

# **Assessment of Public Knowledge, Values and Attitudes toward Biodiversity and Sustainable Forestry**

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## Introduction

In Stage 1 of this project, the available literature was reviewed which addresses the beliefs, attitudes, and values of the public toward biodiversity and related issues. Though the review is comprehensive in the range of the topics it covers and is representative of the existing literature within those topics, every possible source is not included. Studies which specifically inquire about the concept of biodiversity are few. Because of this, it is useful to examine the definition of biodiversity to investigate what other research areas might act as proxies for understanding public perceptions of biodiversity.

Even a quick perusal of scientific studies which deal with exploring or measuring biodiversity reveals that the term is often not defined at all, but when it is there are a wide range of definitions. DeLong, Jr. (1996) analyzed 85 of those definitions in an attempt to develop a more coherent and useful meaning of biodiversity. He discovered there are five basic approaches to defining biodiversity: by derivation, by classification, by listing characteristics, properties, qualities, and parts, by comparison and contrast, and by operation. It is worthwhile to consider these approaches to better understand how scientists and managers interpret the term and how they might convey it to the public as well as how the public might define biodiversity.

The first approach involves dividing biodiversity into its two root words, “bio” and “diversity.” In studies which ask respondents to define biodiversity, this is typically how people who are unfamiliar with the term create a working definition (Belden, Russonello, & Stewart Research and Communications 1995; Hunter & Brehm 2003). However, this is only marginally helpful because while “bio” is well-defined, “diversity” is not.

The same problem occurs when attempting to define biodiversity by classification. Biodiversity can be considered a type of diversity, but that still requires a further explication of diversity. Most of the definitions DeLong, Jr. (1996) reviewed referred to diversity as a state or attribute though some used it to mean a measure or an index of a state or attribute. However, he does not agree with the inclusion of measurement in the definition of biodiversity because of continually shifting methods of measurement.

Listing the characteristics, properties, qualities, and parts of a term can also be helpful in defining it. Biodiversity can be broken down for further analysis into three attributes: composition, structure, and function. It is common in the literature to see definitions which concentrate only on composition. For instance, Wilson (1988, 1992) focuses on the sheer number and variety of species and somewhat on the destruction of habitat in respect to those species but refers to it all as biodiversity. Dividing biodiversity into its attributes forces us to acknowledge not only species richness and diversity (composition), but also things such as habitat diversity (structure) and biotic processes (function).

These attributes are referred to by many different terms, which further confuse the issue. By comparing and contrasting the various terms, a better idea of what biodiversity is and is not can be achieved. DeLong, Jr. (1996) argues that many scholars tend to conflate the meanings of terms like species diversity with biodiversity. He feels that species diversity and richness are merely components of biodiversity, while biodiversity is a component of ecological diversity. Ecological diversity includes abiotic processes which, while critical to the maintenance of biodiversity, should be excluded from any truly biotic definition.

Defining biodiversity by operation can be difficult because it often leads to an emphasis on measurement. Again, while attempting to measure the values of biodiversity can be a positive activity, DeLong, Jr. (1996) feels that the measurement of those values should be attached to a basic definition of biodiversity as a clause which can change over time with different methods of measurement.

The NCSSF (2005) has created a definition which incorporates all aspects of biodiversity, including abiotic processes:

*The variety and abundance of all life forms in a place – plants, animals and other living organisms – and the processes, functions, and structures that sustain that variety and allow it to adapt to changing circumstances. (p. 9)*

This definition allows for many proxies to be explored in examining people's knowledge, attitudes, and values toward biodiversity. Studies which address forest values and management, ecosystem management, fire management, wildlife, including endangered species, and their management, and any number of preservation or conservation issues can all be included under the umbrella of biodiversity. Granted, none of these can substitute for biodiversity, but as components or reflections of biodiversity, they can help to identify the public's feelings about the concept.

## **Biodiversity**

Scientists may have difficulties coming to a consensus about the meaning of biodiversity but the public often has a hard time even defining the term. Belden, Russonello, and Stewart Research and Communications (BRSRC 1995, 1996a, 1996b, 1996c, 2002) conducted a series of focus groups and surveys to better understand what the public knows and feels about biodiversity. They found that biodiversity was not a familiar term to most people and when it was defined, many respondents felt that the term implied there are "differences," but not "connections." People suggested several other terms to convey the concept and ecosystem was generally agreed upon as a good alternative (BRSRC 1995). Hunter and Brehm (2003) also discovered that people were uncertain about defining biodiversity but that most managed to create a workable, though limited, definition by dissecting the term. Most of the respondents spoke only about species diversity and richness, but some also mentioned habitat diversity and ecological diversity.

A lack of knowledge about the concept of biodiversity apparently does not translate into a lack of concern. In one study, after the term was defined, over 80% of the respondents felt that maintaining biodiversity was important to them (BRSRC 1996c). Respondents cited several reasons for protecting biodiversity, among the most general being protecting the earth for future generations, providing a healthy environment for one's family, and recognizing that nature is God's creation. Other reasons included the loss of ecosystem services such as the cleansing of air and water, the effects of toxic chemicals in the food chain on humans, and the loss of possible new medicines resulting from a decrease in biodiversity. Holsman and Peyton (1999) found similar results with most respondents choosing ecological dependence, existence value, and nature appreciation as the main benefits of biodiversity. However, Montgomery (2002) conducted a survey in which respondents were forced to choose between hypothetical species having ecological, economic, recreation, aesthetic, symbolic, or humanistic characteristics. Though ecological benefits were most important for many respondents, commodity-based benefits were also of moderate importance and ranked above recreation and aesthetic benefits. Male, older, and lower income respondents were more likely to choose economic benefits as most important.

When economic tradeoffs, such as protecting jobs, were introduced, support for protecting biodiversity fell by half in the BRSRC studies. This finding is corroborated by the fact that the public repeatedly places protecting the environment lower on a priority scale than crime, public education, the economy, health care, and cutting government spending (Ladd & Bowman 1995). Furthermore, most respondents did not believe that losing species was having an adverse effect on humans and did not want to preserve species which do not appear to have any value to humans (BRSRC 1995). Hunter and Brehm (2003, 2004) reported similar results, with most of their respondents calling for a balance between the needs of humans and other species. Several people expressed the opinion that the disappearance of a little known or rare species would not affect them or the environment. They also found that respondents viewed species loss as occurring elsewhere in the world, such as in Asia and Africa, even though they identified declines in local species.

## **Forests**

### *Forest Values*

Forest values refer to the benefits that people feel they derive from the existence and use of forests. Studies about forest values abound but few address the question of biodiversity specifically. Several studies focus on general forest values such as economic and ecological values and, overwhelmingly, show that the public values non-commodity benefits of forests more than economic benefits (Cordell & Tarrant 2002; Kant & Lee 2004; Manning, Valliere, & Minter 1999; Patel et al. 1999; Robson, Hawley, & Robinson 2000; Shields, Martin, Martin, & Haefele 2002; Shindler, List, & Steel 1993; Steel, List, & Shindler 1994; Tarrant, Cordell, & Green 2003; Tarrant, Porter, & Cordell 2002; Yarrow & Guynn 1997). For instance, Manning et al. (1999) found that residents

of Vermont ranked aesthetic, recreational, and ecological values as most important in forest management and economic, spiritual, and intellectual values as least important. In a study of Southern states, Tarrant et al. (2003) reported that clean air and scenic beauty were the most important forest values, while wood production was the least important. Bengston and others (Bengston 1994; Bengston, Fan, & Celarier 1999; Bengston, Webb, & Fan 2004; Xu & Bengston 1997) conducted content analysis of newspapers, forestry journals, and environmental magazines which revealed that commodity-related forest values declined in importance while recreation values increased from the early 1980s to 2001. However, ecological and moral/spiritual/aesthetic values changed very little in importance over this time.

There are some differences among demographic groups in terms of what values are most important to certain sections of the population. A nationwide study revealed that protection or ecological values are more important for women, younger respondents, whites, and urban residents while output or economic values are more important for older, lower income, less educated, non-whites, and rural respondents (Tarrant, Cordell, & Green 2003). Other studies have generally concurred with these findings (Brown & Harris 2001; Cordell & Tarrant 2002; Steel, List, and Shindler 1994; Steel & Lovrich 1997; Tarrant & Cordell 2002; Tarrant, Porter, & Cordell 2002), though some studies find no substantial differences between rural and urban respondents (Fortmann & Kusel 1990; Morrissey & Manning 2000). For example, Fortmann and Kusel (1990) reported that rural residents who had just moved from an urban area were no more likely to have a proenvironmental attitude toward forests than long term residents.

### *Forest Management*

As the review of forest values above suggests, people are more supportive of forest management which focuses on ecological concerns. For example, a study of forest management alternatives in Colorado revealed that both local environmentalists and long-term residents preferred a management option which resulted in the highest level of species protection rather than choosing others which stressed recreation or economic benefits (Martin, Bender, & Shields 2000). In a study of national and Oregon publics, the majority of respondents supported ecosystem based forest management policies, such as protecting old growth forests and wildlife habitat, over commodity-based policies like removing endangered species laws in order to preserve timber jobs (Shindler, List, & Steel 1993; Steel, List, & Shindler 1994).

Though most people do not support management of a forest for a dominant or single use but rather prefer management for a variety of nonmaterial benefits, respondents often express a desire for a balance in management between ecological and economic concerns (Bliss et al. 1994, 1997; Minter & Manning 2000; Shindler, List, & Steel 1993). Minter and Manning (2000) reported that the majority of the respondents in a Vermont survey agreed with statements which set out management strategies that incorporated both human and ecosystem needs. For instance, over 70% of respondents agreed that the Green Mountain National Forest should be managed to accommodate human needs and desires provided that the ecological integrity of the forest is retained. This view is also

reflected in opinions about the environment in general. Ladd and Bowman (1995), in reviewing a number of national surveys and polls conducted from 1970 to 1995, found that most Americans feel that economic growth and environmental protection are not mutually exclusive and should be pursued simultaneously.

Despite support for more holistic management, there is evidence that the public is not very knowledgeable about forest management techniques or what a healthy forest looks like. The public's concept of forest health includes obvious visual indicators such as the number, variety, and condition of trees, soil stability, and no evidence of human influence, and less apparent indicators such as biodiversity, ecosystem integrity, and functioning cycles of change (Hull, Robertson, & Kendra 2001; Patel et al. 1999). Any human influence is viewed negatively, indicating a lack of knowledge about the means used to maintain a healthy forest. People are concerned with retaining the naturalness of the forest, which helps to explain why management practices such as clearcutting are considered unacceptable by the public (Bliss 2000; Shindler, List, & Steel 1993).

### **Ecosystem Management**

Ecosystem management is closely linked to the preservation of biodiversity and should be considered when examining knowledge, attitudes, and values toward biodiversity. There are few studies which address the concept of ecosystem management directly but those that do indicate a neutral to slightly positive attitude toward ecosystem management actions (Holsman & Peyton 2003; Jacobson & Marynowski 1997; Reading, Clark, & Kellert 1994; Solecki 1998; Tarrant, Overdeest, Bright, Cordell, & English 1997). Holsman and Peyton (2003) found that respondents placed more importance on ecosystem benefits, such as ecological services for humans and the opportunity to appreciate nature, than on non-wildlife related recreation or extraction of material commodities. However, when faced with management actions that forced trade-offs between these benefits, respondents were often neutral or only slightly positive toward ecosystem management practices.

Attitudes toward ecosystem management vary among different groups. Consumptive users of natural resources, such as hunters and anglers, tend to be less positive about ecosystem management than the general public and members of conservation groups (Holsman and Peyton 2003, Jacobson and Marynowski 1997). Factors which are positively related to support of ecosystem management include more education, higher income, urban residence, and professional occupation (Jacobson and Marynowski 1997, Solecki 1998). For example, Solecki (1998) found that those respondents with a college degree were more likely to support a regional ecosystem management plan than those with less education.

Knowledge about ecosystem management practices is low. Tarrant et al. (1997) reported that less than a third of respondents answered six questions about ecosystem management correctly. It also appears that greater knowledge of ecosystem management does not necessarily translate into a more positive attitude toward it. For instance, Jacobson and

Marynowski (1997) found that hunters were the most knowledgeable about ecosystem management but yet had the most negative view of it.

## **Fire Management**

There are several studies which have addressed knowledge of and attitudes toward fire management, including the use of prescribed fire. Many of these studies also looked at education about fire and the changes which it may bring in both knowledge and attitudes. Given the aggressive campaigns by public land management agencies supporting fire suppression, it is not surprising that early studies revealed negative public attitudes toward fire and strong support for suppression of all wildfires (Hall 1972). In fact, a Forest Service study (USDA 1968) concerning the effectiveness of the Smokey the Bear campaign did not ask whether respondents felt forest fires were destructive or beneficial but which of the listed problems caused by forest fires, such as destruction of timber and killing of wildlife, was the worst.

During the 1970s, support for fire suppression continued though there was increasing recognition of the role of fire in ecosystems. A study done in the Selway-Bitterroot Wilderness in 1971 revealed widespread support for fire suppression but most visitors were willing to accept more flexible fire policies which did not focus solely on complete suppression of every fire (Stankey 1976). However, another study of visitors to wildland areas in the San Francisco and Los Angeles areas found that around three-quarters of the respondents felt that all fires should be suppressed, even if they did not threaten people or property (Folkman 1979). Yet over half of these respondents acknowledged the positive role which fire could play in natural ecosystems. Similar results were found in a study conducted at Olympic National Park in 1978, which discovered that more than two-thirds of visitors and residents living near the park were in favor of complete suppression of all fires in the park, despite general recognition of the beneficial effects of fire on forest ecosystems (Rauw 1980).

In the mid-1970s, the official stance on fire management changed to allow consideration of a variety of options for every fire (Cortner, Gardner, & Taylor 1990). Allowing fires to burn became acceptable in certain circumstances, as did using prescribed fire as a management tool. In the 1980s, public attitudes also began to change, most likely in response to these new policies and the education efforts which accompanied them. This change can be seen in two longitudinal studies which replicated previous work on attitudes toward fire in wilderness areas. Lucas (1985) found that almost half of the visitors to Montana wilderness areas supported letting fires started by lightning to burn in 1982. In 1970, only a quarter of the respondents supported this action. McCool and Stankey (1986) repeated the 1971 study of visitors to the Selway-Bitterroot Wilderness in 1984. They found that support for allowing at least some fires to burn in wilderness areas increased by 29% and also that support for complete suppression of all fires dropped from 31% to 5%. The second survey also asked about prescribed fire, which most respondents had heard of and almost half believed it could be beneficial to wilderness areas through improving wildlife habitat, reducing fire risk, and creating open areas. A third study conducted in 1986 which focused on attitudes toward fire in wilderness areas

revealed that visitors were more supportive of fires that were started by natural causes rather than by managers (Stine 1987). The majority also agreed that fires should be allowed to burn in little used areas of the wilderness.

Three separate studies conducted in the 1980s included the same set of questions concerning knowledge of and attitudes toward fires as well as attitudes toward recreation and fire's effect on recreation environments (Cortner, Zwolinski, Carpenter, & Taylor 1984; Gardner, Cortner, Widaman, & Stenberg 1985; Taylor & Daniel 1982, 1984; Taylor et al. 1986; Zwolinski, Cortner, Carpenter, & Taylor 1983). The samples for these studies included both general and forest user publics from Arizona and nationwide. More than half of the respondents in all three studies disagreed that fires should be allowed to burn even if they were monitored whether started by lightning or human carelessness. However, the majority agreed that managers should burn underbrush and debris periodically and disagreed that all fires should be put out immediately. More than half the respondents also agreed that low intensity fires which were burning only underbrush and debris, but not trees, should be allowed to burn if they are monitored. Taylor and Daniel's study (1982, 1984) also examined the effect of fire on recreational acceptability and scenic beauty. They found that light intensity fires in ponderosa pine forests produced landscapes which respondents found more beautiful than unburned areas while severe fires caused a decline in scenic beauty. Light fires had little negative effect on recreational acceptability, with the exception of camping, while severe fires had a detrimental effect on all recreation activities.

More recent studies have demonstrated the complexity of fire issues by demonstrating the variability of attitudes toward fire depending on several factors. Geographic location of respondents has been shown to have a relationship with attitudes. Loomis, Bair, and González-Cabán (2001) found that Floridians were more supportive of strict fire suppression policies but just as tolerant of prescribed burning as respondents from Arizona and Oregon. Another study of Florida residents further revealed that three-quarters of the respondents favored stricter regulations on burning (Jacobson, Monroe, & Marynowski 2001). A study of residents of Colorado, Arizona, Utah, and Oregon found differences in the acceptability of various fuel reduction strategies, including prescribed burning (Brunson & Shindler 2004). The majority of all respondents were accepting of burning, mechanical thinning, and grazing as fuel management tools, but Oregonians were the most accepting of burning and thinning while respondents from Utah were the least accepting. Coloradoans were more likely to support using fire for management around populated areas than other respondents. Oregonians were more likely to believe that prescribed burning and mechanical thinning reduced the intensity and frequency of future fires. Social and economic factors such as urbanization and existing industries of logging and livestock raising most likely contributed to the differences between the residents of these states. Manfredo, Fishbein, Haas, and Watson (1990) discovered differences between people residing near Yellowstone National Park who had been affected by the 1988 fire and a nationwide sample concerning attitudes toward prescribed burning. The regional group tended to feel more strongly about fire issues than the national group, whether those feelings were positive or negative.

The acceptability of fire management actions is also affected by various situational factors. Kneeshaw and others (Kneeshaw 2002; Kneeshaw, Vaske, Bright, & Absher 2004) investigated the effects of five factors (fire origin, air quality, risk of property damage, forest recovery, and impact on recreation) on attitudes toward fire management. Respondents from Colorado, California, and Washington were presented with eight scenarios composed of varying combinations of the five factors and asked to choose one of three management actions: put the fire out, contain the fire, or let the fire burn. Letting the fire burn was deemed unacceptable for all scenarios, while putting the fire out and containing the fire were acceptable in all cases. However, putting the fire out was more acceptable when the fire was caused by humans, air quality decreased, risk of property damage was high, forest recovery would be slow, and recreation areas were closed. Conversely, containing the fire was more acceptable when the opposite of each of those factors was part of the scenario. None of the factors was much more important than the others in determining the acceptability of a given management action, though the effect on recreation was the least important in all cases.

Knowledge has also been found to be related to attitudes. Many studies have demonstrated a relationship between increased knowledge and increased tolerance of fire. Early on, Stankey (1976) found that respondents who scored high on fire knowledge were much less accepting of management options which stressed suppression. In fact, a respondent's knowledge score explained 60% of the variance in the choice of the most acceptable fire management action. Since then, several studies have supported Stankey's conclusions by showing that increased fire knowledge is related to support for more flexible fire policies which allow for some fires to burn (Cortner et al. 1984; Gardner et al. 1985; Manfredi et al. 1990; McCool & Stankey 1986; Zwolinski et al. 1983). Most of these studies have revealed generally low levels of knowledge about the effects of fires among Americans, but others demonstrate that educational materials can both increase knowledge and create more positive attitudes toward the use of fire as a management tool (Cortner et al. 1984; Loomis et al. 2001; Taylor & Daniel 1982, 1984; Taylor et al. 1986). Taylor and Daniel (1982, 1984) administered fire knowledge tests before and after providing some participants in Tucson with informational brochures about fire effects. They found that those respondents who had received the brochures became more knowledgeable and more tolerant of allowing fires to burn. However, this information did not change respondents' evaluations of recreational acceptability or scenic beauty of forests affected by fire. More recently, Loomis et al. (2001) conducted surveys with respondents in Florida before and after mailing educational booklets about wild and prescribed fire. Knowledge in Florida was relatively high to begin with, compared to other areas, but did increase after the booklets were provided, as did tolerance toward prescribed fire. The percentage of respondents who answered "don't know" to knowledge and attitude statements decreased significantly, indicating that people felt less uncertain about prescribed fire.

## **Wildlife and Wildlife Management**

### *Wildlife*

There are a myriad of studies which address the public's views of wildlife (e.g., Bright & Manfredo 1996; Brooks, Warren, & Nelms 1999; Hook & Robinson 1982; Kellert 1985b; Lamb & Cline 2003; Lee & Miller 2003; Lybecker, Lamb, & Ponds 2002; McKinstry & Anderson 1999; Reading, Miller, & Kellert 1999; Scarce 1998; Tucker & Pletscher 1989; Williams, Ericsson, & Heberlein 2002; Zinn & Andelt 1999). These focus mainly on individual species, especially endangered species, predators, and pests, but there are also some which address wildlife in general. Kellert's work in this area for the U.S. Fish and Wildlife Service is well-known. He developed a typology of attitudes toward animals (1978, 1979, 1980a, 1980b, 1980c, 1980d, 1981) and numerous studies have used his typology as a basis for their own research (e.g., Peyton & Langenau, Jr. 1985; Reading & Kellert 1993; Vitterso, Bjerke, & Kaltenborn 1999). He described ten attitudes which are listed and defined in Table 1.

Purdy and Decker from the Human Dimensions Research Unit at Cornell University created a Wildlife Attitudes and Values Scale (WAVS) which has been used in several studies (e.g. Decker & Gavin 1987; Purdy & Decker 1989). WAVS is focused on describing the noneconomic values of wildlife with an emphasis on investigating interactions between people and wildlife. Purdy and Decker identified four dimensions of attitudes and values toward wildlife which are listed and defined in Table 2.

**Table 1**  
**Kellert's Typology of Attitudes toward Animals (1980b, p. 34-35)**

<b>Attitude</b>	<b>Definition</b>
Naturalistic	Primary interest and affection for wildlife and the outdoors.
Ecologicistic	Primary concern for the environment as a system, for interrelationships between wildlife species and natural habitats.
Humanistic	Primary interest and strong affection for individual animals, principally pets. Focus is on large attractive animals with strong anthropomorphic associations.
Moralistic	Primary concern for the right and wrong treatment of animals, with strong opposition to exploitation of and cruelty toward animals.
Scientistic	Primary interest in the physical attributes and biological functioning of animals.
Aesthetic	Primary interest in the artistic and symbolic characteristics of animals.
Utilitarian	Primary concern for the practical and material value of animals.
Dominionistic	Primary satisfactions derived from mastery and control over animals.
Negativistic	Primary orientation is an active avoidance of animals due to fear or dislike.
Neutralistic	Primary orientation is a passive avoidance of animals due to indifference.

**Table 2**  
**Dimensions of the Wildlife Attitudes and Values Scale (Butler, Shanahan, & Decker 2003, p. 1031)**

<b>Dimension</b>	<b>Definition</b>
Social benefits	Importance of the quality of environment related to wildlife, existence value of wildlife, ecological role of wildlife, wildlife as a learning subject, and understanding wildlife behavior.
Traditional conservation	Importance of trapping, hunting for sport and food, economic benefits from wildlife related recreation, and wildlife as a renewable resource.
Communication benefits	Importance of talking about wildlife, viewing wildlife, seeing wildlife depicted in art, and expressing opinions about wildlife to public or private wildlife officials.
Problem tolerance	Importance of tolerating nuisance wildlife, risk of disease from wildlife, property damage by wildlife, and personal safety hazards posed by some wildlife.

Manfredo and others from the Human Dimensions in Natural Resources Unit at Colorado State University have developed a set of items to measure wildlife value orientations which have been used in many studies to understand public thought related to wildlife and wildlife management (e.g., Bright, Manfredo, & Fulton 2000; Fulton, Manfredo, & Lipscomb 1996; Manfredo, Pierce, Fulton, Pate, & Gill 1999; Manfredo et al. 2003; Teel, Bright, & Manfredo 2003; Zinn, Manfredo, Vaske, & Wittman 1998; Zinn & Pierce 2002). They have identified two wildlife value orientation scales: protection-use and appreciation. People who express a utilitarian value orientation believe that wildlife should be used and managed for human benefit and typically support hunting and fishing. Those who express a protectionist value orientation believe wildlife and humans should have similar rights and usually are against hunting and fishing. People who highly appreciate wildlife place importance on wildlife education, wildlife viewing, and protecting wildlife for future generations (Manfredo et al. 2003).

The attitudes and values measured by these various methods are associated with sociodemographic factors such as age, sex, education, occupation, income, and place of residence, as well as participation in different types of animal-related activities. In general, younger people are more likely to be protection oriented, while older respondents tend to be more utilitarian. Kellert (1980a, 1980b) found that respondents under the age of 35 were more likely to be naturalistic and humanistic and less likely to be utilitarian than the elderly. Mankin, Warner, and Anderson (1999) also found younger respondents were more likely to value wildlife the same way they value people or pets than older respondents. However, Butler, Shanahan, and Decker (2003), in a review of WAVS studies, found that respondents under the age of 25 were more likely to support traditional conservation practices than their older counterparts.

Men tend to be more utilitarian oriented than women. Butler et al. (2003) found that men consistently supported traditional conservation practices more than women. In the Kellert study, men scored higher on the utilitarian, dominionistic, naturalistic, and

ecologicistic scales. Women scored higher on the humanistic, moralistic, and negativistic scales and preferred domestic and aesthetically pleasing animals (Kellert & Berry 1987). In another study of gender and species conservation attitudes, women were more supportive of protecting species even if it meant reduced property rights and also supported strengthening the Endangered Species Act more often (Czech, Devers, & Krausman 2001).

Education also plays a role in people's values and attitudes toward animals. Kellert (1980a, 1980b) reported that less educated people had much higher dominionistic, utilitarian, and negativistic scores. Manfredo et al. (2003) found that lower levels of education were related to higher proportions of utilitarians within Western states.

Occupation and income are closely tied together and are related to values and attitudes toward wildlife. Kellert (1980a, 1980b) found that livestock producers and farmers were more utilitarian than other people and professionals were more ecologicistic than other groups. Peyton and Langenau, Jr. (1985) also reported that occupation has an effect, with biologists working for the federal government exhibiting much higher ecologicistic, scientific, dominionistic, and naturalistic and much lower utilitarian and negativistic scores than the general public. Manfredo et al. (2003) found that the percent of people above the mode for income in a state was inversely related to the proportion of utilitarians in the state. Kellert (1980a, 1980b) discovered that very low income respondents (<\$5000/year) were more utilitarian and negativistic and less naturalistic and humanistic than those with higher incomes.

Place of residence can also make a difference in attitudes and values toward animals. Kellert (1980a, 1980b) reported that Alaskans and those in the West had a greater appreciation and knowledge of animals while Southerners had the highest utilitarian scores and the least interest in and knowledge about animals. Urban and rural residents also differ in their feelings toward wildlife. Manfredo et al. (2003) discovered that higher urbanization in a state correlates with a smaller proportion of utilitarians. Butler et al. (2003) also found that rural residents were more likely to support traditional conservation practices than urbanites.

People who participate in wildlife related activities have different attitudes and values. Studies of wildlife value orientations have found that those people with utilitarian orientations are more likely to have positive attitudes toward hunting and trapping and to have hunted than those with protectionist orientations (Bright et al. 2000; Fulton et al. 1996; Manfredo et al. 1999, 2003). Kellert (1980a, 1980b) also found that hunters tended to be more utilitarian and dominionistic than other wildlife users.

In general, respondents in the Kellert (1980a, 1980b) study had very limited knowledge about animals, but men had significantly more species knowledge than women. However, another study found no difference in species knowledge between men and women (Czech, Devers, & Krausman 2001). In terms of wildlife-related issues, the public was more aware of those involving specific, attractive, and "higher" animals rather than those that were more abstract, involved habitat loss, and "lower" animals. This

attitude was also evident in which species people preferred and which they would choose to protect. Preferred species were aesthetically pleasing, large, more intelligent, and more closely related to humans, among other characteristics (Kellert 1980a, 1980b).

It appears that attitudes toward animals may change over time. Kellert (1985a) did a content analysis of the animal-related stories in two urban and two rural newspapers from 1890 to 1976. The most common attitude was utilitarian, followed by humanistic, neutralistic, and negativistic. The utilitarian attitude decreased in all papers over time but the rural newspapers consistently had a much higher percentage of utilitarian articles than the urban papers. The humanistic attitude increased in the urban papers while decreasing in the rural papers. The negativistic attitude declined in the rural papers while increasing slightly in the urban papers. Most of the articles covered local issues and very few were about endangered, extinct, or declining species. The analysis indicates a change did occur over the last century but that a utilitarian attitude still prevails in America.

Manfredo et al. (2003) provide a theory as to why this shift may be occurring. They argue that value orientations toward wildlife are linked to societal values. According to Inglehart (1990, 1997; Inglehart & Baker 2000), values have shifted from a focus on basic material needs to higher order psychological needs in postindustrial nations like the United States. The movement away from materialist values toward post-materialist values is reflected in societal-level factors such as education, income, urbanization, and residential stability. Manfredo et al. show that materialist values and utilitarian wildlife value orientations are associated with lower levels of education, income, and urbanization and higher levels of residential stability. This indicates that changes in wildlife value orientations are likely to be linked to shifts in societal values.

However, Butler et al. (2003) dispute the claim that utilitarian attitudes have declined over time. They examined studies which were undertaken using WAVS from 1984 to 1996 and concluded that support for traditional conservation practices had increased among men and stayed about the same for women. They also found that attitudes concerning the social benefits of wildlife did not change appreciably over time.

### *Wildlife Management*

Knowledge, values, and attitudes toward wildlife management practices can also be helpful in determining what the public thinks about biodiversity. Several studies have examined how people view techniques used to manage wildlife. Many of these focus on management activities which are used to diffuse human-wildlife conflict (e.g., Loker, Decker, & Schwager 1999; Manfredo, Zinn, Sikorowski, & Jones 1998; Reiter, Brunson, & Schmidt 1999; Teel, Krannich, & Schmidt 2002), but others address wildlife management in the context of habitat and species diversity (Diefenbach, Palmer, & Shope 1997; Duda, Bissell, & Young 1998; Leuschner, Ritchie, & Stauffer 1989; Mankin, Warner, & Anderson 1999; Muth, Zwick, & Mather 2002; Sargent-Michaud & Boyle 2002; Schreyer, Krannich, & Cundy 1989).

Duda et al. (1998, p. 55-65) found that the public generally supported management which focused on ecological rather than recreational values. In various surveys conducted in nine states from 1988 to 1998, respondents repeatedly placed protecting habitat and managing for threatened and endangered species above managing for game species or creating hunting and fishing opportunities. However, Sargent-Michaud and Boyle (2002) reported that respondents in Maine felt that equal effort should be allocated to managing non-game and game species. Diefenbach et al. (1997) found that the attitudes of hunters toward deer management in Pennsylvania were at odds with the biological reality which guided management actions. Hunters felt that there were not enough deer and that deer did not cause serious damage to forests while the biological research showed an overpopulation of deer which were causing harm to the regeneration of forests.

These studies have found that there are differences in the way diverse groups feel about management. Mankin et al. (1999) reported that urban, younger, and female respondents were less likely to support hunting as a management technique than their counterparts. Zinn and Pierce (2002) also found that women were less supportive than men of destroying mountain lions which entered residential areas. Schreyer et al. (1989) reported that both consumptive and nonconsumptive wildlife users were more supportive of management actions which privileged wildlife protection over economic and commodity activities than respondents who did not participate in wildlife recreation. In a study of six Western states, Teel et al. (2003) found that hunters and anglers differed very little from non-hunters and anglers in accepting of a wide range of actions used to manage predator populations. However, in some cases, hunters and anglers were more supportive of lethal management techniques. For instance, in all states, hunters and anglers were more likely to support aerial gunning of coyotes than non-hunters and anglers.

Kennedy (1985) suggests that wildlife managers should be considered a professional culture with unique attitudes and values. This idea is supported by literature which shows that managers have been found to differ from the public and among themselves in their views of management practices (Bright, Lipscomb, & Sikorowski 1997; Gigliotti & Harmoning 2003; Koval & Mertig 2004; Leuschner, Ritchie, & Stauffer 1989; Messmer, Cornicelli, Decker, & Hewitt 1997; Muth, Zwick, & Mather 2002). For instance, in a recent study of conservation professionals, those over 49 years of age were less likely to agree that species have inherent value and that management should focus on ecosystem management and biodiversity than their younger counterparts (Muth, Zwick, & Mather 2002). Many felt that managing for harvestable species should take priority over biodiversity and that wildlife are resources which are meant to be sustainably harvested. When the view of resource managers and wildlife users were compared in another study, managers were more likely to support harvesting timber and hunting as management techniques than nonconsumptive users (Leuschner, Ritchie, & Stauffer, 1989). Wildlife managers are also more likely to support lethal management of wildlife than the general public (Koval & Mertig 2004; Messmer et al. 1997).

## *Endangered Species*

There are many studies which address individual species and the issues surrounding them. One area of this literature which seems especially relevant to biodiversity issues is studies which examine knowledge of and attitudes toward endangered species and their management. Support for the Endangered Species Act itself seems to be widespread, even though some people feel that it needed to be strengthened or modified in order to work more efficiently (Cook & Cable 1996; Czech & Krausman 1999). There is also substantial support for individual species, whether they are birds, mammals, or fish (Aipanjiguly, Jacobson, & Flamm 2003; Brook, Zint, & Young 2003; Brooks, Warren, & Nelms 1999; Gresswell & Liss 1995; Harris, Krusmand, & Shaw 1995; Kotchen & Reiling 2000; Solomon 1998). Even when restrictions were placed on activities of recreational users, the majority were still supportive of those management actions (Gresswell & Liss, 1995; Harris, Krausman, & Shaw, 1995). However, in a revealing study, Brook, Zint, and Young (2003) determined that landowners who were aware they had habitat for the endangered Preble's jumping mouse on their land were equally likely to manage to improve or damage that habitat. Phillips, Boyle, and Clark (1998) uncovered differences in the attitudes of wildlife managers in Maine towards endangered species. There were several internal discrepancies concerning which species were most important to protect and whether all the species on the state's endangered list truly belonged there.

When economic trade-offs are introduced against endangered species protection, public support diminishes but remains (Cook & Cable 1996). However, in willingness-to-pay studies, respondents usually said they would pay at least a small amount to protect endangered species and improve their habitat (Ekstrand & Loomis 1998; Kotchen & Reiling 2000; Loomis & White 1996b). For instance, one study found that people were willing to pay up to \$27 on a one time tax to protect peregrine falcons or shortnose sturgeons (Kotchen & Reiling 2000). These results indicate that the public will accept some economic losses in order to protect endangered species.

### **Conclusions from the Literature Review**

While much of the literature reviewed above does not address how the public feels about biodiversity directly, people's knowledge, attitudes, and values toward forest values and management, ecosystem management, fire management, and wildlife and wildlife management, including endangered species, may act as proxies. In examining this literature, several trends become apparent.

- Biodiversity is not consistently defined in the scientific community. Though it is ubiquitous in the scientific literature, the public is not familiar with the term.
- There is general support for protecting biodiversity and its many components among the public. This is not an unexpected finding, given that many surveys find that the majority of Americans support protecting the environment in general. Most

Americans also say they are sympathetic to the environmental movement (Ladd & Bowman 1995).

- At a smaller geographic scale, support for protecting biodiversity is heavily influenced by more immediate economic and social impacts of land management decisions on people's lives
- Americans value the non-commodity benefits of forests over the commodity benefits. There has been a shift toward using forests in a non-extractive manner for recreational, spiritual, and aesthetic purposes, rather than for the production of timber, minerals, or grazing land. This does not necessarily indicate a shift away from a utilitarian viewpoint, however, but may point to a concurrent increase in protection oriented values.
- Fire as a management tool has gained in acceptance since the 1970s but various factors affect the acceptability of fire in any given situation. Education about fire and its effects has proven successful in increasing people's tolerance toward the use of fire in management.
- Americans are diverse regarding attitudes toward wildlife, but generally support ecologically based wildlife management over just managing for game species.
- Most Americans are willing to sacrifice some economic benefits in order to protect biodiversity. However, the majority also believe that economic growth and environmental protection can exist together (Ladd & Bowman 1995) which means that these types of questions may not be salient to many people.
- Knowledge, attitudes and values vary among different groups of Americans. Several factors, such as age, sex, place of residence, education, and income, can play a role in determining these things.
- There is an obvious lack of knowledge among the American public about biodiversity and related issues. Furthermore, increased knowledge about a biodiversity issue does not necessarily translate into a more positive attitude toward protecting biodiversity, except in the case of fire management.