



Policy instruments to enhance multi-functional forest management [☆]

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Abstract

Sustainable forest management has become the salient cross-cutting theme in forestry throughout the world today. This paradigm recognizes that forests are managed for a wide variety of ecological, economic, and social benefits. This explicit recognition of many outputs and services as management objectives has recast our economic analyses on the values of forests. Similarly, our policy tools must adapt to achieve the goals of multi-functional forestry across a broad range of ownerships and values. We review factors that affect forest policy selection, including the nature of goods and services, social values, and economic values. We then discuss traditional and newly developing natural resource policy tools in this context and discuss their applications in meeting the objectives of forest landowners and society in achieving multi-functional sustainable forestry goals in the future.

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1. Introduction

Private and public sector goals for forest resources evolve over time. Individual and societal goals change as values, economic conditions, political situations, and natural resource stocks change. Contemporary

public forest resource management goals are expanding to encompass a broader suite of goods and services. Our forest policy tools must change to reach these broader goals.

In this article, we examine various factors that influence forest resource allocation, management, and protection, including the types of goods and services provided by forests, social values and institutions, and economic valuation of those goods and services. The objective of this paper is to synthesize the interaction of factors influencing policy with the development of new policy tools to achieve broad multifunctional forestry goals. As such, we review the factors that affect forest

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policy development and selection; summarize how these factors are used to justify and to select among various categories of policy instruments; and assess the evolving nature of forest policy instruments based on trends in social values and government capability.

Characterizing changes in social goals for forests is challenging, but new trends in forest resource values and uses can be identified. To cast these in old terms, we might think of Maslow's hierarchy of needs as a means to represent the changing nature of forest uses (Maslow, 1954). Initially, we sought to satisfy basic physiological needs from forests—such as food, shelter, or clothing—or security needs—such as protection from danger or threats. We have slowly expanded from these basic needs to higher needs of social, self-esteem, and self-actualization. Higher level needs encompasses a greater set of amenity, spiritual, or social needs and values. Forests provided multiple goods and services to very low-income, rural, agrarian societies. These ranged from spiritual, cultural, and religious outputs, to agricultural inputs such as watershed protection and fodder, to products including fuelwood, timber, and medicines. As societies develop, they become less connected to forests and rely on them primarily for products. At higher income levels, forests are again valued for multiple goods and services, including amenity values.

A contemporary natural resource explanation of this shift in the demand for environmental services is the environmental Kuznet's curve (Grossman and Kruger, 1995). This inverted U-shaped curve relates deforestation or extractive use of forests to income per capita. As countries develop, both their ability to exploit the forest and their demand for forest goods increase, pushing them up the Kuznet's curve. At some point, countries undergo a transition in production technology (e.g., from fuelwood to kerosene) and in demand (e.g., greater value placed on non-use and passive use of forests). This marks the "forest transition" from shrinking to expanding forest area, as has occurred in both the U.S. and Europe. However, contemporary evidence for this pattern is mixed. The turning point, where deforestation rates start to fall, appears to vary across countries and to depend on other conditions, such as the distribution of wealth and political freedoms (Bhattarai and Hammig, 2001).

Contemporary values of forests have evolved in the industrialized world. First, forests and forest products are still needed to satisfy basic human needs, just as

agriculture is needed. However, the suite of goods and services desired from forests has expanded as incomes have risen, just as agriculture is now valued for open space as well as food products. Both public and private forests in most of Europe and in much of the United States are valued at least as much for recreation and tourism, water production (quantity) and quality, amenity values, wildlife, and biodiversity as for wood products (e.g., Bliss and Martin, 1989, Bengston et al., 1999; Butler and Leatherberry, 2004). Second, there is increased recognition that the wide range of forest goods and services that are necessary to even satisfy basic food and shelter has expanded. The recognition of the importance of ecosystem services, such as oxygen production, carbon storage, and hydrological cycles has expanded our concerns for basic needs beyond local stand or watershed issues into national policies and international affairs (e.g., Janson et al., 1994; Daly and Cobb, 1994; Odum, 1993). Third, research has demonstrated the value of forests to native local people and communities, and the need to integrate these local values with national and the global values to allocate and manage forest lands (e.g., Ascher, 1994; Leach et al., 1999; Mauro and Hardison, 2000).

This rapid expansion in the uses of forests as countries develop, combined with the expanded definitions of forest values, forces us to re-think forest policies to achieve these broader social goals. Some traditional forest policies may help us achieve production and protection of a broader set of forest goods and services. However, it seems unlikely that a set of forest policy tools originally designed to achieve production goals will be equally well suited for broader conservation, amenity and social goals. Furthermore, social conditions have changed, as countries have developed, governments have reformed, private sector markets have expanded, and international politics and power relationships evolved.

2. Policy determinants

The types of forest goods and services, social values, and ability to estimate economic values affect the selection of forest policies. These policy determinants have influenced selection of traditional forest policies and will be equally important as we develop and select new policy instruments to achieve sustainable forest management and multi-functional forestry objectives.

2.1. Types of goods

Natural resource characteristics affect the appropriateness of markets or governments to best allocate and protect those resources. Goods and services may be classed into four categories based on their properties of consumption (rivalry) and exclusion (Savas, 1982). Excludability is an institutional construct based on government, religion, or custom that allows one to protect his or her property. A rival good is one for which the use of a unit by one person prohibits the use of that same unit at the same time by another. Conversely, a non-rival good is a good or service where one person has an insignificant impact on the quantity or quality of good or service available for another person to use (Farley, 2005).

In his classification, Savas (1982) wrote that *private goods*, consumed individually and exclusively (rival), are most amenable to production and trade in markets. *Toll goods* that are consumed jointly, but for which exclusion is possible, may be provided well by markets or may involve government provision, perhaps for a fee. Prototypical private forest goods include timber and lumber. Example toll goods include forest parks and trails where visitors maybe excluded and pay the forestry agency of a concessionaire to hike, camp, park, or otherwise use the forest for day or extended trips.

Common-pool goods, such as open range, ocean fish, water, and air are consumed individually, but it is difficult to exclude other users (they are rival but not excludable) and charge fees. As a result, common-pool goods may be consumed to the point of exhaustion, or at least until the cost of extraction exceeds the utility of the individual. Public control or allocation of common-pool goods is typically advocated to ensure proper assignment of costs and socially acceptable levels of use. Water runoff (quantity) or quality from forests or air quality in parks are examples of common-pool goods.

Collective goods are jointly consumed, non-rival, and not excludable. Limiting consumption and collecting payments through a market is difficult or impossible. Examples could be national defense, control of wildland forest fires, provision of scenic vistas, combating widespread insect and disease attacks, or provision of carbon storage. Generally, these goods will be supplied poorly if at all in a pure market economy, and the public sector often provides some level of these services or regulates them.

These types of goods can be affected by social and government institutions and by technology. While rivalry may be inherent, the bundle of property rights affecting excludability is subject to external definition. Many of our modern forest policy instruments attempt to clarify property rights and tenure so that users become owners, and increase their ability to enjoy the produce of their forest lands, and protect the lands for the future. Technology also may enable us to shift public goods toward common pool goods. For example, toll roads with automatic scanners and readers have become common in the western world, changing the public goods of highways into toll goods. Similarly, use of remote sensing to monitor logging activity could turn open-access forests into private resources.

2.2. Social values

In addition to the nature of goods and services, many other factors influence the choice between markets or governments to allocate and protect forest resources and to identify government policy alternatives. Cubbage and Brooks (1991) suggest five broad categories of factors that influence public policy selection in a continuum from individual liberties to community interests to professional prerogatives.

First, policies that allow individual freedoms are often considered desirable, per Cubbage and Brooks (1991). These criteria may include allowing people to achieve their individual desires, maximize their number of choices, foster capitalism and entrepreneurship, and limit government involvement (Worrell, 1970).

Second, private property rights, which include the ability for complete or partial exclusion and private exchange, are often considered preferable to allocate and protect resources. These property rights may be individual or communal, but are excludable. Forest land ownership and tenure is crucial in determining the fate of forests and the use of markets or government in resource allocation. In the world, 80% of the forests are publicly owned (FAO, 2005). This varies widely, with almost 90% of the U.S. South being privately owned (Smith et al., 2004), and 95% and 93% of Asia and Africa, respectively, being publicly owned (FAO, 2005).

Ownership implies that an entity claims land tenure rights to a forest. Tenure rights are the ability to acquire, use, control, and dispose of a piece of property—either

the land itself or the produce derived from it. Tenure rights are often, but not always, exclusive, but seldom absolute (Troup, 1938). Tenure rights determine how comprehensive an owner's ability to use land or its produce are and the length of time an owner controls those rights. They also determine which rights the owner controls, the capability of buying or selling those rights, and the excludability of those rights (Pearse, 1998). Tenure rights greatly affect the ability of markets to allocate resources and to protect forests from destructive exploitation. Clear property rights can help internalize forestry externalities (Markandya et al., 2002). It is possible for the government or the private sector to exercise strong tenure rights and control over forestland—each sector has advantages and disadvantages (Siry and Cubbage, 2003).

Third, perhaps at another end of this individual-community continuum, community and equity criteria favor families and community values rather than unbridled individual rights. These criteria focus on ensuring inputs and involvement of citizens, communities, and indigenous populations in decision-making. They dictate equal opportunities, if not outcomes, for people. They also favor democratic decision-making and public governance processes that include those affected by public policies. Community and public involvement in natural resource governance has received increasing focus to ensure equitable resource decision-making and satisfactory outcomes (Brunner et al., 2005). The public welfare may be included in equity criteria as well—forest owners should be protected from nuisances from other owners. Similarly, landowners should protect resources over time for future generations, termed usufructuary values (Troup, 1938; Spurr, 1976).

Fourth, market failures may force government interventions. These may be due to the nature of common-pool or collective goods creating externalities, both positive and negative. Externalities occur when the side effects of production or consumption are not included in market prices (Pearse, 1998). Market failures also may include imperfect competition or imperfect knowledge, which create distortions in optimal market outcomes. Market failures are differentiated from policy failures due to non-competitive markets, which can be corrected by shadow-pricing in economic analyses (Harou, 1987; Markandya et al., 2002.)

If externalities create severe problems, government interventions may be needed. Externalities have been

the most common reason claimed for government intervention and development of forest regulatory and incentive programs. These programs include efforts to stop pollution and control erosion from forest practices, combat desertification by tree planting, or prevent timber shortages and provide industrial wood supplies through tree planting subsidies. Imperfect competition is often cited as a reason to regulate markets to ensure an equal playing field for all or to justify education so that buyers and sellers are equally informed about market or nonmarket values. This market failure may be particularly relevant in calls for various policy instruments to provide environmental services.

Fifth, professional norms have influenced natural resource management and protection for centuries, including professional foresters in Europe. Gifford Pinchot returned from the Nancy Forestry School in France at the end of the 19th century and then led the creation of U.S. Forest Service and the Society of American Foresters, adapting the European silvicultural heritage to the U.S. situation at the time (Pinchot, 1947). In the U.S., wildlife and other natural resource professions formed after the forestry profession, following the intellectual and professional leadership of Aldo Leopold (1949). Natural resource professionals generally believe in scientific management of forest resources, sustainable yield and sustainable forest management, the prerogatives and wisdom of professional managers, and the need to focus on increasing resource supplies (Duerr, 1982). Modern sustainable forest management has its roots in sustained yield of timber harvests (Floyd, 2000).

However, professionals also seek their self-interest, not just the public interest, termed public choice theory (Buchanan and Tullock, 1962). Professionals seek to expand their responsibilities and pay, as well as the influence and power of their agency. They also may place excessive faith in their scientific training and prerogatives and avoid or minimize public input into agency decisions. They may collaborate too closely with interest groups in allocating resources, be captured by narrow groups rather than serving the broad public, and deliver services with poor efficiency and excessive costs (Stroup and Baden, 1973; Yandle, 1999).

The nature of goods and services and social and professional norms discussed above influences the reliance on free markets, public policies, and policy selection. So do societal values and priorities for forest

resource allocation, management, and protection. The competition of forest resources for scarce capital—whether it be financial or political—also is important. Government budgets and personnel affect policy selection and implementation. The interaction of all these factors determines the eventual selection of policies. So do the eventual criteria that are used for selection of forest policies and the relative importance—biological/ecological, economic, social equity, political, and administrative practicality (Clawson, 1974).

2.3. Economic values

The estimation of economic values of goods and services can improve the effectiveness of policy instruments in forest management and protection. As suggested above, social values regarding economic efficiency, democratic processes, community governance, equity, and professional norms influence policy decisions. The economic values of goods and services is only one way to determine how they should be produced and allocated, but an important one. Markets allocate the majority of the world's resources. Timber, nontimber forest products (NTFPs), illegal forest products, land sales, plantation investments, and other forest products are allocated by markets. Markets also are used to allocate most goods and services that are produced on public lands. For example, for the U.S. economy in Fiscal Year 2006, the federal government budget was 20% of the total U.S. Gross Domestic Product (Office of Management and Budget, 2005). Considering other levels of government, the public sector probably comprises more than one-quarter of the total U.S. economy. With the case of forests, the public sector may be larger, since 43% of U.S. forests are publicly owned (Smith et al., 2004), but markets still allocate most forest goods, and many services such as recreation and water outputs.

Nonmarket valuation has become increasingly important as a shadow price for estimating the social benefits of forests and other natural resources (Harou et al., 1994). Estimating the economic value of forests is complex. One should consider land use alternatives of forests, benefits to users of those forests at a variety of scales ranging from local to global, and the valuation methods employed. Economic values can be classified in many ways (Kramer et al., 1992). One classification is that of use or non-use values. Use values may include

extractive (harvest) values or non-extractive values. Extractive values may include timber, game, pine straw, or minor plant harvests. Non-extractive values include recreation services, scenic beauty, wildlife watching, water filtering, or carbon storage, also called “passive use” values. Non-use values include existence value and could be considered to include option and bequest values. Non-use values are not reflected in the market by prices. Some use values are traded or potentially traded, while others are nonmarket values. Nonuse values are not reflected in the market by prices. These include option value (willingness to pay for future use), existence value (value placed on the resource for its existence), or bequest value (value for endowing forests for future generations) (Kramer et al., 1992; Holmes and Kramer, 1996).

Forests provide various nonextractive goods and services. These include the indirect market-based values of forests as recreation sites and viewsheds, the imputed value of water quality protection, and the nascent markets for wetland restoration sites, endangered species or biodiversity protection, or carbon storage. Specific nonextractive values include protection of water quality from pollutants in stormwater runoff, avoidance of soil erosion, and provision of filtered water by wetlands. Direct government payments and markets for protection of these environmental or ecosystem services are developing rapidly (Walsh et al., 1990; Perman et al., 1996; Landell-Mills and Paorras, 2001).

3. Policy instruments

The preceding public policy determinants influence both the forest policy goals and the selection of forest policy instruments. To recapitulate, forest resource characteristics, social goals, and economic values contribute to forest resource retention, allocation, management, and protection. Government is often required to intervene with policy instruments when the nature of goods and services impedes adequate resource allocation in markets. These includes cases such as of forest fire protection and major insect and disease attacks (collective goods) and collection of NTFPs on public forests (common-pool goods). Social values also prompt calls for policy interventions, such as to foster economic development, provide equitable benefits from forests for indigenous and native populations, protect against negative externalities from timber harvests on water

quality and fish or on wildlife, or to promote professional management of forest resources. The interplay of the nature of forest goods and social values and the ability of markets to generate efficient and equitable resource allocation outcomes determine the use of forest policy instruments. As the social values for broader multi-functional forestry evolve, so will the demand for new forest policy instruments. In addition, continuing budget pressure on governments has created problems in making public policy responses, and prompted increasing involvement of foundations and nongovernment organizations, as well as other private donors.

Broad forest resource goals may include forest retention, forest restoration, forest management, forest conservation, and forest protection. These forest land uses are means to achieve greater societal goals of production of goods and services from forests, in a means-ends hierarchy as suggested by [Worrell \(1970\)](#). This infers that broad policy goals are achieved by policy instruments, and that these instruments may be policy goals for subsidiary policy tools. These goods and services may be use or non-use in nature, as discussed, and have market or nonmarket economic values.

Numerous authors have discussed forest policy instruments ranging from private markets to government ownership and production of goods and services. Textbooks by [Ellefson \(1992\)](#) and [Cubbage et al. \(1993\)](#) discussed traditional forest policy tools with a focus on the United States. [Sterner \(2003\)](#) reviews regulation, tradable permits, taxes, subsidies, property rights, laws, international policies, and national policy and planning as relevant forest policy instruments, as does [Laarman \(1997\)](#). [Simula et al. \(2002\)](#) covered financial policy instruments regarding credit lines, environmental funds, market development, private capital, and philanthropic grants. We integrated these sets of policy tools to develop a list of traditional and contemporary policy instruments that are relevant for multi-functional forest resource management.

[Simula et al. \(2002\)](#) provide a useful discussion of the role of the public and private financing that illustrates the evolving nature of forest policy tools to enhance multi-functional management. They describe three types of forestry projects: (1) production/commercial forestry projects; (2) socially targeted forestry projects; and (3) environmental forestry projects. They classify production or commercial projects as those implemented for

profit in the private sector. In the past, such projects were also funded through government subsidies, but this is less common now, except perhaps for various tax breaks that forest landowners still receive throughout the world. Socially targeted projects focus on alleviating poverty and improving social equity through the generation of income and employment. Equity and poverty criteria favor small owners and development of institutional capacity for communities. Environmental projects would be intended to provide public goods through the environmental services of forests. They intend to improve resource conservation and protection, particularly to avoid negative market externalities or to provide resources with large nonmarket values, such as biodiversity, wetlands, or water quality. The social and environmental projects and policy tools are generally instituted by governments, and production policies are more apt to be provided by the private sector. There are increasing amounts of public and private partnerships as well.

[Table 1](#) summarizes these policy instruments ranging from government ownership and planning to markets to selected new private and public financing and market development instruments. The continuum of instruments reflects the evolving nature of public and private forest policy, and increasing scope from single purpose to multi-purpose forest policy goals and instruments. Policy instruments span sectors ranging from government ownership, production, planning, or regulation; to subsidies, protection, education, and research; to private markets and new public/private mixes of these sectors. Similarly, we have become more creative in the application of our policy instruments in each of these broad categories. Government ownership is focusing more on devolving national control to local communities, and international sustainable forest management fora have proposed international accords to protect forests. International trade agreements, forest law and governance efforts, private industry policy, nongovernment organizations, provision of amenities and ecosystem services, and forest certification efforts all have evolved rapidly as new forest policy goals or instruments to achieve those goals. Public and private financing and market development tools have created many new policy instruments that are particularly well adapted to achieve multi-functional goals involving common pool and collective goods, reflecting the relative importance of current policy determinants and forest values.

Table 1
Selected policy instruments for multi-functional forestry

Government ownership and planning	Government regulation	Subsidies and protection	Education and research	Private markets	Private/public project financing	Private/public market development
Land Ownership	Best practices	Plantations	Education	Land ownership/management	Financing and Grants	Tradable development rights
National	Harvesting, roads	Timber stand improvement	Professional	Small private	International bank loans	Conservation easements
Community	Illegal logging	Income tax reduction	Continuing	Industrial	Debt-for-nature swaps	Concession/extraction quotas
Native/indigenous	Water quality and quantity	Property tax reduction	Public	Timber investment organizations	Venture capital funds	Tradable protection rights
Production	Wildlife, biodiversity	Forest industry and manufacturing	Landowner	Environmental organizations	National forestry funds	Water resource use charges
Timber products	Endangered species	Ecosystem management	Logger and worker	Cooperatives	Policy/business guarantees	Bioprospecting fees
Nontimber products	Landscape effects	Environmental services	Research	Goods and services	Conservation trust funds	Payments for environmental services
Final products	Aesthetics	Fire protection	Federal	Products	Environmental protection funds	Payments for environmental degradation
Services and amenities	Conversion	Insect and disease protection	State	Services	Securitization	Carbon offset payments
Recreation	Workers/safety/pay	Invasive species	Forestry schools	Amenities	Grants by philanthropies, NGOs	Clean development mechanism
Environmental services	Community benefits/impacts	Trespass, theft, illegal logging	Other academic disciplines	Financing	Joint management arrangements	
International fora and SFM processes	International trade agreements	Forest law enforcement and governance	Private industry	Banks/loans/credit	Contracting, leasing, joint	
SFM criteria and indicators			Nongovernment organizations	Foreign direct investment	Build operate transfer	
UN Forum on Forests				Forest certification	Build own operate	

We have divided policy instruments into traditional instruments and contemporary innovations for discussion and relate those instruments to the nature of forest goods and the social goals discussed above. In practice, there is a continuum between traditional and contemporary forest policy instruments, not a sharp division, but the classification facilitates analysis and discussion.

3.1. Traditional classifications

A plethora of policy instruments may be employed to achieve societal goals. As noted, Ellefson (1992) and Cabbage et al. (1993) summarize these broadly as a

range from free markets, to education and research, to incentives, to regulation, to government ownership and allocation. Schneider and Ingram (1990) list five broad forest policy alternatives for private forests, ranging from authority to learning. Other authors have developed classifications of policy instruments as well that are relevant for our contemporary context (e.g., Weiss, 2000; Bemelmans-Videc et al., 1998; Best and Wayburn, 2001).

Free enterprise and private markets allocate forest resources on most private forestlands, given various government policy institutions, laws, constraints and incentives. While private forests cover only about 20% of the world's forest area, they provide an important

share of the industrial timber. Brown (1998) estimated that fast-grown forests provide about 27% of the world's industrial fiber supply. They are projected to provide up to one-half by 2020. These private goods are well produced in private markets where prices and profits allocate scarce land, labor, and capital. On the other hand, politics, democratic or not, allocate resources on about 80% of the world's forests.

Bemelmans-Videc et al. (1998) classed policy actions for private lands into three broad categories: (1) carrots—policies that offer incentives, mostly economic, to encourage a particular behavior; (2) sticks—policies that are punitive, such as regulation; and (3) sermons—policies that are informational such as education. Schneider and Ingram (1990) developed a private forest policy tool spectrum based on the behavioral assumptions associated with a policy tool: (1) authority, (2) incentives, (3) capacity building, (4) symbolic/hortatory, and (5) learning. These tools are used to dissuade, prevent, promote, or enable certain landowner behaviors and carry out socially desirable actions that they would not do otherwise. Capacity building, symbolic, and learning are tools that do not change values, but rather provide means to change behavior that is in concordance with the landowners' beliefs (Weiss, 2000, Schaaf and Broussard, 2006).

Rivera (2002) reviews similar literature for implementing environmental programs and classifies policy instruments as consisting of voluntary tools, such as self-regulatory programs; mixed instruments such as subsidies, information, and pollution taxes; and compulsory instruments such as pollution mandatory regulations. He adds that policy instrument choice is not only influenced by efficiency and effectiveness criteria, but also by the political context, the resources available, and the culture of the implementation agency.

3.1.1. Regulation

Traditional regulatory tools often were initially focused to prevent excessive timber harvests, ensure forest regeneration, and prevent widespread pollution and forest fires after logging. Regulations may be required for common-pool goods to prevent resource exhaustion, or to prevent externalities and market failures from leading to damage to other resources. In forestry, they often are instituted to protect the long-term external values that are not provided well by

markets, such as forest retention, regeneration, biodiversity, or timber supply.

The less excludable that a forest resource may be, or the more that one action is apt to cause pollution or degradation to another resource, the greater the justification for regulation. Regulations are justified at times to ensure equity or protect the public welfare. Last, regulations are now justified by the divergence between market values and nonmarket values, with the presumption that public protection is needed to allocate resources that are not priced or that are undervalued in markets. Per the Simula et al. (2002) classification, regulations on private or public lands would generally be environmental projects.

Most countries have various levels of forest regulations and standards. Regulations usually address clear-cut size, required reforestation; best management practices; water quality, quantity, wetlands; fisheries and wildlife; threatened and endangered species; biodiversity; timber and other forest products harvesting and roads; and illegal logging. Many other regulations may exist as well, limited only by the imagination of federal, state, or local governments. Aesthetics may be regulated in scenic viewsheds or at the stand level; reserves of natural areas are required in some countries; rotation ages may be dictated; and harvesting may be required to ensure national timber supply. A host of other regulations affect worker safety, pay, benefits, trucking, public safety, shipping, and international trade. One may think that this instrument is economical, but regulation can impose a heavy burden in some countries, creating large government expenditures, substantial owner costs, and significant loss of market efficiency. Regulations without enforcement usually have little impact on the ground.

Cashore and McDermott (2004) compared the stringency of forestry laws in many countries based on clear-cut size, allowable cut constraints, stream buffers, road protection, and reforestation requirements. They found that western Canada, California, Russia, and the U.S. Forest Service had the strictest regulatory environments (a 9 score, with 10 as most rigorous); Indonesia was fairly strict (a 7). Chile (6), Brazil Amazon (5), and Sweden (4) were among countries ranked in the middle; and the Japan (3) and the U.S. South and Portugal (0) had the least strict regulatory environment in the world. This does indicate the spectrum of regulations in law is certainly wide, and that the strictness of the laws

does not seem to correspond directly with the general perceptions regarding policy strictness. Comprehensive conclusions about effective regulatory rigor may be difficult to reach since it is difficult to collect data on implementation, such as agency budgets, personnel, fines, which determine government policy effectiveness. Most developing countries have enacted strict regulatory laws, but regulations are poorly enforced at best in most of those countries. Critics have also noted that extensive regulations may just provide more opportunities for corrupt officials to extract bribes and payments for personal gain, so be less desirable than presumed, or at least be linked to public choice behaviour to expand agency influence and power, with little regard for natural resource protection.

3.1.2. *Education and research*

Education of the public, landowners, professionals, loggers, policy-makers, and others involved in forest resources has been a long-standing policy tool. While not de rigeur, it is accepted that most public and most professional education today is an appropriate role for government. Professional education could be a toll good, but public education is generally available for citizens in most counties in the western world—the United States, Europe, and Latin America—at either free tuition or largely subsidized rates. Rigorous exams or admission standards are used to ration entrance in some countries, and high attrition rates enforced in others that allow almost all students a chance to enter. The premise for subsidized public education rests on equity criteria primarily, as well as the collective commonweal benefits of an educated populous, assistance in fostering communal values, and in promoting technical capacity for economic development.

Environmental education also is extended to the general public at public expense, implicitly based on the premise of exhorting desirable management and protection of natural resources, for both market and nonmarket values. These programs presume that landowners lack knowledge about the values of their resource or best management practices, which can be redressed through public education programs.

Professional forestry schools and programs train foresters and other natural resource professionals to manage resources to meet landowner goals, with technical skills in the areas of biology, measurements, management, and economics and administration

(Society of American Foresters, 2006). Practicing natural resource professionals also receive continuing education to ensure that they stay current with technical and social skills. In a survey regarding best management practice implementation in the United States, Kilgore and Blinn (2004) found that foresters and loggers preferred educational approaches more than regulatory approaches for implementation.

Research and science create new innovations and knowledge and provide the basis for professional management and, at least in the long run, the basis for public policy making (Guldin, 2003). Forest research, especially for nonmarket values such as biodiversity, is often justified on the basis of its collective good characteristics. Equity also is cited, since the many small nonindustrial private forest landowners are unable to perform research at a reasonable scale for their small forests. Thus, public involvement provides benefits for small owners and the public as a whole.

The National Research Council report (NRC, 2002) examined forestry research capacity in the United States, noting that both the number of research scientists and undergraduate and graduate student enrollment declined significantly in the 1990s. From 1980 to 2002, USDA Forest Service appropriations were fairly constant in real dollars, at about \$100 million per year, but the number of scientist-years of effort declined from 964 to 723. Forestry enrollments were actually fairly stable during the 1990s, with more than 700 undergraduates, 1200 master's degree students, and 700 PhD students enrolled in 1998 (NRC, 2002). However, since then, undergraduate enrollments in forestry programs have declined by almost half. The same trend seems to occur in Europe (de Steiguer and Harou, 2005). These trends indicate that the number of forest resource professionals is waning, which will impede our ability to enhance multi-functional management. These trends also suggest that public choice issues with public agencies may exist, but the diminishing number of forest resource professionals seems to be a more severe problem.

3.1.3. *Protection*

Forest protection is another crucial policy alternative to ensure that lands remain forested, forest ecosystems function fully, and production and amenity values are sustained. While some large industrial firms may be able to provide their own protection from forest fire and disease, the large number of small forest

owners throughout the world precludes this in most cases. Furthermore, the spread of insects and diseases and now invasive foreign species is a collective good problem. Forest protection from human depredation as well as from natural pathogens also is a collective good necessity. Protection from natural forest pathogens may focus on production projects or to protect environmental values of natural forests. Protecting forests from criminals infers a social priority, with perhaps production or environmental higher level goals.

Protection from forest fires is probably one of the first, most important, and most successful policies in retaining and nurturing forests as countries develop, and was a key to growth and sustainability of U.S. forests (MacCleery, 1994). Much of the fame and reputation of the U.S. Forest Service at the beginning of the 20th century stemmed from its fire-fighting abilities. The Clarke–McNary Act of 1924 authorized a pioneering cooperative effort between the federal and state governments in the U.S. to fight forest fires on private lands. Perhaps at times, these efforts have succeeded too well, and more small fires should have occurred to prevent major conflagrations that occurred in the early 2000s in the U.S. Also, fire protection is becoming increasingly expensive in the urban wildland interface, such as in Mediterranean Europe.

Fire protection remains a central theme of the U.S. Forest Service and comprises more than half of the agency budget in severe fire years. Fire prevention and control is equally problematic and important in developing countries and can literally mean the difference between having forests or not. Indonesia had major fires in the El Niño years of 1997, which destroyed millions of hectares of native and plantation forests. Fire is also a major issue in the Amazon, with concern focused on the potential for massive fires in forests that have been selectively logged in exceptionally dry years, or under future climate change scenarios.

Protection against insect and diseases is another important policy intervention. In the U.S. South, one of the main foci of tree breeding efforts has been to select trees that are resistant to fusiform rust. Protection against insects and diseases has become much more important with widespread world trade, which has spread pathogens widely. Chestnut blight, Dutch elm disease, and others diseases have virtually eliminated these species throughout most of the United States. Gypsy moth, ash borer, butternut blight, oak wilt, and a

host of other pathogens are attacking U.S. forests and urban trees as well. In addition to direct pathogens, invasive species also are becoming ecological competitors that may threaten native species. Chinese tallow tree, ailanthus, and paulownia have spread across much of the eastern U.S.; honeysuckle, kudzu, privet, and microstegium grass choke out native forest regeneration. North American species planted for production purposes, such as loblolly and slash pine, have become naturalized in Argentina and South Africa.

Adequate governance is the main constraint to the maintenance of forest areas and forest management in many parts of the world. Police protection against forest and timber trespass, theft, and illegal logging also is necessary. Illegal logging is one of the greatest public policy and trade issues today, and the focus of innumerable research and policy studies. A recent study estimated the amount of illegal logging in the world and found that illegal timber exports ranged up to 50% of the market in some countries (Seneca Creek Associates, 2004). Control of these timber harvests is fundamental to ensure sustainable forest management and protection. At a smaller scale, forestland and forest products trespass are to be avoided to ensure that forest landowners receive the benefits of their produce and to keep an interest in the management of their forest resources.

Illegal forest activities range from expropriation to lack of establishment of land rights, corruption in forest concessions, graft in management of forestland, and illegal harvest or production of forest goods. These illegal activities may contribute to increased poverty and conflict and violence, increase poor governance, threaten forest ecosystems, and cause loss of tax revenues. In response, regional Forest Law Enforcement and Governance (FLEG) processes are taking place in Asia and Africa, and various developed countries have formed agreements to assist in these efforts (CIFOR, 2005).

3.1.4. Subsidies

Timber planting and harvesting subsidies—or incentives as their advocates prefer to call them—are pervasive means to encourage forest development and processing industries. The types of tree subsidies are extremely broad, including payments in whole or in part to plant trees, payments to perform timber stand improvement, income tax reductions to favor timber investments, property tax adjustments to benefit forest

retention and management, payments to encourage forest conservation, especially of native species or on rare stand types, and payments to encourage landscape or ecosystem management. Governments usually pay for these subsidies, but NGOs, international banks and development agencies, or other granting organizations may provide funds as well. Subsidies have been justified for a plethora of market failures, externalities, nonmarket values, economic development, small owner assistance/equity, and other reasons.

Examples of tree planting subsidies are pervasive. Brazil offered tree plantation subsidies to all forest landowners from about 1966 to 1986, which helped contribute to planting of several million hectares of forest land at that time, almost all of exotic timber species of U.S. southern pine or Australian eucalypts. Uruguay, Argentina, and Chile all offer timber planting subsidies to forest landowners, Argentina has few restrictions for their landowners; Uruguay offers subsidies to landowners who plant in designated forest development zones; and Chile has gradually tightened its subsidy requirements to favor small landowners, erosive soils or sensitive sites, and native species. However, Sterner (2003) notes that tree planting subsidies are not always successful, especially for small forest owners, and agricultural subsidies for roads and development create particular problems for forest retention. He adds that subsidies may generate equity problems, favor powerful beneficiaries, and that their reduction would save public funds.

Income tax incentives or subsidies tax income from forest products at a lower rate than regular income, generally on the premise that long-term forest investment externalities or market imperfections require some government recognition and tax break. Most countries provide some form of favorable income taxation to forestry. Property tax reductions are often given to remove the taxes of timber until it is cut or to value forestland at preferential rates in order to encourage its retention rather than development. If land near rapidly developing areas is taxed at full development value rates, landowners will be forced to convert the land to pay the increasing taxes (Klemperer, 2003).

Large subsidies are often granted to private firms that are given concessions to harvest timber and manage public forest lands. Notable among these are the alleged subsidies given to Canadian forest products firms that harvest timber; large concessions granted to

timber companies to exploit timber and promote rural development in Indonesia; and timber/agricultural development policies for settlement in the Amazon. These policies presume that timber exploitation is better than protection as an appropriate means to foster rural development. Sterner (2003) catalogs several problems with concessions, ranging from noncompetitive or corrupt allocation, rapacious industry practices, and severe degradation of open-access forests.

3.2. Contemporary innovations

The traditional spectrum of policy instruments has evolved and been modified to adapt to current economic, political, and resource conditions. As suggested by the preceding literature, these new policy tools focus more on multi-functional forestry elements, including nonmarket resources, social and community criteria, and collective and public goods. At the same time, new multi-functional tools must cope with increasingly limited government budgets, and fewer resource professionals. Thus, the tools often must rely on government as a catalyst and rule maker, and market tools and firms, communities, and individuals to implement new resource policies.

For example, traditional multilateral and bilateral aid has been the primary source for support of forestry in developing countries. Such official development assistance (ODA) includes grants, concessionary loans, and technical assistance. However, all the increases in ODA since 1991 have been provided by private sector investment from foundations and nongovernment organizations (NGOs) (Becker, 2005).

3.2.1. Market mechanisms

The default forest policy tool is a more explicit recognition of the utility of simply allowing markets to allocate resources. This would apply directly to private lands, which can produce, sell, and trade private, rival forest goods and services as well as the forest land itself. Even for these lands, a whole set of land use and tenure rights must be established and maintained well by government in order to ensure that the forest owners have secure rights in the forest land and its produce, which they can exchange in financial markets. Establishing these property rights is difficult in many developing countries, where there are conflicting land ownership claims and weak government. It also is

difficult to let markets allocate resources in community ownerships or for environmental services, where tenure and exclusion rights are less clear, and the market exchanges are subject to higher transaction costs (Katila and Puustjärvi, 2004).

Despite the requirement for clear bundles of rights for private land, markets provide perhaps the most powerful force to allocate resources and can be shown theoretically at least to be the most economically efficient inputs for forest production and conservation (means to minimize resource use for a given level of output). This is a very desirable characteristic, since it will minimize waste of resources and, by minimizing costs, allow more people to use the lower cost forest products. Thus, environmentalists and conservationists as well as economists are seeking new ways to harness market forces to protect the environment as well as produce goods and services efficiently. Markets also are argued to favor individual freedom, where individual choices are made based on market prices, not government dictates (Bayon, 2004).

The free enterprise private market approach will produce rival private and toll goods if clear sets of forest land rights exist for products, services, or amenities. Several other policy tools listed in the first section of Table 1 are variations of this approach. Forest resource monetization refers to the selling of forest land by large industrial firms (or governments such as New Zealand and South Africa) in hopes of converting forest land assets with low financial returns into cash for other purposes. On the other hand, a large number of timber investment management organizations (TIMOs), which often hold tax advantages that large firms do not, are buying forestlands and managing them as intensively as industrial private forest landowners (Munn and Rogers, 2003). Foreign direct investment in forestry projects is another important contributor to the industrial forest sector development, especially in developing countries with fast-growing industrial plantations and the associated forest products manufacturing capacity (Uusivuori and Laaksonen-Craig, 2001).

Cooperatives and community forest landowner associations have become a necessity in many countries because of the fragmentation of forests. They act as players in forest markets by providing technical expertise to small landowners, economies of scale, and bargaining power in markets with larger timber buyers.

Community-based forest management (CBFM) or community natural resource management (CNRM) is another means to employ collaborative decision-making in a community and to achieve broader social and environmental goals. Kellert et al. (2000) examined CNRM cases in Kenya, Nepal, and the U.S., using criteria of equity, empowerment, conflict resolution, knowledge and awareness, biodiversity protection, and sustainable resource utilization. They found that CNRM provided few observable benefits in developing countries with weak institutions and pressing environmental problems, but were more successful in the U.S. Other studies have found more success from community forest-based management (Yadav et al., 2003), and efforts for devolving governmental control to communities and local users continue, along with efforts for institution building and reform.

3.2.2. *New market approaches*

A variety of new market policy approaches have been developed to achieve multi-functional forest management in the last two decades, with varying levels of government involvement. Forest certification, reduced impact logging certificates, country of origin validation, international banking and loan strictures, and other approaches have been used to seek and verify improved forest protection and management taking international trade as lever for these reforms. Loan securitization, conservation easements, tradable protection rights, and payments for environmental services have expanded greatly since 1990.

Various environmental management systems and forest certification systems have been adopted by the forest industry to demonstrate compliance with desirable forest practices that meet economic, social, and environmental goals—the pillars of sustainable development and sustainable forest management (Rametsteiner and Simula, 2003; World Wildlife Fund, 2005). The international Forest Stewardship Council (FSC) council was created by environmental nongovernment organizations (ENGOs) in 1993 to encourage and certify responsible forest management practices, initially for the tropics. This served as one means for private and public forest owners to demonstrate acceptable forest management practices, and prompted creation of competing forest certification systems, including the U.S. Sustainable Forestry Initiative in 1995, the Pan-European Forest Council in 1998, and

the Canadian Standards Association in 1996. By March 2006, forest certification systems in the world had expanded to cover about 270 million ha according to the major program web sites, which comprises 7% of the world's 3.9 billion ha of forests (FAO, 2003).

In addition to forest certification, a rapidly developing market-based mechanism for all sustainable development is the area of corporate social responsibility (CSR). This paradigm can be defined as “an obligation to pursue those policies, to make those decisions, or to follow those lines of action that are desirable in terms of the objectives and values of our society” (Bowen, 1953, as cited in Panwar et al., 2006). Much debate exists about the specifics of CSR, but it centers on means to implement social, environmental, and economic dimensions of business practices to ensure both profitable and responsible businesses (Panwar et al., 2006). The institutionalization of CSR is reflected the new Dow Jones (2006) Sustainability Index, which rates the leading sustainability-driven companies worldwide. Similarly, more than 40 international commercial investment banks now use the Equator Principles (2006) to manage environmental and social issues in project financing.

A recent and controversial new approach in international finance is securitization. Securitization is a process where an asset, debt, or obligation or aggregation of these is turned into a marketable security (a stock or bond). Usually, loan securitization occurs when creditors pool a series of loans and use these assets to issue a bond that can be traded in capital markets. Securitization has been proposed based on future revenues from park revenues, water user fees or bioprospecting (Bayon et al., 2002). Another tool, policy and business guarantees, ensures that investors in forestry will not face drastic policy changes during their investments that will adversely affect expected financial returns. Debt-for-nature swaps have allowed some areas to be reserved for forest protection in developing countries in exchange for partial or full payment of international loans and other debts (Deacon and Murphy, 1997).

Markets also may be used for relatively new nontraditional policy instruments such as tradable development rights, conservation easements, tradable protection rights payments, bioprospecting fees, production of nontimber forest products, ecotourism, carbon offset payments, payments for environmental services, or payments for environmental degradation.

These new market-based policy tools have been widely promoted as having great promise to blend biodiversity conservation, economics, and sustainable development (Powell et al., 2002).

Pagiola et al. (2002) provide a review of developments in payments for environmental services (PES) related to biodiversity protection, watershed protection, and carbon sequestration, concluding that these merging markets offer considerable promise to reduce forest destruction and compensate local forest owners. Wunder (2005) provides a review of PES. He concludes that PES schemes will increase, but they must demonstrate clear added service values against established baselines and build trust with service providers. PES tend to work best where clear threats to conservation exist, often in marginal lands with moderate conservation opportunity costs. While promising, PES is not likely to surpass other opportunities for conservation instruments (Pagiola et al., 2004).

Transfer of or tradable development rights (TDRs) may be used to help conserve entire habitats for valuable forests and wildlife. TDRs essentially remove some of the property rights from land, so that it may be retained in a more natural condition. TDRs work because they help developing countries monetize valuable biodiversity conservation benefits, and developing countries reimburse them for the benefits of protection (Panayotou, 1994). These deals often limit all development, and sometimes forest management and timber harvesting. ENGOs such as The Nature Conservancy and Conservation International have become actively purchasing and managing forests, grasslands, swamps, and other important natural areas. These organizations purchase land or the development rights to the land, either through fee simple ownership or some form of permanent or temporary conservation easements (Albers et al., 2004; Land Trust Alliance, 2005). This has paralleled a renewed effort on the part of state and local governments and occasionally on the part of the federal government, to purchase valuable natural areas or the development rights in those areas.

Direct payments and the creation of markets for protection of environmental or ecosystem services have been developing rapidly. These environmental service payments provide financial subsidies to encourage conservation and may be received by individuals, firms, or governments. First, direct payments may be made by governments to private landowners in order to

enhance ecosystem services. Second, large groups of people can exchange credits for environmental services in newly developed markets, usually created through new government institutions/rules such as cap (of pollution or loss of endangered species) and trade (of permits to pollute or protected species habitat). These markets include air pollution permits, wetlands mitigation credits, or endangered species protection credits. These payments/markets are intended to protect environmental services through payments or market trade for protection of those services. Third, there are various private deals that exist to obtain or in anticipation of receiving environmental protection credits, such as electric power companies to purchase carbon storage credit from landowners who plant trees (Powell et al., 2002; Scherr et al., 2004). Total funding is small to date for most sectors, but wetlands banking in the U.S. has involved more than \$1 billion to date (Bayon et al., 2002; Bayon, 2004).

Carbon offsets are essentially international subsidies or financial incentives to help mitigate climate change by storage in natural reservoirs (Sturner, 2003). Markets for carbon storage, via tree planting or avoided deforestation, are promising under the Kyoto Climate Change Agreement, although the U.S. is not a signatory. Europe developed the European Union Emissions Trading Scheme in 2005, and there is a nascent Chicago Climate Exchange, but it has few participants to date. The new United Nations Clean Development Mechanism (CDM) process under the Kyoto Protocol (UNFCCC, 2006) allows industrialized countries with a greenhouse gas reduction commitment to invest in emission reducing projects in developing countries as an alternative to emissions reductions in their own countries. Biomass projects comprise a small part of these CDM projects to date (Wikipedia, 2006). Some individual carbon storage deals also have occurred between firms and individual landowners in Latin America and in the U.S. Carbon sequestration will probably be the most significant forest based environmental service in terms of trade (Katila and Puustjärvi, 2004).

Katila and Puustjärvi (2004), however, note that these new markets are still relatively rare and limited in scope with the exception of carbon offsets. Simpson et al. (1996) concluded that the potential of bioprospecting was overrated and not adequate to promote widespread forest conservation throughout the world. Simpson (1999, 2004) extended that argument to

conclude that bioprospecting, NTFPs, and ecotourism alone would be inadequate to relieve local pressure on tropical forests, and that Integrated Conservation and Development Projects have not succeeded in protecting biodiversity in developing countries. He advocates that developed nations who value biodiversity in developing countries must identify appropriate land holders and make direct payments to achieve forest conservation and biodiversity.

3.2.3. Government ownership, market sales, and production

Governments control the brunt of the world's forests. Their level of management, conservation, and protection varies widely, and they have a variety of policy tools. Government ownership of forests, as well as production of market and nonmarket goods and services, is justified on the basis of the nature of those goods, social and political choices, nonmarket values, and a long tradition of professional resource management. Government management of forests has been criticized for a host of problems and issues, including rent seeking, public choice, corruption, poor policies, and poor implementation (e.g., Stroup and Baden, 1973; Repetto and Gillis, 1988; Vincent, 1990; Ascher, 1994).

Sturner (2003) characterizes the state (national government) in many developing countries as a poor manager for various reasons—because of the low value of the forest resource compared to their high management costs; the lack of knowledge that a local manager would have; and the open-access nature of national forest lands. He suggests devolution of tenure rights to local users, through community forestry or small-scale private ownership. He notes that the World Bank now favors communal forestry, which may be more cost-effective because land titles are costly to manage in developing countries and may favor the better off, leading to inequity and inefficiency.

Despite the critics, governments do own 80% of the world forests, and manage them for better or for worse. Rainey and Steinbauer (1999) write that empirical evidence suggests that most government agencies perform very well. Research indicates that effective government programs have support from external stakeholders such as political authorities; agency autonomy in refining and implementing its mission; an attractive mission; a strong, mission-oriented culture; and good leadership. The authors term such

good agencies as galloping elephants—swift agencies with thick skins, but sensitive, altruistic, and nurturing. The classic [Clarke and McCool \(1985\)](#) treatise on natural resource agencies identified many as stars, such as the U.S. Forest Service and the U.S. Army Corps of Engineers. These assessments were based on the fairly single purpose role of the agencies and high esprit-de-corps as they expanded. While encouraging in serving as role models for good government, successful multi-functional government forestry models are less readily accessible, because they are probably more difficult to develop.

Governments may reserve land from protection completely; may set aside areas as part reserves and part commercial production; may operate the forests themselves and manufacture secondary timber or nontimber forest products; may establish contracts and concessions for exploitation; may sell products and services through negotiated sales or various bidding strategies; or may just neglect their lands and allow local users to exploit the forests. Public forests may be managed at the federal level, by community groups who live in the forests, by native or indigenous people, by states, provinces, counties, cities, or by other types of government ownership. Governments may also use joint management approaches with private firms; have private firms build and operate activities for fixed time periods, and return them to the government; or have firms build, own, and operate, facilities public lands, or take over government owned facilities ([Simula et al., 2002](#)).

Demands for government ownership and management continue, although the nature and level of government control remains crucial. Increasing calls are made for devolving more control to local communities, with less national control. In a Center for International Forestry Research review, [Ostrom \(1999\)](#) notes that destruction or degradation of forest resources is most likely to occur in open access areas where external or local authorities have not established effective governance. Users with more knowledge of, interest in, autonomy, trust, and prior organizational experience will have more success in organizing to protect and enhance forest resources.

Given the large area in public forests and the amount of issues involved with those forests, we will demur on providing a more detailed discussion of forest policies for them. Debates over land tenure, public choice theory, preservation, parks, reserves, concessions, contractors, subsidies, regulation, local benefits, deci-

sion-making approaches, and other factors are legion. Even public lands are becoming more reliant on market mechanisms for allocating their resources ([Sills and Abt, 2003](#)) and are expected to be efficient—minimize resource waste and budget expenditures—as well as provide a wealth of multiple public benefits.

3.2.4. International sustainable forest management processes

Multi-country and multilateral initiatives have led to the development of regional and international criteria and indicators for measuring and monitoring success in achieving sustainable forest management (SFM) and to international discussions that may lead to international principles about forest management ([Siry et al., 2005](#)). The United Nations Forum on Forests has debated development of specific principles on forests for two decades and just concluded its 6th International Forum in 2006. That forum agreed to reverse loss of forest cover worldwide; enhance forest-based benefits; increase the area of protected and sustainable managed forests; and reverse the decline in official development assistance for SFM ([UNFF, 2006](#)). Achieving these goals will be very difficult, but agreeing on them among developed and developing countries is a significant first step, and not trivial.

Sustainable forest management criteria and indicators (SFM C&I) are tools for assessing forest conditions and sustainability at national and regional levels, not performance standards for certifying forest management. The regional and international SFM C&I processes are being used to characterize sustainable forest management; coordinate data collection, storage, and dissemination; monitor and assess the trends in forest conditions; and inform decision-making. These efforts are supported by a number of international organizations, such as the Food and Agriculture Organization, the International Tropical Timber Organization, the Center for International Forestry Research ([Montreal Process, 2003a](#)).

As of 2003, close to 150 countries were participating in at least one of nine international and regional processes to develop, implement, and use SFM C&I ([Montreal Process, 2003b](#)). Today, the principal SFM C&I initiatives that are active and making progress are the Montreal Process for temperate forests, the International Timber and Trade Organization (ITTO, [2005](#)) guidelines for tropical forest products producers

and global forest products consumers, the Ministerial Conference on the Protection of Forests in Europe (MCPFE, 2006), the Tarapoto Process for the Amazon Basin (Elías, 2004), and the Dry Forest Asia Process. These new international accords place more scrutiny on forestry issues; encourage better forest monitoring, management and protection; and focus public and private efforts on evolving forestry issues.

4. Conclusions

Forest policies help determine the retention, use, and protection of forests. In the last decade, sustainable forest management has become a widely accepted paradigm. This paradigm states that we should manage forests for a broad set of economic, ecological, and social values. This infers that our forest policies must provide a broad set of multi-functional goods and services. The evolving nature of sustainable forestry goals requires advances in forest policy instruments for multi-functional forestry. In particular, the new forest policy instruments must improve our ability to provide and to protect common pool and collective goods; to account for and mitigate market failures and externalities; and to include communities and new nongovernment stakeholders better. Furthermore, policy instruments for multi-functional forestry must rely on government and perhaps even forest resource professionals less, which are becoming more constrained by lack of public funds. Determining when to seek to employ public policy instruments, which policy instruments to employ, and how fund and implement them is fundamental.

Table 1 summarizes a continuum of forest policy instruments that may be used for single-purpose or for multi-functional forestry. Traditional policy instruments—those in the upper left four or five rows and left five columns—have been applied most often to single purpose forest production and conservation goals. Broader, multi-functional goals embodied in sustainable forest management have required more creative new instruments, such as those depicted at the bottom two or three rows or and two right hand columns of the continuum shown in Table 1. Traditional instruments may still be applied to achieve broader goals, either separately or in conjunction with new policy tools. But new policy instruments have been developed and are required given changing values, resource characteristics, and professional and budget realities.

Governments are actively involved in forest ownership, management, incentives, and regulation. While markets have been allowed to allocate resources, particularly in the case of timber and fuelwood or charcoal for urban consumption, policy intervention is common in most other respects. This intervention assumes that the difference between socially desired outcomes and market outcomes requires government involvement in resource allocation. The greater discrepancy between social goals and market outcomes, the greater the presumed need for government action. However, this prospect must be tempered by careful analyses, and the possibility that public choice theory and agency self-interests may prompt excessive demands for government intervention.

A method to identify most efficiently the priority investments is the dual financial-economic analysis of the society's desired action (Harou, 1987). The benefit-cost analysis made from the forest owners' perspective is repeated from society's point of view duly shadow pricing with environmental valuation (Markandya et al., 2002). By studying the discrepancies between the two analyses, instruments are designed that ideally (from an efficiency perspective) would make the owners just break-even in implementing society's desired action. The instruments so proposed are then competing in a limited government budget for forestry and natural resources in which short-run problems could be perceived as more pressing. Food, nutrition, shelter, clothing, and health care are lacking in many areas of developing countries, and forests are often seen as natural capital that can be used to enhance these basic needs. So our forest policy often is linked to basic human needs, and those needs often relate to rural development and quality of life that exploitation of forests may provide.

Higher level needs, including environmental protection, global climate change, carbon storage, aesthetics, and biodiversity are increasingly recognized as important contributors to our quality of life and survival with high demands to increase protection and provision of these services. Simula et al. (2002) note that contemporary forest policies may focus on production or commercial forestry projects, socially targeted projects, or environmental projects. Not all policy instruments work well with each broad goal, and often, a mix of instruments will be preferred. Under limited government budgets, creative people are

developing new policy instruments to achieve the new set of goals.

These new policy tools are increasingly relying on market mechanism to achieve conservation, because markets allow minimizing transaction costs. However, this does not mean that government is becoming less crucial or that subsidies for conservation are cheap or superior to direct payments for biodiversity and environmental protection (Bayon, 2004; Simpson, 2004). In fact, government is absolutely required to set the policy rules and mandates for market exchanges to work in conservation as well as in production. For example, the Kyoto Protocol for climate change has been implemented by a European government decision to provide funding for carbon storage, set the rules for how credits may be received, and allocate funds for payments. In the U.S., the no net loss policy for wetlands protection has required all development actions by government and by the private sector to offset any wetlands destruction with wetlands restoration or banking efforts and thus create an active market for wetlands construction and sales to pay for environmental degradation that does occur.

The selection of the appropriate policy instrument to achieve these multi-functional forestry goals in the future will depend on the context, country, nature of the goods, societal values, land tenure, market effectiveness, and the government funding and authority. At a minimum, policy instruments should be efficient, be arrived at through due processes, be fair for forest users and owners, be practical and effective, and be affordable. The challenge for forest policy makers is to identify societal goals well, decide when government should intervene, select the policy tools wisely with public and private cooperation, and implement the policies effectively. We have a number of new and creative forest policy tools that have been developed to achieve out broad multi-functional forestry goals. The challenge will be to garner adequate public, political, and financial support for these new policy instruments and to implement them well.

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