1994
Society and Natural Resources, Volume 7, pp. 515–533
Printed in the UK.
0894-1920/94 $10.00 + .00

Changing Forest Values and Ecosystem Management

DAVID N. BENGSTON

USDA Forest Service
North Central Forest Experiment Station
St. Paul, Minnesota, USA

There is substantial evidence that we are currently in a period of rapid and significant change in forest values. Some have charged that managing forests in ways that are responsive to diverse and changing forest values is the main challenge faced by public forest managers. To tackle this challenge, we need to address the following questions: (1) What is the nature of forest values? That is, can all forest values be reduced to a single dimension, as assumed in utilitarian-based traditional forestry and economics, or are these values multidimensional and incommensurate? (2) What specific values are involved? (3) What is the structure of forest values? That is, how are they related to each other in value systems? (4) How and why have forest values changed over time? and (5) What do changing forest values imply for ecosystem management approaches? This article discusses key issues related to these questions.

Keywords ecosystem management, forest values, methodological pluralism, multidimensionality, new forestry

A growing number of social scientists and other observers have discerned a fundamental shift in environmental values in recent decades. A "new environmental paradigm" of humans and nature is challenging the longstanding constellation of values, attitudes, and beliefs that form the "dominant social paradigm" through which many in industrialized societies view the world.[1] The dominant social paradigm emphasizes economic growth, control of nature, faith in science and technology, ample reserves of natural resources, the substitutability of resources, and a dominant role for experts in decision making. In striking contrast, key themes of the new environmental paradigm include sustainable development, harmony with nature, skepticism toward scientific and technological fixes, finite natural resources, limits to substitution, and a strong emphasis on public involvement in decision making. Many studies and public opinion polls have indicated growing acceptance of the new environmental paradigm among the general public. This fundamental shift has been accompanied by related paradigmatic challenges in a large number of fields.[2]

Professional forestry in the United States is also in the midst of a paradigmatic challenge—a new resource management paradigm—that is related to the above shifts.[3] The old paradigm, "multiple-use sustained-yield" forest management, or traditional forestry, has guided public forest managers for many decades. Sustained yield dates back to the

Received 8 February 1993; accepted 3 September 1993.

Address correspondence to David N. Bengston, Ecological Economist, USDA Forest Service, North Central Experiment Station, 1992 Folwell Avenue, St. Paul, MN 55108. Internet: <bengs001@maroon.tc.umn.edu>

18th and 19th century central European tradition of forest management that aimed to maximize and sustain the yield of a single resource—commercial timber (Behan, 1991). The introduction of sustained-yield forestry to North America in the 1890s was an important innovation, intended to ameliorate the devastating exploitation of forests in the 19th century. Multiple-use forestry began to be discussed in the 1930s, but was not seriously considered until after World War II when demand for recreation, wildlife, water, and other nontimber forest resources began to increase. The basic idea of multiple-use forestry was to broaden forestry's traditional focus on timber production to include the production of other commodities. Multiple-use forestry was required by law on the national forests beginning with the Multiple-Use Sustained-Yield Act of 1960. But the practice of multiple-use forest management has fallen short of the ideal—the long-held doctrine of "timber primacy" has continued to dominate forestry practice (Clary, 1986; Glück, 1987; Hays, 1988; McQuillan, 1990; Shepard, 1990). As late as 1992, the president of the Society of American Foresters wrote ". . . timber comes first" (Barton, 1992, p. 3). Shands (1988) has argued that "multiple use has become a pejorative term that many people believe is synonymous with management that emphasizes timber production to the detriment of other forest resources" (p. 14).

The emerging forestry paradigm that is challenging traditional forestry is called by various names: new forestry, new perspectives,[4] forest ecosystem management, holistic forestry, sustainable forestry, multi-resource forest management, multi-value forest management, kinder and gentler forestry, and, by its detractors, a "gimmick" (O'Keefe, 1990), "glossy dogma" (Kerr, 1990), and "hype" (Zuckerman, 1992). New forestry is probably the most widely used term to date, but the more descriptive "forest ecosystem management" is becoming more common. This article therefore refers to the new forestry paradigm as forest ecosystem management or, simply, ecosystem management.

Alternative definitions of ecosystem management are even more numerous than its names. Clark and Stankey (1991) conducted a Delphi mail questionnaire that, among other things, asked participants what they felt should be included in a definition of new perspectives (ecosystem management). Almost 90 wide-ranging items were suggested by respondents as elements to be considered in a definition. These elements were grouped into six distinct categories. Some respondents defined ecosystem management primarily as an ecologically based approach to forest management, which would apply ecological information and principles. A central theme of this view is that ecosystem management should follow nature's lead, i.e., mimic natural disturbance patterns and recovery strategies, leave biological legacies such as standing live and dead trees and fallen logs, and so forth. Others viewed ecosystem management primarily as a socially based approach to forest management that would focus on changing public values associated with forests. A central theme of this view is that ecosystem management should recognize these values and make forestry practices more responsive to them. Other categories of definitions contained certain elements of the ecologically and socially based definitions: an integrative approach, more participatory decision making, and improved scientific understanding. The final group of respondents were skeptical of ecosystem management and questioned the motives of those promoting the concept. Despite the wide range of views, respondents expressed a surprisingly high level of agreement about the diverse definitions in a subsequent questionnaire, indicating an appreciation of other perspectives.

Table 1 summarizes the key differences between traditional forestry and forest ecosystem management. Because the nature and legitimacy of ecosystem management are still being vigorously debated in the forestry community, there is no consensus on the characteristics listed in the table (e.g., compare Table 1 to Behan, 1990a; Brown & Har-

Table 1
Key differences between traditional forest management and forest ecosystem management

	Traditional forest management	Forest ecosystem management
Philosophical base	Utilitarian	Leopoldian environmental ethic
Objectives	Maximize commodity production	Maintain the forest ecosystem as an interconnected whole, while allowing for sustainable commodity production
	Maximize net present value	Maintain future options
Constraints	Sustained yield: periodic harvest or use of outputs must be less than or equal to their periodic growth or capacity (e.g., allowable cut for timber, carrying capacity for recreation)	Long-term ecosystem sustainability Maintain forest aesthetics Social acceptability of management practices
Role of science	Views forest management as applied science	Views forest management as combining the scientific and the social
Value	Forests valued as a resource—instrumental value only	Forests valued instrumentally and intrinsically
	Value monism	Value pluralism
Major themes	Focuses on outputs (goods and services demanded by people, e.g., timber, recreation, wildlife, and forage)	Focuses on inputs and processes (e.g., the soil, natural capital, biological diversity, and ecological processes)
	Management that fits industrial production processes (the "regulated forest")	Management that mimics natural processes
	Timber is the most important forest output (timber primacy)	All species—plant and animal—are important
	Impending timber famine	Biodiversity loss
	Mechanistic, reductionist view of forests	Systems view of forests—the forest is more than the sum of its individual parts
	Scale: typically stand-level	Scale: ecosystem- and landscape-level
	Planning/management unit: political or ownership boundaries	Planning/management unit: ecosystems
	Economic efficiency	Cost-effectiveness, social acceptability

Source. Adapted in part from Behan (1990a) and Brown and Harris (1992b).

ris, 1992b). But most agree that the main objective of ecosystem management is maintaining the forest ecosystem as an interconnected whole, not just producing wood and other commodities (Franklin, 1989). In addition to this broad scientific objective, there is widespread agreement among proponents of ecosystem management that the social objectives of maintaining the aesthetic qualities of natural forests and achieving social and

political acceptability of management practices through a public dialogue must be an integral part of the new paradigm (Behan, 1990b; Brunson & Shelby, 1992; Clark & Stankey, 1991; Fiedler, 1992; McQuillan, 1993; Shepard, 1990).

As traditional forest management has been increasingly questioned, much discussion has been generated about why the old paradigm is no longer appropriate or adequate for public forest management.[5] Several interrelated factors have been proposed that, taken together, suggest the social context for forest management has changed and traditional forestry no longer fits contemporary circumstances. As early as 1975, Behan argued that the guiding assumptions of traditional forestry were no longer valid due to social changes, and that a radically new approach to forestry was needed. One such social change is an increasingly urban population (Hendee, 1989; Shepard, 1990). Urban-based groups that have less direct contact with forests than traditional forestry stakeholders have nonetheless become eager to be involved in decision making, and have exerted greater influence on forest management. An influx of urban migrants to rural and remote areas since the early 1970s is a related factor. The urban migrants often have different value priorities and different views of the forest than long-time rural residents (Shannon, 1988). Kennedy (1985) summarizes the differences between the urban and rural orientations to nature, and discusses their implications for conflict over forest management. Related to increased urbanization, structural changes in the economy such as the reduced relative economic importance of primary raw material industries, decreased employment in these sectors, and the rise of employment in the service sector have also played a role.

Another reason for the dissatisfaction with traditional forestry is the growing unwillingness to accept professional authority in society (Hendee, 1989). Traditional forestry in the United States developed during the Progressive Era, ". . . an era characterized by a belief in the neutrality of scientists and the confidence that knowing the 'facts' was sufficient to resolve most public policy questions" (Brown & Harris, 1992a, p. 74). The idea that scientifically based, "rational" management could replace politics was a central tenet of the progressive conservation movement. A science-based approach to forest management was highly successful for the Forest Service for many decades, but the authority of the science-based professional forester—as well as other experts—has eroded in recent decades.

Ironically, growing dissatisfaction with traditional forestry from *within* the forestry profession has been prompted in part by increased scientific understanding of the dynamics of forest ecosystems, which has raised questions about the impacts and sustainability of forest practices (Stankey & Clark, 1992). Growing professional dissatisfaction with traditional forestry has also been driven by workforce diversification within public land management agencies. Brown and Harris (1993) conclude that the growing numbers of nonforesters within the Forest Service will have a significant impact on organizational values and on the agency's resource management paradigm. Forestry and range management—both commodity-oriented disciplines—have dominated the Forest Service. But disciplines that emphasize the protection of ecosystem health, such as ecology, wildlife biology, and soil science, have grown in representation and influence within the Forest Service.

Perhaps the underlying reason for the challenge to traditional forestry, however, is its failure to adjust to changing social and environmental values. The relative importance of nonconsumptive and nonutilitarian values of forests has grown in recent decades. The utilitarian philosophical base and focus on commodity production of traditional forestry have blinded many professional foresters to aesthetic, spiritual, and amenity values and, more recently, to the ecosystem function value of forests—the role of forest ecosystems in maintaining a healthy and resilient setting for all life. Foresters in general, and the USDA For-

est Service in particular, have been harshly criticized as being biased against the emerging values, and a growing body of research has supported this alleged bias (e.g., Clary, 1986; Mohai, 1987; Twight & Lyden, 1989; Vining & Ebreo, 1991; Wellman, 1987).

An indicator of growing professional dissatisfaction with traditional forest management is the rapid growth of the Association of Forest Service Employees for Environmental Ethics (AFSEEE). AFSEEE was formed in 1989 to change forest management practices on the national forests, and has been called an "internal revolt" (Anon., 1990, p. 50). The mission statement of the organization reads as follows: "The association is dedicated to promoting ecologically sustainable management practices and an environmentally sensitive resource ethic in public resource management agencies, especially the Forest Service, through educational and outreach activities." A recent study (Brown & Harris, 1992b) found that the attitudes and values of AFSEEE members differ significantly from those of most Forest Service employees. A broader organization called Public Employees for Environmental Responsibility (PEER) was formed in 1992 to encourage all state and federal land managers and Environmental Protection Agency employees to speak out for environmental ethics and to protect whistleblowers who dissent for ethical reasons (DeBonis, 1992).

It is increasingly recognized that the crucial questions the Forest Service and other land management agencies face—i.e., how and for whom public lands ought to be managed; what objectives should guide public forest management—cannot be answered by science. Normative and ethical questions such as these require an examination of values (Baird, 1991; Fiedler, 1992; Shepard, 1990). Proponents of ecosystem management have called for managing the national forests for "multiple values" rather than multiple uses, and critics have charged that managing the national forests to respond to new public values is the "core problem" faced by the Forest Service (Shands, 1988). To manage public forests in ways that respond to diverse and changing forest values, we need to address the following questions:

(1) What is the nature of forest values? Can all forest values be reduced to a single dimension, as assumed in utilitarian-based traditional forestry, or are these values multidimensional and incommensurate? Can all forest values be expressed in monetary terms, as implicitly assumed by most economists?
(2) What specific values are involved? Aesthetic, spiritual, moral, economic, scientific, ecosystemic, others?
(3) What is the structure of forest values? How are they related to each other in value systems? What is the relative importance of different forest values, and according to whom? What indicators can be used to validly and reliably measure forest values? What policy-relevant factors explain differences in forest value systems?
(4) How and why have forest values changed over time? Have new values arisen (e.g., biodiversity value)? Has the relative importance of forest values changed? How are forest values likely to evolve in the future?
(5) What do changing forest values imply for ecosystem management? How can information about the ways in which people value forests be used in policy and management decisions?

The remainder of this article explores some of the key issues related to these questions and discusses possible research approaches to address them. To set the stage, the following section briefly discusses various disciplinary perspectives on studying values and the need for methodological pluralism.

Disciplinary Perspectives on Value and Methodological Pluralism

Rokeach (1968a) notes that ". . . values have long been a center of theoretical attention across many disciplines—philosophy, education, political science, economics, anthropology, and theology, as well as psychology and sociology" (p. 158). Each of these disciplines—and others as well—has a dominant concept of value, surrounded by a host of competing schools of thought. Because each discipline approaches the topic from a different perspective, each sheds some light on the nature of value and the value of nature. Any effort to examine changing forest values needs to recognize this diversity of perspectives and methodologies.

Brown (1984) describes three interrelated "realms of value" that are helpful for sorting out the many disciplinary approaches: The conceptual, relational, and object realms. In the conceptual realm, a value is defined as an enduring conception of the good. Value in this sense is used as a noun, and is sometimes referred to as an ideal or a *held value.* Brown notes that held values can be classified as desirable modes of conduct (e.g., courage, honesty), end-states of existence (e.g., equality, freedom), or qualities (e.g., beauty, uniqueness). Many other classifications of held values are possible. We define a held forest value as an enduring concept of the good related to forests and forest ecosystems. In the relational realm, value is viewed as arising from a relationship between a subject and an object in a given context. Value in the object realm is concerned with the relative importance or worth of an object, often called the object's *assigned value.* Brown (1984) notes that confusion sometimes arises because held values are objects in a broad sense, and therefore can be assigned value: "When one states that one held value (e.g., generosity) is superior to another (e.g., frugality), one is assigning value to held values. That is, one is expressing the relative importance or worth of an object (a thought) in a given context" (p. 234). Social psychologist Milton Rokeach's (1973) classic work on values involved assigning value to held values. We define assigned forest value as the relative importance or worth of objects related to forests and forest ecosystems.

The relationship between the conceptual, relational, and object realms is useful for understanding the relationship between and classifying the many disciplinary perspectives on value. The conceptual realm is concerned with an important part of the *basis* of value, the relational realm is concerned with the valuation *process,* and the object realm is concerned with the end *result* of the valuation process. Thus, those who define value in terms of one of the three realms are focusing on part of a broader valuation process.

Brown's (1984) three realms are not complete, however, because his relational realm focuses exclusively on one type of value relationship, namely, individual preference. Andrews and Waits (1978) identify three broad types of value relationships, which they term preference, obligation, and function. Table 2 presents a system for classifying disciplinary approaches to studying values that combines Brown's realms of value with Andrews and Waits' three types of value relationships.[6] The following paragraphs describe these value relationships and identify where the dominant disciplinary approaches to studying value fit within the framework of Table 2.

Andrews and Waits define preference as a value relationship based on individual desire. For example, I might prefer tropical rainforests to tundra, or wilderness camping to developed camping. The value concepts and indicators of value in neoclassical economics and social psychology fall squarely within this notion of preference-based value. Economists rarely venture beyond the bounds of assigned value based on individual preferences and expressed in monetary terms. Utility is the only held value recognized by most economists: "They are strangely monotheistic about the idea of utility; 'there is only

one value and its name is utility' " (Boulding & Lundstedt, 1988, p. 15). Social psychologists explore the realms of held and assigned value based on individual preference. Assigned value is often expressed in terms of ordinal rankings in social psychology studies. Some political scientists and utilitarian philosophers also define and analyze value in terms of individual preferences.

Andrews and Waits' second broad type of value relationship is *obligation,* which they define as a relationship of social norms. Value relationships of this type must be inferred from aggregate or social behavior; they cannot be studied by simply summing up individual preferences. In fact, obligations and social norms often conflict with individual preferences. Thurow (1983) notes that:

> Societies are not merely statistical aggregations of individuals engaged in voluntary exchange but something much more subtle and complicated. A group or community cannot be understood if the unit of analysis is the individual taken by himself. A society is clearly something greater than the sum of its parts (pp. 222–223).

Anthropologists use an obligation- or norm-based concept of cultural values that refers to the standards and ideals that characterize a people. A common cultural or social group is the unit of analysis in this approach to studying value, often demarcated by language, geographic boundaries, a common ethnic heritage, or other characteristics. The sociolo-

Table 2
System for classifying disciplinary approaches to the study of values

Relational realm	Conceptual realm (held value)	Object realm (assigned value)
Individual preference	*Studies of individually based, held values* Philosophy (e.g., Martin, 1979) Social psychology (e.g., Rokeach, 1973) Political science (e.g., Milbrath, 1984a)	*Studies of individually based, assigned value* Economics (e.g., Rubin et al., 1991) Social psychology (e.g., Holler, 1990) Political science (e.g., Milbrath, 1984a)
Obligation/social norms	*Studies of group- or obligation-based, held values* Philosophy (e.g., Sagoff, 1988) Anthropology (e.g., Kluckhohn & Strodtbeck, 1961) Sociology (e.g., Twight & Lyden, 1989) Political science (e.g., Ophuls, 1977) History (e.g., Clary, 1986)	*Studies of group-based, assigned value* Anthropology (e.g., Brandt, 1992a) Sociology (e.g., Twight, 1983) Political science (e.g., Culhane, 1981) History (e.g., Hays, 1987)
Function	*Studies of function-based, held values* Philosophy (e.g., Rolston, 1985) Ecology (e.g., Smith & Theberge, 1986)	*Studies of function-based, assigned value* Ecology (e.g., Sankovskii, 1992) Ecological economics (e.g., Judson, 1989)

gist's notion of value as norm would also be included here, as reflected in the following definition by Twight (1983): "Value indicates a normative standard that persists over time; in other words, it is a standard or code that exerts a normative (controlling) influence on human behavior" (p. 137).[7] Philosophers reflecting the deontological tradition, political scientists, and historians also define and analyze value in terms of obligations or norms. Social scientists in many different fields have studied social conflict over values, which generally falls into the realm of group-based assigned value, i.e., how societies and cultures work out the relative importance of competing values.

Finally, Andrews and Waits define function as a relationship of usefulness or service or system maintenance. For example, the wide range of environmental services or functions provided by wetlands—such as breaking down pollutants and serving as nurseries for wildlife populations—represent value relationships with reference to the system in question (e.g., the particular ecosystem) regardless of whether they are recognized by individual preferences or social norms. Similarly, a spring serves a function for the "system" of a watch, a vein for the body's circulatory system, a part of speech for a language system, and so on. A functional value relationship is basically technological in nature, and is identified in terms of the consequence it engenders for the operation of the system of reference. Some would argue that function does not belong to the same level of analysis as the other two general types of value relationships—there is no "valuer" for functional values, and they are therefore better viewed as objects of individual or social value relationships.

Within the realm of held values, some environmental philosophers have explored nonanthropocentric, function-based notions of environmental value, and ecologists have developed criteria for ecological value. These are values in a conceptual sense, although they may not be held by individuals or social groups (other than the ecologists who "discovered" them). Within the realm of assigned value based on a functional relationship, ecological economists have proposed a nonanthropocentric approach based on the energy content or energy cost of production of goods and services. Judson (1989) reviews several alternative approaches to measuring energy values. Ecologists have developed methods for measuring the relative ecological or function values associated with natural objects (Sankovskii, 1992; Smith & Theberge, 1987).

Each disciplinary approach to conceptualizing and studying values can contribute to a more complete understanding of the diverse values of forests and forest ecosystems. Sole reliance on any one perspective or analytical framework would provide an incomplete picture. As Stone (1988) notes, summarizing the view of Paul Feyerabend, ". . . the history of sciences reveals an incompleteness and even inconsistency of each framework which should be regarded as routine and inevitable, and . . . a pluralism of theories and metaphysical viewpoints should be nourished as a means of advancing on the truth" (p. 148). The perspective taken in the following sections, which discuss the five key questions previously identified, is that methodological pluralism is essential in studying forest values.

What is the Nature of Forest Values: Unidimensional or Multidimensional?

The study of forest values requires an understanding of their nature, i.e., what are the key characteristics and qualities of held and assigned forest values at different relational levels? One key characteristic that has been debated for centuries and is either explicitly discussed or implicitly assumed in all disciplinary approaches is the plurality or dimensionality of values: Are all values reducible to a common measure and thus commensurate

(value monism or unidimensionality), or are they irreducible (value pluralism or multidimensionality)? Kuntz (1970) explains the unidimensional perspective as follows:

> The bold speculation of Plato is that presumably all that falls under the good can be ranked in a single scale. This means, in our language, that all values are commensurate. There is a "common scale" by which we can grade any two values of different rank so that the one is higher than the other or the second is lower than the first. (p. 267)

The framework of Table 2 suggests several questions related to value pluralism/monism: Are held forest values reducible to a single, transcending held value (such as utility)? Is there a single scale by which value can meaningfully be assigned to objects? Are the held and assigned values of different relational realms commensurate? Value pluralism is the subject of many ongoing (and probably irresolvable) philosophical debates. The important point for the present discussion, however, is that the choice of either the pluralist or monist perspective will significantly affect, if not determine, the types of questions asked in studying forest values, the methodology for addressing these questions, the types of indicators used to measure assigned forest values, and the ways in which the resulting value information is used in decision making.

Traditional forestry, with its philosophical roots in utilitarianism, embraces the unidimensional view of value: "Trapped in a positivist belief that all values were reducible scientifically to a single measure of utility, foresters construed multiple use as an essentially mathematical problem" (McQuillan, 1992, p. 16). Foresters have been heavily influenced by the theory of value of neoclassical economics (Kennedy, 1985), which is also thoroughly unidimensional. Many economists implicitly assume that all the ways in which people value forest ecosystems can be expressed in dollars, in terms of market prices, willingness to pay for benefits associated with forests, or willingness to accept compensation for the loss of those benefits.[8] Economic value is viewed as a meta-value that comprehends all others, as revealed in the following statement by Bishop (1987): "Economics takes people as it finds them, and to the extent that such ethics [Leopold's land ethic] are present, they should express themselves as economic values" (p. 31).

The unidimensional approach of traditional economics has been increasingly questioned by environmental philosophers, ecological economists, and others in recent years. For example, Sagoff (1988) makes a strong case that many people value the environment in ways that cannot be expressed in dollars and cents: "It is fair to say that the worth of things we love is better measured by our unwillingness to pay for them . . . the things we are unwilling to pay for are not worthless to us. We simply think we ought not to pay for them" (p. 68–69). Fischer (1975) notes that "Few would argue . . . except economists, that people value only what they can buy" (p. 36).

The multidimensional or pluralist perspective maintains that held values cannot be reduced to a single dimension and that all objects cannot be assigned value on a single scale—values are inherently multidimensional. For the value pluralist, expressing all forest values in a single measure would be like attempting to express the diverse and incommensurate dimensions of the nutritional value of food—calories, sodium, vitamin A, calcium, iron, and so forth—in a single index. Nutritionists would argue that it is not possible to produce a meaningful single index of nutritional value. Value pluralists would argue that attempts to express economic, aesthetic, spiritual, and other forest values in a single measure are misguided, unhelpful, and ultimately unobtainable. According to this perspective, unidimensional approaches such as economics and classic utilitarianism need

not be discarded (Brennan, 1992; Stone, 1988). They simply provide a partial account of environmental values. Other analytical frameworks that are able to account for additional value dimensions are needed to provide a more complete picture.

An important question for public forest managers and policymakers today is whether or not all forest values are commensurate. Is there a single scale on which all forest values can be expressed and ranked? Or do multiple-value frameworks and indicators need to be considered? Can all forest values be expressed in economic terms, and if not, which cannot? Ecosystem management approaches must deal with these basic questions if they are to be helpful in managing public forests for multiple values.

What Specific Values Are Involved?

Philosophers have long distinguished between two basic types of held values: instrumental and intrinsic. Many environmental philosophers and social scientists have found this to be a useful distinction for environmental values. The instrumental values of the environment stem from the fact that ". . . nature benefits us. Nature is useful: it serves a purpose, satisfies a preference, or meets a need" (Sagoff, 1991, pp. 1–2). Instrumental values, sometimes called contributory or means values, are means to an end. Brennan (1992) states that something has ". . . instrumental value when its existence is necessary for the preservation or realisation of some other value" (p. 18). The instrumental values of a forest ecosystem stem from its utility as a means to specific ends or the realization of other values. For example, sawtimber is not prized for its own sake, but rather for its usefulness in building things that increase human welfare. Economic efficiency is an example of a held instrumental value—we want to reach goals efficiently, but efficiency is never an end in itself. We must step back and ask ourselves: Efficient for what and for whom?

Sagoff (1991) notes that the basis of intrinsic value lies in the object itself, rather than the benefits we receive from the object. Intrinsic value is concerned with the inherent worth of something as an end in itself. We value our children, our spouse, other loved ones, and other human beings intrinsically, in addition to valuing them instrumentally. They have a "good of their own"; they are not substitutable.[9] It is important for forest managers to recognize that many people value forests intrinsically, as well as instrumentally.

Intrinsic and instrumental values are not mutually exclusive. Cobb (1980) cautions that the distinction between these two basic value types should not be exaggerated or misunderstood: "There may be some things whose *only* value is instrumental, but there is nothing whose only value is intrinsic. That is, everything or every event has consequences for other things or events. . . . Hence, though not everything can be evaluated in terms of its intrinsic value, everything does have its instrumental value" (p. 163).

Beyond the basic distinction between instrumental and intrinsic value, several detailed classification systems of held forest values have been proposed. For example, Rolston and Coufal (1991) identify the following 10 categories of forest values: life support, economic, scientific, recreational, aesthetic, wildlife, biotic diversity, natural history, spiritual, and intrinsic. While this classification system is not exhaustive, it does indicate the variety of forest values that have been suggested and studied.[10] Some of the classification systems that have been put forward attempt to be comprehensive, while others are clearly incomplete; some of the value categories are mutually exclusive, while others overlap. A comprehensive classification system for held forest values is needed. Such a system could be based on a review of the forestry literature, forest regulations and laws, or it could be derived from open-ended surveys in which respondents would be asked to identify their own held forest values. Because public forestland often has unique charac-

teristics and provides resources and services that private land does not, separate value taxonomies could be developed for public and private forestlands.

What Is the Structure of Forest Values?

Given a comprehensive classification system, an understanding of the structure of held forest values would be useful in decision making and public policy making. The "structure" of values refers to how diverse held values are organized and related to each other in *value systems*. Rokeach (1968b) has defined a value system as ". . . a hierarchical arrangement of values, a rank-ordering of values along a continuum of importance" (p. 551). As defined by Rokeach, a value system or hierarchy is the outcome of assigning value (or relative importance) to held values. Value systems of this type have a central role in decision making: "Whenever we assert that one course of action is preferable to another, we are indirectly asserting a value hierarchy" (Milbrath, 1984a, p. 115). Understanding the relative importance of forest values—and key factors affecting ratings of relative importance—could be useful in developing socially acceptable ecosystem management approaches and in dealing with conflict over the management of public forestland.

Rokeach's concept of value systems and his method for obtaining them seem to imply a unidimensional view of value—all values are rank-ordered along a single, broad scale of relative importance. Although this may be more reasonable than attempting to order all values along a single, narrow scale, such as willingness to pay, this approach appears to assume that diverse values are commensurate. The earlier discussion of value pluralism suggests that this may not be the case. But the fact that two things cannot be measured on a common scale of value does not necessarily mean that they cannot be compared and ranked. The act of choosing one thing over another implies ranking or assigning value. "The concept of comparing and ranking competing values is much broader than the concept of measurement by a common scale. . . . As Kant says, there is no common measure for the value (dignity) of human beings and that (price) of material things. But Kant ranks their values when he exalts the dignity of human beings over the value of all material things" (Seung & Bonevac, 1992, p. 800).

Rokeach's approach to conceptualizing and analyzing value systems can be broadened to an explicitly multidimensional perspective by including multiple frameworks for determining value rankings.[11] For example, Rolston (1985) has identified seven "meaning levels" of value: individual preference, market price, individual good, social preference, social good, organismic value, and ecosystemic value. These meaning levels are alternative valuation frameworks that could be considered in a multidimensional analysis of forest value systems. Rolston's valuation frameworks range from individually based to collective in nature, where collective is defined to include the broader biotic community as well as human collectives. More simply, Andrews and Waits' (1978) three types of value relationships could serve as valuation frameworks to obtain three alternative rank-orderings of forest values in a particular context.

Multiple rank-orderings of forest values based on multiple valuation frameworks would provide a richer and more complete understanding of forest value systems than one-dimensional rankings. Multiple indicators of value are needed for each valuation framework in a multidimensional approach; i.e., a variety of indicators should ideally be used to measure each of the different value dimensions. Practitioners of the various disciplinary approaches have developed and tested many indicators that attempt to measure different dimensions of environmental values (Andrews & Waits, 1978). Unfortunately, the partial nature of these indicators is seldom recognized.

An important factor to consider in any approach to the analysis of value systems is the specific context in which the ordering takes place—the relative value assigned to objects is very sensitive to the valuation context. For example, the importance of the preference-based aesthetic value of a forest relative to other forest values will likely depend on whether those doing the valuing live in poverty or abundance, whether their livelihoods depend on or are unrelated to commodity outputs of the forest, and so on. People in very different circumstances may hold equally high aesthetic values on an absolute scale, but quite different aesthetic values relative to other values due to different weightings of the other value dimensions. Economic studies using the contingent valuation method have found that the context in which respondents are asked to express their willingness to pay (e.g., the amount of background information provided and the wording, sequence, and type of questions) can significantly affect the resulting economic value estimates (Anon., 1992; Hoevenagel & van der Linden, 1993; Rolston, 1985; Sagoff, 1988). The relative importance of forest values will also likely differ between different groups of forest stakeholders, geographic regions, places of residence (urban/rural), income levels, educational levels, and so forth.[12] Factors such as these need to be taken into account in the analysis of forest value systems. Brown and Slovic (1988) discuss many factors that characterize the valuation context and influence the assignment of value to objects. Failure to unravel the complex ways in which the relative importance of values change with different circumstances has been a source of much confusion and conflict in environmental policy.

How and Why Have Forest Values Changed Over Time?

As outlined in the introduction to this paper, there is substantial evidence that we are currently in a period of rapid and significant change in forest values—change in held forest values, in the types of value relationships considered, and in the relative value assigned to forest-related objects. The inception of this change dates from the massive increase in outdoor recreation following World War II, according to some observers (e.g., Hays, 1988). The first Earth Day in 1970 is often regarded as another turning point in the expansion of environmental awareness and the evolution of environmental values. In recent years, the view of forests has continued to evolve, and nonhuman as well as human interests are increasingly being expressed.

The evolution of forest values has been discussed and debated in the forestry community. It is increasingly recognized that although traditional forest management was appropriate for the period in which it developed, the social context for forestry has changed and our scientific understanding of forest ecosystems has grown. But the dynamics of value change are poorly understood, theories of value change have rarely been applied, and relatively little empirical analysis has been carried out on value change in forestry. A more systematic understanding of past changes in forest values and the factors driving these changes is needed to anticipate future changes. Given the rapidity of change in recent years, those who would attempt to develop and implement ecosystem management approaches will have to be deft forecasters of forest values.

One way to examine past changes in forest values is to develop a theoretical framework through which historical events and trends are analyzed and interpreted. For example, Twight (1983) used the theory of sociologist Talcot Parsons to analyze the clash of organizational values between the USDA Forest Service and the USDI National Park Service that resulted in the Olympic National Forest becoming the Olympic National Park in 1938. Other examples of the historical approach applied to the analysis of forest values include Clary (1986), Hays (1988), and Williams (1989).

Another way to study past changes in forest values is to empirically analyze documents using a content analysis procedure. This approach has been used to analyze changes over time in public attitudes toward wildlife. Kellert (1985) analyzed the content of newspaper articles as an indicator of public attitudes: "Newspapers are generally oriented to local constituencies and thus can be relatively good indicators of generally held views and interests. If judiciously selected, newspapers can reflect urban, rural, and regional attitudes" (p. 20). Kellert and his associates sampled and analyzed a total of 4,873 animal-related articles from four continuously published newspapers (two urban and two rural, from different geographic regions) covering the period 1900 to 1976. They collected information about the frequency of expression of 10 attitudes: aesthetic, dominionistic, ecologistic, humanistic, moralistic, naturalistic, negativistic, neutralistic, scientistic, and utilitarian.[13] Using this approach, Kellert was able to track the relative frequency of expression of the 10 attitudes over time. They found marked differences in the frequency of expression of certain attitudes between urban and rural newspapers. For example, expression of utilitarian attitudes toward animals declined substantially in the *Los Angeles Times*, but decreased only slightly in the rural newspapers. Another finding was that expression of the ecologistic attitude, defined by Kellert as "primary concern for the environment as a system, for interrelationships between wildlife species and natural habitats" (p. 21), was found to have increased significantly during the 1960s and 1970s in the *Los Angeles Times*. In the rural newspapers, however, expression of this attitude increased only slightly. A similar content analysis approach could be used to analyze past changes in forest values over time.

Projecting the evolution of forest values into the future is also of interest. A widely used approach in forestry and many other fields is the Delphi method, a collection of techniques for eliciting and refining the opinions of a group of people, typically those who are knowledgeable in the area of interest. A Delphi exercise could be carried out in which participants would be asked to forecast recent trends in forest values into the short-term future. Alternative approaches include extrapolation of historical trends in forest values, and the construction of formal scenarios dealing with future forest values.

Conclusions and Implications: What Do Changing Forest Values Imply for Ecosystem Management?

A better understanding of the held and assigned values associated with forests and forest ecosystems is an essential part of forest ecosystem management. If it is to succeed, ecosystem management cannot be simply a collection of biological research findings and forest practices:

> If "new forestry" rests solely upon the assumption that failures in forest management are the result of the application of inadequate science, then "new forestry" will become as irrelevant to the issues of the 1990's as the "old forestry" was inadequate to the confrontation of the 1970's and the 1980's. (Shepard, 1990, p. 10)

The persistent Progressive Era belief that scientific analysis can substitute for public involvement, debate, deliberation, and conflict over the management and use of natural resources has proven to be unfounded and unworkable in the present-day social milieu. Ecosystem management must come to grips with the social, political, and ethical dimensions of forest management, as well as the scientific dimensions. In conducting research on these issues, however, it is important to be self-conscious about how one's own values introduce bias into the design and interpretation of value studies.

Forest managers, planners, policymakers, and scientists involved in developing and implementing ecosystem management approaches can benefit from a better understanding of forest values in several ways. The first benefit is in establishing appropriate goals for ecosystem management. Studies of forest values shed light on the normative and ethical questions that traditional forest science is unable to address. Information about people's values and the relative importance of forest values is essential to helping managers establish and justify appropriate goals and define the broad, strategic guidelines within which ecosystem management is practiced. The old assumption that the goal of public forest management should be to maximize economic efficiency while sustaining the yield of timber and other outputs is no longer tenable.

Second, studies of forest values can help managers determine how people will react to forest practices that are part of ecosystem management. An example is Brunson and Shelby's (1992) study of aesthetic and recreational values of "new forestry" or ecosystem management. This study involved collecting and analyzing ratings of the scenic and recreational quality of six Douglas-fir stands: an old-growth stand, three stands on which ecosystem management timber harvesting treatments had been carried out (patch cut, two-story, and snag retention), and two stands with traditional timber harvesting treatments (thinning and clearcutting). Ninety-five people visited and rated the acceptability of these sites as a scenic landscape, as a place to hike, and as a place to camp, thus indirectly expressing certain aspects of their forest values. Brunson and Shelby (1992) found that the ecosystem management stands were rated higher than the stands with traditional forest practices, suggesting that it may be possible to ". . . simultaneously address biodiversity objectives and meet visitor standards for scenic or recreational quality" (p. 41). Studies of this type may be helpful for forest managers struggling to better integrate biological objectives with social values. Managers need to understand how people will react to changes in forest management.

Finally, forest value analysis may be helpful in dealing with inevitable conflicts over public forest management. Better understanding forest values and incorporating that understanding into ecosystem management approaches will not eliminate conflict. Indeed, conflict is an important part of the social process of making decisions about and managing natural resources (Brandt, 1992b). However, an improved understanding of forest values may help illuminate the true nature of environmental conflicts, and help resource managers and policymakers distinguish between fundamental value differences and value disputes for which the prospects of resolution are much brighter. Rokeach (1968a) has noted that an individual's value system functions as ". . . a learned organization of rules for making choices and for resolving conflicts" (p. 161). Clarifying the value systems of groups of forest stakeholders could similarly facilitate conflict management and resolution.

A central premise of this article was concisely stated by Hays (1988): "New values have emerged about what the forest in America is and what role it ought to play in modern society" (p. 550). Controversies over national forest planning and management can be understood as confrontations about the old and new conceptions of the forest—the new "environmental forest" versus the old "commodity forest." Public land management agencies such as the Forest Service, rooted in a utilitarian view of forest management, have been struggling to adapt and respond to these changing values and perceptions. The New Perspectives and Ecosystem Management initiatives of the Forest Service can be interpreted as a response to changing forest values.

Forest economists and policy analysts often make strong policy recommendations on the basis of narrow, unidimensional, and incomplete notions of forest values. But narrow approaches have limited relevance for making decisions about public forest management

because many held forest values, types of value relationships (especially group- and function-based), and relevant criteria for determining the relative importance of forest values are not considered. When decisions are made or justified primarily on the basis of economic value, the result is likely to be increased social conflict over resource management and use. Forest managers and policymakers need a broader understanding of forest values—the diverse, complex, and multidimensional values associated with forests—to develop and successfully implement ecosystem management approaches that are socially and politically acceptable as well as biologically sound.

Notes

1. See, for example, Albrecht et al. (1982); Caron (1989); Cotgrove (1982); Dunlap and Van Liere (1978, 1984); Henderson (1976); Milbrath (1984a, 1984b); Pirages (1977); Pirages and Ehrlich (1974). Some observers see the shift in environmental values as part of the broader shift from modernism to postmodernism (Marx, 1990; McQuillan, 1992, 1993; Wickstrom, 1987).

2. For example, paradigmatic challenges related to the new environmental paradigm are evident in economics (Costanza, 1991; Daly & Cobb, 1989), ecology (Botkin, 1990), philosophy (Norton, 1991), sociology (Spaargaren & Mol, 1992), anthropology (Hardesty, 1980), political science (Rodman, 1980), landscape architecture (Rosenberg, 1986), and environmental management (Colby, 1990; Norton, 1992).

3. Signs of a paradigm shift in forest management have become evident in Canada, Europe, Australia, New Zealand, and other areas (Clark & Stankey, 1991). This article, however, focuses on forestry in the United States.

4. New Perspectives in Forestry was the name of the USDA Forest Service program, initiated in 1990, to encourage new forest management approaches on the national forests. This program was rechartered and renamed Ecosystem Management in July 1992.

5. Forest ecosystem management concepts and techniques have developed mainly within the context of public forest land. But more and more private forest landowners and forest industries are expressing an interest in and support for ecosystem management approaches (Gosz, 1992; Leland, 1992; McQuillan, 1993).

6. The three relational realms in Table 2 could be expanded, e.g., Rolston (1985) identifies seven "meaning levels" of value that can be thought of as different types of value relationships. The figure is limited to Andrews and Waits' (1978) three broad types of value relationships to simplify the exposition and more readily categorize the main disciplinary approaches.

7. The values of professional forestry and the organizational culture and values of the USDA Forest Service have been the subject of extensive analysis using the norm-based concept of value (Brown & Harris, 1992b; Bullis & Kennedy, 1991; Kaufman, 1960; Kennedy, 1988; Twight, 1983; Wellman, 1987).

8. Aside from the question of whether all values are derivative of economic value, there is much controversy among economists about whether so-called nonuse environmental values (option value, bequest value, and existence value) can reliably be measured. Recent experiments to test the reliability of the contingent valuation method indicate that it is unable to generate even rough estimates of people's true preference for nonuse values. See Anon. (1992) and studies cited therein.

9. Sagoff (1991) identifies substitutability or fungibility as an important distinction between instrumental and intrinsic value: "Insofar as we care about an object for instrumental reasons, we would accept a substitute—for example, ball point pens in place of quills—if it performs the same function at a lower cost. . . . With intrinsic value, it is different" (p. 5).

10. Contact the author for a list of references on classification systems for forest values, wilderness and wildland values, wildlife values, and general environmental values.

11. Other multidimensional ranking approaches include "nonalgorithmic" ranking based on intuition (Seung & Boonevac, 1992) for individual preference-based values, and ranking based on

what Sagoff (1988) calls deliberative rationality for social or group-based values. To the extent that difficulties in determining the relative importance of competing forest values are due to fundamental or innate indeterminacy rather than a lack of information, this may be the more promising approach.

12. See Wilson (1992) for a summary of hypotheses regarding differences in forest value systems for landowners.

13. See Kellert (1985, p. 21) for definitions of each attitude.

References

Albrecht, D., G. Bultena, E. Hoiberg, and P. Nowak. 1982. The new environmental paradigm scale. *Journal of Environmental Education* 13:39–43.

Andrews, R. N. L., and M. J. Waits. 1978. Environmental values in public decisions: A research agenda. University of Michigan, School of Natural Resources, Ann Arbor.

Anon. 1990. The Forest Service: Time for a little perestroika. *The Economist* (March 10):50.

Anon. 1992. "Ask a silly question. . .": Contingent valuation of natural resource damages. *Harvard Law Review* 105(8):1981–2000.

Baird, L. 1991. Can foresters romance a land ethic? *Journal of Forestry* 89(4):11.

Barton, W. J. 1992. Telling our story [editorial]. *Journal of Forestry* 90(1):3.

Behan, R. W. 1975. Forestry and the end of innocence. *American Forests* 81(5):16–19, 38, 40–42, 45–49.

Behan, R. W. 1990a. Multiresource forest management: A paradigmatic challenge to professional forestry. *Journal of Forestry* 88(4):12–18.

Behan, R. W. 1990b. The RPA/NFMA: Solution to a nonexistent problem. *Western Wildlands* 15(4):32–36.

Behan, R. W. 1991. Forests and plantations and Potomo-centric statutory fixes (but downhome forestry is here). *Forest Perspectives* 1(1):5–8.

Bishop, R. C. 1987. Economic values defined. In *Valuing wildlife: Economic and social perspectives,* eds. D. J. Decker and G. R. Goff, pp. 24–33. Boulder, CO: Westview Press.

Botkin, D. B. 1990. *Discordant harmonies: A new ecology for the twenty-first century.* New York: Oxford University Press.

Boulding, K. E., and S. B. Lundstedt. 1988. Value concepts and justifications. In *Amenity resource valuation: Integrating economics with other disciplines,* eds. G. L. Peterson, B. L. Driver, and R. Gregory, pp. 13–22. State College, PA: Venture Publishing.

Brandt, L. K. 1992a. Conflict, cooperation and change: Managing Minnesota forests, 1989–1992. Master's thesis, University of Minnesota.

Brandt, L. K. 1992b. Some sociocultural challenges to the management of Minnesota forests, 1989–1991: Issue expansion, shared interpretations of past events and present problems, and future risks. Paper presented at the fourth North American Symposium on Society and Resource Management, 17–20 May, Madison, Wisconsin.

Brennan, A. 1992. Moral pluralism and the environment. *Environmental Values* 1(1):15–33.

Brown, G., and C. C. Harris, Jr. 1992a. National forest management and the "tragedy of the commons": A multidisciplinary perspective. *Society and Natural Resources* 5(1):67–83.

Brown, G., and C. C. Harris, Jr. 1992b. The Forest Service: Toward the new resource management paradigm? *Society and Natural Resources* 5(3):231–245.

Brown, G., and C. C. Harris, Jr. 1993. The implications of work force diversification in the U.S. Forest Service. *Administration and Society* 25(1):83–113.

Brown, T. C. 1984. The concept of value in resource allocation. *Land Economics* 60(3):231–246.

Brown, T. C., and P. Slovic. 1988. Effects of context on economic measures of value. In *Amenity resource valuation: Integrating economics with other disciplines,* eds. G. L. Peterson, B. L. Driver, and R. Gregory, pp. 23–30. State College, PA: Venture Publishing.

Brunson, M., and B. Shelby. 1992. Assessing recreational and scenic quality: How does new forestry rate? *Journal of Forestry* 90(7):37–41.

Bullis, C. A., and J. J. Kennedy. 1991. Value conflicts and policy interpretations: Changes in the case of fisheries and wildlife managers in multiple use agencies. *Policy Studies Journal* 19(3/4):542–552.

Caron, J. 1989. Environmental perspectives of Blacks: Acceptance of the "new environmental paradigm." *Journal of Environmental Education* 20(3):21–26.

Clark, R. N., and G. H. Stankey. 1991. New forestry or new perspectives? The importance of asking the right questions. *Forest Perspectives* 1(1):9–13.

Clary, D. M. 1986. *Timber and the Forest Service.* Lawrence, KS: University of Kansas Press.

Cobb, J. 1980. Ecology, ethics, and theology. In *Economics, ecology, ethics: Essays toward a steady-state economy,* eds. H. E. Daly, pp. 162–176. San Francisco, CA: W. H. Freeman.

Colby, M. E. 1990. Environmental management in development: The evolution of paradigms. World Bank discussion paper no. 80, Washington, DC.

Costanza, R., ed. 1991. *Ecological economics: The science and management of sustainability.* New York: Columbia University Press.

Cotgrove, S. F. 1982. *Catastrophe or cornucopia: The environment, politics and the future.* New York: John Wiley & Sons.

Culhane, P. J. 1981. *Public lands politics: Interest group influence on the Forest Service and the Bureau of Land Management.* Baltimore, MD: Johns Hopkins University Press.

Daly, H. E., and J. B. Cobb, Jr. 1989. *For the common good: Redirecting the economy toward community, the environment, and a sustainable future.* Boston, MA: Beacon Press.

DeBonis, J. 1992. "Super AFSEEE" gets off the ground. *The AFSEEE Activist* 2(3):1.

Dunlap, R. E., and K. Van Liere. 1978. The new environmental paradigm. *Journal of Environmental Education* 9:10–19.

Dunlap, R. E., and K. D. Van Liere. 1984. Commitment to the dominant social paradigm and concern for environmental quality. *Social Science Quarterly* 65:1013–1028.

Fiedler, C. 1992. New forestry: Concepts and applications. *Western Wildlands* 17(4):2–7.

Fischer, D. W. 1975. Willingness to pay as a behavioral criterion for environmental decision-making. *Journal of Environmental Management* 3(1):29–41.

Franklin, J. F. 1989. Toward a new forestry. *American Forests* 95(11/12):37–44.

Glück, P. 1987. Social values in forestry. *AMBIO* 16(2/3):158–160.

Gosz, J. R. 1992. Sustainable forest ecosystem management: Interpretations from the sustainable biosphere initiative. William P. Thompson Memorial lecture series, XVI. School of Forestry, Northern Arizona University.

Hardesty, D. L. 1980. The ecological perspective in anthropology. *American Behavioral Scientist* 24(1):107–124.

Hays, S. P. 1987. *Beauty, health, and permanence: Environmental politics in the United States, 1955–1985.* New York: Cambridge University Press.

Hays, S. P. 1988. The new environmental forest. *University of Colorado Law Review* 59:517–550.

Hendee, J. C. 1989. Forestry, society and changing values. *Renewable Resources Journal* 7(4):6–8.

Henderson, H. 1976. Ideologies, paradigms and myths: Changes in our operative social values. *Liberal Education* 62:143–157.

Hoevenagel, R., and J. W. van der Linden. 1993. Effects of different descriptions of the ecological good on willingness to pay values. *Ecological Economics* 7(3):223–238.

Holler, J. I. 1990. Valuing wildlife: A Minnesota perspective. Master's thesis, University of Minnesota.

Judson, D. H. 1989. The convergence of neo-Ricardian and embodied energy theories of value and price. *Ecological Economics* 1(3):261–281.

Kaufman, H. 1960. *The forest ranger: A study in administrative behavior.* Baltimore, MD: Johns Hopkins University Press.

Kellert, S. R. 1985. Historical trends in perceptions and uses of animals in 20th century America. *Environmental Review* 9(1):19–33.

Kennedy, J. J. 1985. Conceiving forest management as providing for current and future social value. *Forest Ecology and Management* 13(4):121–132.

Kennedy, J. J. 1988. Legislative confrontation of groupthink in U.S. natural resources agencies. *Environmental Conservation* 15(2):123–128.

Kerr, A. 1990. New (age) perspectives: Glossy dogma to hide old habits. *Forest Watch* (October):22–25.

Kluckhohn, F. R., and F. L. Strodtbeck. 1961. *Variations in value orientations.* Evanston, IL: Rowe, Peterson & Company.

Kuntz, P. G. 1970. The serial order of values: An argument against unidimensionality and for multidimensionality. In *Human values and natural science,* eds. E. Laszlo and J. Wilber, pp. 267–288. New York: Gordon and Breach Science Publishers.

Leland, D. D. 1992. Combining conservation and commercial goals in private forests. *Forest Products Journal* 42(10):15–17.

Martin, J. N. 1979. The concept of the irreplaceable. *Environmental Ethics* 1(1):31–48.

Marx, L. 1990. Post-modernism and the environmental crisis. *Report from the Institute for Philosophy & Public Policy* (University of Maryland, College Park) 10(3/4):13–15.

McQuillan, A. G. 1990. Is national forest planning incompatible with a land ethic? *Western Wildlands* 15(4):7–11.

McQuillan, A. G. 1992. New perspectives: Forestry for a post-modern age. *Western Wildlands* 17(4):13–20.

McQuillan, A. G. 1993. Cabbages and kings: The ethics and aesthetics of new forestry. *Environmental Values* 2:191–222.

Milbrath, L. W. 1984a. A proposed value structure for a sustainable society. *The Environmentalist* 4(2):113–124.

Milbrath, L. W. 1984b. *Environmentalists: Vanguard for a new society.* Albany, NY: SUNY Press.

Mohai, P. 1987. Rational decision making in the planning process: Some empirical evidence from RARE II. *Environmental Law* 17(3):507–556.

Norton, B. G. 1991. *Toward unity among environmentalists.* New York: Oxford University Press.

Norton, B. G. 1992. A new paradigm for environmental management. In *Ecosystem health: New goals for environmental management,* eds. R. Costanza, B. Norton, and B. Haskell, pp. 23–41. Washington, DC: Island Press.

O'Keefe, T. 1990. Holistic (new) forestry: Significant difference or just another gimmick? *Journal of Forestry* 88(4):23–24.

Ophuls, W. 1977. *Ecology and the politics of scarcity: Prologue to a political theory of the steady state.* San Francisco, CA: W. H. Freeman.

Pirages, D. C. 1977. Introduction: A social design for sustainable growth. In *The sustainable society,* ed. D. C. Pirages, pp. 1–13. New York: Praeger.

Pirages, D., and P. Ehrlich. 1974. *Ark II: Social response to environmental imperatives.* San Francisco, CA: W. H. Freeman.

Rodman, J. 1980. Paradigm change in political science: An ecological perspective. *American Behavioral Scientist* 24(1):49–78.

Rokeach, M. 1968a. *Beliefs, attitudes and values: A theory of organization and change.* San Francisco, CA: Jossey-Bass.

Rokeach, M. 1968b. The role of values in public opinion research. *Public Opinion Quarterly* 32:547–559.

Rokeach, M. 1973. *The nature of human values.* New York: Free Press.

Rolston, H., III. 1985. Valuing wildlands. *Environmental Ethics* 7(1):23–48.

Rolston, H., III, and J. Coufal. 1991. A forest ethic and multivalue forest management. *Journal of Forestry* 89(4):35–40.

Rosenberg, A. M. 1986. An emerging paradigm for landscape architecture. *Landscape Journal* 6:75–82.

Rubin, J., G. Helfand, and J. Loomis. 1991. A benefit-cost analysis of the northern spotted owl: Results from a contingent valuation survey. *Journal of Forestry* 89(12):25–30.

Sagoff, M. 1988. *The economy of the earth: Philosophy, law, and the environment.* New York: Cambridge University Press.

Sagoff, M. 1991. Zuckerman's dilemma: A plea for environmental ethics. *Hastings Center Report* 21(5):32–40.

Sankovskii, A. 1992. Toward evaluation of natural objects. *Environmental Management* 16(3):283–287.

Seung, T. K., and D. Bonevac. 1992. Plural values and indeterminate rankings. *Ethics* 102(4):799–813.

Shands, W. E. 1988. Beyond multiple use: Managing national forests for distinctive values. *American Forests* 94(3/4):14–15, 56–57.

Shannon, M. A. 1988. Changing people, changing values, changing forests. In *Healthy forests, healthy world,* pp. 337–341. Proceedings of the 1988 Society of American Foresters National Convention, Rochester, New York, 16–19 Oct. 1988. Bethesda, MD: Society of American Foresters.

Shepard, W. B. 1990. Seeing the forest for the trees: "New perspectives" in the Forest Service. *Renewable Resources Journal* 8(2):8–11.

Smith, P. G. R., and J. B. Theberge. 1986. A review of criteria for evaluating natural areas. *Environmental Management* 10:715–734.

Smith, P. G. R., and J. B. Theberge. 1987. Evaluating natural areas using multiple criteria: Theory and practice. *Environmental Management* 11:447–460.

Spaargaren, G., and A. P. J. Mol. 1992. Sociology, environment, and modernity: Ecological modernization as a theory of social change. *Society and Natural Resources* 5(4):323–344.

Stankey, G. H., and R. N. Clark. 1992. *Social aspects of new perspectives: A problem analysis.* Gifford Pinchot Institute for Conservation Monograph Series. Milford, PA: Greytowers Press.

Stone, C. D. 1988. Moral pluralism and the course of environmental ethics. *Environmental Ethics* 10(2):139–154.

Thurow, L. C. 1983. *Dangerous currents.* New York: Random House.

Twight, B. W. 1983. *Organizational values and political power: The Forest Service versus the Olympic National Park.* Pennsylvania State University Press.

Twight, B. W., and F. J. Lyden. 1989. Measuring Forest Service bias. *Journal of Forestry* 87(5):35–41.

Vining, J., and A. Ebreo. 1991. Are you thinking what I think you are? A study of actual and estimated goal priorities and decision preferences of resource managers, environmentalists, and the public. *Society and Natural Resources* 4(2):177–196.

Wellman, J. D. 1987. Foresters' core values and cognitive styles: Issues for wildland recreation management and policy. *Policy Studies Review* 7(2):395–403.

Wickstrom, J. H. 1987. Moving forestry into the post-modern world. *AMBIO* 16(2/3):154–156.

Williams, M. 1989. *Americans and their forests: A historical geography.* New York: Cambridge University Press.

Wilson, G. A. 1992. A survey of attitudes of landholders to native forest on farmland. *Journal of Environmental Management* 34:117–136.

Zuckerman, S. 1992. New forestry? New hype . . . *Sierra* 77(2):40–45, 67.