



SUSTAINABLE FORESTRY MANAGEMENT AND WOOD PRODUCTION IN A GLOBAL ECONOMY

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Sustainable Forestry Management and Wood Production in a Global Economy

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INTEGRATING WOOD PRODUCTION WITHIN SUSTAINABLE FOREST MANAGEMENT

Integrating Concerns About Wood Production and Sustainable Forest Management in the United States

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SUMMARY. The implementation of Sustainable Forest Management (SFM) in the United States is strongly influenced by U.S. forest products markets and the numerous management decisions made by individual landowners and managers. These decisions are influenced by a mix of market incentives and regulatory actions reducing predictability in as-

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sessing progress toward SFM and causing angst for some proponents of SFM because prices might provide insufficient incentive for what they believe are necessary forest practices. At the same time, conservation proponents are advocating forest management regimes that lead to reduced financial returns. These dual concerns are leading to new alliances and new approaches for forest-based conservation and management. doi:10.1300/J091v24n01_01 [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>>.]

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INTRODUCTION

The U.S. forestland base is 298.3 million ha (737 million acres) that includes 197.9 million ha (489 million acres) of timberland defined by criteria of productivity and availability for harvest (see Smith et al., 2001 for a detailed description of the U.S. timber resource). The largest share of timberland (73%) is privately owned by a variety of owners including forest industry, farmers, and numerous private individuals.

Over the past century, persistent rising stumpage prices have provided adequate returns to maintain or expand forests and forest management. This improved forest management and protection has created a vast commons of forest or ecosystem services and goods, many of which are free to those who choose to enjoy them. By the end of the 20th century, the presence of these forested commons led to societal expectations for relatively well managed and productive forests capable of producing a wide array of goods and services. Coincidentally, institutions motivated by concerns about forests and sustainable development have and are continuing to evolve to assist in governing this forest estate.

But the recent weakening of expected returns for forest management raises concerns about whether North American forests can meet societal expectations for both making progress toward sustainable forest management (see Haynes, 2004) and the provision of ecosystem services expected by increasingly urbanized populations. At the same time, questions are emerging about the effectiveness of the institutions that have evolved to promote forest management and to control (or modify) human behavior to conserve non-market ecosystem services (see Brechin et al., 2002).

We also need to be clear about what we mean when we use the term 'forest management.' Here it is used to describe the process of manag-

ing a stand, collection of stands, or a forest to meet the objectives of the landowners. In the case of private forestland owners, particularly those interested in financial returns (timber is considered a capital asset and part of an individual's portfolio of investments), their objectives often center on the production of marketable goods such as timber, hunting rights, and selected nontimber forest products such as floral greens in an environmentally sound fashion. Public forestland owners typically have broader management objectives including the production of both market and nonmarket goods.

The purpose of this paper is to discuss the changing basis for forest-based conservation and management in the coming century. There are several issues to consider. First, there are the dual arguments that proponents of forest management relied on in the past. What is the specter for changes in these arguments? Related to these, are two management issues that will challenge landowners.

The first issue is the role that long-term stumpage price increases have played in generally enabling the public to have both relatively cheap timber products and a variety of nonmarket goods that have been provided free to the public. With weakening stumpage prices and continued loss of forestland to development, concern is growing that the public may have to provide financial incentives to maintain the expected level of environmental goods and services.

There are two related issues to the question of incentives that will challenge policy makers. First, what are the sizes of the incentives that might be necessary for landowners to remain financially neutral to changes in management for public goods? Second, why do some landowners continue to invest in forestry in spite of what might seem like weak price expectations?

A second set of issues includes the emerging challenges of how to govern the forested ecosystem when forest management takes place across relatively large geographic spaces composed of many different landowners with a myriad of land management objectives. Here governance refers to the various models of decision making and power sharing. While not covered here, the issue of governance also includes various justice issues such as who has the right to participate and how to include people who are typically underrepresented.

WHAT IS THE CONTRIBUTION OF RISING PRICES?

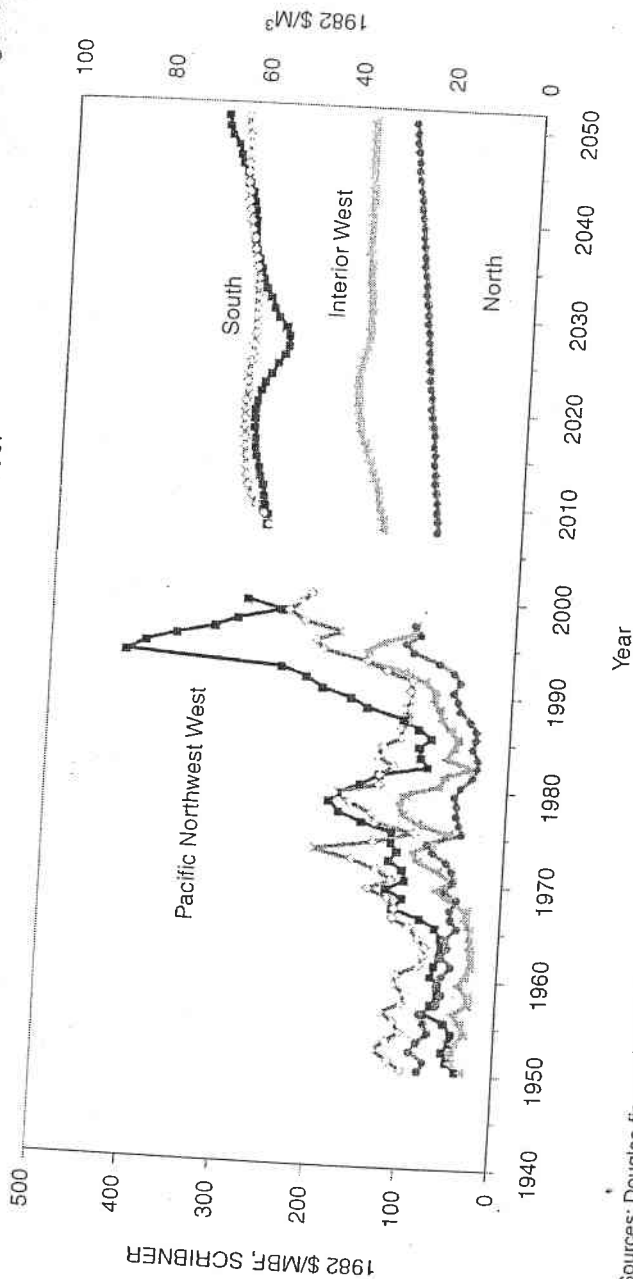
Past prices and markets for various types and sizes of timber have influenced the goals for land management and the evolution and applica-

tion of various management regimes. As shown in Figures 1 and 2, these forest product prices are often characterized as highly volatile but are increasing faster than the overall rate of inflation. In both the Douglas-fir region (western Oregon and Washington) and in the South, for those landowners sensitive to financial returns, rising prices for timber products have led to the adoption of relatively systematic forest management regimes consisting of practices that tend to speed development of well-stocked forests (see Haynes et al., 2003 for a history of increasing forest management in the Pacific Northwest). At the same time, rotation ages for these managed forests have dropped, leading to more frequent entries and a greater proportion of the forest in relatively young stands (stands 20 years or less). This increases the financial returns to those (individuals, companies, and various publics) who own timberlands. Current and expected trends show private timberland owners continuing to invest in forest management, subject to increasing regulations of various forest practices (see Haynes, 2003). Public lands, on the other hand, are expected to be managed for diverse goals—many not involving the marketplace—reflecting increased recognition of the benefits of many nontimber forest goods and services.

The data in Table 1 show three periods with separate price trends: until 1990 for each of the data sets, the last decade, and projected price trends for the next 50 years (see Haynes, 2003 for an expanded discussion of the timber situation and projections for the U.S. forest sector). Since World War II, the long-term trends reflect slightly faster growth in consumption relative to timber supplies, which has led to increased imports to help meet demand.

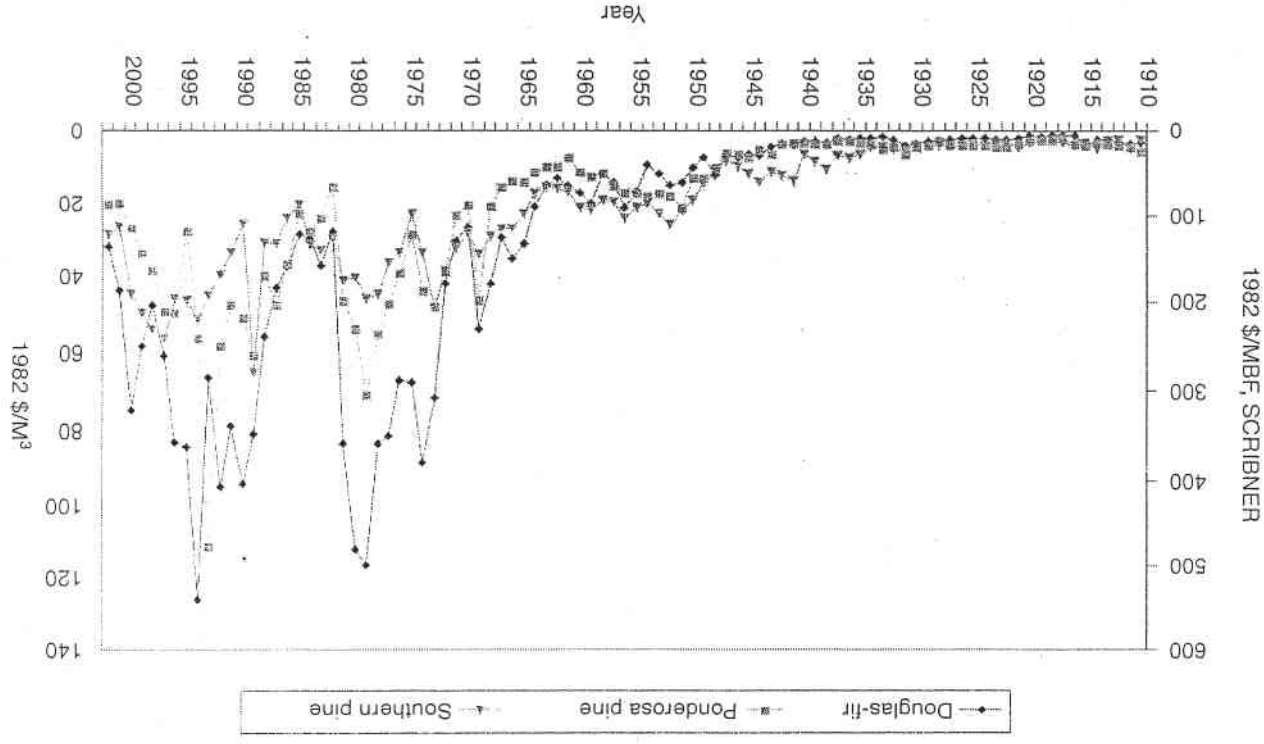
From an economic perspective, the general history of rising prices (as shown in Figure 2) suggests that timber is relatively scarce and, all else being equal, that there should be changes in various market factors to alleviate the price increases. This behavior is expected as these are relatively efficient (free) markets comprising numerous producers and consumers making decisions based on understanding of available information. The history of rising prices should also encourage consumers to substitute nonwood material in some uses such as residential construction (e.g., steel studs for framing) if the real prices of the substitute are less (or more stable) than wood prices. These rising stumpage prices have encouraged increased efficiency and diversity in the mix of forest products as producers looked for ways to increase returns. Rising prices should also encourage landowners and managers to increase the intensity or extent of land management to produce more timber (to the point where timber prices become stable).

FIGURE 1. Softwood sawtimber stumpage prices in 1982 dollars per thousand board feet (MBF) Scribner log rule and 1982 dollars per cubic meter (M^3), by major U.S. region, 1950-2050.



Sources: Douglas-fir, ponderosa pine, and southern pine sawtimber prices are updated from series published in *The Outlook for Timber in the United States* (USDA, 1973 Appendix 5, Table 2). Northeast prices are updated from data published by Sendak (1994). Projections for 2010 to 2050 are from Haynes (2003).

FIGURE 2. Stumpage prices by species, 1910-2002.



Sources: Douglas-fir, ponderosa pine, and southern pine sawtimber prices are updated from series published in *The Outlook for Timber in the United States* (USDA, 1973 Appendix 5, Table 2).

TABLE 1. Rates of stumpage price appreciation.

A. Traditional softwood sawtimber prices				
Years	Douglas-fir sawtimber	Ponderosa pine sawtimber	Southern pine sawtimber	
		Percent		
1910-2002	5.1	3.6	3.4	
1910-1990	5.6	4.0	3.8	
1991-2002	-6.9	-8.8	0	
2000-2050	.2	N/A	.6	
B. Northeast prices				
Years	Hardwood sawtimber	Hardwood pulpwood	Softwood sawtimber	Softwood pulpwood
		Percent		
1961-2002	4.6	.5	1.3	.7
1961-1990	4.5	.9	.8	0
1991-2002	3.8	0	3.9	0
2000-2050	.2	0	.4	.7

Sources: Douglas-fir, ponderosa pine, and southern pine sawtimber prices are updated from series published in *The Outlook for Timber in the United States* (USDA, 1973 Appendix 5, Table 2). Northeast prices are updated from data published by Sendak (1994). Projections for 2000 to 2050 are from Haynes (2003).

The general slowing of the price trends in the 1990s reflects the growing importance that managed forests (with higher volumes of wood per hectare) are playing in providing timber supplies in the United States (see Table 20 in Haynes, 2003). The projected price trends (also shown in Figure 1) reflect this increased role of managed forests that are located on a relatively small part of the forest land base (that is, we anticipate a large increase in both harvest and inventory volumes on a relatively constant area base—see Haynes, 2003 for details). Such forests offer a relatively certain supply of timber at lower logging costs. The projected price trends reflect continued growth in U.S. consumption (roughly 0.9% per year), increases in imports (U.S. net trade continues to favor imports relative to exports) and increases in U.S. forest resources (both total inventories and net growth increase).

In the United States, we frequently debate the role that prices play in private timberland management. In periods of weak stumpage markets (e.g., for some hardwoods or for small softwood trees in the West) there is concern that landowners and managers will not implement certain forest practices such as thinning to reduce fire risk. In the case of private timberlands, relatively low returns to forestry may also lead to changes in land use as landowners seek higher returns by converting to agricul-

ture or residential developments (see USDA FS, 1988; Kline and Alig, 2001; Ahn et al., 2002; Haynes, 2003, for additional details). At the same time, the lack of perceived effectiveness of markets in increasing quantities of timber supplies (or other forest outputs) in periods of rising prices and perceived scarcity have often prompted the establishment of public and private programs designed to improve forest management with the intention of slowing the expected rises in timber prices (see Cubbage and Haynes, 1988 for a summary).

The recent flat to decreasing stumpage prices (see Table 1) will lower expectations for long-term returns for forest management. They will also raise, in some manager's minds, questions about the incentives for sustainable forest management. From their perspective, the issue is how to produce a range of goods and services that also meets their financial expectations. This concern for financial returns has long been recognized as the heart of the forest management question (see Baker, 1950; Davis, 1966; Davis and Johnson, 1987; Davis et al., 2001). The concerns about financial returns pose a challenge to advocates for sustainable forest management who may find themselves championing selected management practices with doubtful financial returns. Further complicating these challenges are the diverse array of management objectives of numerous landowners and managers. The importance of financial returns also means that many of the benefits of forest management need to accrue to those who pay the costs. Some landowners with more financially oriented management objectives may lack the incentive to implement costly practices that have mostly broad societal benefits.

FORESTS AS A SET OF COMMONS

The public has come to expect that forest management contributes to maintaining a broad set of environmental values including timber, wildlife habitat, aesthetics, biological diversity, water flows, ecological integrity, and recreation. At the broad scale, the public acts as if forested ecosystems are a set of 'commons' capable of producing both marketed and nonmarket goods and services. In this context, forest management decisions are viewed as involving broader environmental problems dealing with complex tradeoffs (or compatibility) among a broad set of environmental values. In the United States, many of these goods and services are thought to be fairly available to anyone. For example, consider how clean air and water, scenic integrity, and wildlife habitat are taken for granted by much of the public.

This interest in forested 'commons' is a consequence of the shift to managing broader ecosystems. Increasingly, this shift has been motivated by ecological as well as socioeconomic considerations. The ecological arguments rest on the need to place management actions within a spatial and temporal hierarchy that considers the broad context for actions at a specific place as well as an understanding of how ecological processes work at that site (these are often scaled up from site-specific information). The socioeconomic considerations include the role of civic engagement about the importance of ecosystem goods and services to overall societal well-being. These considerations have also manifested themselves in the discussions of sustainable development (and sustainable forest management) where the goal is to promote economic prosperity that is socially just and environmentally sound.

Considering forested ecosystems as a set of commons whose goods and services are fairly available to anyone raises three issues. These are concerns about common property, institutions to guide actions, and how property rights are assigned.

First, there are the traditional economic arguments about how common property is abused rather than protected when no property rights exist. Hardin (1968) laid out these 'open access' property issues in his classic article the *Tragedy of the Commons*.¹ The essence of his argument and the one that has become part of economic dogma was that if no one held property rights to various goods and services, then there was no incentive to manage the resource to sustain production but the incentive was to capture as much of the value as quickly as possible before others seized the various goods and services.

Second, champions of greater civic engagement argue for more attention to be paid to the goods supplied by the 'commons' (see the 22 January, 2005 *Economist* for an article on the movement for corporate social responsibility). They advocate for expanded institutions and greater governance as a means to provide guidelines for private land management. Often these champions are motivated by the actions of private landowners who act as if they are more interested in making money or sustaining the values of their asset portfolios than in the provision of a broad array of ecosystem goods and services.

Third, there are also questions about how and who could assign property rights to sustain various environmental services and goods. Some of the contemporary arguments (such as those for corporate social responsibility) focus assigning property rights to various stakeholder groups who have traditionally been marginalized in market based approaches to resource allocation and management. In this case, the issue

of governance is more about how firms, agencies, and organizations conduct themselves in relation to stakeholders than about actual shared power.

Interest in this last issue is rapidly expanding among champions for greater civic involvement in managing ecosystems who argue that many ecosystem goods and services benefit all of society and for the most part (except for the small set where property rights have been established and assigned) are nominally free to users. The management of these goods involves active engagement of stakeholder groups and other regulatory costs to insure a balance between the marketed goods and services, and those provided altruistically. Many of the public see this as establishing the "license to operate" for those individuals involved in land management and, in essence, dividing forest property rights into those that can be traded in some form and those that cannot. Among these champions are advocates for systemic reforms of the market system involving increased regulatory approaches that many land managers consider encroaching on their decision making.

There are two management needs to clarify if we are to consider managing forested ecosystems as a set of 'commons.' First, there is the specification of the set of goods and services produced from forested ecosystems. These include goods and services like timber, wildlife habitat, aesthetics, biological diversity, carbon storage, water flows, ecological integrity, and recreation. In addition to the list of products, we also need to be able to provide measures of them and their associated values so we can determine the values associated with ecosystem management. Second, the increased level of civic engagement raises questions about the role and effectiveness of governance, especially in those cases where the social prices/values are perceived to be greater than what might be market determined. Classic cases of this are wilderness values or habitat conservation values where markets are thought to undersupply goods or services with positive externalities. In these cases civic interaction exercised through a mix of governmental and non-governmental organizations seeks to advance social well being.

In an economic sense, one of the roles of expanded governance is a need to assign property rights to what had been formally open access public goods and another is to intervene in markets where the specter of market failures seem high. Related to this last point is the need to consider different power-sharing perspectives in allocation decisions. There is a growing recognition that broad-scale conservation goals can be achieved if we can include added values associated with forest management for a range of goods and services, especially on private forest

lands (Best, 2002). A key first step is to assign property rights to some of the goods for which we can develop notions of values. The next step is to assist in developing markets and trading. By providing or improving returns to landowners we will improve the conservation and management of those goods or services. This approach is workable for only those goods or services for which property rights can be assigned. Other goods or services such as clean air or water for habitat are considered public consumption goods and remain a governmental function.

TWO PRIVATE LAND MANAGEMENT CHALLENGES

The increased civic interest in the broad set of ecosystem goods and services raises two possible policy issues. First, there are questions about what it would cost the public to make landowners financially neutral to producing environmental goods and services. That is, how much would landowners have to be compensated to broaden their management objectives to produce both their primary management objectives as well as a set of goods (and services) of interest to the broader public? The second issue is the general tendency to make judgments about management intentions from price signals alone. This tendency was illustrated in the earlier discussion about markets being a barrier to sustainable forest management.

In the first case, we see various proposals in contemporary forestry literature about the need to consider compensation of private landowners for contributing to greater conservation goals (such as protection of biodiversity). Best (2002) introduced these notions in her discussion of challenges to private forest conservation. This raises questions about how much compensation would be needed to make landowners indifferent to broadening management objectives. For example, in the Douglas-fir region there have been proposals, described as high-quality forestry, to lengthen rotations to provide both high-quality habitat and timber (for a discussion of the specific high-quality regimes see Weigand, 1994; Barbour et al., 2003). This raises the question of how much the public would need to pay landowners to extend the length of their rotation assuming that a greater array of public goods could be produced.

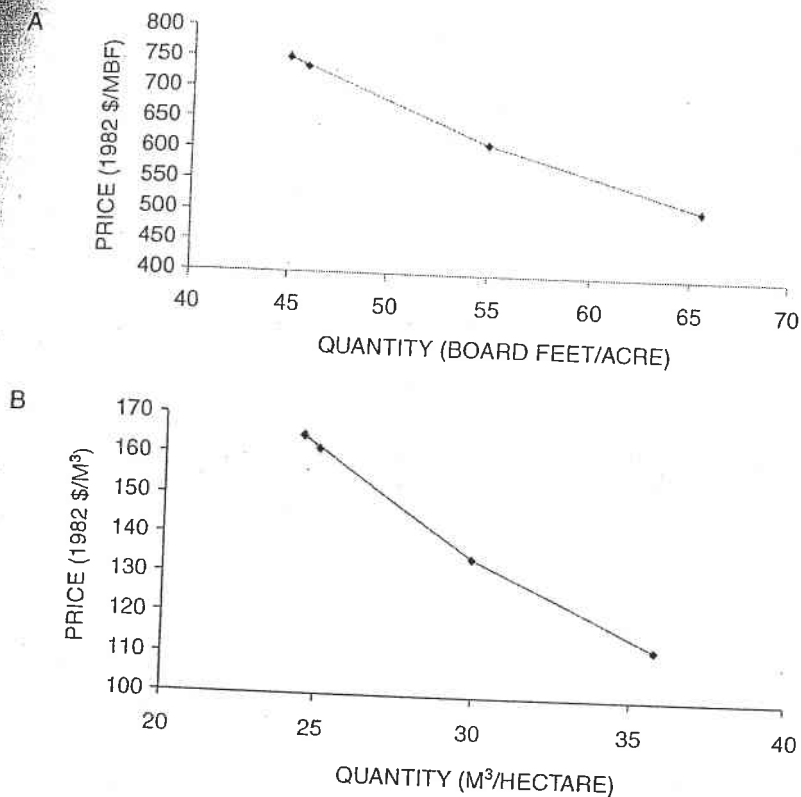
In the Douglas-fir region where rotations on private timberland are 40 to 50 years (see Haynes et al., 2003 for more details), there are proposals to double such rotation lengths. In this case, the present value at a real interest rate of 4% (expected returns) for a 40-year rotation is \$14,321 or an annualized value of \$25/ha (see Haynes, 2005 for de-

tails). The present value per hectare of two consecutive 40-year rotations is \$14,941 or \$27/year. The present value per hectare of a single 80-year rotation is \$8,956 or \$16 per year. To make a landowner indifferent to rotation length over this 80-year period, a payment of \$11/ha/year will be required. Although this may not seem like a great sum (and may not be needed in all cases), there are 4.36 million ha of private timberland in Oregon; if all private timberland owners require compensation, this involves 48 million dollars per year in payments.

The second issue is the propensity of landowners to intensify land management even when stumpage prices are expected to remain relatively stable. As discussed in an earlier section, there has been a tendency among foresters to assume that rising prices were key in stimulating higher levels of investment in forest management. But the calculation of financial returns (or the soil expectation value²) to intensifying management includes both price and quantity harvested. In this context Figure 3 shows that as long as quantity increases as prices decrease, financial returns remain the same for the landowner (the data are from Haynes, 2005). The slope of the relation in Figure 3A is -15.625 suggesting that land owners will remain indifferent to financial returns as long as there is a gain from increased management of 4.53 m^3 (1,000 board feet [mbf]) per reduction of $\$3.45/\text{m}^3$ (or $\$15.62/\text{mbf}$) of stumpage prices. As indicated by the data used to develop Figure 3, landowners with a high propensity to invest would be indifferent to their returns as long as increases in management intensity would lead to the same or greater returns.

Another way to consider the implications of Figure 3 is to look at the volume increases among different management regimes. In the example used before, the yields were computed from using an average yield of $25 \text{ m}^3/\text{ha}$ at age 50, but in the Douglas-fir region there are several management regimes generally used. Custodial management involves only site preparation and planting sufficient to meet State forest practices act requirements. A second regime involves more site preparation and a more intensive plantation regime but little else until harvest at stand age 40 to 50 years. A third type of regime involves site preparation, planting, precommercial thinning (or some form of stocking control), and thinning (depending on final age of harvest). This last regime was popular among landowners managing for the export market where a premium was placed on larger logs that had little taper and few limbs. At age 50, the yields computed from empirical yield functions developed from remeasured plot data were 24.5, 29.9, and $35.8 \text{ m}^3/\text{ha}$ for these three regimes. This range in values represents the entire price range illustrated in Figure 3A or B. There are also cost differences among the

FIGURE 3. The tradeoff between stumpage prices and volume per hectare (or acre) while maintaining the same per hectare (or acre) expected returns for a 50-year rotation.



Source: Developed from data published in Haynes (2005).

regimes; regime 1 does not contain precommercial thinning costs, which increases net returns by 5 to 6% (all else held equal). The costs for the two other regimes are assumed to be the same for a 50-year rotation (the third regime contains a thinning, which adds to overall returns).

CHANGING THE PROPENSITY TO REGULATE

The growing public recognition of the array of goods and services provided by forests will change the nature of governance for forest man-

agement actions. In this context, governance is defined as excising authority over actions and has evolved in the United States from being market based to being a mix of market and regulatory functions (see Haynes et al., 2003 for an expanded discussion of how this has evolved in the Pacific Northwest). For federal forestlands, forest planning has been developed to implement forest management. It includes very formal processes, broad management objectives, and increased stakeholder participation. Management on private forestlands is determined by a mix of market and regulatory functions. A different set of regulations (e.g., State forest practice acts) influence both the design and applications of forest management practices on private lands.

For the most part, these regulations reflect public concerns about forestlands or forest conditions. These growing public concerns have long been a determinant of forest policies, and since the early 1990s, forest policy has increasingly been internationalized (see the discussion in Haynes, 2003: pp. 173-179) in contexts of economic globalization and sustainable development. Currently much of the international debate deals with suggestions about the need to supplement market-determined actions with processes to attain equilibrium among interests advocating environmental protection, employment that contributes to economic prosperity, public access, and social justice (see Andersson et al., 2004 for a variety of perspectives on these issues).

The adoption of broad-scale land management plans such as the Northwest Forest Plan (USDA and USDI 1994) for federal lands in the Pacific Northwest is a step in this evolution of shifting societal expectations for forest management. It involves the development of institutions to supplement the existing mix of market and regulatory processes already present in the region. These institutions include a mix of formal and informal groups and organizations whose roles are evolving and which now provide a forum for discussing emerging problems beyond just plan implementation. At the same time, some of these groups and organizations are engaged in the development of collaborative efforts in the subdivision of forest property rights. The Northwest Forest Plan included 10 formal adaptive management areas, several of which illustrated that successful collaboration depended on early engagement of stakeholders in the assessment part of the planning process and on more fully involving stakeholders with the goal of gaining social acceptability for designed treatments (Stankey et al., 2003). In selected cases, engagement with informal groups led to partnerships that were able to accomplish specific actions in a collaborative fashion.

CONCLUSION

Changing expectations of returns from forest management raise concerns about whether North American forests can meet societal expectations for making progress towards both sustainable forest management and the provision of the suite of ecosystem services expected by increasingly urbanized populations. At the same time, questions are emerging about the effectiveness of the institutions that have evolved to both promote forest management and to control (or modify) human behavior to conserve nonmarket ecosystem services.

The projections of relatively constant real prices (Figure 1) for the next five decades will provide an incentive for those landowners with a strong propensity to manage (industrial landowners, large private landowners, timberland investment organizations, public timberlands) but by themselves will not engender much enthusiasm among the majority of landowners who display a lower propensity to manage.

What does this mean in the context of sustainable forest management? Simply put, it means that the majority of timberland will be lightly managed while a small minority of hectares will be heavily (or actively) managed (on relatively short rotations). The net effect is that prices, although not a barrier, will also not provide a strong incentive to improve land management or to expand the production of ecosystem services. This raises a dilemma among the advocates for improved forest management when they find themselves supporting either more regulation to insure progress toward sustainable forest management across a broader area of forestland or developing alliances with the broader conservation community who are starting to consider financial incentives for the production of various ecosystem services.

This predicament is troublesome to many traditional forest managers who tend to see regulations as impeding their management discretion and conservation advocates as challenging long-held views about the "proper goals" for land management. But there is an emerging alliance between forest owners and conservation advocates motivated by a shared desire to protect open spaces and the associated goods and services (that many consider as public goods) from dwindling away as human populations increase. A frequently cited strategy to protect open space is to increase the economic attractiveness of current land uses by compensating private landowners for their contributions to broad scale conservation goals. The early examples (see Best and Wayburn, 2001) have largely involved private funding as part of environmental impact mitigation, but for larger scales it will require public funding. This

could proceed in a number of ways such as various conservation programs, but to reach the scale needed, it will eventually involve public compensation of private owners for their contributions to conservation goals. These latter approaches will depend on some key steps, but one early step will be assigning property rights to some of the former public goods derived from the forested land. Clear property rights enable those who own the resources to gain the income that can be derived from the production of goods and services. Another early step is development of markets and price signals necessary to sustain the production of a range of goods and services. Markets will evolve only for the tradable subset of goods and services derived from forested land; there will always be public consumption goods produced jointly that must be protected as trading develops.

NOTES

1. The distinction between 'open access' and 'common property rights' is important because much has been made of behavior under open access, but incorrectly identifying it as behavior relating to common property. Common property rights (sometimes called communal property rights) are those applying formally or informally to a particular group of people and use of a particular set of assets.

2. The present value of all future net returns, the soil expectation value or SEV, from a simple plant-and-harvest management regime can be expressed as:

$$SEV = \frac{Price * Volume \text{ at rotation} - Planting \text{ cost}}{(1 + Interest \text{ rate})^{Rotation} - 1}$$

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