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Landscapes, tourism, and conservation

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Abstract

One key aspect of global change is a decrease in ecological integrity as more and more landscapes are developed, leaving a mosaic of *intact* refuges and *degraded* patches that may not be sufficient for conserving biodiversity. While increases in human population and shifts in the distribution of people affect land use, the temporary movement of people can have major implications for conservation and biodiversity. Three examples are presented where recreation/tourism can enhance the conservation of land on a landscape scale, leading to habitat protection and biodiversity preservation: (1) Shorebirds often require a matrix of different habitat types during migratory stopovers, and ecotourism can serve as a catalyst for landscape scale protection of habitat. (2) Riparian habitats can serve as corridors to link diverse habitat patches, as well as serving as biodiversity hotspots. (3) Remediation and rehabilitation of contaminated lands, such as those of the US Department of Energy, aimed at developing recreational activities on the uncontaminated portions, can be the most economical form of re-development with no increase in human or ecological risk. Since large areas on many DOE sites have been undisturbed since the Second World War, when they were acquired, they contain unique or valuable ecosystems that serve an important role within their regional landscapes. In all three cases the judicious development of recreational/tourist interests can encourage both the conservation of habitats and the wise management of habitats on a landscape scale. While some species or habitats are too fragile for sustained tourism, many can be managed so that species, ecosystems and ecotourists flourish. By contributing to the economic base of regions, ecotourists/recreationists can influence the protection of land and biodiversity on a landscape scale, contributing to ecosystem management. The human dimensions of land preservation and biodiversity protection are key to long-term sustainability, and ecotourists/recreationists can be one management option.

Keywords: Global change; Ecotourism; Recreation; Sustainability; Biodiversity; Shorebirds; Riparian; Contaminated lands

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1. Introduction

Although there is worldwide concern for climate change, other global changes involve increases in human populations, shifts in land use, concentration of people in coastal regions of the world, and increases in the temporary movement of people. While increasing human populations clearly place ecosystems at risk, other changes can be equally devastating. Although the width of the dense population band along coasts may vary, depending upon climate and productivity of the land, increasing population places demands on fragile land–ocean margins and associated ecosystems. Furthermore, an increase in tourism, or the temporary movement of people within these systems, places additional stresses on these systems.

In the coming years, the human dimensions of conservation and protection of biodiversity will gain even more importance as global changes in population size, population distribution, and land use occur. It is not enough to decry the continual loss of habitat and biodiversity, we must seek creative solutions that are advantageous both for human civilization and for protection of habitats and biodiversity. While the intrinsic value of biodiversity are clear to some (Bengtsson et al., 1997), it must be valued by a wider range of cultures and economies. Making use of tourism and recreation as drivers for sustainable development, however one views this concept (Gale, 1991), can provide one tool for preserving biodiversity. Ecotourists/recreationists can influence environmental policy, thus influencing ecosystem management (Haeuber, 1996).

In this paper three examples of the interface between humans and ecosystem integrity on the landscape-scale are explored: (1) shorebirds, tourism, and fragmentation; (2) rivers, corridors and conservation; and (3) contaminated lands, recreation, and conservation. These examples all involve changes in populations, land use, and habitat fragmentation that have major impacts on ecosystem integrity, conservation, and biodiversity. All three examples involve evaluating increasing degradation and fragmentation in the light of conservation, and in all three cases, tourism/recreation can play a major role in preserving biodiversity.

2. Tourism, recreation, and conservation

Tourism, particularly ecotourism, is on the increase worldwide, and will continue to increase as global economies improve and leisure time increases. For the United States as a whole, walking is the most popular recreational activity, followed by sightseeing, picnicking, swimming, fishing, bicycling, and birdwatching (Cordell et al., 1999). Some types of tourism and recreation are increasing more than others. Birdwatching, hiking, backpacking, downhill skiing, and primitive camping are the five fastest-growing activities in the United States. In 1982, 21.2 million Americans (12%) were birdwatchers, while in 1995 the number had grown to 54.1 million (27% of Americans; Cordell et al., 1999). Although some of these activities can be accomplished near home, most involve expenditures for travel, accommodations, meals, and guides. The importance of ecotourism to local economies must be studied and exploited to ensure adequate protection of the natural resources on which it depends.

One measure of ecotourism is the number of people visiting National Parks or other reserves. In the United States, the National Park Service administers historic sites, battle fields, military parks, national monuments, national parks, preserves, seashores, scenic rivers, and recreational areas. Other Federal Agencies such as the Forest Service also administer extensive areas open for recreation. To some extent, the people who visit some of these sites are ecotourists. The number of people visiting all types of sites managed by the US National Park Service has been on the increase for many years, as has the number of people visiting the National Parks specifically (Fig. 1, after National Park Service, 1999). While it is more difficult to obtain this type of information for national parks and reserves worldwide, all indications are that ecotourism is on the rise. It is time to exploit this ecotourism to ensure that habitats and biodiversity are preserved on a landscape scale, while at the same time managing it so

that sensitive habitats and wildlife are not jeopardized.

3. Shorebirds, tourism, and wetland habitat mosaic

3.1. The problem

While there are both national and international laws and treaties to protect threatened and endangered species, many other species or groups of species are at risk either because of small numbers, scattered populations, or unique behavioral traits. Moreover, sensitive habitats are usually not protected by such treaties. Shorebirds provide such an example. Most shorebirds are long-distance migrants and may travel from the high Arctic to southern Africa or South America (Burger and Olla, 1984). During migration, shorebirds concentrate in huge numbers to feed in coastal wetlands, called migratory stopovers.

In North America and Europe only a very few places support more than a million shorebirds

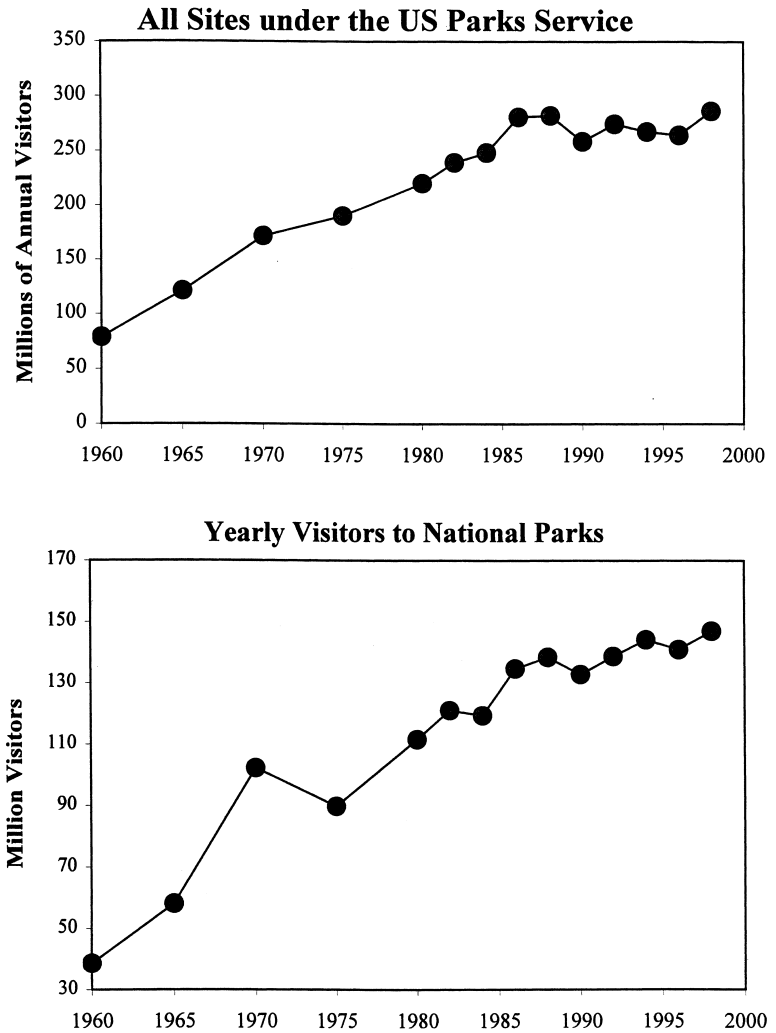

Fig. 1. Number of people visiting all the sites managed by the US National Park Service (top), and those visiting only the National Parks (bottom).

during migration, including the Copper River Delta (Alaska), Delaware Bay (New Jersey), and Texel in the Netherlands (Myers et al., 1987; Clark et al., 1993; Bishop and Warnock, 1998). While shorebirds regularly feed on mudflats, other habitats, such as marsh habitat, are important for foraging and roosting (Burger et al., 1997a). Since most shorebirds are neither threatened nor endangered, it is difficult to secure public support or funds for their protection or for land acquisition. Yet shorebird populations are only as secure as the weakest link, which is often during their brief migratory stopovers. Furthermore, many countries protect breeding birds and their habitats, but do not protect foraging habitats for migrants.

3.2. Solutions that aid conservation and biodiversity

One program to secure land for the protection of migratory shorebirds is through the Hemisphere Shorebird Reserve Network, an international network of wetlands and beaches established to protect shorebird habitats (Tsipoura and Burger, 1999). While this designation provides a framework for protection and management, such management is up to local and regional officials. In some places the designations are not accompanied by enforcement, budgets, or any form of protection.

An additional method of protection is to encourage ecotourism so that there is economic support locally to stimulate both the scientific understanding of what is required to maintain diverse habitats and to assure adequate protection of the birds and their habitats. Masses of migrating shorebirds are impressive, and are a big attraction for ecotouists in many places in the world. While birdwatchers are looking for the rarities that seldom appear, almost anyone finds the thousands upon thousands of migrating shorebirds fascinating. Well-known shorebird migratory stopover areas can draw ecotourists from around the world.

In the following discussion Delaware Bay, located between New Jersey and Delaware in the United States, is used as an example. Traditionally, most of the shorebirds migrating through Delaware Bay have concentrated on the New Jersey side in Cape May County (Clark et al., 1993).

Approximately 1 million shorebirds pass through Delaware Bay each spring, in a 2–3-week period. The birds are attracted to the massive supply of eggs of spawning horseshoe crabs (*Limulus polyphemus*), and during this time they can nearly double their weight (Botton et al., 1994; Piersma, 1998; Tsipoura and Burger, 1999). Although there is controversy over the protection of spawning horseshoe crabs in many Atlantic coastal states, it is clear that the shorebirds depend upon the excess eggs churned up by massive numbers of spawning horseshoe crabs, and that this food supply is essential for their rapid weight gain and subsequent non-stop migration to the high Arctic (Tsipoura and Burger, 1999; Burger and Gochfeld, 2000).

In Delaware Bay, as in many coastal regions, there is a mixture of sandy beaches, mudflats, and marshes that range from relatively low areas that are flooded daily, to high marshes that flood only on the highest tides (Fig. 2). Until fairly recently, scientists and naturalists believed the sandy beaches and mudflats were the major attraction for the shorebirds.

However, recently the importance of a matrix of habitats that include beaches, mudflats, tidal mudbanks, and marshes, has been documented (Burger et al., 1997b). Data on the presence and behavior of shorebirds indicate that they feed in the full range of habitats, depending upon the

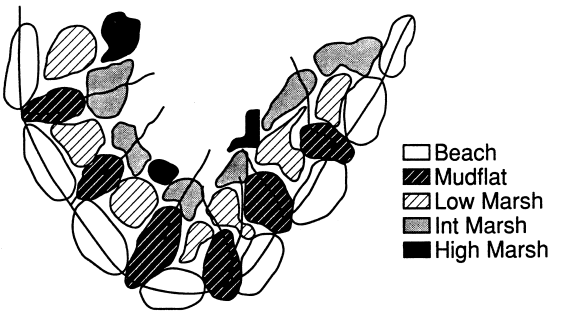

Fig. 2. Schematic of a matrix of different habitats in south Cape May, New Jersey. All are important to migratory shorebirds.

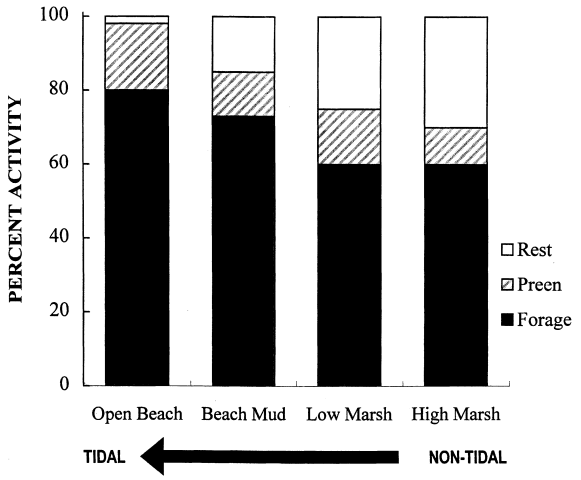

Fig. 3. Behavior of shorebirds in different habitats as a function of tidal regime (after Burger et al. 1997a).

tidal state (Fig. 3, after Burger et al., 1997a). Shorebirds fly between these habitats several times a day, depending upon the winds, tide and time of day. The foraging value and roosting/resting value change depending upon the habitat (Fig. 4). Beaches and mudflats are preferred for foraging, especially during low tides, but the shorebirds forage on the marshes during high tide, and use the highest marshes for roosting.

These data, and others from other shorebird migratory stopovers (Burger et al., 1997b; Farmer and Parent, 1997), suggest that adequate protection of habitat for migratory shorebirds requires planning on a landscape scale. Protecting only one or two beaches or mudflats is not sufficient for migratory shorebirds; a matrix of habitats is required. Shorebirds prefer foraging habitats that are close together, requiring only short local movements (Farmer and Parent, 1997), but they will fly several miles between habitats if required to do so. Complexes of integrated beaches, mudflats, mudbanks, and marshes are required for conservation of shorebirds (Burger et al., 1997a). Although wetlands laws often protect these habitats, landscape level considerations are rare, and few risk assessments for these habitats consider either matrix effects or linkages between patches (Lemly, 1996).

While there are federal and state laws that protect migratory shorebirds, their habitats are vulnerable to destruction and development, and although harassment is illegal, the birds are vulnerable to disturbance. Since enforcement personnel are inadequate, protection of shorebirds and their habitats is heightened with local support. In the case of Delaware Bay where the economy of Cape May County is enhanced by the vast number of ecotourists and birders that come to see the spectacle of the shorebirds feeding on the horseshoe crab eggs (Burger and Gochfeld, 2000), there is local support to protect the shorebirds. The state of New Jersey has provided a series of viewing stands at key shorebird beaches, to concentrate the ecotourists on particular beaches, and maintain a suitable distance between the people and shorebirds (Pettigrew, 1998). Since Cape May derives a large economic benefit from ecotourism, local people are supportive of the

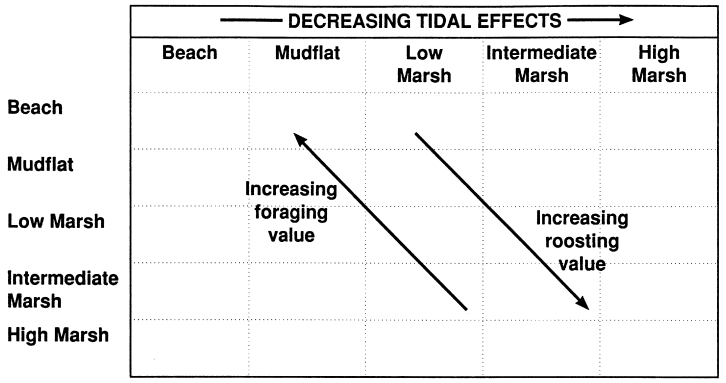

Fig. 4. Schematic showing the relative importance of different habitats to foraging and roosting shorebirds.

protection of both the shorebirds themselves, and a matrix of suitable habitats on the Cape May peninsula. Making use of the economic benefits of ecotourism can clearly benefit conservation, promoting biodiversity generally, by ensuring that there is adequate landscape scale protection of habitats for a wide range of species.

As the number of people interested in ecotourism grows, so too can the protection afforded to natural wonders. Today nearly 30% of Americans admit to watching birds, and many others are interested in nature in general. While places such as Cape May are noted as spectacular places to watch the spring and fall migration of songbirds and hawks, in addition to migrant shorebirds, many other places worldwide have spectacular concentrations of animals that can draw tourists from abroad. Although caution must be applied to ensure that the number of visitors does not disrupt behavior or affect reproductive success and survival, ecotourism can provide an impetus for protection of habitats and biodiversity. The economics of tourism/recreation can be harnessed and directed toward ecosystem management, particularly at a landscape scale.

4. Rivers, corridors, and conservation

4.1. The problem

Habitat fragmentation is the major problem in many parts of the world, for many species, particularly for neotropical migrants and other species

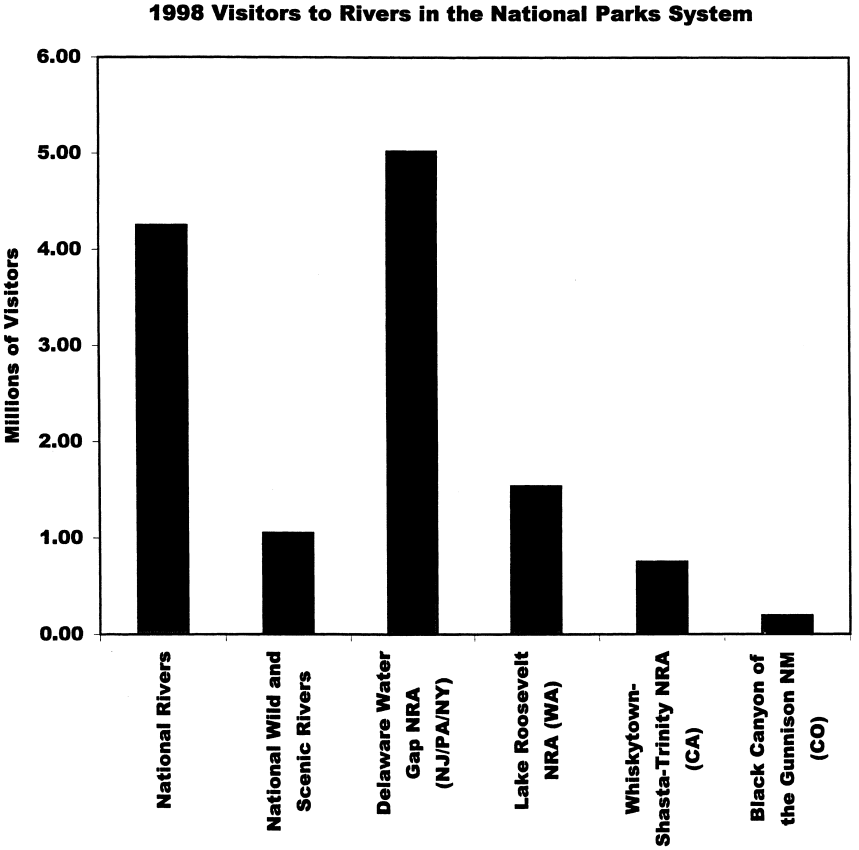

Fig. 5. Number of people visiting the river parks and recreation areas (NRA) within the National Parks system. NJ = New Jersey, Pa = Pennsylvania, NY = New York, Wa = Washington, Ca = California, and Co = Colorado.

that require extensive forests (Villard et al., 1993; Kattan et al., 1994). The relationship among habitat patches and the matrix in which they are embedded is a critical factor in species survival and in enhancing biodiversity (Fahrig and Merriam, 1994). While there is considerable disagreement about the single species vs. ecosystem approach, as well as the hierarchical preservation of biodiversity (Tracy and Brussard, 1994), the importance of fragmentation and habitat loss is clear.

Although the best approach to reducing fragmentation is to maintain large patches or tracts, this is not always possible. Many communities and regions are already developed and innovative ecosystem management is required to reduce the continued loss of habitat, with attendant fragmentation.

4.2. Solutions that aid biodiversity and conservation

One method of mitigating fragmentation for some species is the provision of corridors that allow movement between habitat patches. Stream or river corridors are one of the major integrative structural characteristics of landscapes (Forman and Godron, 1981). Although the relative merits of corridors for different species are controversial (Hess, 1994), some species benefit from corridors (Downes et al., 1997). Furthermore, in some cases, corridors themselves are a unique habitat worthy of protection because of their contribution to biodiversity (Bentley and Catterall, 1996). For example, rivers and their associated habitats are important biodiversity corridors, both for resident and for migrant animals (Skagen et al., 1998). For many species, such as salmon (*Oncorhynchus* spp.), rivers provide critical spawning habitats and are the weakest link in their life histories (Nehlsen et al., 1991). Furthermore, the wetland needs of terrestrial, but mobile animals, are often ignored (Haig et al., 1998), and riparian habitats fulfill these needs.

Enhancing and protecting riparian habitats is critically important, particularly where they link large patches of habitat. Engendering public support for such conservation is often possible on the basis of flood control and water management, however, recreation and tourism can also serve to garner support. In addition to fishing, a wide range of other sports and activities are centered around rivers (Fig. 5). If controlled and managed appropriately, such recreational activity is compatible with preserving ecosystem structure and function. Furthermore, many recreational activities that take place on the water cause little disturbance to nearby forests or other riparian habitats that may be critical for maintenance of biodiversity.

There is a growing number of people that recreate on riverine systems, and these individuals can provide a core of support for riparian ecosystems and their associated uplands. Riparian systems, by their very nature, provide corridors for a wide range of species, as well as providing linkages and greenways.

5. Contaminated lands, recreation, and conservation

5.1. The problem

One of the major global changes that has occurred in the last two centuries is the contamination of land through industrial processes, accidents, and transport of hazardous chemicals. Most industrialized nations have contaminated sites that require remediation to prevent risks to humans and to ecosystems. Furthermore, developing nations are creating more and more contaminated sites as they move forward industrially and economically. In addition to industrial sites, the military complex in many nations has left a legacy of radionuclide and chemical contamination.

In the United States, contaminated sites are evaluated and placed on the National Priorities List (NPL, or 'Superfund') for eventual clean-up and restoration to other land uses (Lucero, 1991). Superfund sites can be small, such as a spill area or factory, or they can encompass hundreds of acres. Federal facilities are at the top of the cleanup list of the US Environmental Protection Agency's (EPA) Office on Solid Waste and Emergency Response. Whenever there are pressing environmental problems that must be solved at

considerable public expense, mechanisms must be found to perform the necessary research and assessments on alternatives to make sound decisions (Levin, 1992).

The Department of Energy (DOE) owns approximately 3700 individual waste sites, and many of the large DOE sites (Savannah River Site, Idaho National Engineering and Environmental Laboratory, Los Alamos, Oak Ridge) are on the NPL (Department of Energy, 1996a). Some of the DOE land holdings are very large, such as Idaho National Engineering Laboratory (approx. 800 square miles), Hanford (550 square miles in Washington), and Savannah River Site (310 square miles in South Carolina). Most of the DOE lands were acquired during or immediately after the Second World War. In many cases the industrial areas occupy only a small fraction of the total land area, and the remainder has been largely undisturbed for nearly 50 years. In this section I use the Department of Energy lands as a case study of large partially contaminated sites where recreation and tourism can serve as a land use that is compatible both with landscape integrity and conservation, and with preservation of a DOE mission.

The potential contamination problems of DOE are widespread, but not uniformly distributed across these sites. In many places on a given site, mixed chemical and radioactive wastes require immediate stabilization because they were stored temporarily, and their current storage containers are close to leaking. At the other extreme are less toxic wastes that are present in low concentrations. The risk from these may be very low, particularly if exposure is controlled while contaminants degrade. The ultimate price tag for complete cleanup of DOE lands, which could exceed $300 billion, will be borne by the public, unless there are other land use solutions that require less remediation (Department of Energy, 1996a).

5.2. Solutions that aid biodiversity and conservation

The DOE, and other similar agencies or companies, have to find solutions to the management of contaminated lands that take into account human and ecological health, preservation of cultural and social resources (including archeological sites), costs, and long-term missions (Burger, 1999a). Furthermore, since large tracts of these lands have been undisturbed by people for 50 years, they represent functioning ecosystems that are regionally valuable.

I propose that one solution to the expenditure of billions of dollars on remediation and restoration of contaminated lands is to consider recreation/tourism and preservation as suitable future land uses for some sections. Such a solution could result in a lower standard of cleanup, below that required for residential, thus reducing the total costs of cleanup, while preserving valuable ecosystems for the future. Clearly risk assessment must play a role in evaluating future land uses (Burger, 1999a).

On many of the DOE lands there are valuable, functioning ecosystems that, over the last 50 years, have undergone succession. For example, Hanford has the only undisturbed reach of the Columbia River (Dale and Parr, 1997), and the Idaho National Engineering and Environmental Laboratory has some of the only remaining shrub-steppe in the country (Department of Energy, 1994). To disrupt them now by removing contaminated surface soil will result in ecosystem destruction, with a relatively long lag time for ecosystem recovery. Furthermore, many of these lands have very low levels of contamination that are below thresholds for ecological effects.

Many of the DOE sites are very large, covering hundreds of square miles, making land use decisions important for the ecological landscape. There are thus landscape issues on the sites themselves, as well as between the sites and the surrounding regions. Using methods from landscape ecology, Bartell et al. (2000) showed that for many of the DOE sites, the most significant land use changes occurred in the 5 years following facility construction, when farming ceased, and reforestation and wetland restoration occurred naturally.

DOE could select parcels of DOE lands with negligible contamination (buffer zones for the industrial sites), and convert these to recreational/tourist uses. The efficacy of such an action will depend on the available recreational/tourist

opportunities in the region, and the relative value of the DOE land holdings. Many of the DOE sites identified recreation as one possible future land use (Department of Energy, 1996b), and seven of the largest sites have been designated as National Environmental Research Parks (NERP) for the assessment of the effects of radionuclides and other contaminants on plants and animals (Department of Energy, 1994).

At many of the DOE sites there is currently limited recreation, such as hiking (some parts of Los Alamos National Laboratory, adjacent to Bandalier National Monument, in New Mexico) and hunting (Savannah River Site in South Carolina, Sanchez and Burger, 1998). Wildlife-related activities are the most favored future land uses of the Savannah River Site and the Idaho National Engineering and Environmental Laboratory (Burger et al., 1997b, 1998; Burger, 1998, 1999b). Maintaining the sites as a National Environmental Research Park and using them for recreation ranked the highest of preferred land uses in a series of interviews with on-site hunters, nearby residents, recreationists, and the general public living in the region (Fig. 6). Furthermore, at INEEL the results were similar for these same groups (Burger et al., in press a), as well as for the Shoshone-Bannock American Indians at nearby Fort Hall (Burger et al., in press b).

Economic simulation models indicate that additional spending on wildlife-related recreation in the SRS region can provide jobs and income that

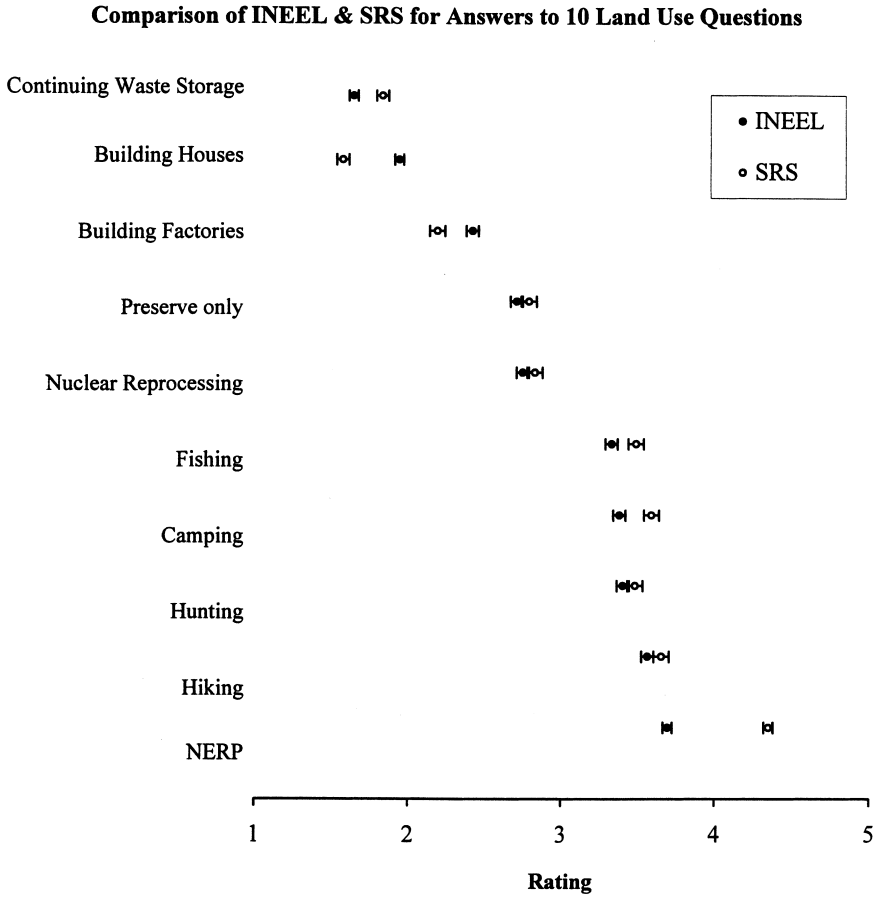

Fig. 6. Mean (±S.E.) rating for different future land uses of 1069 people interviewed around Savanna River Site, and 1690 people interviewed around the Idaho National Engineering and Environmental Laboratory.

contribute to the local economy (Solitare et al., in press). The model uses national forecasts developed by the US Department of Labor for 53 different economic sectors, and is a dynamic representation of the relationships among capital stock, final demand, labor supply, prices, profits and wages from the period 1969 to 1994. When compared to similar models for environmental restoration (cleanup activities), a tritium accelerator, and education, recreation is a sound investment, and in the long run, provides more economic development than other activities (except for investment in education, which is equal, Solitare et al., in press).

These models suggest that ecologists and economists should collaborate to develop models for the effect of recreation/tourism on landscapes that are large enough to conserve habitats and preserve biodiversity. The economic multipliers of recreation/tourism may be sufficient to halt unnecessary remediation and development of some sensitive areas. The importance of ecotourism is clear to some Nations, such as Kenya and Tanzania that depend on wildlife tourism, but it may be equally important to less spectacular areas that are nonetheless critical to biodiversity.

6. Conclusions

From these three examples it is clear that the human dimensions of global change must be considered during management of ecosystems. People are part of every landscape, and influence every landscape, either directly or indirectly. The influences are often detrimental, contributing to habitat loss and degradation, biodiversity losses, and to other disruptions of ecosystem structure and function. However, I suggest that tourism/recreation can be harnessed as a useful method of securing protection for a wide range of ecosystems. Although there are costs to tourism/recreation, these costs can be mitigated with careful planning and management of both the people and the ecosystems. There are simply some ecosystems, and some species that are too delicate or vulnerable to disturbance to allow ecotourism.

Sophisticated economic models, employing appropriate multipliers, must be used to demonstrate the importance of tourism and recreation to local economies. By examining the wider economic and social benefits of tourism/recreation, local and regional elected officials can be persuaded of the benefits of protecting the ecosystems and species on which the tourism and recreation depend.

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