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Assessing Economic Tradeoffs in Forest Management

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Abstract

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Method is described for assessing the competing demands for forest resources in a forest management plan by addressing economics values, economic impacts, and perceptions of fairness around each demand. Economics trends and forces that shape the dynamic ecosystem-economy relation are developed. The method is demonstrated through an illustrative analysis of a forest-management decision in the southern Appalachian Mountains.

Keywords: Economics, timber sales, endangered species, natural amenities, recreation

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Introduction

Why Was This Report Prepared?

The objective of this report is to provide economists, as well as forest managers, resource scientists, community leaders, and members of the general public, with a technically sound, but readily understandable, method for assessing the full range of economic consequences that can accompany forest-management decisions. Toward this end, we look at the relation between a forest and the surrounding economy from two general perspectives. From the first, we provide an analytical framework for answering the question, What parts of the economy will be affected by forest-management decisions? The framework rests on the observation that there are competing demands for all forest resources, and hence, any forest-management decision will generate economic tradeoffs, with some parts of the economy benefiting from the decision and others losing from it.[1] The framework can help readers in understanding the structure of the competing demands and trace the tradeoffs among them that will accompany a particular forest-management decision.

From the second perspective, we discuss some of the factors that come into play as the economic effects of a forest-management decision evolve over time. In particular, we describe four major economic trends that are fundamentally changing the forest-economy relation throughout the United States by diminishing the economic importance of conventional activities, such as logging and mining, that convert forest resources into manufactured goods, and by increasing the importance of activities, such as the protection of undeveloped landscapes, that enhance the supply of recreational and other services. We also describe the ability of local and regional economies to adjust to any change in forest management, so that any adverse initial impacts, such as mill closures and layoffs, generally are mitigated over time and dispersed over space.

[1] Although we have couched this in terms of tradeoffs, we fully realize that under some conditions it may be possible for a forest-management decision to increase multiple outputs at once. We focus on structures involving tradeoffs, however, because it is here that it's most important to have a good understanding of the economic consequences of management alternatives.

It is important to note that this report does not answer the question, Which forest-management decision is best? Instead, it offers assistance—an analytical handbook—to those trying to answer this question in the context of a specific forest and a particular economy. Preparation of the report was prompted by our observations of many instances where decisionmaking about forest management was made more difficult because individuals, families, business owners, community leaders, and forest managers failed to see the full temporal and spatial range of the economic consequences of the alternative management decisions. We anticipate that most professional economists will find little that is new in what we say, although they may be interested in how we say it. We believe what we say is important nonetheless, because we are trying to bridge the gap between economists and noneconomists. Too often the controversy over forest management is fueled because different interested parties have distinct, limited perspectives of the economic consequences of alternative policies and are unaware of the relevant knowledge from the more technical economics literature. This report is an attempt to make the logic and analytical tools of economics more accessible to those who make forest-management decisions and to those who are affected by them.

What Does This Report Contain?

This report has three chapters. In the first, we describe the competition for scarce forest resources and discuss how to assess the tradeoffs among these demands that are likely to occur in response to specific forest-management decisions. This discussion recognizes that a large part of the competition for the resources of any forest takes place outside the marketplace and is difficult to observe or measure. We describe three types of tradeoffs of concern to the individuals and groups competing over the allocation of forest resources. One is related to the changes in the economic value of the bundle of goods and services derived from the forest, and another to the impacts on the structures of local and regional economies, including changes in the levels of jobs, incomes, and standards of living derived from the forest. The third involves perceptions of the fairness arising from the outcomes of forest-management decisions.

In the second chapter, we examine the long- and short-run dynamics of the forest-economy relation. Long-run changes in the relationship stem from powerful national and international economic forces that alter the relative strength of the different competing demands for forest resources. We highlight four long-run trends that currently are especially important: (1) the declining ability of resource-intensive industries to generate increases in jobs, incomes, and standards of living; (2) the rising importance of education and training as determinants of workers' earnings; (3) the increasing influence of quality-of-life amenities on the locational decisions of households and firms; and (4) the strengthening economic connections between metropolitan and nonmetropolitan areas. Short-run changes in the forest-economy relation reflect the ability of workers, households, business owners, and communities to mitigate the adverse effects and to capitalize on the positive opportunities generated by a change in forest management. We summarize the nature of the transition process that accompanies such a change and discuss the ability of different analytical tools to describe the process accurately.

In the third chapter, we illustrate the application of the contents of the prior two chapters. Specifically, we conduct a brief, general examination of the potential economic consequences of decisions that would allocate forest resources of the southern Appalachian highlands to industrial timber production. This chapter builds on an assessment of the forest resources of the area recently completed by multiple Federal agencies and cooperating entities. This chapter is not intended as a detailed examination of specific resource-allocation decisions but is to provide a broad demonstration of how one could approach such an exercise.

Chapter 1: The Competition for Forest Resources

Decades ago, it was not a huge error to conclude that demand for forest resources came only from the extractive consumption of forest resources and the development of forest lands. Today, however, the competition is more diverse. The conventional demands of logging, urban development, irrigation, grazing, mining, and roadbuilding have been joined by widespread demands for both goods, (for example, clean water), and services (for example, recreational opportunities). Additional demands have materialized from the concerns of scientists and the public about the environmental impacts of conventional forest practices.

In short, competing demands exist for the resources of every forest ecosystem, watershed, or other environmental unit in the United States. Any decision allocating resources to one component of the economy inevitably deprives another, so that some demands for goods or services are met while others are not, some groups experience an increase in standard of living while others experience a decrease, and some perceive that the decision is fair while others see it as unfair.

In this chapter, we present a framework for describing the competition for forest resources and identifying the winners and losers of forest-management decisions. We first outline a conceptual model of the competition and describe the various mechanisms groups use to press their respective demands. We then discuss issues associated with quantifying and mapping the geographic parameters of the winners and losers associated with different forest-management decisions.

The Northern Spotted Owl and the Economy: An Ongoing Debate

The debate over proposals to protect the northern spotted owl (*Strix occidentalis*) in the Pacific Northwest highlights the complex competition for forest resources. To many observers, the debate has a single focus: timber jobs vs. owls. According to this view, efforts to protect the owl have been extremely costly, measured in human enterprise and welfare (McKillop 1991, Paul F. Ehinger & Associates and Robert Flynn & Associates 1995, Schallau 1991). To others, however, these efforts have had a mixed, even positive, effect on enterprise and welfare in the region (Greber and Walsh 1992, Whitelaw 1992). Commercial fishermen and others showed that efforts to protect timber jobs could jeopardize jobs in other industries (Spain 1995). Economists and community leaders in the region recognized that maintaining a high level of environmental quality contributes to the development of jobs in a wide spectrum of sectors in the region (Oregon Economic Development Department 1989, Power and others 1996). The debate was broadened further as the FEMAT report showed that the environmental resources at stake included far more than just owls (Forest Ecosystem Management Assessment Team 1993) and as surveys of the general public found a widespread belief that tightening environmental regulations in this region would do more to sustain a healthy economy in the future than would relaxation of regulations to benefit industry (Oregon Business Council 1993). Concerns about the influence of timber production on forest health and flooding—not just in the spotted-owl region but throughout the Nation—continue to increase the complexity of the debate (Beschta and others 1995, Henjum and others 1994, Jones and Grant 1996).

A Model of the Competition

There are many ways to represent the competition for forest resources. Figure 1 offers a model—a conceptual framework—that has proven particularly useful, especially in settings where resource managers and the public are weighing proposals that would affect the level of logging, mining, grazing, or some other resource-intensive activity. Because this weighing process generally is broadest when applied to public land, most of our discussion occurs in this context. The fundamental principles, however, are equally germane to private lands.

Competition for Natural Resources Affected by Decoupling the Economy From Manufacturing

In his 1996 book, Power summarizes (p. 36) the changing competition for natural resources and the subsequent difficulties facing communities seeking to derive prosperity from forest resources by relying on conventional extractive industries: "Since 1969 the share of U.S. jobs and income provided by manufacturing has dropped 30 to 40 percent. ... Those communities that do rely on manufacturers have to be concerned about their long-term reliability as sources of income, given the instability associated with international competition, and the trends of manufacturers shifting locations in the pursuit of lower costs. At the very least, local economic vitality will depend on other sources of jobs and income."

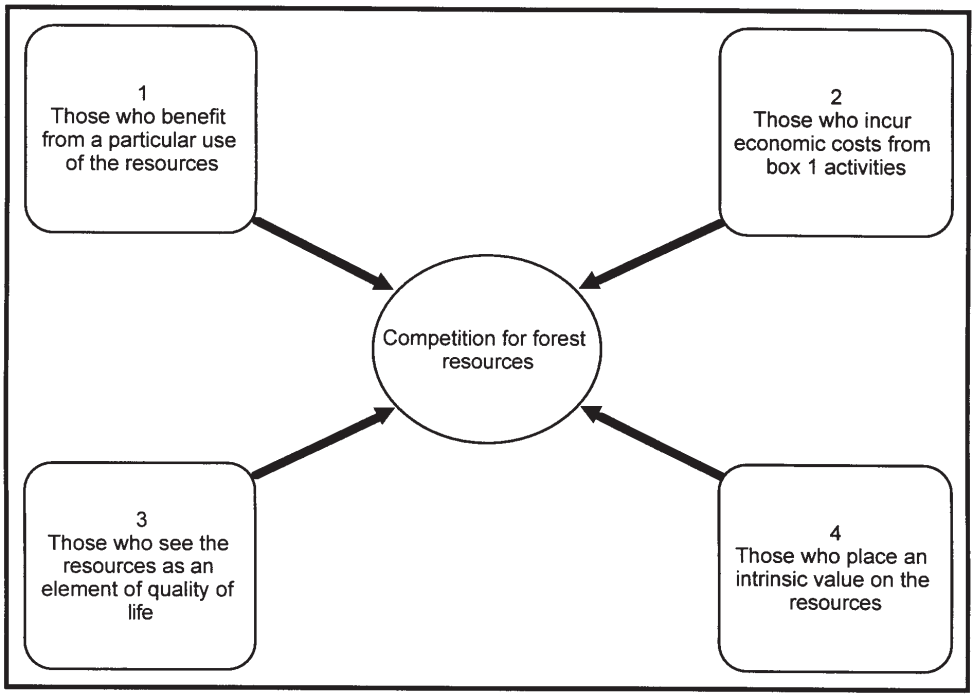

Figure 1—The competing demands for forest resources.

Box 1 in figure 1 represents those who compete for the resources because they derive economic benefits from a particular use of the resources. The most common uses in box 1 are the extractive and development industries: timber, mining, road-building, hydropower, urbanization, and grazing. In some situations, however, box 1 might include other activities, such as recreation, or fire suppression. Although such activities are not typically viewed as resource-intensive industries, they do compete for forest resources with those represented by boxes 2 to 4. Box 1 represents not only those firms and workers directly engaged in a particular intensive use but also the firms, workers, households, and communities that derive sales, profits, wages, incomes, and tax revenues from this use. Ultimately, the assignment of industries to boxes 1 and 2 depends on the types of management decisions under consideration.

Box 2 represents those who incur costs from box 1 activities. We include four categories of costs in box 2: (1) economic displacement costs; (2) opportunity costs; (3) subsidies; and (4) environmental externalities. In addition to those directly incurring a particular cost, box 2 also includes the firms, workers, households, and communities whose sales, profits, wages, incomes, and tax revenues are affected directly or indirectly. Economic displacement costs occur when the activities of those in box 1 industries reduce the net earnings of their direct market competitors; for example, when the development of one ski resort reduces sales at another resort nearby. “Opportunity costs” is the term economists use to refer to the fact that, whenever there are competing demands for a resource, devoting it to one use necessarily deprives others of the opportunity to use it. The opportunity cost of a box 1 use of a forest resource is the value of what the economy forgoes by not having the resource available for the best alternative use.

Subsidies occur whenever firms or households other than those benefiting from a box 1 activity underwrite the cost of the activity, increase the payment for products from the activity, or both. Environmental externalities are similar to subsidies, in that their existence means those engaged in a box 1 activity do not bear the full direct

cost of the activity. Environmental externalities are the costs box 1 activities impose, through their manipulation of environmental resources, on others who are uninvolved in the activities and have no direct market links with those in box 1. Sometimes the external costs affect industries, as when the runoff from mining on a forested mountainside carries toxic materials into a stream and causes a downstream food processor to incur additional costs to make the streamwater usable. External costs may be borne directly by households and communities, as when debris torrents stemming from the failure of forest roads during a storm damage homes, municipal water systems, and roads. Society as a whole also can incur external costs when, for example, taxpayers, firms, and households incur the costs of coping with the endangerment of forest-dependent species brought on by the destruction of habitat by resource-intensive activities.

Box 3 represents those who compete for the forest resources affected by the activities in box 1, because they see these resources as an element of the region's quality of life. Quality of life generally refers to the benefits one derives from being proximate to the natural-resource, social, and cultural amenities of a region.[1] By living in a region, residents have access to its set of amenities and can take advantage of them more frequently and at less cost than if they lived elsewhere. The benefits they realize from these amenities, minus the cost (if any) of accessing them, produce a net increase in the standard of living for local residents. Economists call this increase consumer surplus. In effect, this consumer surplus represents a "second paycheck" that local residents receive from living in this place, so that the total welfare of local residents is the sum of this "second paycheck" plus whatever they can earn through a "first paycheck" of wages, deferred earnings received from a pension, or transfer payments.

Box 4 represents those who compete for the forest resources affected by box 1 activities because they place an intrinsic value on these resources. Intrinsic values do not entail an explicit use of the resource. They arise whenever individuals place a value on the sheer existence of a species, scenic waterfall, or other resource, or the prospect that the resource will be useful, for example, to future generations.[2] In effect, individuals view these resources as wealth, similar to jewels in a bank vault. Actions

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[1] Quality of life also incorporates the costs (negative benefits) one incurs from the disamenities of a place. To facilitate the discussion, though, we focus on the positive benefits of amenities.

[2] We use the term "intrinsic value" because it is more accessible to a layperson than equivalent terms, such as "passive nonuse value," that economists commonly employ. It refers to value separate from the current or expected use of a resource, including both consumptive and nonconsumptive use. Economists have devised several approaches for separating the intrinsic value of a resource into component parts. A common approach is to distinguish between option value and existence value (Cicchetti and Wilde 1992). Option value is the value one derives from knowing that the resource will be available for one's use in the future. Existence value can be either the inherent value one places on the existence of the resource, itself, or the vicarious value of knowing that the resource is or will be available for others to use. The vicarious value of knowing that the resource will be available for future generations is commonly called bequest value. For the purposes of this discussion it is not necessary to examine these components separately.

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 value of this wealth; conversely, actions that degrade the resources decrease the value (Cooper 1994, Roback 1988, von Reichert 1992).

The Mechanisms of the Competition

Some of the competition represented by figure 1 manifests itself through market mechanisms, but much—perhaps most—does not. Market mechanisms are most common where resources are privately owned or where prices can readily be used to govern transactions involving the goods or services derived from the resources. Markets shape, for example, the competition for lumber and wood products, and for the sawtimber and timberlands that constitute the raw-material foundation for these products. Market mechanisms are absent, however, where the forest-related goods or services, such as scenic vistas of forested mountains visible from far afield, lack characteristics that lend themselves to transactions and prices. Between these two extremes, markets regulate some, but not all, of the links that connect forest resources to consumers' consumption of forest-related goods or services. Markets generally apply, for example, to the equipment, food, and travel associated with a recreationist's trip to go camping and fishing in a National Forest but not to the camping and fishing sites, themselves.

The absence of comprehensive market mechanisms means that groups competing for forest resources must employ both market and nonmarket currencies to express their demands.

The absence of comprehensive market mechanisms means that groups competing for forest resources must employ both market and nonmarket currencies to express their demands. Market currencies are employed when they participate in the direct buying and selling of timber, mineral rights, water rights, riverfront property, conservancy areas, and grazing permits. Persons and groups also may attempt to influence the allocation of forest resources to their benefit by exerting pressure on the political processes and administrative proceedings governing forest management. Those who believe they have been injured by the allocation of resources to others, or by the actions of those who have been allocated the resources, sometimes seek redress through the courts.

Many groups seek to increase their share of resources through marketing campaigns aimed at swaying public opinion, and some invest in scientific research, believing that the results will buttress their demands.

There is no single clearinghouse for expressing and responding to all the competing demands for forest resources, and hence, there is no single method for measuring the absolute and relative strength of the demands. Depending on their purpose, some groups emphasize both the economic values of allocating resources to a particular use and the impacts on jobs, incomes, and communities. Most express the opinion that allocating resources to what they care about most is the right thing to do.

Measuring the Competition

In such a setting, employing any single method to describe the competition necessarily will favor some groups over others and, if actually used to allocate resources, elicit outrage from those who are disadvantaged. Using prices and incomes generated in the market sector of the economy generally will favor the demands of resource extraction and resource development industries over those of conservationists. Using the results of studies of recreationists' behavior, such as their expenditures on trips to visit developed-recreation sites, might yield insights into some of the consumptive demands for forest amenities, such as camping facilities, but not the nonconsumptive demands, such as the demand for clean air. Using the results from other research methods, such as surveys designed to elicit a respondent's willingness to pay for or willingness to accept changes in the forest environment, can highlight demands related to the intrinsic value of forest resources.[3] Much remains to be done, however, before the results from survey studies can reliably be reconciled with the results from studies of market prices and consumers' behavior.

Employing any single method to describe the competition will necessarily favor some groups over others.

Given the diverse mechanisms groups use to compete for forest resources, and the absence of a comprehensive method for measuring competition, one has no choice when describing the competition but to take an eclectic approach, use whatever information is relevant for describing the specific demands represented by each of the four boxes in figure 1, and try to reconcile the findings. Based on our observations of the competition for forest resources, we recommend that the description focus on three general aspects of this competition: (1) economic value, (2) economic impacts, and (3) fairness. We also recommend that a with-without perspective be adopted to examine the competition for forest resources.

Adopt a With-Without Perspective

Assessing the full set of economic consequences stemming from a particular forest-management decision is not easy. The relations between the forest environment and the economy are many and complex. To determine the economic effects of a forest-management decision, we must isolate its effects from those of all other factors. To do this, one must compare and contrast two scenarios, one with the decision and one without it, so that the difference between the two represents the decision's incremental economic effect. Then, focusing on this difference, one can access changes in economic value, economic impacts, and fairness.

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[3] The value of a change in an environmental good or service stems from what society would be willing to exchange for it. One can approach this exchange from the perspectives of a buyer or a seller. From the buyer's perspective, the value of a good or service is the amount the buyer is willing to pay (WTP) to acquire ownership. From the seller's perspective, the value of a good or service is the amount the seller is willing to accept (WTA) as compensation in return for relinquishing ownership. When market conditions prevail, the WTP for a good or service equals the WTA, and both equal the market-clearing price. While the equality of WTP and WTA is a cornerstone of economic theory for market-based goods and services, empirical studies consistently find that WTA frequently is 2 to 10 times larger than WTP, even for goods commonly traded in markets. Therefore, whenever there is a discrepancy between WTP and WTA, adoption of one or the other as the value of the environmental externality will embody a statement about who owns the affected environmental goods or service. For a discussion of when to choose one perspective over the other, see Shogren and others (1994).

This perspective differs from the before-versus-after comparisons that frequently are conducted to evaluate resource-management decisions. Such comparisons take the economy prior to the decision, compare it with the economy afterwards, and attribute the entire difference to the decision. For example, critics of actions that have been taken to protect endangered species routinely have compared the levels of timber-industry employment following these actions with the higher levels of the past and blamed the endangered species restrictions for the entire reduction. These comparisons overlook the long record of studies concluding that the past rate of logging could not be sustained, regardless of issues related to environmental protection (Sessions and others 1990).

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Adopting a with-without perspective is especially important whenever a resource-management decision is adopted at a time of fundamental restructuring between the forest and each set of factors in boxes 1 through 4 of figure 1. One such change influencing virtually all firms in boxes 1 and 2 is the restructuring of wages and earnings evidenced over the past 15 years, with earnings of workers with manual skills, especially young workers, falling relative to the earnings of workers with greater levels of education and older workers. As a result, resource-based economic-development strategies, such as increasing the timber harvest, will be far less effective in the future than they were in the past in providing jobs and incomes for young workers and workers with lower levels of education (Bound and Johnson 1995, Burtless 1995).

Economic Value

One way to measure the relative strengths of the competing demands for forest resources is to compare the values society ascribes to the different bundles of goods and services derived from the forest under alternative forest-management decisions.[4] This comparison can help members of the public and those who allocate forest resources assess the extent to which the alternatives are economically efficient and have the potential to increase the economic well-being of society as a whole. In general, the value an individual places on a specific use is the amount the person is willing to pay for it if the person does not already possess the right to use the resource in this manner, or if the right is possessed, the amount the person is willing to accept to relinquish the right and forgo this use. For a more detailed discussion of the issues and analytical methods related to estimating the value society ascribes to different uses of forest resources, we refer the reader to standard texts on natural-resource economics such as Freeman (1993), Goodstein (1995), and Tietenberg (1992).

Figure 1 can help organize the valuation of the bundles of goods and services derived from the forest under alternative management decisions. In the following discussion, we examine the economic values associated with boxes 1 through 4. Although there are many industries that we could have focused on as our box 1 industry, such as urban development or agriculture, we chose to focus our discussion on the timber industry. To illustrate, we drew on examples from the Pacific Northwest and the southern Appalachian Mountains.

[4] Economists tend to identify the relevant bundle of goods and services by looking through the eyes of consumers rather than those of producers.

Box 1 values—For any proposed forest-management decision, box 1 represents those who benefit from timber production. Economists typically would define these benefits by looking at the net economic value of the final products derived from timber production. To illustrate this definition, consider a logging operation that leads to the production of raw materials (logs) and finished products (lumber and wood products). The economic benefit to society from this production process is not the total, gross value of the logging, the timber, or the lumber and wood products, per se. Instead, it is the difference between the market value of the final products—lumber and wood products—and the cost of producing these final products. If the value of the final products is greater than the cost of producing them, then the production process generates an increase in the total value of goods and services available to consumers. This increase is the economic benefit derived from the logging activities.

There is no guarantee that the logging activities (or any box 1 activity) will yield an increase in the total value of goods and services available to consumers. If the value of the final products equals the cost of producing them, the economic benefit from the activities will be zero. If the production cost exceeds the value of the final products, the activities will reduce the total value of goods and services available to consumers.

When the difference between the value of a product and the cost of producing it is positive, economists call the difference, economic surplus. Under conditions normally associated with competitive markets, even though some consumers are willing to pay more than others for a product, all consumers pay the same price. Also, even though some producers have lower production costs than others, they all sell their products at the same price. As a consequence, most of the transactions taking place in the market yield an economic surplus for the consumer, producer, or both. This economic surplus is often called profit when it accrues to the producer. When it accrues to the consumer, it represents an increase in the standard of living, termed “consumer surplus.” At what economists call the margin of the market, however, are consumers whose willingness to pay for the product and producers whose willingness to sell the product just equal the price. For the marginal transactions there is little, if any, economic surplus.[5]

[5] Timber production and other box 1 activities often occur under conditions different from those of a competitive market so that the buyer or the seller in a transaction at the margin might realize a surplus. Given the overall competitiveness of the markets for products derived from timber, however, the general conclusion that there is little, if any, net surplus for timber-sale transactions at the margin still holds, because the surplus is offset by a cost materializing elsewhere. The noncompetitive conditions result only in a transfer of economic resources from one party to another. A mill might experience a profit when public subsidies and timber-sale policies allow it to purchase timber from public lands at a price below what would be obtained under competitive market conditions, but the profit is offset by costs borne by taxpayers. Similarly, offsetting surpluses and costs can occur when either the seller or the buyer of timber has sufficient market power to control the price.

The absence of a significant surplus at the margin has important implications for assessing the box 1 value of a change in forest management. If the change will result in only a small increase or decrease in the amount of lumber and wood products sold in the market, then it will affect only a small number of transactions at the margin of the market, where neither the consumer nor the producer captures any appreciable surplus. Hence, in a competitive market, a forest-management decision yielding a small increase in the supply of timber will generate essentially no positive net economic benefit for society, because the cost of producing the finished products from the timber will be almost equal to the value of the product. Conversely, a decision causing a small decrease in the supply of timber will generate essentially no net economic loss to society because, although society will forgo the finished products, it will not have to incur the costs of producing them.

These conclusions about the box 1 values of small changes in timber production must be tempered in the short run, however, insofar as producers in the timber industry have fixed costs. A producer with fixed costs cannot avoid these costs in the short run if a forest-management decision leads to a reduction in the supply of logs. Hence, in the short run an overall reduction will occur in the box 1 benefit, or economic surplus, that the economy derives from the producer and from the forest. To the extent that there is any net reduction in surplus, it probably will accrue primarily to the landowner (Gorte 1995).

One estimate of the value of forgone timber is the total, gross value the landowner would receive for it. The total, gross value, however, overstates the net economic cost, or lost surplus, associated with the forgone timber production because it fails to recognize that the landowner will be able to avoid some timber-production costs. The highly competitive character of the timber industry indicates that the landowner's long-run cost of producing timber on the margin must be close to the price received for the efforts. In the short run, however, a landowner who finds that the timber cannot be sold as planned will not avoid certain costs, such as the cost of planting the trees, and hence, will incur a net loss greater than zero but less than the forgone gross timber revenue. It is difficult to develop a reliable estimate of the actual net loss because private landowners generally do not reveal details of their operations. In addition, no currently available accounting formula provides the full picture regarding the net economic benefits of industrial timber-management programs (Gorte 1994). Whatever the short-run loss, it should attenuate in the long run, as landowners act to avoid costs that are fixed in the short run.

Another potentially valuable component of the bundle of goods and services associated with box 1 comes from the changes in economic value produced by workers, firms, and communities that might arise from the forest-management decision. To the extent that the decision would curtail the removal of timber from affected lands, it also would displace the use of labor, capital, and other factors of production in the extractive process. These displaced factors generally will find some alternative use, but in the short term, a reduction probably will occur in their contribution to the national economy. This reduction in economic value is a cost to the worker or the owner of the factor, as well as to society. A reduction in economic value is not necessarily inevitable, especially in the long run. A reduction is more likely, however, when the displacement involves older workers with long job tenure in a regional economy not currently experiencing robust job growth (Jacobson and others 1993).

The foregoing discussion of the box 1 economic surplus associated with changes in forest management has presumed the existence of competitive market conditions. Under these conditions, no landowner would convert a forest to timber unless the returns from doing so exceeded the landowner's costs. Public-sector landowners, however, sometimes sell timber for a price below the cost of producing it for reasons associated with political pressure and concerns over community stability (Alkire 1994). In these cases, a forest-management decision that increases the supply of timber results in a net reduction in economic surplus for society as a whole (although some local millowners, workers, and communities may enjoy positive economic impacts). A decision that restricts below-cost timber harvests can lead to an increase in the overall, societal economic surplus.

Box 2 values—As we described earlier, four categories of indirect costs can be incurred by firms outside box 1 because of the timber-production (or any other) activities of a firm in box 1. These are (1) **economic displacement costs** occurring within the box 1 industry; (2) **opportunity costs** associated with forgone alternative uses of the resources allocated to box 1; (3) **subsidies** to the box 1 industry; and (4) **environmental externalities** produced by box 1 activities. These costs are distinct from and in addition to the production costs the box 1 firm incurs. One must account for all four types of costs to ascertain the net effect of a forest-management decision on the value of the bundle of goods and services derived from the Nation's forests. The lines separating these categories are not always clear, though, and the focus often must be less on estimating each type of cost separately and more on estimating their aggregate value.

Economic-displacement costs arise when a forest-management decision increasing the amount of resources going to a box 1 firm causes the firm to take market share from a competing firm in the same industry. Careful accounting of economic-displacement costs is necessary to distinguish between the gross value and net value of the bundle of goods and services society derives from the decision. When competition is intense, as is the case for most commodities in the timber industry, increasing the amount of timber harvested by one landowner is likely to induce other owners of timber to reduce their harvest by a roughly equal amount.[6] The extent of the economic-displacement costs will vary, depending on many factors, such as the size of the box 1 increase in timber harvest and the overall competitiveness of the box 1 mill(s) relative to competitors.

Another indirect cost of timber production (or other box 1 activity) occurs when allocation of a forest resource to a particular box 1 industry deprives another industry of the resource, and hence, the economy forgoes the economic surplus associated with the excluded resource use. This forgone economic surplus is called the opportunity cost of the allocation decision. Opportunity costs are most easily seen when the allocation of resources to timber production and to a particular firm in the timber industry closes the door on another firm in another industry that otherwise would use the resources. For example, when a National Forest sells timber to a mill rather than leasing land to a ski resort, the total cost to society of this decision includes not just the direct costs that the Forest Service and the mill incur for logging, transportation, and reforestation

[6] These offsets operate through price signals, as when a decrease in timber production by one landowner causes an adjacent landowner's timber prices to rise. The offsets can occur at the local, regional, national, or international level (Haynes and others 1995).

but also the forgone economic surplus from the ski resort. Opportunity costs also occur when the firms are in the same industry or the resources are privately owned, or both. For example, when a private firm sends timber from its lands to its own antiquated and distant mill rather than to a competitor's more efficient mill nearby, the economy as a whole incurs opportunity costs that exceed the first firm's profits.

Opportunity costs also arise when resource-allocation decisions have adverse impacts on recreation, such as hiking and sightseeing. Economists consider recreation a special type of industry where the consumer, the recreationist, also plays a part in the production of the product. Resource-allocation decisions that reduce the quantity or quality of recreational opportunities create opportunity costs by causing recreationists to forgo economic surplus. Clearcutting an area, for example, can reduce its scenic attractiveness and make it less desirable for recreational activities, such as hiking, camping, and fishing (FEMAT 1993, Palmer and Sena 1992, Palmer and others 1993, Pings and Hollenhorst 1993). As a result, recreationists experience a reduction in the economic surplus they derive from the area, insofar as they will continue to visit the area and experience a reduction in the quality of its recreational attributes, or incur costs to go elsewhere to sites that otherwise would be less desirable.

Subsidies to a box 1 firm arise whenever others underwrite some of the costs of the firm's activities. Subsidies may occur in three forms. The most direct subsidies are tied to the natural resources, themselves, and allow the firm to consume the resources at prices below their full market value. This type of subsidy arises, for example, when under the Mining Law of 1872 mining companies obtain rights to ore on public lands for a small fraction of the value of the ore; when mills purchase "below-cost" timber from public agencies; and when the managers of mills owned by vertically integrated corporations do not recognize the full costs of logs obtained from its lands. Another form of subsidy underwrites the costs of the inputs, other than the forest resources, by a firm. Common examples include the inducements and concessions given by states and communities to corporations for capital investments in mills and other facilities. The third form of subsidy is linked not to the firm's inputs but its outputs. Examples include price-support payments for farm products produced with irrigation water diverted from forest streams and incentives firms receive for exporting forest-related products.

On the surface, subsidies are inherently neither good nor bad, insofar as they reflect decisions by legislatures to employ this public-policy mechanism to promote the accomplishment of particular objectives. From this perspective, subsidies are nothing more than the costs society incurs to obtain the target benefits. It is not uncommon to see the link between subsidies and these benefits erode, however, as the social and economic conditions that prompted the subsidy change over time. Even when the link is tight, subsidies distort the use of forest resources by giving box 1 firms an additional incentive to use the resources and imposing costs on those who provide subsidies. These costs must be accounted for if one is to see the full economic value of forest-management decisions.

Unemployment Insurance: A Subsidy for the Timber Industry

A common subsidy of Pacific Northwest timber production during the past decade occurred when firms failed to pay the full costs of labor practices that yielded high unemployment. Virtually all employers must pay an annual premium to provide unemployment insurance for their employees. The unemployment-insurance program, in concept, is designed so that, over time, the premiums each firm pays should balance the amount of unemployment-insurance benefits paid to its laid-off workers. The amount of benefits paid to workers in the lumber and wood products industry often has exceeded the industry's premiums. Between 1980 and 1991, for example, the unemployment-insurance benefits paid to workers laid off from Oregon's lumber and wood products industry exceeded the total premiums paid by more than $221 million (1992 dollars).[7] Business owners in other industries, and their workers, bore the burden of making up this difference.

Environmental externalities occur when industrial timber-production activities (or other box 1 activities) alter a forest resource and inadvertently impose increases in costs on firms in other industries.[8] Clearcutting a hillside or building roads to reach a logging site, for example, can result in increased turbidity and temperatures for adjacent streams, impacts that can increase the costs of downstream fisheries and municipal water systems.

Environmental externalities are not changes in the environment, per se, but the costs associated with these changes. They lower the economic surplus of those who bear them, and hence, the distinction between the opportunity costs and externalities of a box 1 activity often is murky. The concept of externalities is a useful one, however, as it focuses attention on the total costs associated with different resource uses. The overall economic welfare of society is diminished whenever the price of a good or service does not reflect the full cost of producing it. Environmental externalities represent real costs to society not reflected in the price of the good or service generating them. One must be careful, however, to avoid double counting when examining both opportunity costs and externalities.

Figure 2 identifies seven categories of environmental externalities that might be associated with industrial timber production. Most of these environmental externalities stem from alterations in streams that occur when logging and related activities increase the level of sediment, raise the water temperature, increase streamflows during some periods, and alter riparian vegetation and the hydrologic structure of stream channels (Brown and Binkley 1994, Jones and Grant 1996, Meehan 1991, Reid 1993). These alterations, in turn, can degrade the productivity of fish habitat and can have an adverse impact on recreational and commercial fishing industries. Sediment in streams fills stream channels and increases costs to taxpayers, landowners, and water consumers who must pay to remove it. Industries that use sediment-laden water in their industrial processes often incur additional costs to maintain their machinery, remove the sediment, or both. As sediment clogs stream

[7] ECONorthwest with data provided by the Oregon Employment Division. Data on file with: ECONorthwest, 99 W. Tenth, Suite 400, Eugene, OR 97401.

[8] Although changes in the environment can create benefits for other industries, we focus on the more common types of external costs.

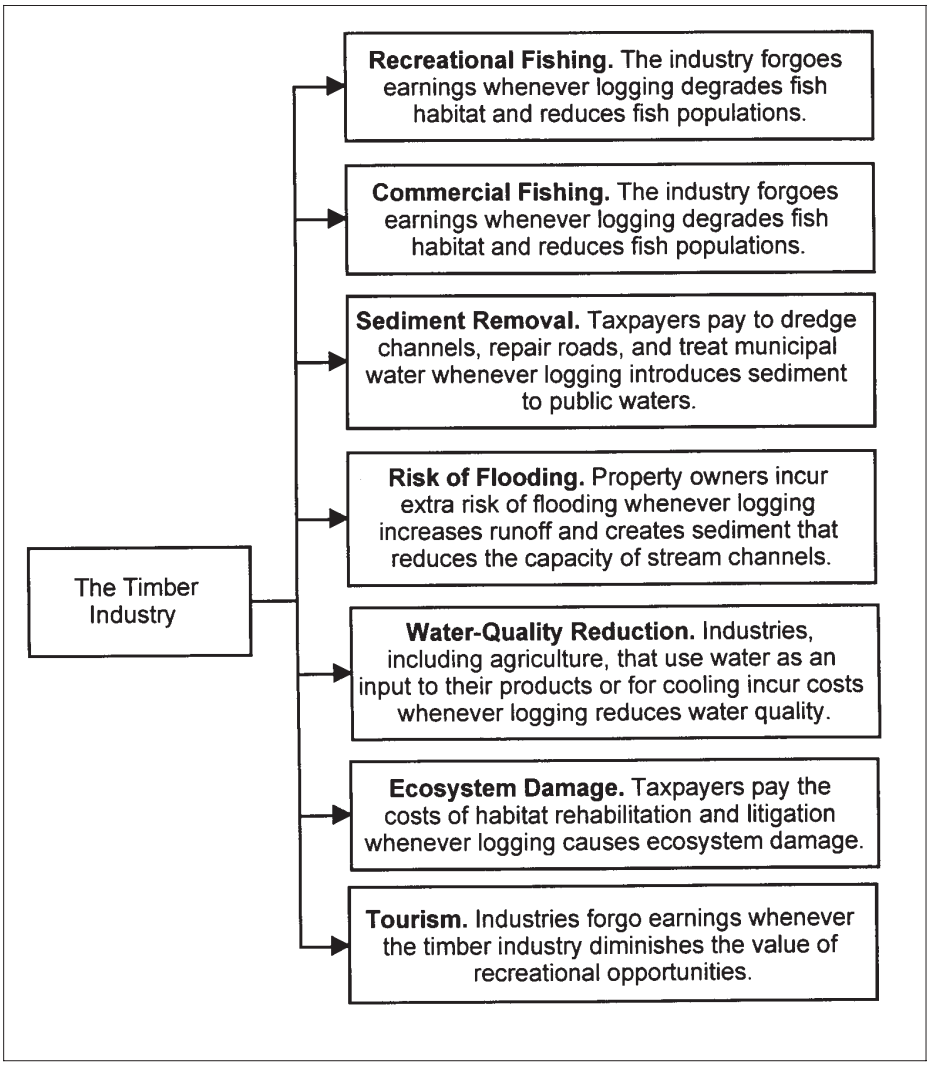

Figure 2—Potential environmental externalities from industrial timber production.

channels, the risk of flooding increases for owners of adjacent land, and this risk is increased further whenever logging leads to increases in runoff. Logging also can directly destroy or degrade archaeological and other cultural resources.

The environmental externalities associated with any specific allocation of forest resources to timber production is difficult to estimate, although some evidence is available that can be used to estimate the general magnitude of some of the costs. Of particular interest are the sediment-related costs estimated for agricultural operations on a per-ton basis for different regions of the country (Ribaudo 1989). Other studies, such as Grant and Wolff (1991) and Weaver and Hagans (1994) have estimated the impacts of logging and related activities on the amount of sediment in streams, and found that the impact differs from place to place and according to the logging techniques employed. Based on 30 years of data from a research forest, Grant and Wolff (1991) determined that clearcutting in the Pacific Northwest can generate an additional 1 ton of sediment per acre per year, and clearcutting plus road building can

generate 3.5 tons of sediment per acre per year for about 25 years. These numbers indicate that the offsite environmental externalities that logging imposes on others because of sediment-related damage, alone, can be more than $250 per acre.[9]

The sediment-related costs would be magnified by costs that arise because conventional logging and related practices increase the flow of flood water from forest lands with harmful onsite effects. A recent report based on 34 years of data from a research forest in the Oregon Cascade Range (Jones and Grant 1996) found that clearcut areas have higher peak discharges and greater volumes of storm-water runoff than forested areas, and that roads exacerbate these effects. The authors conclude that "Forest harvesting has increased peak discharges [of runoff water] by as much as 50% in [small] basins and 100% in large basins over the past 50 years" (1996: 959). These effects persisted for 25 years in small basins after an area was logged or roaded. Research to estimate the economic damages associated with such increases in runoff has not yet been completed. Research on the impacts of sedimentation in the southern Appalachian Mountains is discussed in chapter 3.

Conventional timber practices impose a number of other offsite effects, for which it is even more difficult to assign economic values. Forest fragmentation caused by clearcutting and road building can disrupt ecological systems and create abrupt edges between forested and clearcut areas. These "edge effects" affect the distribution and the composition of plant and animal species in surviving forest fragments (Chen and others 1992, Jennersten 1988, Mills 1995, Murcia 1995). Additionally, water quality is degraded by the application of fertilizers, pesticides, and herbicides, as part of industrial timber production (Edwards and others 1991).

To this point, we have addressed only off site damages. Additional box 2 costs can occur when the timber-production activities impact the future productivity of a site and the consequences of this are not borne by the timber producer. Reductions in productivity can occur through soil compaction or the loss of topsoil, both of which depress the production of forage, timber, fish, and other flora and fauna (Hornbeck and Swank 1992). Intensive site preparation can reduce productivity by increasing erosion and removing a significant amount of nutrients from the soil (Pye and Vitousek 1985). Similar reductions in productivity occur when entire riparian habitats and other aspects of the forest ecosystem are destroyed.

Box 3 values—In many regions of the United States, an important element of quality of life is access to the natural-resource amenities in the area. To the extent that a forest-management decision reassures current and prospective residents of the region that they will have additional access to these amenities, it increases economic welfare by raising the expected future value of the benefits that residents will derive from the amenities. Amenities that can be affected by industrial timber production include:

- The visual aesthetics of riparian areas. In general, the more natural the appearance of these areas, the greater their aesthetic value. Insofar as the decision will maintain the natural appearance, it will maintain the amenity value.
- The visual aesthetics of some upland areas that otherwise would experience timber harvests. Timber production can reduce the amenity values of these areas by altering their natural appearance. In some cases, the impact may be minor, but in others it can be significantly disturbing to viewers.

[9] The actual present value of sediment-related damages depends on the timing of the storms and other events that trigger the movement of soils into stream channels.

- The aesthetics and water-related recreational opportunities associated with streams where water quality is affected by timber-production activities, especially those activities that introduce stream sediment.
- The aesthetics and recreational opportunities associated with the quantity and timing of water runoff. Timber production can alter seasonal streamflow patterns, with more runoff as peak flow in the spring, when recreational demand typically is lower, and less as base flow during the summer, when demand typically is higher.
- The visual aesthetics and recreational opportunities associated with populations of wildlife related to riparian areas.
- The visual aesthetics and viewing opportunities associated with plant and wildlife populations unique to ancient forests.

Rarely is enough information available within the scope of existing analyses to quantify the impact of specific timber-production activities on specific amenities.[10] Indeed, quantifying quality-of-life values derived from forest resources is a difficult task. These values supplement the benefits residents and others derive from the actual recreational use of these amenities as conventionally measured. Economic convention ascribes the term "recreational use" to specific trips made to use specific recreational resources. Using "travel-cost" methods, economists measure the economic value of such trips by looking at a consumer's willingness to incur costs to travel from home to a recreational site; for example, the fishing hole. These techniques overlook the impact of amenities on the residential-location decisions of households and ignore the value people derive from the amenity when they are not using the amenity recreationally. In doing so, they tend to underestimate the actual amenity-related economic value of a resource.[11]

Travel-cost models implicitly assume that people decide where to live and work independent of the recreational resource. If one angler travels from home in Miami to fish for trout on a river in western North Carolina, these techniques would conclude that a greater value is placed on the trout by this angler than it is by another angler who travels from Knoxville, because the former incurs greater travel costs. Furthermore, they would conclude that a third angler, who has purchased a house on the river and fishes off the back porch, places very little value on the trout because this angler incurs essentially no travel costs to go fishing.

This reasoning overlooks the possibility that the third angler places the greatest value on trout and has based his residential-location decision on a desire to live next to the river. It also overlooks the possibility that the second angler based the residential-location decision on a desire to live near the trout and other considerations and, on balance chose to live in Knoxville rather than on the river, in Miami, or anyplace else.

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[10] Several researchers have estimated viewer preferences and scenic values for different forest management regimes: Palmer and Sena (1992), Palmer and others (1993), and Pings and Hollenhorst (1993).

[11] Some analytical techniques, such as hedonic modeling, have the ability, at least in concept, to measure the value society places on individual amenities. In practice, these techniques are limited by the current lack of suitable data. See, for example, Cushing (1987).

"Recreation-value" studies can have similar flaws. These studies often overlook the economic value people place on forest amenities in contexts other than recreational trips. One may be just as willing to pay to see clean, bubbling streams rather than desiccated, dirty ones, or forested vistas rather that clearcuts, while on a business or shopping trip or sitting in the backyard.

Quality-of-life values generally are measured indirectly, based on the theoretical expectation that persons who place a high value on living close to particular amenities may accept a reduction in incomes or an increase in housing costs, or both, to do so. Numerous studies have confirmed the theory by measuring the effects of amenities, such as average winter and summer temperatures, on incomes and housing (Blomquist and others 1988, Knapp and Graves 1989, Roback 1982). Research on the value of specific forest amenities, however, is scarce (Cushing 1987), although recent efforts have examined the value of proximity to some general amenities, such as Federal land (Gabriel and others 1996) and wilderness (Rudzitis and Johansen 1991). Thus, one is left with a strong theoretical foundation for expecting that society expresses this aspect of the competition for forest amenities through labor and land markets, but the empirical record for quantifying this demand, especially for specific forest-amenity resources is seriously incomplete. The problem is made especially difficult because some effects occur in metropolitan areas some distance from the amenity itself. In the next chapter, we discuss the relevant literature demonstrating that people do move for reasons related to quality-of-life.

As people place an increasing value on the "second paycheck" associated with quality of life, their consumption patterns change. People may purchase more recreational equipment. If they find an area they particularly like, they may decide to build a seasonal home, or even retire there. Box 3 reflects this change in consumer preference in the competition for forested resources. It is important, however, to envision the feedback loop that exists between boxes 3 and 1. An increase in the demand for seasonal homes, for example, will increase the demand for timber. As people desire to build homes with forested views, the pressure to cut down the forests in their view increases. In extreme cases, recreational development can be considered a box 1 industry.

Box 4 values—Many members of society may ascribe an intrinsic value to multiple aspects of a forest ecosystem, including individual species, the mix of species, individual physical features, such as waterfalls, and the mix of features and species that constitute broad landscapes. Estimating intrinsic values presents a difficult challenge because they are not reflected in observable behavior. In trying to measure these values indirectly, economists often use what they call the contingent-valuation method. This method uses a survey of individuals to reveal how they would behave if forced to choose between more or less of a particular forest resource. In general, survey respondents are asked to reveal how much they would be willing to pay to have more of a resource, or, alternatively, how much compensation they would require before they willingly would accept less.

There is considerable controversy among economists regarding the accuracy and efficacy of contingent-valuation studies. Skeptics of the method question the extent to which respondents' hypothetical expressions of the amount of money they would be willing to pay or accept for a resource are consistent with the amount they would pay or accept if confronted with an equivalent, actual situation. In particular, critics observe that contingent-valuation studies can yield internally inconsistent results, with the sum of the values respondents attribute to several species, considered separately, exceeding the value they attribute to them when considered jointly. Advocates of contingent valuation respond that there is no alternative to measuring intrinsic values in

monetary terms and are working to demonstrate that the techniques are both theoretically and empirically sound. Within this context, one should view the results from contingent-valuation studies with caution. For a more thorough discussion of issues associated with the valuation of intrinsic values, see Freeman (1993), U.S. Department of Commerce, National Oceanic and Atmospheric Administration (1995), and Schamberger and others (1992).

Economic Impacts

Much of the public's concern over forest management is associated with how forest-management decisions will affect economic opportunities available to workers, families, and investors and the structures of the local, regional, and national economies. These effects are commonly called the economic impacts of a decision and are different from the effects on economic value, which are based on costs and willingness to pay for different outcomes. The model of competition (see fig. 1) provides a useful framework for tracing the impacts of forest-management decisions. As with the analysis of economic values, in most instances the analysis of impacts generally is made easier if a resource-intensive industry, such as timber, is assigned to box 1.

The economic impacts of a forest-management decision are different from the effects on economic value.

In this instance, box 1 represents those business owners, workers, households, and communities deriving economic benefits from the activities of the timber industry (or other industry). These benefits materialize primarily as jobs, incomes, and quality of life, but in some circumstances, they also may be measured in other terms, such as level of support for public services. Allocating specific resources to a box 1 industry, say timber, increases the levels of employment, payroll, profits, and so forth in this industry. These impacts are multiplied, through the so-called multiplier effect, throughout the adjacent community and region.

At the same time, however, there will be reductions in employment and the other variables associated with the box 2 industries, reflecting the economic-displacement costs, opportunity costs, subsidies, and environmental externalities described above. Increasing the allocation of forest resources to a sawmill in one place, for example, might lead to reductions in jobs and incomes at a distant sawmill (economic displacement costs), a nearby plywood mill (opportunity costs), and a downstream food processor (environmental externalities). Each of these initial reductions will be multiplied through the ripple effect. The box 1 and box 2 impacts will be augmented by impacts operating through box 3 mechanisms, insofar as the allocation of forest resources to the box 1 industry alters the perceived quality of life and influences the locational decisions of workers and firms.

Box 2 Economic Costs Can Affect Incomes, Wealth, and Jobs

Box 2 economic costs can influence the economic impacts of a forest-management decision in several ways:

- By reducing the incomes, wealth, and jobs for one group and increasing them for another.
- By altering the distribution of economic activity among geographic localities, industries, and households.
- By lowering the overall levels of incomes, wealth, and jobs if the productivity of the receiving group is lower than that of the donors.

Professional economists have tended to overlook the economic impacts of resource-management decisions and have focused instead on net monetized values, out of a professional emphasis on concerns about economic efficiency and maximization of welfare. For example, the principles and guidelines for evaluating Federal water projects, which often are applied to forest resources, require agencies to assess the effects of a resource-management decision on the value of the national output of goods and services (U.S. Water Resources Council 1983). Concerns about the decision's effects on the distribution of jobs, incomes, and other indicators of economic well-being at the local level are assigned secondary importance. The priorities are reversed, however, when one turns away from professional economists. For workers, business people, and local politicians, the competition for forest resources plays out as concerns about how a forest-management decision will affect the jobs of individual workers, the incomes of specific households, the risks to existing firms and their investors, and the overall well-being of actual communities. If an assessment of the potential economic consequences of a forest-management decision is to be germane to these concerns, it must measure these community-level economic impacts with the same diligence that it measures overall changes in national economic value.

Every technique for estimating the economic impacts of a forest-management decision necessarily embodies some simplifying assumptions to facilitate the analysis. A conventional simplifying assumption arrests the economy in its current configuration so that an increase or decrease in the supply of a particular product can be traced through the now-assumed-to-be-static economy. In general, 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 forest-management decision but instead will continue to behave as if the management decision had not occurred (Mendelsohn and others 1994). In reality, investors, managers, workers, and consumers are neither static nor dumb. The regional and subregional economies of the United States are tremendously dynamic, and they adapt remarkably to changing conditions. (We discuss the dynamic nature of the economy in chapter 2.) 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.

Admittedly, there often is considerable uncertainty regarding the magnitude and speed of the adaptation, especially when the relation between forest resources and the structures of local and regional economies is undergoing substantial change. Despite the uncertainty, however, one thing is certain: people and economies will adjust, and failure to describe the adjustment generally leads to serious misrepresentation of the economic impacts of a forest-management decision.

In particular, one should be wary of a popular analytical tool, economic-base models.[12] These models divide 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 in money from the outside that

[12] The precepts underlying economic-base models are explained in texts for urban or regional economics; see, for example, O'Sullivan (1993). For a more thorough discussion of the conceptual errors and empirical pitfalls of economic-base models, see Barkley and Allison (1968), Cunningham (1995), Krikelas (1992), O'Sullivan (1993), and Richardson (1985).

is spent and respent on local goods, it is the “economic base” that “supports” the local sector. With such models, the fate of a region’s economy is in the hands of outsiders: the only way the welfare of local residents improves is if outsiders buy more of the goods being exported from the area. Because resource-intensive industries typically export their products to other regions or countries, proponents of the economic-base approach often conclude that these industries play a key role in sustaining the welfare of local residents (Beuter 1995, Schallau 1994).

Users of an economic-base model err when they assume that increasing the sale of exports is the only way to increase the welfare of local residents and ignore, among other things, the contribution of the local quality of life. All else remaining unchanged, the welfare of local residents increases if, say, an improvement in riparian habitat makes the river water flowing through the middle of town less toxic, less murky, and less susceptible to flooding. A quality-of-life improvement also can affect the export sector itself. If the improvements in the river make the town more attractive to workers and their families, an export firm will be able to either hire more productive workers at the same wage or hire equally productive workers at a lower wage than its counterparts in other towns. The resulting decrease in unit labor costs will allow the firm to decrease its price, sell more of its product, and increase the amount of export-derived money moving through the economy.

An economic-base model errs when it assumes that an economy is static and that increasing the sale of exports is the only way to increase the welfare of local residents.

Proponents of economic-base models err when they disregard the importance of local actions, such as rational management of land use or improvements in education and training programs, that improve the efficiency of the nonexporting firms and agencies and enable local residents to enjoy the same products at a lower cost or better products at the same cost. Such actions represent a direct increase in the welfare of the residents; they also can lower the cost of locally produced inputs for an exporting firm, thereby increasing productivity and leading to increases in output, employment, and net revenues for the export sector.

Users of economic-base models almost always characterize resource-conservation actions that impede the output of a resource-intensive industry, such as mining or timber, solely as a loss to the economy and ignore their potential to increase economic welfare and productivity. The errors of such economists are compounded when they employ dumb-person assumptions and look backward to see what the forest-economy relation was in the past, failing to anticipate what it will be in the future. When they employ only static, historical data, for example, and see that a sawmill, mine, or some other resource-using facility played a conspicuous historical role in the surrounding local and statewide economies, it is difficult to recognize that these economies now may be functioning largely independent of, and perhaps in spite of, these traditional industries.

Fairness

Where there is competition for forest resources, any resource-allocation decision necessarily creates both winners and losers. The characteristics of these two groups influence perceptions about the fairness of the decision. These perceptions, in turn, can play an important role as resource managers, decisionmakers, and the public evaluate forest-management decisions. Hence, an assessment of the competition for forest resources should keep track of winners and losers and examine the impacts on perceptions of fairness. In particular, the assessment should examine issues associated with property ownership, box 2 costs, and groups of special concern.

Many would agree with the following statement: The owner of a parcel of timberland generally has the right to manipulate the soil on it however desired, so long as that owner bears responsibility for the costs and hazards those actions impose on others. But owners of natural resources have both rights regarding the use and disposition of the resources and responsibilities not to exercise these rights in ways that unreasonably restrict the rights—whether private or public—of others (McElfish 1994). Another way to look at this issue is that when upstream property owners exercise their property rights to degrade the water quality of a stream, they infringe on the property rights of downstream owners to have clean water. Specifying property rights and responsibilities can influence public perceptions of the fairness of a resource-conservation decision, insofar as society tends to use different standards to judge environmental regulations restricting what are seen as property-owners' rights and those requiring owners to satisfy what the public generally believes to be owner responsibilities. Similar differences apply to regulations restricting the use of private property and those restricting the use of public property.

In particular, assessment of the competition should examine issues associated with property ownership, box 2 costs, and groups of special concern.

Perceptions about the distribution of property rights and responsibilities also can affect the valuation of environmental resources and, hence, an individual's perception of the magnitudes of the wins and losses associated with a forest-management decision. Consider these two extremes: (1) endangered fish in a stream belong to the landowners, who are entitled to engage in activities that kill the fish unless society pays them not to do so; and (2) the fish belong to society as a whole, which can decide to allow the activities only if the landowners compensate society fully for the loss of the fish. The latter case will yield a higher overall societal value for the fish insofar as some members of society appear less willing to allow extinction of a species that belongs to them than to allow the extinction of a species that belongs to someone else (Berrens and Kerkvliet 1994, Gregory and others 1995, Shogren and others 1994). In a less extreme situation not involving the extinction of a species or the destruction of a singular environmental resource, the specification of property rights and responsibilities may have less effect on the valuation of an environmental resource and perceptions of fairness. Nonetheless, the possibility generally exists, especially whenever some consider a resource to be irreplaceable.

Owners of natural resources have both rights regarding the use and disposition of the resources and responsibilities not to exercise these rights in ways that unreasonably restrict the rights—whether private or public—of others (McElfish 1994).

Concerns about fairness also can arise in a forest-management decision when significant box 2 costs occur. By definition, when there are box 2 costs, the group benefiting from an activity does not bear the full costs of its actions. For example, sediment generated by clearcutting can impose costs on industries, municipalities, households, and recreationists hundreds of miles away. Additional concerns about fairness arise when use of forest resources today imposes costs on future generations, such as when mining leaves residue that jeopardizes future access to potable water.

Questions about the fairness of forest-management decisions almost always arise when groups of special concern are affected. These groups generally include the poorest members of society, minorities, or groups with a unique relation to forest resources, such as families who can trace their use of forest resources over an exceptionally long period. Abrupt changes in forest management that adversely affect some groups may be seen as less fair than gradual changes. Additionally, forest-management decisions that seem to concentrate negative tradeoffs on populations without a political voice in the decision often raise environmental justice concerns.

Weighing the Results

Given the current state of techniques and data, it is unlikely that one will be able to reconcile fully the separate findings on economic values, economic impacts, and perceptions of fairness. This then, requires a clear exposition of each type of demand so that resource managers, decisionmakers, or members of the public can weigh the evidence. Sometimes, merely cataloging the full set of competing demands for a set of forest resources and then describing qualitatively how different forest-management and forest-allocation decisions will affect them can prove useful.

Even this descriptive task, though, can have pitfalls. Any integrated discussion of how a forest-management decision might affect economic values, economic impacts, and perceptions of fairness necessarily will look at a single event from multiple perspectives, thus creating opportunities for double counting. It is especially important to measure the effects on value and impacts only once and not to mix the two. For example, where an alternative exists that will increase the jobs and incomes in the timber industry, as well as the value of its products, one should measure this increase only once, preferably measuring the economic value of the additional timber in net stumpage value and the impact as an increase in timber jobs. One should not measure the increase by adding the value and employment associated with the raw timber, the value and employment associated with the logs derived from the raw timber, the value and employment associated with the lumber manufactured from the logs, and the value and employment associated with houses built with the lumber.

One also must resist a subtle but pervasive tendency to bias the description of how a forest-management decision might affect the different competing demands for resources. This tendency arises because, in general, the availability of data and the level of understanding regarding the demands for forest resources declines as one moves from box 1 to box 4. This sets the stage for a biased assessment of the competing demands for forest resources because people often associate the importance of an impact with the amount of data describing it (Josephs and others 1994). Thus, analysts, decisionmakers, and the public might be inclined to give unwarranted weight to the demands represented by box 1 relative to those represented by boxes 2 to 4. Countering this bias may require doing more than just portraying explicitly all the potential economic consequences of a forest-management decision. One must continually demonstrate the existence of the bias and challenge analysts, decisionmakers, and the public to reject it.

Mapping the Competition

People often associate the importance of an impact with the amount of data describing it.

The competing demands for a forest's resources, represented by boxes 1 to 4 of figure 1, do not originate from a common set of workers, households, firms, communities, and regions. Each interest group exerts an influence on forest management through its own set of competitive mechanisms, operating through markets, administrative proceedings, political contests, and other forums. Accordingly, one should not expect that the different types of competition will exhibit common geographic boundaries.

A general, but typical, illustration reinforces this conclusion. In a given situation, the competition for forest resources coming from those who benefit from timber production (box 1) might be concentrated on one side of the forest, in nearby communities having both milling capacity and transportation facilities appropriate for hauling heavy loads. If the timber production results in increased turbidity and flooding in streams, the competition coming from those who incur these environmental externalities (box 2) might encompass residents of the mill communities as well as others living hundreds of miles downstream in the watershed. The competition coming from those who see timber production as having an adverse impact on the quality of life (box 3) might include residents of the watershed, as well as residents who live nearby but are outside the watershed. Those competing for forest resources because they place an intrinsic value on forest resources affected by timber production (box 4) may live in the vicinity of the forest or far afield.

Only by chance will all the competing demands for a forest's resources share a common boundary. Furthermore, in most situations, the economic landscape relevant to a forest extends far beyond the economy itself. Although some individuals, groups, and communities with competitive interests in a forest's resources live nearby, or perhaps even within the forest itself, the bulk of the competition can come from hundreds, perhaps thousands of miles away.

Chapter 2: The Dynamic Character of the Forest-Economy Relation

In this chapter, we build on our description in chapter 1 of the competition for forest resources. We also discuss some of the major factors causing this competition to change over time. We distinguish between two aspects of the relation between forest resources and the economy. First, we discuss the major long-run forces that are changing the forest-economy relation over time. Second, we narrow our focus and examine the short-run transition that a local or regional economy experiences as it adjusts to a change in forest management. We conclude the chapter by discussing the issue of sustainability.

Competition for Forest Resources Changing

Any forest-management decision occurs within the context of powerful, international and national economic trends that shape the competition for forest resources, which in turn shape the economic consequences of the decision. Such trends include changes in the age structure of the population, changes in family structure, interregional migration, shifts in the ethnic mix of regional populations, and a growing network of international agreements on managing environmental resources. In this section, we examine four especially important trends:

1. The decline in employment in resource-intensive industries and the increase in employment in service and high-tech manufacturing sectors of the economy.
2. The growing importance of education as a determinant of wages and household income.
3. The increasing role of amenities and other nonwage factors as determinants of the locational decisions of households and firms.
4. The evolving economic integration of nonmetropolitan and metropolitan areas.

These trends result from fundamental changes in tastes, technologies, and demographics within the United States, as well as changes in the economic relation between the United States and other countries. The economic forces underlying these changes will persist for many years, perhaps decades. The four trends we have identified have brought and will continue to bring about profound shifts in the contributions natural resources make to the economic well-being of workers, families, and communities in the United States. They do not, however, uniformly influence each regional or subregional economy, or by extension, each community, or household. Depending on the characteristics of the individual economies, some will respond more strongly to the trends, and others less so.

Employment and Incomes Stagnant or Declining in Resource-Intensive Industries

As we stated earlier, groups use different mechanisms to compete for forest resources. To the extent that workers, communities, and political leaders place a premium on increasing the employment opportunities available to them or their constituents, they promote forest-management decisions that will yield this result. Typically, this means promoting decisions that allocate more forest resources to resource-intensive industries, such as agriculture and the resource-extractive industries, typically logging and mining.[1] Long ago these industries, along with their derivative industries, such as food processing, sawmills and smelters, were the primary sources of income and wealth in the United States. Today they play a much smaller role in the Nation's economy. Employment in the resource-related industries has declined, both relatively and absolutely, and we can expect this decline to continue. Now, and for the foreseeable future, most increases in jobs and incomes will occur in industries other than the resource-intensive industries. This trend represents a fundamental reduction of the role of resource-intensive industries in the jobs-related competition for uses of forest resources.

Most increases in jobs and incomes will occur in industries other than the resource-intensive industries.

Figures 3 and 4 illustrate the magnitude of the decline in the resource-intensive industries relative to other industries. Figure 3 shows that, between 1969 and 1994, direct employment in agriculture (farm employment and agricultural services), mining, and timber (lumber and wood products, pulp and paper, and forestry services) declined from about 7 percent of total U.S. employment to about 5 percent. Figure 4 shows that, during this same time period, while the percentage of total U.S. employment attributed to manufacturing declined, employment in the service sector, as a percentage of total U.S. employment, grew dramatically (U.S. Department of Commerce, Bureau of Economic Analysis 1995).

Several economic and social factors underlie the decline in the resource-related industries as a source of jobs and income in the U.S. economy. The adoption of labor-saving technological advances by U.S. firms in the resource-extraction and heavy manufacturing industries is a major factor (Kasa 1994, Lawrence and Slaughter 1993). Technological innovation is especially important in some industries, such as agriculture, where the national farm population declined 25 percent during the 1980s, even as the value of farm output increased 14 percent in constant dollars (U.S. Department of Commerce, Bureau of the Census 1994). Furthermore, technological innovation also is expected to play a major role in the increasing globalization of the wood furniture industry. Failure to apply new technologies to production has been cited as a contributing factor to the recent decline in the competitiveness of U.S. wood

[1] In some situations, elements of the developed-recreation industry, such as destination ski resorts, also can be resource intensive.

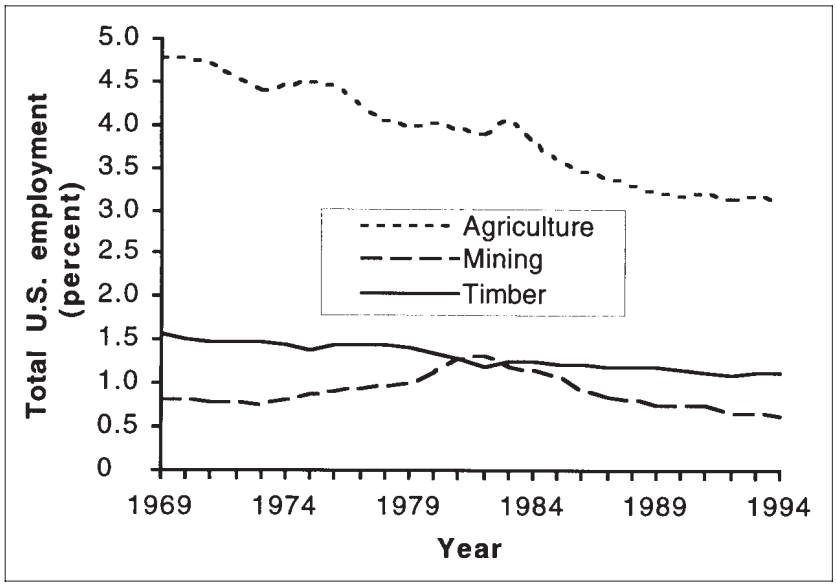

Figure 3—Employment in agriculture, mining, and timber as a percentage of total U.S. employment, 1969–94. Sources: ECONorthwest with data from the U.S. Department of Commerce, Bureau of Economic Analysis (1995).

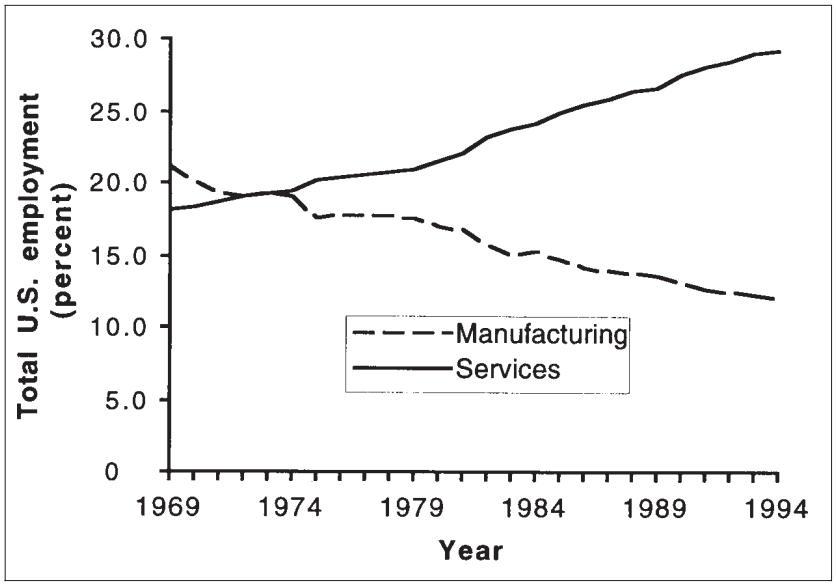

Figure 4—Employment in manufacturing and services as a percentage of total U.S. employment, 1969–94. Sources: ECONorthwest with data from the U.S. Department of Commerce, Bureau of Economic Analysis (1995).

furniture manufacturers in both the domestic and international markets (Smith and West 1994, West and Sinclair 1991). Other factors affecting timber and other resource-related industries during the past decade have been a marked decline in the influence of labor unions (Mishel 1992) and an accompanying decline in real incomes (Power 1996).

In the foreseeable future, these trends will not reverse. Economic forecasters do not expect jobs or wages in the resource-extraction and manufacturing sectors to increase significantly (Franklin 1993). These industries are and will remain important

elements of the Nation's economy, but they will not be as important as they were in the past. In fact, the resource-extractive sector most likely will eliminate jobs and shrink its payroll.

These trends have important implications for the competition for forest resources. Allocating a unit of forest resources—whether measured in acres, million board feet, or other units—to a resource-intensive industry in the future probably will generate fewer jobs and smaller incomes than in the past. Communities seeking to develop new jobs generally will have to look to industries other than resource-related industries. Communities that have depended heavily on resource-related industries generally should expect economic stagnation or contraction in the future if they continue to look mainly to these industries for maintenance of economic vitality.

In those areas where the resource-intensive industries experience the greatest decline, the impact on the competition for forest resources can be dramatic. In the spotted owl forests of western Washington, Oregon, and northern California, for example, the jobs per million board feet of timber harvested declined by about one-quarter and the payrolls (in real terms) per unit of harvest declined by about one-third in the decade preceding the listing of the owl as a threatened species (Niemi and Whitelaw 1994, Stewart 1993). Furthermore, communities where the timber industry constitutes a major segment of the local economy increasingly exhibit high levels of poverty and other indicators of social stress (Cook 1995). In public opinion, lawsuits, and administrative proceedings, where the competition for owl-related forest resources is taking place, these changes undoubtedly weaken the arguments of those supporting allocation of forest resources to timber production.

Education Increasingly Important to Wages

For many reasons, resource-intensive industries exhibit a declining ability to generate jobs and incomes. One of the most important of these is a shift in the factors determining workers' wages. In the past, a general expectation existed that allocations of forest resources to the resource-extraction industries would result in jobs with high wages, allocations to recreation would yield jobs with low wages, and allocations to environmental protection would not yield any jobs at all. Over the past two decades, however, this relation between resource allocation and wage level has disintegrated. Forest-related wages, like wages throughout the economy, are increasingly determined by the characteristics of workers themselves, and by the extent to which different forest-resource allocations attract workers with high-wage characteristics.

A review of historical data on education and earnings indicates that workers with more education earn higher wages, but during the past two decades, education has become an increasingly important determinant of workers' earnings (Bound and Johnson 1995, Juhn and Murphy 1995). In 1980, for example, male workers aged 25 to 34 with a college degree earned about 20 percent more than their counterparts with only a high school diploma, but by 1990, this differential had increased to about 50 percent. The comparable figures for female workers are about 30 percent more in 1980 and 60 percent more in 1990 (Ehrenberg and Smith 1994). One textbook on labor economics gives this summary of the evolving relation between education and earnings:

In 1980, male workers aged 25 to 34 with a college degree earned about 20 percent more than their counterparts having only a high school diploma, but by 1990, this differential had increased to about 50 percent.

> It can be concluded...that the most important dimension of the growth in [earnings] inequality during the 1980s was the increased returns to a college education. These increases were observed among both women and men, and they were especially large in the period from 1985 to 1990. For men in mid-career, the increased returns to college were created by the sharply falling real earnings of high school graduates in an environment in which the real earnings of college graduates remained nearly constant. For women, however, the returns rose because the real earnings of college graduates grew quickly while those of high school graduates grew only slowly [Ehrenberg and Smith 1994: 542].

Multiple economic and demographic factors contribute to the growth in the earnings gap between workers who have a college education and those who do not. One of the more important is a shift in occupational patterns, with an increase in the number of employment opportunities in managerial, professional, and other high-wage occupations and a decrease in the number of workers in middle-wage occupations, including the blue collar jobs that until recently have typified many of the older manufacturing industries (Brauer and Hickok 1995, Kutscher 1993). The shift in occupations has been accompanied by explosive growth in the use of computers and other high-tech equipment that require high-skilled workers to operate. In many instances, as industries install high-tech equipment which lowers the overall demand for labor, and especially the demand for workers with low-to-medium skills, the demand for high-skilled workers increases (Bound and Johnson 1992, Eck 1993). This process underlies much of the displacement of blue-collar workers in the resource-related industries, described above.

These trends are expected to continue as more and more high-tech equipment is developed in the future (Bound and Johnson 1995, Brauer and Hickok 1995). The outlook for wages, adjusted for inflation, of workers and families with low levels of education is far less bright than it was a decade, or even a few years, ago. Furthermore, there is little, if anything, that will compensate for the lack of education. In particular, increasing the supply of raw material to resource-related industries, such as increasing the flow of logs to the timber industry, will not arrest the fundamental economic forces causing the industry to invest in labor-saving technology, eliminate jobs, and reduce the wages of workers lacking a high level of education. Indeed, the resource-intensive industries are subject to the same forces at play in the economy as a whole. Within these industries, jobs are growing fastest in the occupations—executive, administrative, managerial, professional, and precision-crafts—that require the highest training and pay the highest earnings (Ilg 1996). Conversely, jobs are declining in the occupations—operators, fabricators, and laborers—requiring the least training and paying the lowest wages.

Increasing the flow of logs to the timber industry will not arrest the fundamental economic forces causing the industry to invest in labor-saving technology, eliminate jobs, and reduce the wages of workers lacking a high level of education.

Within the context of these changes in the structure of wages and earnings, it is clear that the conventional resource-intensive industries have declining ability to satisfy the economic hopes of workers, families, and communities. Instead, these industries promise economic decline for all but those relatively few who have the requisite skills to command wage increases. The bulk of the workers in the resource-related industries cannot expect substantial wage increases without an increase in their skills.

Amenities Increasingly Important in Locational Decisions

The preceding discussion argues that the economic outlook for many workers, households, and communities tied to the resource-intensive industries is not bright. This does not mean, though, that the influence a forest has on jobs and incomes in nearby communities necessarily will decline. Forests do not have to be logged, mined, or grazed to stimulate the development of new jobs and higher incomes. Substantial evidence indicates that the contributions a forest makes to the quality of life in an area can affect the rate of economic growth by influencing the locational decisions of households.

Americans are highly mobile. Workers move frequently from one job to another, large numbers of families move from one state to another, and even larger numbers move from county to county within states. On average, workers have 10 to 15 jobs during their work life, and many economists expect this number to grow. At the height of the last economic expansion, 3.5 percent of the individuals employed in the United States moved from one state to another during a 1-year period. And, by one estimate, between 12 and 36 percent of all workers in the Nation's manufacturing industries quit, retire, or lose their jobs each year (Ehrenberg and Smith 1994). According to the U.S. Department of Commerce, Bureau of the Census (1995b) about 15.0 million people relocate to a different county each year, and about 7.5 million of those people relocate to a different state.

Because Americans are so mobile, changes in the factors influencing migration patterns can affect not only the locational decisions of workers and households but also the economic outlook for regions, states, and communities. Both economic theory and a long empirical record indicate that most people who move from one community to another do so to increase their prospects for higher standards of living. Similarly, people who remain in a community do so largely because they perceive that their standards of living will be higher if they stay where they are, rather than move. When people assess the standard of living they can expect from living in a region, they take into account multiple factors. Workers, for example, generally consider the overall wage level, probability of getting a job, cost of living, proximity to family, crime rate, recreational opportunities, climate and other aspects of quality of life. Retirees consider a somewhat different set of factors, including the cost of living and the availability of health and other services they find important.

Individuals Use Multiple Factors to Assess the Standard of Living in a Region

When people assess the standard of living they can expect from living in a region, they take into account multiple factors, including:

- Wage level
- Cost of living
- Probability of getting a job
- Crime rate
- Availability of health and other services
- Recreational opportunities
- Proximity to family
- Other aspects of quality of life

Studies of migration patterns generally have concluded that differences in wage levels have been the primary determinants of interregional migration. Most interregional movers are workers and their families, who move from one region to another mainly because they perceive that the destination region offers higher wages or more job opportunities (Ehrenberg and Smith 1994). Several recent studies have concluded, however, that factors other than differences in wage levels and job opportunities are becoming increasingly important. For example, a recent study by an economist at the Federal Reserve Bank of San Francisco (Sherwood-Call 1994: 16) of the factors affecting migration and interstate differences in personal income reached these conclusions:

> Economic factors continue to be strongly associated with migration flows within the United States. However, the nature of [these] economic influences appears to have changed during the 1960s. Prior to 1960, differences in income *levels* were strongly and positively correlated with interstate migration flows....In sharp contrast, the relationship between economic factors and migration after 1965 is consistent with a world in which differences in income levels reflect differences in living costs, amenities, and so forth...[italics in original].

The findings of Sherwood-Call and other researchers on the increasing importance of amenities as a determinant of migration underlie the resource competition associated with box 3, figure 1. This notion that the availability of amenities can affect the standard of living one enjoys from living in a particular place is hardly new; it derives from at least as far back as the early part of this century (Pigou 1920), and it is addressed in most textbooks on urban and regional development (Mills and Hamilton 1994, O'Sullivan 1993). Whitelaw and Niemi (1989: 27) recast this idea in intuitive terms, observing that "Every worker in Oregon receives, in effect, two paychecks: one denominated in dollars and the other in the state's clean air, clear streams, scenic vistas, publicly-owned beaches, and forested mountains."

Living costs and amenities seem to be increasingly important as determinants of migration patterns.

To generalize this statement, residents of any region receive two paychecks: one from work, wealth, or welfare, and one from the quality of life of the area. The second paycheck represents the value to residents of the various factors contributing to the quality of life in the area, including access to social, cultural, and environmental amenities, access they would not enjoy if they lived elsewhere. The sum of the first and second paychecks is a measure of the standard of living in the region. To the extent that a resident perceives that a forest contributes to the quality of life, other conditions remaining constant, then it enhances that resident's standard of living. (In chapter 3, we illustrate how the natural-resource amenities of the southern Appalachians contribute to the second paycheck of the residents.) The effects may extend far beyond this, however, if those who are attracted (or repulsed) by the contribution of a forest to the quality of life systematically possess economic assets, such as human or other capital (Knapp and Graves 1989, Roback 1988). That is, the quality of life of an area may influence the structure of the local and regional economies, and not just by attracting immigrants who, in turn, attract investments. If the immigrants possess higher (lower) levels of human capital, financial capital, or demand for public services, they can increase (decrease) the productivity of the local workforce, influence the industrial structure of the local economy, and alter the size and efficiency of the public sector. In other words, amenities may influence the size of both the first paycheck and the second paycheck available to residents of a region.

Significant changes in the interregional distribution of amenities might affect not just interregional migration patterns, but also the overall structure, efficiency, and productivity of the nation's economy. Three recent studies illustrate the possibilities. The first study focuses on the rural heartland of the United States, 12 states stretching from the Mississippi River to the Rocky Mountains and from Canada to Texas, and seeks to explain why some counties grow faster than the average while others grow more slowly or even shrink (Drabenstott and Smith 1996). The authors found that the counties with robust economies are in areas offering scenic and recreational amenities, while their weaker cousins depend heavily on "traditional natural resource industries."

In the second study, researchers in Washington examined the characteristics of the State's so-called lone eagles, individuals who are able to live anywhere and telecommute to work (Salant and others 1996). About 2,600 lone eagles moved to rural Washington in 1995, many for quality-of-life reasons. At first glance, their overall economic significance may appear small because they are spread across a large area, but their significance becomes more apparent when examined over time. If the current migration pattern for lone eagles continues for the foreseeable future, then the installment each year will be roughly equivalent to the establishment in the State's rural communities of a single business with 2,600 jobs.

The third study examined the potential impact of amenities on U.S. manufacturing industries (Duffy 1994). After observing that, "one of the most noticeable economic phenomena of this century has been the change in the regional distribution of manufacturing," (p. 137), the author examined the factors related to interstate differences in the growth of employment in 19 manufacturing industries between 1954 and 1987. He found that for 4 of the 19 industries, the pattern of employment growth was directly related to amenities, with amenities being represented by two variables: one that distinguishes states with a warm climate from those with a cold climate; and another that identifies 19 states exhibiting both a high population of retirees and high inmigration rates.[2]

More important, Duffy found that 18 of the industries had shifted closer to their product markets and 16 had shifted closer to workers, thereby raising the possibility that the location of manufacturing plants is subject to the location of households and, hence, to the factors influencing households. The actual interaction among households and firms is, of course, complex. In some cases, the data support the conclusion that the locational decisions for firms seem to be made in response to the locational decisions of households and workers; in other cases, the data support the conclusion that the sequence is reversed (Crown 1991). There can be no doubt, however, that a sizable portion of the population is highly mobile and a variety of factors, including amenities, influences migration patterns and, hence, patterns of economic development.

[2] The 19 states considered to have significant amenities were Arizona, Arkansas, California, Colorado, Florida, Maine, Michigan, Minnesota, Missouri, Montana, New Hampshire, New Jersey, New Mexico, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, and Wisconsin.

Although it is well established in the empirical literature that natural amenities can strongly affect regional economies, much remains to be done to determine the relative importance of individual amenities. Indeed, it has been difficult to quantify individual amenities, other than those that have been measured extensively, such as temperature and other indicators of climate. Still more difficult is the task of tracing the impact of a specific public policy, such as the protection of critical habitat for an endangered species, on the quantity and quality of amenities available to residents of a particular region, the impact of the change in amenities on migration patterns, and the impact of the change in migration patterns on industrial structure, incomes, and other economic variables. Hence, the assessment of the economic consequences of a forest-management decision that might have a significant effect on amenities must take into account both the potential economic importance of this effect and the uncertainty regarding its magnitude.

It has been difficult to quantify individual amenities, other than those that have been measured extensively, such as temperature and other indicators of climate.

Economies of Nonmetropolitan and Metropolitan Areas Increasingly Integrated

Implementation of the Endangered Species Act and other resource-conservation legislation has triggered fears that curtailment of conventional resource-extraction industries will have a devastating impact on the economies of nonmetropolitan communities. The preceding discussion indicates, however, that the economies of rural communities dependent on these industries have been experiencing economic contractions for reasons unrelated to environmental legislation. In this section, we examine the implications of using alternative geographic scales to look at the forest-economy relation. The discussion generally indicates that one cannot obtain a full understanding of potential impacts on rural communities from forest-management decisions by looking at these communities in isolation, separate from their economic integration with nearby metropolitan areas.

The historical economic isolation of nonmetropolitan communities is diminishing and, in many respects, it has expired. Clearly, some communities are more isolated than others, and within a given community, some residents are more integrated than others. But virtually all nonmetropolitan residents are getting closer economically to metropolitan centers. To see the full extent of the competition for forest resources and to understand the full economic consequences of forest-management decisions, except in rare instances, one must take into account the economic integration of nonmetropolitan areas with metropolitan centers, near and far.

The importance of rural migration—Technology has reduced many barriers between rural and urban areas. With advances in telecommunications, for example, rural residents and urban residents have almost equal opportunities to gain access to many educational resources, participate in a variety of markets, and provide services to customers. The result is a resurgence of some rural economies and, increasingly, the evolution of a rural economy dependent more on the educational characteristics of its residents and the quality of its telecommunication systems and less on its location (Heberlein 1994). The growing integration of urban and rural areas resulting from new technologies, greater use of existing technologies, and increasing mobility of workers, households, and economic activity permit each type of area to take greater advantage of the amenities offered by the other. Urbanites can relocate to rural environments and telecommute to city offices. Rural shoppers can turn on their television and pick up a phone to purchase goods via satellite shopping networks. Farmers can buy and sell cattle and other products from the farmhouse.

The 1920 census was the first to show more than half the U.S. population living in towns and cities. Currently, more than three-fourths of the population live in metropolitan areas, and more than half live in metropolitan areas with more than 1 million people. The growing concentration of the U.S. population in large metropolitan centers, however, does not mean that these centers are divorced from the surrounding nonmetropolitan areas. To the contrary, the economic and cultural ties between metropolitan and nonmetropolitan areas always have been and continue to be strong and complex. These ties are not static, though. Instead, they are changing rapidly, reflecting in large part the major economic trends described above.

Nonmetropolitan counties, which contain more than 80 percent of the land area in the United States, house about 21 percent of the people, provide about 18 percent of the jobs, and generate about 14 percent of the earnings (USDA Economic Research Service 1995). In general, rural residents are less likely than in the past to be tied to resource-intensive industries. Since World War II, farming employment has dropped from about 8 million to about 3 million, and now only 5 million people—less than 2 percent of the total population and less than 10 percent of the rural population—live on farms. In counties with the highest concentration of farm jobs, these jobs, on average, pay considerably more than nonfarm jobs ($28,000 versus $19,000 in 1989). Nonetheless, of all the households operating farms, nearly 60 percent rely partly on nonfarm income, with one or more household members working in an off-farm job and earning, on average, nearly $30,000 from nonfarm employment (USDA Economic Research Service 1995).

In general, rural residents are less likely today than in the past to be tied to resource-intensive industries.

Rural residents also are less likely than in the past to work in timber, mining, and other industries related to resource extraction. These industries historically located processing plants adjacent to the raw material to reduce the costs of transporting the raw material to the factory. Because of technological changes that both allow and require additional processing per unit of final output, raw materials are a smaller component of costs for most final products, and many manufacturers seek to locate, not near the raw material, but near large markets and large pools of qualified workers. Most of these industries are no longer dispersed throughout rural areas. They have consolidated near urban centers for better access to both buyers and workers (Duffy 1994).

In conjunction with technological changes in manufacturing processes, the development of transportation systems also has reduced economic barriers between nonmetropolitan and metropolitan areas (Mills 1987). Transportation systems, especially the trucking industry and the interstate highway system, have reinforced the technological changes and allowed many manufacturing firms to locate outside metropolitan areas, but still have ready access to urban customers and a large labor pool. In many sections of the country, the location of manufacturing on the fringes of metropolitan centers has considerably blurred the distinction between urban and rural, so that communities once considered rural are rural no more.

Many residents of nonmetropolitan areas have prospered from the increasing economic connections to metropolitan areas. Nonmetropolitan areas, as a whole, now have a smaller portion of persons living in poverty than metropolitan areas (Danziger and others 1994). In fact, by most measures, nonmetropolitan poverty seems to be declining. In 1990, for example, 765 nonmetropolitan counties in the United States had more than 20 percent of their population living in poverty, down from 2,083 counties in 1960 (USDA Economic Research Service 1995).

The location of manufacturing on the fringes of metropolitan centers has considerably blurred the distinction between urban and rural, so that communities once considered rural are rural no more.

The importance of an increasing elderly population—The migration patterns of workers and households and the locational decisions of firms have important consequences for nonmetropolitan-metropolitan links. Nonmetropolitan areas, which historically have had a higher concentration of elderly persons, seem to be attracting even more. Nationally, the number of persons 65 years and over has increased 60 percent since 1970, and this group now represents about 13 percent of the total U.S. population (U.S. Department of Commerce, Bureau of the Census 1992). During each of the three previous decades, elderly persons exhibited general movement from metropolitan areas to nonmetropolitan areas (Heberlein 1994).

An increasing elderly population in nonmetropolitan areas tends to reduce the isolation of nonmetropolitan communities in several ways, primarily by supporting nonmetropolitan-metropolitan trading networks. Because of national entitlement programs, pensions, accumulated savings, and other factors, the elderly, as a group, now have greater wealth and income than in the past. Their expenditure of the transfer payments provides an important source of financial support for nonmetropolitan retailers, health clinics, and other businesses. The economies of nonmetropolitan counties that experienced 15 percent or greater inmigration of persons age 60 or older during the 1980s performed far more strongly than the economies of other nonmetropolitan counties. On average, the elderly population of these counties grew by about 50 percent during the decade and total population by 23 percent (versus 0.6 percent for nonmetropolitan counties as a whole), while total earnings grew more than 25 percent and employment by nearly 35 percent. These counties tend to be in the Sunbelt and to be close to natural-resource amenities. Many military retirees also locate near military bases to have access to medical and shopping facilities on the bases (USDA Economic Research Service 1995). As the contribution of retirees to the local economy grows, so does the connection between metropolitan and nonmetropolitan areas.

The importance of Federal lands—One important economic connection between metropolitan centers of the Nation and many nonmetropolitan counties, especially in the West, occurs because they contain large amounts of Federal lands. There are 270 counties, mostly in the West, where Federal lands constitute more than 30 percent of the land area. In these counties, price distortions often hide the true cost of resource-management decisions. Urban taxpayers provide many of the economic resources available to the residents of these counties through three major channels: (1) appropriations for the administration of Federal lands; (2) subsidies for water-development projects; and (3) the sale of timber, minerals, forage, and other natural resources from Federal lands at prices below market levels (U.S. House of Representatives 1994).

A recent assessment of the economic characteristics of sparsely populated counties highlights the importance of Federal lands (USDA Economic Research Service 1995). The economies of the counties with high concentrations of Federal lands generally outperform the economies of other nonmetropolitan counties. The residents of these counties generally have higher incomes than residents of other nonmetropolitan counties. In 1989, for example, median family income in these counties was about $28,000, versus $26,000 for nonmetropolitan counties as a whole. They also have the lowest levels of poverty and faster growth in population and jobs. Average earnings per job, however, declined faster than those in other nonmetropolitan counties. Much of the increase in population and jobs can be traced to the strong demand for natural-resource amenities and recreational opportunities on Federal lands. More than one-fifth of the counties with the highest levels of Federal lands also have the highest levels of inmigration of elderly people. The population aged 65 and older in these counties grew by 33 percent during the 1980s.

Dynamic Response of Economy to Changes in Forest Management

More than one-fifth of the counties with the highest levels of Federal lands also have the highest levels of inmigration of elderly people.

Changes in forest management can effect strong responses in the local, regional, and national economy, in both the short and the long run. Figure 5 offers a useful framework for examining the adjustment by the economy to the adoption of a forest-management decision. The economic changes initiated by the management decision will occur in four general stages. In stage 1, the decision 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 natural resources. The signals have four major destinations, represented by boxes 1 to 4, which correspond to the boxes of figure 1 and represent the four major components of the competing demands for forest resources. Although figure 5 shows stages 1 and 2 occurring as a single, abrupt event, they generally transpire over a longer period, especially for public lands or whenever the forest-management decision is subject to public regulation.

Stages 3 and 4 of figure 5 illustrate the dynamic character of the economy's response to the adoption of the forest-management decision. In stage 3, the economy responds to the economic signals sent in the second stage through changes in prices or incomes or both. If the prices of goods and services rise or fall to levels that otherwise would not occur, buyers and sellers adjust their behavior accordingly. A change in the output of a good or service, even in the absence of a price change, similarly causes a change in the level and distribution of incomes and a change in the behavior of buyers and sellers. The prices of some goods and services in some locations may rise in response to a reduction in supply or an increase in demand, and for the opposite reasons, the prices of some goods and services in some locations may decline. Separate price-effects and income-effects manifest themselves in boxes 1, 2, and 3.[3]

[3] These changes in prices in turn affect the allocation of resources among each of boxes 1 to 3. In reality, there is an infinite feedback loop from the ecosystem to the economy and back again. However, to assess the consequences of a particular forest-management decision, it is necessary only to go through each of the stages in figure 5.

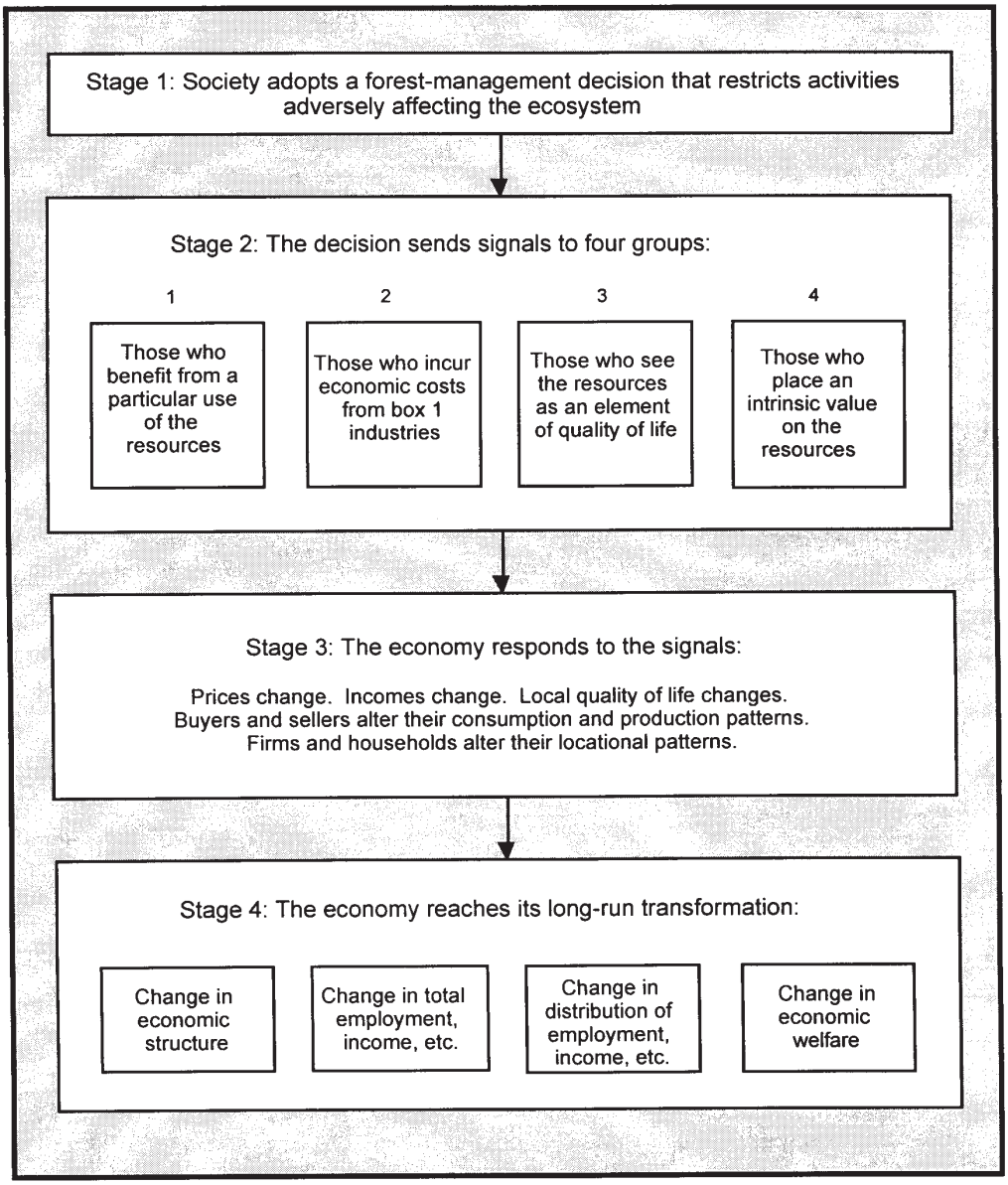

Figure 5—The general process by which the adoption of a forest-management decision will lead to changes in the economy.

In stage 4, prices and incomes reach their new levels, and the economy exhibits the long-run effects of the adoption of the forest-management decision. The decision alters the structure of the economy at the local, regional, and national levels; that is, the distributions of forest-related activity, quality of life, jobs, incomes, and wealth are different at each level than they would have been without it. The precise path through stages 3 and 4—the transitional adjustment to the forest-management decision—will depend, not just on the characteristics of the decision, itself, but also on the multiple economic forces and trends that are continuously altering and shaping the economy at all levels. Individual concern often is raised about the impacts of the transition on capital, property, and labor markets. In the remainder of this section, we address each of these concerns. Most markets should adjust quickly to the forest-management decision, and they may adjust fully in anticipation of the decision. The larger and more diverse the affected economy, the smoother the transition.

Most markets should adjust quickly to the forest-management decision, and they may adjust fully in anticipation of the decision. The larger and more diverse the affected economy, the smoother the transition.

In contrast with the dynamic reality of the ecosystem-economy relation, many common analytical tools for assessing the economic impacts of a forest-management decision take a static view of the relation between natural resources and the surrounding economies. Although we focused earlier on economic base models, this criticism also applies to other analytical tools, such as input-output models, that rely on a static view of the economy. As we discuss above, these tools typically assume that the forest-management decision will occur abruptly and that capital, labor, and other factors of production will be locked in place and unable to respond. This assumption implies that there will be no compensating response by the local economy, that local firms will not tap into alternative markets, and that displaced workers will not find replacement jobs. In reality, firms, workers, households, and communities have demonstrated that they are far more adaptable than the assumptions underlying the static analysis imply; hence, using a static model to assess the economic impacts of a forest-management decision, such as a reduction in timber output, probably represents a worst-case scenario.

Rarely, if ever, will a forest-management decision lead to financial market collapse.

Capital markets—Capital markets generally should adjust rapidly, not just to the adoption of the forest-management decision but also to information anticipating the decision. Deregulation of capital markets and technological changes facilitating information transfer have tended to homogenize capital markets across the country, and only rarely, if ever, will the adoption of a forest-management decision lead to a financial market collapse, such as occurred in the past when a downturn in the timber industry caused bank failures in timber-dependent communities. This does not mean that there will be no impact: Any major forest-management decision will generate an increase in uncertainty regarding the prospects of some workers, firms, and communities whose incomes will be affected by the decision. Those subject to higher uncertainty will experience reduced access to capital and have to pay a higher price for it. This uncertainty will not persist forever, though, and in time, the impacts should abate. Those hurt by the forest-management decision may experience a permanent reduction in anticipated incomes and face a corresponding permanent reduction in access to capital. Conversely, those helped by the decision should face expanded access to capital.

Property markets—A forest-management decision similarly will have both positive and negative impacts on property markets. The value of a ranch would decline if its value was linked to grazing access on Federal forest land and this access were limited. Or, the value of a sawmill using logs from a nearby forest would decline if the decision reduced the flow of logs. Where there is competition for forest resources, however, there will be offsetting impacts on other properties. As the value of one ranch declines because grazing access on Federal lands is restricted, the values of other ranches, locally and elsewhere, that are not subject to the restriction will increase. As the value of one mill declines because of a restriction on the availability of logs, the values of other mills will increase. To the extent that the forest-management decision benefits the environment, improvement to the local natural amenities will increase property values. As discussed earlier, people are placing increasing importance on quality-of-life aspects in their location decisions. This is reflected in the property markets in high amenity areas. One should not expect, however, that all the offsetting impacts will occur in the same locality. In general, the adoption of a particular forest-management decision will suppress property values in some places and increase them in others.

In general, the adoption of a particular forest-management decision will suppress property values in some places and increase them in others.

Residential-property markets generally will adapt quickly to the adoption of a forest-management decision, so long as the markets continue to expand. If property values decline, however, these markets can become sluggish for several years as owners hold on to their homes rather than take a loss. Commercial-property markets exhibit similar characteristics. Industrial-property markets can be even more sluggish. This is especially true for sites previously occupied by heavy industry and not easily converted to either light industry or nonindustrial uses.

Labor markets—Although any forest-management decision will increase job opportunities for some and diminish them for others, most of the concern about the impact on labor stems from fear that a decision, such as a reduction in timber production, will result in intense economic distress for dislocated workers. This concern has such an important influence on policy decisionmakers that it generally warrants thorough investigation to identify who will be affected, to what extent, and for how long.

Local labor markets throughout the United States are dynamic and will adjust to the adoption of a forest-management decision, although the character of the adjustment will depend on local conditions. The adjustment will be smoother in larger, diverse labor markets or in areas experiencing economic expansion. The greater the distance between a dislocated worker's residence and the local metropolitan centers, for example, the smaller the set of replacement-job opportunities readily available to that worker. One should not necessarily anticipate that most of the workers dislocated by the adoption of a forest-management decision will be in small, rural labor markets. At least in the Pacific Northwest, the timber industry itself has concentrated many operations in or near metropolitan areas to take advantage of the greater availability of labor, transportation, and other services. Almost half of the timber jobs in Washington occur in metropolitan areas around Puget Sound, for example, and many of the remaining are within commuting distance of Olympia or Vancouver (Conway and others 1991)

A reduction in timber production in a given place will not necessarily result in layoffs at the adjacent mill. If the adjacent mill is more competitive than distant ones, it will respond to the reduction in local timber availability by competing for logs that otherwise would go to the distant mills. Information from analysts with close ties to Oregon's timber industry indicate that mills in Oregon responded to reductions in timber supplies from Federal lands by obtaining timber from both domestic and international sources in 1994 and 1995.[4] The net result is that the least competitive mill, which may be hundreds of miles away, will feel the impacts of the reduction and lay off workers.

Wherever they occur, workers displaced by the adoption of a forest-management decision will draw on unemployment insurance benefits and whatever savings and other resources they have available to offset a portion of their lost wages. All dislocated workers, no matter their levels of financial and human capital, will face social, emotional, and economic costs in making the transition to new employment. The longer a dislocated worker and his or her family delay in seeking new employment or training, the more they will draw down their financial resources and increase the social and emotional costs of finding replacement employment. This is especially true for workers and families facing dislocation from an industry with declining prospects for employment in the future.

All dislocated workers, no matter what their levels of financial and human capital, will face social, emotional, and economic costs in making the transition to new employment.

Most dislocated workers will find replacement jobs (U.S. Bureau of Labor Statistics 1993). Although some workers will experience prolonged unemployment and severe reductions in incomes, others will experience brief unemployment and limited reductions in incomes, and still others will move quickly to equal or higher paying jobs. Of the workers nationwide who lost their jobs because of plant closures or other mass layoffs in the 1980s, about half were unemployed less than 10 weeks later and, the percentage remaining unemployed after 12 months was roughly the same as the rate of unemployment for the overall labor force (Power and others 1996).

Sustainability Issues in the Long Run

An economy is on a sustainable path if each generation acts in a manner allowing every future generation the option of being as well-off as its predecessors (Solow 1992).[5] This does not mean that the economy is unchanging over time. Instead, it means that one generation passes to the next an endowment of assets—a bundle of natural resources, capital resources, and knowledge—enabling it to achieve a standard of living at least as high as the previous one. The composition of the bundle will change as assets are depleted and replaced with others. The challenge is to ensure that the depletions do not exceed the replacements (Serageldin and others 1994).

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[4] The domestic and international sources included Alaska, Colorado, Montana, Texas, Arkansas, Idaho, Nevada, Utah, California, Louisiana, New Mexico, Washington, Wyoming, Chile and South America, Mexico, and New Zealand (Paul F. Ehinger & Associates and Robert Flynn & Associates 1995).

[5] This is the economist's view of sustainability. We realize that for others the temporal or spatial lens through which sustainability is viewed may differ. For example, a family's view of sustainability might focus on the ability of the parents to provide a good standard of living and a college education for their children. Others might call sustainability the ability of their community to grow without changing the quality of life of its residents.

Accounting for the Environment

The standard accounting systems applied to the U.S. economy largely ignore environmental assets and liabilities and provide few insights into the sustainability of actions affecting forest and other resources. Common indicators, such as the gross domestic product (GDP), recognize environmental degradation as an improvement in the economy, sometimes counting it more than once—as the sales of products from a firm that pollutes, as the firm's subsequent expenditures to clean up the pollution, and as sales of medical services to those harmed by the pollution. Several efforts are underway to develop environmental accounting schemes, such as the genuine progress indicator (GPI) and the United Nation's system for integrated environment and economic accounting (SEEA) to recognize natural-resource degradation as a depletion of environmental assets (Cobb and others 1995, Goodstein 1995, Nestor and Pasurka 1995, Steer and Lutz 1993, Tietenberg 1992).

To meet this challenge, each generation must curtail its own consumption of assets—natural resources, physical capital, and human capital—and make enough investments to increase the future supply of assets so that a reasonable likelihood exists that future generations can sustain the current level of consumption. No generation, however, can predict the future with certainty. Thus, a generation trying to act in a sustainable manner must, at a minimum, strive to avoid big mistakes that would seriously jeopardize the living standards of future generations.

The first requirement for avoiding big mistakes is to determine the extent to which substitutes exist for the consumption of individual assets. The likelihood of making a big mistake diminishes with abundant substitutes but increases where substitutes are scarce. For example, insofar as there are abundant, alternative building materials that can substitute for lumber from old-growth trees, forest-management decisions restricting allocation of these trees to the timber industry are not likely to be big mistakes seriously jeopardizing the living standards of future generations. Conversely, decisions to log these trees might constitute a big mistake, if the trees play a critical role, for which there are no substitutes, in sustaining the productivity of a forest ecosystem (Tilman and others 1996).

A desire to sustain living standards and to avoid big mistakes does not necessarily mean that the current generation should forgo consumption of a particular resource. Extraction of ore, lumber, and other products from a forest might yield machinery and support research and educational activities whose value to current and future generations far exceeds the forgone value of an unexploited forest. As the competing demands for forest resources increase, however, so too will questions about the potential impacts of alternative resource-management decisions on the living standards of future generations. Responding to these questions requires looking, not solely at the impact of each decision on this generation's consumption but also at the impact on the endowment of assets this generation passes to the next. Where a detailed analysis is not possible, the assessment, at a minimum, should look explicitly at the availability of substitutes for each affected element of the endowment and focus attention on situations where the availability of substitutes is severely limited.

Chapter 3: Applying the Framework to the Southern Appalachians

The analytical framework of the preceding chapters rests primarily on research conducted in Western States that addresses issues associated with the management of National Forests (MacMullan and others 1996, Niemi and Whitelaw 1995b), designation of critical habitat for threatened and endangered species (MacMullan and others 1995, Niemi and others 1996), river management (Niemi and others 1995), and the role of resource management in economic-development strategies (Niemi and Whitelaw 1995a, Power 1995). In this chapter, we test the hypothesis that the framework is applicable elsewhere.

Specifically, we examine the suitability of the framework for examining the potential economic consequences of forest-management decisions in the forested highlands of the southern Appalachians, which are distributed over parts of Virginia, North and South Carolina, Georgia, Alabama, Tennessee, and West Virginia (see fig. 6). We chose this area because of the striking differences from western forests and the recent completion of an assessment for the southern Appalachians (Southern Appalachian Man and the Biosphere [SAMAB] 1996b), which renders much relevant information readily accessible. Except for illustrative purposes, we do not examine specific sites and forest-management decisions within the southern Appalachias, tasks that lie far beyond the scope of this effort. Instead, we apply the analytical framework to data from the assessment and other readily available sources to see if it can provide useful insights into the competition for the forest resources of the area.

We find that the framework works as well in the southern Appalachias as it does in the West. Evidence from the former area supports the general themes in the previous chapters—that the demand for forest resources is complex and the forest-economy relation is dynamic. The framework is fully capable of accommodating differences between this area and the West, such as differences in major tree species, the extent

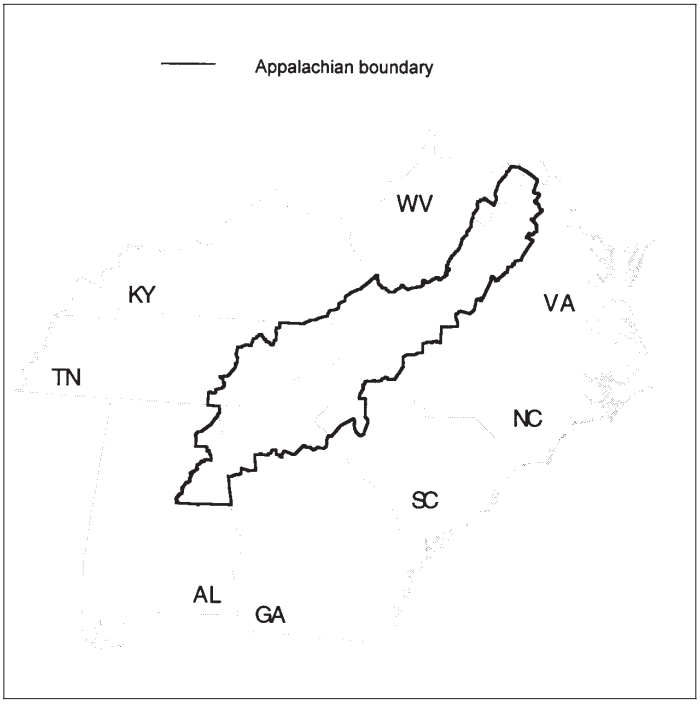

Figure 6—The southern Appalachian region.

of Federal land ownership, and structure of regional economies. Indeed, the framework highlights the roles these differences play (or do not play, as the case may be) in determining the economic consequences of forest-management decisions.

This chapter has four sections.

1. A description of the geographic setting, with a focus on the attributes of the forest ecosystem that influence competition for forest resources.
2. A description of the economic setting, which illustrates the regional relevance of national economic trends influencing the competition for forest resources and the response of the economy to alternative levels of timber production.
3. An analysis of the economic values and economic impacts associated with each category of competition for forest resources.
4. A summary of the potential economic consequences of alternative approaches to forest management.

Several factors limit the scope and detail of this chapter, which is offered as an illustration of the analytical approach described in the previous chapters, not as a comprehensive assessment of forest-management decisions in the southern Appalachians. It focuses on a narrow subset of economic tradeoffs, those associated with conventional methods of timber production and their impacts on water quality. It relies exclusively on readily available information, especially the descriptions of the area's ecological and socioeconomic characteristics published recently by Federal natural-resource agencies (SAMAB 1996b).

This chapter reinforces an underlying theme of this report: the forest-economy relation is complex. Any forest-management decision, including one to maintain the status quo, will have multiple, intertwined effects on many households, firms, and communities. Anyone striving to evaluate different decisions must understand this complexity and avoid being overwhelmed by it. This chapter confirms that the analytical framework we present here is useful because it both communicates central features of the relation between forests and economies and it helps different groups focus on their individual concerns. It responds equally to the concerns of those wanting to know if a forest-management decision will increase or decrease the economic value of the goods and services derived from the forest, those worried about the impacts on jobs, and those focused on whether or not the decision fairly distributes benefits and costs.

The Geographic Setting

The southern Appalachian region, as we examine it here, includes parts of the Appalachian Mountains and Shenandoah Valley extending southward from the Potomac River to northern Georgia and the northeastern corner of Alabama. It covers parts of seven states and stretches across 135 counties and about 37 million acres. Although over 75 percent of the land in the region is in private ownership, the seven National Forests in conjunction with the three national parks, Blue Ridge Parkway, and Appalachian Trail form the largest contiguous block of public lands east of the Mississippi River. About 20 percent of the forests in the region are publicly owned (fig. 7). Compared to parts of the West, this share is small; however, it is the highest concentration in the South (SAMAB 1996b).

Although over 75 percent of the land in the region is in private ownership, the southern Appalachians contain the largest contiguous block of public lands east of the Mississippi River.

The 24.9 million acres of forested land are noted for their high species diversity. More species of trees are native to the southern Appalachians than to any other northern temperate region in the world. In the northernmost part of the region, chestnut oak (*Quercus prinus* L.) and select oak species (*Quercus* spp.) dominate, but Virginia pine (*Pinus virginianan* Mill.), chestnut oak, nonselect red oaks, yellow-poplar (*Liriodendron tulipfera* L.), and shortleaf pine (*Pinus echinata* Mill.) become more prevalent as one moves south. In eastern Tennessee, the forests are predominately nonselect white and red oaks, Virginia pine, and yellow-poplar. This high species diversity complicates the timber markets of the region greatly because a stand may contain an array of forest products with widely differing market values (SAMAB 1996b). In addition, 28 animals and 11 plants listed as endangered species depend on the habitat found in the diverse southern Appalachian forests (Flather and others 1994).

The southern Appalachian region, with its abundant rainfall and network of streams, supplies water for the region as well as for major cities in the Eastern and the Southeastern United States. All the South's major rivers have their headwaters in the southern Appalachian Mountains, including the Mississippi-bound Tennessee and Ohio Rivers, the Appalachicola and Alabama Rivers feeding into the Gulf of Mexico, and the Atlantic-bound rivers—the James, Roanoke, Great Pee Dee, Cooper, and Savannah. Any change in water quality in this region has the potential to affect a large portion of the United States.

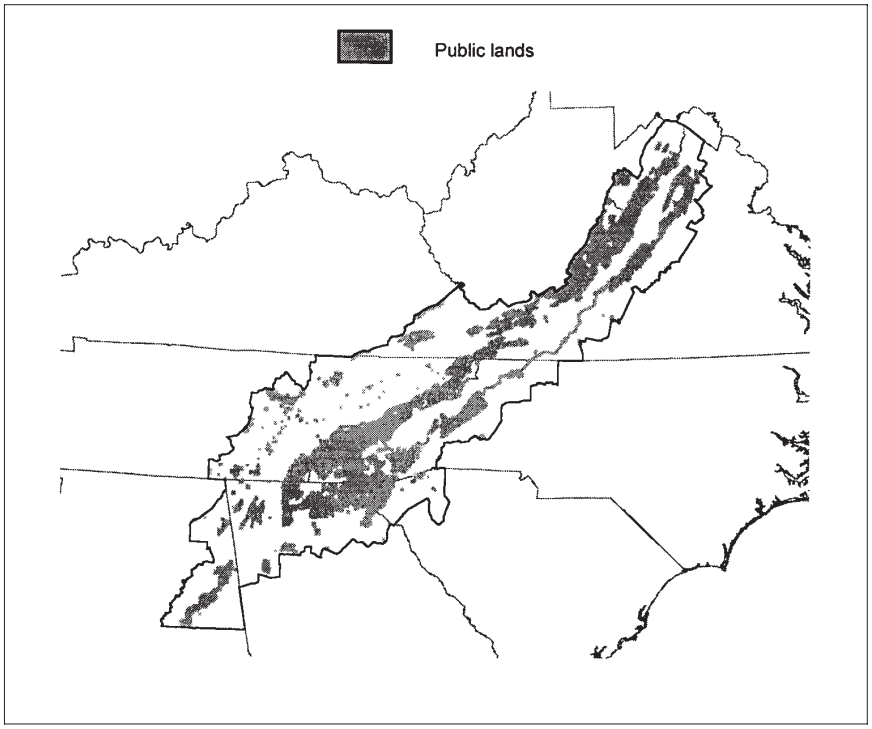

Figure 7—Public lands in the southern Appalachians.

As a result of the immense geographic and ecological significance of the southern Appalachians, out of 59 biosphere reserves worldwide, the United Nations has designated two in this region: one at Coweeta Hydrologic Laboratory and one in Great Smoky Mountains National Park.

The Economic Setting

In this section, we examine the extent to which the southern Appalachian region reflects the four national economic trends affecting competition for forest resources (discussed in chapter 1): (1) the declining economic importance of the timber industry, (2) the increasing returns to education in the labor market, (3) the growing links between metropolitan and nonmetropolitan areas, and (4) the role of natural amenities in the locational decision of firms and workers in the region.

Employment and Income in Timber Industry Declining

In chapter 2, we documented the diminishing role of resource extractive industries in the national economy. Here, we examine the history of the timber industry in the southern Appalachian economy and reach similar conclusions. We find that, although the supply of merchantable timber is expected to increase (not decrease as in the West), the timber industry in the southern Appalachians will not be a major source of new jobs or higher incomes in the foreseeable future.

Economic values from timber production in the southern Appalachians are typically lower than in other regions. Part of the difference occurs because the region was extensively logged early in the 20th century. Most of the readily accessible timber is quite young, whereas most of the older, more valuable timber lies on steep slopes that substantially increase production costs. A more general explanation, however, is related to the high species diversity found in southern Appalachian forests. Only a handful of species are desirable for lumber production. Most of the species found in the forests can be used only for pulp or composite board. Any acre of forest might contain multiple hardwood and softwood species of different potential for use as sawtimber or pulpwood. This diversity increases sorting and processing costs and is not as conducive to mass production as, say, single-species clearcuts in the West.

According to SAMAB (1996b), economic values associated with wood products in general have been relatively steady in the Southeast over the last 20 years. Production and price trends, however, differ by market. Overall saw-log production between 1980 and 1992 was relatively stable at 200 million cubic feet, with hardwood saw-log production falling somewhat during that time in West Virginia, Virginia, and North Carolina. Prices for hardwood saw logs, consequently, have risen over the last 20 years at an average annual rate of 2 to 3 percent, reflecting their scarcity value. Softwood saw-log prices have been more volatile, recently rising to unprecedented levels in South Carolina and Georgia, which reflects the connection to the broader markets in the South and Nation. Although high-quality saw logs are scarce, low-quality saw logs are not, and wood for pulp and composite board is not scarce, relative to saw logs. Total industrial output in the timber industry as a percentage of the economy remained stable at 5.2 percent between 1977 and 1991, but the mix of products shifted. The output of high-quality lumber declined, while output of pulp and composite board increased. In general, production has remained relatively flat with prices increasing as scarcity values have begun to kick in and new markets are being explored.

The USDA Forest Service projects a shift in national timber production away from the Pacific Northwest and toward the South.

Both timber production and prices are expected to increase in the region in the future, suggesting that overall economic values can be expected to rise. The USDA Forest Service projects a shift in national timber production away from the Pacific Northwest and to the South (Haynes and others 1995). The South's share of national softwood production is expected to increase from 54 percent in 1991 to 64 percent in 2040. Likewise, it is expected that U.S. hardwood harvest will increase by 52 percent between 1991 and 2040 with the South consistently contributing 58 percent of the total. Although Southern stumpage prices historically lagged behind those in western regions, rising demand for timber products coupled with supply constraints elsewhere are expected to force Southern softwood stumpage prices up by an average of 1.9 percent per year between 1991 and 2040. Similarly, hardwood sawtimber prices in the South are expected to more than triple between 1991 and 2040 (Haynes and others 1995).

In contrast to the trend in economic values, the economic impact of the timber industry exemplifies the larger economic transitions away from resource extractive industries occurring across the Nation. Figure 8 illustrates the downward slope of the timber industry's share of total employment, earnings, and income for the seven states encompassing the southern Appalachians.[1] We are unable to present the economic trends for just the southern Appalachian portion of the states because data at the county level are unavailable.[2] Timber industry employment in the seven-state region declined steadily from about 3.5 percent of total employment in 1969 to 2.5 percent in 1994. The share of income and earnings derived from the timber industry also show a similar decline over the last 25 years.

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[1] The seven states are Alabama, Georgia, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia.

[2] To preserve anonymity for individual firms, the Bureau of Economic Analysis does not provide county level data when doing so will reveal specific information about a firm, such as total wages or employment. This is a significant problem in the southern Appalachian counties because often there is only a single employer in manufacturing and extractive industries in a county. We therefore chose to use the more accurate state level data.

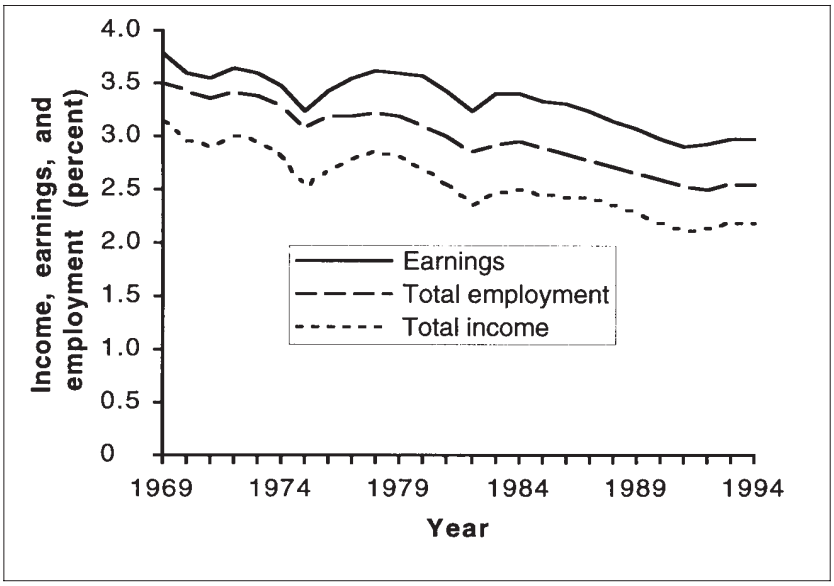

Figure 8—Income, earnings, and employment from the timber industry as a percentage of total in the seven-state region, 1969–94. Sources: ECONorthwest with data from the U.S. Department of Commerce, Bureau of Economic Analysis (1994, 1995).

The timber industry encompasses three subindustries: (1) lumber and wood products (Standard Industrial Classification [SIC] 24); (2) furniture and fixtures (SIC 25); and (3) paper and allied products (SIC 26). According to SAMAB (1996b), although wages per job increased for all three subindustries in the southern Appalachians, the average wage in the lumber and wood products industry ($14,250) and the furniture and fixture industry ($15,020), remained about 15 percent below the national average wage throughout the last 20 years. These two sectors together account for about 75 percent of employment in the timber industry. The paper and allied products industry stands out among timber industry jobs with an average wage of $28,147, but it is a small component of the overall job market, employing about 1 percent of the total labor force in the region (SAMAB 1996b).

For Many Workers, Wages in the Timber Industry in the Southern Appalachians Are Not High Enough to Escape Poverty

1993 poverty level for a family of four: $14,763

Timber industry	Average employment	1994 Average wage
Lumber and wood products	24,300	$14,250
Furniture and fixtures	51,800	$15,020
Paper and allied products	23,200	$28,147

Table 1--Combined timber production, employment, and income for Georgia, North Carolina, and South Carolina, 1983 and 1992

Year	Timber production	Employment in timber industry	Payroll in timber industry	Employment	Income
	Million cubic feet	*Number*	*Thousand 1993 dollars*	*Per million cubic feet*	*Thousand 1993 dollars per million cubic feet*
1983	2,175	251,403	6,596,512	115.6	3,033
1992	2,612	258,203	7,538,347	98.9	2,887
Percent change 1983-92	20.1	2.7	14.3	-14.4	-4.8

Source: ECONorthwest with data from the U.S. Department of Commerce, Bureau of Economic Analysis (1994, 1995) and Howell (1994).

Several factors support the conclusion that increased timber production and stumpage prices in the South probably will not mean increased employment and income for most communities in the southern Appalachians (Alig and others 1994, Haynes and others 1995). Jobs and incomes in the recent past were declining or stagnant. While the timber production level increased by 20.1 percent from 1983 to 1992, real income increased by only 14.3 percent and employment increased by just 2.7 percent (table 1). Even though harvest in 1992 was greater, the number of jobs per million cubic feet of timber harvested was 14.4 percent smaller, and the industry's payroll per million cubic feet of timber harvest, adjusted for inflation, was 4.8 percent smaller. In other words, each log truck filled with logs in 1992 represented 14.4 percent fewer jobs and 4.8 percent less income for workers and families in Georgia and North and South Carolina than in 1983.

Each log truck filled with logs in 1992 represented 14.4 percent fewer jobs and 4.8 percent less income for the workers and families in Georgia and North and South Carolina than in 1983.

The SAMAB (1996b) also estimates that the ratio of jobs to volume harvested in the solid-wood industries is about three times higher than the ratio for pulp and paper industries. Expected shifts toward pulpwood production and away from saw-log production in the region would consequently cause a decrease in derivative employment. Because pulpwood travels farther to fewer mills, an increase in paper manufacturing would concentrate employment and income in a few locations and paper mills. The adoption of labor-saving technological advances by solid-wood industries also may lead to a decline in jobs and income. As industries install high-technology equipment, the demand for overall labor, and especially the demand for workers with low-to-medium skills, will decrease (West and Sinclair 1991).

The decline of the timber industry mirrors the transitions occurring in the manufacturing industry in the region. Historically, the manufacturing industry has been a major source of employment and wages for the southern Appalachian region. According to the limited data specific to this region from SAMAB (1996b), manufacturing comprised about 36 percent of regional employment and about 38 percent of wages in 1977. Manufacturing was responsible for over half of the total industrial output in the region in 1977. By 1991, manufacturing had shrunk to 23 percent of employment, 30 percent of wages, and 40 percent of total regional output. Even with this significant decline, however, manufacturing employment in the southern Appalachians remains much higher than the 1994 national average of 13.2 percent.

To illustrate the economic transition more fully, we present data for the seven southern Appalachian states encompassing this region for 1969 to 1994 (figs. 9 and 10). Manufacturing employment steadily declined for the previous 25 years, to account for 16.5 percent of employment and 15.2 percent of total personal income (U.S. Department of Commerce, Bureau of Economic Analysis 1995).[3] This steady decline reinforces Krikelas' (1992) premise that it is imprudent to assume that the future industrial composition of a region will resemble that of the past. In particular, economic-base models reflecting the postindustrial structure almost surely will yield major misleading errors when used to project timber-related jobs and incomes in the future.

Today, the region has a diversified economy, with a large and growing service sector. As figures 9 and 10 illustrate, the service sector has grown significantly over the last 25 years in the seven states, to account in 1994 for 25.1 percent of employment and 17.4 percent of income. Much of the growth in the service industry is related to the increase in nonlabor income in the region.[4] As shown in figure 10, a growing share of the region's income is derived from transfer payments, investments, and private pensions (U.S. Department of Commerce, Bureau of Economic Analysis 1995).

The SAMAB assessment (1996b) predicts that growth in the service sector will add stability to the southern Appalachian economy. Having a large share of employment in manufacturing in the 1970s and 1980s made the region vulnerable to economic contractions. The increased diversification in the regional economy should decrease the severity of economic recessions and related unemployment.

Education Increasingly Important to Wages

Education has become increasingly important as a determinant of earnings in the southern Appalachians, just as throughout the Nation, even though southern Appalachian educational levels have consistently remained behind the rest of the Nation (Bound and Johnson 1992, Juhn and Murphy 1995, Tyler and others 1995). Even though the area improved between 1970 and 1990, the southern Appalachians still lag behind the national average in achieving the most basic of all education levels: a high school diploma (fig. 11). In 1990, 31 percent of the residents aged 25 years or over in the seven-state southern Appalachians had not graduated from high school compared to a national average of 25 percent (U.S. Department of Commerce, Bureau of the Census 1994).

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[3] Manufacturing includes industries with SIC codes 20 to 39.

[4] Nonlabor income includes dividends, interest, rent, and transfer payments.

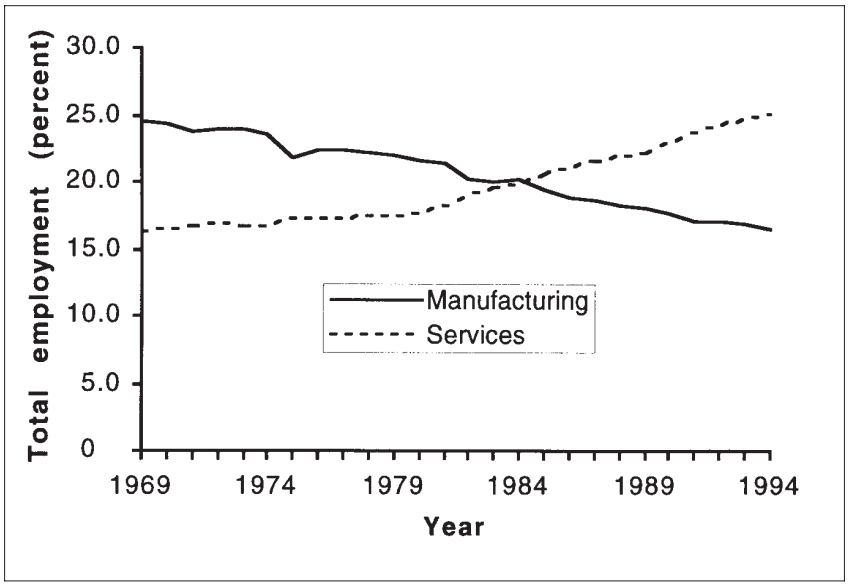

Figure 9—Employment in the manufacturing and service industries as a percentage of total employment in the seven-state region, 1969–94. Sources: ECONorthwest with data from the U.S. Department of Commerce, Bureau of Economic Analysis (1995).

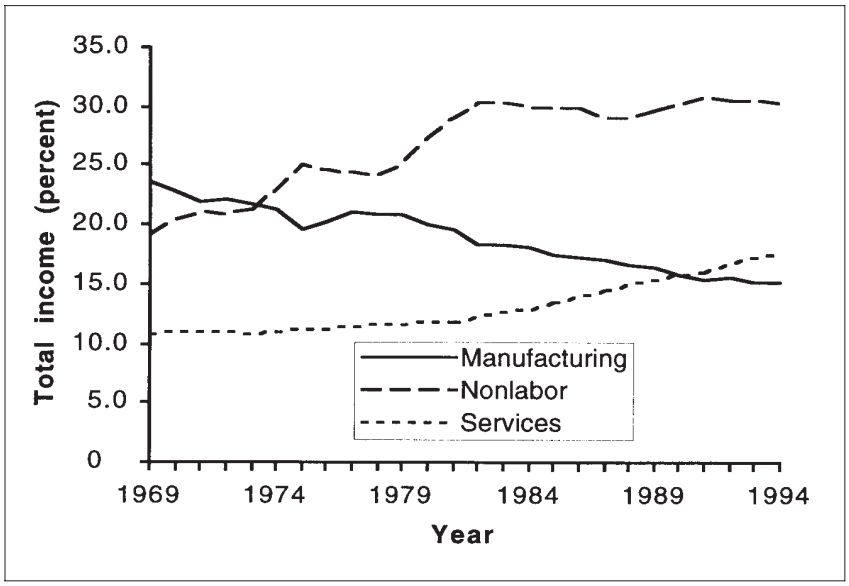

Figure 10—Income from manufacturing, service, and nonlabor income as a percentage of total income in the seven-state region, 1969–94. Sources: ECONorthwest with data from the U.S. Department of Commerce, Bureau of Economic Analysis (1995).

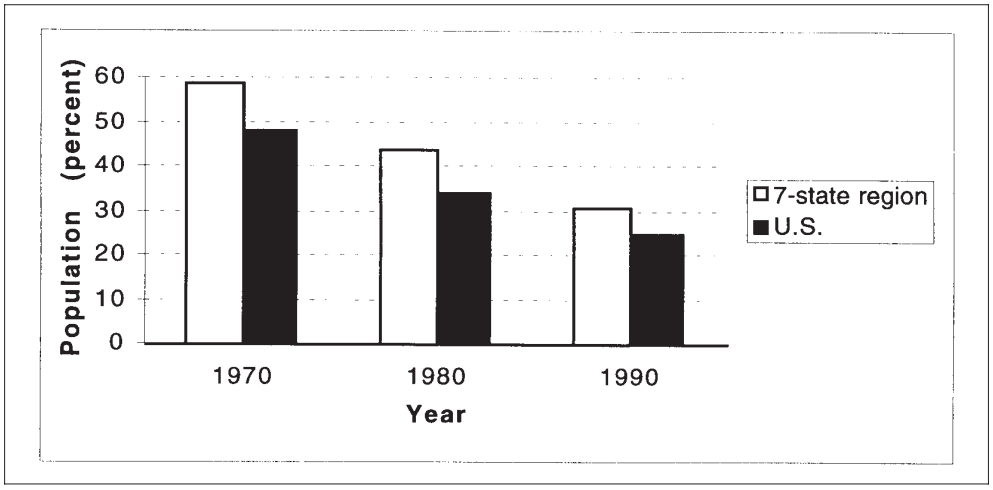

Figure 11—Percentage of population aged 25 years and over without a high school diploma. Sources: ECONorthwest with data from the U.S. Department of Commerce, Bureau of the Census (1995a).

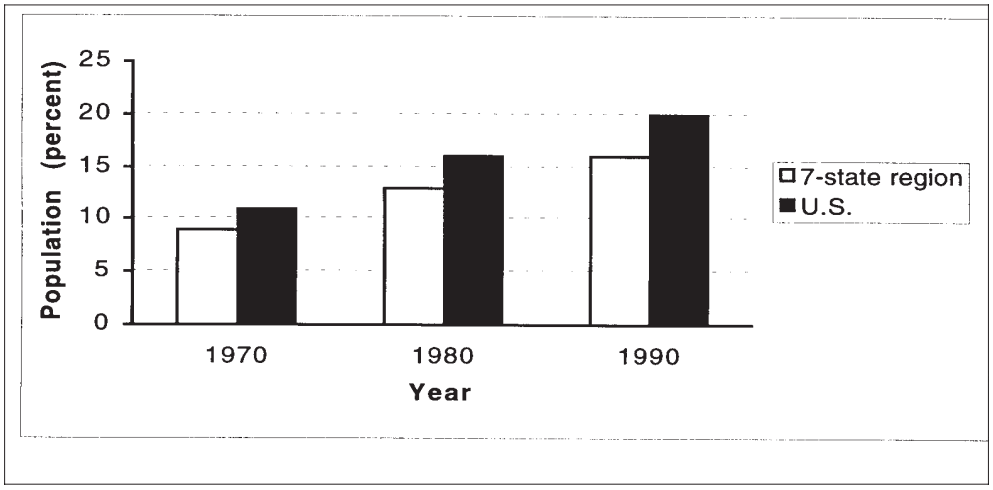

Figure 12—Percentage of population aged 25 years and over with at least a bachelor's degree. Sources: ECONorthwest with data from the U.S. Department of Commerce, Bureau of the Census (1995a).

In 1990, 31 percent of the residents aged 25 years or over of the seven-state southern Appalachians had not graduated from high school.

Although improvement has occurred at the bottom of the educational range, the gap at the top has been growing over time. The seven states containing the southern Appalachians have consistently lagged behind the rest of the Nation in the proportion of the population earning at least a bachelor's degree (fig. 12). From 1970 through 1990, about 20 percent fewer people had advanced degrees in the southern Appalachians than in the Nation (U.S. Department of Commerce, Bureau of the Census 1995a). In part, the lower education rates of the southern Appalachians are a result of self-selection. Residents over 25 years of age with a college education tend to migrate to urban areas, and those without one tend to live in rural areas (SAMAB 1996b).

The cumulative effect of a legacy of past inefficiencies in education and the migration patterns of educated workers drags down wages in the region. From 1970 to 1990, the average per-capita income in the southern Appalachians was consistently at 80 percent of average per-capita income for the seven-state region. The poverty rate for the southern Appalachians, however, has fallen dramatically from 20 percent in 1970 to less than 11 percent in 1990 and is now below that of the seven-state region (SAMAB 1996b). These data indicate that while conditions may have improved for those at the bottom of the labor market in the southern Appalachians, the majority of workers are currently no better off compared to their counterparts in other regions than they were in 1970.

The skill level of the workers limits the ability of the region to attract high-wage employers. For example, high-technology industries, which have spurred economic growth in many regions of the South, have tended to avoid rural areas such as the southern Appalachians with its low-skill population base. In contrast, manufacturers looking for a low-wage, nonunion labor force have tended to locate in the rural South (Falk and Lyson 1988). Thus, it appears that the links between the skill level of the labor force and the industrial structure of the region are strengthening.

Economies of Metropolitan and Nonmetropolitan Areas Increasingly Integrated

The southern Appalachians have a legacy of rural economic isolation from the rest of the national economy. Several factors are diminishing this, as is happening elsewhere in the United States. Among them is the growth of metropolitan centers in or near the southern Appalachians, the development of transportation and communication networks, and the outgrowth of housing development and recreation markets. These and other factors must be taken into account if one is to understand fully the economic consequences of forest-management decisions.

The southern Appalachian region is very close to several large population and market centers. Twenty metropolitan areas (urban areas with population greater than 100,000) are inside or within 50 miles of the southern Appalachian forests (fig. 13). The largest of these, Atlanta, has a population of over 1 million and lies adjacent to the southern Appalachian boundary. Other large metropolitan areas, such as Washington, DC, Pittsburgh, and New York City are 100 to 325 miles away. Given the proximity of these metropolitan areas and their overwhelming economic power relative to the rural areas, one cannot meaningfully evaluate the full forest-economy relation by looking solely at the southern Appalachian region itself; that is, the boundaries of the economic region relevant to this relation extend far beyond the ecological boundaries.

The economic power of the metropolitan areas in the seven states containing the southern Appalachians is reflected in multiple indicators. Although a majority of southern Appalachian residents still live in rural areas, the region, like all areas of the United States, is becoming more urban. The population density of the region changed markedly from 1970 to 1990, with the most dramatic changes occurring in the urban areas in northern Georgia, northeastern South Carolina, and isolated sections in Tennessee, North Carolina, and Virginia. Furthermore, counties near metropolitan centers in these areas witnessed substantial increases in per capita income and subsequent decreases in poverty rates from 1970 to 1990 (SAMAB 1996b). Growth in North Carolina and Tennessee has stimulated simultaneously the service economies in the metropolitan areas and the recreational and retirement communities of the nonmetropolitan areas (Billings and Tickameyer 1993). This evidence reinforces the conclusion that the economies of the metropolitan areas in or near the southern Appalachian area are powerfully robust and that this power extends to the nonmetropolitan parts of the area.

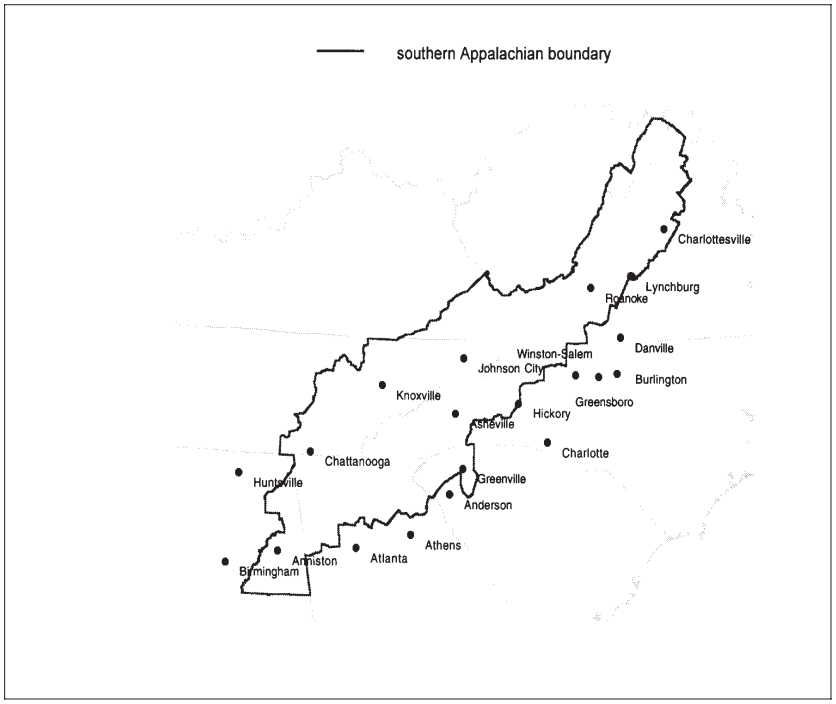

Figure 13—Selected metropolitan areas linked to the southern Appalachians.

Road construction has accelerated the integration of both southern Appalachian metropolitan areas with the rest of the national economy and the metropolitan and nonmetropolitan areas within the region. Fifteen interstate highways now cross the southern Appalachian region. Each is a major transportation corridor connecting major regional and national metropolitan areas (SAMAB 1996b). Recent research by Clark and Murphy (1996) indicates that road density is correlated with employment growth in the South but not in the North or Midwest. This suggests that, although the other regions are saturated with roads, additional development of roads in the South will further reduce the economic isolation of the region's rural areas. Although the southern Appalachians have made progress in road construction, the region apparently continues to receive increasing employment returns from transportation investment.

The development of the communication industry also has helped to integrate the nonmetropolitan sections of the southern Appalachians with the different metropolitan centers. Assessments of electronic media markets show that metropolitan television and radio broadcasts cover the entire area, and many areas have overlapping coverage from more than one center (Arbitron Ratings Company 1994).

Over 100 million outdoor recreation-based trips were taken to and within the southern Appalachian region in 1995.

As the southern Appalachians have become more accessible, a strong recreational market has emerged to reinforce the links between metropolitan and nonmetropolitan areas. More than 100 million outdoor recreation-based trips were taken to and within the region in 1995. Great Smoky National Park, alone, received over 8 million visits in 1990, more than all visits to Grand Canyon and Yosemite National Parks combined (Morton 1994). Metropolitan areas generate most of the recreationists seeking outdoor recreational opportunities (Dwyer 1993). When metropolitan residents take advantage of forest-related recreational opportunities, they support the service economy of adacent nonmetropolitan areas and contribute to nonmetropolitan income, employ-

ment, and value added (Bergstrom and others 1990). Hence, economic conditions in the nonmetropolitan areas of the southern Appalachians are directly and strongly linked to conditions in metropolitan areas. Nearby metropolitan residents visit the southern Appalachian forests on day trips and trips of longer duration. More distant metropolitan residents come to the area on longer trips, and many people temporarily reside in the area, such as retirees from Florida who come for the area's cooler elevations in the summer months.

Housing development at the edge, or within commuting distance, of a metropolitan area reinforces the integration of metropolitan economies with those of areas that not too long ago were commonly considered rural and isolated. Such development is occurring throughout the region, but it is especially noticeable north of Atlanta, in the forested highlands at the southern edge of the southern Appalachians. Average commuting times indicate that residents throughout the region are choosing to live in areas not immediately close to their work. Average travel time to work in the region was 21 minutes in 1990, only 1 minute less than the average for the surrounding seven-state area (SAMAB 1996b). As housing development extends toward rural areas, the boundary between urban and rural areas will become less distinct.

Natural Amenities and Locational Decisions

As in the rest of the Nation, natural-resource amenities exert an influence on the location, structure, and rate of economic growth in the southern Appalachians. This influence occurs through the so-called people-first-then-jobs mechanism, in which households move to (or stay in) an area because they want to live there, thereby triggering the development of businesses seeking to take advantage of the households' labor supply and consumptive demand. Insofar as forest-management decisions in the southern Appalachians affect the supply of amenities important to locational decisions of households, those decisions will have ripple effects throughout the local and regional economies.

Greenwood and others (1991) examine the patterns of migration across the 50 States and attempt to determine the relative strengths of two primary motives workers and households have for moving: to earn a higher wage (adjusted for differences in the costs of living among the states), and to have access to the particular amenities of the individual states. Workers tend to move from places with lower wages to places with higher wages, all else being equal, and from places with lower levels of amenities to places with higher levels. Hence, to attract and maintain a comparable productive workforce, employers in places with lower levels of amenities generally have to pay higher wages than firms in places with higher levels of amenities. In general, the difference in wages between two states provides an indirect measure of the difference in the values of the state's respective amenities.

Based on migration patterns for 1971 to 1987, the authors found that the amenity-related differentials for the seven states containing the southern Appalachians were sufficiently attractive to those who work in those states that, on average, these workers would not relocate elsewhere in the United States unless they received an increase in wages of 2 to 10 percent, depending on the state.[5] Other research (Cooper 1994) finds that individuals with higher than average wages appear more sensitive to the pull and push effects of amenities in markets such as Atlanta, where wages are perceived to be determined more by local than national factors. With the growing mobility of residents and firms over the past decade (documented in chapter 2), it is likely that the amenity-related wage differential has increased and will continue to do

[5] Amenity-wage values for the different states are Virginia, 0 percent; West Virginia, 10 percent; North Carolina, 5 percent; South Carolina, 8 percent; Georgia, 2 percent; Kentucky, 9 percent; and Tennessee, 9 percent (Greenwood and others 1991).

so for the foreseeable future. Cunningham (1995) identifies the structural advantage of the Southeast in terms of it being a good place to live and to do business and suggests that the advantage explains the concentration of manufacturing investment in the region, particularly in the construction and automobile industries.

Workers are not the only ones who find the southern Appalachians' natural amenities attractive. Retirees are flocking to the region to take advantage of the unique combination of climate, beauty, and culture. According to the USDA Economic Research Service (1995), there are several retirement-destination counties (counties experiencing 15 percent or more inmigration of people age 60 and older in the 1980s) in the southern Appalachian region. These counties are close to the area's public lands which are clustered in the southwestern corner of North Carolina, western South Carolina, and northern Georgia. Communities offering natural amenities are able to attract tourists, seasonal-home owners, and retirees, whose expenditures support the service economy. In particular, researchers are noting that one of the differences between nonmetropolitan communities that are thriving economically and those that are not is a connection to natural amenities (Billings and Tickameyer 1993, Drabenstott and Smith 1996, Sears and others 1992). The presence of retirees and their nonlabor income is especially valuable because they stay longer in the community adjacent to the amenities and purchase goods and services (Stewart and Stynes 1994).

Communities offering natural amenities are able to attract tourists, seasonal-home owners, and retirees whose presence supports the service economy.

There are different attributes of the region's natural amenities and each operates like a magnet for different portions of the population. Surveys of southern Appalachian residents confirm that forest resources and their accompanying scenic vistas, wildlife habitat, and recreational opportunities add to the quality of life for many residents (SAMAB 1996b). A majority of residents support critical habitat protection for plants and animals and do not favor increased timber harvesting on public or private lands. A survey of southwestern Virginia residents revealed that two-thirds of the respondents believe that when it comes to clearcutting trees, safe environmental measures outweigh the economic development benefits (Cromer 1994).

Some residents of the southern Appalachians are attracted by the high concentration of public lands. Great Smoky Mountain National Park plus contiguous National Forests in Tennessee, North Carolina, South Carolina, and Georgia total 4 million acres of public land and represent the largest block of Federal lands in the East. Only a small portion, about 10 percent, of the total public lands are in what is considered undeveloped wilderness areas. By 2005, demand is expected to increase 150 percent from 1990 levels for recreational activities such as rock climbing, rafting, kayaking, and backcountry camping and hiking, that are enjoyed in undeveloped areas. This rate of increased demand for wilderness recreation in National Forests is more than double that for the Nation and is estimated to exceed the current capacity of wilderness areas (Morton 1994). Perhaps as a reflection of this anticipated shortage, 69 percent of residents believe that more public land should be set aside for wilderness (SAMAB 1996b).

For many residents of the southern Appalachians, the abundant hunting and fishing opportunities are a substantial draw. Almost two-thirds of the residents favor stocking fish in streams and lakes to provide increased sportfishing (SAMAB 1996b). For some residents, the tradition of hunting and fishing is a valuable part of a cultural heritage going back hundreds of years, and survey results indicate that the desire to preserve the outdoor hunting and fishing lifestyle is strong (The Nature Conservancy 1996).

Survey results reported in SAMAB (1996b) demonstrate that many residents of the southern Appalachians also value the area's high environmental quality. Over 70 percent agree with the statement, "land that provides critical habitat for plants and animals should not be developed." Residents also overwhelmingly believe that "industries which pollute the water and air should pay for the clean-up even if it means the loss of jobs or profits." Residents even are willing to expend their own money to maintain or increase environmental quality. Results of a contingent valuation survey indicate that residents in Gaston County, North Carolina, are willing to pay for improvements in water quality (Danielson and others 1995). Three-fourths of the respondents to a survey in southwestern Virginia stated that the quality of life in the area would prevent them from ever leaving the area (Cromer 1994). Although it is difficult to specify the particular amenities that residents value, there is no question that natural-resource amenities play an important economic-development role, influencing all sectors of local and regional economies in and near the southern Appalachians. Forest-management decisions affecting these amenities can have wide-ranging economic impacts throughout the region.

Competition for Forest Resources

The taxonomy (see fig. 1) of competing demands for forest resources can provide useful insights into the relation between the forest resources and economies of the southern Appalachian region. To illustrate, we look at some of the demands competing with the timber industry. Following the structure of figure 1, we use box 1 to represent those who benefit from conventional timber-production activities in the southern Appalachians, and box 2 includes those who incur costs because of the impacts of these activities on recreation and water. Box 3 represents those who incorporate the forest amenities of the southern Appalachian region into their locational decisions, and box 4 represents those who place an intrinsic value on specific forest resources. The readily available data from SAMAB (1996b) and other sources demonstrate that the competing demands are strong and that any decision regarding the allocation of resources to the timber industry will have complex effects on the overall value of the bundle of goods and services derived from the forest and on the distribution of forest-related jobs and incomes.

Box 1: Benefits Associated With Allocating Forest Resources to Industrial Timber Production

Our earlier discussion of the southern Appalachian timber industry shows that, although it has played an important role in the local and regional economies in the past, its importance probably will remain at best stagnant in absolute terms and decline relative to other sectors. The volume logged is expected to increase, but most logs will be of low quality and become raw materials for composite board, pulp, and other commodities. Strong global competition for these commodities will put downward pressure on prices and encourage producers to pursue labor-saving and other cost-cutting strategies. The USDA Forest Service projects a 21-percent decline in timber-industry employment in the South by 2030 from 1984 levels, or a loss of 54,000 jobs in the lumber and wood industry and 31,000 jobs in the pulp and paper industry (USDA Forest Service 1988) . Similar pressures apply to the high end of the industry, in the furniture sector, where imports of wood furniture have increased from about 7 percent of U.S. consumption in 1978 to nearly 25 percent in 1990 (Smith and West 1994).

The implications of these trends for forest-management and economic-development policies are clear. Few workers, households, and communities can count on the industry as a reliable generator of secure jobs and higher incomes. The number of jobs and the amount of income generated per acre logged will become smaller and smaller. Few communities can expect expansion of the industry to provide the basis

for future economic growth, and most communities currently highly dependent on the industry should expect economic stagnation or decline unless they find alternative sources of growth. Increasing the allocation of forest resources to timber production (that is, logging more acres at a faster pace) might forestall these trends for a short time, but eventually the powerful, global market forces underlying them will prevail.

Box 2: Recreation-Related Opportunity Costs From Timber Production

Its mountains, cooler temperatures, scenic views, and recreational opportunities make the southern Appalachians a recreational oasis for many residents of the Eastern United States. When forested lands are used for recreation, economic value is obtained. Logging can have a complex impact on the recreational values derived from a parcel—increasing some hunting values, for example, while decreasing fishing values—but the net effect in many, perhaps most, cases is negative. When logging causes a reduction in recreational use, the forgone economic value, called opportunity costs by economists, is lost to the community, region, and Nation. To understand the full economic consequences of allocating forest resources to the timber industry, one must consider these recreational opportunity costs.

When recreational resources are abundant, relative to demand, the opportunity costs may be low, insofar as recreationists can respond to the logging of one site by shifting to another. The South—indeed, all of the United States east of the Mississippi River—has a limited supply of forest lands in Federal or other public ownership and readily available for recreational use. Hence, recreationists in that area generally have far fewer options than those in, say, the West when logging reduces the recreational attractiveness of a particular site. Cordell and others (1990), for example, found that recreationists in the West have about 5 to 15 times more land-based recreational opportunities than do those in the South.

Other factors limit the availability of recreational substitutes even further. Strong emotional and symbolic ties to a specific recreational setting may reduce an individual's willingness to substitute settings (Williams and others 1992). For individuals who have a strong attachment to a specific site, the setting itself may be as important a reason for visiting the site as the recreational activities pursued (Mitchell and others 1993). For such individuals, no other site may be viewed as an adequate substitute.

Given the current supply of forested land, many recreational sites in the southern Appalachians already face greater demand than can be accommodated (English and others 1993). Figure 14 illustrates the distribution of the 241 hotspots, or locations where recreation managers observe capacity is reached on peak weekends. It also shows selected urban centers. Hotspots follow the outer edge of the southern Blue Ridge Mountains and are not far from urban areas, such as Atlanta, Charlotte, and Knoxville. With short weekend trips growing in popularity, these hotspots are likely to become even more congested as the population in the region grows (Dwyer 1994). As people continue to move into the rural sections of the southern Appalachians, demand will increase also for the more isolated wilderness experiences.

Future demand for outdoor recreation in the southern Appalachian region is expected to be influenced by several demographic changes. A growing regional population, coupled with increased participation in outdoor activities by seniors, women, and minorities will probably affect patterns of outdoor recreation use and participation rates. According to SAMAB (1996b), demand for recreation in the southern Appalachia region is expected to increase for such as activities as pleasure driving, sightseeing,

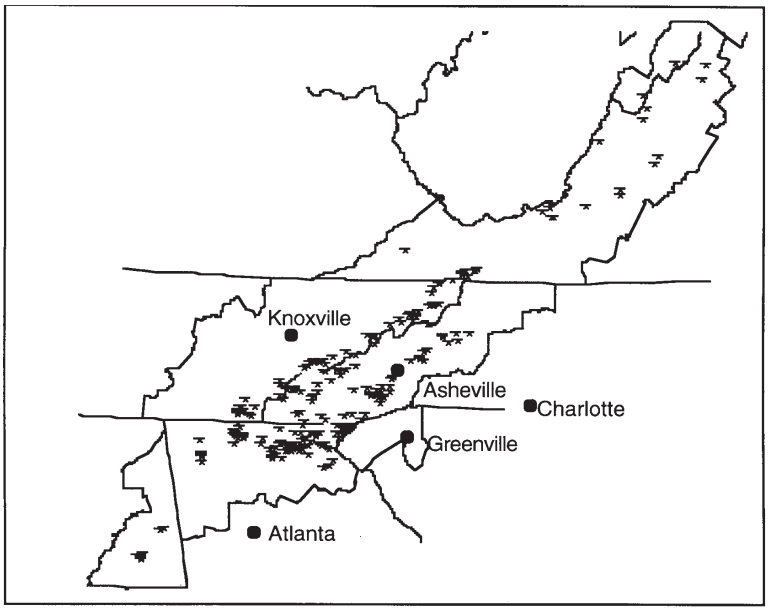

Figure 14—Recreational sites at full capacity in the southern Appalachians.

and camping. A 1993 Forest Service study (English and others 1993) projects demand in excess of supply at existing prices at rates between 25 and 50 percent for the supply of recreational services in day hiking, wildlife observation, photography, cross-county skiing, and backpacking in the South by 2040.

The SAMAB (1996b) also reports that the economic value of total output from recreation-based tourism nearly rivals the combined value of the agriculture, forestry, and fisheries industries. Recreation expenditures in the region in 1995 totaled $5.8 billion (1995 dollars) with the highest amount, $3.1 billion, being spent on activities at developed sites, such as camping, picnicking, and sightseeing (see table 2).

Outdoor recreation generated 100,700 jobs in the southern Appalachian region in 1995, with almost one-third of the jobs directly related to recreation on Federal lands.

These recreation-based expenditures generate jobs and incomes for southern Appalachian residents. Outdoor recreation generated 100,700 jobs in the region in 1995, with almost one-third of the jobs directly related to recreation on Federal lands. The counties having the most jobs dependent on recreation on public land are close to two national parks in the area and to the concentration of National Forests in western North Carolina. In six counties, recreation on Federal lands supports over 10 percent of total employment.[6] To put this in perspective, the economic impact of recreation-based tourism is almost as high as the combined employment from agriculture, forestry, and fisheries in the southern Appalachians, which together generate 114,000 jobs.

The economic impact of the availability of recreational resources extends far beyond the borders of the southern Appalachians. Almost 80 percent of all recreational trips to the area originate outside the region (SAMAB 1996b). For example, most visitors to the Smoky Mountains come from Florida and Georgia and most visitors return to

[6] These counties are Rabun County, Georgia; Bath County, Virginia; and Avery, Graham, Swain, and Transylvania Counties, North Carolina (SAMAB 1996b).

Table 2--Total expenditures for outdoor recreation activities in the southern Appalachians,1995

Outdoor recreation activity	Total expenditures
	Million 1995 dollars
Developed sites	3,145.3
Dispersed	1,384.7
Developed water	673.6
Wilderness	64.1
Fishing	292.0
Hunting	37.2
Nonconsumptive wildlife	215.6
Total	5,812.5

Source: ECONorthwest with data from SAMAB (1996b).

the area at least once a year (Smoky Mountain Host of North Carolina 1995). This implies that residents from as far away as Florida have come to rely on the availability of recreational opportunities in the southern Appalachians, consider the region an important component of their quality of life, and make their locational decisions accordingly. Additionally, although the magnitude is unknown, some recreational expenditures associated with trips to the southern Appalachians occur, not near the recreationists' destination, but near their residence. Some visitors from Florida, for example, undoubtedly buy camping equipment, fishing supplies, and recreational vehicles in Florida, so that resource allocation decisions made in the southern Appalachians affect the economy of Florida.

The fact that many recreationists using forest resources in the southern Appalachians come from outside the immediate vicinity adds geographic complications to the competition for those resources. Often, the beneficiaries of logging (represented by box 1 in figure 1) reside nearby, but the recreationists who incur the opportunity costs when logging degrades a recreational site, live elsewhere. Looking at the economic consequences of forest-management decisions affecting recreational resources solely from the perspective of one group or the other necessarily will reveal only part of the whole story.

Box 2: Water-Related Environmental Externalities of Timber Production

The degradation of aquatic ecosystems and the creation of sediment by logging practices has a long history. Although these and other water-related externalities of timber production today differ in important ways from those of the past, they continue to be substantial (Belt and others 1992, Furniss and others 1991, Megahan 1986) and to have a depressing impact on local and regional economies. The water-related costs imposed on others offset many of the benefits that accrue to those directly associated with the timber industry. Internalizing of these costs would induce landowners and logging operators to forgo logging of some sites or adopt logging techniques less likely to degrade aquatic ecosystems and generate sediment. Continued externalizing of these costs will increase the costs for households, public agencies, and firms in nontimber sectors.

With the extension of the railway system into the southern Appalachian Mountains, logging companies clearcut most of the forested land by 1919 with devastating effect on the ecosystem. The SAMAB (1996a: 12) provides a good summary:

> Loggers had little regard for aquatic systems. Roads and railroads were built in many of the river and stream bottoms. They extended up the narrow mountain hollows where the stream channel itself was commonly used as a road bed. Stream crossings were numerous and were not constructed with any intent to protect the channel or its resources. Splash dams were constructed on many small streams to store water and flush logs downstream to saw mills. Riparian vegetation was often cut to clear the channel logs while floating downstream.
>
> Logging often resulted in excessive erosion and sedimentation of the channels, frequently causing braided or multichannel streams. Streams sometimes began flowing down abandoned roads instead of the natural channel. Some streams were scoured clean, while other streams were choked with logging debris. Impact to stream biology ranged from little effect to a total change in species mix or even elimination of fish life.

The Weeks Act, which created the National Forests in 1911, authorized the purchase of "forested, cutover, or denuded private lands within watersheds of navigable streams, as necessary, to secure favorable flows of water." With the healing of time and decades of restoration efforts, much of the physical devastation from early logging is no longer an issue. From the early 1930s to the adoption of the Clean Water Act in 1972, industrial and municipal waste remained the primary focus of water quality experts. In the last 25 years, the rate of water quality improvement has slowed. The easy jobs have been completed. The remaining sources of pollution, such as storm runoff, sediment contamination, and spills, are more expensive and difficult to control.

A Tennessee Valley Authority study of the Little Tennessee River basin in northwestern North Carolina illustrates the significance of problems associated with soil erosion; soil loss is estimated at a rate of 2.62 million tons per year in a basin of 197,000 acres (Hagerman 1992).[7] See table 3 for the breakdown of soil loss by land use categories. Conventional forest-harvesting practices, present in 1.4 percent of the study area, accounted for 0.5 percent of the total soil loss. Clearcut areas, defined as recently harvested areas with an open canopy, generated 18.6 tons per acre per year. In contrast, sedimentation in forested areas with a closed canopy was assumed to be negligible. Unpaved roads, which often are associated with timber production, accounted for 26.0 percent of total soil loss and produced an estimated 120 tons per acre per year of sediment (Hagerman 1992).

The chain of events connecting specific timber-production practices on sites with specific geomorphological and vegetative characteristics in the southern Appalachians to changes in sediment and aquatic systems, and hence, to the downstream economy, has not been pieced together. Numerous studies elsewhere and for the Nation as a whole, however, provide a strong general sense of the mechanisms associated with these events and, in some cases, their magnitude. A study of a program to limit erosion from farms and ranches (Ribaudo 1989) describes the ways in which sediment from a particular site can cause offsite economic damage and identifies these major types of offsite economic damage from sediment:

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[7] The study area encompasses the portion of the Little Tennessee watershed from the headwaters in Rabun County, Georgia, to Porters Bend Dam, which forms Lake Emory, near Franklin, North Carolina (Hagerman 1992).

Table 3—Estimated soil loss by land use, Little Tennessee River, North Carolina

Land use	Total land	Annual estimated soil loss	Soil loss
	Percent		*Tons per acre per year*
Forest harvest area	1.4	0.5	18.6
Closed canopy forest	75.8	0	0
Pasture	10.6	30.9	29.3
Unpaved roads	2.2	26.4	120.0
Disturbed	0.5	18.2	360.4
Urban	5.7	11.7	20.6
Crop land	1.2	8.1	66.9
Scrub	2.9	4.2	14.7

Source: ECONorthwest with data from Hagerman (1992).

- Reduction in the value of freshwater and marine recreation
- Increase in damage from floods
- Increase in the cost of maintaining roadside ditches
- Reduction in the productivity of commercial fisheries
- Increase in municipal drinking water treatment costs
- Reduction in the quality of municipal and industrial water
- Increase in the cost of using water for industrial cooling processes

The economic costs imposed on others by the runoff of sediment average $1.94 per ton of sediment per year in the Appalachian region.

The economic costs imposed on others by the runoff of sediment, according to Ribaudo (1989), average $1.94 per ton of sediment per year (updated to 1995 dollars) in the Appalachian region, which includes the Little Tennessee River basin area. Hagerman (1992) estimates that soil loss occurs at a rate of 2.62 million tons per year in a 197,000-acre portion of the Little Tennessee River basin. Assuming that the value per ton of sediment estimated by Ribaudo can be applied to the annual soil loss on a portion of the Little Tennessee River that Hagerman studied, the current annual cost imposed on others from offsite damages from a variety of land uses is about $5.1 million per year. Forest harvesting, which covers an area of about 2,740 acres, causes 0.5 percent of the total soil loss and, hence, about $25,500 of damage per year. Estimates of how long it takes for the sedimentation rate to return to preharvesting levels after clearcutting differ in the Southeast (Dissmeyer and Stump 1978, Glasser 1989, Van Lear and others 1995). It is clear, however, that both sedimentation and the costs it generates persist for several years. Because Hagerman's (1992) sedimentation estimates apply to only a two-county area of the southern Appalachians, the economic impacts on the region as a whole are much larger. Furthermore, these figures do not include the onsite economic damage that occurs when the sediment flowing from the site reduces the site's future productivity. Ribaudo (1989) observes that these onsite damages may be roughly of the same magnitude as the offsite damages.

This illustration suggests, however, that the timber industry realizes an implicit subsidy when it imposes costs on others in the form of sediment and other environmental externalities. If the timber industry had to compensate those who bear these costs, it undoubtedly would conduct less logging or change its logging practices, or both, to reduce the flow of sediment. Workers and investors in other industries, together with taxpayers, currently bear these costs, and in doing so, they subsidize the workers and investors in the timber companies that log in southern Appalachian National Forests.

Households and municipalities facing a forest-management decision need to evaluate the impact of rising water-filtration costs on the development of the region.[8] When timber-related sediment increases the water filtration costs of municipal water suppliers, these costs eventually become the equivalent of a tax on households and industries. Industry alone accounts for about two-thirds of water withdrawals within the southern Appalachians, with domestic use responsible for another 20 percent (SAMAB 1996a). As the area continues to attract retirees, second-home owners, and others in search of natural amenities, the demand for domestic withdrawals will likely increase.

Demand for a high level of water quality is increasing in the southern Appalachians. Standing forests produce less sediment and also provide a natural filtration system for removing pesticides, toxins, and other substances from the water (Bolstad and Swank, n.d, Swank and Bolstad 1994). Because nine major rivers have their headwaters in the southern Appalachians, forest-management decisions there could affect the water supply and productivity of a large portion of the United States. As the competition for water increases, the economic impacts of conventional logging practices will similarly increase (SAMAB 1996a).

As the southern Appalachians continue to attract retirees, second-home owners, and others in search of natural amenities, the demand for domestic water withdrawals will likely increase, creating a need to evaluate the impact of rising water-filtration costs on regional development.

Box 3: Quality-of-Life Costs of Timber Production

Our discussion above, especially in chapter 1, shows ample evidence to conclude that forest-management decisions significantly altering the supply of amenities important to the locational decisions of households can affect the size and structure of local and regional economies throughout the southern Appalachian area. Much uncertainty remains, however, regarding the identification of the relevant amenities and the size of their importance.

[8] Although the problem of sediment is growing in the area, municipal and industrial sources of pollution in the study area now degrade the river ecosystem less than in the past. In 1991, for example, the Burlington Industries Carpet Mill at Rabun Gap, Georgia, the major industrial discharger in the watershed, ceased discharging, thereby leading to noticeable increases in aquatic macrophytes in the river downstream. In the municipal side, Dillard, Georgia, doubled the capacity for its wastewater treatment plant and the town of Franklin, North Carolina, sought a discharge permit more stringent than that proposed by the State Division of Environmental Management (Tennessee Valley Authority 1993).

One measure of the amenity-related economic value of outdoor recreation is the consumer surplus derived from the recreational activity. The consumer surplus is the economic value recreationists receive from their recreational experience in excess of the cost they incur for the experience, and in concept, the sum of the expenditures and consumer surplus equals the total value of the recreational activity. Recreational activities affect household locational decisions insofar as recreationists choose to live close to the amenity and increase their consumer surplus. A loss of consumer surplus represents an economic loss no less real for being intangible than the loss of more tangible assets, such as money.

The SAMAB (1996b) reports both the number of trips and the consumer surplus per trip for different categories of recreation. To estimate the value of consumer surplus, we multiply the total number of trips in each category by the range of values assigned to activities that fall within the general category (table 4).[9] In 1995, for example, 10.2 million fishing trips were made. Consumer surplus in 1995 depends on the type of fishing, cold-water ($62.47 per trip) or warm-water ($23.26 per trip), which indicates that the total fishing-related consumer surplus in 1995 was in the range of $237 to 637 million. The annual consumer surplus for all types of recreational activities in 1995 fell between $1.6 and 11.2 billion for the entire region.

The annual consumer surplus for all types of recreational activities in 1995 fell between $1.6 and 11.2 billion for the entire southern Appalachian region.

These numbers give a rough approximation of the extent to which recreational activities might serve as a magnet and affect household locational decisions. One must use such numbers carefully, however, because the value recreationists place on a recreational activity represents more than the enjoyment of performing the recreational activity itself. The value recreationists assign to an activity is affected by variables, such as the travel distance, the weather, and the density of other recreationists. Given this complexity, one must bear in mind that estimates of recreationists' expenditures and consumer surplus are aggregate indicators of the value of the recreational activity and not precise measurements. One must also be careful when using the average value of recreational activities in the past to estimate the value recreationists will place on future recreational opportunities. In general, economists expect the value per recreational experience to increase (decrease) as quality and quantity of recreational opportunities decrease (increase) when all other conditions are held constant.

Despite all these cautions, however, it seems clear that forest managers in the southern Appalachians, as they make decisions affecting forest activities, also make significant economic decisions affecting households throughout the Southeast.

Box 4: Biodiversity-Related Intrinsic Values of Timber Production

The forested ecosystem of the southern Appalachians houses several threatened and endangered species at risk of extinction from habitat-degrading activities of forestry, agriculture, and grazing. The risks to these species and their habitats diminish the economic well-being of persons who care, regardless of their place of residence. "In Southern Appalachia, agricultural development and associated factors of aquatic contaminants and sedimentation were the most important activities leading to species rarity in this region" (Flather and others 1994: 23). Three-quarters of the endangered species in the southern Appalachians are associated with stream ecosystems and

[9] Researchers used the travel cost method and survey data from various recreation sites in the Southeastern United States to obtain net economic values. For a full explanation, see SAMAB (1996b).

Table 4--Consumer surplus derived from selected outdoor recreation activities in the southern Appalachians, 1995

Outdoor recreation activity	Total trips	Range of net economic value per trip	Consumer surplus
	Millions	*1995 dollars*	*Million 1995 dollars*
Developed sites	58.6	16.23- 85.43	951- 5,006
Dispersed	18.1	13.39- 291.22	242- 5,274
Developed water	7.7	25.86- 39.17	199- 302
Fishing	10.2	23.26- 62.47	237- 637
Total			1,629-11,219

Source: ECONorthwest with data from SAMAB (1996b).

are especially vulnerable to logging practices that impinge on them. Furthermore, the increase in sedimentation that accompanies conventional logging and other extractive practices has been found to contribute to the endangerment of 60 percent of the species (Flather and others 1994).

The rich biodiversity of the region is an integral part of the culture of the southern Appalachians.

The rich biodiversity of the region is an integral part of the culture of the southern Appalachians. National survey results summarized in SAMAB (1996b) suggest that the economic values associated with the ecosystem are large, although difficult to measure. By explicitly addressing them in box 4 of figure 1, however, we complete the story of the demands competing with the timber industry for the southern Appalachian forest resources. Whenever agencies, officials, or the public at large face decisions on the management of the forests, they should acknowledge the existence of these values and incorporate them formally into their decision-making.

Economic Long-Run Adjustment to a Forest-Management Decision

Most markets in the economies of the southern Appalachians should adjust quickly to most forest-management decisions and, in particular, to decisions restricting timber-production policies based on past, incomplete consideration of all competing demands for forest resources. The adjustment should be relatively minor for the area as a whole for three reasons: (1) a Federal forest-management decision would impact only 20 percent of the forested land in the region, rendering the negative impacts of a decision minimal in absolute and relative terms compared to the total economic activity in the area; (2) the negative impacts of a curtailment of timber production would directly affect a sector of the economy that is declining in importance and is anticipated to contribute little to the growth of the economy; and (3) the potential positive impacts of the decision may help mitigate or even outweigh the negative impacts.

The transition for local markets may not be as quick or as smooth as the transition for larger regions. The most rapid adjustments are likely to occur in markets where labor, land, or capital resources have multiple employment opportunities and can take advantage of these opportunities with little difficulty. These conditions prevail throughout most, if not all, sections of the southern Appalachians, especially those with the closest economic connections to metropolitan areas.

Capital Markets

Given the extensive expansion and dramatic transitions of U.S. capital markets in the past decade or so, we expect rapid adjustments in capital markets, such as the markets for business and residential loans. To bring allocations for timber production into line with competing demands, a forest-management decision should trigger a reduction in the availability of funds for a narrow set of activities, but it should have little effect on the availability of funds for other activities. Business loans for the least competitive firms in the lumber and wood products sector, for example, may become incrementally harder to obtain because of the decision, but the supply of capital for firms in other sectors and for competitive lumber and wood products firms should be unaffected. In general, capital markets throughout the area probably would experience minor or insignificant transitions as a result of a forest-management decision.

Property Markets

Reduction in the allocation of forest resources to timber production, consistent with the other competing demands, will depress the value of some properties, relative to what otherwise would occur, increase the value of others, and leave the remainder unaffected. Reductions will occur for properties whose value incorporated expectations of residential, commercial, or industrial benefits from higher timber production. Increases will occur for those that will benefit from the reduction in box 2 timber-related costs and the adverse impacts of timber production on quality of life (box 3).

Residential-property markets generally adapt quickly to changes in market conditions as long as the markets continue to expand. If property values decline, however, these markets can become sluggish for several years as owners hold on to their homes rather than take a loss. Forest-management decisions reflecting the full consequences, boxes 1 through 4, of timber production would be unlikely to cause contraction in the economic regions closely tied to the southern Appalachians. To the contrary, we anticipate that the economy would continue to grow for reasons unrelated to the decision. Hence, any contraction of residential-property markets would be local in nature, if at all. To the extent that the decision reduces the box 2 costs on nontimber sectors and enhances the quality of life of the area (box 3), it would reinforce long-run population, employment, and economic growth and increase property values locally and throughout the area.

Labor Markets

Local firms experiencing reduced demand for their goods and services as a timber firm cuts back its production and payrolls would seek new markets. Depending on characteristics of the firm and the economy, some firms will be more successful than others at finding new markets. If the impacts of a forest management decision are minimal, the impacts on labor markets would be similarly small. As with property markets, reductions in the allocation of forest resources to timber production would have mixed impacts on labor markets. The demand would decline for some workers, increase for others, and leave the remainder unaffected.

It is essentially impossible to predict where layoffs would occur in response to a forest-management decision. Wherever they occur, though, the displaced workers would draw on unemployment-insurance benefits and whatever savings and other resources they have available to offset a portion of their lost wages. Many would have access to timber-retraining benefits, including community college programs, and other assistance programs. Most dislocated workers would find replacement jobs, though the search for new employment is not without social, emotional, and economic cost to the workers and their families (U.S. Bureau of Labor Statistics 1993). A study of how quickly displaced workers find new jobs shows that workers in the South, which includes the seven states containing the southern Appalachians, have a 7 to 13 percent higher chance of being reemployed, relative to other regions of the United States (Herzog and Schlottmann 1995).

The impacts on the individual who loses his or her job would be different and more intense than those on the overall labor market. Based on past experience, we anticipate that some workers would experience prolonged unemployment and severe reductions in incomes, others would experience brief unemployment and limited reductions in incomes, and still others would move quickly to equal or higher paying jobs. Of the workers nationwide who lost their jobs because of plant closures or other mass layoffs in the 1980s, about half were unemployed less than 10 weeks, and the percentage remaining unemployed after 12 months was roughly the same as the rate of unemployment for the overall labor force (Power and others 1996).

All dislocated workers, no matter what their levels of financial and human capital, face social, emotional, and economic costs in making a transition to new employment. The longer a dislocated worker and his or her family delay in seeking new employment or training, the more they draw down their financial resources and increase the social and emotional costs of finding replacement employment. This is especially true for workers and families facing dislocation from an industry with declining prospects for employment in the future, such as the timber industry in the southern Appalachians.

Economic Consequences of Allocating Forest Resources to Timber Production

The focus of this exercise was to illustrate the application of the analytical framework represented by figures 1 and 3. Applying the framework in a setting (the southern Appalachians) where the actual assessment of the economic consequences of alternative forest-management decisions is necessary required aggregating the separate findings for boxes 1 through 4 and looking at the aggregate effects of each alternative decision on the economy. The assessment describes the economic value of the goods and services derived from the forest under each alternative. To streamline this analysis, visualize a scale with box 1 economic values on one side and the economic values associated with boxes 2 through 4 on the other side. In our discussion above, we show that box 1 economic values are stagnant or falling for the southern Appalachian National Forests as box 2 values are increasing. At some point, the costs associated with sediment outweigh the economic benefit from logging on National Forest lands. Add to the scale the increasing economic returns to natural amenities, and the scale tips more rapidly in favor of boxes 2 through 4. The intrinsic value associated with the existence of species threatened by logging practices raises the scale even more.

We repeated this analysis for the short- and long-run impact on jobs, incomes, and other variables that embody the relation between the forest and the structure of the regional economies in the southern Appalachians. In this case, the jobs and income generated by timber production are weighed against the forgone jobs and income from box 2 and box 3 industries. The economic impacts from box 1 are falling and likely to continuing falling in the future even as timber production increases. At the same time, the economic impact of the forgone jobs and incomes associated with the degradation of natural resources likely will continue to grow.

Although most economists might conclude the analysis there, we believed it was important to include a discussion of how different groups are likely to perceive the fairness of each alternative decision and focused on issues related to the rights and responsibilities of property owners and groups of special concern. The distribution of the economic values and impacts from a forest-management decision imply a great deal about the future structure of economic growth. Every forest-management decision results in job and income gains and losses. It is important to acknowledge who will bear these losses and who will benefit.

Any discussion of the aggregate economic consequences of specific forest-management decisions will be complex. The forest-economy relation is in itself complex, as are the uncertainties inherent in the information readily available for describing this relation. Our experience has shown that the analytical framework we present here is useful, because it both communicates this complexity and helps different groups focus on their individual concerns. It responds equally to the concerns of those wanting to know if a forest-management decision will increase or decrease the economic value of the goods and services derived from the forest, those worried about the impacts of the decision on jobs, and those focused on whether the decision is fair.

Providing information about all the potential economic consequences of a forest-management decision sets the stage for double counting. One should not, for example, add the value of the timber derived from the forest to the value of the wages paid to timber-industry workers and the value of the taxes paid by mill owners to derive a total value associated with this box 1 use of forest resource. Similar examples can be developed for boxes 2 through 4. Both analysts and consumers of the information bear a responsibility for using the information appropriately.

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Method is described for assessing the competing demands for forest resources in a forest management plan by addressing economics values, economic impacts, and perceptions of fairness around each demand. Economics trends and forces that shape the dynamic ecosystem-economy relation are developed. The method is demonstrated through an illustrative analysis of a forest-management decision in the southern Appalachian Mountains.

Keywords: Economics, timber sales, endangered species, natural amenities, recreation

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