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Applications of Computer-Aided Text Analysis in Natural Resources

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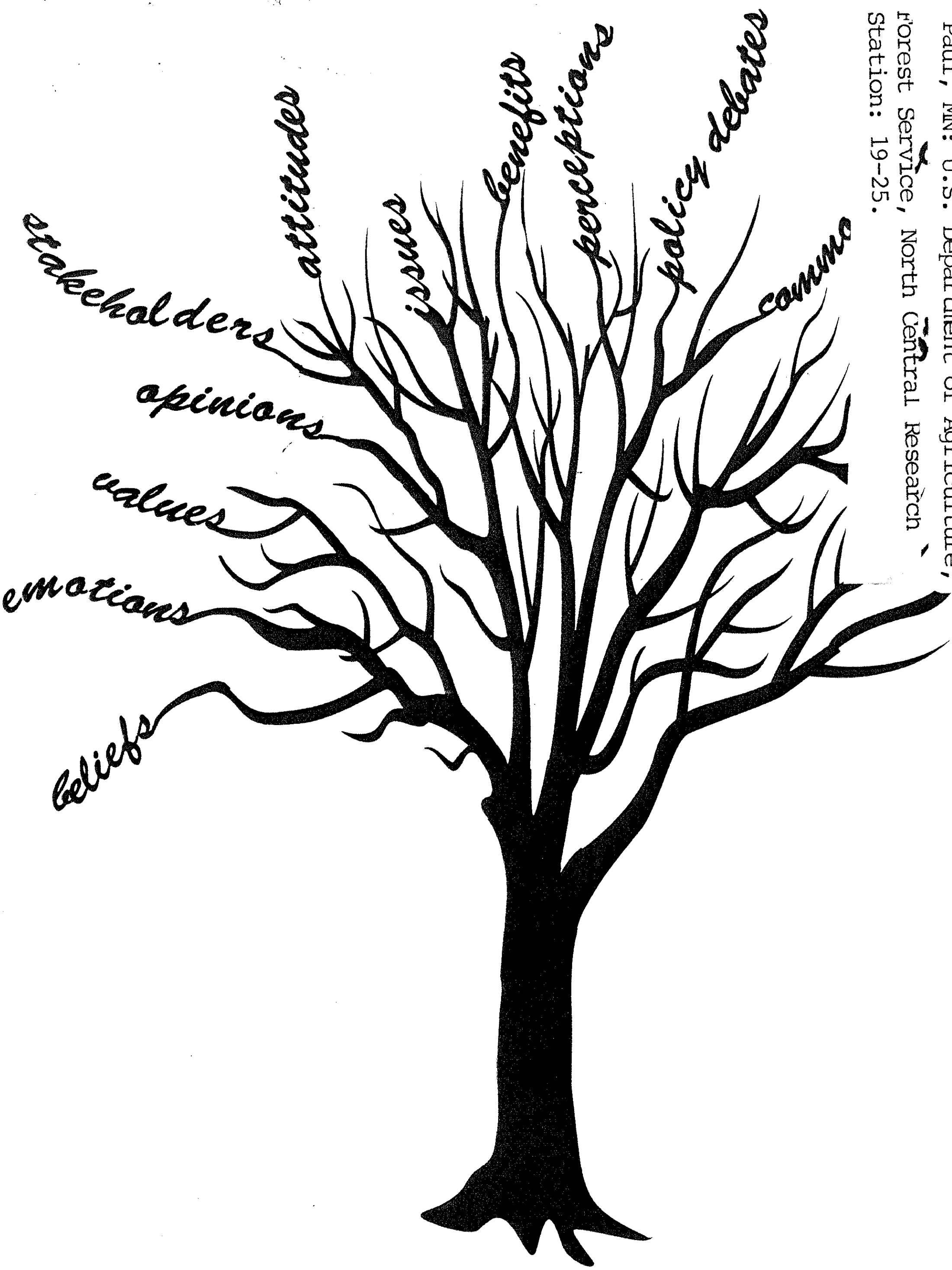

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Ten contributed papers describe the use of a variety of approaches to computer-aided text analysis and their application to a wide range of research questions related to natural resources and the environment. Taken together, these papers paint a picture of a growing and vital area of research on the human dimensions of natural resource management.

KEY WORDS: Computer-aided, computer-coded, content analysis, human dimensions, text analysis, textual data.

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Exploring the National Benefits of Alaska's Tongass National Forest

Stewart D. Allen, David N. Bengston, and David P. Fan[1]

Abstract.—A large sample of national news media stories about the Tongass National Forest—covering January 1, 1985, through July 31, 1997—was analyzed using the InfoTrend software and method. The main purpose of the analysis was to explore the national-level benefits and values reflected in news accounts about the Tongass. Results indicate that the nature of social debate about management of the Tongass was consistent over the 12-year period, focusing mainly on the clash between commodity-related benefits (timber harvest) and ecosystem benefits and values. Media discussion of recreation and moral/spiritual/aesthetic benefits and values lagged behind.

The Tongass is the Nation's largest national forest, consisting of nearly 17 million acres in southeast Alaska. The Tongass provides a variety of benefits for the 74,000 inhabitants of the region, including recreation; opportunities for employment and income; and subsistence gathering of fish, wildlife, and plants. Under the revised land management plan adopted in 1997, the Tongass National Forest has an active collaborative stewardship program that seeks new ways to work more closely with local communities.

As the largest remaining relatively unaltered coastal temperate rain forest in the world (Everest *et al.* 1997), the Tongass National Forest clearly has national and even global value. The more widespread benefits of the Tongass include recreation and tourism opportunities (present and future), provision of habitat and biodiversity, and the preservation values that accrue simply from its existence. Public lands in Alaska, in fact, are often cited as examples of resources having great value apart from human use.

The Forest Service has adopted an ecosystem-based approach to management of the national forests, which calls for understanding and articulation of the relevant attitudes, beliefs, and values of people who care about public lands (McCool *et al.* 1997). Collaborative stewardship provides a sound approach for understanding local communities. But what about the national public—how can Forest managers keep more in tune with their attitudes, beliefs, and values? We know that local or regional views and perceptions about natural resources and public land management may systematically differ from those of the national public (Steel *et al.* 1994).

National sentiments about the Tongass could be explored through survey research. However, national surveys are expensive, would likely be a low priority given declining budgets, and typically take a significant amount of time and effort to gain the approval required by the Paperwork Reduction Act. A recent ranking of possible research projects by Tongass managers and scientists rated a national survey far down the list, well below the amount of funding available.

Another option is through public involvement efforts, which help agencies identify national public values. However, the views of people who participate in public land planning efforts may differ systematically from those of people who do not participate (McCool *et al.* 1997), leaving many land managers wondering about the attitudes, beliefs, and values of the general public, especially national audiences. The Tongass received about 21,000 comments on its recent land management plan revision (USDA Forest Service 1996). But the vast majority of comments received were form letters or petitions, raising concerns that the public comment process may be strongly

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influenced by a few special interests and may not accurately reflect the views of the broader public.

A new option for developing a better understanding of public attitudes, beliefs, and values, made feasible by online technology, is computer content analysis of mass media coverage specific to the topic at hand—in this case, the Tongass National Forest. Detjen (1995) cited a number of national surveys that found that about two-thirds of the public get most of their information about the environment from television and newspapers; he also noted that the public demand for coverage of environmental issues has increased substantially.

Content analysis has been widely used in the field of forestry and natural resources (Bengston and Xu 1995), but analysis has seldom focused on the mass media. Content analyses of the news media have produced results consistently similar to findings of surveys and opinion polls (Bengston *et al.* 1999).

This study used content analysis of a large sample of national news media stories to explore the national benefits associated with the Tongass National Forest. Because the news media appear to accurately reflect social debate about natural resource issues, coverage of the Tongass should provide insight into the perceptions and values of the national public.

DATA AND METHODOLOGY

The Tongass study took advantage of a similar study undertaken to explore media coverage of the Forest Service and the national forests nationwide (Fan and Bengston 1997). Applying the content analysis procedures used in that earlier study allowed us to collect and analyze the data very efficiently—the results were delivered in less than 2 months. Like the national effort, the Tongass study focused on four categories of benefits associated with management of national forests:

- *Recreation Benefits* reflect the values of the Tongass for recreational use. Following national trends, visits to the Tongass have increased dramatically in recent years, due in large part to the burgeoning cruise ship industry which, in the summer of 1998, brought nearly 600,000 visitors to Juneau alone.

- *Timber Commodity Benefits* reflect the value of the Tongass to provide commodities desired by society. On the Tongass, this is primarily timber, which has always been the most contentious issue for forest managers.

- *Ecological Benefits* reflect the value of the Tongass as a functioning ecosystem that provides habitat for many species and a variety of life-supporting functions for humans.

- *Moral/Spiritual/Aesthetic Benefits* reflect the value of the Tongass as a place that provides scenic beauty, opportunities for spiritual renewal, a natural heritage to pass on to future generations, and a vast expanse of land and water that exists and has value apart from its use by humans.

The analysis involved four main steps: (1) downloading news media stories about the Tongass National Forest from an online commercial database; (2) filtering the text to eliminate irrelevant paragraphs; (3) developing and refining computer instructions to score the remaining text for the concepts of interest (i.e., the four benefit categories); and (4) checking the validity of the analysis. Each step is briefly described below.

1. Downloading news media stories

Stories discussing the Tongass National Forest were downloaded from the NEXIS online commercial database using the search command (tongass or ((southeast! alaska!) w/p forest)) from January 1, 1985 through July 31, 1997. The exclamation points in the search command meant that any trailing letters were permitted, and the w/p meant that a phrase referring to southeast Alaska had to be within the same paragraph as the word "forest." Therefore, this search found all stories referring either to the Tongass National Forest or to forests in southeastern Alaska.

The following news sources were included in this analysis: Associated Press, Chicago Tribune, Christian Science Monitor, Los Angeles Times, MacNeil-Lehrer Newshour, New York

Times, Southern News Service, States News Service, United Press International (both the State and national wires), and the Washington Post. The full texts of these news sources were all available in NEXIS for the entire time period of the study. These news sources contained 788 stories about the Tongass over the period January 1, 1985, through July 31, 1997, and text from all 788 stories was downloaded for analysis. Only text within 100 words of the search command—50 words on either side—was downloaded. This greatly reduced the amount of irrelevant text that would have been retrieved from stories that mentioned the Tongass only in passing.

2. Filtering text

The retrieved text was analyzed using the patented InfoTrend method and computer software (Fan 1990, 1994, 1997). 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 Tongass National Forest or that mentioned the Tongass only incidentally (e.g., stories about two Native Alaskan teenagers who were banished to a remote area as punishment for a crime). The focusing of text through filtration greatly simplifies and improves the accuracy of computer coding.

3. Scoring paragraphs

InfoTrend computer instructions were developed to score the remaining paragraphs for each of the concepts of interest, i.e., to count the number of times each of the concepts was expressed in the database of news media text about the Tongass. This involved developing a set of *dictionaries* related to each concept (i.e., groups of words and phrases associated with each category) and a series of computer instructions that specify how the dictionaries are combined to identify the concepts. For example, one set of computer instructions specified that words and phrases with the connotation of *ecological objects* (e.g., aquatic, animals, fauna, flora, ecosystem, habitat, riparian, species, wetland, wilderness) appearing in the same paragraph as words expressing the idea *ecological damage* (e.g., collapse, decimate, decline, degrade, fragment, imperiled, shrinking, unravel, vanishing) combined to create the new meaning of concern over *ecological damage*, which was one of the dimensions of the concept *Ecological Benefits*. An example of news media text that was coded using this set of computer instructions is:

> "The Tongass ecosystem is collapsing," said SEACC Executive Director John Sisk. "No environmental group is going to sit around and watch wildlife populations disappear." (States News Service, 12/28/92).

In this example, "ecosystem'" and "wildlife" were coded as *ecological object* and "collapsing" and "disappear" were coded as *ecological damage*. Therefore, this paragraph was coded as an expression of the concept *Ecological Benefits*.

As another example, computer instructions specified that words or phrases with the connotation of *timber commodity* (e.g., board feet, board-feet, clearcut, forest products, logging, lumber, sawlogs, stumpage, timberlands, wood products) appearing within 50 characters of words or phrases of the connotation *job concern* (e.g., community stability, employment, jobs, labor, laid-off, layoffs, local economy, paycheck, wages, working people) combined to create the new meaning of concern about *timber industry jobs*, which was one of the dimensions of the concept *Timber Commodity Benefits*. An example of news media text that was coded using this set of computer instructions is:

> "The leisure lobby now wants to go back on its word," said Young, who argued that the guarantees are necessary to preserve some 6,000 timber-related jobs in southeast Alaska. (The Associated Press 7/28/88).

In this example, "timber" was coded as *timber commodity* and "jobs" was coded as *job concern*. This paragraph was therefore coded as an expression of the concept *Timber Commodity Benefits*. Similar computer instructions were developed to identify and count expressions of each of the other concepts of interest.

4. Checking validity

After the content analysis computer instructions were developed and refined, 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 were coded using our computer instructions so that we could determine if our instructions were able to identify expressions of the concepts of interest at least 80 percent of the time—a rule of thumb sometimes used in content analysis. After final refinements in the computer instructions, the accuracy rates were all greater than 80 percent.

DISCUSSION OF FINDINGS

The results demonstrate that the nature of social debate about management of the Tongass was consistent over the 12-year study period, focusing mainly on the clash between timber harvest and ecosystem benefits (fig. 1).[2] Media discussion of recreation and moral/spiritual/aesthetic benefits lagged behind, with greater attention paid to recreation.

Perhaps the biggest difference between the Tongass-specific analysis and the nationwide analysis conducted by Fan and Bengston (1997) is the extreme peaks and valleys evident in the Tongass data. This is not unexpected given the much smaller sample in this study (788 articles compared to about 28,000). This difference made it difficult to assess trends in coverage for the Tongass, but it was clear that less attention was given to recreational benefits of the Tongass compared with Fan and Bengston's (1997) nationwide analysis, with little increase in coverage of recreational issues evident. This makes sense because few people have visited the Tongass, which is remote and difficult to access for most people. Media coverage of all national forests, on the other

[2] *The downturn in the number of paragraphs expressing each one of the concepts in figures 1 through 3 is due to the fact that our text database extended only through July 31, 1997. The results for 1997 should therefore be interpreted with great caution.*

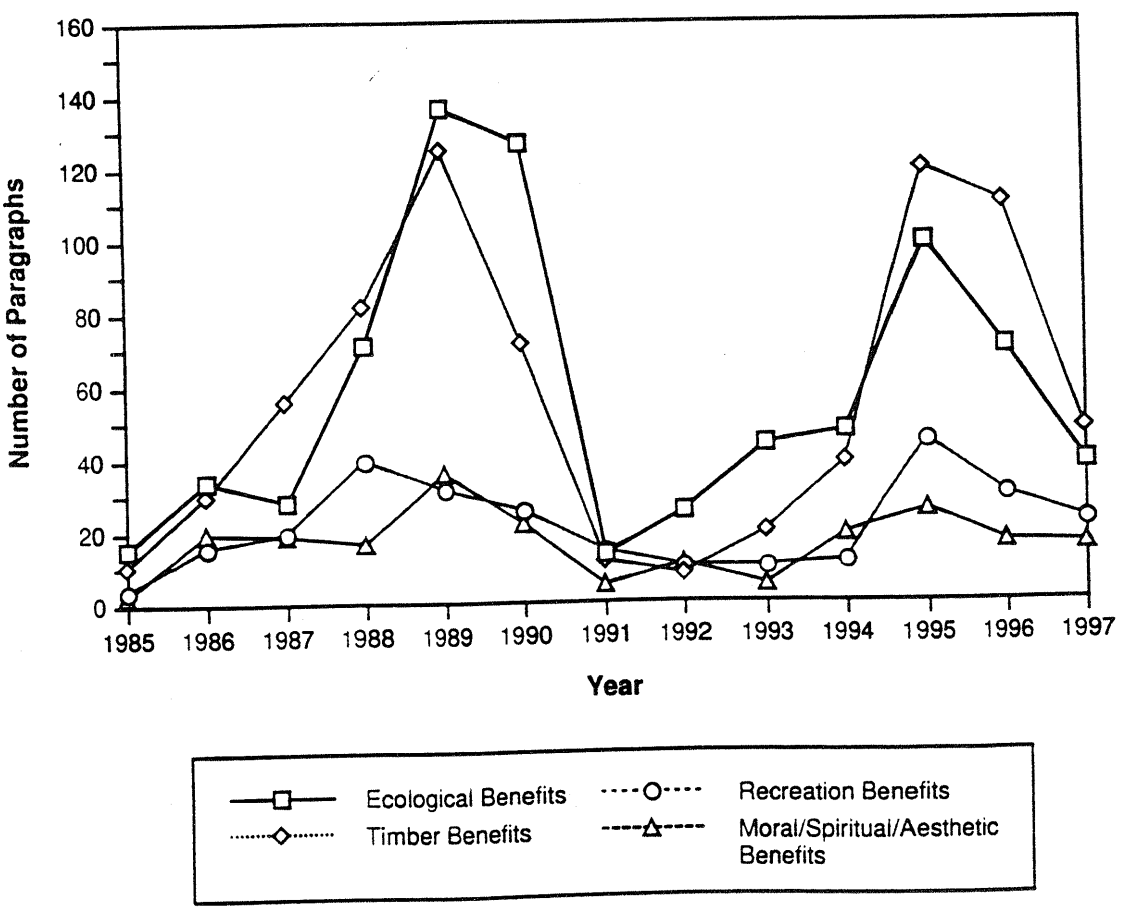

Figure 1.—*Number of news media paragraphs expressing four categories of benefits associated with the Tongass National Forest, 1985-1997.*

hand, would be expected to deal more with local Forests, where recreation is typically the dominant use.

Coverage peaked in years surrounding events deemed worthy of national attention. The first of these peaks occurred just before 1990, when Congress passed the Tongass Timber Reform Act in response to concern over clearcutting on the Forest. The subsequent peak in coverage in the mid-1990's reflects national attention on the Forest Service's ongoing revision of the Tongass land management plan, with media discussion again highlighting timber harvest and ecosystem values. This time, however, more attention was paid to timber than to ecological benefits. This finding was surprising and contrary to the nationwide analysis that showed diminishing discussion of commodity benefits from 1992 to 1996 and increasing discussion of recreation and moral/spiritual/aesthetic benefits (Fan and Bengston 1997). Opinion polls also have tended to show a change in public values about the management of public lands, from a commodity orientation to one more grounded in recreation (McCool *et al.* 1997).

The timber lobby may simply have been more effective than the environmental lobby in obtaining coverage in the mid-1990's, but we also searched for other explanations. Analysis of the coding of *Timber Commodity Benefits* statements suggested that these were more complex. Re-analysis of the coding rules for *Timber Commodity Benefits* may lead us to separate these statements into more than one category.

Subsequent analyses probed deeper into the nature of opposition to timber harvest as portrayed in the media. During the 1990 peak in coverage, opposition appeared to be based equally on perceptions of environmental damage and of concern over subsidies being provided to the timber industry (fig. 2). In the mid-1990's, this pattern changed, with greater concern over the environmental effects and less over subsidies. This peak in news media discussion barely preceded national discussion of a new roads policy announced by the Forest Service, with a moratorium on new road building in unroaded areas—except on the Tongass and a few other areas.

We also were interested in how the media portrayed the Forest Service stewardship of the Tongass, and used the computer instructions and dictionaries developed by Bengston and Fan (1999) to analyze this issue. Overall, the Forest Service's stewardship of the Tongass was portrayed more positively than negatively,

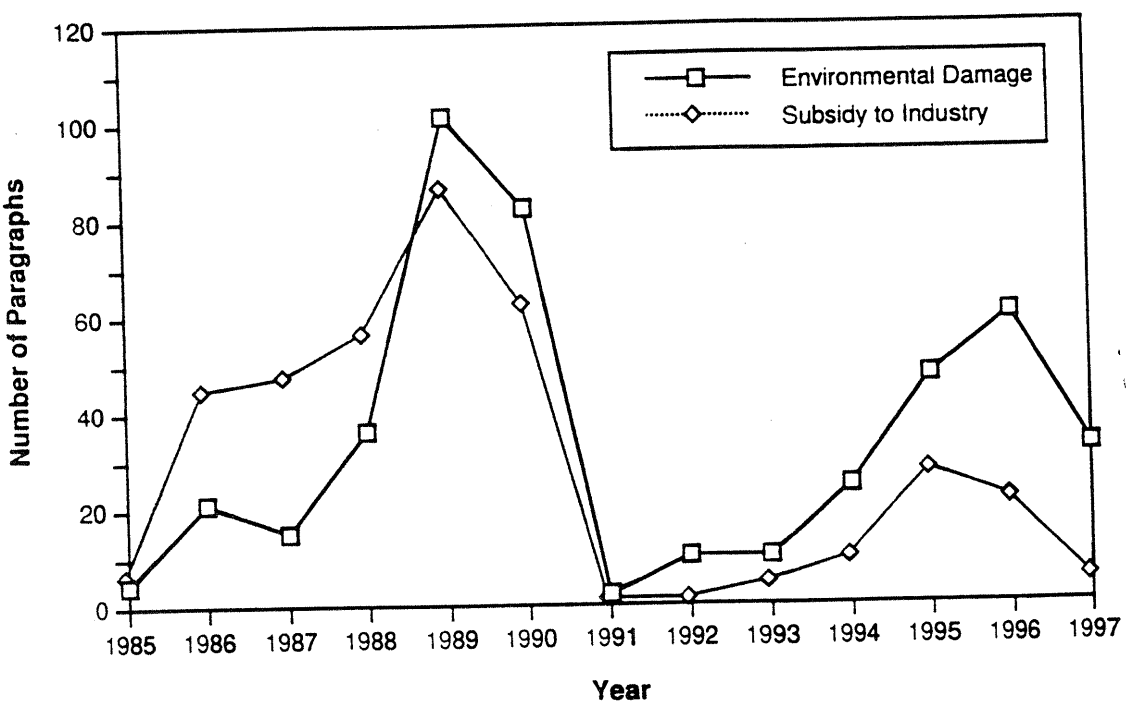

Figure 2.—*Number of news media paragraphs expressing the views that timber harvesting is environmentally damaging and that subsidies are being provided to the timber industry, 1985-1997.*

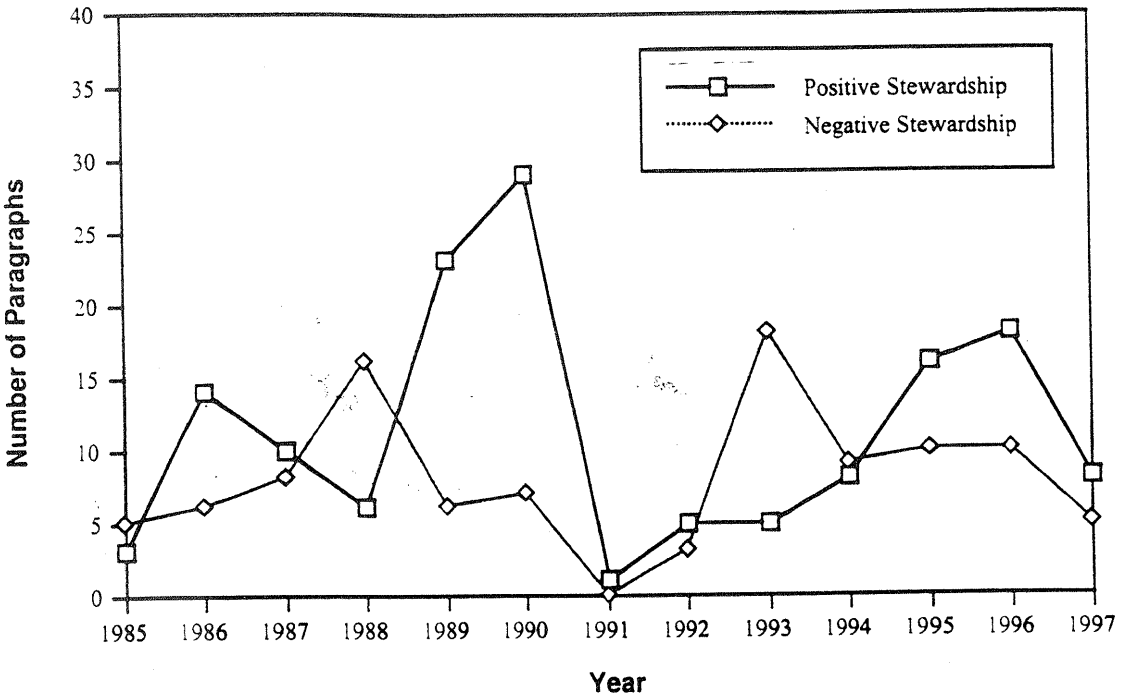

Figure 3.—*Number of news media paragraphs expressing positive and negative attitudes toward the Forest Service's stewardship of the Tongass National Forest, 1985-1997.*

although coverage of the issue was fairly low. The results showed an interesting pattern first of negative coverage of the agency's stewardship, followed by a peak in positive coverage (fig. 3). The highest peak, in fact, followed passage of the Tongass Timber Reform Act. Perhaps the agency also had a role, effectively responding to initially negative coverage. These findings demonstrate the importance of timing in conducting opinion polls, suggesting, for example, that results may have differed in 1988 and 1990.

Using the Bengston and Fan (1999) computer instructions, we also analyzed media discussion of the Forest Service's use of collaboration with Tongass stakeholders and the agency's use of science in managing the Forest. We found far more positive than negative discussion of collaboration and science-based management (although in both cases the total amount of coverage was very low).

CONCLUDING REMARKS

The findings indicate the value of content analysis of online media coverage as a means of identifying trends in public perceptions of benefits regarding Forest management—not just for the entire National Forest System, but for individual Forests. This method allows analysis of trends over various time periods and for various topics. It is perhaps the ultimate in adaptive research, because one can change the analysis given initial findings, e.g. expand the set of topics explored, refine the concepts under investigation. The method can be a highly efficient means of addressing complex issues with broad publics and can be tailored to the immediate need.

Tongass land managers have expressed interest in applying the data for a number of uses. For example, the Forest's public affairs office plans to use the data to help develop a national communication strategy for the Tongass. Knowing the extent and nature of existing and past coverage is extremely valuable in designing an effective strategy. The results also counter the perception of many agency employees (and many members of the public) that all news is bad news and that the agency is only reviled by the press. The results can also be compared to conclusions based on public comments or can be used to assess the impact of news events on public perceptions. When supplemented with data from other sources, content analysis of the news media is a valuable tool in forest planning and management.

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