A new approach to monitoring the social environment for natural resource management and policy: The case of US national forest benefits and values[1]

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This paper describes a new approach for monitoring the social environment for natural resource management and policy, based on content analysis of online news media stories. Content analysis of the media has repeatedly been shown to produce results that are closely correlated with attitude surveys and opinion polls. Computer methods were used to analyse almost 30 000 online news stories about the US national forests for expressions of four broad categories of benefits and values. Recreation benefits and values were expressed more often than other categories, both at the national and regional levels, followed by commodity, ecological and moral/spiritual/aesthetic benefits and values. Over the years 1992 through 1996, a gradual upward trend was found in expressions of recreation and moral/spiritual/aesthetic benefits and values and a gradual downward trend was found in expressions of commodity-related benefits and values at the national level, suggesting shifting environmental values and the need to ensure that natural resource management and policy are responsive to changing social values. Computer content analysis of online news stories provides a new method for the continuous monitoring and assessment of a broad range of trends in the social environment in which natural resource decision making takes place.

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Introduction

The job of natural resource managers and policy makers is growing increasingly complex because of rapid change in the social, political, economic and scientific environments in which management is carried out. For example:

- Environmental attitudes and values have shifted significantly in recent decades (Kempton *et al.*, 1995; Ladd and Bowman, 1995; Deason, 1996–97);
- The public and other stakeholders increasingly demand collaborative approaches to natural resource planning and

management (Daniels and Walker, 1996; Selin and Chavez, 1995); and
- Resource management paradigms are shifting from traditional multiple-use to ecosystem-based approaches (Gordon, 1994; Behan, 1997).

Managing forests and other ecosystems in ways that are responsive to these and other social changes requires continuous monitoring and assessment of relevant trends. However traditional methods for monitoring the social environment such as surveys are slow and expensive.

The US Department of Agriculture (USDA) Forest Service is an example of a large natural resource management agency that has been buffeted by external change and could benefit from new methods to monitor the social environment in which the organisation

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operates. The Forest Service is responsible for managing the National Forest System: 191 million acres of public land or about one-eighth of the landscape of the contiguous 48 states. In recent decades, the agency has endeavored to deal with conflicting demands from diverse stakeholder groups and shifting environmental attitudes and values of the US public (Hays, 1988; Hirt, 1994). Shands (1991) stated that managing the US national forests in ways that are responsive to changing public values is the core problem faced by the Forest Service.

In this paper we describe a new approach for monitoring the social context for natural resource management. We developed a social monitoring system based on computer content analysis of almost 30 000 online news media stories about the USDA Forest Service and national forests over the period 1992–1996. The availability of electronic databases of news stories and computer methods to analyse text has made it possible to rapidly and efficiently analyse large quantities of stories on a particular topic or issue. This large data volume can be used to create quantitative time trends that provide insights into the prevalence and importance of key ideas relative to each other. Using computer analysis of online news stories to develop a monitoring system makes it possible to update information easily, expand to include additional issues and extend back in time to establish time trends.

This approach was applied to examine trends in expressions of four broad categories of benefits and values associated with the US national forests. Forest benefits and values are defined here as relatively enduring conceptions of 'the good' related to forests and forest ecosystems. In this study, we distinguish the following four types of forest benefits and values: recreation, commodity-related, ecological and moral/spiritual/aesthetic. These categories are broad, encompassing the following:

Recreation benefits and values reflect the view that the national forests are good because of the recreational and tourism opportunities they provide. Recreational use of the national forests has increased steadily in recent years. Recreation benefits and values are expressed in news media stories about the national forests through discussion of the objects of recreational value, e.g. the full range of recreation activities (bird watching, off-road vehicle use, etc.) and recreation resources (campgrounds, snowmobile trails, etc.), and through discussion of the social and personal benefits of recreation and tourism activities.

Commodity benefits and values reflect the view that forests are good because they provide products needed by society and other benefits related to commodity production. Commodity-related outputs of the national forests have declined in recent years, but remain an important use. Commodity benefits and values associated with the national forests are expressed in news media stories through discussion of the production of various commodities, jobs and other economic benefits associated with commodity production (economic growth, economic health and prosperity, etc.), concern over loss of jobs and economic benefits, and other language reflecting commodity-related benefits and goals.

Ecological benefits and values reflect the view that forest ecosystems are good because they provide life-supporting environmental functions and services upon which human well-being depends. In the news stories we analysed, expressions of ecological benefits and values included discussion of a wide range of ecologically oriented benefits, including various ecosystem functions and services, goals related to ecological value and indicators of the achievement of these goals, and expressions of concern about loss of ecological values or damage to ecosystems.

Moral/spiritual/aesthetic benefits and values reflect the view that forests have value that goes beyond the instrumental benefits we receive from them; they have a good of their own. We value nature morally or spiritually when we regard it with love, affection, reverence and respect (Sagoff, 1991). Aesthetic value is a type of non-instrumental value in which beauty is the concept of what is good. In the news stories we analysed, we found expressions of the spiritual value or sacredness of nature, the moral obligation to pass on a healthy and high quality natural heritage to future generations, attachment-orientation to nature, heritage and cultural values, aesthetic value and concern about the loss of these values.

The following section describes the link between discussion in the news media of a particular topic and public attitudes and opinion about that topic. This is followed by an explanation of the computer methods used in this study, and a discussion of our findings. A concluding section describes the potential uses of this new approach to monitoring the social environment for natural resource management.

The news media and public opinion

Analysis of the content of the news media has repeatedly been shown to produce results that are remarkably similar to attitude surveys and opinion polls. Many studies have shown that the media have played an important role in influencing public opinion about various environmental issues (e.g. Parlour and Schatzow, 1978; Keppliger and Roth, 1979; Salwen, 1988; Gamson and Modigliani, 1989; Brosius and Kepplinger, 1990; Noelle-Neumann, 1991; Hoffman, 1996; Ranthum, 1996) and a wide range of other issues (e.g. Hauss, 1993; Fan, 1994b; Fan, 1997). Other studies have found that the news media have an influence on agenda-setting for environmental issues, i.e. there is a relationship between the relative emphasis given by the media to environmental issues and the degree of salience these topics have for either the general public (e.g. Atwater *et al.*, 1985; Ader, 1995; Anderson, 1997) or the political agenda (e.g. Downs, 1973; Solesbury, 1976; Schoenfeld *et al.*, 1979; Protess *et al.*, 1987).[2]

The reason for this link between the news media and public opinion is two fold. First, natural resource management issues are debated in a variety of forums in society. As shown in Figure 1, social debates about natural resources and the environment take place in the courts, legislatures, meetings and hearings, confrontations and the media. The media play two important roles in these debates, serving as a direct forum for public
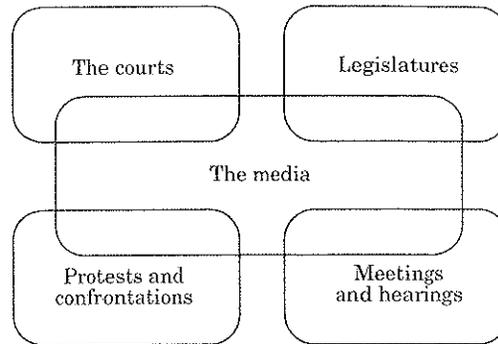

Figure 1. Forums for public debates about natural resource policy and management.

discourse on natural resources (through editorials, letters to the editor, etc.) and also reporting on debates occurring in all other forums. Pollster George Gallup theorised in 1939 that the media were creating a national town meeting in which issues were debated:

'The newspapers and radio conduct the debate on national issues, presenting information and argument on both sides, just as the townsfolk did in person at the old town meeting' (quoted in Smith, 1997: p. 56).

More recently, social theorist Jürgen Habermas has defined the term 'public sphere' as a realm of social life in which citizens can come together as a rational body and discuss and debate issues of public concern, and in which public opinion can be formed. Habermas states that 'Today newspapers and magazines, radio and television are the media of the public sphere.' (Habermas, 1974: p. 49). Computer content analysis of the news media thus allows us to take the pulse of on-going debates and discussions about natural resource issues as reflected in tens of thousands of stories.

Second, several studies have shown that the news media are the most important source of information for most people about environmental issues (e.g. Atwater *et al.*, 1985; Ostman and Parker, 1987; Fortner *et al.*, 1991; Wilson, 1995). Shindler *et al.* (1996) found that the most important source of information about federal forest management for residents of the state of Oregon was newspapers, followed by television, radio, magazines/books, friends/relatives, interest groups and lastly natural resource agencies. In a study of forest policy committees in state

[2] Communications researchers have also studied the extent to which the media reflect public opinion. Evidence in the literature suggests that the media both shape and reflect the views of the public. See Ansolabehere *et al.* (1993) for a summary of this literature.

legislatures, Lewis and Ellefson (1993: p. 37) found that:

> 'Committee staff identified the press and media organizations as the most skilled at mobilizing public opinion...The media is clearly seen as a powerful communicative actor, being the principal medium (in a logistical sense) for disseminating to the general public both factual information and the views and recommendations of actors in a state's forest policy domain.'

Therefore, since the news media summarise ongoing social discussion and debates about these issues and are the main source of information for the public about natural resource issues, analysis of the content of the news media is an efficient way to indirectly measure public views.

Data and methodology

This analysis involved four main steps: downloading news media stories about the US national forests from online commercial databases; 'filtering' the text to eliminate irrelevant paragraphs; developing computer instructions to score the remaining text for the four categories of benefits and values; and checking the validity or accuracy of the analysis. Each step is briefly described below.

Downloading news media stories

The news items used for this analysis were those discussing the USDA Forest Service and the national forests. All stories were retrieved from the LEXIS-NEXIS and Dialog online commercial databases, and the full texts of news sources chosen for the analysis were all available on the databases for the entire period of the study. Separate analyses were made for the United States as a whole (covering the period 1992–1996) and three regions of the United States (covering 1994–1996). The national analysis could be extended further back in time than the regional analyses and still retain a large number of news sources representative of the total news structure. More news sources were included in the regional analyses because additional news sources have become available online

Figure 2. Regional breakdown used in this analysis: East (Forest Service Regions 8 and 9), InterWest (Forest Service Regions 1, 2, 3 and 4) and West (Forest Service Regions 5 and 6). Forest Service Region 10 (Alaska) was not included due to a lack of news sources available online during the entire period 1994–1996, and there is no region 7.

with time. Figure 2 shows the regional breakdown, which is based on aggregations of Forest Service administrative regions. The regional breakdown is based on place of publication rather than the geographic focus of a news story.

A random sample of 28 669 Forest Service and national forest stories were retrieved for the analysis:

National story sample (1992–1996):

- 9995 out of a total of 22 634 stories from 24 newspapers, five newswires, and four television and radio news transcripts;

Regional story sample (1994–1996):

- East (Forest Service Regions 8 and 9): 5996 out of a total of 10 230 stories from 42 newspapers;
- InterWest (Forest Service Regions 1, 2, 3 and 4): 6000 out of a total of 7737 stories from nine newspapers; and
- West (Forest Service Regions 5 and 6): 6678 out of a total of 10 184 stories from 10 newspapers.

Filtering text

The retrieved text was analysed using the patented InfoTrend method and computer software (Fan, 1990, 1994a). The InfoTrend software can discard paragraphs that do not fit with user-specified criteria. In this study, paragraphs were discarded that did not discuss the Forest Service or national forests,

or only mentioned these topics incidentally (e.g. stories about homicide investigations in which a body was found on a national forest). This iterative process of filtering text has been termed the method of successive filtrations: 'From biochemistry, I learned that the study of complicated materials frequently benefits from a series of purifications steps, each one removing extraneous components to yield progressively more homogeneous preparations enriched in relevant materials. This logic led to the strategy of successive 'filtrations' during the text analyses.' (Fan, 1988, p. xvii). The focusing of text through filtration greatly simplifies and improves the accuracy of computer coding.

Scoring paragraphs

Individual paragraphs were the unit of analysis in this study. Info Trend computer instructions were developed to score paragraphs for each of the four concepts of interest, i.e. to count the number of times each of the four categories of benefits and values was expressed in the databases of news media text. Paragraphs which contained multiple expressions of one benefit category were counted as a single expression. If a paragraph contained expressions of more than one of the four categories of benefits and values, however, then each of the categories were counted once.

Scoring paragraphs involved developing a set of *dictionaries* related to each benefit category (i.e. groups of words and phrases associated with each category) and a series of *idea transition rules* (i.e. computer instructions which specify how the dictionaries are combined to identify the benefit categories). Developing the dictionaries and idea transition rules to capture expressions of each category of benefits and values was an iterative process. In the development stage of the analysis, the still-evolving computer instructions were applied to random samples of text, the coding decisions were examined, and the dictionaries and idea transition rules were modified as needed.

To illustrate the methodology, one of the dimensions of commodity benefits and values we coded for was concern over loss of commodity-related jobs. An expression of this concern is one of many ways in which people

express the importance of commodity production and the benefits it generates.[3] For example, one set of computer instructions specified that words and phrases with the connotation of *mills* (e.g. lumber mill, pulp mill, sawmill, etc.) appearing with 50 characters of words and phrases expressing the idea of *closing* (e.g. closing, idled, shut down, etc.) combined to create the new meaning of concern over loss of commodity-related jobs, which was one of the dimensions of commodity benefits and values. An example of news media text that was coded using this set of computer instructions is:

'Soon, Comer is speaking confidently with the aide to Oklahoma Sen. Don Nickles. 'Ma'am, I work for a <u>lumber mill</u> (mills word) *being <u>shut down</u> because it can't get tim-* (closing word) *ber sales loose from the Forest Service. Wonderin' if you knew about it?'* (Bridge, 27 March 1994, p. N1).

As another example, one of the ways that people often express the importance of ecological benefits and values is concern over damage to or destruction of ecological systems or components. We developed computer instructions which specified that words and phrases with the connotation of *damage* (e.g. decimate, fragment, jeopardise, etc.) appearing within 50 characters of words and phrases expressing the idea of *ecological or biological objects* (e.g. ecosystem, habitat, species, etc.) be combined to create the new meaning of concern over damage to ecological systems, which was one of the dimensions of ecological benefits and values. An example of news media text that was coded using this set of computer instructions is:

'The amphibian . . . is the first creature to get the designation after a yearlong moratorium by Congress. Projects that could <u>damage</u> its <u>habitat</u> will now face (damage word) (ecological object word) *federal review'* (Cone, 21 May 1996, p. A3).

[3] Creighton (1983) noted that one strategy for communicating values is prediction of dire consequences: 'The kind of consequence they fear will reflect their values. The man from the Chamber of Commerce will predict a loss of jobs, while the preservationist will predict a total disruption of the ecosystem' (p. 153). Our experience developing computer instructions to capture expressions of forest benefits and values confirms Creighton's observation.

Table 1. Examples of expressions of national forest benefits and values from the news media

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Recreation benefits and values:

...people in Idaho and Montana do not want to cede more of their prime hunting and camping lands to Ursus Arctos Horribilis. [Kenworthy (1995). Unlikely alliance finds common ground for grizzlies. The Washington Post, 29 October, p. A3.]

...But the region is home to bald eagles, timber wolves, bears and moose and it's treasured by a wide variety of outdoor enthusiasts, including snowmobilers, fishermen, backpackers and canoeists, with often conflicting interests. [Brasher (1995). Wellstone caught between environmentalists, outdoor enthusiasts. The Associated Press, 6 November.]

Commodity benefits and values:

The Forest Service says the proposal would boost timber industry employment in the Sierra by 2000 jobs, a 50% increase. [Barnum (1996). White House intervenes to protect spotted owl in Sierra Nevada. San Francisco Chronicle, 22 August, p. A14.]

...for grazing animals on public land. The 1993 rate will be $2·04 per animal unit per month. That's down 21 cents from the 1992 rate. An animal unit is the amount of forage needed to sustain one horse, a cow and her calf or five sheep or goats. The rate is pegged to private land lease rates, beef cattle prices and the cost of livestock production. The land is held by the Forest Service and the... [United Press International (1993). Farming today: Farmers want paybacks for needless investigations. UPI, 13 January.]

Ecological benefits and values:

'Causing these declines is habitat damage caused by human activities,' said Willa Nehlsen, lead author of the report. [Barnard (1983). Rivers hold key to salmon survival. The Associated Press, 12 April.]

If the project succeeds...it could have a profound impact on the resolution of other conflicts over endangered species and on the federal government's approach to managing imperiled wildlife. [Kenworthy, p. A3.]

Moral, spiritual and aesthetic benefits and values:

'The 'Path of Life Trail Lands' will remain a wilderness for longer than we can envision,' said Vincente Lujan, the tribe's warchief. 'For as long as our people exist, the sacred areas will remain a place of prayer for all life, and a place of mediation for our people.' [Seybert (1994). Pueblos call for government's return of sacred lands. States News Service, 21 April.]

Spanning 17 million acres on the rocky shores and numerous islands, the Tongass is the biggest of the national forests, once described by the naturalist John Muir as 'an endless rhythm and beauty.' [Cushman (1994). U.S. to cancel a timber deal in Alaska. The New York Times, 15 January, section 1, p. 8.]

Similar computer instructions were developed to identify and count expressions of each of the four categories of national forest benefits and values. Table 1 provides examples of news media text coded by our computer instructions for each of the four main categories of benefits and values. See (Fan, 1988) for a detailed description of the computer content analysis methodology.

Checking validity

Following the development and refinement of the content analysis computer instructions, a formal validity analysis was carried out. A content analysis variable is valid to the extent that it measures the concept it was intended to measure (Weber, 1990). We examined random samples of several hundred stories that
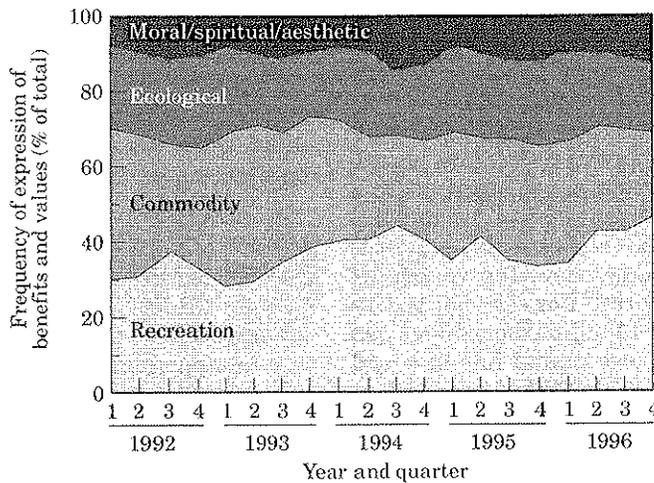
Figure 3.   Frequency of expressions of recreation, commodity, ecological and moral/spiritual/aesthetic benefits and values associated with the national forests, plotted quarterly 1992–1996.

were coded using our computer instructions to determine whether or not they were able to identify expressions of the four categories of benefits and values accurately at least 80% of the time—a rule of thumb sometimes used in content analysis. After final refinements in the computer instructions, the accuracy rates were as follows: recreation: 86%; commodity: 88%, ecological: 85%; and moral/spiritual/aesthetic: 87%. The narrow range of accuracy rates indicates that we have not systematically over- or under-counted any of the categories of benefits and values.

Discussion of findings

National findings

Figure 3 presents national trends in expressions of benefits and values associated with the US national forests. This figure shows change over time in the relative frequency of expression of benefits and values. Recreation benefits and values were expressed most frequently over the 5 year period, and were expressed more often than commodity benefits and values except in the first half of 1992 and the first half of 1993. Figure 3 reveals a gradual decrease in the relative frequency of expression of commodity-related benefits and values, and a gradual increase in recreation's share. Both

of these trends were found to be statistically significant. A test for trend in proportions based on Kendall's statistic S was carried out for each type of benefit (Brown and Hollander, 1977). The null hypothesis of no trend was tested against an increasing trend alternative for recreation and moral/spiritual/aesthetic benefits, a decreasing trend alternative for commodity benefits and a two-sided test for ecological benefits and values. The null hypothesis of no trend was rejected at the 0·01 level for recreation and commodity benefits (providing evidence of increasing and decreasing trends, respectively), but not for the other two types of benefits. However, the null hypothesis was rejected at the 0·05 significance level for moral/spiritual/aesthetic benefits, providing some evidence of an increasing trend.

The dominance of recreation benefits and values that we found is consistent with survey results. In a national survey of the general public, 62% of respondents agreed or strongly agreed (and 22% disagreed or strongly disagreed) with the statement:

'Creating recreation opportunities (boating, hunting, camping, etc.) on public forest lands is important to me' (Hammond, 1994). When the same survey asked about commodity benefits and values, however, only 36% of the public agreed or strongly agreed (and 47% disagreed or strongly disagreed) with the statement: 'Natural resources in public forests and grasslands should be made available

to produce consumer goods'.[4] The National Survey on Recreation and the Environment (Cordell, 1999) found that participation in outdoor recreation by the US public has continued to grow in the 1990s, and Forest Service data on the number of recreation visitor days in national forests show rapid growth in the 1990s, from about 288 million in 1992 to 341 million in 1996 (a visitor day equals a 12 h visit). At the same time, the volume of timber sold from Forest Service lands has dropped from about 11 billion board feet per year in the 1980s to less than 4 billion board feet per year by the mid-1990s (a board foot is a measure of wood volume equal to a board 1 foot long by 1 foot wide by 1 inch thick).[5]

Expressions of the ecological benefits and values of the national forests accounted for about 22% of the total over the 5 year period (Figure 3). This level of discussion—falling just below expressions of commodity-related benefits—indicates a relatively high level of concern about the environment and protecting ecosystems. No clear trend is evident for expressions of ecological benefits at the national level. Previous research using computer content analysis found increasing expressions of ecological values from the early 1980s through the early 1990s (Xu and Bengston, 1997). Surveys have also found strong ecological value orientations toward forests among the public (e.g. Steel *et al.*, 1994; Manning *et al.*, 1999).

Moral/spiritual/aesthetic benefits and values were expressed less often than the other categories, accounting for about 10% of the total on average over the 5 year period. But given the intangible nature of these benefits, that percentage may seem surprisingly high. Several surveys have found high levels of agreement about the importance of the moral and spiritual values of the environment. For example, Hammond (1994) found that 90% of the public agreed or strongly agreed with the following statement referring to a moral obligation to future generations: 'The federal government has the responsibility of conserving public forest resources for future generations.' Kempton *et al.* (1995) found a remarkable degree of agreement about the

moral and spiritual values of nature among diverse social groups.

Therefore, the fact that moral/spiritual/aesthetic values were expressed less often than other categories of benefits and values does not mean they are unimportant. To the contrary, these 'deeper' values help explain why people care so passionately about natural resource issues. Schroeder (1994) has argued that moral and spiritual values are critical for understanding conflict over forest policy and management:

'Experiential values that do not lend themselves to this kind of measurement and valuation (for example, sense of place and spiritual values) have often been disregarded. Yet it is precisely these kinds of values, rooted in intuitive and emotional experiences, that have motivated many people to take legal and political action against forest managers. For ecosystem management to truly include humans as a part of ecosystems, these kinds of values must be recognized and dealt with in managing forests.' (p. 3).

Regional findings

The regional analysis revealed similar value profiles for each of the three regions (Figure 4). Due to the relatively short time frame of the regional analysis, Figure 4 shows the average frequency of expression for each value aggregated over the entire 3 year period 1994–1996. Differences between the regions were minor for each type of benefit and value. Recreation benefits and values were expressed most often in the Inter West (45% of total expressions) and least often in the West (40%). Commodity-related benefits and values were expressed most often in the West (29% of total expressions) and least often in the East (25%). Ecological benefits and values were expressed with about the same frequency in each region, and moral/spiritual/aesthetic values were expressed most often in the East (13% of total expressions) and least often in the Inter West (9%).

The similarity in national forest values across regions is striking, especially because many people assume that environmental values in the West and Inter West (which have lower population densities, many national

[4] Our findings are also consistent with US Forest Service employees' perceptions of how the public values recreation *vs.* commodity production (Kennedy *et al.*, 1994).
[5] See the annual *Report of the Forest Service* (http://www.fs.fed.us/pl/pdb/97report/).
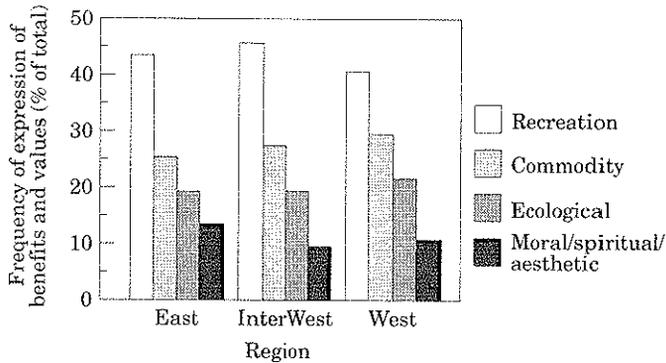
Figure 4.   Frequency of expressions of recreation, commodity, ecological and moral/spiritual/aesthetic benefits and values associated with the US national forests, by region (1994–1996 combined).

forests and more commodity production) are quite different than those in the Eastern United States (which has higher population density, few national forests and less commodity production). The conventional wisdom is that commodity-related benefits and values would be emphasised more in the West and Inter West, and that recreational, ecological and moral/spiritual/aesthetic values would be predominant in the East. But a variety of social scientists have found that core environmental values are now widely shared in US society (e.g. Deason, 1996–1997; Hays, 1988; Kempton *et al.*, 1995; Ladd and Bowman, 1995). These and other studies strongly suggest a reorientation of environmental values for the general public across the United States.

Implications for forest policy

This study found an increasing relative frequency of expression of recreation and moral/spiritual/aesthetic benefits and values associated with the US national forests, no significant trend in expressions of ecological benefits and values (but a sizeable share of ecological values), and declining relative frequency of expression of commodity-related benefits and values over the period 1992 through 1996. There are many forces behind these trends. Environmental historians have detailed the slow but steady reorientation in public environmental values that has taken place in the US in recent decades and the factors underlying this change: 'Evolving environmental values were closely associated with rising standards of living and levels of education...The social context within which environmental values flourished was twofold: younger people and the more educated.' (Hays, 1987, p. 3). Forests and other ecosystems are increasingly valued as amenities to enhance quality of life rather than simply a source for material commodities.

Our analysis of US national forest benefits and values points to a central dilemma for forest policy and management. On the one hand, we found frequent expression of non-commodity benefits and values: Recreation, ecological and moral/spiritual/aesthetic values accounted for 68% of all value expressions over the 5 year period at the national level, and they accounted for a slightly higher percent of all value expressions over the 3 year period in each of the regions. These values have been characterised as the new or emerging forest values by Hays (1988), and they parallel broader emerging environmental values in post-industrial society (e.g. Kempton *et al.*, 1995; Paehlke, 1997). On the other hand, traditional commodity-related values associated with the US national forests are still important, accounting for about 32% of all value expressions in our analysis. Value change and the tension between commodity and non-commodity forest values have been underlying sources of conflict over public forest management in recent decades. Despite the overall regional similarities in forest values that we found, significant differences exist between forest stakeholder groups and bitter clashes between stakeholders with diverse values have characterised debates over forest management.

The increasing importance of non-commodity values and continuing importance of commodity values have important implications for forest policy makers and managers. First, the tension between traditional and emerging forest values implies the need for planning and decision making processes that are better able to negotiate and incorporate diverse values. There is a greater need than ever before for meaningful stakeholder participation in forest planning and decision making. In the past, natural resource management agencies have often used limited forms of stakeholder involvement, but generally have not implemented meaningful public participation and shared leadership. But participatory and collaborative approaches are a key to getting diverse values on the table and working them out. It is through discourse and deliberation that people discover and express social values, which can then be incorporated into management. By better incorporating diverse values, collaborative approaches have been shown to reduce conflict over public forest management. For example, Gericke and Sullivan (1994) found evidence of a relationship between the form of public participation and the probability of a high level of conflict over forest plans. They found that public participation activity in small groups was a statistically significant variable in reducing the probability of high conflict, where conflict is defined as the average time required to resolve forest plans.

Another implication of the tension between traditional and emerging forest values is that ecosystem management—an emerging paradigm for natural resource management—may be an appropriate and timely policy response to the current social milieu in the United States. Most definitions of ecosystem management emphasise that its goal is to sustain ecological health and integrity while simultaneously meeting socio-economic needs, including the need for commodities produced by forests. Furthermore, collaborative approaches—an important part of ecosystem management—are widely advocated as the way to integrate the human and biophysical dimensions of ecosystem management (Gerlach and Bengston, 1994). Thus, ecosystem management can be interpreted as an attempt to manage simultaneously for the emerging forest values and traditional commodity values. This is an ambitious goal, and it remains to be seen whether or not ecosystem management will be able to deliver on its promises.

Concluding comments

The method for monitoring the social environment described in this study is a new tool for natural resource managers and policy makers. It does not replace traditional social science tools for assessing people's values, attitudes and other aspects of the human dimensions of natural resource management. Traditional methods for analysing the social environment—such as surveys, focus groups and interviews—are complementary to the method described in this paper.

However analysing social debates and discourse using computer content analysis of online media text does have some important advantages over traditional methods. Our approach can be:

- extended back in time in order to establish time trends for the concepts of interest, i.e. the effects of important events, such as a change in policy, can be observed;
- updated easily, efficiently and quickly, i.e. recent news media text can be downloaded and analysed to update an analysis every year, every quarter or whatever time frame is of interest to decision makers; and
- expanded to include additional issues and concepts of interest, or to analyse key trends in greater depth.

Social science research is often used indirectly by decision makers, helping them better understand the context in which decisions and policies need to be made, thereby resulting in better informed decisions that are more responsive to the changing social environment (Weiss, 1980). The ability of computer content analysis of online media text to identify and track emerging social trends makes this approach especially useful to strategic planners. At the other end of the time scale, decision makers in a crisis situation can have access to information about public response immediately using this approach. Other potential uses for this type of analysis include:

- bringing an issue to the attention of decision makers;

- formulating new policies or programs;
- evaluating the merit of alternative proposals for action;
- improving existing programs;
- mobilising support for a position or point of view;
- changing decision makers ways of thinking about an issue; and
- planning new decision-relevant research.

Rapid change in the social environment in which natural resource and environmental management is carried out has become the norm. Managing natural resources in ways that are responsive to changing social conditions is the main challenge faced by managers today. The method described in this paper provides a new approach for the continuous monitoring and assessment of a broad range of trends in the social environment.

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