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US NATIONAL FOREST POLICIES REGARDING LOGGING

A case study of citizens and scientists in the Chattahoochee National Forest

Elizabeth A. Corley

This article explores how differences in scientist and citizen mental models regarding logging in a US national forest can lead the two groups to support divergent policies, although they agree about the goals that logging policies should achieve in the forest. A case-study methodology of logging in the Chattahoochee National Forest in the United States is used. The case study is informed by two methods: in-depth interviews and a written questionnaire. The in-depth interviews were conducted with both scientists and citizens to elicit their mental models regarding logging in the Chattahoochee National Forest. Upon completion of the in-depth interviews, respondents were asked to complete a written questionnaire that elicited demographic information, as well as information regarding management goals for the forest. We conclude that scientists and citizens agree about the management goals for the Chattahoochee National Forest, but differences in the mental models of the two groups regarding the scientific effects of logging cause disagreement about the optimal logging policy option required to achieve those goals. The article considers the implications of the case study findings for risk communication and public involvement in environmental decision-making.

Introduction

Over the last decade, many scholars have studied the public's understanding of science (Alsop, 1999; Bauer *et al.*, 2000; Bensaude-Vincent, 2001; Bickerstaff & Walker, 2003; Bonfadelli *et al.*, 2002; Bord *et al.*, 2000; Bulkeley, 2000; Bush *et al.*, 2001; Condit *et al.*, 2002; Frewer *et al.*, 2002; Kallerud & Ramberg, 2002; Locke, 1999; McNally, 2003; Priest, 1995; Shaw, 2002; Stamm *et al.*, 2000; Tytler *et al.*, 2001; Ungar, 2000; Yearley, 1999, 2000). The aim of this article is to describe how the public's understanding of science can affect the way citizens translate their values into future policy goals for a natural resource, in this case a US national forest. The public's level of understanding regarding the science of a potential new policy can raise complex obstacles for public participation, especially if the public conceptualizes the science in a significantly different way than experts do.

Many qualitative studies exploring the 'public understanding of science' have dealt with cases in which the public's interest is at odds with the interests of the agency issuing the scientific information (Yearley, 1999). Yearley points out that there are three general themes that emerge from case study analyses of the public understanding of science: (1)

the public's understanding of science often is not as much a question of whether people understand science as it is a matter of the public's opinion of the institutions where that science is developed and communicated, (2) the public commonly has its own type of knowledge that may complement or rival scientist scientific knowledge, and (3) science is a framework that is unavoidably social, as well as scientific and technical.

Irwin and Wynne (1996) studied the case of residents living near potentially hazardous factories. While citizens were trying to protect their health, factory managers were attempting to balance the costs and benefits of investing in safety. Irwin and Wynne (1996) found that citizens formed an assessment of the scientific details of the issue by taking into account what they understood about the science, as well as how they evaluated the trustworthiness of the agency responsible for the science.

The research presented here focuses on a case in which the public is apparently at odds with the decision-making agency (the United States Forest Service) regarding the issue of logging in the Chattahoochee National Forest. While many citizens oppose logging in the Chattahoochee National Forest, the United States Forest Service (USFS) wants to continue to log the forest in accordance with their forest management plans.

A Shift in Resource Management Policies

From around 1930 until the 1960s and 1970s, the major goal of renewable resource management in US National Forests was sustained yield of commodities and timber. The concept of sustained yield grew out of the utilitarian values of the Progressive Era of the late 1800s and the early 1900s. The overall concept behind sustained yield is that only renewable resources that can be replenished should be taken; however, the implementation of sustained yield led to taking the maximum supply of a resource that a system could withstand (i.e., the maximum production that would not impair the resource's ability to reproduce). This approach to sustained-yield was incorporated into the statutes of agencies like the USFS and the Bureau of Land Management (Andrews, 1999).

The beginning of the environmental movement in the US during the 1960s and 1970s, however, forced resource management agencies to respond to changing social values regarding the environment. Even though analytical tools began to allow trade-offs between development and the environment, the tools still reflected a bias toward maximum sustained yield (Cortner & Moote, 1999). Linear programming models were developed in an attempt to balance multiple uses and yet they were unable to maximize more than one use at a time. They therefore maximized a single use while treating all other uses as management constraints. In 1976, the US National Forest Management Act (NFMA) was implemented to initiate a system that would encourage balanced forest management, with a goal of multiple-use sustained timber yield (Andrews, 1999). The NFMA was instigated following several debates regarding the legality of clear-cutting forests.

By the end of the 1980s, resource management began to focus less on sustained yield and increasingly on sustainability. Sustained yield focused on outputs and viewed resource conditions as constraints on maximum production, but the concept of sustainability treated resource protection as a precondition for meeting human needs over time. By the early 1990s, US governmental agencies began to focus on a more holistic type of resource management. As a result, public values have been increasingly taken into account in long range planning efforts across US governmental agencies.

The Chattahoochee National Forest as a Case Study

The first management plan for the Chattahoochee National Forest was adopted in 1985. As of 1 October 1999, the Chattahoochee National Forest covered about 750,000 acres in North Georgia (USFS, 2000). The forest spans eighteen counties in North Georgia including Banks, Catoosa, Chattooga, Dawson, Fannin, Floyd, Gilmer, Gordon, Habersham, Lumpkin, Murray, Rabun, Stephens, Towns, Union, Walker, White, and Whitfield counties (see Figure 1).

The tree growth within the Chattahoochee National Forest is mostly of an Appalachian-oak forest type and the forest is the primary provider of quality hardwood timber in the state. Clearcutting within the forest has been a significant concern for environmentalists. Public concern resulted in the reduction of clearcutting to 24 per cent of the planned harvests by 1995 (USFS, 2000). Before 1986, almost all of the timber harvested in the forest was a result of clearcutting. In 1999, all commercial logging in the Chattahoochee National Forest was banned. Yet, many environmentalists are concerned about the potential effects of the President George W. Bush's Healthy Forests Initiative. On the other hand, some scientists and USFS planners are concerned that completely restricting logging in the forest could lead to devastating impacts on the communities that surround the forest. They argue that if the USFS is not able to remove some trees in

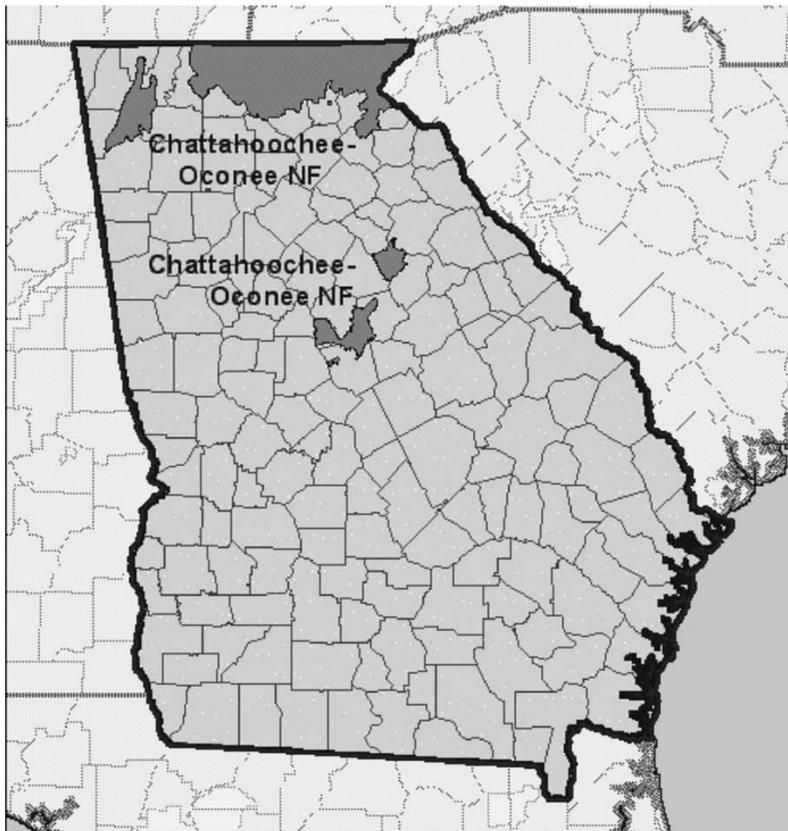


FIGURE 1

A map of Georgia and Chattahoochee – Oconee National Forests

the forest (through logging or other methods), then the forest might become overly susceptible to forest fires and pest infestations (such as the Southern pine beetle in the Chattahoochee National Forest).

The case of logging in the Chattahoochee National Forest serves as an ideal opportunity for the study of scientist and citizen mental models for several reasons. First, logging is an issue that is currently receiving considerable media attention and, therefore, is on the minds of scientists and citizens alike. Secondly, when the data for this project were collected (during the summer of 2001), the USFS was developing its next long-term plan for the forest and they were requesting public input into the decision making process.¹ Thirdly, science plays a key role in logging issues, specifically in defining the ecological effects of logging operations in a national forest. Fourthly, the USFS spends extensive time and resources on public involvement in their planning and policy formation processes.

When developing management plans for the Chattahoochee National Forest, the USFS has continued to use a philosophy focused on public involvement and participation. They hold periodic public meetings and request that citizens write letters of support for their preferred policy actions in the forest. Several contemporary scholars have argued that this inclusion of public values into policy analysis and any planning process is particularly important (Beierle & Cahill, 2000; Beierle & Cayford, 2002; Bozeman, 2002; deLeon, 1995; Fischer, 2000; McGovern & Beierle, 1997; Moore, 1995; Reich, 1990; Stern & Fineberg, 1996). Additionally, many scholars in the environmental policy literature have recently argued strongly for the use of public participation and deliberative methods at the local level as a way to include citizens' social values into the policy-making process (Brennan, 1998; Fischhoff, 1996; Gibson *et al.*, 2000; Gundersen, 1995; Keeney, 1996; Keeney *et al.*, 1996; Norton & Hannon, 1998; Prugh *et al.*, 2000; Renn, 1999; Wilshusen, 2000).

Eliciting Mental Models: Empirical Considerations

Mental models were postulated first by Craik (1943) when he wrote that the mind constructs 'small-scale models' of reality to anticipate events and to underlie explanation. In the past, mental models research has been used primarily in the risk analytic literature (e.g., Bostrom *et al.*, 1992; Maharik and Fischhoff, 1992, 1993; Morgan *et al.*, 1992, 2002). The research presented here utilizes the definition of mental models presented in Morgan *et al.* (2002), that mental models are not models in the formal sense; rather they are fragmented bits of information that a person carries around in his/her head to describe some complex process or idea. Yet mental models, in general, provide a semi-coherent inference engine and a way for people to make sense of complex ideas. Exploring citizen mental models regarding science is one way to examine how the public understands science in a particular context.

The elicitation of mental models from scientists and citizens is explored by scholars in many fields (Baguley & Payne, 2000; Banks & Millward, 2000; Borges & Gilbert, 1999; Bostrom *et al.*, 1992; Greca & Moreira, 2000; Johnson-Laird, 1983; Johnson-Laird & Byrne, 1991; Kearney & Kaplan, 1997; Morgan *et al.*, 2002; Peterson *et al.*, 2000). Bostrom *et al.*

¹ In March 2003, the USFS released the draft management plan for the Chattahoochee National Forest. The ninety-day public comment and involvement period ended in July 2003. The USFS hopes to release the final management plan by the end of 2003.

(1992) used mental models of environmentally hazardous processes to determine lay people's ability to respond to an environmental hazard. Bostrom and her colleagues stressed that the first task for risk communicators, when they are informing the public about a specific risk, is to determine what lay people believe about the issue. Then, after risk communicators have elicited the mental models of lay people regarding the risk, they can compare those mental models with scientists' mental models regarding the risk. Ultimately, risk communicators can determine what type of information should be included in any risk communication process.

Most recently, Morgan *et al.* (2002) synthesized the growing body of work that explores mental models for risk communication. They provided an outline for managers and decision makers to communicate scientific information to the public, using a mental models approach for developing risk communication. Morgan *et al.* (2002) explained how interview protocols could be developed and data could be coded and analyzed to better understand individuals' mental models surrounding the science of an issue. While Morgan *et al.*, proposed using this mental models approach to develop better forms of risk communication for the public, our focus is to use a mental models approach to explore the differences between the mental models of scientists and citizens regarding the issue of logging in a US national forest.

Morgan *et al.* (2002) argued that structured data collection methods (such as structured questionnaires) can inadvertently provide cues to respondents who are unsure of the correct answer to a question. They therefore emphasized that an open-ended interview procedure, such as the one used in this research, can minimize many of the problems associated with traditional questionnaire design. Most importantly, open-ended interview questions do not lead the respondent and, therefore, it is much easier to get a clear picture of the participant's mental model.

Methods

Two methods of data collection were used in this research study: (1) scientist and citizen in-depth interviews and (2) a written questionnaire administered to the scientists and citizens.

In-Depth Interviews

The first set of in-depth interviews was conducted with fifteen scientists on the topic of logging in National Forests. The scientists were chosen because of their educational background or experience with forestry and/or the Chattahoochee National Forest. Seven of the scientists were professors of either forestry or ecology. Each of the professors had completed recent research on the Chattahoochee National Forest. One of the scientists was employed by a Georgia state agency that focuses on forestry issues. Four of the scientists were federal government employees and they were directly involved in the development of the new management plan for the Chattahoochee National Forest. The remaining three scientists were employed by non-governmental, environmental organizations that focus on issues of logging in the Chattahoochee National Forest. Each interview with a scientist lasted between thirty and ninety minutes and a written questionnaire was administered to the scientists after they completed the in-depth interviews.

The second set of in-depth interviews was conducted with fifteen citizens who live in the counties that are located near the Chattahoochee National Forest in the state of Georgia (see Figure 1). The list of possible respondents for these interviews was obtained from the Forest Supervisor's Office for the Chattahoochee-Oconee National Forests in Gainesville, Georgia. The list is a mailing directory compiled by the USFS that records contact information for over 4,000 citizens who are interested in receiving updated information about the Chattahoochee National Forest. Citizens voluntarily added their name, address, and phone number to the list whenever they visited the Chattahoochee National Forest. Since all fifteen of the citizen interviewees were identified from the USFS mailing list, they were somewhat aware of the logging situation in the Chattahoochee National Forest. However, several citizens had been placed on the mailing list many years earlier and they no longer kept up with the events in the forest. Citizen interviewees were chosen from the mailing list based on the following criteria: (1) they had a working telephone number that was reported on the mailing list and (2) they had lived (for at least five years) in one of the Georgia counties that contains part of the Chattahoochee National Forest. The first requirement was important for arranging an interview with citizen participants. In several cases, the mailing list did not contain a phone number for a particular person (it only contained an address). In other cases, the phone number listed was no longer in service or a different person was using the number.

The rationale behind the second requirement was that we wanted to focus on 'interested' citizens – people who have a stake in any changes in the forest. We also believed that citizens living in counties near the forest would be exposed to more media information about the Chattahoochee National Forest (through local news coverage and local newspapers). We satisfied the second requirement by only contacting people on the USFS mailing list who had an address that was located in one of the national forest counties. Then, after contacting potential participants via telephone, we asked them how long they had lived in that particular county. If they had lived in the county for less than five years, we did not continue with a set-up time for the face-to-face interview. Each completed citizen in-depth interview lasted from thirty to seventy-five minutes and a written questionnaire was administered to the citizens after they completed the interviews.

Written Questionnaires

In addition to conducting in-depth interviews with the citizens and scientists, we also administered a written questionnaire to the thirty participants after their in-depth interviews were completed. One aspect of the study design was to interview citizens who had lived near the forest for an extended period of time. In addition to asking demographic information about the participants, the questionnaire requested information from respondents about their outdoor recreational interests and hobbies. Additionally, on the written questionnaire, we asked respondents about their own perceptions of their individual level of knowledge regarding logging, both in general and within the context of the Chattahoochee National Forest.

Data Analysis

Upon completion of the in-depth interviews with the citizens and scientists, the full interviews were transcribed. This transcription resulted in 144 typed, single spaced pages for the citizen interviews and 173 typed, single-spaced pages for the scientist interviews. After the interviews were transcribed, they were formatted and loaded into the software program 'QSR N4 Classic' for coding and content analysis; a software program that has been used by many scholars for qualitative data analysis (for detailed examples, see Bengston and Fan, 1999a,b, 2001; Xu & Bengston, 1997). The program allows researchers to (1) store and organize text databases, (2) code words and/or phrases within the text, (3) search and retrieve the text for instances of a particular coded theme, and (4) generate theory by displaying the categories or themes and their interconnectedness. 'QSR N4 Classic' is more helpful as a qualitative content analysis software package rather than as a quantitative content analysis package because any searches or synonyms of words are developed and input by the researcher. The results of the questionnaires were entered into the software package SPSS for further statistical analysis.

Written Questionnaires

In the written questionnaire, citizens and scientists were asked to self-report their level of knowledge about 'logging in general' and 'logging in the Chattahoochee National Forest in particular'. On a six-point scale (i.e., 1 = not informed and 6 = very well informed), scientists reported that they were quite well informed about 'logging in general', with an average of 5.27. The citizens also thought that they were pretty well informed about 'logging in general' with an average of 3.80. Similarly, the citizens and scientists both reported that they were pretty well informed about logging in the Chattahoochee National Forest. The scientists self-reported an average of 4.80 and the citizens self-reported a mean of 3.07 for how well informed they were about logging in the Chattahoochee National Forest.

Both citizens and scientists believed that other residents in the areas surrounding the forest were less informed than themselves. The scientists reported that other citizens in the area were somewhat informed about the issue of logging in general (with a mean of 2.73) and slightly more informed about logging, specifically in the Chattahoochee National Forest (with a mean of 3.13). The citizen participants also reported that their fellow residents were more informed about logging in the Chattahoochee National Forest (mean of 2.40) than about logging in general (mean of 2.27). The results of this analysis (along with *P* values for a comparison of a means *t*-test) are presented in Table 1.

The *t*-tests demonstrate that the means of the citizen and scientist responses were significantly different for three of the questions: (1) 'How well informed are you about logging in the Chattahoochee National Forest?' (2) 'How well informed do you believe other residents of the counties surrounding the Chattahoochee National Forest are about logging in the forest?' (3) 'How well informed are you about logging in general?' The one question that the citizens and scientists reported similar answers for was 'How well informed do you believe other residents of the counties surrounding the forest are about logging in general?'

In addition to asking respondents about their level of knowledge regarding logging, we also included items in the questionnaire that focused on demographic information and

TABLE 1
Self-reported knowledge of logging related activities

| Question | Mean value (citizen interviews) | Mean value (expert interviews) | P value for comparison of means <i>t</i> -test |
|---|---------------------------------|--------------------------------|--|
| How well informed are you about logging in the Chattahoochee National Forest? | 3.07 | 4.80 | <0.001* |
| How well informed do you believe other residents of the counties surrounding the Chattahoochee National Forest are about logging in the forest? | 2.40 | 3.13 | 0.026* |
| How well informed are you about logging in general? | 3.80 | 5.27 | <0.001* |
| How well informed do you believe other residents of the counties surrounding the forest are about logging in general? | 2.27 | 2.73 | 0.162 |

* = indicates significance at the 0.05 level

recreational interests within the Chattahoochee National Forest. Sixty-seven per cent of the citizens considered themselves to be natives of the area near the forest. The average length of time that the citizens had been living near the forest was 33.5 years, with a minimum of seven years and a maximum of seventy-eight years. The questionnaire also requested information from respondents about their outdoor recreation interests and hobbies. This information was helpful in determining whether the respondents were active recreationists or non-recreationists in comparison with the scientists. The recreation results are presented in Table 2.

From this table, we can conclude that a large portion of both the citizens and the scientists enjoy hiking, camping, fishing, canoeing, and bird watching. Neither the citizens, nor the scientists, did much ATV-riding, mountain biking, white water rafting, hunting, or horseback riding. Interestingly, citizens were slightly more likely to hunt than the scientists and the scientists were slightly more likely than the citizens to go fishing for sport.

TABLE 2
Results of questions on hobbies and interests for citizens and experts

| Percentage of respondents who have done the listed activity in the past year | Expert questionnaire | Citizen questionnaire |
|--|----------------------|-----------------------|
| Hiking | 93.3 | 86.7 |
| Camping | 66.7 | 46.7 |
| ATV-riding | 13.3 | 13.3 |
| Mountain biking | 20.0 | 0 |
| White water rafting | 26.7 | 26.7 |
| Fishing | 53.3 | 40.0 |
| Hunting | 6.7 | 20.0 |
| Kayaking-Canoeing | 53.3 | 26.7 |
| Horseback riding | 0 | 26.7 |
| Bird watching | 73.3 | 60.0 |

In-Depth Interviews

We utilized the methods outlined by Morgan *et al.* (2002) for coding the interview transcripts. An influence diagram of the scientists' mental models was used as a template for coding the interviews with lay people. An influence diagram is technically a visual set of events that shows how the distributions of those events depend (probabilistically) on other decisions or events. Schematically, an influence diagram is a graph that resembles a flow chart. However, the influence diagram is not a traditional flow chart. Instead, the diagram has arrows that represent 'influences' and these arrows connect 'nodes'. The oval nodes represent uncertain circumstances or possible outcomes of the influence. The rectangular nodes represent choices that can be made by decision makers. Therefore, sets of more than one rectangular node show that there is more than one decision that could be made by decision-makers for the particular case. An arrow between two nodes indicates that the node at the tail of the arrow has an 'influence' on the node at the head of the arrow.

After analyzing the scientists' interviews, we created a scientist influence diagram (shown in Figure 2) which represents the mental models of scientists regarding three different logging policy options in the Chattahoochee National Forest: smaller scale logging with the goal of forest management, larger scale logging with a focus on making a profit, and restricting all logging in the forest.

These three management options are presented in the influence diagram as rectangles. The effects of these three management options, as discussed by the scientists, are listed in the ovals. The numbers in the parentheses by the nodes in the influence diagram represent the percentage of scientists that discussed the influence relationship which is presented by the node and arrow. We developed a codebook for use with 'QSR N4 Classic' that was used to code the scientist and citizen influence diagrams. The original codebook was developed based on the scientist in-depth interviews, and then it was used to code each of the citizen interviews. The results of the coded citizen manuscripts are shown in Figure 2, superimposed on the expert influence diagram that was created from the interviews with the scientists. The percentage of scientists and citizens agreeing with various relationships from the scientist influence diagram are listed in parentheses within each node (the scientist percentage is listed first and the citizen percentage is listed second).

A comparison of the percentages for citizens and scientists in Figure 2 demonstrates that the two groups' mental models are similar regarding some of the effects of smaller scales of logging, including road building (100 per cent of scientists and 67 per cent of citizens) and erosion (67 per cent of scientists and 40 per cent of citizens). The citizens were less likely, however, to connect smaller scales of management-oriented logging with: (1) enhanced habitat (60 per cent of scientists versus 7 per cent of citizens); (2) sedimentation (60 per cent of scientists versus 13 per cent of citizens); and (3) reduction in forest fires (53 per cent of scientists versus 0 per cent of citizens). For larger scale logging that would focus on profit-making, the citizens and scientists expressed similar mental models for road building (100 per cent of scientists versus 67 per cent of citizens), habitat destruction (40 per cent of scientists versus 60 per cent of citizens), and erosion (67 per cent of scientists versus 40 per cent of citizens). But, again, the citizens were less likely to connect the larger scales of logging with sedimentation (60 per cent for scientists versus 13 per cent for citizens).

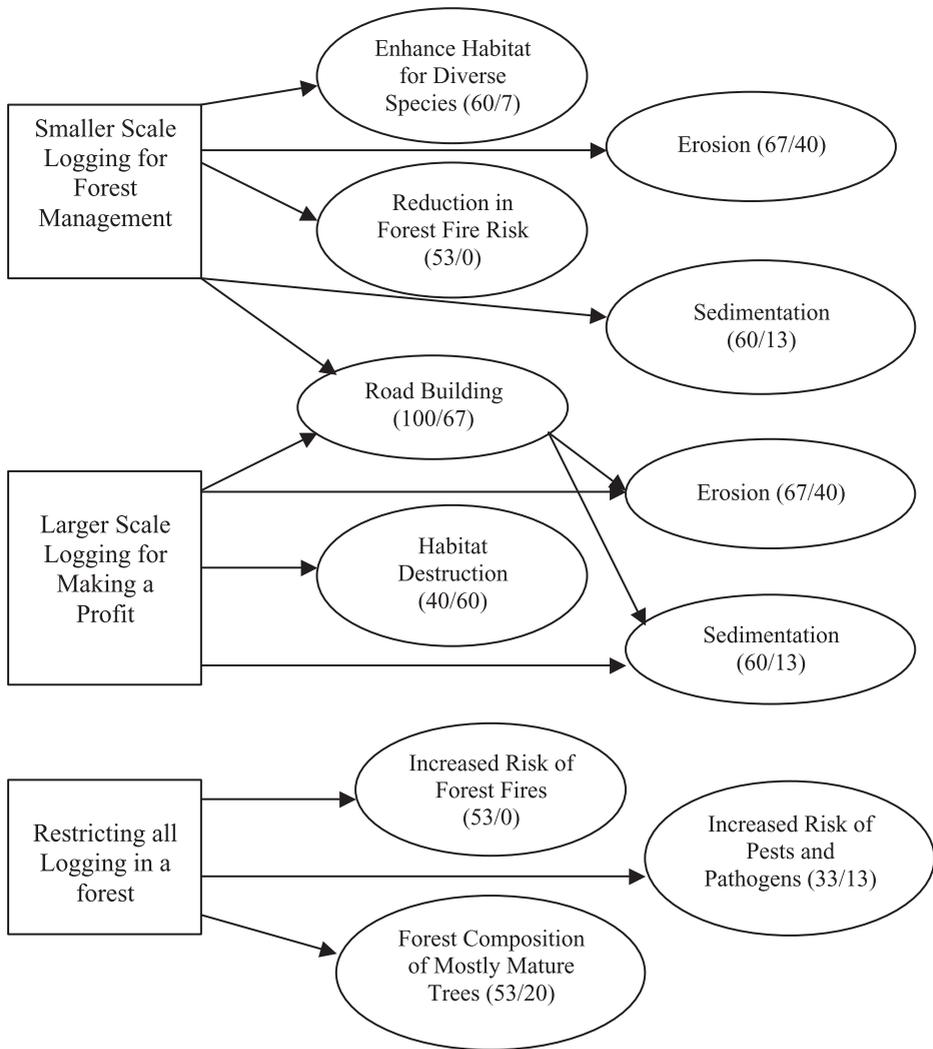


FIGURE 2

An influence diagram for scientist and citizen mental models of logging options in the Chattahoochee National Forest. Notes: 1) The first value in the parentheses represents the percentage of scientists that included a particular aspect of the influence diagram in their discussion ($N=15$). The second value in the parentheses represents the percentage of the citizens that included the aspect in their discussion ($N=15$). 2) Inter-coder Reliability for Influence Diagram =94 and 95% for scientist and citizen mental models, respectively

With regard to the option of restricting all logging in the forest, the citizens and scientists demonstrated the strongest differences in their mental models. The citizens were less likely to believe that completely restricting logging would lead to potentially negative impacts, such as: (1) increased risk of forest fires (53 per cent of scientists versus 0 per cent of citizens); (2) increased risk of pests or pathogens (33 per cent of scientists versus 13 per cent of citizens); and (3) a predominantly mature species composition in the forest (53 per cent of scientists versus 20 per cent of citizens).

In the main, this group of citizens did not make the same connection that scientists did between the scale of logging and the effects on wildlife. The scientists were more likely to argue that a small-scale, management-oriented logging operation would lead to the largest number of positive effects in the forest. They also indicated that restricting all logging would be better than large-scale logging; however, they stressed that completely restricting logging would prevent the USFS from maintaining the health of the forest. The citizens were more likely to mention the negative effects of larger-scale logging for profit. Additionally, the citizens did not state the negative effects of restricting all logging as often as the scientists did.

The group of citizens that we interviewed tended to think of logging in extremes, with logging either occurring on the forest for profit or not occurring at all. Within their mental models of logging, most of the citizens we interviewed did not articulate how small amounts of logging might improve forest health. Yet the scientists argued that small amounts of logging in the forest could provide diverse habitats for more species, including late and early successional species. Late successional species are those that thrive in old growth forests and undisturbed areas of land. Early successional plants and animals are those that need new growth and direct sunlight in the forest to survive. In addition, the scientists stated that logging could stop or prevent pest infestations that could potentially harm the forest. For the Chattahoochee National Forest in particular, many scientists mentioned recent infestations by the Southern pine beetle (a pest in the Southern Appalachian forests). Several scientists mentioned that small-scale, localized logging could help prevent 'fuel build-up' (i.e., undergrowth, dead trees, and dry twigs) and therefore reduce the risk of devastating forest fires. Most of the scientists we interviewed believe that reducing forest fires in the Chattahoochee National Forest is a greater concern than for other National Forests because the Chattahoochee is so close to several urban centres and towns.

Public Values and Management Goals

During the citizen interviews, we asked participants to list those things that they valued most in the Chattahoochee National Forest. Their responses are displayed in Table 3. The three values that citizens expressed most often were: (1) aesthetics (53.3 per cent); (2) recreation (46.7 per cent); and (3) diversity of habitat (46.7 per cent). These results are consistent with those found by Manning *et al.* (1999). In their study, they asked respondents what they valued about the Green Mountain National Forest in Vermont. The values most strongly held by the respondents were recreation and aesthetics. One-third of the citizens sampled said that they valued the protection of watershed and water quality in the Chattahoochee National Forest. Twenty per cent of the citizens valued the forest for use by future generations, while 13 per cent valued it for either protection of old growth or for the forest's intrinsic/existence value.

In addition to asking citizens about their values regarding the Chattahoochee National Forest, we also asked them about their ideas regarding future management goals in the forest. The majority of the citizens thought that recreation and wilderness habitat protection should be part of the future management focus (73.3 per cent). Only a few of the citizens (13.3 per cent) thought that logging should play any part in the management focus for the forest. Clearly, the data indicate that the majority of the citizens do not believe that the Chattahoochee National Forest should be used simply for logging

TABLE 3Public Values Reported by the Citizens for Chattahoochee National Forest^a

| Valued activity or good | Percent of citizens valuing activity or good |
|---------------------------------------|--|
| Aesthetics | 53.3 |
| Recreation | 46.7 |
| Diversity of habitat | 46.7 |
| Protection of watershed/Water quality | 33.3 |
| Saving forest for future generations | 20.0 |
| Protection of old growth | 13.3 |
| Intrinsic/Existence value | 13.3 |

^aInter-coder Reliability = 94 per cent.

purposes in the future. Furthermore, the majority of the citizens thought that the current level of management exercised by the USFS on the Chattahoochee National Forest was best for the health of the forest (not more and not less). In the in-depth interviews, the scientists were asked about their opinions regarding future management goals of the Chattahoochee National Forest. The majority of the scientists believed that in the future the Chattahoochee National Forest should be used for the same things that the citizens wanted – wilderness habitat and recreation.

The citizens and scientists agreed about the ‘ends’ for the future management plans in the Chattahoochee National Forest – largely, recreation, aesthetics, and diversity of habitat. However, the citizens and scientists did not agree about the ‘means’ that should be used to achieve these ‘ends’. The citizens thought that the management goals of recreation, aesthetics, and diversity habitat would be best served by restricting logging, while the scientists thought that small amounts of logging would be the best way to achieve these goals. Therefore, part of the answer for how and why the citizens and scientists disagreed about the means to achieve the forest management goals in the Chattahoochee National Forest can be revealed in the analysis of the mental models regarding logging for the two groups.

Language and Skepticism: Citizens and the USFS

While exploring the citizens’ attitudes regarding public involvement in the forest planning process, we encountered some scepticism and distrust regarding the USFS. The citizens believed that the USFS was just including the public in management plans ‘for show’ and that the public’s opinions did not really make a difference in the way the USFS developed its next multi-year plan. One citizen summed up this belief in the following quote:

A lot of these government contracts slide by the people in the middle of the night and lay hooked onto the end of this bill and that bill. Let [someone] go ahead and cut this 10,000 acres and they have no input from the people.

The citizens that we interviewed for this research did not trust the USFS and they tended to believe that the USFS only logged the Chattahoochee National Forest to make money. Forty-seven per cent of the citizens thought that the USFS logged the Chattahoochee National Forest ‘for profit’. The citizens were also sceptical regarding the goals of the USFS for logging in the

Chattahoochee National Forest. They believed that if the USFS was allowed to log the Chattahoochee forest at all, they would 'sneak trees out at night' and log the forest to maximize the money they could make off the sale of the trees. One citizen described this attitude of distrust for the USFS in the following interview quote:

I think that the level of information could be a lot better. Say we have some news coverage and this type of thing. See all of this develops in Washington or down here in the state capital. And I think a lot of it is trying to be put by on the sly so to speak.

Another citizen summed up the belief that the USFS is cutting the Chattahoochee National Forest for profit in the following quote, 'I suspect [the USFS will] cut off all we can and then denude Canada. The economics . . . as long as the economics are there, we are going to expand'. This distrust of the USFS was linked with citizens' beliefs that their opinions would not matter in the planning process for the Chattahoochee National Forest – the USFS would just do whatever was most profitable.

On the other hand, many scientists discussed how logging is a money-losing operation in the Chattahoochee National Forest. None of the scientists indicate that they believed that the USFS was making forest planning decisions for the Chattahoochee National Forest based on economics. The scientists stressed that the USFS lost money on logging in the Chattahoochee National Forest, but that small-scale logging was needed for management purposes. Several scientists said that the Southern pine beetle was infesting the forest and that the USFS was not able to slow down the infestation by removing damaged trees because lawsuits restricted them from conducting any logging activities in the forest.

Study Limitations

While the use of qualitative data obtained from the in-depth individual interviews allowed us to explore this topic in great detail, the small sample size does not allow for generalisability to additional environmental policy cases. Additionally, the citizens that were interviewed were all on the USFS mailing list and did not represent a random sample of citizens. However, because they were somewhat informed and interested, these citizens were willing to agree to the thirty- to seventy-five-minute interview. In addition, we legitimised our request for a face-to-face interview with the citizens by telling them that their names and addresses were obtained from the USFS mailing list. Although the citizens interviewed were not chosen from a random sample, the demographic information and career information obtained from the written questionnaires that followed the interviews suggest that the sample is fairly representative of the citizens living in the communities surrounding the Chattahoochee National Forest.

Discussion

Analysis of the mental models of scientists and citizens regarding logging (through the use of the influence diagram method) demonstrates that citizens and scientists do have similar mental models regarding some aspects of logging, namely erosion risk, necessity of road building, and habitat destruction. But, the citizens and scientists have quite different mental models regarding the beneficial aspects of small-scale logging,

especially habitat enhancement for certain plants and animals and the reduction in risk from forest fires.

The citizens tended to believe that the effects of logging were the same regardless of the scale and type of logging activity (e.g., clearcutting or thinning). On the other hand, the scientists believed that there were obvious benefits to maintaining a minimal level of management-style logging in the forest to reduce forest fire risk and maintain habitat for a broad range of species. We believe that these differences in mental models between citizens and scientists explain why the two groups agreed about the policy goals regarding logging in the forest, but not the 'means' for achieving those goals. The public tended to emphasize only the negative aspects of logging and not the management reasons behind small-scale logging (like pest control, maintenance of an area for recreation, reduction of forest fires, and habitat enhancement).

Like the citizens, the scientists believed that the most important values of the Chattahoochee National Forest were in recreation and wildlife habitat, not logging. However, the scientists did stress that small-scale logging is required to maintain the value of the forest for recreation and wildlife habitat. The scientists differed from the citizens because they believed that the USFS could responsibly log the forest on a small-scale (for management purposes) and that this would not lead to large-scale logging for profit.

Logging the forest for profit, on a large-scale, would be an example of using a short time horizon to make a policy decision when a long-term view showed that the scale of the policy decision is counter to public values. Both the citizens and the scientists believed that large-scale logging in the forest would: (1) destroy habitat; (2) ruin the beauty of the forest and thus make it undesirable for recreation; and (3) instigate watershed and erosion damage. These side effects would be counter to public values for the forest. The scientists stated that these would be the negative outcomes of logging the forest for profit. The scientists and the citizens therefore agreed that large-scale logging for profit was not a management option that would be scientifically wise or sufficiently protect the public's values for the forest. The citizens argued that they wanted the forest to be used for recreation and wildlife habitat, not for logging. They also voiced several negative side effects of logging that would ultimately run counter to these long-term values for the forest (namely, erosion and sedimentation). Hence, based on the citizen interviews alone, the only option for the USFS that would protect long-term public values would be to completely restrict logging in the Chattahoochee National Forest.

The scientists, on the other hand, believed that small-scale logging in the Chattahoochee National Forest would not lead to a breach of public values. Small-scale logging in the forest, as described by the scientists, would actually protect the long-term values of the public (i.e., recreation and wildlife habitat). In contrast, the scientists largely said that small amounts of logging in the forest would help prevent pest infestations, reduce the risk of large forest fires, and provide a diverse habitat for plants and animals. These beneficial side effects of small amounts of logging in the forest would lead to protection of recreation and aesthetic values, as well as wildlife habitat values (i.e., the public's values for the forest).

So if policy-makers just listened to the citizens, they would conclude that both large-scale logging and small-scale logging would lead to a breach of public values. If policy-makers just listened to the scientists, they would learn about the beneficial effects of small-scale logging, but would not be able to incorporate the public's long-term values for the forest into any policy decisions. Combining the interviews with both groups, the

scientists and the citizens, we find that small-scale logging in the Chattahoochee National Forest is the best way to protect the public's long-term values for the forest. This option is in line with the science of environmental protection and protects the public's long-term values for the forest. Although without an exploration of mental models, policy-makers would believe that the two groups disagreed about policy goals for logging in the forest.

Conclusions

Studying the differences between scientists' and citizens' mental models regarding the science of a policy issue can reveal details about the interaction between public values for a particular environmental resource and the translation of those public values into policy goals for the resource. In this case, the exploration of scientists' and citizens' mental models revealed that while both groups agreed on long-term policy goals for the forest (i.e., both groups thought that the forest should be managed to encourage habitat protection and recreation), they disagreed about how to achieve those policy goals because their understandings of the effects of logging were quite different.

The results of the study presented here reinforce the findings by Irwin and Wynne (1996). In-depth interviews with citizens and scientists on the issue of logging in the Chattahoochee National Forest reveal that the citizens are somewhat well-informed about the environmental effects of logging on the forest. The citizens, however, do not trust the USFS to handle the issue of logging responsibly. In cases such as this one, three-way communication between scientists, the public agency involved, and citizens is vital to develop policies that are technically feasible, economically viable, and can protect long-term public values. This can be a particularly significant step when the public agency (like the USFS) encourages large amounts of public involvement in its policy-making process. If citizens think that the decision-making agency (such the USFS) has chosen a policy path that violates their values, even if it does not violate them (like small-scale logging), they will be sceptical of the agency and less likely to participate in the future. If mental models of scientists and citizens are elicited, then public agencies can structure risk communication and public involvement to resolve any differences in mental models and, ultimately, consider both public values and scientific feasibility when designing future policies.

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