development) and outreach arms of federal agencies (e.g., Forest Service State and Private Forestry program). Private industry also supports research in forest wildlife habitat management, largely through the forest industry-supported organization, National Council on Air and Stream Improvement (NCASI). Information from all of these research efforts is extended to public and private land managers, and to the general public, to enable more effective management of land and water resources.

State Laws

State laws, generally, have focused on traditional game management approaches, with a lower priority given to protection of nongame species and biodiversity in general, but that trend seems to be changing. There is increasingly more pressure being placed on states to accept responsibility for biodiversity conservation and protection of endangered species. Most states do not have funding mechanisms adequate to address these issues. Nonetheless, many states do have state laws protecting endangered species and policies that influence management of habitat for these and other species (George et al. 1998). I provide a few examples of state wildlife laws that influence habitat management; these examples were largely extracted from Musgrave and Stein's (1993) overview of state wildlife laws.

Massachusetts identifies significant habitats for rare, threatened, and endangered species under its state endangered species act. Since most land in the state is privately owned, there are significant impacts on private forest-land owners. Before a landowner can alter forest in a "significant habitat" (with some exceptions), the landowner must provide to the regulatory agency (MassWildlife) the following:

- A complete description of the project
- Alternatives to the proposed project
- Impacts of the proposed project on the subject species
- Plans for protection of the subject species and mitigation measures to be taken to offset these impacts
- A description of potential economic effects of the proposed project on the landowner and the community

A permit to proceed with a project would be granted only upon finding that the proposed action will not reduce the viability of the significant habitat to support the population of the subject species. Massachusetts also has developed a landowner incentives program for habitat improvement (Figure 24.2). So, rather than simply regulating private landowner actions, the state encourages landowners to apply to participate in a cost-share program that would benefit certain species. Regulations and incentives represent the carrot and stick approaches to maintaining biodiversity.

Louisiana also has policies regarding habitat improvement, and protection for certain species. The state is authorized to contract with a private landowner for use of lands for at least 25 years, to allow establishment of wildlife management areas, with a tax-free incentive to the landowner. In addition, the Louisiana Department of Wildlife and Fisheries established a "Louisiana Acres for Wildlife" program, which provides landowner assistance in habitat management. Biologists provide planting stock, guidance for habitat management actions, and habitat evaluation surveys. The

FIGURE 24.2 Grasslands and early successional woodlands managed for birds using Wildlife Habitat Incentives Program grant dollars, Arcadia Wildlife Sanctuary, Easthampton, Massachusetts.

program is voluntary, and participants must have >0.4 ha of land and agree that management continues for at least one year. To date, the focus of this program has been on game species production, but clearly there are benefits for nongame species as well. Many other states, such as Oregon and Kentucky, have similar programs, allowing the state to contract with landowners to establish wildlife refuges or management areas. Most states are also authorized to purchase lands to protect habitat, though, until recently, these purchases have been primarily to allow hunting of game species.

Minnesota's regulations include provisions for improvement or acquisition of "critical natural habitat." Identification of what constitutes a critical natural habitat is based on

- Significance as existing or potential habitat for fish and wildlife, and providing fish- and wildlife-oriented recreation.
- Significance to maintain or enhance native plant, fish, or wildlife species, designated as endangered or threatened.
- Presence of native ecological communities that are now uncommon or diminishing.
- Significance to protect or enhance natural features within, or contiguous to, natural areas, including fish spawning areas, wildlife management areas, scientific and natural areas, riparian habitat, and fish and wildlife management projects.

Purchase of lands for these purposes is restricted by availability of state funds, so areas must be prioritized, based on the above factors. States such as Massachusetts must prioritize purchases, because urbanization is causing purchase prices for important patches of habitat to be excessively high.

The degree to which various states have begun to shift from a game management focus on their lands, to an ecosystem management approach, is high variable. Because most state wildlife agencies are funded primarily from hunting and fishing license sales, expenditures on nongame species can easily be brought into question by their constituents. However, most state biologists have realized that "keeping all the pieces" is a correct course of action that will benefit both game and nongame species (Jacobson et al. 2010). Indeed, reform of the wildlife conservation institution was proposed by Jacobson et al. (2010) who recommended the following changes to maintain relevancy to constituents: "broad-based funding, trustee-based governance, multidisciplinary science as the basis of recommendations from professional staff, and involvement of diverse stakeholders and partners."

Many states also have forest practices acts or policies restricting forest management actions to minimize adverse effects of forest harvest and management on various ecosystem services. Initially, these were largely focused on water quality and habitat for fish (e.g., Oregon and Washington Forest Practices Acts) but have expanded to include headwater and vernal pool amphibians (e.g., Massachusetts) and upland species (snag and green tree requirements in Oregon). Massachusetts, for instance, requires that a cutting plan be submitted to a state service forester, who reviews it for compliance with state laws and also ensures that the plan is reviewed for presence of state-listed rare species by biologists in the Natural Heritage Program of MassWildlife. Such an approach may then lead to additional restrictions on activities, based on the possible presence of a rare species and its habitat needs. The level of restrictions and level of review, both prior to and following a harvest, varies considerably from state to state. Often separate state agencies within the same state are involved in forest practices law enforcement and habitat management enforcement. Such an approach can, at times, pit one set of natural resources professionals against another. Approaches that allow both groups to identify a desired future condition (DFC), and mutually agree on approaches to work toward that DFC, would often be more effective. In addition, increased levels of coordination of habitat management among states can increase effectiveness for many species, because animals usually do not respond to political boundaries. Animals cross state lines during migration and dispersal. As climate change places additional pressures on geographic ranges, cross-boundary movements may become even more important. Interstate coordination of habitat acquisition, leasing, management, and prioritization may improve the effectiveness of approaches among participating states (Meretsky et al. 2012).

Municipal Policies

Local governments are leaders in the development of policies that influence local production of ecosystem services, because local communities are the direct beneficiaries of these regulations (Hirokawa 2011). Habitat is one of those regulated ecosystem services and is considered explicitly in the policies enacted in some counties and towns. These sorts of policies vary tremendously and are often associated with land-use laws such as zoning laws, urban growth boundary designations, and building permit laws. For instance, Wisconsin County Forests are governed by the County Forest Law requiring that these forests be managed for multiple uses, such as forest products, recreation, wildlife habitat, and watershed protection. Twenty-eight northern Wisconsin counties own and manage nearly one million hectares of county forest lands. Counties are required to develop comprehensive land-use plans for each forest. Eau Claire, Wisconsin, manages a county forest specifically as habitat for wildlife "common to Wisconsin." This plan recognizes that each species requires different forest conditions ranging from recently disturbed to old growth. The county also pays particular attention to endangered species on the property (Karner Blue Butterfly, a federally listed endangered species) and has developed a habitat conservation plan for the Karner Blue Butterfly.

In the northeastern United States, county governance is not as important as town governance. Towns have policies that influence habitat management and availability, and these vary widely from town to town. Few explicitly consider wildlife habitat. The town of Milan, New York, however, participates in an effort to "… protect the integrity and value of Milan's natural areas, and protect the town's watershed and significant biological resources." The townspeople recognize that the diverse natural resources of the town are particularly vulnerable to adverse impacts associated with development and sprawl. They are conducting habitat assessments to provide baseline information and improve the town planners' ability to protect significant biological resources in the face of increasing development pressure. The habitat assessment program takes into consideration a number of environmental impacts associated with development, including direct loss of habitat and reduced populations, habitat fragmentation and adverse edge effects, increasing effects of invasive species, degraded water quality, and increased pollution. Such a detailed approach to planning is becoming

increasingly common, especially in communities where land-use change is rapid, and local communities become increasingly concerned about the long-term adverse effects of such changes.

There is also is a growing movement toward more community-based conservation approaches, in which local communities benefit from conservation-associated efforts (Kothari et al. 2013). Such approaches can be particularly effective in cultures where locally derived values are achievable in concert with conservation of biodiversity. Community forests in northern New England in the United States were managed based on shared governance, inclusive participation, shared distribution of benefits, and effectiveness in achieving conservation goals (Lyman et al. 2013). Community forests have been a part of Mexican culture for many years. Known as *ejidos*, community forest lands comprise 80% of Mexico's forests. These community lands are used for forest products as well as agricultural production. Community managed forests tend to have lower annual deforestation rates than protected forests (Porter-Bolland et al. 2012). In situations where the local community's social and economic needs are considered, community forests have the capacity to offer protection to many aspects of biodiversity in forests managed to meet human needs, as well as the needs of other species. Similar examples of community forests can be found in Costa Rica and Nepal (Kothari et al. 2013).

POLICY ANALYSIS

The layers upon layers of policies that apply to forests—across, within, and among countries around the world—can easily overwhelm managers of forest lands. Policies are many, complex, and frequently changing. It is a challenge to develop forest management plans that follow current policies. By having foresters work with biologists to develop plans, it is more likely that pertinent forest practices, rules, and wildlife laws, will be followed. Assuming that all policies are followed (clearly an incorrect assumption!) will they achieve society's goals? Will the application of the federal, state, and local policies to forest parcels, across a mixed-ownership landscape, lead to better biodiversity protection in 10 years? 100 years? Will forest management continue to be economically viable? In many instances, the answer to these questions from policy makers is, "We think so." But in nearly every case, it is unclear how effective any single policy might be in achieving its goal, and even less certain when considered in the presence of a set of additional policies, some with entirely different objectives.

Uncertainty of achieving desired results from policy implementation is related to the complexity or messiness of the policy problem. Lackey (2006) indicated that messy ecological policy problems often share several qualities: (1) complexity—innumerable options and trade-offs; (2) polarization—clashes between competing values; (3) winners and losers—for each policy choice, some will clearly benefit, some will be harmed, and the consequences for others is uncertain; (4) delayed consequences—no immediate "fix" and the benefits, if any, of painful concessions will often not be evident for decades; (5) decision distortion—advocates often appeal to strongly held values and distort or hide the real policy choices and their consequences; (6) national versus regional conflict—national (or international) priorities often differ substantially from those at the local or regional level; and (7) ambiguous role for science—science is often not pivotal in evaluating policy options, but science often ends up serving inappropriately as a surrogate for debates over values and preferences.

Lackey (2006) then proposed nine axioms that are typical of most current ecological policy problems that must be considered during policy development and debate: (1) the policy and political dynamic is a zero-sum game; (2) the distribution of benefits and costs is more important than the ratio of total benefits to total costs; (3) the most politically viable policy choice spreads the benefits to a broad majority, with the costs limited to a narrow minority of the population; (4) potential losers are usually more assertive and vocal than potential winners and are, therefore, disproportionately important in decision making; (5) many advocates will cloak their arguments as science to mask their personal policy preferences; (6) even with complete and accurate scientific information, most policy issues remain divisive; (7) demonizing policy advocates supporting competing policy options

is often more effective than presenting rigorous analytical arguments; (8) if something can be measured accurately and with confidence, it is probably not particularly relevant in decision making; and (9) the meaning of words matters greatly, and arguments over their precise meaning are often surrogates for debates over values.

Although scientific information is just one element of complex political deliberations in a democracy (Lackey 2006), it can—and has—influenced policy direction. One approach to considering the potential effectiveness of policies is to conduct a *policy analysis*, an organized projection of how implementation of the policy over space and time might possibly affect the resources valued by society. It is most useful to think of policies as hypotheses. The ones enacted now are being tested now, especially if we monitor the results. But there are two primary questions that should be asked by policy makers in particular, and society in general: (1) Are current policies achieving our goals? and (2) Would an alternative policy be more effective in achieving our goals?

Regional policy analyses that examine the tradeoffs among policies on economic, social, and ecological values are becoming more common. Analyses have been conducted in Canada (Hauer et al. 2010), Finland (Primmer 2011), and the United States (Spies et al. 2007; Rittenhouse and Rissman 2012), among others. Spies et al. (2007) used the Oregon Coast Range as a case study to examine how forest policies might affect various measures of biodiversity over a multiownership region. The dominant federal policy, the Northwest Forest Plan, is designed to increase habitat for species associated with late successional forests on federal lands (FEMAT 1993). Using projections of forest landscape development under pertinent federal and state policies, the forests of the region are expected to move toward the historical range of variation for most age classes of forest (Spies et al. 2007) and improve habitat for associated late successional species. But habitat recovery for some species may take >100 years; a very long-term policy would need to be in place! In addition, the current set of policies is expected to result in declines in diverse early successional forests and in hardwood forests in the region, with predicted declines in habitat availability for several species associated with these types of forests (McComb et al. 2007). These unanticipated changes in forest composition and structure may cause policy makers to develop alternative policies to ensure that such changes do not lead to a landscape in which additional species are placed at risk. Projections such as these represent "thought-experiments" that can provide policy makers insights into the possible outcomes of forest management policies (Oreskes 1997).

HOW DECISIONS IN THE UNITED STATES INFLUENCE HABITAT IN THE WORLD

Many nations of the world have complex forest-land management policies that are enforced to ensure that ecosystem services demanded by society are provided into the foreseeable future. But the degree to which various countries have international policies addressing biodiversity conservation (the United States does), reducing the effect of climate change (the United States does not), or trade in endangered species varies tremendously. And policies enacted in the United States that conserve biodiversity can have significant impacts on biodiversity conservation in other countries.

The world has become a smaller place with global transportation and economies. All countries aspire to a high standard of living. They want a clean environment, a safe place to live, adequate healthcare, and, to the degree possible, stability and security in the lives of its citizens. Some countries can afford such a set of conditions (the "haves"), while others struggle to provide the basic services needed for human survival (the "have-nots"), and, of course, these extremes represent endpoints of a spectrum. The "haves" not only can afford to meet the expectations of most of its citizens most of the time, they also often have large appetites for resources such as energy, water, and timber. If the timber does not come from the "haves" then it will come from the "have-nots," the countries least able to afford enforcement of environmental laws. Where the "have-not" countries also represent areas of high biodiversity (e.g., some tropical countries), the "have" countries conserve their biodiversity while threatening it in other countries and worldwide. How do we solve this problem? Altruism, a human quality of placing others before yourself, is a human behavior

that could be espoused by both citizens and the politicians who represent them. Realizing that for the greater good of both humanity and biodiversity, some societies must have less so that others can have more, would begin to address these problems of inequity. Use less energy, less water, less wood, make fewer babies, accept stable economies, and do not expect them to continue to grow, grow the food you eat, grow the wood that you use. These things have not happened yet. It is not clear what it might take for altruism to be more broadly expressed in the world.

CASE STUDY: THE ENDANGERED SPECIES ACT AND CLIMATE CHANGE

Nearly every climate scientist in the world agrees that the Earth's climate is changing at a rate that is unprecedented, at least as presented in the geologic record. The most noticeable changes thus far have been at the poles and in high alpine areas. The image of the polar bear on an ice flow that is shrinking, with nothing but ocean surrounding it, true or not, has captured the attention of many people. But what happens to those species found at the poles, on mountain tops, along shorelines (with sea-level rise), and in other ecosystems, where the changing climate will lead to novel conditions that these organisms have never faced? To call them threatened seems an easy case to make, unless they can move to new sites, adapt to new conditions, or be moved to sites habitable by them (Kostyack et al. 2011).

In the United States, these ecosystems at risk of loss or significant change due to climate change could be considered critical habitat under the Endangered Species Act. Indeed, by 2008, 60% of the ESA Recovery Plans referenced climate change (Polvilitis and Suckling 2010). Considering climate change in Habitat Conservation Plans has also gotten some attention. Bernazzani et al. (2012) provided nine recommendations for integrating climate change into the HCP process: (1) identify species at risk from climate change; (2) explore new strategies for reserve design; (3) increase emphasis on corridors, linkages, and connectivity; (4) develop anticipatory adaptation measures; (5) manage for diversity; (6) consider assisted migration; (7) include climate change in scenarios of water management; (8) develop future-oriented management actions; and (9) increase linkages between the conservation strategy and adaptive management/monitoring programs. Other scientists have offered suggestions for taking proactive measures to mitigate the potential adverse effects of climate change in forests.

Spies et al. (2010) suggested that forest-stand and landscape structure could be managed to increase ecological resistance and resilience; species and genotypes could be actively moved to new locations; and multiownership planning could be implemented over regions, to make adaptive actions more effective. But remarkably little progress has been made in addressing the effects of climate change on endangered and threatened species. Taking actions to address climate change effects is more often discussed than implemented, and institutional barriers within agencies can limit what can be accomplished (Jantarasami et al. 2010). Archie et al. (2012) cited lack of information at relevant scales, budget constraints, lack of specific agency direction, and lack of useful information, to be the most common barriers to adaption planning. Budget constraints and perceived lack of importance to the public were obstacles to implementation of adaptation projects (Archie et al. 2012).

So what can we do to minimize the risk of losing species when little management has been implemented, and the rate of change in climates is rapid? Scientists need to be careful to cite the risks to species from climate change, without becoming viewed as policy advocates, if we are likely to see a change in policies that will significantly reduce the rate of accumulation of greenhouse gases. Without objective policy analyses that demonstrate risks associated with different courses of action, we may stay in policy debates, while options decrease due to the rapidity of change around the globe.

SUMMARY

The myriad interacting policies at the federal, state, and municipal levels influence the amount and distribution of habitat for various species, from forest stands to global forests. Policies have

begun to evolve at all levels from a strong focus on habitat for game species to one of biodiversity conservation. Increased levels of coordination in policy formulation across political lines (international, interstate, cross-county) may be necessary to ensure biodiversity conservation in forested landscapes. Analyses of the future implications of forest policies can allow policy makers to better understand the time needed to see the results of their policies, if there are unanticipated consequences from their policies, and if alternative policies might better achieve their goals.

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