Lyn Sedlak-Ford's *The Great Return* reflects both the beauty of salmon and their plight in finding it increasingly difficult to return to their spawning grounds each year (represented by their swimming in opposing directions). Several species of salmon throughout the Pacific Northwest are threatened or endangered. Timothy Beatley's article proposes a new approach to helping these and other endangered species survive.

The artist, who holds degrees in psychology and art therapy, has been creating works in clay since 1989 after working 9 years as an art therapist. She resides on Lacamas Lake in Camas, Washington, and her works can be seen in galleries throughout Washington and Oregon and in private collections across North and South America. Thanks to the Riversea Gallery in Astoria, Oregon, for their help in putting us in touch with this artist.

Preserving Biodiversity

Challenges for Planners

Timothy Beatley

Preserving biodiversity represents a major challenge for American planners, as threats to biodiversity are increasingly the result of urbanization and land use change. Present and past conservation strategies, including the federal Endangered Species Act, have not been successful; new, bolder strategies are needed. Long-range land use planning, aimed at creating large-scale integrated ecological systems of connected greenspace and habitat, is the key. Nested approaches in which regional systems of protected greenspace connect with and link to larger statewide and continental systems are

Now that the federal Endangered Species Act of 1973—the centerpiece of efforts in the U.S. to preserve biodiversity—has passed the 25-year mark, it is perhaps an especially appropriate time to take stock of the effectiveness of our current conservation strategies. This commentary does that and suggests that we need a new conservation paradigm—one using more proactive, bolder, and larger-scale conservation strategies. This new agenda must focus on land use planning as well as on redefining the role of cities and communities in protecting and preserving biodiversity.

The Trends are Not Encouraging

To begin, there is considerable consensus now that we are indeed in the midst of an unprecedented spasm of species extinction and biodiversity loss. While there is a tendency to view this problem as occurring largely outside the U.S. (e.g., the loss of tropical rain forests), it is also taking place very much in our own American backyards. The trends in this country are disturbing, to say the least. In 1999, there were 1181 species on the federal list of endangered and threatened species, and the number continues to grow (U.S. Fish and Wildlife Service, 1999a). The Nature Conservancy's (1997) species status report card, monitoring the condition of over 20,000 U.S. plant and animal species, concluded that about one third are imperiled or vulnerable.[1] According to the U.S. Fish and Wildlife Service (1999a), every state contains listed species, but the highest numbers tend to be found in states with high population growth. The states with the greatest number of listed plants and animals are Hawaii (298), California (260), Florida (102), Alabama (97), Tennessee (88), and Texas (73). By contrast, Alaska has only 7 listed species, and the less populated states of North and South Dakota have only 10 and 11 listed species, respectively.

While there are many types of threats to biodiversity in this country, destruction of habitat has become the most significant. In one of the first quantitative analyses of the types of threats to listed species, Wilcove et al. (1997) concluded that some 85% of the species they examined were threatened by

necessary. Habitat conservation goals must be more ambitious and wasteful development patterns must be checked if biodiversity is to be preserved. Other elements of the conservation strategy must include new approaches to funding acquisition, creative incentives for conservation on private lands, envisioning new roles for cities in restoring and conserving biodiversity, and giving greater attention to biodiversity conservation in planning curricula.

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habitat degradation and loss. This habitat loss takes a number of forms, but much of it is the direct result of urbanization, as when a wetland is filled for a new home or a prairie converted to a subdivision. Urbanization patterns and trends create serious problems of habitat fragmentation, as well, as when habitats become splintered by roads and other forms of development. Increasingly, this habitat loss is the result of wasteful patterns of low-density development. These threats place biodiversity loss squarely and undeniably in the realm of planning.

In this splintered and fragmented natural landscape, it is especially difficult to sustain larger species such as wolves, grizzly bears, or Florida panthers. We continue to try to reintroduce populations of certain species in areas where they have been extirpated, but this also becomes increasingly difficult in the face of scattered human populations and development pressures. Examples include reintroduction of the lynx in Colorado, the red wolf in North Carolina, and the Mexican wolf in Arizona.

Biodiversity by definition requires greater diversity in ecosystems and biological communities, and here the news is equally disturbing. Noss, LaRoe, and Scott (1995) documented significant losses of biodiversity at the ecosystem level. Specifically, they identified 30 critically endangered ecosystems (98% or greater decline), 58 endangered ecosystems (85–98% decline), and more than 38 threatened ecosystems (70–84% decline). The losses were particularly evident in those parts of the nation where population and land use pressures have been the greatest: the Northeast, South, Midwest, and California. The types of ecosystems in decline ranged from sea grass meadows in Florida, to tall grass prairies in the Midwest, to coastal sage scrub in California.

A more recent extensive study of North American ecosystems undertaken by the World Wildlife Fund—the North American Conservation Assessment—reached similar troubling findings. While concluding that there is tremendous biological diversity here, a large number of ecoregions (broad-scale groupings of habitat types) and a large area of the continental U.S. were found to be in critical or endangered condition. A large number of these ecoregions, including southeastern conifer forests, central tall grasslands, and northern California forests, among others, were found to be globally outstanding (having great biological diversity and uniqueness compared with similar habitats around the world) yet in need of immediate protection or restoration (World Wildlife Fund, 1997a, 1997b; Louma, 1997; Abell et al., 1999).

In part, planners must face up to the biodiversity challenge because increasingly, and in so many metropolitan areas around the country, habitat loss and fragmentation are the direct results of urbanization and suburban and exurban growth pressures. Evidence can be seen throughout the country (Lassila, 1999). In the Seattle, Washington, region, decades of habitat destruction have culminated in the federal listing of the Puget Sound chinook and several other species of salmon. Southern California, a region of high species endemism (species existing nowhere but there), is home to a number of endangered species, and major conflicts between habitat conservation and urban development have been occurring there. In the Texas hill country, housing developments and shopping malls have threatened habitat for two species of migratory songbird, a number of cave-adapted invertebrates, and a unique subterranean archipelago (see Beatley, 1994). In the Florida Keys, second home and resort development has had both severe direct effects (loss of habitat) and indirect effects (mortality from increased traffic) on the en-

dangered Key deer and other species. Other animals, such as the Florida black bear, have been heavily impacted by traffic kills, as new roads and hard surfaces crisscross and dissect that state's landscape. Along the Colorado Front Range, suburban growth is decimating the habitat of the black-tailed prairie dog, currently under consideration for federal listing as a consequence of precipitous declines in population and restricted habitat (now estimated to be 1% of what it had been; Eddy, 1999). Everywhere, it seems, species and ecosystems are under siege from urbanization.

Current Approaches Have Not Worked Well

For the most part, biodiversity conservation in the U.S. has been driven by the requirements of the federal Endangered Species Act (ESA). The ESA has accomplished much, and still represents one of the most important pieces of environmental legislation ever enacted. Once listed, species are afforded unprecedented legal protection, including prohibitions on their "take" by public agencies and private landowners alike (*take* is defined broadly to include not only killing, harming, or harassing a species, but also destroying essential habitat).

But the approach of the ESA has many limitations and is in many ways not up to the present and future challenges we face. It has been largely a reactive law, an example of what some have called "emergency-room conservation": by the time species have gone through the federal listing process and receive protection, their ecological condition is often dire. While the ESA has been effective at stabilizing or improving the populations of many listed species (about 40%),[2] only a small number (11 species) have recovered sufficiently to be removed from the list (U.S. Fish and Wildlife Service, 1999d). While protection of habitat is mentioned prominently in the law, the protections under the ESA have been driven by the condition of individual species.

Also alarming is that many of the conservation actions and solutions undertaken are fragmented and piecemeal. Small-scale mitigation projects typically required under federal and state environmental mandates often produce only minor improvements. Project-by-project environmental analysis and mitigation will not solve our environmental problems and will not ensure that we will be able to maintain healthy ecosystems or biodiversity in the long run.

As the new millennium approaches, we must fundamentally rethink our conservation strategies. We need a new conservation vision and a redefined role for planners. As habitat loss continues and the number of species in jeopardy continues to rise, we must explore new alternatives. To be truly effective in the long run, our efforts must be intentionally multispecies in emphasis and must seek to protect the integrity and health of the broader habitats and ecosystems that support biodiversity—those of species that are endangered and threatened and of ones that are not. We need more integrated, comprehensive biodiversity conservation strategies that are long-range, proactive, and preventive in nature. We need to get ahead of the curve of decline and preserve species before their numbers and habitats are so reduced that emergency-room conservation is our only option.

Land Use Planning is the Key

Long-range land use planning must be the linchpin of our new biodiversity conservation strategies. Increasingly, this challenge must be faced by planners, as it will be a necessary part of any successful conservation strategy in the future. Those states and regions experiencing the greatest population and development growth pressures, moreover, also tend to be home to extensive numbers of species and diverse ecosystems. These clashes will continue and indeed become more intense in the future, and consequently finding ways to preserve biodiversity in the face of these pressures will become an even greater challenge.

Many of the current clashes between urban development and biodiversity—what Secretary of the Interior Babbitt has aptly called "train wrecks" (Reinhold, 1993, p. A1)—could have been avoided through careful, effective land use planning and growth guidance. In Austin, Texas, for instance, a forward-looking plan called *Austin Tomorrow* used an impressive series of ecological analyses to chart a growth corridor that would have minimized the ecological damage there (City of Austin, 1977). For a variety of political and other reasons, the plan was not implemented, and the booming growth that followed happened in some of the most ecologically sensitive areas of the region. While this plan would not have provided a complete solution, the region's need for an expensive habitat conservation effort[3] might have been avoided had effective land use planning taken place early.

The story is much the same in many other parts of the country where ecological "train wrecks" have occurred. The threats to biodiversity in the Pacific Northwest and the tremendous protection and restoration costs to be incurred from salmon and steelhead listings might have been substantially avoided if more stringent and demanding land use controls had been in place earlier on. It is, of course, not too late in such places. In a press release, Mike Burton, executive director of Oregon's Metropolitan Service District (Metro), emphasized

the importance of a new land use resolve which he believes the region must now be willing to accept: "We will not succeed at recovering salmon in the metropolitan area unless we change our development patterns and change our transportation patterns." And, he puts it even more bluntly: "We must stop building stupid buildings in stupid places" (Burton, 1999). This means, among other things, avoiding riverbanks and riparian areas, and requiring better and more effective storm water management measures for new development.

Comprehensive land use policies which protect essential habitat corridors and linkages must be at the core of these strategies. Land use and growth guidance techniques may steer development away from inappropriate and damaging locations, and prevent land use patterns and practices that fragment and isolate habitat. In the Puget Sound region, recovery of species such as the Chinook salmon will be undeniably linked to more sensible and sustainable patterns of land use. It will require more stringent controls on logging and development along stream banks, and more stringent restrictions on filling wetlands and building in sensitive and damaging locations.

A land use planning approach to biodiversity conservation will require more than simply redirecting future growth away from a few ecological hot spots or saving a small amount of habitat. Indeed, what will also be required is a fundamental rethinking of types and forms of urban growth. One of the most troubling aspects of many of our recent habitat conservation initiatives has been the acceptance of prevailing low-density, scattered development patterns and the belief that all that is needed to preserve biodiversity is to set aside a few areas of protected habitat. Biodiversity preservation will also require that we reevaluate the ways in which our communities and regions grow and develop. Containing urban growth in a compact urban form will be essential in protecting biodiversity.

Part of the agenda must also be how such comprehensive strategies are characterized in the regions in which they are envisioned. New land use planning restrictions and initiatives must be viewed as contributing substantially to the quality of life of residents (and thus to the economy). Perhaps at the deepest levels, biodiversity preservation must be redefined as self-preservation, an idea we have not yet been willing to accept. In an oped article in the *Seattle Times*, Alex Steffen puts it well:

> We know that what's bad for wild salmon is bad for us. Polluted waters, eroding land, wetlands which protect our communities from flooding being dredged and filled, lakes and bays whose bottoms are coated with toxic sludge, raw sewage churning out of open pipes, farmland being eaten up by runaway sprawl and the last nearby woods being clear cut and paved over for a strip mall—this is not what we want for our children, and we know, both in our guts and from the work of scientists, that it's hurting not only the salmon but the health of our whole region. (Steffen, 1999, p. B5)

In many situations, the loss of habitat results in other substantial and significant societal costs. Clear cutting and developing in sensitive, steep-slope areas of the Northwest—major causes of the present plight of endangered salmon there—have also been instrumental in the extremely costly flooding and flood damage that have occurred in recent years (e.g., Mazza, 1996). The connections between biodiversity conservation and other important local goals, such as economic development and enhancement of quality of life, will increasingly need to be made if comprehensive networks of habitat are to be preserved.

Much political power has been gained recently from an emphasis on green infrastructure, the idea that preserving forests, wetlands, and rivers is as essential as building roads, power lines, and airports—indeed, more important in the human life-support functions they provide. These elements of the natural environment are not expendable or optional, but essential, as the term *infrastructure* implies.[4]

New Tools for Conservation

New biodiversity conservation tools are available to communities that will protect habitat and species, and greatly aid in effective land use planning. Several are worthy of special mention. One of these tools is the habitat conservation plan (HCP), a balancing tool that dates from the early 1980s. This tool has been used with much greater frequency in the last 5 years and has become a major plank in the conservation platform of the Clinton administration. HCPs allow "incidental take" of federally listed species and contain conservation measures, habitat acquisition, and the creation of one or more habitat preserves. More than 200 HCPs have been approved and another 200 are in some stage of development (U.S. Fish and Wildlife Service, 1999c).[5] More than 6 million acres of land, in 16 states, are now covered by HCPs.

While the early HCPs tended to focus on one or a few species and covered fairly limited geographical areas, many of the more recent ones have taken broader, multispecies- and ecosystem-oriented approaches. These are certainly positive trends, though the biological adequacy of these plans remains in question (see Beatley, 1994).

They do allow for the potential to rise above the project-by-project conservation standards and the more fragmented mitigation and conservation measures that typically result. Regional HCPs have the potential to generate significant financial and political support for securing and managing substantial blocks of habitat and protected land, often in close proximity to metropolitan areas.

One of the most ambitious regional and multispecies HCP efforts to date is underway in southern California, one of the most significant biodiversity hot spots in the country. California's Natural Community Conservation Planning (NCCP) program began in 1991 with its pilot application in the coastal sage scrub ecosystem. Stimulated largely by the impending federal listing of the California gnatcatcher, the NCCP was intended to support a scientifically-based, ecosystem-oriented habitat protection strategy. Under the program, a five-member scientific review panel was convened to prepare conservation guidelines. Choosing to focus on three target species (including the gnatcatcher), the panel delineated a series of "subregional focus areas," around which more detailed protection schemes have been focused (Murphy et al., 1999; Natural Resources Defense Council, 1997). Multispecies plans have now been prepared (and approved locally) for two subareas: the Orange County Central/Coastal Plan and the San Diego Multiple Species Conservation Program Plan. The San Diego Plan is ambitious in scope, covering some 582,000 acres, 172,000 of which are included in a preserve network in the southwestern portion of the county (see Murphy et al., 1999).[6]

There are many admirable attributes about the NCCP, including its collaborative, regional, multijurisdictional approach and its attempts to look at the habitat needs of a number of species (the San Diego plan includes 85 species, many of which appear on both federal and state endangered species lists). But the results to date also point out the difficulties in doing such regional habitat conservation and the challenges ahead for planners. Many environmental groups have been understandably critical of the adequacy of the results—plans that have not been subjected to scientific peer review, have not stopped continued habitat destruction, and, despite the obviously impressive land area involved, do not at all appear to provide sufficient habitat or adequate levels of funding (e.g., Vogel, 1999; Tansey, 1998). The southern California example, furthermore, while arguably setting aside important pieces, does not create or even envision an integrated ecosystem and habitat protection framework.

A recent comprehensive study of HCPs cosponsored by the American Institute of Biological Sciences and the National Center for Ecological Analysis (1999) has raised a number of concerns about them. In particular, there are serious questions about the lack of information about the biology of the species covered by the plans, the failure of plans to estimate the numbers of species to be affected by take permits, and the lack of clear monitoring provisions. The report includes several key recommendations for improving habitat conservation plans, including greater use of "explicit scientific standards"; inclusion of biological goals and the likely number of species to be taken; and the establishment of scientific advisory committees and greater use of scientific peer review in evaluating the adequacy of plans (see National Center for Ecological Analysis and Synthesis, 1999; Schoch, 1998).

For such plans to be truly effective, they will need to cover larger geographical areas and protect broader ecosystem functions. These plans need to be much more cautious in content, more ambitious in their habitat protection goals, and guided considerably less by political and legal expedience than they currently are. Moreover, while the best HCPs may lead to the setting aside of significant amounts of habitat, they also result in opening up for new development much larger areas of habitat. And the form and density of this new development—typically very-low-density residential—is rarely questioned as to the habitat it destroys.

Many in the environmental community have also been understandably concerned that too many HCPs are developed and negotiated behind the scenes, and that insufficient opportunities for input by scientists and citizens have been provided (e.g., see Kostyack, 1997a, 1997b). For HCPs to be a credible conservation tool, planners and others must ensure that they are developed and reviewed in an open, public process, in which all parties and perspectives are allowed input.

Some of these concerns and criticisms will be addressed by a new set of HCP guidelines, released in draft form in March, 1999. The guidelines will, among other things, require each plan to clearly delineate biological goals and objectives. The guidelines also address and clarify adaptive management strategies (in the many situations in which biological data for species covered by a plan is inadequate) and public review requirements (stipulating minimum periods of public review and comment). These guidelines, then, as addenda to the U.S. Fish and Wildlife Service HCP handbook, should serve to strengthen and clarify the HCP process. Noss, O'Connell, and Murphy (1997) have also put forth a set of principles for habitat conservation that if followed could substantially strengthen the resulting plans.

Other tools help in analyzing and organizing information about species and ecosystems in need of protec-

tion. One of the more powerful tools is Gap Analysis (Scott & Jennings, 1998). Historically, the absence of accurate biological data and inadequacy of mapping techniques that permit the identification of key areas in need of protection and management has substantially limited effective land use planning. Gap Analysis is an important technique for identifying these areas. By overlaying maps of land cover, vegetation, and vertebrate distribution onto maps of existing parks and protected areas (and with the heavy use of GIS), "gaps" in the existing protective system can be identified. Since the late 1980s, the U.S. Gap Analysis Program has been spearheaded by the Biological Resources Division of the U.S. Geological Service (formerly the National Biological Resources Service). Gap analyses have been completed in eight states and are underway in a number of others (Scott & Jennings, 1998). While the technique has its limitations, it does represent a powerful tool for planners and land managers in designing biodiversity conservation strategies.

While more commonly developed for states, gap-style analyses have been undertaken on regional and metropolitan scales, as well, and will be important tools for planners working at these levels (e.g., see map prepared for southern California [Crowe, 1996]). Such analyses have been used in the preparation of regional HCPs. A notable example is the Balcones Canyonlands Conservation Plan, a regional multispecies plan prepared for the hill country near Austin, Texas (see Beatley, 1994). Extensive mapping there of the habitat for two species of songbird, karst invertebrates, and other species were overlaid onto maps of existing parks and areas otherwise protected (i.e., areas off limits under the City's comprehensive watersheds ordinance). This was a useful process in designing the preserve system, a network of more than 30,000 acres, in six primary habitat blocks. Such techniques can be useful in guiding regional-scale comprehensive conservation strategies, and planners can and should be better versed in their use.

Deciding what to protect will, of course, be more complex and involve more considerations than Gap Analysis typically address. There are a host of other important data layers that must also be considered in crafting conservation strategies. For instance, hydrologic, geologic, and biologic features are as essential as patterns of biodiversity and biodiversity hot spots. Efforts to map and preserve the ecological processes and the dynamic functions of ecosystems and landscapes are as important as species distribution patterns. Nevertheless, techniques such as Gap Analysis represent significant new tools for land use planners.

Preserving Larger Ecosystems and Landscapes

There is considerable biological virtue to rediscovering Daniel Burnham's exhortation to make no little plans (Hines, 1979). Indeed, while biodiversity conservation can and must happen at every scale, long-run effectiveness will require thinking on increasingly larger ecological scales. Too much effort in the past has been directed at preserving isolated patches of habitat, postage stamps that will eventually be surrounded by development, with questionable long-term ecological viability. What is ultimately needed are integrated, large-scale systems of protected natural green space and habitats, nested approaches in which regional systems connect with larger statewide and continental systems.

The vision of large-scale ecosystem protection and restoration is certainly not new. The Wildlands Project, a nonprofit grassroots organization of conservation biologists and environmentalists, has pushed for such a vision for years. Working to develop holistic visions of preserve systems in different parts of the country, their explicit goal is to set aside 50% of the nation's land base as "wildlands," organized into core areas (from 100,000 to 25 million acres in size), buffer zones, and corridors connecting habitat blocks (see Wildlands Project, 1999). This is similar to the concept of biosphere reserves, which have been established around the world (including in the U.S.) under the UNESCO Man and the Biosphere Program (see U.S. Man and the Biosphere Program, 1999). While in practice biosphere reserve status has tended not to result in the land use planning and management envisioned, there are now a number of them around the world, including the 47 in the U.S.

One very positive example of the biosphere reserve concept can be seen in Ontario's Niagara Escarpment Biosphere Reserve. This 725 km–long protected area encompasses nearly 200,000 hectares (about 500,000 acres) of land and represents an effective balance between heavily protected core areas, essentially off limits to development, and buffer and transitional areas, where some development and other activities are permitted but are severely limited (e.g., one new building lot per 40 hectares in Escarpment Rural Areas, a transitional zone; see Borodczak, 1995; Coalition on the Niagara Escarpment, 1998). The Niagara Escarpment Plan, furthermore, provides a provincial-level ecological template that 37 local municipalities respect and work within. The plan does other important things as well, such as linking over 100 existing parks and public open spaces. It also contains the explicit goal of steering development into existing urban areas, and thus provides a regional land use strategy for biodiversity protection. There is much merit to a

view of our ecological future in which large blocks of land and habitat are conserved, connected by corridors and surrounded by transitional areas of compatible urban and rural development.

A number of promising tangible examples of even larger-scale land conservation strategies are now beginning to emerge. One such strategy is the Yellowstone to Yukon Conservation Initiative (Y2Y). Here, a coalition of some 120 environmental and scientific organizations have developed a comprehensive strategy for conserving large blocks of habitat into a coherent, large-scale ecological mosaic. The vision is of a "bright green thread, uncut by political boundaries, stitching together 1800 contiguous miles of the Rocky, Columbia and Mackenzie Mountains, all the way from Yellowstone to Yukon" (Yellowstone to Yukon Initiative, 1999). This strategy builds onto existing national parks and protected areas, and seeks to overcome the fragmenting effects of the existing highways and infrastructure through, among other things, the building of road overpasses to permit wildlife movement (Locke, 1997).[7]

An Emphasis on Integrated Ecological Networks

We must begin to think in terms of comprehensive, multiscale ecological networks. What is especially needed are integrated strategies, in which local habitats connect with and are meshed into regional systems, which are in turn woven into larger continental-scale systems. And here, as well, there are inspiring examples.

At national and continental levels, Europe provides some important examples of efforts to visualize and create broader ecological networks. The most developed of these initiatives can be seen in the Netherlands' Nature Policy Plan (see Van Zadelhoff & Lammers, 1995). As a densely populated nation, the Netherlands has experienced tremendous stresses on its natural environment and indigenous biodiversity. As a result it has devised and adopted a national ecological network based on preserving and connecting large blocks of the remaining natural lands and representative sets of ecosystem types, which are of regional, national, and international significance. Based on extensive background studies, a map (see Figure 1) was prepared delineating a "coherent and robust" ecological network. This map serves as the framework for national, regional, and local conservation actions.

In the Dutch scheme, several categories of designation are included on the map. *Core areas* generally are existing natural areas of at least 500 hectares that are considered biological "hot spots, capable of recolonizing surrounding smaller ecosystems" (Van Zadelhoff & Lammers, 1995, p. 80). *Nature development areas* are areas suitable for ecological regeneration or restoration, often farmlands that can be converted back to wetlands or woodlands. About 10% of the network will be made up of land currently in agricultural use (Van den Brink, 1994). *Ecological corridors* are intended to provide connections and migration opportunities between core areas. In practice, these corridors are likely to be such things as "hedgerows, dikes, banks of waterways and roads" (Van Zadelhoff & Lammers, 1995, p. 84). Buffer zones are also viewed as an important part of the network, but are not delineated on the map.

For each category, the map delineates more land or area than the final network will include, as its creators understood that not every parcel will actually be secured and protected. This allows flexibility in acquiring or redeveloping lands, and anticipates the working out of greater detail at the provincial and local levels. For nature development areas, about three times the actual target is contained on the map; for core areas, about twice as much land is indicated.

Under this Nature Policy Plan, most development or alteration of lands within core areas or development areas is prohibited. Implementation of the plan and realization of the national ecological network will require a variety of public actions and projects, including acquisition of lands and agreements with farmers willing to support nature values. The national ecological network places clear spatial parameters on planning and development at lower jurisdictional levels. In the Dutch system, decisions about which lands will actually be secured and restored and about specific boundaries are made at the provincial level. Each provincial government must work out the more precise details in its own Nature Policy Plan, and local municipal planning must build upon these regionally-specified networks.

There are considerable political benefits from the comprehensive, integrated approach the Dutch have taken. For instance, delineating an ecological network on a map and providing defined ecological targets allows the public to understand and rally behind a coherent vision of what will be protected and created. The network, moreover, serves as a logical framework within which to coordinate and integrate a whole variety of conservation and management decisions, not the least of which is the spatial organization of housing, infrastructure investments, and other types of development decisions.

The United States generally lacks and desperately needs such organizing ecological frameworks to guide planning and policy, and to ensure that the conservation investments we make (at a number of levels) will in the end protect biodiversity. Perhaps the most direct transfer of the Dutch experience in the U.S. could occur at the

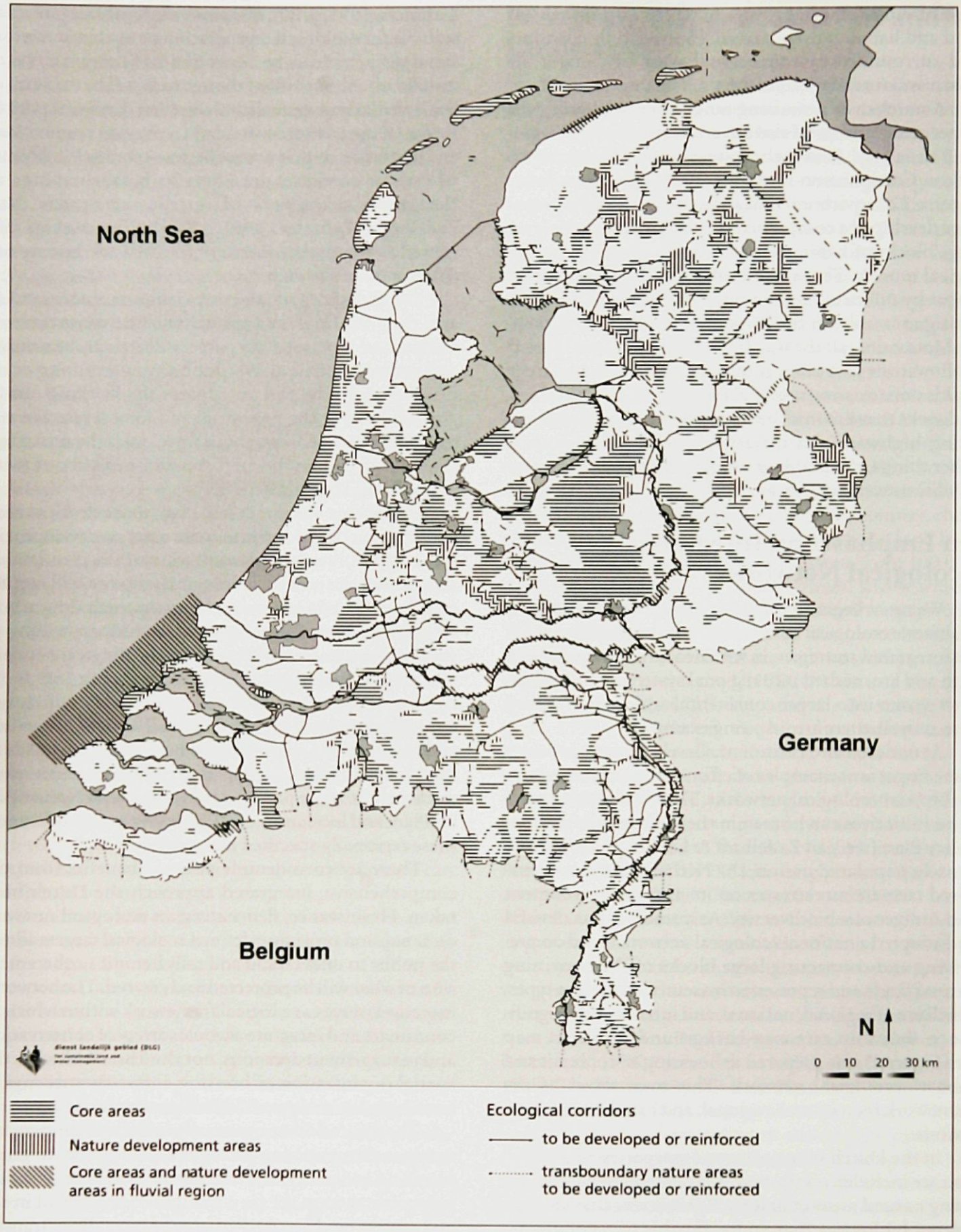

FIGURE 1. The Dutch National Ecological Network (courtesy Dienst Landelijk Gebied).

state level. Developing (and officially adopting) statewide ecological networks or integrated, connected systems of habitat would do much to provide such an important ecological planning framework.

Some progress has been made in the U.S., and several important initiatives point the way. Few states have progressed as far in this thinking as Florida, which has been seriously working toward developing a comprehensive statewide greenways system since the early 1990s. In 1998 the state Greenways Coordinating Council,[8] in collaboration with six regional greenway task forces, completed a 5-year Florida Greenways Implementation Plan (Florida Department of Environmental Protection, 1998). Among other things, the plan provides an impressive "vision" of a protected system of greenways "that interconnects fragmented or isolated elements of green infrastructure, and that connects people with their natural, historic and cultural heritage" (p. 9). The system emphasizes providing ecological connections between different habitats and landscapes, and, importantly, has the goal of ensuring the "ability of these ecosystems to function as dynamic systems and to maintain the evolutionary potential that will allow them to adapt to future environmental changes" (p. 11). The system integrates both an ecological network component and a trail/recreational network component.[9] A "vision map" of the general contours of the resulting statewide system will be issued as well. Already, through its 10-year Preservation 2000 Initiative, the state has purchased some 900,000 acres (about 365,000 hectares) of land (Florida Department of Environmental Protection, 1998). In 1999 the Florida Legislature chose to support even further acquisition through a new 10-year program *Florida Forever* (Florida Department of Community Affairs, 1999). This level of land acquisition is commendable but strongly suggests the need for a comprehensive statewide framework in which to coordinate and guide many acquisition decisions.

A number of regional or metropolitan green space conservation programs around the country are also moving in the right direction. In the Portland, Oregon, area, the Metro Geenspaces program is one such example. Adopted by the Portland Metropolitan Services District (Metro) in 1992, the regional greenspaces masterplan calls for the creation of a "regional system of parks, natural areas, greenways and trails for fish, wildlife and people" (Portland Metropolitan Service District, 1999b, 1999c). Eventually 57 urban natural areas and 34 trails and greenway corridors will be included. A bond measure passed in May 1995 is providing about $135 million to acquire 6000 acres (4400 has already been acquired; Portland Metropolitan Service District, 1999b). In the Twin Cities region of Minnesota, another example of a collaborative process to develop a similar green spaces program has been underway since 1996 (Pfeifer & Balch, 1999). Spearheaded by the Minnesota Department of Natural Resources Metro Region Office, substantial analysis of animal and plant communities in consultation with scientists and resource professionals has led to the preparation of a Metro Area Nature Resources Map. Adding greenway corridors and habitat linkages has resulted in a "concept map of opportunities" (Pfeifer & Balch, 1999).

To be sure, these efforts are impressive steps towards implementing a regional land protection vision, and these examples should be followed in other regions of the country. Yet, despite these promising beginnings, most such efforts are meager in scope and limited in aspiration, resources, and "land use resolve" applied (to use Burton's [1999] terms). In the Twin Cities, the proposed nature resources system would include only 4% of the region's 2 million acres.[10] And in Portland, 6000 acres set aside through new acquisition (in addition to acreage already included in parks and protected areas) is a modest accomplishment. As Howe (1998) notes, open space and natural areas continue to be lost in the region at a fast clip, and despite this region's deserved kudos for regional growth containment, there has been too little consideration of the ecological and natural conditions and resources in planning for this growth.[11]

Land Acquisition and Beyond

The biodiversity challenges facing planners will require the creative use of a panoply of land use tools to implement the broad, large-scale conservation strategies I've advocated here. Land acquisition will remain a highly desirable approach, particularly for core protected areas in any ecological network. The high cost, however, especially for parcels in close proximity to urban areas, will make acquisition difficult. Planners advocating more comprehensive ecosystem protection strategies will need to find creative, new (and steady) funding sources. Higher levels of government, especially federal and state governments, will continue to play an essential funding role. Part of the answer must surely be expanded funding assistance at the federal level. Many conservationists have called for full funding, for instance, of the federal Land and Water Conservation Fund; the Clinton-Gore-proposed $1 billion (in FY 2000) Lands Legacy Initiative is a step in the right direction. What would be especially helpful is a federal revolving fund to support habitat conservation planning and acquisition, which could make large amounts of seed capital available to regions and localities, perhaps conditioned upon the development of regional, integrated conservation plans. The existing Co-

operative Endangered Species Conservation Fund, which provides grants to states for acquisition and other conservation activities under ESA (and which would receive expanded funding under the Lands Legacy Initiative), could perhaps serve as the logical foundation of such an idea.

States, of course, have special roles here as well. In this regard, few states have gone as far as Florida, which has set a clear standard for other states (every state) to follow. Under its Preservation 2000 Initiative, the state has sold bonds sufficient to generate $300 million per year, for a 10-year total of $3 billion (Florida Department of Environmental Protection, 1998, p. 40). Debt service on the bonds is paid through a statewide documentary stamp tax (a tax on the recording of documents such as deeds, stocks and bonds, and mortgages; see Florida Department of Revenue, 1999). The new *Florida Forever* program extends this exemplary acquisition effort for an additional 10 years, at the same $300 million per year level (thus providing another $3 billion over 10 years). Each state should take up the Florida challenge and work to match or exceed these ambitious funding levels.

Local (and regional) governments can and must be more ambitious in setting their own acquisition and protection targets and in coming up with the monies to pay for them. Acquisition now rather than later will almost certainly be the least-cost option. A variety of specific funding tools have been used around the country to provide steady acquisition monies, including dedicated sales taxes, land-transfer taxes, and ad-valorem taxes through open space districts. Invoking the notion of green infrastructure, local governments may need to become more effective at making the pitch of value for money. The 1995 open space bond measure in Portland illustrates the modest level of personal investment required. There it has been estimated that the $135 million bond will cost the average owner of a $100,000 home a mere $12 per year (Portland Metropolitan Services District, 1999a). This represents about what the average person pays for a haircut. Without trivializing the political difficulties, should not our funding and land acquisition targets be extended and expanded substantially? Should they not be as visionary as our conservation paradigm needs to be?

Mitigation fees—typically a per-acre assessment on new development within historic habitat—have been used extensively to fund habitat conservation plans, and should remain an important implement in the funding tool kit. While affordable housing advocates worry about the effect they have on housing costs, I believe such fees can and do send appropriate price signals about the problems of building in ecologically sensitive places, appropriately reflecting the high environmental costs imposed on society by such building patterns. Another tool is *conservation banking*—allowing landowners or organizations to undertake habitat protection or restoration and then to bank these credits, making them available for purchase by others (developers, companies) in situations where some form of environmental mitigation is required. Such a mechanism could be useful in circumstances where these resulting conservation actions are coordinated within and contribute to the implementation of a comprehensive regional conservation vision.

Land acquisition, of course, is not the only implementation strategy needed. Indeed, it simply can't be. Implementation will require a package of other tools, including land use regulation, fiscal and financial incentives, transfer of development rights, and others. Especially for ecological buffers and transition areas, land use regulations (in combination with mechanisms that allow landowners to transfer density to other less-sensitive sites) will be essential elements of biodiversity conservation. And, for many areas of high biodiversity—wetlands, riparian areas, beachfronts, canyons, and high-slope areas, among others—there are public safety concerns and other legitimate reasons for restricting development and growth.

There is no doubt as well that we will need to find more effective strategies for enlisting the help and positive participation of private landowners in the biodiversity conservation challenge. It is frequently observed that a relatively high percentage of federally listed species are found entirely or partially on privately-owned lands (Bean & Wilcove, 1997). This suggests both the need for new, creative landowner incentive programs and the need to work towards fostering a new land ethic that values biodiversity and recognizes the responsibility to use land without undue threat or harm to species and habitat. Here, indeed, is a major role for planners. There are some federal incentive programs, including the Department of Agriculture's (1999) Conservation Reserve Enhancement Program, and the U.S. Fish and Wildlife Service's (1999c) Partners for Fish and Wildlife Program, but they are limited in scope, resources, and effectiveness at preserving biodiversity. Perhaps we can learn again from the Netherlands, where programs have been in place for some time that compensate landowners when they find endangered species on their land. Farmers in fact look for and take positive steps to protect, for instance, critical bird nesting sites, because they are financially rewarded for doing so.

A significant new tool for encouraging conservation among landowners is *safe harbor agreements*. Now possible under the ESA, they have been heralded by some as a "significant breakthrough," and an option that converts landowners into "allies, not adversaries" (Bean, 1999).

Through this mechanism, landowners can enter into agreements with the U.S. Fish and Wildlife Service to undertake a variety of habitat restoration actions while shielding themselves from future legal liability. Landowners are also now able to enter into candidate conservation agreements. In similar fashion, landowners who undertake conservation measures for candidate species or species proposed for listing are shielded from future restrictions or requirements should these species eventually be listed. Getting private landowners on the side of biodiversity conservation represents a challenge for planners. Our profession has a major contribution to make in helping to develop new strategies for educating private landowners about and involving them in conservation efforts, and in identifying new mechanisms (financial and otherwise) for encouraging biodiversity-friendly forms of private land ownership and use.[12]

Rethinking the Role of Cities

There are often profoundly important ways in which cities can be part of the solution to the biodiversity crisis, and here as well, planners can serve an important leadership role. They can promote more sustainable, cautious patterns of land use, as already discussed. It is my view that more compact, land-efficient forms of urban growth and growth directed to infill, reurbanized, and brownfield sites will do much to preserve the integrity of our biodiversity stock. Planners can also begin to see and understand cities more organically, as places where nature can and does reside. Indeed, an ecological view of cities recognizes that they can be homes to extensive biodiversity. We know, for instance, that peregrine falcons successfully nest in city-center environments, that kit foxes use urban flood plains as movement corridors, and that ecological rooftops (with grass and flowers) can serve as important habitat for birds, butterflies, and other invertebrate life. We must become more capable and sophisticated at understanding and promoting urban biodiversity and begin to see the potential positive roles urban environments might play. Here are important new areas of research for better understanding the ecological functions of urban forests, stream corridors, and other more fragmented urban environments. The designation by the National Science Foundation of two explicitly-urban Long Term Ecological Research (LTER) sites—Phoenix and Baltimore—represents a promising recognition of the need for additional knowledge about urban biodiversity and the ecological dynamics and functioning of cities (Jensen, 1998).

Furthermore, while there is an understandable tendency to view the mission of developing green networks and habitat areas as one focused outside of urban areas, the integrated conservation strategies advocated here apply to both sides of the urban growth boundary or limit line. Wilderness habitat and green spaces can and should penetrate into the very core of our cities. Compact urban form can occur (and indeed is made more feasible) in the presence of large and extensive tentacles and wedges of greenspace entering into the core of urban areas. Indeed, many Scandinavian cities exemplify this urban form (e.g., Beatley, in press).

Another essential role of cities is more restorative. There are a tremendous number of ways in which habitat can be protected, restored, and replaced in and around urban developments. A number of recent positive examples can be cited. More compact urban form will make such opportunities more plentiful, but they will exist in any metropolitan area. One is the new wastewater/stormwater treatment wetlands system in Davis, California. The Davis Wetlands Project is an exemplary effort to restore and replace habitat (see Figure 2). The result of a collaboration between the City, the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, UC-Davis, and others, the project entailed the creation of a 400-acre system of wetlands, ponds, and lagoons that receives the City's stormwater and treated wastewater (at tertiary levels), providing further treatment before the wastewater is discharged (eventually into the Sacramento River). In addition to new permanent wetlands, the project also creates significant seasonal wetlands, new riparian woodlands, and grasslands habitats. Only native vegetation has been planted. Water levels in the lagoon system are managed seasonally to maximize their habitat potential. During the winter months, higher water levels are maintained to support winter waterfowl, and during the spring, water levels are lowered to increase habitat for wading shorebirds. The Davis Wetlands Project represents an effort to replace some of the nearly 95% of the wetlands lost to agriculture in the Central Valley. In the past, portions of this region would seasonally flood, providing important habitat for waterfowl, many of which were migrating along the Pacific Flyway.

What is significant about projects like this one is that they recognize important roles for cities in restoring and enhancing habitat and biodiversity. Such projects, moreover, can enhance biodiversity while they creatively treat and recycle urban wastes, helping to move us in the direction of creating circular waste streams and balanced urban metabolisms. "Re-naturalizing" urban environments should become a more central planning mission in the future. This means daylighting streams, desealing and deconstructing (literally) heavily engineered waterfronts and river channels passing through cities, and many other actions to enhance and restore nature in and around developed environments.

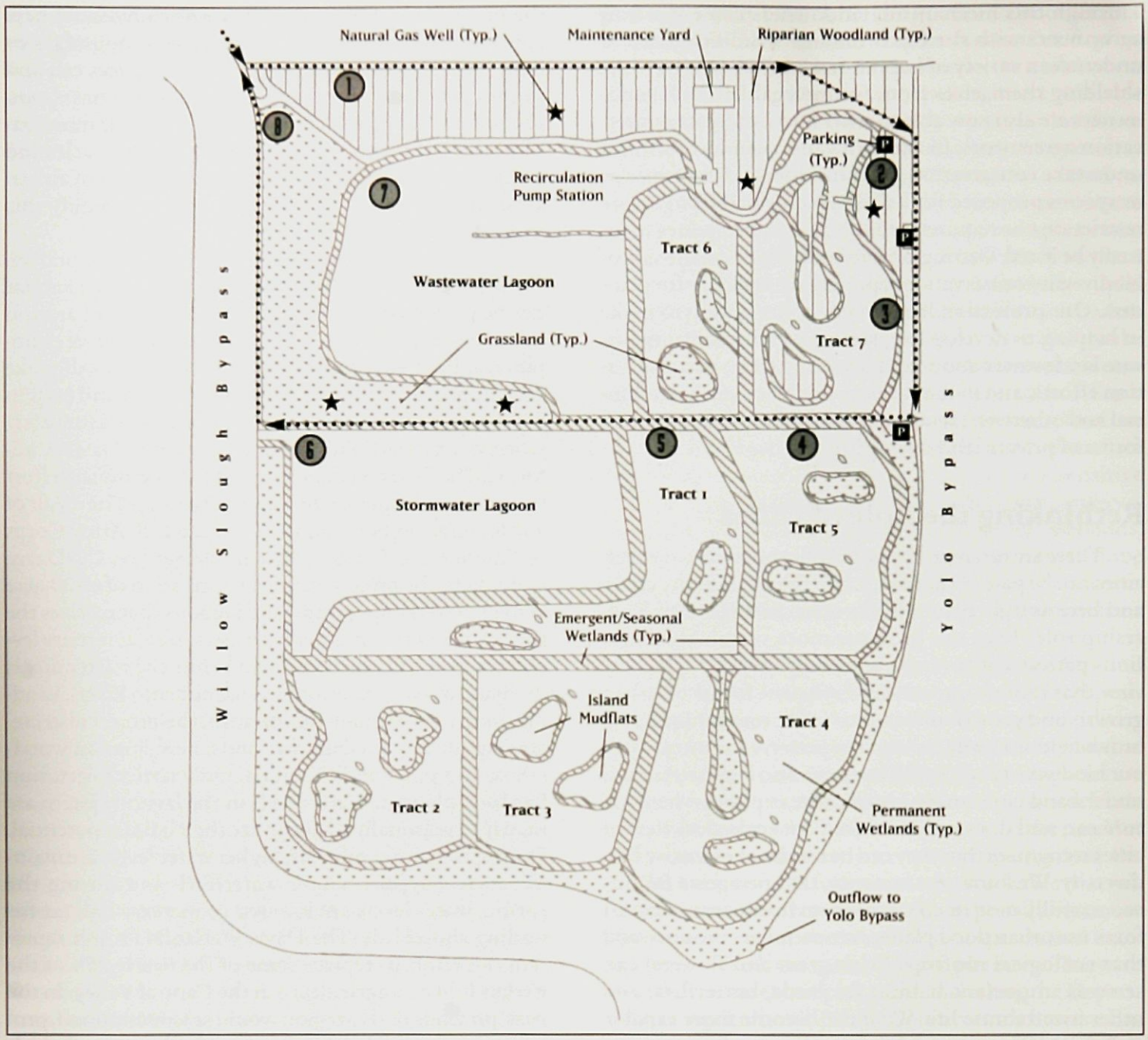

FIGURE 2. The Davis Wetlands Project (courtesy City of Davis, CA). Numbers 1–7 and dotted arrows refer to a guided walking tour.

Still another new role for cities involves recognizing and directly addressing the impacts on biodiversity that result from the metabolic flows of energy and resources needed to support urban populations. Thanks especially to concepts such as *ecological footprint analysis*, we now appreciate the extent to which cities (and their populations) exert pressures on local and global environments and resources, many of them resulting in direct destruction and loss of habitats (Wackernagel & Rees, 1997). As one recent commentator noted, "The first and most obvious thing about cities is that they are like organisms, sucking in resources and emitting wastes" (Tickell, 1997, p. vi).

Considerable pressures on biodiversity result from the water, energy, and other demands of urban populations. Understanding more fully the ecology-damaging and habitat-destroying implications of satisfying urban needs and lifestyles would be an important first step. We then need to explore ways of reducing those demands and/or the impacts associated with them. For example,

controversy has emerged around plans to expand the water holding capacity of Roosevelt Dam in the Phoenix area, the result of which may be the loss of nesting habitat for the Saltwater Willow Flycatcher, an endangered songbird.[13]

There are many direct and indirect effects of satisfying urban demands that require careful and concerted consideration to find those alternatives that would impose the least ecological damage. In Phoenix, for example, facilities could be designed to minimize impact or alternatives could be explored in which the energy and water demands can be sufficiently reduced or rechanneled.

Cities can facilitate less environmentally destructive ways of satisfying local needs and demands. Community-supported agriculture is one example, providing locally- or regionally-produced food, ideally through organic and low- or no-pesticide means. Local production of energy and promotion of the reuse and recycling of water, energy, and material flows in cities would do much to reduce these pressures on biodiversity regionally and globally, as well as locally.

Cities, towns, and other local governments can also begin to address these impacts by setting positive examples. Adopting procurement policies, for instance, which stipulate the purchase of nondestructive or less destructive products and services, would help. As ecolabeling programs grow in credibility and sophistication, local governments can, with modest effort, reduce their own habitat-destroying impacts and encourage similar decisions among their citizens. Any wood used to construct city facilities, for instance, could be certified sustainably harvested (e.g., by the Forest Stewardship Council; see Forest Stewardship Council, 1999). Beef served in city and school cafeterias could be certified habitat friendly and fish certified as coming from sustainably-managed fisheries (e.g., by the Marine Stewardship Council; see Marine Stewardship Council, 1999). City governments and other public agencies can make a tremendous difference through these conscientious purchasing decisions.

Biodiversity conservation must, then, be viewed as an important component in all local planning, whether in the form of an element in the local comprehensive plan, an addendum to the local budget (the biological health of a community ought to be at least as important as its fiscal health), or a stand-alone strategic plan. Perhaps American communities should take the lead of British local authorities, which must now prepare *Local Biodiversity Actions Plans*, as a main implementation measure under the U.K.'s National Biodiversity Action Plan (U.K. Department of the Environment, 1994). These plans typically incorporate biodiversity audits, the identification of vulnerable species and habitats, and a prioritization of conservation actions. They also strive to build strong community partnerships, bringing different groups and organizations together to address biodiversity protection (see London Biodiversity Partnership, 1996). To be sure, even in the most urban of cities —American or British—significant species and habitats will exist, and opportunities for preservation and restoration will be present.

The Education of Planners

Planners can and must play an integral role in creating and implementing these larger-scale, comprehensive conservation strategies. Community land use planning will play an important role in protecting corridors, buffer lands, and transitional areas, and in steering future growth away from important habitat and ecologically fragile land, and into already urbanized areas.

To be effective participants in these new proactive conservation approaches, planners will need new skills and new forms of knowledge. This new conservation agenda has significant implications for how and what we teach planners in graduate programs. Notably, graduate planning programs—especially those with environmental planning concentrations—will need much more coverage of the technical concepts and ideas of conservation biology and landscape ecology. Planners will need to be conversant with a range of important terms, concepts, and analytic techniques: concepts such as island biogeography, edge effects and connectivity, minimum viable populations, and population viability analyses; adaptive management techniques; and principles of preserve or protected area design, to name a few (see Peck, 1998). Especially important are an understanding of the (evolving) science of preserve design and the biological (and management) issues involved in the configuration of preserve systems and protected areas (Dramstad et al., 1996). Planners will often be in the best position to serve an organizing and convening role in regional ecosystem conservation efforts. They have played a key liaison and coordinating function already in the preparation of habitat conservation plans, and this role will likely become even more important in the future, if the conservation paradigm shifts advocated here are at all advanced.

A review of the most recent *Guide to Graduate Education in Urban and Regional Planning* (Fisher et al., 1996) is alarming in that it contains but a handful of planning scholars with expertise and training in these areas. There will, of course, be opportunities to link with landscape architecture and environmental science departments in providing the necessary technical training, but the scant attention within planning departments is troubling, to say the least. Planners will need to be comfortable with the technical information and be able to effectively com-

municate with ecologists, wildlife biologists, and other scientists and members of the resource management community who will by necessity be involved in crafting comprehensive biodiversity strategies.

Concluding Thoughts

The passage of the Endangered Species Act in 1973 was a remarkable event in our environmental and social history. It was a visionary act without precedent, and, as one recent commentator notes, has resulted in a "profound change in how we view and treat the land" (Hebert, 1998, p. A14). Yet the primary strategy of this law and others like it has been largely reactive, single-species driven, piecemeal in focus, and fragmented in geographical scope. Planners, on the other hand, are taught to think comprehensively and in integrative fashion. It is time to rethink and redesign our conservation strategies to emphasize these qualities. In particular, large-scale ecological conservation strategies and bolder plans must be the starting points. A nested, hierarchical strategy is required, in which large-scale conservation strategies provide the template and framework for planning and actions at lower (smaller) geographical levels. Each state should prepare (or be required to prepare?) a plan that delineates a comprehensive ecological network, and each region or metropolitan area a plan which fits within and further reinforces these larger ecological structures. It is only through such an approach that the many smaller actions of conservation and mitigation add up to anything ecologically meaningful.

A key approach is to redefine the role of cities. These new biodiversity conservation strategies include containing and guiding growth within regional ecological networks, but also acknowledge the duties of *cities* to reduce direct and indirect impacts on biodiversity, and to take actions to enhance and restore it. The new biodiversity paradigm must include cities and urban areas as key players.

To be sure, the political waters associated with broader, larger-scale conservation strategies will be difficult to navigate. This problem merits some thinking about the most convincing ways in which to sell the public and politicians on the need for such actions. Staring down the barrel of the Endangered Species Act has certainly helped. Another tack is arguing that the long-term costs associated with continuing the current scattered, fragmented, and ineffectual conservation approach will be much greater than the short-term burdens of proactive, comprehensive strategies. In the end, perhaps it is time for communities and regions to begin a dialogue about their serious ethical roles and responsibilities in the world. E. O. Wilson (1980) is fond of saying that the extinction of life on the planet is what future generations would least forgive us for. In many parts of our country and in many ways, we have startling opportunities to save and restore our biological and natural legacy. To do so, though, will require moving *far* beyond conservation business as usual.

NOTES

1. Freshwater aquatic species, such as mussels and amphibians, were found to be in the most dire condition.
2. Out of 960 species listed in 1996, 352 were classified as either having populations stabilizing or improving (U.S. Fish and Wildlife Service, 1999d).
3. The cost of implementing the Balcones Canyonlands Conservation Plan has been estimated at $160 million. Though focused at a fairly large geographical area, it should be remembered that the Balcones Canyonlands Conservation Plan does not address biodiversity protection for the entire Austin region. See Beatley (1994).
4. An important example of the use of the term *green infrastructure* can be seen clearly in the recent inaugural speech of Maryland Governor Glendening. Here Governor Glendening describes preservation of the natural environment in terms of securing important *green infrastructure*:

   > Just as we must carefully plan for and invest in our capital in infrastructure—our roads, our bridges, and water lines—we must also invest in our environment, our green infrastructure—our forests, our wetlands, our streams and our rivers. And just as we carefully plan for and invest in the human infrastructure—education, health services, care for the elderly and disabled—we must also invest in our green infrastructure. (Glendening, 1998, p. A12)

5. There were 255 incidental take permits issued as of June 1999 (U.S. Fish and Wildlife Service, 1999b).
6. Most recently, a draft of a second plan prepared by San Diego County—its so-called Multiple Habitat Conservation Plan (MHCP)—has been released. It would preserve 19,840 acres of habitat over a 30-year period, providing habitat for 77 different species.
7. The jury is still out on the ecological effectiveness of such measures; clearly the best strategy remains one of resisting new roads that dissect and isolate in the first place. See Noss and Cooperrider (1994) for a discussion of these issues.
8. The Florida Greenways Coordinating Council was replaced in 1999 with a new Florida Greenways and Trails Council.
9. Steps in modeling the ecological network have included identifying important ecological features in the state; identifying priority ecological areas within them (e.g., employing screens requiring minimum 5000-acre parcels); and identifying linkages between ecological hubs. For a more detailed explanation of the GIS-based decision model used to develop the statewide greenways system, see Florida Department of Environmental Protection (1998).

10. Meager funding has been appropriated by the state legislature to begin implementing the plan, and estimates have been made that some $20 billion would be needed to purchase all of the lands identified in the system's "green infrastructure."
11. Howe (1998) refers to what has actually happened in the Portland region as an inverting of McHarg's ecological planning process, i.e., "natural resources considered last and not first" (p. 70).
12. There is an active debate and extensive literature arguing for the need for greater financial incentives for private landowner conservation. Suggestions include relief from inheritance taxes and the provision of tax credits and tax reductions for biodiversity conservation measures and practices. See, for instance, Wilcove et al. (1997) and Noss, O'Connell, and Murphy (1997) for a discussion of incentives.
13. Another example is the recent agreement between the City of Portland, Oregon, and Portland General Electric to dismantle a dam along the Little Sandy River. The result will be to restore an important habitat for salmon and steelhead trout (Brinckman, 1999).

REFERENCES

Abell, R. A., Olsen, D. M., Dinerstein, E., Hurley, P. T., Diggs, J. T., Eichbaum, W., Walters, S., Wettengel, W., Allnull, T., Loucks, C. J., & Hedao, P. (1999). *Freshwater ecoregions of North America: A conservation assessment.* Washington, DC: Island Press.

Beatley, T. (1994). *Habitat conservation planning: Endangered species and urban growth.* Austin: University of Texas Press.

Beatley, T. (in press). *Green urbanism: Learning from European cities.* Washington, DC: Island Press.

Bean, M. J. (1999). Endangered species, endangered act? *Environment, 41*(1), 13–18, 34–38.

Bean, M. J., & Wilcove, D. S. (1997). The private-land problem. *Conservation Biology, 11*(1), 1–2.

Borodczak, N. (1995, March). *Ontario's Niagara Escarpment: Implementing the biosphere reserve concept in a highly developed region.* Paper presented to the International Conference on Biosphere Reserves, Sevilla, Spain.

Brinckman, J. (1999, May 26). PGE agrees to remove two dams. *Oregonian*, p. A1.

Burton, M. (1999). Salmon listing press conference [On-line]. Available: <http://www.multnomah.lib.or.us/metro/glance/exce/salmonlisting.html>.

City of Austin, TX. (1977). *Austin Tomorrow comprehensive plan.* Austin, TX: Department of Planning.

Coalition on the Niagara Escarpment. (1998). *Protecting the Niagara Escarpment: A citizen's guide.* Toronto: Author.

Crowe, R. E. (1996). Use of gap analysis in regional planning in southern California. In J. M. Scott, T. H. Tear, and F. W. Davis (Eds.), *Gap analysis: A landscape approach to biodiversity planning* (pp. 221–238). Bethesda, MD: American Society of Photographic and Remote Sensing.

Dramstad, W. E., Olson, J. E., & Forman, R. T. T. (1996). *Landscape ecology principles in landscape architecture and land-use planning.* Washington, DC: Island Press.

Eddy, M. (1999, March 24). Prairie dogs target of study: Protection of black-tailed species being considered. *Denver Post*, p. B4.

Fisher, P. S., Contant, C. K., Moraski, J. M., Vorhes, J. A., & Graduate Program in Urban and Regional Planning, University of Iowa. (1996). *Guide to Graduate Education in Urban and Regional Planning* (10th ed.). Association of Collegiate Schools of Planning.

Florida Department of Community Affairs. (1999). *Our capitol communities: A legislative update from the Florida Department of Community Affairs.* Tallahassee: Author.

Florida Department of Environmental Protection. (1998). *Plan for a statewide system of greenways: Five year Florida greenways system implementation.* Tallahassee: Author.

Florida Department of Revenue. (1999). Documentary stamp tax [On-line]. Available: <http://sun6.dms.state.fl.us/dor/taxes/doc_stamp.html>.

Forest Stewardship Council. (1999). FSC principles and criteria [On-line]. Available: <http://www.fscoax.org/principal.htm>.

Glendening, P. N. (1999, January 21). 3 great challenges: Education, environment, and equality. *Washington Post,* p. A12.

Hebert, H. J. (1998, December 28). Endangered Species Act at 25: Praised, despised as conflicts go on. *Washington Post*, p. A14.

Hines, T. (1979). *Burnham of Chicago: Architect and planner.* Chicago: University of Chicago Press.

Howe, D. (1998, January). Metropolitan Portland's greenspaces program. In *Creating sustainable places*, symposium proceedings (pp. 67–72), Tempe: Arizona State University.

Jensen, M. N. (1998, April 4). Ecologists go to town. *Science News, 153,* 219–221.

Kostyack, J. (1997a). Habitat conservation planning: Time to give conservationists and other concerned citizens a seat at the table. *Endangered Species Update, 14*(7 & 8), 51–55.

Kostyack, J. (1997b). Reshaping habitat conservation plans for species recovery: An introduction to a series of articles on habitat conservation plans. *Environmental Law, 27,* 755–765.

Lassila, K. D. (1999). The new suburbanites and how America's plants and animals are threatened by sprawl. *Amicus Journal, 21*(2), 16–21.

Locke, H. (1997, October). *The Yellowstone to Yukon conservation initiative.* Keynote address made at the Y2Y Connections Conference, Waterton, Ontario.

London Biodiversity Partnership. (1996). *Capital assets: Conserving biodiversity in London.* London: Author.

Luoma, J. R. (1997, September 16). Treasure of biodiversity discovered, and its in nation's yard. *New York Times,* p. C4.

Marine Stewardship Council. (1999). Mission statement [On-line]. Available: <http://www.msc.org/>.

Mazza, P. (1996). *Cascadia's great flood of '96: A clear-cut case of modifying the waters* [On-line]. Available: <http://www.tnews.com/text/flood3.html>.

Murphy, D., Stine, P. A., Whalen, J. W., Rempel, R., McLeod, A. H., & Luesebriuk, M. (1999). Southern California natural community conservation planning. In K. N. Johnson, F. Swanson, M. Herring, & S. Greene (Eds.), *Bioregional as-*

sessments: Science at the crossroads of management and policy (pp. 229–268). Washington, DC: Island Press.

National Center for Ecological Analysis and Synthesis. (1999). *Using science in habitat conservation plans.* Santa Barbara, CA: Author.

Natural Resources Defense Council. (1997). *Leap of faith: Southern California's experiment in natural community conservation planning.* New York: Author.

Nature Conservancy. (1997). *The 1997 species report card: The state of U.S. plants and animals.* Arlington, VA: Author.

Noss, R., & Cooperrider, A. (1994). *Saving nature's legacy: Protecting and restoring biodiversity.* Washington, DC: Island Press.

Noss, R., LaRoe, E., & Scott, M. (1995). *Endangered ecosystems of the United States: A preliminary assessment of loss and degradation.* Washington, DC: National Biological Service.

Noss, R. F., O'Connell, M. A., & Murphy, D. D. (1997). *The science of conservation planning: Habitat conservation under the Endangered Species Act.* Washington, DC: Island Press.

Pfeifer, S., & Balch, F. (1999, February). *Planning for nature in the face of urban growth: The metro greenways program, twin cities region* [On-line]. Paper presented at the Challenges to Urban Sustainability conference, Stanford, CA. Available: <http://www.socsci.umn.edu/~bongman/urbansustainability/pfeifer.htm>.

Peck, S. (1998). *Planning for biodiversity: Issues and examples.* Washington, DC: Island Press.

Portland Metropolitan Services District. (1999a). *Frequently asked questions, Regional Parks and Greenspaces Department* [On-line]. Available: <http://www.metro-region.org/glance/faqs/parkfaq.html>.

Portland Metropolitan Services District. (1999b). *Metro's open space lands acquisition: Report to citizens* [On-line]. Available: <http://www.multnomah.lib.or.us/metro/parks/openspaces/report>.

Portland Metropolitan Services District. (1999c). *Planning for a green future: Metro's natural resources strategy* [On-line]. Available: <http://www.multnomah.lib.or.us/metro/parks/parkfuture.html>.

Reinhold, R. (1993, March 16). Tiny songbird poses big test of U.S. environmental policy. *New York Times,* p. A1.

Schoch, D. (1998, July 20). New approach to protecting fragile habitats criticized. *Los Angeles Times,* p. A3.

Scott, J. M., & Jennings, M. J. (1998). Large area mapping of biodiversity. *Annals of the Missouri Botanical Garden, 85*(1), 34–47.

Steffen, A. (1999, February 22). Salmon recovery debate: Time is now to take care of wild salmon in our own backyard. *Seattle Times,* p. B5.

Tansey, B. (1998, November 28). Contra Costa is pressed for regional habitat plan; Land tradeoff debate rolls into county. *San Francisco Chronicle,* p. A19.

Tickell, C. (1997). Introduction. In R. Rogers, *Cities for a small planet* (pp. vi–xi). Boulder, CO: Westview Press.

U.K. Department of the Environment. (1994). *Biodiversity: The UK action plan.* London: Her Majesty's Stationery Office.

U.S. Department of Agriculture. (1999). *Conservation reserve enhancement program* [On-line]. Available: <http://www.fsa.usda.gov/dafp/cepd/crep/crephome.htm>.

U.S. Fish and Wildlife Service. (1999a). *Boxscore* [On-line]. Available: <http://www.fws.gov/r9endspp/boxscore.html>.

U.S. Fish and Wildlife Service. (1999b). *List of habitat conservation plans* [On-line]. Available: <http://www.fws.gov/r9endspp/hcp/hcptable.pdf>.

U.S. Fish and Wildlife Service. (1999c). *Partners for fish and wildlife program* [On-line]. Available: <http://www.fws.gov/r9dhcpfw/index.htm>.

U.S. Fish and Wildlife Service. (1999d). *Report to the Congress on the recovery program for threatened species and endangered species, 1996.* Washington, DC: Government Printing Office.

U.S. Man and the Biosphere Program. (1999). *U.S. biosphere reserves* [On-line]. Available: <http://www.usmab.org/brprogan/usbr.html>.

Van den Brink, A. (1994, November). *Rural planning in the Netherlands: The interrelationships between policy levels and the role of land development.* Paper presented to a seminar on provincial planning, Milan, Italy.

Van Zadelhoff, E., & Lammers, W. (1995). The Dutch ecological network. *Landschap, 95*(3), 77–88.

Vogel, N. (1999, February 11). Suit may halt Notomas home building. *Sacramento Bee,* p. A1.

Wackernagel, M., & Rees, W. (1996). *Our ecological footprint: Reducing human impact on the Earth.* Gabriola Island, British Columbia: New Society Publishers.

Wilcove, D. S., Bean, M. J., Bonnie, R., & McMillan, M. (1997). *Rebuilding the ark: Toward a more effective endangered species act for private land.* New York: Environmental Defense Fund.

Wildlands Project. (1999). *Summary of the Wildlands Project* [On-line]. Available: <http://www.wildlandsproject.org/htm/summary.htm>.

Wilson, E. O. (1980, January/February). The conservation of life. *Harvard Magazine,* pp. 28–37.

World Wildlife Fund. (1997a). *North America's living legacy: A new approach aims to conserve our continent's vast biological wealth.* Washington, DC: Author.

World Wildlife Fund. (1997b). *Mapping North America's biological wealth: Terrestrial ecoregions of the U.S. and Canada.* Washington, DC: Author.

Yellowstone to Yukon Initiative. (1999). *Why Yellowstone to Yukon?* [On-line]. Available: <http://www.rockies.ca/y2y/>.