Economic Benefits of Protecting Natural Resources in the Sonoran Desert

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Acknowledgments
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Residents of Pima County, Arizona, face a large array of decisions affecting the natural resources and landscapes of the Sonoran Desert. Most times, these decisions are cast as a choice between a healthy environment or a healthy economy—we can have one or the other but not both.

A variety of initiatives have been brought forward in Pima County in the last years regarding conservation of Sonoran Desert lands. The most recent, and by far the most comprehensive, is the Sonoran Desert Conservation Plan, the planning process for which was begun in late 1998 and is ongoing as this report is completed.

In this report we explain why the environment-vs.-economy view of things represents a false choice. This choice may have made sense in the distant past, when natural resources were abundant, the economy was simple, and exploiting the environment was a common way of making a living. Today, all of these dimensions of the relationship between the environment and the economy have changed. Now, the health of Arizona’s economy increasingly depends on having a healthy environment.

In the first chapter we explain the new roles that the environment plays in the economy of the western states. In the second, we draw on studies from throughout the West to explain how resource conservation in the West affects the number of jobs, level of incomes, and overall structure of local economies. In the third, we present readily available information about four categories of potential economic benefits of resource conservation initiatives in the Sonoran Desert: (1) the increased supply of valuable natural resources; (2) savings for taxpayers, utility ratepayers, and property owners; (3) a stronger local economy, with more jobs and higher incomes; and (4) reinforcement of efforts to accomplish other important goals.

The discussion shows there can be no doubt that well-designed resource conservation initiatives in the Sonoran Desert can yield substantial economic benefits: more jobs, higher incomes, higher property values, and lower utility bills. In addition, the resources that may be protected by conservation programs are, themselves, often priceless.

Though few if any studies have directly measured the economic benefits from protecting lands in the Sonoran Desert, Summary Table 1 outlines the bounty of research from Arizona and across the West that underscores the substantial economic benefits of protecting places like the Sonoran Desert.

Many of these benefits lie outside the familiar economic context of markets and dollar-denominated prices. This does not mean they are unimportant,
### Summary Table 1: Studies from Arizona and the West Indicate that Conserving Natural Resources in the Sonoran Desert Will Yield Economic Benefits

<table>
<thead>
<tr>
<th>Potential Economic Benefits</th>
<th>Study and Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intrinsic Values:</strong></td>
<td>A study in New Mexico found that the state’s residents were willing to pay:</td>
</tr>
<tr>
<td>Instream flows necessary for fish survival</td>
<td>• $30/yr for 5 years to provide the minimum instream flows in the Rio Grande River to prevent extinction of one fish species, and</td>
</tr>
<tr>
<td></td>
<td>• $79/yr for 5 years to provide minimum instream flows in all the state’s major rivers (Berrens et al., 1995).</td>
</tr>
<tr>
<td></td>
<td>Over 80% of the respondents in another survey were willing to pay $80/yr to increase the streamflows in New Mexico rivers and streams (Berrens et al., 1998). These results are indicative of the economic benefits of protecting instream flows in the Sonoran Deserts, assuming that Arizonans and New Mexicans hold similar values.</td>
</tr>
<tr>
<td>Habitat for at-risk species</td>
<td>A study found that U.S. households were willing to pay $50-$330/yr to protect habitat critical to the survival of at-risk fish in the Southwest, including habitat along the Gila River (Ekstrand and Loomis, 1998). Some portion of this value, still unquantified, would derive from habitat protection in the Sonoran Desert.</td>
</tr>
<tr>
<td></td>
<td>Researchers studying the protection of the Mexican Spotted Owl found that U.S. households were willing to pay an average of $40.49 to protect the owl and its 4.6 million acres of critical habitat in Arizona, New Mexico, Colorado, and Utah. A conservative estimate places the benefits at $1.8 billion to $2.6 billion. These findings are another indication of the magnitude of economic benefits associated with Sonoran Desert conservation, insofar as it protects habitat for species of concern (Loomis and Ekstrand, 1997).</td>
</tr>
<tr>
<td>Native ecosystems and landscapes of the desert</td>
<td>California residents indicated they were willing to spend $177 million to $448 million per year to support legislation to protect 6.9 million acres of the state’s desert lands (Richer, 1995). If Arizonans value the Sonoran Desert to the same degree that Californians value California’s deserts, these findings indicate that the economic importance of protecting desert landscapes is considerable.</td>
</tr>
</tbody>
</table>
### Potential Economic Benefits

<table>
<thead>
<tr>
<th>Study and Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recreation and Aesthetic Values:</strong></td>
</tr>
<tr>
<td>Bird-watching and nature-related tourism</td>
</tr>
<tr>
<td>Recreational fishing</td>
</tr>
<tr>
<td>Wilderness recreation and intrinsic value</td>
</tr>
<tr>
<td><strong>Increased Property Values:</strong></td>
</tr>
<tr>
<td>Increased property values near protected riparian corridors</td>
</tr>
<tr>
<td>Increases in property values near open space and natural lands</td>
</tr>
</tbody>
</table>
however. To the contrary, many benefits of conservation do not lend themselves to markets and prices precisely because of their importance.

Ernie Niemi and Kristin Lee, economists with ECONorthwest, prepared this report for the Coalition for Sonoran Desert Protection. Many people have provided valuable insights and assistance, but we remain solely responsible for the report’s contents. We prepared this report based on our knowledge of the natural resources and the economies of the Sonoran Desert and surrounding areas, as well as information derived from government agencies or other sources believed to be reliable. Any statements nonfactual in nature constitute our current opinions, which may change as more information becomes available. As time passes, the results of this report should not be used without accounting for more recent data and relevant assumptions.

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In this chapter, we examine the web of connections between ecosystems and economies and describe the ways in which actions to conserve resources in their natural state can affect economic growth and prosperity. We begin with a conceptual framework for understanding the relationship between ecosystems and economies. We then apply the framework, first to describe trends in the economic importance of different goods and services derived from ecosystems, and then to examine the potential economic consequences of resource conservation actions. Though the discussion is general, reflecting emerging forces and trends at play throughout the West, it sets the stage for our subsequent examination of resource conservation in the Sonoran Desert.

**Ecosystems and Economies—A Conceptual Framework**

To help elucidate the economic consequences of resource conservation initiatives, we turn to a fundamental focus of economic analysis: competition. In Arizona and elsewhere in the West, it once may have made sense to conclude that there was no competition for natural resources. The resources were abundant, and the economy made use of the resources in limited ways. Jobs, wealth, and prosperity were derived from natural resources primarily through extractive industries that converted resources into commodities or via development industries that displaced natural resources with human-made assets, such as buildings, roads, and dams.

In those days, resource conservation proposals could be seen as involving an inherent tradeoff between the economy and the environment. One could have a healthy economy or a healthy environment, but not both, as represented by the diagram in Figure 1-1. When resources were abundant, relative to the demands placed on them, there was, in effect, no economic competition for the resources available from western wildlands—they were free for the taking.

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1The discussion in this section relies extensively on previous work, including Courant et al. (1997) and Niemi (1999).

2Of course, perceptions that there was no competition for western wildlands ignore the long-lived competition among different Indian groups for some resources and between Indians and Euro-American settlers. They also overlook the implicit competition among the current and future generations over the sustainability of resources and resource uses over time.
Today, things have changed. Economic competition for western natural resources is real, complex, and growing. Natural resources are not abundant as human populations have grown, and wildlands in the West cannot satisfy all the human demands placed on them. Hence, whenever wildland resources—through inertia, public policy, markets, or some other mechanism—are allocated to one use, other, competing uses go without. These competitive tradeoffs have wide-reaching ramifications for local economies and for the current and future residents of nearby communities and entire regions.

To evaluate the economic consequences of resource conservation initiatives, one must know what their impacts will be on the competition for wildland resources: which competitors and uses will benefit, which will not, and how these initial impacts will ripple through the overall economy. Moreover, it is essential that one view these impacts in the context of regional, national, and even global forces and trends that, throughout the West, are fundamentally altering the ecosystem’s role in supporting jobs, creating wealth, and shaping entire economies.
One could categorize the current competition for wildland resources in any of a number of ways, but we propose a taxonomy that distinguishes among four types of demand for the goods and services derived from wildlands. The four types of demand are illustrated in Figure 1-2. The left side of the figure shows two types of commercial demand for resources, i.e., for elements of wildlands that help firms earn profits. The right side shows two types of consumers’ demand for elements of wildlands that directly influence individuals’ quality of life and standard of living. Each type of demand exists independently, but the competition among them is best understood by assuming that one type, the “Dominant Commercial Use” in the upper left corner, prevails, and then looking at the consequences for the others.

**Figure 1-2: Competition for Natural Resources—Current Reality**

![Diagram of competition for natural resources]

**Competition from Commercial Uses**

The most easily identifiable commercial demands entail the extraction or development of natural resources. We use the term *extraction* to embrace activities, resource uses, and industries associated with crop production, timber production, grazing, mining, and other activities that chemically, electrically, or physically remove one or more elements (flora, fauna, mineral, or energy) of the ecosystem from its source.

We use the term *development* to refer to the occupation of a site by human structures, such as occurs during urbanization. Development also includes intense human activity—draining a wetland, changing the composition of a forest’s floral community, concentrating off-road-vehicle traffic, and so forth—
that substantially alters an ecosystem’s natural processes. Mining, ranching, and development are among the most important of the commercial demands, although there are many others, including industrial tourism.

Commercial demand for natural resources comes from private and public enterprises, which we define broadly to include chartered institutions, such as private corporations, incorporated cities, and public agencies, as well as households that farm land, build a house, or recreate, and other groups that sponsor extractive or development activities.

**Dominant Commercial Demand.** We distinguish among two types of commercial demand for natural resources. We first identify a specific, extractive or development use of a specific piece of wildland that has three important characteristics: it directly uses natural resources; depletes the stocks of resources; and has a dominant position relative to competitors because of its economic competitiveness, political support, or historical inertia. The identification of a particular use as the dominant one is arbitrary, but purposeful. This type of demand usually is associated with a familiar extractive industry, such as industrial farming, ranching, or mining, or with common development activities: urbanization; developed recreation; road construction; and the like.

In general, only one commercial industry benefits from a particular use of wildland resources, but sometimes there may be more than one.

In public discussions of resource protection initiatives, the economic importance of the dominant commercial use of wildlands usually is expressed in terms of jobs and incomes for local residents, as well as profits for local firms. In many cases, this commercial use is portrayed as the sole way for local residents to derive jobs, incomes, and profits from wildlands. In the Sonoran Desert, for example, it is common to hear the belief that, if land development or cattle ranching are allowed, then the local economy will gain jobs, incomes, and profits, but if the natural resources of the land are protected, then the land will have no positive impact on these variables. In the most extreme form, this is the economy-vs.-environment argument reflected in the first diagram in this chapter, Figure 1-1.

**Other Commercial Demands.** In today’s economy, the dominant commercial use generally is not the only one competing for wildland resources. We purposefully distinguish between the two categories of commercial uses to drive home the message that there often is competition, within the extractive and development sectors themselves, for natural resources. This message is important because, too often, the competition for wildland resources is characterized...
as simply a jobs-vs.-environment contest between a (dominant) industry seeking to use a resource as a productive input and those who want to protect the environment. By highlighting competing commercial industries that incur economic costs from the dominant one’s use of natural resources, we emphasize the point that the positive consequences arising from one set of extractive or development activities frequently have negative effects on one or more others.

In the Sonoran Desert, one readily can see the competing commercial demands for wildland resources. Urban development competes with ranching, development competes with segments of the recreation industry linked to the desert’s wide-open spaces, and one sector of the development industry competes with another.

**COMPETITION DIRECTLY FROM CONSUMERS**

On the left side of Figure 1-2, natural resources are economically important because they are inputs in the production of other things, such as beef, housing, and transportation systems, that consumers want to have. On the right side, the connection between these resources and consumers is more direct. That is, consumers consider these resources economically important for what they are and for how they directly contribute to consumers’ well-being. Figure 1-2 shows there are two types of demand for natural resources coming directly from consumers: one affects those residential location decisions linked to quality of life; the other does not.

**Quality-of-Life Demand.** We use the term *quality-of-life demand* to represent consumption amenities that influence location decisions. Sometimes wildlands produce amenities, such as recreational opportunities, scenic vistas, and healthy environments, that contribute directly to the well-being of people who have access to them. In the language of economics, these are known as consumption amenities. Their contribution to consumers’ well-being makes consumption amenities economically important in their own right, but they also influence the location decisions of households and firms (Knapp and Graves, 1989; Mathur, 1993; Mueser and Graves, 1995), thus, adding to their economic interest. The nearer people live to these amenities, the better their access and the greater their consumer surplus.

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Whitelaw and Niemi (1989) have likened this relationship to a second paycheck residents receive by living in a place where they have easy access to amenities, so that the total welfare of residents within commuting distance of the amenities is the sum of this second paycheck plus the purchasing power of their money income. The size of the second paycheck affects behavior in the local and regional economies by influencing household demand for residential location. If the second paycheck is large enough, it will attract households that otherwise would have located elsewhere. The influx of people increases both the labor pool and the number of consumers. The former attracts firms seeking workers, and the latter attracts firms seeking consumer sales. Both mechanisms allow natural-resource amenities from wildlands to affect where goods and services are produced. Thus, the quantity and quality of natural resource amenities can affect the levels and types of jobs, incomes, profits, and economic activities in general throughout the local and regional economies, including sectors with no direct link to the use of ecosystem resources.

The strength of the quality-of-life impacts on the economy depend on many variables, including the distinctiveness of the amenities available from the wildlands and how these interact with households’ preferences and other building blocks of economic development, such as transportation and communication systems. It is clear, though, that quality-of-life impacts can be powerful. Researchers from the USDA Economic Research Service, for example, found that amenities influence economic growth throughout the Rockies (Vias, 1999), and the rural West (Cromartie and Wardwell, 1999). Repeated surveys have found that recent in-migrants to Oregon resoundingly say that having access to the state’s quality of life is a primary motivation for moving, and that they are willing to accept a reduction in incomes to do so (Helvoigt, 1999). Separate studies have documented that western counties with higher acreage of wilderness or unroaded areas on federal lands experience faster growth in jobs and incomes (Rudzitis and Johnson, 2000; Southwick Associates, 2000).

**Intrinsic Economic Value Demand.** The lower right corner of Figure 1-2 represents the demand for elements or characteristics of an ecosystem that people value for their intrinsic properties. Intrinsic values, often termed “existence values,” do not entail an explicit current use of the resource.\(^4\) They arise whenever individuals place a value on maintaining the existence of a species, scenic waterfall, or other resource for its own sake, or on the prospect that the resource will be useful, for example, to future generations. Actions that increase the robustness of the resources, for example, by preventing degradation of critical habitat for an endangered species or by ensuring the flow of the waterfall, increase the welfare of those concerned about these issues, and actions that degrade the resources decrease this welfare.

Unlike the other three demands for natural resources, demands related to intrinsic values, by themselves, are unlikely to have any manifest economic effect on jobs, income, or other indicators of economic activity. The protection of scenic vistas in the Sonoran Desert may be of intrinsic value to some residents of Miami, Los Angeles, and other distant places, but the effect of this on economic activity in and near the desert will be small unless it is articulated through tourism (in which case it appears as a commercial demand) or the political system. Still, the resource affects the real well-being of real people, and this well-being belongs in any comprehensive analysis of the value of the resource.

For some environmental issues, intrinsic values may be surprisingly large, especially to those who are used to equating the economic importance of wildlands to their extractive and development uses. Consider wild and unroaded lands, for example. The large, undisturbed landscapes of these areas offer opportunities for private, secluded recreation, provide habitat for native species, and support scientific monitoring and research that cannot be conducted on lands that have been heavily roaded or developed. Given these characteristics, plus a widespread desire to protect wild lands for future generations, most Americans see unroaded areas as national assets that warrant protection. In a nationwide poll conducted in January, 2000, 76 percent of respondents supported the protection of roadless areas in national forests from logging, road-building, and other development (DiVall and Onorato, 2000).

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\(^4\)Some argue that the intrinsic value category, alone, does not fully recognize the value of the life-support services ecosystems provide that make the earth habitable (Baskin, 1997). We do not debate the point here but, instead, expand the category of intrinsic values to include this life-support value.
TRADEOFF MECHANISMS AND RIPPLE EFFECTS

We have constructed the analytical framework associated with Figure 1-2 to demonstrate the complex and growing competition for wildland resources in the West. A central message to be drawn from the framework is that, when one type of demand enjoys the use of a given set of natural resources, some competing demands go without. In this context, there are economic tradeoffs that ripple through local and regional economies from any use of wildland resources, including protection of the land’s natural characteristics. Hence, when trying to trace the economic consequences of initiatives to protect the natural character of wildlands, one cannot look solely at the historical use of the resources but, instead, must also look at the impacts on the competing uses. To illustrate this principle, we extend our framework, again setting the dominant commercial use as the winner of the allocative process and looking at the costs on the others (but emphasizing that the same logic applies when resources are allocated to the other three types of demand). These costs materialize through two mechanisms: direct displacement and subsidies.

Direct displacement. This type of cost can materialize via two pathways: competitive bidding and negative externalities. The former materializes when an increase in the output of a resource use, other things equal, reduces the output of other uses. To extend the framework associated with Figure 1-2, expanding the output of the dominant commercial use reduces the value of competing commercial uses, the quality of life for residents, the intrinsic value of the wildland resources, or perhaps all three. This outcome might materialize, for example, when an urban development reduces the amount of water available for other uses, such as instream flows.

Displacement also occurs when the production of the dominant commercial industry is accompanied by negative externalities. Negative externalities are ubiquitous when extractive and development activities affect the quality of air, water, habitat and landscapes. There currently is considerable concern in the Sonoran Desert, for example, about the impacts of urban development on the

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5In some cases externalities are positive. We include such cases as a part of the input demand.

6There is an extensive literature regarding when a particular cost or benefit is or is not an externality, or whether a particular price or production phenomenon stems from displacement, an externality, or a subsidy. See, for example, Baumol and Oates (1988 pp. 14-15).
quantity and energy of water flowing downstream during a flood event. Some types of development can increase the risks of flood-related damage downstream, thereby displacing opportunities for future development of downstream parcels.

**Subsidies.** The second mechanism by which the dominant commercial use of natural resources can impose costs on those with other, competing demands comes into play when government subsidies distort the prices or production levels of the dominant commercial industry. Similar distortions can arise from regulatory and other actions, but, to conserve space, we lump them all under the rubric of subsidies. Subsidies draw money from, and thereby restrict the output and profits of other commercial industries. They also lower the disposable incomes of households. Hence, subsidies are akin to externalities.

Subsidies may be conspicuous, as when states give tax concessions to an industry, but they may be more hidden. Regardless of their visibility, subsidies suppress the level of production in other industries and lower the well-being of affected households. These effects may materialize in the vicinity of the subsidized industry, but not necessarily.

**THE MIX OF GOODS AND SERVICES FROM WILDLANDS**

There exists no comprehensive evaluation of the value of the different ecological goods and services derived from western wildlands. A rough idea of their value can be obtained, however, by looking at data for the nation’s national forests. We first examine the economic importance of easily measured goods and services, then look at two that are not so easily measured: high-quality streamflows; and wild and unroaded areas.

**Easily-Measured Goods and Services.** In 1995 researchers at the Forest Service estimated the contributions to the Gross Domestic Product, or GDP, of different ecological goods and services from the national forests (U.S. Department of Agriculture, 1995). GDP is a common indicator of the value of all goods and services produced domestically and provides a widely accepted measure of the nation’s overall economy. As it usually is calculated, however, GDP ignores the environment, personal recreation, and other unpriced goods and services. Hence, the researchers attempted to fill in some of the blanks.

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7The discussion in this section relies on previous work, including Niemi and Fifield (2000).
They estimated that the most easily measured goods and services from the national forests would contribute $145.1 billion to GDP, about two percent of the national total, by the year 2000. Recreation accounts for three-quarters of this contribution, or $108.4 billion, as shown in the left side of Figure 1-3, and fish and wildlife account for another $14.4 billion. In contrast, the researchers found that timber, forage, and minerals—the goods that historically were so important—now account for less than 12 percent of the total. Moreover, the researchers predicted that, for the foreseeable future, the value of the services would increase, relative to the value of timber, range, and minerals.

Figure 1-3: An Accounting of the Most Easily Measured Items Shows that Services Account for the Bulk of the Value and Jobs Produced by the National Forests

<table>
<thead>
<tr>
<th>Contribution to Gross Domestic Product</th>
<th>Contribution to Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Value: $145 billion (1999 dollars).</td>
<td>3.3 million jobs derived from the national forests.</td>
</tr>
<tr>
<td>Excludes carbon sequestration, clean water and other services provided by national forests.</td>
<td>Excludes carbon sequestration, clean water and other services provided by national forests.</td>
</tr>
</tbody>
</table>

The right side of Figure 1-3 shows a similar pattern for jobs. Recreation, alone, accounts for more than three-quarters of the total jobs derived from the easily-measured goods and services the national forests provide the American public.8


8The Forest Service recently reported that historical data have over-estimated actual recreational use of the national forests, but it has not yet corrected its estimates of the jobs and GDP attributable to recreation. As we explain below, however, the national forests also produce other services, such as high-quality streamflows, and unroaded and wild areas.
Table 1-1 provides some additional insights into the make-up of recreational values. The data in the table come from an extensive analysis of federal lands in the interior Columbia River Basin. For these lands, all recreational activities generated a total value of $23 per acre per year. Further research is needed to discern the comparable values in other areas of the West, but these values provide some reference points for understanding the recreational values of wildlands throughout the West.

**Table 1-1: Illustrative Values of Recreation on Western Public Lands (Federal Lands in the Interior Columbia Basin)**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Annual Value (Dollars Per Acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishing</td>
<td>5.54</td>
</tr>
<tr>
<td>Hunting</td>
<td>5.32</td>
</tr>
<tr>
<td>Day Use</td>
<td>2.96</td>
</tr>
<tr>
<td>Winter Sports</td>
<td>2.84</td>
</tr>
<tr>
<td>Camping</td>
<td>1.94</td>
</tr>
<tr>
<td>Trail Use</td>
<td>1.84</td>
</tr>
<tr>
<td>Motoring Viewing</td>
<td>1.05</td>
</tr>
<tr>
<td>Viewing Wildlife</td>
<td>0.94</td>
</tr>
<tr>
<td>Nonmotor Boating</td>
<td>0.22</td>
</tr>
<tr>
<td>Off-Road Vehicle Use</td>
<td>0.13</td>
</tr>
<tr>
<td>Snow Mobiling</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22.85</strong></td>
</tr>
</tbody>
</table>

*1998 dollars.

Source: ECONorthwest with data from Haynes and Horne (Haynes and Horne, 1997).

Recreation is not the only service derived from wildlands that has considerable economic value. Others include (1) the delivery of high-quality streamflows; 2) the provision of unroaded, wild areas; and (3) the sequestration of atmospheric carbon. Thus, even though the data on the easily measured values and jobs clearly show that recreational services derived from the national forests far outweigh timber, range, and the other goods, adding into the mix these other services demonstrates that the services are even more important. In the following discussion we elaborate on the values of two types of services especially important in the Southwest: high-quality streamflows and unroaded, wild areas.
High-quality streamflows. For the entire national forest system, the total value of all water flowing from the national forests is conservatively estimated to be $3.7 billion per year (Niemi and Fifield, 2000). By this estimate, the water coming from the national forests is worth slightly less than the timber value in the left pie chart in Figure 1-3. The water-value estimate, however, is rough and “conservative” and future refinements may show that the actual value is greater.

As with the national forests as a whole, the value of services derived from national forest water often outweighs the commodity value. Historically, it was widely believed that water was most valuable if withdrawn from a stream and used to irrigate crops or for municipal-industrial purposes. As the agricultural sector has become less profitable and a smaller portion of the overall economy, however, the economic benefits of using water for irrigation have diminished. At the same time, as the increasingly affluent population sought more recreational opportunities, but the opportunities associated with free-flowing streams became more scarce, the economic benefits of leaving water in streams have risen.

A study by the U.S. Department of Agriculture of the potential economic effects of shifting marginal amounts of water from irrigation to instream flows found that, in virtually all parts of the country, the net effect would be positive (Hansen and Hallam, 1991). In most places, reducing the amount of water used for irrigation by one acre-foot would not reduce farm production, whereas leaving the water instream would trigger significant increases in the opportunities for recreational fishing. This is especially true in the Southwest, where the recreational-fishing value per acre-foot of water can exceed $1,000, but the irrigation value is zero. Additional recreational values associated with boating, swimming, and other activities also could materialize.

Streamflows with high-quality water in a natural setting generally are more valuable than those with low-quality water quality or degraded natural conditions, such as trampled streamside vegetation. Water from the national forests generally is cleaner and cooler than stream water originating from other sources, largely because the national forests occupy higher lands and often have experienced less intensive development. Undeveloped areas also tend to exhibit more stable flows, with lower peak flows during wet months and higher minimum flows during dry months.

Resource conservation can affect many of these attributes. Roads can affect both the timing and quality of runoff, as can grazing and other activities in riparian (streamside) areas (Brown and Binkley, 1994). Some recreational activities, if not managed correctly, can affect the concentration of pathogens
in streams and increase siltation. Recommended conservation actions on typically reduce the amount of development that distorts natural streamflows (Doppelt et al., 1993).

**Unroaded, wild areas.** Wild lands without roads have some special economic values: for recreation, the protection of species, and increasing human understanding of ecological processes. Measuring these values is difficult, but some useful insights into the general size was revealed by recent research regarding the 78 million acres of federal lands in the Columbia River Basin (Haynes and Horne, 1997). Forest Service economists working in the area found that the values recreationists placed on activities taking place in a wilderness area were roughly double the values of similar activities on federal lands outside wilderness areas. They also found that the existence value of unroaded areas was roughly equal to the total value of all recreation occurring on federal lands.

- **Wild lands without roads have some special economic values:** for recreation, the protection of species, and increasing human understanding of ecological processes. In other words, the special values associated with wild and unroaded areas exceed the value of recreation on all federal lands in the region. In other words, the special values associated with wild and unroaded areas exceed the value of recreation on all federal lands in the region. The national analysis described above indicates that recreation accounts for three-quarters of the total value in the accounting of easily measured goods and services derived from the national forests. Combined, the research results for the nation as a whole and the Columbia Basin indicate that the special values associated with wild and unroaded areas constitute the largest component of the total value of the goods and services derived from wildlands.

**REFLECTIONS**

The central theme of this discussion is that the relationship between natural resources and the economy is complex. With competing demands for the resources, a resource conservation initiative will generate benefits as well as costs. Evidence from throughout the West shows that the benefits of conservation often are increasing relative to the costs, insofar as the costs involve reductions in the supply of plentiful commodities, and the benefits come from increases in the supply of otherwise scarce goods and services, such as clean water and roadless-area recreational opportunities.

Evidence also shows that the mixture of competing demands for natural resources is constantly shifting, with some demands growing relative to others. Any careful evaluation of the costs and benefits of a resource conservation initiative must take this evolutionary process into account. In many instances, conservation initiatives restrict the supply of resources for long-standing demands that are diminishing in their economic importance, and increase the
supply for demands that have emerged only recently. Such shifts mirror those that would occur if the resources were governed by market mechanisms. Hence, whereas criticism of conservation initiatives commonly conclude that they interfere with markets, the reality is often—if not generally—just the opposite, and the initiatives result in resources being transferred from a low-value to a high-value use.
The growing competition for natural resources, described in the preceding chapter, means that any resource-management decision that increases one group's access to resources at the expense of others will have both positive and negative impacts on the economy. Furthermore, growing evidence indicates that, in general, the services that might be derived from natural resources, and especially wildlands, are increasing in value relative to the goods. This shift in values indicates that, to promote greater prosperity, society ought to shift its resource management regimes, through resource conservation initiatives, to increase the supply of services, such as recreational opportunities, scenic vistas, and natural streamflows.

Many people and public officials, however, are not too interested in the fact that resource conservation initiatives can increase the value of natural resources. They are more concerned about the economic impacts, i.e., how resource conservation affects jobs, incomes, and the overall economic structure of local and regional economies.

To address these concerns we proceed in two steps. First, we discuss a common model of economic impacts, called the economic-base model, to see why it often predicts that resource conservation initiatives will have powerful, adverse economic impacts. We then describe an alternative model that more accurately represents how economies adjust to resource conservation initiatives (or any other changes).

A WRONG WAY TO THINK ABOUT IMPACTS—THE ECONOMIC-BASE MODEL

Perhaps the most common model used to predict the impacts of resource conservation initiatives is the economic-base model. We explicitly reject the validity of this model because it so often yields widely misleading results. But, because it is so widely used, we first briefly describe it and explain why it doesn’t work.

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9This discussion is derived from Niemi et al. (1999).
THE REASONING UNDERLYING THE ECONOMIC-BASE MODEL

An economic-base model divides the economy of an area into two sectors: the export sector, which produces goods and services sold to buyers outside the area, and the local sector, which sells its products within the area. Proponents of the economic-base model conclude that, because the export sector brings from the outside money that is spent and respent on local goods, it is the “economic base” that “supports” the local sector. Because resource-extractive industries typically export their products to other regions or countries, their supporters frequently rely on the economic-base model to conclude that this industry supports—or plays the primary role in supporting—western economies. Accordingly, supporters extend the reasoning to assert that the basic industry must be nourished if the overall economy is to grow, and protected if the economy is to be insulated from contraction.

An economic-base analysis typically proceeds in a straightforward manner. The analyst first assumes that the export sector consists of only those industries with certain characteristics. The focus almost always is on resource-extraction, development, or manufacturing industries, although sometimes they include major industries in the service and trade sectors, such as tourism, universities, or a concentration of government agencies. After deciding which industries are included in the export sector pie, the analyst then decides how big a slice to allocate to each industry. This typically is done by looking at the percent of statewide employment in each of the so-called exporting industries and comparing it to the industry’s national percentage. The reasoning is that the more a state’s (or region’s) percentage exceeds its national counterpart, the more the industry contributes to the state’s total exports. Having determined that an industry produces X percent of the total exports from the export sector the analyst concludes that the industry supports the same percentage of the local sector.

With this line of reasoning, economic-base studies have found that extractive, development, and manufacturing industries exert tremendous leverage over the economies of western states and communities. Not surprisingly, with these results, both the analysts who applied such models and the lay members of the community who accepted the reasoning of the economic-base model readily believed that any curtailment of basic industries would have devastating economic and social consequences.

The ultimate flaw, of course, is that the economic-base model gives wrong answers. Repeatedly, the model has predicted that shrinkage in a basic industry would trigger a collapse in a local or regional economy, but the opposite has happened.
WHY THE ECONOMIC-BASE MODEL DOESN’T WORK

Several serious flaws in reasoning cause economic-base models to give a highly inflated sense of the basic industries’ economic importance. It takes only some common sense, plus a quick look at economic history, to expose these flaws.

The ultimate flaw, of course, is that the economic-base model gives wrong answers. Repeatedly, the model has predicted that shrinkage in a basic industry would trigger a collapse in a local or regional economy, but the opposite has happened. Numerous studies have demonstrated the model’s failure (Bray, 1980; Krikelas, 1992; Leven, 1986; Power, 1996; Tiebout, 1956). In the Pacific Northwest, for example, the model predicted massive reductions in employment and widespread economic and social chaos if logging on federal lands were reduced to prevent extensive environmental damage, but these catastrophes did not materialize. Instead, the region enjoyed prolonged, robust growth in jobs, incomes, and industrial diversification (Niemi et al., 1999).

To help drive home the ultimate failure of the economic-base model, in the following paragraphs we discuss some of the particular flaws in its underlying line of reasoning.

The initial steps of an economic-base analysis entail identifying the industries included in the export sector and determining their relative strengths. The typical approach is to look only at an area’s big industries, especially resource extraction, development, and manufacturing, and to concentrate on those whose percentage of the subject area’s total employment exceeds the comparable, national percentage.

This reasoning seems plausible at first blush, until one considers the implications. What happens, for example, if the economic mix of a community, state, or region exactly matches the national mix? In the economic-base framework, such an economy would be dead in the water, with no export sector, no economic base and, hence, nothing to support the local sector. Furthermore, even if one accepts all the rest of the economic-base reasoning, consider how it views an industry that exports all of its product, but has a smaller percentage of local employment than its national counterpart has of total, national employment. The analyst would exclude the industry from the export sector even though it is entirely an exporting industry. These and other logical inconsistencies render the exercise largely meaningless.

Economic-base models also take a snapshot of the economy and pretend it is a movie. That is, they contain a simplifying assumption that arrests the economy in its current configuration so that any increase or decrease in the basic industry can be traced through the now-assumed-to-be-static economy. In gen-
eral, the results from this approach tend to overestimate the negative impacts and underestimate, even ignore, the positive impacts of any change from the status quo. This bias can be called the dumb-person bias, because the technique explicitly assumes that investors, managers of firms, workers, and consumers will not adapt to the change in the basic industry but instead will continue to behave as if the management decision had not occurred (Mendelsohn et al., 1994). In reality, though, investors, managers, workers, and consumers are neither static nor dumb. The regional and subregional economies of the U.S. are tremendously dynamic, and they adapt remarkably to changing conditions. If the supply of a productive input is restricted, or if the demand for a final product falls, investors will try to reduce their risks and the managers of firms will adapt their production processes accordingly.

Courant, et al. (1997b) demonstrate that when using an economic-base model to crank through the effect on employment or income of eliminating a given amount of employment in the basic industry, an analyst is answering the following question: What would happen if the given amount of basic-industry employment were eliminated, and

- Those who lost their jobs as a result never worked again, but also did not move;

- The local and regional establishments that sold goods and services to the dislocated, basic-industry workers permanently lost that business and obtained no replacement business (and also did not move);

- Those enterprises in the region that used the output of the original workers when they had jobs obtained no replacement inputs from elsewhere (and also did not move); and

- Everyone throughout this chain who lost her or his job acted exactly the same way as the original job losers, in that they never worked again and stayed put?

There may be reasons for answering this question: it puts a theoretical upper bound on the extent of adjustment an economic region will have to undergo in response to a change in policy (or technology, or demand). However, as Power (1996) so nicely puts it, using the economic-base model for forecasting is like driving a car while looking in the rear-view mirror. Thus, the economic-base model, at best, generates a measure of the maximum extent to which changes might take place, but this is very different from a forecast of what will actually happen.
A BETTER MODEL FOR UNDERSTANDING THE ECONOMIC IMPACTS OF RESOURCE CONSERVATION

The key to forecasting how an economy will respond to a resource conservation initiative is having an understanding of how the economy responds to any change or stimulus.

Adjusting to change is one of the widely trumpeted virtues of market economies. Experience in the western states of the U.S. and elsewhere show that, when a specific industry in a specific location goes into decline, for whatever reasons, the adjustment process entails two sets of things, which must happen in some combination: (1) other activities will replace the industry in decline; and (2) capital and people whose incomes fall will seek replacement employment and, if they don't find it locally, they search for it elsewhere. To forecast how a given local economy will adjust requires not only a detailed knowledge of what that economy currently does and how capital and people are currently employed but also knowledge of other things that it might do and of how quickly capital and people respond.

Developing this detailed knowledge, and explicitly recognizing the dynamic character of the economy, is the approach we recommend for understanding the economic impacts of resource conservation initiatives on jobs, incomes, and the overall structure of local and regional economies. We call this approach the Dynamic-Adjustment Model. The model recognizes that restricting some activities to conserve desired characteristics of some natural resources will alter the relationship between these resources and the economy along two pathways. Along the first, which is the most direct, the restrictions in resource-degrading activities and the ecosystem’s response will alter the vegetation, hydrology, and other biological and physical characteristics not just on the affected lands but also elsewhere in the larger landscape or watershed, especially downstream. These alterations will change the supply of goods and services to meet the four types of demand shown in Figure 1-2, and the economy will respond accordingly.

Along the second pathway, the restrictions in resource-degrading activities will lead to alterations in society’s knowledge about the interactions between the resources and the economy, the institutions society uses to manage these resources, and the incentives the institutions create for different types of resource management behavior. Information developed during scientific analyses associated with a
conservation initiative, for example, might improve local residents’ understanding of and stimulate a change in their behavior toward these resources. Resource-use restrictions might lead to changes in institutions, such as the property-tax system and the willingness of private lenders to extend credit to landowners helping restore native ecosystems.

There is no simple way to trace all the changes. If one wants to understand the impacts a resource conservation initiative will have on jobs, incomes, and the like, one has no alternative but to trace the economy’s adjustments, recognizing that each worker, household, firm, and community will try to mitigate the impacts it considers negative and to accentuate those it considers positive. In the following discussion we present some of the highlights.

**THE RESPONSE OF COMMERCIAL RESOURCE USERS**

The economic-base model suggests that commercial resource users respond to a resource conservation initiative in a simple, linear fashion: a reduction in the supply of resources for an extractive, development, or manufacturing industry will cause the industry and all dependent activities to contract. End of story.

In reality, though, one should expect a wide array of response from a large set of enterprises. When a resource conservation initiative constricts the supply of resources for a resource-degrading activity, one should expect the commercial firms associated with that activity to pursue alternative supplies of the resource, develop alternative production processes that use less of the resource, or both. Reductions in logging on federal lands in western states, for example, have induced mills to increase their utilization of logs that otherwise would have been exported, and expanded their use of technology and labor to produce more finished products per unit of timber.

As a resource conservation initiative constricts the supply of resources for resource-degrading activities, it increases the supply of resources for activities that capitalize on the recreational and other services available from protected and restored resources. Accordingly, one should expect to see commercial interests search for ways to take advantage of the situation.

As a resource conservation initiative constricts the supply of resources for resource-degrading activities, it increases the supply of resources for activities that capitalize on the recreational and other services available from protected and restored resources. Accordingly, one should expect to see commercial interests search for ways to take advantage of the situation. An initiative that would protect open space by restricting urban development, for example, should induce developers of adjacent lands to pursue developments attractive to households, consumers, and firms that prefer to locate near open space.
THE BEHAVIOR OF CONSUMERS

When consumers’ demand for natural-resource amenities affects household-location decisions, as we described in the previous chapter, the mechanisms that translate resource conservation into changes in economic behavior are varied and complicated. The mechanisms come into play when the resource conservation initiative will affect the attractiveness of a given site (and adjacent properties), relative to the attractiveness of different sites. Generally, quantifying this impact lies beyond the reach of current analytical techniques. The changes in attractiveness in turn will affect residential location. Here, again, however, the available analytical tools generally have little grip.10

The effects on attractiveness and households are not limited to the immediate vicinity. Rural amenities can affect residential location in or near regional urban centers. The improvement (or degradation) of a natural resource amenity in the hinterland can affect the attractiveness of residential location for workers and retirees in metropolitan areas, because these households value proximity, even at some distance, to the amenity. In this way, rural resource management can affect both urban and regional development.

How big these effects are we (and others) don’t yet know. Two relevant lines of empirical economic research suggest, however, that the effects could be important. The first is reflected in the literature on amenities, wages, and housing prices, which persuasively establishes that wage and price differentials across the U.S. are generally more closely related to amenity levels than to cost-of-living differences or temporary, labor-market disequilibrium. Surveys of immigrants to Oregon, for example, indicate that consumers are willing to accept considerably lower wages to enjoy Oregon’s quality of life (Judson, 1999).

The second appears in the literature on the sacrifices households make to gain access to amenities, such as outdoor recreation opportunities, scenic beauty, clean air and water, secure neighborhoods, etc. (Bergland, 1988; Brown, 1982; Eberle, 1991; Englin, 1991; Stewart, 1994; Uysal, 1985). This literature establishes that people who live near recreational sites use them more. Thus, as the population of western states grows, the demands for natural resource amenities should grow even faster.

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10It is important, however, to remember that despite our current inability to measure these impacts accurately, the evidence clearly supports the conclusion that they can exceed zero, often by a large amount.
Restrictions on resource-degrading activities will not have a single, one-time-only impact on the economy. Instead, the economy’s response will evolve over time. Whatever the initial, negative impacts, the economy will attempt to mitigate, and whatever the initial, positive impacts, it will try to accentuate.

The evolution will occur in the four general stages shown in Figure 2-1. In Stage 1, the resource conservation initiative is adopted and, in Stage 2, this action sends economic signals to the local, statewide, regional, and national economies, indicating a change in the economic role of the affected resources. The signals have four major destinations, represented by the four types of competing demands for the resources, as indicated in Figure 1-2. Although Figure 2-1 shows Stages 1 and 2 occurring as a single, abrupt event, they generally transpire over a longer period.

Stages 3 and 4 of Figure 2-1 illustrate the dynamic character of the economy’s response to the adoption of the restrictions. In Stage 3, the economy responds with changes in prices or incomes or both. In Stage 4, prices and incomes reach their new levels, and the economy exhibits the long-run effects of the resource conservation initiative. The long-run adjustment may entail feedback loops, through which changes in prices and incomes may influence future resource-management decisions.

How long does the transition—Stages 3 and 4—take? There is no single, simple answer. There are good reasons, however, to believe that many aspects of the economy are adjusting more quickly than in the past to changes in resource-management policy. For example, by the middle of 1997, lumber prices throughout the U.S. had stabilized in response to the April 1994 adoption of drastic logging reductions. This was far quicker than many industry analysts had expected (Bernton, 1997). Labor markets also are dynamic. Power (1996) reports that, of the workers nationwide who lost their jobs because of plant closures or other mass layoffs in the 1980s, about half were unemployed 10 weeks later and the percent remaining unemployed after twelve months was roughly the same as the background rate of unemployment in the overall labor force. In the 1990s, workers apparently adjusted more quickly and, toward the end of the decade, most displaced workers found replacement jobs within a few weeks and about half of those found replacement jobs with equivalent or higher wages (Helwig, 2001; Ilg, 1996).

This is not to say that everyone adjusts this quickly, or that the costs of adjusting to resource conservation initiatives are trivial. Instead, we are only
Figure 2-1: The General Transition Process by Which a Resource Conservation Initiative Leads to Changes in the Economy

Stage 1: A community acts to adopt and implement a resource conservation initiative

Stage 2: The change in resource-management practices, and the process leading to it, sends signals to four groups:
- Those who benefit from the dominant commercial use absent the initiative
- Those associated with competing commercial uses of the resources, absent the initiative
- Those who experience a change in quality of life from initiative
- Those who experience a change in the resources' intrinsic value

Stage 3: The economy responds to the signals:
Prices change. Incomes change. Local quality of life changes. Buyers and sellers alter their consumption patterns. Firms and households alter their locational patterns.

Stage 4: The economy reaches its long-run transformation:
- Change in economic structure
- Change in total employment, income, etc.
- Change in distribution of employment, income, etc.
- Change in economic welfare
pointing out that adjusting to change is one of the widely-trumpeted virtues of market economies. To understand the economic consequences triggered by conservation initiatives, one must take this dynamism into account. Ignoring it invariably leads to exaggerated estimates of job losses and unrealistic predictions of economic catastrophe.

**RELEVANT AUTONOMOUS TRENDS**

The precise path through the transition will depend not just on the characteristics of the restrictions on logging and related activities but also on the multiple economic forces and trends that are continuously altering and shaping the economy at all levels. Three of these seem especially important:11

- Increasing importance of education;
- Increasing integration of metropolitan and nonmetropolitan economies;
- Rising demand for consumer amenities.

The three are closely related, and define fundamental changes throughout the West. In past decades, workers could increase their expected earnings by locating near an exploitable resource, such as a mineral deposit about to be mined. Mines, sawmills and other resource-exploitation industries located in rural communities, and supported high wages for unskilled workers. Such industries were deemed so crucial to the economy that people accepted the pollution and ecosystem degradation they caused.

Today, though, things are different. It is more important for a worker to have a good education than to locate near a particular industry. With the expansion of global trade, U.S. producers of commodity products often no longer command the premium prices and their workers no longer receive the premium wages they once did. Economic activity is increasingly concentrated in metropolitan areas, and improved roads and communication systems have reduced the economic isolation of smaller communities. Virtually everyone has less tolerance for the pollution, degraded streams, and unattractive landscapes associated with extractive and development activities. Moreover, communities and firms of all types are learning that they have difficulty attracting and

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11For a more detailed discussion of these trends, see ECONorthwest (1996) and Niemi, Gall and Johnston (1999).
keeping skilled workers if the environment is degraded and the quality of life is low.

If these trends hold, workers and communities seeking to prosper will increasingly have to look for opportunities other than those that entail the extraction and development of natural resources. Hence, throughout the West strong economic pressures will push once-dominant industries from the economy’s center stage to its periphery. They will continue as an important part of the economy, but will not be a major source of new jobs and higher incomes.

**FEEDBACK TO THE ECOSYSTEM**

As we argue above, a resource conservation initiative may affect the geographic distribution of the human population as well as its consumption and production behavior. These changes, in turn, will affect the ecosystem which, in turn, will have further effects on the economy, and so forth. Of particular concern is the potential for a feedback loop in which resource conservation yields enhanced consumption amenities, which induce development, which degrades the amenity, which reduces the amenities’ value.

This outcome is not that different from the one that occurs when an extractive industry operates without having to bear the full costs of its impacts on the environment. If there is no market or regulatory mechanism to rein in amenity-based development the resulting demand for the amenities will exceed the optimal level. If competitive market conditions and fully specified property rights do not exist to provide this regulation more or less automatically, through Adam Smith’s “invisible hand,” then it must come through deliberate societal management and regulation.

**REFLECTIONS**

The preceding discussion describes the myriad ways in which an economy can adjust to a resource conservation initiative. For the most part, these adjustments will take place unseen and incrementally as individuals, households, investors, landowners, business managers, and public entities react to the initiative in their own way, in pursuit of their own objectives.

One should not assume, however, that a community necessarily must sit back and let the transition occur on its own, powerless to influence its direction. To the contrary, communities throughout the West have demonstrated that they can, through concerted action, enhance their ability to capitalize on economic transitions stemming from resource conservation initiatives.

One of the most important steps communities can take to manage the transition is to ensure wide dispersal of accurate information about what the transition will, and will not, entail. Because many people will view a resource
conservation initiative through the lenses of the economic-base model, they will anticipate that it will have only adverse impacts on the economy and fail to see the positive potential. To the extent this occurs, the community will fail to look for, recognize, and seize opportunities to capitalize on the positive impacts. By making disseminating information about the full range of potential impacts, a community can help its members make better decisions about how the initiative will affect them.

Other steps that may be relevant include developing the physical and social infrastructure appropriate for new commercial activities that might be induced by the initiative. If the initiative entails plans to repair ecological damage from past activities, for example, it might be appropriate to ensure that workers have relevant training, and the entities that will oversee the restoration effort are prepared to develop efficient contractual relationships with vendors. If the initiative enhances opportunities for outdoor recreation, the community might take actions to facilitate recreational use and ensure that the local economy is prepared to sell appropriate goods and services to users. If the initiative will protect scenic vistas from development, it may be appropriate to ensure that the vistas remain visible from different neighborhoods or public facilities.

In sum, there is much that individuals, firms, and communities as a whole can do to improve the economic outcome from a resource conservation initiative. Thoughtful, deliberate action can make the negative impacts smaller and the positive impacts larger than they otherwise would be.
Chapter 3  

POTENTIAL ECONOMIC BENEFITS OF SONORAN DESERT CONSERVATION

The discussion in the preceding chapters outlines the various mechanisms by which conservation of natural resources in the West can alter the values of the goods and services derived from the resources and influence the jobs, incomes, and economic structures of local and regional economies. Here, we build on this foundation to provide an initial, preliminary description of the potential economic benefits of resource conservation in the Sonoran Desert. As in the preceding chapters, we apply a broad definition of economic benefits, embracing the range of potential, positive economic effects illustrated in Figure 3-1. Thus, we embrace outcomes where conservation would increase the value of the resources themselves, generate cost savings for local residents, generate jobs and incomes, and reinforce efforts to accomplish other goals.

We emphasize that our description is necessarily rough and incomplete. Few studies have addressed even narrow slices of the relationship between this area’s environment and its economy and, to our knowledge, nobody has previously assembled a comprehensive description of the potential economic benefits of resource conservation in the Sonoran region. Accordingly, our objectives are limited. We aim, first and foremost, to describe the set of potential economic benefits from resource conservation in the Sonoran Desert. Where there are supportive data and studies, we also discuss the possible magnitude of individual, potential benefits.

INCREASED SUPPLY OF VALUABLE NATURAL RESOURCES

The most direct economic benefits from resource conservation initiatives in the Sonoran Desert would result from an increase in the supply of the resources themselves. A successful initiative that protects, maintains, and restores the desert’s natural resources would increase the quantity of native resources and landscapes, their quality, or both. To the extent that the resources have value to residents of the desert, visitors, or others, then the increase in quantity or quality would represent real economic benefits.

These economic benefits could materialize in many different ways. Some people would place an intrinsic value on protecting, maintaining, and restoring the resources and landscapes, concluding that the conservation initiative is beneficial insofar as it increases the probability that their children, grandchildren, and others of future generations will be able to see the desert in essentially the same condition. Others will see benefits from enhancements in the recreational opportunities and aesthetic characteristics resulting from resource conservation.
Increased Supply of Valuable Natural Resources

- Conservation can protect and enhance the intrinsic values of native species and landscapes, relative to what would exist absent conservation
- Conservation of native species and landscapes can provide recreational and aesthetic benefits

Savings for Taxpayers, Utility Ratepayers, and Property Owners

- Protecting at-risk species and landscapes can be cheaper than restoring them after they’ve become degraded
- Conservation can retard urban sprawl and reduce the associated costs
- Conservation can enhance values of nearby property by protecting natural open space, reducing flood-related risks, preventing subsidence from depletion of groundwater, etc.

Stronger Local Economy: More Jobs & Higher Incomes

- High-quality natural resource amenities can lead to a more diverse economy, more jobs, and higher incomes
- Reinig in activities that are wasteful of native species and landscapes and/or impose spillover costs on other industries and households can make the economy more efficient and productive

Reinforcement of Efforts to Accomplish Other Goals

- Conservation can contribute to improvements in public health by encouraging healthier lifestyles and discouraging harmful pollution
- Conservation can reinforce efforts to promote social cohesion among different groups, neighborhoods, and communities
INTRINSIC BENEFITS OF NATIVE SPECIES
AND LANDSCAPES

One primary objective of most resource conservation initiatives is to protect and enhance the intrinsic values of native species, ecosystems, and landscapes. Considerable evidence indicates that such values can be substantial, though it is analytically difficult to quantify them.\(^{12}\)

One category of intrinsic values is associated with the spiritual and cultural roles natural resources play in the lives of the region’s Indian people. The details of these roles can vary for different natural resources and from tribe to tribe. In some instances, however, the individual resources, as well as the overall ecosystems, affected by a conservation initiative may be integral elements of a tribe’s religion and central to its cultural activities and identity. This relationship seems especially true for streams and the associated riparian areas.

We know of no estimate of the potential size of the spiritual and related values that might accrue to Indian people from conservation initiatives in the Sonoran Desert. Indeed, we do not anticipate that any such estimates will be forthcoming in the foreseeable future, as determining such benefits is a daunting challenge, conceptually and practically, for it entails answering such knotty questions as, What is the value of a culture? and What is the value of a group’s religion? To many the values are without limit and, insofar as a conservation initiative would sustain a culture and it religion, the benefits would be priceless.

Native ecosystems and landscapes of the Sonoran Desert, and the biological diversity they foster, make additional, intrinsic contributions to human well-being by providing essential habitat for sensitive plant and animal species. Many Americans consider the Sonoran Desert and its native biological diversity to be important national treasures, the loss of which would diminish their well-being. The impacts of resource conservation initiatives on the intrinsic value of the desert’s native resources are measurable in principle, but we know of no research that has applied these principles to these resources. Several related studies, however, demonstrate that the values probably are substantial.

\(^{12}\)In the past three decades or so, economists have devoted significant attention to the measurement of intrinsic values. A vast literature on the subject exists. For an introduction, see Cropper and Oates (1992), Power (1996), and Power and Barrett (2001).
Survey research in neighboring New Mexico, for example, found that the state’s households indicated they were willing, on average, to pay $30 per year for five years to protect the minimum instream flows needed to prevent extinction of a small fish in the Rio Grande. Respondents to the survey further indicated they were willing to pay $79 per year over the period to provide minimum streamflows in all the state’s major rivers (Berrens et al., 1995). Related research found that residents of New Mexico indicated a strong willingness to pay to increase the natural streamflow in the state’s rivers and streams: more than 80 percent of respondents to a survey indicated a willingness to pay about $80 to increase streamflows (Berrens et al., 1998).

Similar results have been found elsewhere, documenting the values the public places on protecting at-risk species and desert land. Ekstrand and Loomis (1998), for example, found that U.S. households responding to a survey indicated a willingness to pay $50-330 per year to protect habitat critical to the survival of at-risk fish in the Southwest, including habitat along the Gila River. Researchers in the Pacific Northwest (Hagen et al., 1992) found that the intrinsic value benefits of protecting the old-growth forests that provide critical habitat for the Northern Spotted Owl far exceeded the costs. Loomis and Ekstrand (1997) found that U.S. households were willing to pay an average of $40.49 to protect the Mexican Spotted Owl and its 4.6 million acres of critical habitat in Arizona, New Mexico, Colorado, and Utah. Richer (1995) found that California residents indicated they were willing to spend $177-448 million per year to support legislation to protect 6.9 million acres of the state’s desert lands.

We report these results not to imply that residents of Arizona and other states are willing to spend the same amounts to protect at-risk species, streamflows, and desert lands in the Sonoran Desert. Indeed, we caution readers that the results cannot be transferred from one setting to the another without further, careful research to confirm the validity of doing so. Nonetheless, the research findings from these other settings strongly indicate that Arizonans, as well as Americans in other states, place considerable economic importance on protecting the intrinsic values of at-risk species, instream flows, and desert landscapes in the Sonoran Desert.

Ecological research further supports the importance of focusing resource conservation initiatives on protecting lands and waters that have not been substantially altered by human activities. A recent study of eight native trout species in the Inland West, for example, found they currently occupy less than 5 percent of their former ranges and that the remaining strongholds are strongly concentrated on roadless areas. This conclusion is especially true for one of the species, the Gila Trout, native to Arizona: it currently occupies only
0.7 percent of its historical range and all of the remaining strongholds are on roadless areas (Kessler et al., 2001).

Conservation of natural resources in the Sonoran Desert also might maintain or restore natural hydrographs in streams. Relative to developed areas, the soils of conserved areas might retain more water when it rains, releasing the water and creating higher stream flows during dry periods. Increases in base streamflows are valuable for their sustenance of aquatic species and riparian (streamside) habitats for numerous native plants and animals. These areas are especially important ecologically. A recent summary of the relevant literature (Finch et al., 1995) reported:

- In the Southwest, the highest richness of bird species and density of individuals occurs in riparian ecosystems.

- Of 166 bird species in the region from southern Arizona to west Texas, 51 percent were completely dependent and another 20 percent were partially dependent on riparian habitat.

- Loss of riparian habitat in the Southwest could result in the regional extinction of 47 percent of the 166 bird species that breed in the region.

A study of the Hassayampa River Preserve, near Wickenburg, Arizona, shortly after it was established to protect one of Arizona’s few remaining cottonwood-willow forests and mesquite bosques, provides some evidence of the economic value of protected natural areas (Crandall et al., 1992). The researchers found that visitors associated the area’s value with the extent of its streamflows. If its perennial flows were to deteriorate and become intermittent, the diminished flows plus the resulting shift in riparian vegetation would cause the area to lose 80 percent of its economic value.

**RECREATIONAL AND AESTHETIC BENEFITS**

Increases in opportunities for recreational use constitute a considerable portion of the economic benefits that resource conservation initiatives in the Sonoran Desert would generate. Native landscapes in the desert provide uncommon opportunities for recreation, and these opportunities yield direct benefits to users, as well as commercial opportunities for outfitters and others who sell goods and services to recreationists.

Researchers from the University of Arizona recently studied the potential recreational benefits of resource conservation in Arizona, focusing on tourism related to bird-watching in Ramsey Canyon Preserve and the San Pedro National Conservation Area, near the city of Sierra Vista (Leones and Colby, 1998). They concluded that nature-based tourism, and especially visitors to Ramsey Canyon, generated $1 million in value-added activity in the Sierra Vista area. Furthermore, nature-based tourists spend about $13 per person,
per day more than visitors not oriented toward bird-watching and other nature-based interests.

Additional insight into the value of protecting open space in the Sonoran Desert can be obtained from studies elsewhere. The data in Table 1-1, for example, shows the values associated with different recreational activities on federal lands in the interior Columbia River Basin. The values per recreational user–day are not transferable to the Sonoran Desert without further research. Nonetheless, the data indicate the general magnitude of recreational benefits that can be obtained from resource conservation initiatives in the West. The research in the interior Columbia Basin has further interest because it showed that unroaded, wild areas generate additional recreational and other (including intrinsic) values that are roughly double the corresponding values of roaded areas. Also important, the research indicates that recreational values are expected to increase significantly relative to the values of extractive and development uses of federal lands (Haynes and Horne, 1997).

Other research confirms the potential benefit Americans can derive from resource conservation initiatives that sustain wilderness areas, i.e., wildlands protected from roads, extractive industry, and development. These studies have analyzed two types of benefits: the enhanced value of future recreational use of the wildlands; and the intrinsic value of ensuring that the lands would remain accessible to the public but undeveloped.

About two dozen studies have examined the recreation-related benefits of wilderness in the U.S. On average, they indicate that each visitor sees a day’s visit to a wilderness area as being worth about $40 more than it costs to travel to the area.

Two other studies estimated the combined recreational and intrinsic value benefits that would materialize from increasing the amount of wilderness in Colorado and Utah. They found that increasing the amount of wilderness in Colorado by 1.2 million acres and in Utah by 2.7 million acres initially would yield benefits worth about $1,250 and $409 per acre, respectively. With the prospect of further expansion of wilderness, the benefits per additional acre would decline, to about $220 per acre in Colorado and $120 per acre in Utah.

Loomis (2000) focuses on just the intrinsic value of wilderness lands in western states, outside Alaska. Distilling relevant studies, he estimates that these lands typically have an intrinsic value of $168 per acre.

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13Summarized in Loomis (2000).

14Walsh (1984), and Pope (1990). These and other related studies are summarized in Loomis (2000).
One should use these estimates cautiously, recognizing the inherent difficulties in applying to the Sonoran Desert values derived elsewhere. Many unknown variables might make the benefits here higher or lower than those found in other ecosystems and economies. The results from these studies do, however, demonstrate that, in general, the recreational and intrinsic values associated with leaving lands in a wilderness status can yield significant economic benefits. There is no apparent reason why this general finding would not apply to wildlands in the Sonoran Desert. The actual benefits from conservation initiatives that would leave individual acreage in a wilderness-like status could be higher or lower than those found elsewhere, but it is highly unlikely that they would be zero.

Conservation initiatives resulting in increased streamflows can yield economic benefits that are surprisingly large. Hansen and Hallam (1990), for example, compared the economic benefits of the additional opportunities for recreational fishing that would result from leaving water in a stream versus the benefits of withdrawing the water to irrigate crops. For central and southern Arizona, they found that an acre-foot of water used for irrigation had essentially a zero economic benefit, that is, the value of the crop produced by the irrigation was less than the cost of producing it. In contrast, leaving the acre-foot of water in the stream would generate 150 angler-days of recreational fishing, with an economic value of about $3,000, in today’s dollars. Increases in streamflows also generally are viewed as being more aesthetically attractive, although the attractiveness declines with extremely high flows (Brown and Daniel, 1991).

These studies demonstrate the recreational and intrinsic values associated with leaving lands in a wilderness status can yield significant economic benefits. There is no apparent reason why this general finding would not apply to wildlands in the Sonoran Desert.

The results from these studies are important not just for evaluating resource conservation initiatives that would shift water from irrigation to instream flows. They also provide insights into the potential benefits of initiatives that would increase instream flows by reducing diversions for municipal-industrial use and by preventing land-use activities that alter the natural hydrograph by accelerating runoff during wet seasons, reducing infiltration, and, hence, curtailing stream flows during dry seasons.

**SAVINGS FOR TAXPAYER, UTILITY RATEPAYERS, AND PROPERTY OWNERS**

Depending on their scope, design, and location, resource conservation initiatives in the Sonoran Desert can yield numerous savings for taxpayers, utility ratepayers, and property owners throughout the region. Three common mecha-

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15An acre-foot of water is the amount that would cover one acre of land one foot deep. It is equal to about 329,000 gallons.
nisms for producing these benefits are reduced costs for managing at-risk species and landscapes, avoiding costs associated with urban sprawl, and creating spillover increases in property values for nearby lands.

**Benefits from Protecting vs. Restoring At-Risk Species and Landscapes**

With proper planning, conservation initiatives can be the most cost-effective way for residents of the Sonoran Desert to accomplish environmental and economic goals. Examples of the opportunities are numerous. Acting early to prevent the degradation of native habitat for an at-risk species is cheaper than hesitating, allowing the habitat to be degraded, and then paying to reverse the degradation. The same is true if communities want to protect lands, such as hilltops, ridgelines, and streamside corridors, that help define the community’s aesthetic character.

Despite (or perhaps because of) the obvious nature of the savings that can be realized through anticipatory conservation initiatives, quantification of the potential savings associated with different types of initiatives is hard, even impossible to find. One illustration of the potential savings, however, comes from recent assessments of the road system in the nation’s national forests. With more than 400,000 miles of roads, the national forests now face a backlog of more than $8 billion in maintenance costs, an amount that does not include the collateral costs, such as risks to human lives and downstream flooding, that could materialize from potential road failures. Taxpayers and nearby, e.g., downstream, landowners eventually will have to shoulder these costs, unless the roads are decommissioned through an appropriately designed conservation initiative at less cost (Pacific Rivers Council, 2000).

A more local example comes from unsustainable pumping of groundwater, which can result in a lowering of the water table and land subsidence. Lowering of the water table, which has fallen more than 100 feet in some places, increases the costs of further pumping, and removes water that helps buoy the land above it. The resulting land subsidence currently occurs in more than 3,000 square miles of Arizona, including the Tucson and Phoenix areas, and, in the extreme case, has caused surface levels to subside 18 feet. Any subsidence can cause damage, especially when it occurs unevenly, scrambling the support for homes, roadways, bridges,

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16Except where otherwise indicated, the discussion in this paragraph and the next are derived from Physicians for Social Responsibility (2001).
natural-gas pipelines, and other infrastructure. Other researchers have noted that preventing land subsidence by maintaining groundwater levels in the Tucson area will yield economic benefits, but those benefits have not been quantified. As a point of comparison, cost estimates of the damage from 8 feet of land subsidence in California’s Santa Clara Valley ranged from $15 million to $131 million (Al-Sabbry et al., 2002).

A related example comes from the extension of arroyos, as inappropriate grazing and land-use patterns heighten the runoff from rainfall events and channel it into arroyos, where the higher flows accelerate erosion that deepens and widens the arroyos. The flow of mud downstream worsens flood risks, while the deepening arroyos can drain aquifers.

**Benefits from Reining In the Costs of Urban Sprawl**

Poorly designed and implemented urban development can increase the overall costs of providing public services and conducting private-sector commerce. Leapfrog development, for example, can increase the costs of tying together different neighborhoods into efficient systems for municipal water, sewage treatment, stormwater management, public parks, and the like. The net result is lower levels of service, higher taxes and utility bills, or all three.

Resource conservation initiatives may be able to help curtail these inefficiencies. Conserved native landscapes might serve double duty as parks so a community can avoid the costs of converting already developed land into parks. Or they might serve as an integral element of a region-wide effort to manage stormwater.

At a more fundamental level, conservation initiatives might help shape the pattern of development so that, over time, the overall region can realize cost savings. This outcome might materialize, for example, from an initiative to protect and enhance the native vegetation in riparian (streamside) zones. As we explain above, these areas are critically important to the desert’s ecosystems and, hence, typically rate a high priority in conservation proposals. Not incidentally, developers often like to locate housing and other developments in these areas, however, to take advantage of their natural attractiveness. It is not uncommon to see urban sprawl extend outward from urban centers along these corridors. Unfortunately, development in riparian areas not only can cause greater ecological damage it also can alter streamflows—e.g., when developers narrow the stream channel, thus causing storm runoff to move faster and at higher speeds—and result in greater risks and damage for downstream landowners and taxpayers. To the extent that a conservation initiative for protecting the native characteristics of riparian zones would prevent such developments, it also would reduce the costs of urban sprawl in these areas.
The extent of the potential benefits from such interactions between conservation initiatives and the costs of sprawl has not been quantified. Pima County, however, has recently issued a series of reports documenting some of the potential costs that taxpayers will incur if the county is not successful in arresting, or at least slowing, recent patterns of sprawl-like development in unincorporated areas. One of the reports (Distribution of Fiscal Resources) concludes, “It does Pima County no good to accommodate population in the rural and exurban areas where the lack of infrastructure keeps the tax base benefit of development very low, and the service demand that Pima County incurs costs more than the development will ever be able to return in revenue.” The potential interaction between the county’s desire to avoid further sprawl and its efforts to conserve high-priority elements of the Sonoran Desert’s ecosystems have yet to be seen. In concept, though, some elements of the conservation plan might help the county rein in the uncontrolled costs of sprawl and accomplish its fiscal objectives.

**BENEFITS FOR NEARBY PROPERTIES**

Location, location, location. This mantra of real estate valuation captures an essential fact: the value of a parcel is strongly influenced by what is around it. Many characteristics of the surrounding properties can be important and their natural character can be among the most important. The value of residential properties, for example, is higher when they look out on scenic vistas of hilltops with native vegetation than on industrial activity or on the rooftops and alleyways of subdivisions. Recent newspaper reports from throughout the West, for example, have reported concerns that industrial activity associated with oil/gas development markedly reduces property values in the area—realtors in Colorado have estimated a reduction of 60 percent, according to one account.17

The influence that natural landscapes exert on the value of nearby properties can be substantial. For example, a recent study in the Tucson area, described in the text box on the following page, found that houses within .5 miles of a desert riparian corridor sold at prices 3 to 6 percent higher than other comparable houses. One survey of the literature (Brabec, 1992) offers these additional illustrative findings:

- A study in Seattle found that houses near a bike/hiking trail sell for 6 percent more than more distant, similar houses.

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• A study in Salem, Oregon, found that urban land adjacent to a greenbelt was worth $1,200 more per acre than similar land 1,000 feet away.

• A study in Boulder, Colorado, found that house prices declined $2.20 for each foot of distance from a greenbelt. Houses adjacent to the greenbelt were valued 32 percent higher than comparable houses 3,000 feet away.

• A study in Massachusetts found that houses within 20 feet or so of a park were worth $2,675 more than similar houses 2,000 feet away. The relationship was reversed, however, if the park were heavily used and congested.

A recent study of residential property values near riparian corridors in one area of Northeast Tucson found that riparian areas provide measurable economic benefits to nearby landowners.

• Homes within 1.5 miles of a riparian corridor commanded higher sales prices than comparable homes.

• Homes within .5 miles of a riparian corridor were valued three to six percent higher than other comparable homes, accounting for the effects of lot and home size and other factors.

• For the 25,560 homes in the area studied, the property value premium attributable to the riparian corridor amounted to over $103 million.

• Vacant land near the riparian corridor was valued 10 to 27 percent higher than other vacant land.

The researchers attributed these results, in part, to landowner benefits from natural amenities associated with riparian areas. Birds, wildlife, trees, and other natural vegetation provide scenic views, open space, opportunities for wildlife viewing and a buffer from urban noise. Riparian areas also provide shade, which lowers cooling costs, and maintain the water table, which benefits existing well owners.

As we indicate elsewhere, it would be inappropriate to apply these numbers, without further corroborative research, to estimate the value of open space or other attributes in the Sonoran Desert. The numbers do, however, confirm that proximity to open space and natural lands can significantly increase the value of nearby properties, and, unless real estate markets in the Sonoran Desert operate in an unforeseen manner, a similar relationship undoubtedly applies here.

Conservation activities may also affect the values of nearby properties by reducing erosion associated with agricultural, industrial, or urban activities. No study of this relationship has been completed for the Sonoran Desert, but a national study completed more than a decade ago indicates the potential benefits of reducing erosion can be substantial.

In the study (Ribaudo, 1989) an economist with the Department of Agriculture found that, within the Mountain region that includes Arizona, each ton of sediment prevented from entering streams generated off-site, i.e., downstream, economic benefits of about $1.60 (adjusted to 2000 dollars) that would accrue to landowners and other water users. This amount repre-
sents several types of benefits, including avoided costs that resulted from reducing the amount of sediment clogging waterways and causing flood damage downstream. The estimate underrepresents the true benefits of preventing sedimentation, insofar as it does not include the on-site benefits of keeping soils in place, or the benefits associated with protecting at-risk species adversely affected by abnormally high sedimentation rates. The estimate also does not reflect increases in the value of preventing soil erosion and protecting water quality that have materialized since the study was completed. These increases would reflect, for example, subsequent increases in human populations that would be affected by reductions in sedimentation.

**STRONGER LOCAL ECONOMY: MORE JOBS & HIGHER INCOMES**

Resource conservation initiatives can generate jobs and incomes directly, through expenditures on designing and implementing resource protection and restoration activities. The extent of this impact has received little attention in the Sonoran Desert, largely because there has been so little experience with conservation initiatives in this region. Studies of restoration programs elsewhere, however, indicate that they can generate jobs for thousands of workers (Pacific Rivers Council, 1995; U.S. Environmental Protection Agency and U.S. Army Corps of Engineers, 1994).

More significant impacts on jobs, incomes, and the structure of the economy can materialize indirectly, as the conservation initiatives affect the supply of resource-related amenities, and hence, amenity-related growth, as well as the efficiency of resource uses.

**AMENITY-RELATED GROWTH**

As we explain in the previous chapters, a growing body of evidence indicates that the protection of a region’s environmental amenities can provide an important stimulus to local economic development. Opportunities for recreation in native ecosystems are particularly important. Areas that are currently protected, in national forests and national parks, meet some of this recreational demand, but as these protected areas become increasingly congested, the protection of additional public lands becomes increasingly important.

Rudzitis and others (1995) compared the rates of population growth in counties near protected areas—wilderness areas or national parks—with those of other counties in the West. They found that, during the 1980s, the populations of counties with wilderness increased nearly twice as fast as other nonmetropolitan counties in the West, and six times faster than the national average for nonmetropolitan counties. When recent in-migrants to nonmetropolitan counties with wilderness areas were asked why they moved, the answers overwhelmingly indicated the importance of protected, natural landscapes
(Rudzitis, 1999). Asked to identify one or more reasons for moving to the area, respondents identified the scenery (72 percent), environmental quality (65 percent), and opportunities for outdoor recreation (59 percent).

Similar results come from an analysis of state parks (Duffy-Deno, 1997). Looking at 250 non-metropolitan counties in the Intermountain West, the study found that, all else constant, a 10 percent higher density of state park lands was, in the long run, correlated with 1.4 and 2.3 percent higher populations and employment densities. This conclusion is reinforced by a study that surveyed senior officials of businesses that had recently been started, expanded, or relocated in Colorado (Crompton et al., 1997). The study found that quality of life, represented by recreational opportunities, parks, and open space, was among the most important determinants of business-location decisions.

One cannot say that exactly the same outcomes would arise if conservation initiatives increased the amount of wilderness area and park lands in the Sonoran Desert. It is safe to conclude, however, that judicious, well-planned protection of unroaded areas in the region probably would, over time, be associated with more robust economic growth. The same is true of initiatives to increase the number of parks. To the extent that these outcomes are considered desirable, then they should be seen as economic benefits of conservation.

**Benefits from More Efficient Use of Resources**

Resource conservation initiatives also can stimulate local economic prosperity by rationalizing the use of scarce resources. As we demonstrate in the previous chapters, mounting evidence indicates that the economic value of native western resources and landscapes is growing, absolutely and relative to traditional extractive and development uses. The rise in value occurs as consumers’ preferences for natural amenities increases and as the resources become more scarce. Growth in the value is simulated even more when the scarcity becomes extreme, as when species are threatened with extinction.

If market mechanisms were at work, these rising values would automatically but inexorably result in greater conservation of resources and landscapes. For the most part, though, market mechanisms do not function well in this arena. As a consequence, resources and landscapes tend to get stuck in sub-optimal
uses. That is, they are used for extractive industries, subjected to urban development, or simply ignored and allowed while their native characteristics are degraded and higher-value conservation uses are forgone.

Such outcomes leave an area less prosperous than it would have been with appropriately designed conservation. This adverse outcome also materializes in more practical terms. As resources and landscapes are used suboptimally, and advocates of conservation can find no effective market mechanisms to promote their interests, they look for alternatives. In most instances, they must turn to the political arena and, in so doing they distract the political system from addressing other problems. The adoption of an appropriately designed conservation initiative can bring actual land uses more in line with the optimum, lessen the pressure on the political system, and allow the system to turn its attention to other things. The net result can be a substantial improvement not just in the efficient allocation of natural resources and landscapes but also in the functioning of public agencies.

**REINFORCEMENT OF EFFORTS TO ACCOMPLISH OTHER IMPORTANT GOALS**

The preceding discussion documents many of the ways in which the natural resources of the Sonoran Desert are interconnected with the local economy. It is not surprising, then, that resource conservation initiatives would reinforce efforts to accomplish goals that, at first blush, might not seem related to conservation. We discuss two of these reinforcing interactions: improvements in public health and increases in the social cohesion of local communities.

**PUBLIC HEALTH BENEFITS**

Resource conservation initiatives can be good for your health. This conclusion is supported by several recent studies, and, though none of them focuses solely on the Sonoran Desert, it seems safe to say that appropriately designed conservation initiatives in this region could yield improvements in the health of local residents. Among the recent reports are these:

- A recent study found that living near natural habitats yields measurable mental-health benefits for children.\(^{18}\)

• Obesity has been rising rapidly in the U.S. and more than one-fifth of adult Americans are now obese (Economist, December 15, 2001, pg. 80). Walking more would help reduce obesity, but walking in conventionally designed urban areas can entail dangerous exposure to automobile traffic. Among the most dangerous areas for walkers are western communities.

• More than 50 percent of the outbreaks of waterborne diseases in the U.S. from 1948 to 1994 were preceded by extreme rainfall events. Conventional urban-development patterns can exacerbate the extreme character of rainfall, as the amount of stormwater washing off a one-acre parking lot is 16 times greater than that of a comparable-size grassy area (Jackson and Kochtitzky, 2001).

• Conventional urban-development patterns also can exacerbate the health effects of poor air quality. For example, in 1996, when Atlanta area authorities implemented traffic-reduction plans for the summer Olympics, weekday morning traffic counts decreased by 22.5 percent, and asthma emergency medical events decreased by 41.6 percent, although non-asthma medical events did not drop during the same period (Jackson and Kochtitzky, 2001).

Resource conservation initiatives cannot resolve these and other health problems, but they potentially can make a significant contribution. By protecting natural landscapes visible and/or readily accessible from urban areas, they can help residents maintain contact with natural environments that are important to mental health. By providing safe opportunities for recreational walking and hiking, they can help residents combat the cultural pressures that induce obesity and related problems. By reinforcing efforts to rein in urban sprawl, they can simultaneously help prevent automobile-based threats to air quality.

**SOCIAL-COHESION BENEFITS**

Well-planned resource conservation initiatives also can influence the degree of social cohesion among different groups within the local community. A joint effort to protect, clean up, and restore a waterway, for example, might be something that all groups within a community might support, and create a sense of shared community pride and accomplishment. Upon this foundation, the community might then be better prepared to address other challenges.

Several cities in the West, including Boise, Idaho, and San Antonio, Texas, have focused on natural resource conservation to build social cohesion, and much can be learned from their experience. Not all conservation targets are good candidates for building social cohesion, of course, for some of them are accompanied by cacophonous disharmony. The discord in some instances should not blind a community to searching for others that can bring different groups together, recognizing their shared interests as neighbors.
There can be no doubt that resource conservation initiatives in the Sonoran Desert can yield substantial, even priceless economic benefits. In this chapter we discuss the benefits that appear especially significant at this point in time. Others almost certainly will emerge in the future as more people learn more things about the desert, and the desert’s native characteristics more strongly come to represent life in southern Arizona. Even within the immediate time horizon, however, we readily acknowledge that resource conservation initiatives may yield economic benefits other than those we discuss here—contributions to ecological research and protection of cultural heritage linked to the natural landscape are but just two. Our failure to discuss these and others is not intended to diminish them, but reflects our concern about keeping the report readable for an audience with limited patience for economics.

Why discuss the potential economic benefits of conservation at all? There are two parts to the answer. The first is that many people and public officials are not familiar with the emerging relationships between natural resources and economic well-being. The lack of familiarity is enhanced further because many of the economic benefits from conservation lie outside the mechanisms and analytical frameworks of markets and dollar-denominated prices. Hence, we anticipate that describing the benefits in some detail helps make the relationships more easily understandable. In particular, we emphasize that the disconnect between conservation benefits and markets does not diminish their importance in any way and, in many respects, augments it.

The second is that the demand for conservation is rising, making it more imperative than ever before that the public and its elected officials have a good understanding of the underlying economic issues. By their nature, many of the benefits of conservation will be less visible than the costs. Besides lying outside market mechanisms, many of the benefits will not materialize immediately, but only as residents of and visitors to the desert come to appreciate more fully the interactions between the ecosystem and the economy. Moreover, most people may not be accustomed to recognizing how rapidly the benefits of conservation can rise, as growth in the human population exerts added, cumulative pressures on an often fragile ecosystem, tightening the scarcity of native species, habitats, and landscapes. Against this background, making good conservation decisions today will be even more important tomorrow.

The 2000 census found that Arizona’s population grew 40 percent during the previous decade, and similar growth is expected into the foreseeable future. Now is the time to ensure that the economic benefits of resource conservation initiatives for the Sonoran Desert receive full, unbiased consideration.
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