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DISSERTATION

INTEGRATIVE COMPLEXITY OF WILDFIRE MANAGEMENT: THE DEVELOPMENT, USE, AND IMPLICATIONS OF A SCALE

Submitted by:

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Natural Resource Recreation and Tourism

In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY JOSHUA CARROLL ENTITLED "INTEGRATIVE COMPLEXITY OF WILDFIRE MANAGEMENT: THE DEVELOPMENT, USE, AND IMPLICATIONS OF A SCALE" BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

"INTEGRATIVE COMPLEXITY OF WILDFIRE MANAGEMENT: THE DEVELOPMENT, USE, AND IMPLICATIONS OF A SCALE"

Among the challenges and requirements of wildfire management, addressing public perceptions regarding fire suppression techniques is a priority. It has been realized that in order to implement fire management techniques that will have enduring success and support, a skilled assessment of the various publics involved in the decision-making process is imperative. One highly sophisticated method of measuring this public perception is through the use of integrative complexity. Though the traditional methods for measuring integrative complexity are rather tedious for researchers and respondents alike, an alternative, more simplified measure is created and discussed here. The preliminary application and results of this new measure are reported, and there is support for its continued use.

The first paper describes the process of designing and testing the scalar instrument, highlighting the methods and scale construction throughout the development. It reviews the logic, construction and testing of the scale, and the results from the pre-testing suggest the scale is a good correlate of the traditional measurement technique.

The second paper takes this newly-developed scale and utilizes it in a large questionnaire format. It tests integrative complexity's relationship with other constructs such as attitude direction and extremity, as well as exploring previously untested roles as

a moderator between value-laden basic beliefs and attitudes. Results of integrative complexity as measured by the scale are similar as to what would be expected based past research, and integrative complexity appears to moderate the basic belief-attitude relationship for certain cases.

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Though the completion of a dissertation is often an individual pursuit, it is not completed in isolation. Many friends and colleagues deserve recognition for their contributions. Jeff Brooks and Tara Teel provided practical input and moral support, while Katherine Morgan and Kerri Poore provided much of the latter. Peter Fix contributed valuable academic advice.

I also extend gratitude to Katherine Furber for her balanced approach and ability to keep challenging moments in check. She has a unique way of inspiring me to strengthen my accomplishments. Finally, I would like to thank the one who listened contently on many morning walks; my dog Betty.

DEDICATION

This dissertation is dedicated to my father for encouraging me to approach academic pursuits as I do 5.10 overhangs, and to my mother for teaching me to trust my instincts.

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I. INTRODUCTION

Fire is both natural and necessary in healthy forest ecosystems. It contributes to essential functions such as regeneration of vegetation, elimination of disease and insect threats, forest reproduction, long-term wildlife habitat improvement, and fuel reduction. However, there are also costs associated with wildland fire. These include threats to private property, timber harvests, air quality, and scenic beauty. It is the trade-off between wildland fire benefits and costs that often results in differences in public beliefs toward wildland fire management.

Dissertation Design

This dissertation is organized into four separate but related chapters, each building upon the preceding chapter. The introduction provides a description of wildland fire history in the U.S. and how fires of the past shape our currently held beliefs about wildfire, followed by a review of past research on public perception of wildland fire management. Then, the chapter introduces and defines the construct of integrative complexity and highlights the advantages of its use for wildland fire research. The chapter closes with a description of the dissertation purpose and objectives.

Chapter two describes the development of a scalar measure of integrative complexity, with implications of further use of the scale in social science research. Chapter three covers the use of this newly-developed measure in a larger general population study and examines the role of integrative complexity in the value-laden basic

belief and attitude relationship. While chapters two and three build upon one another from the introduction chapter, and lead into the final chapter, they are designed to stand alone as individual manuscripts, to be submitted to human dimensions in natural resource journals.

The final chapter provides a summary and additional in-depth conclusions and implications of the research. This chapter attempts to recapitulate the preceding chapters and their implications for this research. Literature cited is presented at the conclusion of each chapter.

Appendices are included at the end of the dissertation. They contain the integrative complexity scale, the survey questionnaire, cover letters and the reminder postcards that were used during the large survey administration.

Fire History

Prior to European arrival on the North American continent, fire was used by Native Americans to increase the output of grazing lands and natural food-producing ecosystems. This light burning or "Indian way" was adapted by early European settlers as they burned "everything from ditches to fallow fields – and accepted the occasional wildfire as they did floods or tornadoes" (Pyne, 2001, p. 8).

As colonization began, fire was often seen as the price of progress, and the ones that did erupt were often minor because there was little to burn as the forests had historically experienced continuous fire exposure, especially in the understory. This natural fire history prevented development of "ladder fuels" that enabled fire to climb into the canopy of larger trees resulting in the conflagrations that can devastate a forest

stand. Even those that did, did so as a distant spectacle, that interfered little with the daily life of those settling in the region.

As European settlers pushed their way west, the results were often heaps of slash piles and development. As they grew more stable and reliant on agriculture, the fuels from cleared forests laid drying. As westward expansion continued, slash piles were left from the construction of the railways and land clearing for structures. Both slash piles and structures would all act as fuels for fires.

In the late 1800's settlement and accompanying levels of timber harvest increased. This left immense land areas covered with fuels such as debris and dense undergrowth (USDA, 2000). In 1878, Major John Wesley Powell gave his *Report on the Lands of the Arid Region of the United States*, and confirmed previous accounts of fire occurring in the west when he wrote "this [fire] destruction is on a scale so vast that the amount take from the lands for industrial purposes sinks by comparison into insignificance". This forced the country to confront the fire dilemma as Gifford Pinchot had predicted when he said, "sooner or later it [fire] must be faced".

Awareness of major fire events occurring in the West stimulated the country's land managers to change its tactic toward fire from one of wide use and acceptance, to a "fire protection plan", which aimed at fire control. This was the legislative sentiment, though not well supported by the public. In fact, the public had little concern for fires unless they perceived direct impacts to human life, livestock, or structures (Davis, 1979).

During a particularly dry and hot fire season of 1910, many destructive fires broke out in the west and referred to as the "Big Blowup". This resulted in 85 casualties and 3 million acres burned. These fires mark the first attempt at a large firefight by the U.S.

Forest Service. In short, they failed at control and extinguishments. The "Big Blowup" was a major trigger event for skepticism toward fire and increased suppression activity by the USFS (USDA, 2000).

Following the "Big Blowup", congress held back appropriations to the Forest Service, and the Senate required documentation of all Forest Service expenditures from 1900 to 1910 (Pyne, 2001). The Weeks bill, which had been previously voted down, was passed during this time, giving a federal role to fire protection, and appropriated $200,000 for grants to those states with forestry bureaus, fire protection programs, and willingness to accept some federal oversight (Pyne, 2001). This encouraged many states to invest and create fire bureaus and put fire protection in the foreground. A political tide had turned toward one of resolute fire fighting.

During the drought-stricken 1930's a plan was created to extend fire fighting into the backcountry, and increased the creation of roads. By now fire suppression was commonplace, but its emphasis in the backcountry was met with some opposition, mainly from sportsmen who disliked the Forest Service's road development into this region. In an interesting response to the public's criticisms of the Forest Service's road building policy, a regional forester of the agency writes about the procedure for road construction in 1936: These roads are "based primarily on the control of fire" and that they "must help deliver fire fighters on the ground within the set period" (Buck, 1936). He continues to justify the roads' existence in the name of fire protection, and admits that until they are all completed, "large areas for which it [Forest Service] was responsible had insufficient fire protection until these roads could be built" and refers to the roads as "vital arteries which, along with equally vital telephone nerves from lookout stations, must be counted

on to save the forests in the hour of need" (Buck, 1936). He summarizes fire in this revealing letter by stating that "forest fire, ...is the arch enemy of wildlife, as anyone who has followed in the track of a fire will agree" (Buck, 1936).

This letter is interesting for several reasons. For one, it offers a unique view into the sentiment of at least one, and based on Pyne's account most likely the majority of, foresters in the 1930's. The tone of the article is so clearly against all aspects of fire, and the idea of accepting any burning is not portrayed in any of the passages. At this point in 1936, fire was evil.

How the Fires Shaped Subsequent Response

The repercussions of the 1910 fires have had enormous effects on the present day attitude toward fire, both in the public and politics. The political ecology of fire is not a science; it is more of a historical and anthropological account (Pyne, 1998).

"The public's perception of the risks associated with fire and its deeply rooted belief that 'fire is bad' poses an immense communications challenge" (Clute, 2000, p. 59). Devices such as the Forest Service's "10 a.m. policy" of requiring managers to have all fires extinguished by 10 a.m. the day following their ignition, and Smokey Bear, who's message was still recognized in over 70% of U.S. young children in 1989 (Clute, 2000) contribute to this. Furthermore, a study of two rural communities experiencing wildfire in Washington State during 1994 showed most adults still considered the 10 a.m. policy as the appropriate technique for the Forest Service's wildfire management techniques (Mendez, et al., 2003).

After 90 years of suppression, and anti-fire messages, fire is now something much of the public fears. As the agencies attempt to change the public's attitude in light of current ecological information that supports fire on the landscape, people are reluctant.

Current Wildfire Management

Due to nearly 100 years of fire suppression by the federal land management agencies, many forests in the U.S. are now loaded with fuels and, as a result, severe wildfire conditions exist. The major fire events within the past decade have been particularly costly and threatening to human lives, and land management agencies are suggesting that some burning or removal of fuels from the forest could help put these ecosystems at a lower risk of a highly destructive wildfire, and increase chances to attain a more sustainable fire regime.

Response to the historical strategy of strict fire suppression has included two common management actions designed to reduce fuels in the forest; prescribed burning and mechanical thinning. *Prescribed burning* is defined as fire applied to a specific land area under selected weather conditions to accomplish predetermined, well-defined management objectives (Pine Forest Management, 2003). When used properly it has been shown to be both effective at achieving its objectives and economically feasible. Some risks associated with improper implementation of prescribed fire are loss of property and life, liability issues, poor air quality, increased water runoff, and a temporary decrease in aesthetics.

Mechanical thinning reduces the amount of vegetation in the forest by physically removing selected trees and plants with the intention of decreasing the likelihood of

large, uncontrollable fires. It often involves heavy equipment (e.g., bulldozers) and/or light equipment (e.g., chainsaws) entering the forest for the cutting of trees based upon a predetermined spacing or pattern technique (Mechanical Thinning, 2003). It has become a viable option along with prescribed fire techniques for removal of fuel and reduction of wildfire potential. Some associated impacts of mechanical thinning are landscape alteration and initial root stability reduction due to the presence of heavy equipment, and susceptibility to competitive weed growth.

Although these management strategies are designed to decrease the danger of wildfire in forests, the mere occurrence of fire and/or presence of mechanical thinning equipment can still impact humans and natural resources. Human lives, private property, wildlife and its habitat, plants, trees, outdoor recreation areas and scenic beauty can all be affected both positively (e.g., preserving the natural forest regime) and negatively (e.g., out of control burns, temporarily scarred landscape) by these wildfire management techniques.

Identifying Public Perceptions of Wildland Fire Management

This shift to proactive measures to reduce wildfire risk has troubled some communities and groups with interests in forested areas because of the dangers associated with prescribed fires going awry and the impacts of heavy machinery and road building that accompanies mechanical thinning. The public has expressed much concern related to these issues, and as a result, public perceptions of fire management has become an important consideration for agencies charged with managing areas susceptible to wildland fires.

Understanding the public's perceptions of wildfire management can help agencies recognize when policies may or may not be supported by the public, and help agencies communicate information in ways that will garner support for potentially controversial strategies. With public support, the agency can manage more efficiently, spending time and money on the resource, as opposed to legal battles and failed policy adjustments.

Research on public perceptions of fire management has been occurring for nearly three decades. For example, studies examining the acceptance of fire management strategies (e.g., Stankey, 1976; Cortner, Zwolinski, Carpenter, and Taylor, 1984), have suggested that education can influence public acceptance of these management strategies (e.g., Taylor and Daniel, 1984). Shelby & Speaker (1990) found that among other factors, the success of prescribed burning campaigns aided in the public's acceptance of prescribed burning, though there was difficulty in fully accepting this management practice due to past messages of the risks and impacts of fire.

Manfredo, Fishbein, Haas, & Watson (1990) found that an individual's intent to support a controlled burn policy was largely influenced by their attitudes toward that management strategy. These researchers concluded that influencing the public's beliefs about fire will likely alter their attitudes toward fire, and ultimately their acceptance of management practices regarding this issue. Based on this past research, it becomes apparent that the public's beliefs are a key element to understanding and perhaps influencing their acceptance of fire management strategies. Identifying specific beliefs and attitudes toward fire management strategies provides important information for managers, however this information is often limited to a "laundry list" of *what* people believe about fire management.

Limitations of Current Attitude and Belief Research Regarding Fire Management

Burtz (2002, unpublished dissertation) suggested that "it is insufficient to simply understand what attitudes are relevant to wildfire and its management, it is necessary to understand *how* people are thinking about the issues". People often have many thoughts about issues such as wildland fire management, many of which may not be consistent, are based on emotions, experience, or neither, and may or may not be based on values, which have been shown to be linked to attitudes (e.g., Fulton, Manfredo, and Lipscomb, 1996). This variety of information helps to make up an individual's complexity of thought.

This level of complexity describes *how* individuals think about an issue, or the structure of their beliefs. One construct that is based on this structure of beliefs is integrative complexity (Tetlock, 1989). Its use in research can provide additional information on how people think about an issue such as wildland fire management. Traditionally it is a qualitative measure. This dissertation describes the process by which a fixed-item scale to measure the concept of integrative complexity was developed, and its use in a large-scale research study.

Integrative Complexity

Integrative complexity is a protocol for measuring a way of thinking and describes the structure of the thoughts people have about an issue such as wildland fire management. It is based on the number of aspects of a problem people consider (Bright & Barro, 2000; Tetlock, 1985). It is important to note that the level of integrative complexity one has toward an issue is based on the structure of thought that a person has about that issue, *not* the specific content of their thoughts (Bright & Barro, 2000; Tetlock, 1985).

Two factors that are measured within the context of integrative complexity are *differentiation* and *integration*. Differentiation focuses on whether a person acknowledges that there are more than one side or dimension to an issue or problem (Bright & Barro, 2000; Tetlock, 1989). Someone who sees an issue as black or white (e.g., prescribed burning is dangerous and 'bad') is exhibiting low differentiation on that subject, whereas one who sees two dimensions to an issue (e.g., prescribed burning is sometimes beneficial to the forest ecosystem but also entails some potential dangers to humans) shows somewhat higher differentiation, and someone who sees several dimensions exhibits even higher differentiation (Bright & Barro, 2000).

The second factor that is important for integrative complexity is integration, which "refers to the development of complex connections among the differentiated characteristics" and is related to the relative importance of perceived arguments for and against an issue (Bright & Barro, 2000; Tetlock, 1985). It is the recognition of interrelations among the different perspectives or dimensions that were acknowledged in the differentiation stage of measurement (Wallbaum, 1993). Therefore, high levels of integration regarding an issue require that the individual has first exhibited an adequate amount of differentiation (Tetlock, 1989).

History of Integrative Complexity

Integrative complexity has been developed and refined over time from past social psychological constructs, tracing back to conceptual differentiation. *Conceptual differentiation* (Gardner, 1953) is a concept that deals with an individual's tendency to place reality within a structure that allows them to go through the act of perceiving more

easily. If someone tends to classify objects into a relatively large number of mutually exclusive categories, they are said to show a high degree of conceptual differentiation. When someone uses few categories, they are exhibiting a low degree of differentiation.

Gardner found that individuals use this level of cognitive process in several situations and tend to be consistent with their various styles. Though this work has been criticized for being statistically flawed due mainly to low sample size (Hashway, 1998) this supports the assumption that an individual will show one level of cognitive process and maintain that level for other situations. It is then defined as individual style and something that will be repeated.

Cognitive complexity (Kelly, 1955) is a measure of the number of decision dimensions that a person uses to come to a cognitive conclusion. If a person uses several dimensions, they are said to be more cognitively complex than another who uses fewer dimensions. It operates on the idea that individuals use a system of constructs, which have been developed through experience, to perceive reality. This appears linked with integrative complexity work that also deals with the process of cognition in terms of numbers of some cognitive element. It attempts to make it more empirical, less subject to error, and more objective.

Bieri (1955) elaborated on this cognitive complexity work to bring it further along the cognitive hierarchy (Fulton et al, 1996) toward behavior. He hypothesized that an individual with higher cognitive complexity would yield higher accuracy of predictive behavior, and that there should be a negative relationship between the level of cognitive complexity and an individual's tendency to perceive others like him or her self. His work supported this claim. Furthermore, it was shown that the level of cognitive complexity

that one individual shows will most likely be the level they show in another situation (Hashway, 1998).

This suggests that the level of complexity or process of thought that an individual uses in one situation will likely be consistent with what they use in other situations. This takes into consideration situational factors, which make each decision its own entity, even though the process of coming to that decision may have used the same cognitive structure. This implies a potential predictive validity of integrative complexity.

Uses of Integrative Complexity

Integrative complexity has been used in many cases where strong dichotomies exist (Bright & Barro, 2000). Issues such as abortion, political affiliation, and United States versus Soviet Union foreign policy have been analyzed to measure individuals' levels of integrative complexity.

Integrative complexity was originally studied for pre-existing speeches, often in the political arena. For example, Tetlock (1981, 1989) examined integrative complexity of United States congresspersons to see if *conservatives* were less integratively complexity on political issues than their liberal counterparts. Tetlock (1984) also analyzed reasoning of members of the British House of Commons, and American versus Soviet foreign policy-makers (Tetlock, 1985, 1988). Wallace and Suedfeld (1988) measured integrative complexity of sixteen leaders before, during, and after seven international crises while Tetlock, Armor & Peterson (1994) looked at debates over slavery in Antebellum America.

Rather than relying on existing speeches as secondary data, other research on integrative complexity has requested its subjects write or talk about a specific issue. Kristiansen & Matheson (1990) analyzed integrative complexity of public attitudes toward nuclear weapons, while Dillon (1993) compared integrative complexity of arguments on abortion between statements made by "pro-choice" and "pro-life" advocates.

In a natural resources context, integrative complexity has been utilized to look at how coursework in environmental education affected college students' level of integrative complexity regarding endangered species (Bright & Wyche, 1998), and attitudes toward plant and wildlife protection (Bright & Barro, 2000). Finally, integrative complexity has been used to assess public attitudes toward wildfire (Burtz, unpublished dissertation).

Advantages of Integrative Complexity Information for Wildfire Research

In addition to understanding how people think about an issue, integrative complexity can also play a role in steering management decisions on topics that produce strong, polarized positions among stakeholders. When management considers the level of integrative complexity that a particular group has about an issue, they can guide their own delivery and enforcement of their management practices, as well as develop information appropriate to different levels of complex thinking.

For example, managers dealing with wildfire are in a particularly difficult position with regard to messages of the past (e.g., fire suppression, fire is evil) and the current understanding that prescribed fire is needed. Many land management agencies now have

permanent positions within their infrastructure where specific duties are to communicate management practices to the public in hopes of garnering public acceptance (e.g., wildland fire communicators). Within their operations manual they make many references to how important it is "to gain public support" (Clute, 2000, p. 59), and that this "is not an easy task for there are many barriers to such an endeavor-not the least of which is the attitude of the American public" (Clute, 2000, p. 59). Clute (2000, p. 61) goes on to recognize that "there is also a need for improved and better coordinated messaging directed to them [the public]". There is an eminent need for a method to "better communicate wildland fire messages in such a manner as to meet societal needs, address community needs/concerns, gain public support, and comply with organizational mandates, all while utilizing the best science and technology available" (Clute, 2000, p. 61).

In light of past experience the public has had with fire, and its management, this is not an easy task. It becomes just as important, if not more so, to convey the message properly. As Clute (2000) points out, it is a requirement for forest managers to keep the public informed. The measurement of integrative complexity has implications for messaging and framing these messages in appropriate contexts and levels of complexity.

This operates with the acknowledgement that individuals will respond to information (e.g., a forest management campaign) that is set at the level of knowledge and complexity at which they function. For example, it has been shown that when an individual is exposed to information of a higher level of complexity than they typically function, they will revert back in levels of complexity and tune out more information to better simplify their input (Hunsberger et al., 1992). The application of integrative

complexity may get beyond this stimulus blockage by first assessing at which levels of complexity individuals, either collectively or individually, are functioning, and then to focus information dissemination at or near these levels of complexity to match its audience.

An individual's cognition deals with organization and interpretation of input (Hashway, 1998). It is shown with past research methods that humans spend much energy attempting to digest complex information (e.g., cognitive complexity, cognitive style, cognitive miser) and that these techniques are used to make complex input more manageable. It therefore seems logical that providing messages of appropriate levels of complexity would make attention to the information more likely. By meeting respondents with appropriate levels of complexity, we may avert the use of heuristics (Aronson, 1995) or cognitive miser tendencies (Fiske & Taylor, 1991).

DISSERTATION PURPOSE

The goal of this research is to develop an alternative and functional method for measuring integrative complexity and to apply it to public perceptions of prescribed burning and mechanical thinning. Furthermore, to examine the role that complexity of thinking plays regarding value-laden basic beliefs and attitudes toward wildland fire management and the *relationship* between them.

In order to accomplish these goals, specific objectives have been identified.

Objective 1: To create a fixed-item scale which will yield integrative complexity scores.

Objective 2: To measure integrative complexity of thought regarding two wildfire management techniques (i.e., prescribed burning and mechanical thinning) using the traditional essay completion method.

Objective 3: To measure integrative complexity of two wildfire management techniques (i.e., prescribed burning and mechanical thinning) with the newly developed scale, using the same sample of respondents as the traditional methods test.

Objective 4: To determine the extent to which the two measures of integrative complexity are correlated. It is presumed that a higher correlation between the two methods indicates a better fixed-item measure of the construct.

Objective 5: To determine if the level of a respondent's integrative complexity about prescribed burning and mechanical thinning was related to their basic beliefs about wildland fire management.

Objective 6: To determine if respondents with positive attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than respondents with negative attitudes toward prescribed burning and mechanical thinning.

Objective 7: To determine if respondents with extreme attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than respondents with moderate attitudes toward prescribed burning and mechanical thinning.

Objective 8: To determine if the relationship between value-laden basic beliefs about wildland fire management and attitudes toward prescribed burning and mechanical thinning was moderated by the level of integrative complexity.

This research has several potential implications.

- Generating a more simplistic and user-friendly method of measuring integrative complexity.
- Overcoming a scale's tendency to become outdated by utilizing an open-ended format, increasing salience of the identified belief structure.
- Enhance the use of integrative complexity in the construction of broader social psychological models of value, attitude and behavior.
- Uncover the value-attitude relationship and the role of complex thinking.
- Better understand how people think about dichotomous issues, and guide more coordinated messaging techniques by natural resource managers.
- Ultimately yield more public acceptability and compliance with natural resource management campaigns.

The data in chapter two of this dissertation come from a Colorado State University student sample of 63 respondents. This composed the pretest sample for the construction of the new scalar integrative complexity instrument. The data in chapter three consisted of residents who live close to forested areas that had experienced frequent wildfire (Front Range, CO), residents who live close to forested areas but had experienced relatively little wildfire (southern Illinois), and residents of an urban area who do not live near a wildland/urban interface (Chicago, IL).

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II. INTEGRATIVE COMPLEXITY OF WILDFIRE MANAGEMENT: DEVELOPMENT OF A SCALE

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ABSTRACT

Wildfire in the West has become a controversial natural resource issue that has divided the public's perceptions regarding its management, and forest managers are now faced with the difficult task of making sound decisions while balancing these varying concerns. Two widely used wildfire management practices are prescribed fire and mechanical thinning. In order to better understand the public's position regarding these two techniques, we have drawn upon the concept of integrative complexity. Integrative complexity is defined as a protocol for measuring the complex way that people think about issues, and is based on the number of aspects of a problem people consider. However, the qualitative nature of this research is lengthy and requires much work from both the respondents and investigators alike. This paper presents the psychometric process by which a combination open-ended and fixed-item scale was developed to

measure complexity of thought that is consistent with integrative complexity. The resulting scale is designed for use in large surveys across any number of natural resource issues, thus allowing the information generated to be generalizeable to broader populations, which is often impractical with this originally qualitative research method.

INTRODUCTION

Fire is both natural and needed by forest ecosystems. It provides essential functions such as regeneration of vegetation, elimination of disease and insect threats, proper forest reproduction, wildlife habitat improvement, and the reduction of fuels. Though these benefits are noteworthy, there are also costs associated with wildland fire. These include threats to private property, natural resource harvests, air quality, and scenic beauty. It is this trade-off between wildland fire benefits and costs that complicates the issue and causes differences in public beliefs toward fire management.

Current Wildfire Management

Due to nearly 100 years of fire suppression by federal land management agencies, many forests in the U.S. are now loaded with fuels and, as a result, severe wildfire conditions exist (Pyne, 2001). The major fire events within the past decade have been particularly costly and threatening to human lives, and land management agencies are suggesting that some burning or removal of fuels from the forest could help put these ecosystems at a lower risk of a highly destructive conflagration, and increase chances to attain a more sustainable fire regime (Pine Forest Management, 2003).

Response to the historical strategy of strict fire suppression has included two common management actions designed to reduce fuels in the forest; prescribed burning and mechanical thinning. *Prescribed burning* is defined as fire applied to a specific land area under selected weather conditions to accomplish a large number of predetermined, well-defined management objectives (Pine Forest Management, 2003). When used properly it has been both effective at achieving its objectives and economically feasible. Some risks associated with improper implementation of prescribed fire are loss of property and life, liability issues, poor air quality, increased water runoff, and a temporary decrease in aesthetics.

Mechanical thinning reduces the amount of vegetation in the forest by physically removing selective trees and plants with the intention of decreasing the likelihood of large, uncontrollable fires. It often involves heavy equipment (e.g., bulldozers) and/or light equipment (e.g., chainsaws) entering the forest for the cutting of trees based upon a predetermined spacing or pattern technique (Mechanical Thinning, 2003). It has become a viable option along with prescribed fire techniques for removal of fuel and reduction of wildfire potential. Some associated impacts of mechanical thinning are landscape alteration and initial root stability reduction due to the presence of heavy equipment, and susceptibility to competitive weed growth.

Although these management strategies are designed to decrease the danger of wildfire in forests, the mere occurrence of fire and/or presence of mechanical thinning equipment can still impact humans and natural resources. Human lives, private property, wildlife and its habitat, plants, trees, outdoor recreation areas and scenic beauty can all be

affected both positively (e.g., preserving the natural forest regime) and negatively (e.g., out of control burns, temporarily scarred landscape) by these management techniques.

Identifying Public Perceptions of Wildland Fire Management

The policy of government land management agencies has only recently emphasized more proactive approaches to reducing wildfire risk through the use of prescribed burning and mechanical thinning. This shift has troubled some communities and groups with interests in forested areas because of the dangers associated with prescribed fires going awry and the impacts of heavy machinery and road building that accompanies mechanical thinning (Kneeshaw, Vaske, Bright, and Absher, 2004). The public has expressed much concern related to these issues, and as a result, public perceptions of fire management has become an important consideration for agencies charged with managing areas susceptible to wildland fires. Understanding the public's perceptions of wildfire management can (a) help agencies recognize when policies might be supported by the public, (b) alert agencies when policies may run into public opposition, and (c) help agencies develop information to garner support for potentially controversial strategies. With public support, the agency can manage more efficiently, spending time and money on the resource, as opposed to legal battles and futile policy adjustments.

Research on public perceptions of fire management has been occurring for 20 years. For example, studies examining the acceptance of fire management strategies (e.g., Stankey, 1976; Cortner, Zwolinski, Carpenter, and Taylor, 1984), have suggested that education can influence public acceptance of these management strategies (e.g., Taylor and Daniel, 1984). Shelby & Speaker (1990) found that among other factors, the

success of prescribed burning campaigns aided in the public's acceptance of prescribed burning, though there was difficulty in fully accepting this management practice due to past messages of the risks and impacts of fire.

Manfredo, Fishbein, Haas, & Watson (1990) found that an individual's intent to support a controlled burn policy was largely influenced by their attitudes toward that management strategy. These researchers concluded that influencing the public's beliefs about fire will likely alter their attitudes toward fire, and ultimately their acceptance of management practices regarding this issue. In this way, it becomes apparent that the public's beliefs are a key element to understanding and perhaps influencing their acceptance of fire management strategies.

In a panel research study, Shindler and Toman (2003) used specific belief measures (e.g., "the use of fuel treatments in the Blue Mountains is unnecessary and should not be utilized") to examine support for prescribed burning and mechanical thinning. They found that over the four-year period between 1996 and 2000, support for these activities in the Blue Mountains remained relatively constant.

Identifying specific beliefs and attitudes toward fire management strategies provides important information for managers, however this information is often limited to a "laundry list" of *what* people believe about fire management.

Limitations of Current Attitude and Belief Research Regarding Fire Management

Burtz (2002, unpublished Dissertation) suggested that "it is insufficient to simply understand what attitudes are relevant to wildfire and its management, it is necessary to understand *how* people are thinking about the issues". People often have many thoughts about issues such as wildland fire management, many of which (a) may not be consistent,

(b) are based on emotions, experience, or neither, and (c) may or may not be based on values, which have been shown to be linked to attitudes (e.g., Fulton, Manfredo, and Lipscomb, 1996). This variety of information regarding people's thoughts about wildland fire management is an important aspect of the complexity toward which they think about the issue.

This level of complexity describes *how* individuals think about an issue, that is, the structure of their beliefs. One concept that is based on this structure of beliefs is integrative complexity (Tetlock, 1989). Its use in research can provide additional information on how people think about an issue such as wildland fire management. Traditionally it is a qualitative measure. This paper describes the process by which a fixed-item scale to measure the concept of integrative complexity was developed.

Conceptual Framework: Integrative Complexity

Integrative complexity is a protocol for measuring a way of thinking. It describes the structure of the thoughts people have about an issue such as wildland fire management, and it is based on the number of aspects of a problem people consider (Tetlock, 1989). It is important to note that the focus of integrative complexity is on the structure of thought that a person has about a particular issue, *not* the content of that issue (Tetlock, 1989).

Two factors that are measured within the context of integrative complexity are *differentiation* and *integration*. Differentiation focuses on whether a person acknowledges that there are more than one side or dimension to an issue or problem (Baker-Brown et al., 1992). Someone who sees an issue as black or white (e.g., prescribed burning is dangerous and bad) is exhibiting low differentiation on that subject,

whereas one who sees two dimensions to an issue (e.g., prescribed burning is sometimes beneficial to the forest ecosystem but also entails some potential dangers to humans) shows somewhat higher differentiation, and someone who sees several dimensions exhibits even higher differentiation (Bright & Barro, 2000).

The second factor that is important for integrative complexity is integration, which refers to the development of complex connections among the differentiated characteristics and is related to the relative importance of perceived arguments for and against an issue (Baker-Brown et al., 1992). It is the recognition of interrelations among the different perspectives or dimensions that were acknowledged in the differentiation stage of measurement (Wallbaum, 1993). Therefore, any level of integration regarding an issue require that the individual has first exhibited an adequate amount of differentiation (Tetlock, 1989).

Uses of Integrative Complexity

Integrative complexity was originally studied for pre-existing political speeches. For example, Tetlock (1981, 1989) examined the integrative complexity of United States congresspersons to see if conservatives were less integratively complexity on political issues than their liberal counterparts. Tetlock (1984) also analyzed reasoning of members of the British House of Commons, and American versus Soviet foreign policy-makers (Tetlock, 1985, 1988). Wallace and Suedfeld (1988) measured integrative complexity of sixteen leaders before, during, and after seven international crises.

Outside of the political arena, there have also been integrative complexity analyses of public issues. Kristiansen & Matheson (1990) analyzed integrative

complexity of public attitudes toward nuclear weapons, while Tetlock, Armor & Peterson (1994) examined debates over slavery in Antebellum America. Dillon (1993) compared integrative complexity of arguments on abortion between statements made by "pro-choice" and "pro-life" advocates.

In a natural resources context, integrative complexity has been utilized to look at how coursework in environmental education affected college students' level of integrative complexity regarding endangered species (Bright & Wyche, 1998), and attitudes toward plant and wildlife protection (Bright & Barro, 2000). Finally, integrative complexity has been used to assess public attitudes toward wildfire (Burtz, unpublished dissertation).

In addition to understanding how people think about an issue, integrative complexity may also play a role in steering management decisions on topics that produce strong, polarized positions among stakeholders. When management considers the level of integrative complexity that a particular group has about an issue, they can guide their own delivery and enforcement of their management practices, as well as develop information appropriate to different levels of complex thinking.

For example, managers dealing with wildfire are in a particularly difficult position with regard to messages of the past (e.g., fire suppression, fire is evil) and the current understanding that prescribed fire is needed. Many land management agencies now have permanent positions where specific duties are to communicate management practices to the public in hopes of garnering public acceptance (i.e., wildland fire communicators). Within their operations manual they make many references to how important it is "to gain public support" (Clute, 2000, p. 59), and that this "is not an easy task for there are many

barriers to such an endeavor-not the least of which is the attitude of the American public" (Clute, 2000, p. 59). Clute (2000, p. 61) goes on to recognize that "there is also a need for improved and better coordinated messaging directed to them [the public]". There is an eminent need for a method to "better communicate wildland fire messages in such a manner as to meet societal needs, address community needs/concerns, gain public support, and comply with organizational mandates, all while utilizing the best science and technology available" (Clute, 2000, p. 61).

In light of past experience the public has had with fire and its management, communication is not an easy task. It becomes just as important, if not more so, to convey the message properly. Managers need to "keep your 'customers' informed" (Clute, 2000, p. 61). This is where the utility of integrative complexity can be realized. It has implications for messaging and framing messages in appropriate contexts and levels of complexity.

It is recognized that individuals will best respond to information (e.g., a forest management campaign) that is set at the level of knowledge and complexity at which they function. For example, it has been shown that when an individual is exposed to information of a higher level of complexity than they typically function, they will tune out further information to simplify their input (Hunsberger et al., 1992). Appropriate measurement and use of integrative complexity may get beyond this stimulus blockage by first assessing at which levels of complexity individuals, either collectively or individually, are functioning, and then to focus information dissemination at or near these levels of complexity to match its audience.

Measuring Integrative Complexity

Traditional methods for measuring the public's integrative complexity use the paragraph completion test (Schroder, Driver, & Streufert, 1967). This involves respondents writing an essay about an issue and describing their attitudes and beliefs, and why they feel that way. Each respondent's essay is analyzed by several raters for differentiation and integration. For each essay the results of the raters' analyses are compared. Differences in evaluation of an essay among raters are investigated and reconciled. If different evaluation scores cannot be reconciled to within one point for a specific essay, the respondent's essay is left out of the analysis. Scoring ranges from 1 to 7, where 1 represents the lowest integrative complexity score and 7 represents the highest. Specific descriptions of scores along the integrative complexity continuum are described below (Bright & Barro, 2000; Baker-Brown et al., 1992; Wallbaum, 1993).

- 1: no differentiation, individual sees the issue in only black or white terms
- 3: individual acknowledges at least two viewpoints and there may be positive and negative aspects of each
- 5: individual acknowledges not only multiple viewpoints, but that there is a moderate level of interactions and tradeoffs among the alternatives
- 7: suggests the individual also has deeply held basic values between the alternative issues

Intermediate scores of 2, 4, and 6 can be assigned if raters have difficulty deciding specifically on a score of 1, 3, 5, or 7. Table 1 provides examples of passages and their coding score for integrative complexity (Bright and Barro, 2000). For a complete list of

all the criteria that determine integrative complexity scoring, see Appendix A (Baker-Brown et al., 1992).

Table 1. Examples of passages about species protection, their overall integrative complexity (IC) score, and individual coder scores

IC Score	Passage
1; both coders = 1	I feel that we should try to leave what life and animals that are in their own habitats alone and try our best to protect them and the environment around them.
2; both coders = 2	Yes but with some restraint. In my opinion the quality of human life comes before the protection of diverse life forms. I would place preservation ahead of pure economic gain.
3; coder 1 = 4, coder 2 = 3	I feel we have to find a balance between the environment and population. It's important to maintain the wildlife and plant life of the wilderness, but people also need jobs. I feel that animals will move to other habitat if man interferes with their areas.
4; both coders = 4	I believe in protecting the diversity as long as it is done with a reasonable budget and fiscally responsible management. The problem with programs like this is that they take on a life of their own. If an endeavor such as this can be done without being over done, than I am for it. But experience tells me otherwise.
5; coder 1 = 4, coder 2 = 5	To a degree yes we must monitor the ecology. However, the government simply seems to go overboard sometimes, as it does in every area it touches. Too many administrative programs exist; some conflict; all are expensive. The idea is a good one but it seems we go about things in an all or nothing fashion. We have evolved to the place where we can determine the degree that a species or animal affects the other living things it interacts with. We need to curb the human problems worldwide—especially overpopulation or this question will one day be moot.

Note 1: there were no scores of either 6 or 7 in the study this data was drawn from.
Note 2: results presented here were adapted from Bright and Barro (2000)
Note 3: grammatical errors were left in passages to depict responses verbatim

Drawbacks of Traditional Measurement of Integrative Complexity

While the use of integrative complexity allows researchers to more deeply investigate an individual's beliefs, the measurement process can be time consuming and requires significant effort from both researchers and respondents. For example, respondents are

asked to complete written or typed essays, and, as a result response rates and quality can suffer. Bright & Barro (2000) point out that one main reason for low response rates is that "potential respondents found that writing an essay about species protection was either too difficult or time-consuming".

Another important factor in the measurement of the construct is how well respondents understand the instructions for completing the survey. In the case of using essays to generate integrative complexity scores, instructions must make clear to the subjects that the composition should reflect opinions, the valuations, or judgments, and should not be merely a descriptive account, which would not be a scorable response for complexity (Baker-Brown et al. 1992).

There are also several concerns for scientists who engage in traditional integrative complexity research. Scoring the essays is quite time consuming and requires several researchers working cooperatively to come to agreement on appropriate scores. As noted above, the paragraph completion test requires at least two (often three or more are used) researchers to score every essay for every respondent, and then discuss scores and their reasoning. This is a difficult and lengthy process.

Finally, the qualitative measurement of integrative complexity makes it unfeasible to be used on a large-scale application, and restricts its generalizability from a small sample to broad populations. This impedes its use in many potentially valuable studies, and has kept integrative complexity unused in large survey research.

GOALS OF THE STUDY

The goal of this research was to develop an alternative and functional method for measuring integrative complexity. We apply it to public perceptions of prescribed burning and mechanical thinning.

A scalar measure would attempt to overcome the limitations of essay completion methods of integrative complexity and has additional benefits. First, a fixed-item scale is easier to complete for respondents. The scale measure does away with the essay, and replaces it with fill-in spaces and circling of a number. Since many people are reluctant to write an essay about a topic, this removes this sometimes-intimidating task. Second, increased simplicity of completing a scale enables the concept to be used in more broad social science studies, allowing a larger sample to be obtained. Third, the use of a larger sample allows integrative complexity to be used in studies where an important objective is to obtain results generalizable to a population. Fourth, the scale makes the scoring more quantifiable and overcomes the challenges associated with translating qualitative data into quantifiable measurement. Lastly, the systematic and quantifiable measure of the integrative complexity scale allows for the concept's use in theoretical models of attitudes and behavior.

To accomplish the goal of the study, four specific objectives were identified. Objective 1: To create a fixed-item scale which will yield integrative complexity scores. Objective 2: To measure integrative complexity of thought regarding two wildfire management techniques (i.e., prescribed burning and mechanical thinning) using the traditional essay completion method.

Objective 3: To measure integrative complexity of two wildfire management techniques (i.e., prescribed burning and mechanical thinning) with the newly developed scale, using the same sample of respondents as the traditional methods test.

Objective 4: To determine the extent to which the two measures of integrative complexity are correlated. It is presumed that a higher correlation between the two methods indicates a better fixed-item measure of the construct.

METHODS

Development of the Fixed-Item Scale

The scale was designed to measure the two primary components of integrative complexity; differentiation and integration. Appendix B shows the integrative complexity scale for mechanical thinning, as it appeared on the survey.

Differentiation

Differentiation is conceptualized as the extent to which a respondent recognizes alternate sides of the issue of wildfire. It is traditionally measured by counting the number of positive and negative statements about an issue in an essay. High differentiation is indicated by an equal, or balanced, recognition of arguments on both sides of an issue.

We designed our scale to be consistent with the traditional method of measuring differentiation. In order to do this, we asked respondents to first list potential "arguments for" and "arguments against" each wildfire management technique. This provided an

indication of the number of positive and negative aspects that they were considering, much like the traditional methods of seeking these out from within an essay.

Integration

Integration is conceptualized as how the respondent recognizes the interrelationships between the different sides to the issue and is linked to the relative strengths of the perceived arguments on both sides. Traditionally, a researcher subjectively infers the level of integration from the respondent's writing and their apparent level of involvement with the topic.

In the scale we measured integration by asking respondents to indicate the strength of each argument they had listed. This is because integration is based on the observation of the integrated relationships between the differentiated characteristics. For example, if an individual gave a "for" argument the same value or strength as an "against" argument, this suggests they recognize similar or equal value to both sides of the argument; an attribute of a more highly integrated individual.

Scoring Differentiation, Integration, and Integrative Complexity

Differentiation was measured as a value between zero and one, based on the ratio of arguments for and against the issue. The lesser of the total arguments "for" versus "against" was divided by the greater of the two to arrive at the differentiation value. A value of zero reflected no differentiation, while a value of 1 reflected the highest differentiation. For example, an individual who listed three arguments for and two arguments against prescribed burns would obtain a ratio of 2 to 3, or a differentiation score of .67. A ratio of 3 to 4 would result if an individual listed 3 arguments for and 4

arguments against prescribed burns for a differentiation score of .75. Therefore, higher differentiation is also reflected somewhat in a higher total number of arguments, beyond the relatively balanced number of arguments on both sides of the issue.

Scoring Integration

A ratio, resulting in a score between zero and one, was calculated for integration. The means of the *strengths* of the arguments "for" and the arguments "against" the issue, respectively, were calculated. The smaller mean was divided by the larger to yield the integration score.

By continuing the previous example where an individual listed three arguments for and two arguments against prescribed burns we can illustrate the scoring of integration. If the three arguments for prescribed burns were considered to be strong arguments (e.g., 6, 6, 7), the mean for the strengths of the arguments for prescribed burning would be 6 + 6 + 7 / 3, or 6.3. If the two arguments against prescribed burning were perceived to be weak arguments (e.g., 2, 3), the mean of the arguments against prescribed burning would be 2 + 3 / 2, or 2.5. Therefore, the integration score for this respondent would be the lesser value divided by the larger, or 2.5 / 6.3, yielding an integration score of .4. Again, an integration score of zero indicates no integration, while an integration score of one indicates high integration.

Generating Integrative Complexity

Integrative complexity was measured as the product of the differentiation and the integration scores. This combination of both of the components of integrative complexity

(i.e., differentiation and integration) allowed their relative weights to be expressed in the analysis. Furthermore, it addressed an important issue found in the essay measurement. Traditionally, if a respondent had little or no differentiation, they would not be scored for integration, thus yielding a low integrative complexity score. By multiplying the differentiation and integration scores, the impacts of low differentiation on general integrative complexity score were accounted for. Very low differentiation would decrease potential levels of integration significantly, similarly to traditional measurement. This calculation would again yield a value between zero and one. Taking the example from above to completion, a differentiation score of .67 and an integration score of .4 would yield an integrative complexity score of .67 x .4, or .27.

Pretest of Integrative Complexity Scale

In the pre-testing of the integrative complexity scale, the following procedures were conducted:

- Respondents were divided at random and placed into one of two groups; a prescribed burn group and a mechanical thinning group, representing the issue they would be writing about.
- For each group, one half of the respondents began by writing an essay about their assigned topic, while the other half completed the scale first.
- After finishing, those who had written an essay worked on the scale, while those who had completed the scale worked on an essay.

This procedure allowed us to conduct the following analyses:

1. An independent samples t-test to determine if there was a significant difference in the traditional integrative complexity score for those who had completed the essay *first* and those who had completed it *last*.
2. An independent samples t-test to determine if their was a significant difference in the scale-generated integrative complexity score for those who had completed the scale *first* and those who had completed it *last*.
3. A correlation between the traditional essay score and the new scale score for both prescribed burns and mechanical thinning.

RESULTS

Results of the Pretest of the Integrative Complexity Scale

The test for bias on the order of delivery of the survey instrument showed no significant differences in integrative complexity score for either the scale or the essay (Table 2). For the essay method, those who had completed the essay first had a mean integrative complexity score of 3.17, while those who had completed it second had a mean score of 2.91, ($n = 33$, $t = .731$, $p = .467$). For the scale method, those who had completed the scale first had a mean integrative complexity score of .592, while those who had completed it second had a mean of .482, ($n = 30$, $t = 1.78$, $p = .078$).

Table 2. Test for order bias on two integrative complexity methods

Method	n	mean	t	p-value
Essay				
1st	30	3.17	.731	.467
2nd	33	2.91		
Scale				
1st	30	.592	1.78	.079
2nd	33	.482		

There were a total of 63 usable essay and scale pairs for the two issues (i.e., prescribed burning and mechanical thinning) that were tested. A correlation between the two methods of measurement (i.e., traditional essay and scale) was run for both issues. The final analysis was done with 63 essay and scale pairs, 33 for prescribed burning, and 30 for mechanical thinning.

The Pearson correlation between the integrative complexity scores for the two measurement methods for prescribed burning was $r = .81$, $p<.01$, $n = 33$ (Table 3). The analysis indicated a strong effect size. For the mechanical thinning issue, the correlation between the two scores for both methods of measurement was $r = .77$, $p<.01$, $n = 30$. Again, a strong effect size was indicated.

Table 3. Results of Pearson correlation of two integrative complexity methods for two wildfire management practices

	Scale Method for Prescribed burning	Scale Method for Mechanical thinning	P-value	n
Essay Method for Prescribed burning	.81		<.01	33
Essay Method for Mechanical thinning		.77	<.01	30

DISCUSSION

Summary of Integrative Complexity Scale Construction

The pretest of the integrative complexity scale yielded a strong correlation between the scale and essay results for both prescribed burning and mechanical thinning. Psychometrically, the scale defines the attributes and uses a straightforward approach to their measurement. This scale is also easier to complete for the respondent, less burdensome to score for the researcher, and has a simplified appearance that may be more likely to encourage cooperation from respondents. Finally, this scale appears to capture the differentiation and integration elements of integrative complexity.

Because this scale avoids some of the common pitfalls of traditional methods (e.g., disinterest in writing, lack of time from participants, much effort and collaboration required between researchers), it appears to be a functional substitute for use on larger and more broad attitude surveys.

Agreement of Measures

It is difficult to capture a truly qualitative component of human cognition with any measure, let alone a quantitative one. While the correlation between the scale and the essay method was strong, it was not 1.0. Therefore, it is concluded that the scale created was not an exact measure of integrative complexity, but rather a measure that seems to reflect and correlate well with the results obtained from traditional integrative complexity methods, suggesting that the scale captures a cognitive component of complex thinking.

Reliability

An appropriate question would be whether subsequent uses of the scale would generate the same or similar results. With the pretest of the scale there was only one test, so reliability analysis is somewhat limited. However, complex thinking about two separate strategies were tested and results of both correlated well with traditional methods. This supports the scale's potential use and adaptability to other natural resource issues.

Strengths in Integrative Complexity Scale

There are a number of benefits to the fixed-item scale for measuring integrative complexity. First, the scale is easier to use than the traditional methods of essay writing and essay scoring which taxes both the respondent and researchers alike. It is simple to fill out, and less time consuming to score.

Second, the scale has power in terms of its open-ended format as opposed to other closed-item scale construction methods. By being open-ended it avoids potential short

falls that other scales experience. Fixed-item scales may lose relevance over time as important aspects of specific issues change. The open-ended format, at least in part, overcomes the issue of lack of salience. For example, fixed-item scales often represent researcher-generated items. This scale always yields respondent-generated items, improving the salience of the items. With regard to the open-ended nature of the scale, it can be used on any number of topics with little alteration.

Lastly, the quantifiable nature of the scale, combined with the previous benefits, can enhance its use in the construction of broader social psychological models of value, attitude and behavior.

In developing the integrative complexity scale, we have attempted to capture the subjectivity of individual thought process and allow it to be revealed and analyzed. The open-ended nature lends itself to more individualistic expression of thought, as well as the flexibility to be used with other topics besides wildfire. The scale is an attempt to simplify and more directly measure an individual's integrative complexity about an issue. Thus, by evading some of the limitations of traditional measurements (e.g., being adaptable to other issues, more simplistic to use, and maintaining some qualitative aspects), it may prove to be a more lucid measure than what has been used thus far.

Application of Results of the Integrative Complexity Scale

Information about the integrative complexity with which a public views an issue can be used to inform managers about how people think about natural resource issues, in this case wildfire management. The results will help managers understand how their actions will be received by the public. One very difficult challenge that managers face is the

balance between resource decisions (i.e., those decisions that are made based on ecological integrity of the resource) and public preferences (i.e., what the public would like, that may not consider ecosystem health). Beyond this is the imminent and binding threat of litigation. Legal battles waste much of managers' time, money, energy and concern. The results of this study aim to provide information about the public constituency which can be used by managers to make more informed decisions.

Specifically, scores on the scale may be used to distinguish levels of differentiation and integration among individuals regarding wildfire in forested areas, and to help guide management campaign delivery. For example, if over 90% of the respondents differentiate between the advantages and disadvantages of prescribed fire and mechanical thinning, and also identify integrative relationships, then managers would be urged to acknowledge this in their management plan and delivery of information to their stakeholders. However, if it is identified that respondents' hold low levels of differentiation and integration about a topic, then managers may find that management plans will be more widely accepted if they consider these lower levels of integrative complexity while enforcing their policy and sharing information.

Beyond this, integrative complexity may be used as a tool to analyze how policy decision-makers (or agency managers) make decisions, similar to traditional uses. Essentially to investigate at what levels of integrative complexity our policy makers are functioning. This would shed light on how much consideration policy makers are giving to multiple sides of controversial issues such as natural resources management.

Future Research Considerations

Future research should continue to utilize the scale on this or other topics to better address reliability concerns. Systematic and unsystematic variance will play a role in the reliability of this measure. Systematic variance such as time allotment for completion, interest in the topic, and prior knowledge will all add consistent variation to the score. Unsystematic variation such as misunderstanding the question or haste in response, will be potential sources of this type of variation that will reduce reliability and should be addressed. Results of traditional measures of integrative complexity should continue to be compared with those of the new scalar measure.

It would also be beneficial to further investigate how this construct fits into the social psychological models of values, attitudes, and behaviors, as well as motivations, preferences, persuasion and norms. Future research utilizing this scale will facilitate a better understanding of these relationships in a more straightforward and efficient fashion.

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III. THE IMPACT OF VALUES ON ATTITUDES TOWARD WILDFIRE MANAGEMENT: THE MODERATING EFFECTS OF COMPLEX THINKING

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ABSTRACT

This paper applies a previously developed and tested scale for integrative complexity in a study of people's perceptions of wildfire management techniques. It explores the relationship between value-laden basic beliefs and attitudes, and integrative complexity's role as a moderator between them. The data come from residents along the front range of Colorado, Chicago metro area, and southern Illinois. Though the scale produced was designed to test perceptions of wildfire management techniques such as prescribed fire

and mechanical thinning, the utility in the scale remains in its ability to be applied to any number of natural resource issues.

INTRODUCTION

Fire is a natural element of forest ecosystems. It provides essential functions such as regeneration of vegetation, forest reproduction, elimination of disease and insect threats, and improvements of wildlife habitat. Fire is also vital for the reduction of fuels. These are important benefits, though there are also costs associated with wildland fire such as threats to private property in the wildland-uban interface, natural resource harvests, air quality, and scenic beauty. This trade-off between wildland fire benefits and costs complicates the issue of its management and leads to differences in public beliefs toward fire management techniques.

Current Wildfire Management

Over a century of fire suppression by federal land management agencies has led to fuels overload, and consequently severe wildfire conditions exist in many parts of the U.S. (Pyne, 2001). The major fire events within the past decade have been particularly costly and threatening to human lives (Pyne, 2001). Land management agencies realize that fuel reduction is necessary, and suggest some burning or mechanical thinning to help put these natural areas at a lower risk of a highly destructive conflagration, and to increase chances of attaining a more sustainable fire regime (Pine Forest Management, 2003).

Response to the historical strategy of strict fire suppression has included two common management actions designed to reduce fuels in the forest; prescribed burning and mechanical thinning. *Prescribed burning* is defined as fire applied to a specific land area under selected weather conditions to accomplish predetermined, well-defined management objectives (Pine Forest Management, 2003). When used properly it has been both effective at achieving its objectives and economically feasible. Some risks associated with improper implementation of prescribed fire are loss of property and life, liability issues, poor air quality, increased water runoff, and a temporary decrease in aesthetic value.

Mechanical thinning reduces the amount of vegetation in the forest by physically removing selected trees and plants with the intention of decreasing the likelihood of large, uncontrollable fires. It often involves professionals entering the forest with heavy equipment (e.g., bulldozers) and/or light equipment (e.g., chainsaws) and cutting trees based upon a predetermined spacing or pattern technique (Mechanical Thinning, 2003). Management agencies view mechanical thinning as a viable option along with prescribed fire techniques for removal of fuels and reduction of wildfire potential. Some associated impacts of mechanical thinning are landscape alteration and initial root stability reduction due to the presence of heavy equipment, and susceptibility to competitive weed growth. Although these management strategies are designed, in part, to decrease the danger of wildfire in forests, the mere occurrence of fire and/or presence of mechanical thinning equipment can impact humans and natural resources. Human lives, private property, wildlife and its habitat, plants, trees, outdoor recreation areas and scenic beauty can all be affected both positively (e.g., preserving the natural forest regime) and negatively (e.g.,

control burns going awry, temporarily scarring the landscape) by these wildfire management techniques. This poses challenges to gaining public support and acceptance of fire management techniques (Kneeshaw, Vaske, Bright, and Absher, 2004), which is imperative to implement successful fire management programs (Shelby & Speaker, 1990).

Identifying Public Perceptions of Wildland Fire Management

Dangers associated with prescribed fires going awry and the negative impacts of heavy machinery and road building that accompanies mechanical thinning has troubled some communities and groups with interests in forested areas. As a result, public perceptions of fire management have become an important consideration for agencies charged with managing areas susceptible to wildland fires (Clute, 2000). Understanding the public's perceptions of wildfire management can (a) help agencies recognize when policies might be supported by the public, (b) alert agencies when policies may run into public opposition, and (c) help agencies develop information to garner support for potentially controversial strategies. With public support, the agency can manage more efficiently, spending time and money on the resource, as opposed to legal battles and futile policy adjustments.

Past Research about Public Perceptions of Wildfire Management

Research conducted since the 1970's has suggested that public perceptions of wildfire management have gradually evolved. On one hand the public acknowledges that some burning is important, but their perceptions are also products of long-standing fire

suppression campaigns and policies. For example, Stankey (1976) showed that people with greater knowledge about fire and its role in forest ecology were more likely to support less fire suppression activity. This was a notable, though slight, change in public perceptions from the heavy suppression beliefs that had resulted from years of fire suppression messaging by the Forest Service (Stankey, 1976).

Folkman (1979) found that 75% of respondents agreed that naturally ignited fires should *not* be allowed to burn even if they did not endanger human life or property. Ironically, over half the respondents also agreed that occasional fires were an important part of ecosystem renewal. Rauw (1980) revealed that 70% of the visitors to Olympic National Park could define the practice of prescribed burning and also understood the beneficial effects of fire, yet almost 65% of these same respondents wanted fires controlled at all costs. These studies suggest that while a large part of the public recognized the role of fire in ecosystems, a significant portion of them also saw fire as primarily a negative occurrence.

By the early 1980's, public recognition of and support for prescribed burning increased. Zwolinski, Cortner, Carpenter, and Taylor (1982) found that 84% of respondents had heard of prescribed burning, and also that 80% of those who had heard about the practice supported its use. Patton and Oliver (1985) found that not a single visitor to the Frank Church River of No Return Wilderness preferred suppression-only wildland fire policy, and McCool and Stankey (1986) determined 70% of respondents supported the let burn policy in wilderness areas.

The 1980's also brought research that focused on influencing public perceptions of wildland fire management. Taylor and Daniel (1984) indicated that education efforts

about aesthetic impacts can increase public acceptance of particular fire management strategies. Shelby & Speaker (1990) found that among other factors, it was the success of prescribed burning campaigns which contributed to the public's acceptance of prescribed burning.

Manfredo, Fishbein, Haas, and Watson (1990) expanded the research on perceptions of wildland fire management by not only exploring the public's attitudes toward these techniques, but also beliefs underlying these attitudes. They measured attitudes toward prescribed fire policy, and individual beliefs about the outcome of the policy. Shortly after the Yellowstone fires of 1988, they found that residents of the western regions were more likely to support prescribed fire (55% support versus 41% oppose) while support/opposition was more evenly distributed (48% support versus 45% oppose) nationally. Furthermore, they found that an individual's attitudes toward prescribed burns were influenced by their beliefs about the outcomes of prescribed burns. The researchers concluded that influencing a public's beliefs about fire will likely alter their attitudes toward fire, and ultimately their acceptance of management practices regarding this issue.

Loomis, Blair, and Armando-Caban (2001) and Shindler and Toman (2003) also identified specific beliefs to generate attitude measures regarding wildfire management techniques. Loomis et al. (2001) indicated that an introduction of educational information increased individual's knowledge and also their tolerance of the use of prescribed fire as a wildfire management tool.

In a panel research study, Shindler and Toman (2003) used specific belief measures (e.g., "the use of fuel treatments in the Blue Mountains is unnecessary and

should not be utilized") to examine support for prescribed burning and mechanical thinning. They found that over the four-year period between 1996 and 2000, support for these activities in the Blue Mountains remained relatively constant. It is clear that the public's beliefs about wildland fire management are a key element to understanding and perhaps influencing their acceptance of fire management strategies.

Limitations of Current Attitude and Belief Research Regarding Fire Management

Two weaknesses are indicated in previous research on perceptions of wildland fire management. The first weakness is a lack of a theoretical framework (Manfredo et al., 1990; Bright, Newman, and Carroll (in review). Most of the research has focused primarily on simply identifying attitudes and beliefs regarding wildland fire management without exploring the theoretical relationships among knowledge, beliefs, attitudes, and values toward these strategies, though there are exceptions (e.g., Kneeshaw, Vaske, Bright & Absher, 2004). This link is important and necessary to further explore the public perceptions of wildfire management.

The second weakness is that the exploration of beliefs has been limited. According to some researchers (Bright and Barro, 2000; Burtz, unpublished dissertation) it is insufficient to merely uncover what attitudes are relevant to wildfire and its management, but necessary to understand *how* people are thinking about the issues surrounding wildfire management. Looking more thoroughly into beliefs, it is noted that beliefs have a certain level of complexity, which contributes to *how* individuals are thinking about an issue. One way of thinking about this pattern of thought is through the

concept of integrative complexity (Tetlock, 1989). Integrative complexity may provide essential additional information about beliefs to fulfill these research needs.

Defining Integrative Complexity

Integrative complexity is defined as a protocol for measuring the complex way that people think about issues, and is based on the number of aspects of a problem people consider (Tetlock, 1989). The primary focus of integrative complexity is the structure of thought that a person has about a particular issue, as opposed to the specific content of that thought (Bright & Barro, 2000).

Two factors that are measured in integrative complexity are *differentiation* and *integration*. Differentiation focuses on whether a person acknowledges that there are more than one side or dimension to an issue or problem (Bright & Barro, 2000; Tetlock, 1989). Someone who sees only one side of an issue exhibits low differentiation on that subject, whereas one who sees two dimensions to an issue (i.e., accepts two alternate sides to a topic) shows higher differentiation, and someone who sees several dimensions exhibits even higher differentiation (Bright & Barro, 2000; Tetlock, 1989). High differentiation is indicated by an equal, or balanced, recognition of arguments on both sides of an issue.

Integration "refers to the development of complex connections among the differentiated characteristics" (Bright & Barro, 2000; Tetlock, 1989). It is the recognition of interrelations among the different perspectives or dimensions that were acknowledged in the differentiation stage of measurement (Wallbaum, 1993). While differentiation is necessary for integration, it is not sufficient for its existence (Bright & Barro, 2000).

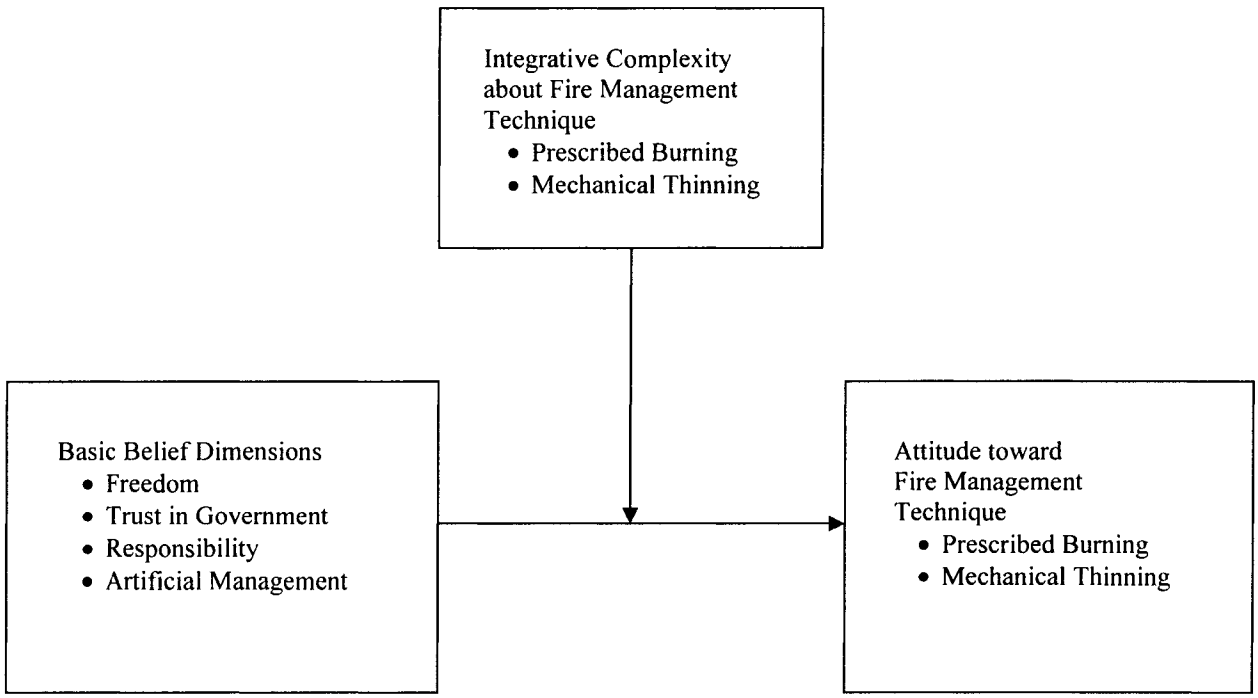
This study addressed the two primary limitations in previous research on public perceptions of wildland fire management. First, it addressed the limited theoretical basis of previous research by examining perceptions of wildland fire management within a value-attitude theoretical framework. Second, it addressed the limited way that beliefs have been previously explored by examining the moderating effects of complexity of people's beliefs about wildland fire management on value-attitude relationships.

The traditional measurement of integrative complexity involved subjective evaluation of essays by a number of raters. While integrative complexity measured in this way has been shown to have many important uses (Bright and Barro, 2000) it can be a lengthy, time consuming, and labor intensive process. This study utilized the fixed-item based method of measuring integrative complexity toward wildland fire management techniques developed in Carroll (previous chapter of this document).

CONCEPTUAL FRAMEWORK

The conceptual framework for this study is based on the value-attitude cognitive hierarchy (Homer & Kahle, 1986), and predicts an additional moderating effect on the value-attitude relationship by complexity of thought. In this model (Figure 1), basic value-laden beliefs toward wildfire management are predicted to influence a person's attitudes toward specific wildland fire management techniques, though moderated by the level of integrative complexity they have about these strategies. This implies that the strength of the value-attitude relationship will depend on the level of integrative complexity an individual exhibits about fire management.

Figure 1. Conceptual model of basic beliefs, integrative complexity, and attitudes toward fire treatments



Cognitive Hierarchy

The cognitive hierarchy has been used in many social science natural resource contexts such as determining and measuring wildlife values (Fulton, Manfredo, & Lipscomb, 1996), and predicting wildland preservation voting intentions (Vaske & Donnelly, 1999). It suggests that values are a precursor of attitudes (e.g., Fulton et al., 1996; Vaske & Donnelly, 1999). A *value* can be defined as "an enduring belief that a specific mode of conduct is personally or socially preferable to an opposite or converse mode of conduct or end state of existence" (Rokeach, 1973). Values guide our perception of what we believe to be true about the world around us, and are the basis of attitudes and behaviors.

However, fundamental values are ineffective predictors of behavior because there are too few in number, and they tend to remain consistent within a culture (Fulton et al., 1996).

Closely related to fundamental values are *basic beliefs*. They are value-laden beliefs that people hold about a particular issue or object. Basic beliefs represent the application of more fundamental values to specific issues and are presumed to be more predictive of attitudes than fundamental values (Fulton et al., 1996). An *attitude* is defined as a mental state or cognitive tendency that must refer to some object (Eagly & Chaiken, 1993; Vaske & Donnelly, 1999). An attitude represents a consistent cognitive tendency to respond either favorably or unfavorably toward the object or behavior in question and is typically measured as a positive or negative evaluation of such (Vaske & Donnelly, 1999).

Integrative complexity has been found to be related to both values and attitudes. First, higher levels of integrative complexity have been shown to be related to greater inclusion of broad fundamental values in guiding one's thought about an issue (Tetlock, 1989). Second, the extremity of an attitude has been connected with the level of complex thought an individual has about an issue. For example, de Vries and Walker (1987) found that moderate attitudes toward capital punishment were accompanied by higher integrative complexity of thought about the issue than were extreme attitudes. In the natural resources field, Bright and Barro (2000) found that moderate attitudes toward the Endangered Species Act were characterized by high levels of integrative complexity regarding the act. Both researchers noted that it is not the attitude direction, but the *extremity* (i.e., the extremity with which one holds a particular attitude) that has a measurable and predictable relationship with integrative complexity.

Because of these relationships with values and attitudes, it follows that the level of integrative complexity someone exhibits will influence the relationship between value-laden basic beliefs and attitudes; that is, that integrative complexity may moderate the relationship between values and attitudes.

Goals and Objectives

The goal of this study was to examine the effect of complexity of thinking on value-laden basic beliefs and attitudes toward wildland fire management.

In order to achieve this goal, specific objectives were identified.

Objective 1 To determine if the level of respondents' integrative complexity about both prescribed burning and mechanical thinning were related to their basic beliefs about wildland fire management.

Objective 2 To determine if respondents with positive attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than respondents with negative attitudes toward prescribed burning and mechanical thinning.

Objective 3 To determine if respondents with extreme attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than respondents with moderate attitudes toward prescribed burning and mechanical thinning.

Objective 4 To determine if the relationships between value-laden basic beliefs about wildland fire management and attitudes toward prescribed burning and mechanical thinning were moderated by the level of integrative complexity.

METHODS

Sampling and Administration

To obtain a broad level of respondents with varying experience and potential knowledge of wildfire issues, a random sample was drawn from three areas: residents who live close to forested areas that had experienced frequent wildfire (Front Range, CO), residents who live close to forested areas but had experienced relatively little wildfire (southern Illinois), and residents of an urban area who do not live near a wildland/urban interface (Chicago, IL). 3000 names and addresses (1000 from each area) were generated randomly from Survey Sampling, Inc.

The administration of the questionnaire used a modified Dillman approach (Dillman, 2000). First, introductory postcards (Appendix B) alerted potential respondents that there would be a questionnaire arriving shortly. Seven days later, the questionnaires (Appendix C) were sent out to each household, and included an introductory letter (Appendix D), and a postage paid return envelope. Ten days later, a postcard reminder (Appendix E) was sent to thank those who had returned a questionnaire and remind those who hadn't to please do so. Approximately two weeks later, a final mailing of the questionnaire and another letter (Appendix F) was sent to households who had not responded.

A non-response test was conducted by sending a shortened 2-page version of the questionnaire (Appendix G) to a random sample of 250 households that failed to respond to the first questionnaire. This non-response questionnaire was limited to measures of attitude toward prescribed burning and mechanical thinning (3 questions each) and demographics. The purpose of the non-response test was to determine if there were

systematic differences in perceptions of fire management between respondents and nonrespondents. A short letter (Appendix G) accompanied this mailing, which informed participants that although they may not have been able to complete the larger questionnaire, their responses to these six short items would be helpful to this research effort.

Measurement of Factors

Items measuring basic beliefs about wildland fire management were designed to reflect value-laden perceptions related to *Freedom* to build in the wildland urban interface, *Responsibility* of agencies/homeowners, *Trust* in agency, and tenability of *Artificial Manipulation* in forests. These items were adapted from a previous study that investigated the public's basic beliefs about wildfire and management techniques (Bright, Vaske, Kneeshaw, & Absher, 2004), and have been applied in a number of other studies on wildland fire management (Bright, Newman, & Carroll, in review; Kneeshaw, Vaske, Bright & Absher, 2004).

Basic belief items were measured using a 7-point scale ranging from 1-"strongly disagree" to 7-"strongly agree". Indices for the basic belief dimensions were created from the items pending adequate reliability.

Integrative complexity about prescribed fire and mechanical thinning was measured with the scale developed by Carroll (chapter 2 of this document). This scale was designed to reflect both aspects of integrative complexity, differentiation and integration. First, for differentiation, respondents wrote down arguments both "for" and "against" prescribed fire and mechanical thinning. Next, respondents indicated the

strengths of each argument on a 7-point scale ranging from 1 "extremely weak" to 7 "extremely strong".

Differentiation was measured separately for each management action. For each strategy the lesser of the total number of arguments "for" and "against", was divided by the larger of the two to arrive at a differentiation score between 0 and 1. A score of 0 reflected no differentiation, while a score of 1 reflected the highest differentiation.

An integration score was calculated similar to differentiation. First, the mean strength of arguments "for" and "against" each management strategy, respectively, was calculated. As with differentiation, the lower mean was divided by the higher mean to arrive at an integration score between 0 and 1. The lowest level of integration, approaching 0, occurs where there is a large difference in the perceived strength of arguments for and against. The highest integration score, 1, reflects the situation where there is no difference in the perceived strengths of pro and con arguments.

Integrative complexity was measured as the product of the differentiation and the integration scores. This combination of both of the components of integrative complexity (i.e., differentiation and integration) allowed their relative weights to be expressed in the analysis. This calculation would again yield a value between zero and one. For a complete description see Carroll (chapter 2 of this document).

Attitudes toward *each* management strategy were measured using three different items on a 7-point scale. Respondents were asked if they thought prescribed burning and mechanical thinning were extremely/moderately/slightly foolish or wise, ineffective or effective, and harmful or beneficial. Attitude toward each management strategy was the mean of the three items, pending adequate reliability.

Analysis Procedures

Objective 1 of the study was to determine if the level of a respondent's integrative complexity about prescribed burning and mechanical thinning was related to their value-laden basic beliefs. Pearson correlations examined the relationship between integrative complexity and each basic belief index of *freedom, trust in government, responsibility,* and *artificial manipulation.*

Objective 2 of the study was to determine if respondents with positive attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than respondents with negative attitudes toward prescribed burning and mechanical thinning. Both attitude indices were split into two groups. One group represented those with positive attitudes (mean >= 4), while the other group represented those with negative attitudes (mean < 4). Independent samples t-tests compared the level of integrative complexity between respondents with positive versus negative attitudes toward both prescribed burning and mechanical thinning.

Objective 3 was to determine if respondents with extreme attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than respondents with moderate attitudes toward prescribed burning and mechanical thinning. Respondents with an attitude score greater than 6 or less than 2 were placed in the extreme attitude groups. Those with scores between 2 and 6 were placed in the moderate group. Independent samples t-tests compared the level of integrative complexity between respondents with extreme versus moderate attitudes toward both prescribed burning and mechanical thinning.

Objective 4 was to determine the moderating effects of integrative complexity on the relationships between each of the value-laden basic belief dimensions and attitudes toward prescribed burning and mechanical thinning. Using moderation analysis (Baron & Kenny, 1986) two regressions were run for each of the four basic belief indices separately. First, attitude toward prescribed burning and mechanical thinning, respectively, were regressed on two independent variables; a basic belief dimension and the relevant integrative complexity score.

The second regression added an interaction term for the basic belief dimension and integrative complexity to the regression equation. The basic belief-integrative complexity interaction term was computed as the product of the two independent variables. If, in the second regression, the interaction term is significant, moderation is deemed to occur. If the betas for the main effects of the independent variable change, this lends additional support for moderation. This framework resulted in eight sets of analyses for moderation. Table 4 describes the independent variable and the dependent variable for the two regressions for each of the eight analyses.

Table 4. Moderation analysis framework of integrative complexity (IC) on basic belief dimension-attitude relationship

	Regression 1	Regression 2
Dependent Variables	Independent Variables	Independent Variables
Attitude Toward Prescribed Burning		
Analysis 1:	Freedom IC	Freedom IC Freedom * IC
Analysis 2:	Responsibility IC	Responsibility IC Responsibility * IC
Analysis 3:	Trust IC	Trust IC Trust * IC
Analysis 4:	Artificial manipulation IC	Artificial manipulation IC Artificial manipulation * IC
Attitude Toward Mechanical thinning		
Analysis 5:	Freedom IC	Freedom IC Freedom * IC
Analysis 6:	Responsibility IC	Responsibility IC Responsibility * IC
Analysis 7:	Trust IC	Trust IC Trust * IC
Analysis 8:	Artificial manipulation IC	Artificial manipulation IC Artificial manipulation * IC

For those analyses that showed moderation, additional regressions were run in order to determine the nature of the moderation. First, a high integrative complexity (integrative complexity > .5) and a low integrative complexity (integrative complexity <=

.5) groups were created. Second, attitude toward prescribed burning or mechanical thinning was regressed on the relevant basic belief dimensions for each integrative complexity group. The R^2 and beta coefficients were then examined separately for each integrative complexity group to provide descriptive information about the nature of the moderation.

RESULTS

Of the 3000 questionnaires sent, 2500 were deliverable, and 468 were returned, for a response rate of 19%. The non-response analysis of attitude toward mechanical thinning showed no significant differences between respondent and non-respondents (5.11 vs. 5.17, $t = .42$, $p = .672$). On the other hand, respondents had a slightly more positive attitude toward prescribed burning than did non-respondents (5.4 vs. 5.15, $t = 2.04$, $p = .042$). however, the difference is non-directional (both positive) and appears relatively un-substantive. Since the goal of this paper was to test the theoretical relationships between cognitions rather than generalize to a population, this small difference was considered to be of little relevance to the study.

Reliability of Study Indices

The basic belief indices were constructed using the items developed and validated in previous research (Kneeshaw, Vaske, Bright, and Absher, 2004). All basic belief indices had a Cronbach's alpha >= .72, supporting their use in further analyses (Nunnally & Bernstein, 1994), (Table 5).

Table 5. Internal consistency reliability of basic belief dimension reliability analysis

Index	Item Total Correlation	Alpha if Item Deleted	Cronbach Alpha	n
Freedom			.84	450
• People should be free to build homes near National Forests if they want to	.66	.80		
• People should be allowed to build homes where they want, even if it is in a high fire zone	.68	.80		
• People should not be allowed to build homes near forest where the homes could be destroyed by fire*	.73	.79		
• The government should pass laws that require private land owners near forests to take steps necessary to protect their homes from forest fire*	.43	.87		
• Private land owners should have the right to choose for themselves if they want to take steps to protect their home from forest fire	.77	.78		
Trust in Government			.87	446
• Government land management agencies do a good job managing fire in forests	.65	.85		
• Government land management agencies (e.g., US Forest Service) do a good job managing National Forests	.71	.84		
• I trust that government land management agencies know best when planning prescribed burns in the forest	.65	.86		
• I trust that government land management agencies like the US Forest Service know best when it comes to mechanically thinning a forest	.72	.84		
• I trust that government land management agencies like the US Forest Service know best when it comes to managing forests	.73	.84		
• Government land management agencies like the US Forest Service are not doing a good job managing fire in forests*	.58	.87		
Responsibility			.76	451
• People who build homes near a fire-prone National Forest have the primary responsibility for protecting their home from forest fire	.46	.74		
• When people build homes near forests, it is their own fault if their homes are damaged by fire	.47	.74		
• When people build homes near forests, they should accept that they might suffer property losses due to a forest fire	.39	.69		
• When people build homes near forests, the government has the primary responsibility to make sure private homes are protected from forest fire	.62	.75		
• If a fire breaks out in a forest, the agency managing that forest is primarily responsible for making sure that private property is not destroyed	.45	.75		
• When people build homes near forests, they have the right to expect that their home will be protected from a forest fire by the government agency that manages that forest	.66	.68		

Artificial manipulation			.72	450
• Forest managers should actively manipulate forest conditions to decrease the chance of a fire	.47	.68		
• Forest managers have every right to actively manage, or manipulate the conditions of a forest in order to decrease the likelihood of a forest fire	.53	.64		
• We should just leave forests alone instead of trying to manipulate them*	.50	.66		
• Forest managers should not use artificial measures (e.g., prescribed burning and mechanical thinning) to decrease the chance of a fire in a forest	.53	.65		

* Indicates items that were reverse coded

The reliability analyses for the attitude indices were strong. The Cronbach's alphas were .89 and .91 for prescribed burning and mechanical thinning respectively.

Value-laden Basic Beliefs and Integrative Complexity

Objective 1 was to determine if the level of a respondent's integrative complexity about prescribed burning and mechanical thinning was related to their basic beliefs. None of the Pearson's correlations were significant in the analyses between basic belief dimensions and integrative complexity (Table 6.). This suggests that there is little or no relationship between value-laden basic beliefs about wildland fire issues and the complexity of thought about fire management strategies.

Table 6. Relationship between integrative complexity and basic belief dimensions: Pearson's correlations

Basic Belief Dimension	Integrative Complexity Toward Mechanical Thinning	Integrative Complexity Toward Prescribed Burning
Freedom	.002 (.973)*	.056 (.409)
Trust in government	.044 (.397)	-.003 (.969)
Responsibility	-.047 (.371)	-.095 (.165)
Artificial manipulation	-.077 (.138)	.02 (.767)

*Numbers in parentheses are the significance level of that correlation

Integrative Complexity and Attitude Direction

Objective 2 was to determine if respondents with positive attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than respondents with negative attitudes toward prescribed burning and mechanical thinning. In past research, attitude *direction* was found to be independent of integrative complexity (e.g., Bright and Barro, 2000; de Vries & Walker, 1987), and in this study, results were mixed.

Independent samples t-tests compared the mean integrative complexity score of persons with positive and negative attitudes toward each management action. For prescribed burning, individuals with positive attitudes toward the fire management practice showed significantly higher integrative complexity toward prescribed burning than those with negative attitudes toward prescribed burning (Table 7). However, for mechanical thinning, there were no significant differences in integrative complexity between those with positive and negative attitudes.

Table 7. Comparison of integrative complexity (IC) between positive and negative attitude groups: independent samples T-tests

Attitude Direction Group	n	Mean IC	Standard Deviation	t-value	p-value
Prescribed Burning					
Positive Attitude	166	.46	.40	3.22	$p < .01$
Negative Attitude	34	.25	.34		
Mechanical Thinning					
Positive Attitude	283	.44	.32	.90	$p = .37$
Negative Attitude	67	.47	.32		

Integrative Complexity and Attitude Extremity

Objective 3 was to determine if respondents with extreme attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than respondents with moderate attitudes toward prescribed burning and mechanical thinning. Past research has shown high integrative complexity to be related to moderate attitudes, while lower levels of integrative complexity were related to more extreme attitudes (Bright and Barro, 2000; de Vries & Walker, 1987). Independent samples t-tests compared the mean integrative complexity score between respondents with moderate and extreme attitudes toward prescribed burning and mechanical thinning (Table 8).

For *prescribed burning,* respondents with moderate attitudes showed significantly higher levels of integrative complexity than those with extreme attitudes. Similarly, respondents with moderate attitudes toward *mechanical thinning* showed significantly higher integrative complexity toward mechanical thinning than those with extreme attitudes.

Table 8. Comparisons of integrative complexity between extreme and moderate attitude groups: Independent samples t-tests

Attitude Extremity Group	n	Mean IC	Standard Deviation	t-value	p-value
Prescribed Burning					
Moderate Attitude	116	.49	.37	2.00	.05
Extreme Attitude	100	.38	.42		
Mechanical Thinning					
Moderate Attitude	188	.54	.28	5.88	.007
Extreme Attitude	178	.36	.32		

Moderating effects of integrative complexity on basic belief-attitude relationship

Objective 4 was to determine the moderating effects of complex thinking on the relationships between value-laden basic beliefs and attitudes toward prescribed burning and mechanical thinning. Two regressions were conducted for each value-laden basic belief and attitude toward a management strategy, resulting in eight separate analyses.

Regression one for each analysis examined only the main effects of the basic belief dimension and integrative complexity on attitude toward a management strategy. Regression two of each analysis added an interaction term computed as the product of integrative complexity and the basic belief dimension scores. Moderation was deemed to have occurred if in the second regression, the interaction term was significant. Of the eight analyses, moderation occurred in four cases, three for prescribed burning and one for mechanical thinning (Table 9).

For *prescribed burning*, the basic belief indices of "freedom", "trust in government", and "artificial manipulation" showed a significant ($p < .05$) basic belief by

integrative complexity interaction. This fulfilled the criteria for moderation, and indicates that integrative complexity functions as a moderator for the basic belief-attitude relationship for these dimensions. The relationship between the basic belief dimension "responsibility" and attitude toward prescribed burning was not moderated by integrative complexity.

For *mechanical thinning*, the basic belief dimension of "artificial manipulation" showed a significant ($p < .05$) basic belief by integrative complexity interaction. This fulfilled the moderation criteria, suggesting that the level of integrative complexity influenced the basic belief-attitude relationship for this dimension. Moderation did not occur for the basic belief dimensions of "freedom", "trust in government", and "responsibility".

Table 9. Regression analyses for the moderating effects of integrative complexity (IC) on the basic belief-attitude relationship

Independent Variables	Dependent Variables in Regression			
	Attitude: Prescribed Burning		Attitude: Mechanical Thinning	
	Regression 1	Regression 2	Regression 1	Regression 2
Freedom	.08	-.17	.04	.023
Integrative Complexity	.08	-.46*	-.15*	-.17
Freedom*IC		.65*		.025
R^2	.013	.052	.024	.024
Trust in government	.38*	.56*	.25*	.24*
Integrative Complexity	.09	.92*	-.16*	-.22
Trust in government*IC		-.88*		.06
R^2	.143	.195	.086	.078
Responsibility	-.029	-.08	.003	-.04
Integrative Complexity	.08	-.17	-.15*	-.30
Responsibility*IC		.025		.15
R^2	.008	.024	.023	.023
Artificial manipulation	.36*	.47*	.52*	.64*
Integrative Complexity	.08	.59*	-.11*	.29
Artificial manipulation*IC		-.54*		-.42*
R^2	.135	.152	.294	.303

*indicates significance at $p<.05$

Note: None of the independent variables showed a Pearson's correlation > .095, therefore multi-colinearity issues were of no concern for these analyses

To examine the nature of the moderating effects of integrative complexity, respondents were placed in either a high or low integrative complexity group for each management action, respectively. Attitude toward prescribed burning and mechanical thinning were then regressed on each basic belief dimension identified previously as a moderator. For each management strategy, the relationship between basic belief and attitude were explored for both the high and low integrative complexity groups.

Artificial manipulation and trust in government explained 23.0 percent (beta = .48) and 17.2 percent (beta = .42) of the variance in attitude toward prescribed burning for the low integrative complexity group, respectively (Table 10). On the other hand, only 1.4% percent (beta = .12) and 4.5 percent (beta = .21) of the variance was explained by artificial management and trust in government, respectively, for high integrative complexity group. Freedom explained 11.8 percent (beta = .34) of the variance in attitude toward prescribed burning for the high integrative complexity group but only 3 percent (b = -.06) for the low integrative complexity group. Also, artificial manipulation explained 35.3 percent (b = .59) of the variance in attitude toward mechanical thinning for the low integrative complexity group, and 14.5 percent (b = .38) for the high integrative complexity group.

Table 10. Comparison of high and low integrative complexity on basic belief-attitude relationship

	Integrative Complexity Group			
	Low		High	
Basic Belief Dimension	R^2	B	R^2	B
Prescribed Burning				
Freedom	3%	-.06	11.8%	.34*
Trust in government	23%	.48*	1.4%	.12
Artificial manipulation	17.2%	.42*	4.5%	.21*
Mechanical Thinning				
Artificial manipulation	35.3%	.59*	14.5%	.38*

*indicates significance at $p<.05$

DISCUSSION

The purpose of this study was to examine the impact of integrative complexity on value-laden basic beliefs and attitudes toward wildland fire management. Specifically, we examined how integrative complexity was related to basic beliefs, attitudes, and the basic belief-attitude relationship.

Integrative Complexity and Basic Beliefs

Past researchers failed to support their hypotheses that a relationship existed between value orientations (i.e., patterns of basic beliefs) and integrative complexity (e.g., Bright

& Barro, 2000). Similarly, this study yielded little or no support for a relationship between integrative complexity and basic beliefs.

Values, and to an extent the beliefs that orient these values, begin forming early in an individual's life. On the other hand, cognitive style is most likely developed later (Hashway, 1998). That integrative complexity and basic beliefs were not correlated, at least in conjunction with a limited number of issues, makes sense. Given the specific, and often situational nature of prescribed burning and mechanical thinning in people's lives, it is not surprising that the non-evaluative structure of thought about these issues (measured by integrative complexity) may be affected by factors other than held values.

Integrative Complexity and Attitude Direction

Attitude direction has been shown to be uninfluenced by integrative complexity in past research (e.g., Bright & Barro, 2000; de Vries & Walker, 1987), and this study supported this for mechanical thinning. However, those with positive attitudes towards prescribed burning had significantly higher levels of integrative complexity. The significance for those with positive attitudes towards prescribed burning may be attributable to the strong safety concerns that often accompany prescribed burning campaigns and the ability of these fears to override rational and logical thought (Daniel, Meitner, and Weidemann, 1997). Since negative attitudes towards prescribed burning may be likely associated with human fear of burns gone awry, concerns about safety may override other factors influencing attitude toward prescribed burning, limiting the complexity with which these people view the issue (Daniel, Meitner, and Weidemann, 1997). For those with positive

attitudes, it may require recognition of many dimensions of prescribed burning to override the potential negative impacts surrounding safety.

Integrative Complexity and Attitude Extremity

Results regarding the relationship between attitude extremity and integrative complexity supported previous research (e.g., de Vries & Walker, 1987; Linville, 1982; Tetlock, 1989; Bright & Manfredo, 1992). Individuals with the ability to see more than one side to an issue, higher levels of integrative complexity, had more moderate attitudes about the topic. On the other hand, individuals with low integrative complexity view an issue in more "black or white" terms, resulting in more extreme attitudes (Bright & Barro, 2000).

Integrative Complexity as a Moderator

Integrative complexity was a moderator in the relationship between basic beliefs and attitude toward prescribed burning, but offered limited support in the basic belief-attitude toward mechanical thinning analysis. For prescribed burning, integrative complexity functioned as a moderator of the basic belief-attitude relationship for the "freedom", "trust in government" and "artificial manipulation" basic belief dimensions. "Freedom" explained more of the variance in attitude toward prescribed burning for the *high* integrative complexity individuals, while beliefs regarding "trust in government" and "artificial manipulation" explained more of the variance in the *low* integrative complexity group. For mechanical thinning there was evidence of moderation for the "artificial

manipulation" dimension only, and this belief element explained considerably more of the variance in the *low* integrative complexity group.

In general, we found values to be more predictive of attitudes for *low* integrative complexity respondents. This makes intuitive sense because higher levels of integrative complexity lead to the recognition of multiple sides to an issue and the situational nature of issues. This leads to less direct impact by values in assessing appropriate fire management tactics.

Conclusions about the Scale

The results presented here suggest that the newly developed scale for measuring integrative complexity is functioning similarly as the traditional method would on a large-scale study. Consistent with past research (e.g., Bright and Barro, 2000; Bright & Manfredo, 1992; de Vries & Walker, 1987; Linville, 1982; Tetlock, 1989) the newly developed integrative complexity scalar measure showed a systematic relationship with moderate and extreme attitudes. This may provide one more element of validity for this new scale measure.

Theoretical Implications

First, integrative complexity impacts *attitudes* by having an effect on the strength or extremity with which one holds an attitude (e.g., moderate or extreme). Second, integrative complexity has less impact on perceptions of a situation such as the *values* people hold or the *direction* of their attitude (e.g., positive or negative). In this study integrative complexity had no relationship with *basic beliefs*, consistent with past

research, however findings were more mixed in terms of direction of attitude toward prescribed burning, likely due to the ability of fear to override one's capacity to think logically (Daniel, Meitner, and Weidemann, 1997). Finally, integrative complexity has an effect on how basic beliefs and values impact attitudes. Given the prevalence of the use of the cognitive hierarchy in social science investigation, understanding when the relationship between values and attitudes is stronger or weaker can have profound affects on future investigations. Furthermore, for those issues that include individuals with strong bipolar attitudes, the value-attitude relationship may differ among groups in the study population.

Management Implications

From the moderator analysis, it was shown that the basic belief-attitude relationship was stronger for the low integrative complexity groups in both mechanical thinning and prescribed burning. This may indicate that for the portion of the population that looks at an issue with low integrative complexity, a manager can expect more basic belief or emotional responses to management plans, whereas for those with high integrative complexity, a more reasoned and cognition-related response may be generated.

From this, a manager may develop information about management campaigns to different groups of varying levels of integrative complexity. Following an adapted version of a product differentiated model of marketing, a manager could use a *communication-differentiated strategy* (Morrison, 2002) where they would disseminate fire management information that included both arguments that would resonate for high integrative complexity individuals, and those that would succeed for low integrative

complexity individuals. This strategy states that with both types of argument information presented, people would "latch on" to the information that resonated with them. An example would be one component of an information campaign containing an emotional or value-laden measure, while a second component of the campaign contains more educational or informative message that draws on the portion of the audience with higher integrative complexity.

Alternatively, different groups of high and low integrative complexity could be targeted and information sent at appropriate levels of complexity for each group to ensure acceptability of management actions.

Beyond this, integrative complexity may be used as a tool to analyze how policy decision-makers (or agency managers) make decisions, similar to traditional uses. Essentially to investigate at what levels of integrative complexity our policy makers are functioning. This would shed light on how much consideration policy makers are giving to multiple sides of controversial issues such as natural resources management.

Future Research Considerations

What would supplement this study, and this field of research as a whole, would be further examination of the integrative complexity scale and further use in other social science contexts. Other investigations into the moderating effects of integrative complexity on the value-attitude relationship would also prove most useful.

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IV. CONCLUSIONS

The preceding chapters suggest conclusions about public perceptions of wildland fire management, integrative complexity, and their use together in the broader social science context. This chapter will summarize and integrate findings while pointing out methodological, theoretical and managerial implications of this research.

Summary of Findings

The specific objectives of this research were:

- To create a fixed-item scale which will yield integrative complexity scores.
- To measure integrative complexity of thought regarding prescribed burning and mechanical thinning using the traditional essay completion method.
- To measure integrative complexity of prescribed burning and mechanical thinning with the newly developed scale (using the same sample of respondents as the traditional methods test).
- To determine the extent to which the two measures of integrative complexity are correlated.
- To determine if the level of a respondent's integrative complexity about prescribed burning and mechanical thinning was related to their basic beliefs about wildland fire management.
- To determine if respondents with positive attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than

respondents with negative attitudes toward prescribed burning and mechanical thinning.

- To determine if respondents with extreme attitudes toward prescribed burning and mechanical thinning had different levels of integrative complexity than respondents with moderate attitudes toward prescribed burning and mechanical thinning.
- To determine if the relationship between value-laden basic beliefs about wildland fire management and attitudes toward prescribed burning and mechanical thinning was moderated by the level of integrative complexity.

The results reported indicate that an alternative and highly correlated measure of integrative complexity has been developed and supported the scale's use on large studies. The results generated by the scale were similar to what would be expected from traditional measurement methods used in past research (e.g., most respondents with low levels of integrative complexity and very few with high levels). The scale method showed that integrative complexity and basic beliefs were not related, similar to past research (Bright & Barro, 2000). For integrative complexity and attitude direction, which has been shown to be unrelated by past research, there was no relation in the mechanical thinning attitude measure, however, for the positive prescribed burning attitude there was a significant increase in level of integrative complexity. Moderate attitudes are shown by past research to be related to higher levels of integrative complexity, as was the case in this research.

IMPLICATIONS OF FINDINGS

Methodological Implications

The development and validation of a fixed-item measure of integrative complexity has several methodological benefits for researchers and respondents. First, the scale is easier to use than the traditional methods of essay writing and essay scoring because it is simple to fill out, and less time consuming to score.

Second, the scale benefits from its open-ended format by not losing relevance over time as issues change, and overcoming, in part, the issue of lack of salience in researcher-generated items. This scale yields primarily respondent-generated items, ensuring salience of the items. With regard to the open-ended nature of the scale, it can be used on any number of topics with little alteration. Finally, the quantifiable nature of the scale, combined with the previous benefits, can enhance its use in the construction of broader social psychological models of value, attitude and behavior.

The results from chapter three supported the new scale measure as a good correlate to the traditional measurement method. Though some inconsistencies resulted (i.e., significance in attitude direction for those with positive attitudes towards prescribed burning) they may be more attributable to the safety concerns that often accompany prescribed burning campaigns as pointed out earlier in chapter two. Other than this one element, the results support the scale's application in large studies.

Theoretical Implications

This alternate measure of integrative complexity with its straightforward format and ease of scoring allows for greater application of integrative complexity, and exploration of the construct in broader social science contexts. Furthermore, the role of integrative complexity as a moderator between the basic belief-attitude relationship was investigated. For the prescribed burning attitude, the basic belief dimensions of freedom, trust in government, and artificial manipulation showed support for moderation, while for the mechanical thinning attitude, only artificial manipulation showed support for moderation.

Further investigations were conducted on those basic belief elements that showed significant moderation. It was revealed for prescribed burning attitude that for the high integrative complexity individuals, the element of "freedom" was a relatively more important factor in shaping one's attitudes regarding prescribed fire than the other elements. This means high integrative complexity individuals will value their freedoms in a natural resources management context because their views of the issue are characterized by greater knowledge (Bright & Barro, 2000), increased salience and familiarity (Hunsberger, Lea, Pancer, Pratt, and McKenzie, 1992), greater emotionality (Pratt & Hunsberger, 1992), and more importance (Aronson, 1995). On the other hand, individuals with low integrative complexity may choose to forgo freedoms when shaping their attitudes toward a management objective because the issue is viewed with less importance and interest (Suedfeld et al., 1996).

For the prescribed burning attitude, low integrative complexity individuals, "trust in government" and "artificial manipulation" were both important elements, but not for high integrative complexity. This indicates that in shaping prescribed burning attitudes,

both trust in government and artificial manipulation, are important for low integrative complexity respondents. This may result because for those who see the issue as one-sided (i.e., low integrative complexity) their level of trust in the government and faith in artificial manipulation was closely linked to their attitude regarding the wildfire management technique. Contrary to this, someone who sees many sides to the issue (i.e., high integrative complexity) may rely on other elements of cognition or their own increased knowledge and familiarity about the topic to shape their attitudes.

It was also revealed for attitude toward mechanical thinning, that the "artificial manipulation" element explained considerably more of the variance in the *low* integrative complexity group than the high integrative complexity one. This may be a result of low integrative complexity individuals relying more on basic beliefs to shape their attitudes, but high integrative complexity individuals tapping into elements of cognition, and increased knowledge, familiarity, and interest in the topic to shape their attitudes.

For both prescribed burning and mechanical thinning attitude, it was indicated that the basic belief dimension and attitude relationship is stronger for low integrative complexity individuals than the higher integrative complexity respondents. This seems to indicate that the low integrative complexity individuals may rely more on value-laden basic beliefs to guide their attitudes, while the higher integrative complexity individuals are most likely using other elements of cognition and reasoning to form their attitudes.

The analysis here does lend support to the integrative complexity variable taking a role as a moderator for this established basic belief-attitude relationship, though it makes itself more apparent in the prescribed burning model for low integrative complexity individuals. This means that this basic belief-attitude relationship appears to be stronger

for lower integrative complexity individuals. That the predictability of cognitive structure differs on a measurable construct such as integrative complexity could have larger implications for this type of research. Identifying a construct on which the basic belief-attitude relationship differs in strength, gives rise to opportunities to measure differences in this relationship and other factors that may influence it.

Management Implications

Several management implications ensue from this alternative measure of integrative complexity, the ability to utilize the construct more easily, and its ability to be adapted to other natural resource contexts. Integrative complexity should be very useful in management situations where a strong dichotomy between users of the resource exist (e.g., wildfire management, acceptable wilderness uses, treatment of wildlife). This is because when management considers the level of integrative complexity that a particular group has about an issue, they can guide their own delivery and enforcement of their management practices, as well as develop information appropriate to different levels of complex thinking.

It is imperative for natural resource management agencies to garner public support, and devise coordinated messaging techniques. It becomes very important to convey messages properly. Managers need to keep their 'customers' informed (Clute, 2000). Integrative complexity has implications for messaging and framing these messages in appropriate contexts and levels of complexity. For example, it has been shown that when an individual is exposed to information of a higher level of complexity than they typically function, they will revert back in levels of complexity and tune out

more information to better simplify their input (Hunsberger et al., 1992). Integrative complexity attempts to get beyond this stimulus blockage by first assessing at which levels of complexity individuals, either collectively or individually, are functioning, and then to focus information dissemination at or near these levels of complexity to match its audience.

Further research investigated the role of integrative complexity as a moderator between the basic belief-attitude relationship. From the moderator analysis, it was shown that the basic belief-attitude relationship was stronger for the low integrative complexity groups for both mechanical thinning and prescribed burning attitude. This may indicate that for the low integrative complexity groups, a manager can expect responses to management plans guided more by basic belief, whereas for higher integrative complexity groups, a more reasoned and cognition-related response may be generated.

From this, a manager armed with integrative complexity information may communicate information about management campaigns differently to different groups of varying levels of integrative complexity. One informational campaign would be sent with a more emotional or value-laden component driving the reasons for the proposed management technique, the other a more educational or informative message.

Research has also found that higher levels of integrative complexity can be prompted (Hunsberger et al., 1992), and therefore individuals can be "brought up to speed" with others on certain issues. This is important because it could address the issue of a general level of integrative complexity not being actualized among publics. It could address this by raising levels of integrative complexity for those who express lower ones. Furthermore, if we can increase integrative complexity with prompts (e.g., pamphlets,

information, well-suited media), then managers may want to investigate the possibilities of using prompts when making their campaign for management actions to help gain support. In this way, integrative complexity and acceptability of management could inform each other, perhaps with normative evaluation information (Shelby, Vaske, and Donnelly, 1996), and hope to make more defensible and widely accepted management decisions.

Beyond this, integrative complexity may be used as a tool to analyze how policy decision-makers (or agency managers) make decisions, similar to traditional uses. Essentially to investigate at what levels of integrative complexity our policy makers are functioning. This would shed light on how much consideration policy makers are giving to multiple sides of controversial issues such as natural resources management.

Future Research

This research also opens up avenues of future research. Future research endeavors should aim to utilize the scale on this or other topics to better address reliability concerns. Systematic and unsystematic variance will play a role in the reliability of this measure. Systematic variance such as time allotment for completion, interest in the topic, and prior knowledge will all add consistent variation to the score. Unsystematic variation such as misunderstanding the question or haste in response, will be potential sources of this type of variation that will reduce reliability and should be addressed. We should continue to compare results of traditional measures of integrative complexity with the new scalar measure.

It would also be beneficial to further investigate how this construct functions in the social psychological models of values, attitudes, and behaviors. To this end, it would be informative to determine how the construct fits in with other models of social psychology such as motivations, preferences, persuasion or norms. For example, what are the effects of integrative complexity on norm crystallization? Though this research has not answered these questions, the scale design may provide the essential foundation for such endeavors to develop.

The role of integrative complexity as a moderator between the basic belief-attitude relationship indicates future research considerations. Though evidence of moderation was found, the management implications hinge on a common level of integrative complexity being realized among groups. What would supplement this study, and the field of wildland fire research as a whole, would be an examination of typical wildfire stakeholder groups to assess whether a shared level of integrative complexity is exhibited in certain groups. From this, managers could better target their messages toward stakeholders to yield the highest level of acceptability, or use prompts to generate similar levels of integrative complexity as discussed earlier in this chapter.

The research conducted here answers some questions, and raises some important other ones. Particularly the role of integrative complexity as a moderator in the basic belief-attitude relationship and its place in other social psychological models is of interest. The preliminary moderation research points to intriguing research opportunities, while the development of the scale establishes an indispensable platform from which to investigate them.

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APPENDIX A: IC SCORING PROTOCOL (Baker-Brown et al., 1992)

Scoring Protocol of Integrative Complexity

Score	*Criteria*
1	***There is no sign of either conceptual differentiation or integration at this scoring level. The author relies, without qualification, on a simple one-dimensional rule for interpreting events and making choices. Only one way of looking at the world is considered legitimate. The author either implies or explicitly states that there is one and only one reasonable approach to an issue. This position is typically expressed in the form of an absolute or categorical rule. The end result of the application of an absolute rule is, however, always the same: The imposition of the dichotomous category structure (right vs. wrong), with or no room for ambiguity or shades of gray. The author seeks rapid closure. The author may go on at great length and provide detailed descriptions, explanations, or examples of the preferred rule. This additional content it does not justify a higher score, as the author is elaborating on the dominant theme and is not introducing alternative perspectives or dimensions.***
2	***In a statement assigned a score of 2, the author recognizes the potential for looking at the same issue in different ways or along different dimensions. Differentiation is, however, emergent rather than fully developed. This scale value represents a transition level between the categorical structure of the score of one and the differentiated structure of the score of 3.***
3	***The crucial aspect of a score of 3 is a clear specification of at least two distinct ways of dealing with the same information or stimulus. The author recognizes that these different perspectives or dimensions can be held in the mind simultaneously, however, there is no evidence of conceptual integration. The critical indicator of a score of 3 is the recognition of alternative perspectives or different dimensions, and the acceptance of these as being relevant, legitimate, justifiable, or valid. Although the author may hold one viewpoint, he or she recognizes that others disagree and feels no need to disparage them. Increased tolerance for ambiguity or conflict is shown when the author considers a number of parallel or contradictory perspectives or dimensions. The author sees multiple perspectives. Differentiation is the key element of a score of 3.***
4	***In the earlier levels, the major elements determining the specific score was the presence or absence of differentiation. In the score of 4, we see signs of the emergence of a second major scoring element, integration. That is, we began to find indicators of the ability to integrate different and sometimes conflicting alternatives. Conceptual integration is not clearly apparent at this level, however. Instead, the integration of alternatives is implicit. There is only a suggestion that interaction exists between alternatives; there is no overt statement specifying the nature of this interaction.***
5	***A score of 5 indicates the explicit expression of integration. Whereas a score of 4 signifies the emergence of integration expressed in a tentative or uncertain manner, the score 5 indicates that integration is clearly evident. Sometimes two or more alternatives are shown to be in a dynamic relationship with one another, in which each perspective affects and is affected by the other. The author must clearly recognize a relationship for the passage to be scored a 5.***
6	***In general, a score of 6 involves a high-level interaction indicating that the author is working with multiple levels of schemata. The alternatives at this level are dynamic; they are expressed as plans, processes, where courses of action made up of several moving parts, and as such they may often be referred to as systems or networks. At this level, alternatives are readily accepted, compared or contrasted, and integrated to present at least one outcome. Global overviews or organizational principles are often presented. Again, the author is aware of two alternative courses of action and is able to compare their outcomes with regard to long-term implications. In comparing alternatives, the author may still favor one over the other, but each is reasonably considered.***
7	***The unique characteristic of a score of 7 is the presence of an overreaching viewpoint pertaining to the nature (not merely the existence) of the relationship or connectedness between alternatives. In a score of seven, these alternatives are clearly delineated and are described in reasonable detail. How each alternative may be seen as part of some overreaching view, or how some overreaching view encompasses these alternatives, is made evident. Further, there is a discussion of the ways in which levels of the problem or concept interact and thus demonstrate the validity of the overreaching viewpoint. In general, this type of highly integrative passage explores specific complex interactions within a complex system, using an overreaching global viewpoint as a way of uniting these observations. The author might begin by taking a global view of the problem and then may provide examples for a particular interpretation.***

APPENDIX B: POSTCARD INTRODUCTION

Dear Sir or Madam:

Within the next 10 days, you will receive a questionnaire in the mail designed to learn about public perceptions and opinion about how fires are managed in forests. Your household, which was randomly selected, is one of a small number in which people are being asked to provide us with this information. When you receive the questionnaire, please complete it and return it in the self-addressed, stamped envelope I will provide for you. Your participation in this study is voluntary and will remain completely confidential. Thank you very much, in advance, for your help in my study.

Sincerely,

Alan D. Bright, Ph.D.
Department of Natural Resource Recreation and Tourism
Colorado State University, Fort Collins, CO 80523-1480

Public Perceptions of Fire Management

Conducted by

The Department of Natural Resource Recreation and Tourism
Colorado State University

and the

United States Forest Service

Your help on the study is greatly appreciated!

Please return your completed questionnaire in the enclosed envelope.
The envelope is self-addressed and no postage is required.

This survey is for EVERYONE!

We are interested in ALL opinions. Please complete this survey regardless of how much you know or don't know about forest fires and their management.

Section IA. Beliefs about Mechanical Thinning. In this section we are going to ask you to list arguments both FOR and AGAINST mechanical thinning.

Mechanical thinning is a fire policy alternative that reduces the amount of vegetation in the forest by mechanically removing some trees and plants. The purpose of mechanical thinning is to decrease the likelihood of large, potentially uncontrollable wildfire. Typically, a fire management crew enters a forest with bulldozers, chainsaws, and other heavy equipment to cut and remove selected trees in order to thin out the forest.

- In **column A** please list any arguments **for** (Part 1) or **against** (Part 2) mechanical thinning. *Please list as many as you can.*

For example: If you were responding to an issue such as wolf reintroduction to Colorado, for arguments for you might respond, "wolves improve tourism" and "wolves would balance deer and elk populations". For arguments against you might respond, "wolves attack livestock" and "wolves put pets and children in danger".

- In **column B**, Indicate how **WEAK** or **STRONG** you think *each* argument you listed is. *Circle the number that represents your response.*

COLUMN A List Arguments **FOR** and **AGAINST** Mechanical Thinning.	***COLUMN B*** How **WEAK** or **STRONG** do you think this argument is?						
	Extremely Weak	Moderately Weak	Slightly Weak	Neutral or No Opinion	Slightly Strong	Moderately Strong	Extremely Strong
***Part 1*: Arguments FOR mechanical thinning (LIST AS MANY AS YOU CAN)**							
1._____	1	2	3	4	5	6	7
2._____	1	2	3	4	5	6	7
3._____	1	2	3	4	5	6	7
4._____	1	2	3	4	5	6	7
5._____	1	2	3	4	5	6	7
6._____	1	2	3	4	5	6	7
7._____	1	2	3	4	5	6	7
8._____	1	2	3	4	5	6	7
***Part 2*: Arguments AGAINST mechanical thinning (LIST AS MANY AS YOU CAN)**							
1._____	1	2	3	4	5	6	7
2._____	1	2	3	4	5	6	7
3._____	1	2	3	4	5	6	7
4._____	1	2	3	4	5	6	7
5._____	1	2	3	4	5	6	7
6._____	1	2	3	4	5	6	7
7._____	1	2	3	4	5	6	7
8._____	1	2	3	4	5	6	7

Section IB. Beliefs about Prescribed Burning. In this section we are going to ask you to list arguments both FOR and AGAINST prescribed burning.

Prescribed burning is a fire policy alternative that involves the intentional lighting of fire by forest managers. It is used in specific locations in the forest and under selected weather conditions. The purpose of prescribed burning is to decrease the likelihood of large, potentially uncontrollable wildfire by systematically burning off excess vegetation in a forest.

- In **column A** please list any arguments **for** (Part 1) or **against** (Part 2) prescribed burning. *Please list as many as you can.*

For example: If you were responding to an issue such as wolf reintroduction to Colorado, for arguments for you might respond, "wolves improve tourism" and "wolves would balance deer and elk populations". For arguments against you might respond, "wolves attack livestock" and "wolves put pets and children in danger".

- In **column B**, Indicate how **WEAK** or **STRONG** you think *each* argument you listed is. *Circle the number that represents your response.*

COLUMN A List Arguments **FOR** and **AGAINST** Prescribed Burning.	***COLUMN B*** How **WEAK** or **STRONG** do you think this argument is?						
	Extremely Weak	Moderately Weak	Slightly Weak	Neutral or No Opinion	Slightly Strong	Moderately Strong	Extremely Strong
***Part 1*: Arguments FOR prescribed burning (LIST AS MANY AS YOU CAN)**							
1._____	1	2	3	4	5	6	7
2._____	1	2	3	4	5	6	7
3._____	1	2	3	4	5	6	7
4._____	1	2	3	4	5	6	7
5._____	1	2	3	4	5	6	7
6._____	1	2	3	4	5	6	7
7._____	1	2	3	4	5	6	7
8._____	1	2	3	4	5	6	7
***Part 2*: Arguments AGAINST prescribed burning (LIST AS MANY AS YOU CAN)**							
1._____	1	2	3	4	5	6	7
2._____	1	2	3	4	5	6	7
3._____	1	2	3	4	5	6	7
4._____	1	2	3	4	5	6	7
5._____	1	2	3	4	5	6	7
6._____	1	2	3	4	5	6	7
7._____	1	2	3	4	5	6	7
8._____	1	2	3	4	5	6	7

Section II. Experience with Fire

We would like to know about the kinds of experiences you have previously had related to fire in National Forests or other natural areas. *Please check any of the following experiences you have personally had related to fires in National Forests and other natural areas.* (Check (√) all that apply).

I have:

___ Observed the flames or smoke of a forest fire.	___ Been evacuated from my house due to a forest fire.	___ Changed plans for a recreation trip due to a forest fire.
___ Observed parts of a forest that had recently burned.	___ Had personal property destroyed due to a forest fire.	___ Read or Watched TV/video about forest fire.
___ Observed regrowth of plants and trees after a forest fire.	___ Experienced discomfort from the smoke of a forest fire.	___ Had family/friends tell me about forest fire.
___ Attended a public meeting about forest fire management.	___ Had my work/job/livelihood affected by a forest fire.	___ Listened to a ranger or other forest official talk about forest fire
___ Been injured as a result of a forest fire.	___ Learned about forest fire in a class.	___ Worked with forest fire at my job.

Now indicate how important the issue of forest fire management is TO YOU PERSONALLY. *Circle the number that best reflects your response.*

	Not at all Important	Slightly Important	Moderately Important	Quite Important	Extremely Important
How important is the issue of forest fire management to you personally?	1	2	3	4	5
How important is it to you personally that you know as much as possible about forest fire management?	1	2	3	4	5

Section III. Attitudes and Beliefs about Forest Fires and Fire Management

We would like to know, IN GENERAL, what you think about PRESCRIBED BURNING and MECHANICAL THINNING in forests as they are described above. For each of the questions below, *circle the number that best reflects what you think of these forest management strategies.*

Do you think that using PRESCRIBED BURNING in a forest is ...

	Extremely Foolish	Moderately Foolish	Slightly Foolish	Neutral or No Opinion	Slightly Wise	Moderately Wise	Extremely Wise
... A FOOLISH or WISE strategy?	1	2	3	4	5	6	7
	Extremely Ineffective	**Moderately Ineffective**	**Slightly Ineffective**	**Neutral or No Opinion**	**Slightly Effective**	**Moderately Effective**	**Extremely Effective**
... INEFFECTIVE or EFFECTIVE at reducing the dangers of wildfire?	1	2	3	4	5	6	7
	Extremely Harmful	***Moderately Harmful***	***Slightly Harmful***	***Neutral or No Opinion***	***Slightly Beneficial***	***Moderately Beneficial***	***Extremely Beneficial***
... HARMFUL or BENEFICIAL to the health of the forest?	1	2	3	4	5	6	7

Do you think that using MECHANICAL THINNING in a forest is ...

	Extremely Foolish	Moderately Foolish	Slightly Foolish	Neutral or No Opinion	Slightly Wise	Moderately Wise	Extremely Wise
... A FOOLISH or WISE strategy?	1	2	3	4	5	6	7
	Extremely Ineffective	**Moderately Ineffective**	**Slightly Ineffective**	**Neutral or No Opinion**	**Slightly Effective**	**Moderately Effective**	**Extremely Effective**
... INEFFECTIVE or EFFECTIVE at reducing the dangers of wildfire?	1	2	3	4	5	6	7
	Extremely Harmful	**Moderately Harmful**	**Slightly Harmful**	**Neutral or No Opinion**	**Slightly Beneficial**	**Moderately Beneficial**	**Extremely Beneficial**
... HARMFUL or BENEFICIAL to the health of the forest?	1	2	3	4	5	6	7

People have many beliefs about the appropriate management of forests and forest fires. Please indicate how strongly you agree or disagree with *each* of the following statements about forests and forest fires. Some of these items may seem worded very similarly, however, it is important that you respond to all the items! *Circle the number of your response for each statement.*

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral or No Opinion	Slightly Agree	Moderately Agree	Strongly Agree
• Government land management agencies do a good job managing fire in forests.	1	2	3	4	5	6	7
• If a forest fire is endangering wildlife and its habitat, the fire should automatically be put out.	1	2	3	4	5	6	7
• People should be free to build homes near National Forests if they want to.	1	2	3	4	5	6	7
• Forest fires started by lightning should automatically be put out.	1	2	3	4	5	6	7
• When people build homes near forests, the government has the primary responsibility to make sure private homes are protected from forest fire.	1	2	3	4	5	6	7
• People who build homes near a fire-prone National Forest have the primary responsibility for protecting their home from forest fire.	1	2	3	4	5	6	7
• Government land management agencies (e.g. US Forest Service) do a good job managing National Forests.	1	2	3	4	5	6	7
• It is OK that some wildlife is lost due to forest fire since fire benefits the overall health of the forest.	1	2	3	4	5	6	7
• National Forests would be managed better if they were privately owned and managed.	1	2	3	4	5	6	7
• People should be allowed to build homes where they want, even if it is in a high fire zone.	1	2	3	4	5	6	7
• Forest fires started by humans should automatically be put out.	1	2	3	4	5	6	7
• People should not be allowed to build homes near forests where the homes could be destroyed by fire.	1	2	3	4	5	6	7
• Private landowners (of forests) would do a better job of managing our National Forests than the government land management agencies.	1	2	3	4	5	6	7
• I trust that government land management agencies know best when planning prescribed burns in the forest.	1	2	3	4	5	6	7
• The government should pass laws that require private landowners near forests to take steps necessary to protect their homes from forest fire.	1	2	3	4	5	6	7
• The loss of wildlife and its habitat is an acceptable result of allowing natural fires to burn in the forest.	1	2	3	4	5	6	7
• There should be laws against building homes where they could be damaged by forest fire.	1	2	3	4	5	6	7
• We should NOT allow wildlife and wildlife habitat to be destroyed by forest fire.	1	2	3	4	5	6	7
• We should NOT allow timber and mining resources to be destroyed by forest fire.	1	2	3	4	5	6	7
• Forest fires should be allowed to burn naturally even if the scenery will be destroyed.	1	2	3	4	5	6	7

Continued	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neutral or No Opinion	Slightly Agree	Moderately Agree	Strongly Agree
• Forest fires should be allowed to burn naturally even if recreation opportunities will be decreased.	1	2	3	4	5	6	7
• Forest managers should actively manipulate forest conditions to decrease the chance of a fire.	1	2	3	4	5	6	7
• Forest fires are unpredictable, and are too difficult for the government land management agencies to control.	1	2	3	4	5	6	7
• Forest fires should be put out if they are going to decrease recreation opportunities in the area.	1	2	3	4	5	6	7
• Forest fires should be put out if they are going to destroy scenery.	1	2	3	4	5	6	7
• I trust that government land management agencies like the U.S. Forest Service know best when it comes to mechanically thinning the forest.	1	2	3	4	5	6	7
• Government land management agencies like the U.S. Forest Service are NOT doing a good job of managing fire in forests.	1	2	3	4	5	6	7
• When people build homes near forests, it is their own fault if their homes are damaged by fire.	1	2	3	4	5	6	7
• Private landowners near forests should have the right to choose for themselves if they want to take steps necessary to protect their homes from forest fire.	1	2	3	4	5	6	7
• Forest managers have every right to actively manage, or manipulate the conditions of a forest in order to decrease the likelihood of a forest fire.	1	2	3	4	5	6	7
• Forest fires started by humans should be allowed to burn as long as they can be controlled.	1	2	3	4	5	6	7
• If a fire breaks out in a forest, the agency managing that forest is primarily responsible for making sure that private property is not destroyed.	1	2	3	4	5	6	7
• We should just leave forests alone instead of trying to manipulate them.	1	2	3	4	5	6	7
• When people build homes near fire-prone forests, they should accept that they might suffer property losses due to a forest fire.	1	2	3	4	5	6	7
• I trust that government land management agencies like the U.S. Forest Service know best when it comes to managing forests.	1	2	3	4	5	6	7
• Forest fires started by lightning should be allowed to burn naturally as long as they can be controlled.	1	2	3	4	5	6	7
• When people build homes near forests, they have the right to expect that their home will be protected from a forest fire by the government agency that manages that forest.	1	2	3	4	5	6	7
• Forest managers should not use artificial measures (e.g., prescribed burning and mechanical thinning) to decrease the chance of a fire in a forest.	1	2	3	4	5	6	7

Section IV. Acceptability of Fire Policies

Below are 8 scenarios that describe several characteristics of a hypothetical National Forest. These characteristics, which vary depending on the scenario, include:

- **Location..... The National Forest is located either in a REMOTE, UNPOPULATED AREA or NEAR A HIGHLY POPULATED URBAN AREA.**
- **Primary Use..... The most prevalent use of the National Forest is for OUTDOOR RECREATION (e.g., backpacking, viewing scenery, hiking, camping etc.) or COMMERCIAL ACTIVITIES (e.g., logging or mining).**
- **Fire History..... The area has a RECENT HISTORY or LITTLE OR NO HISTORY OF FIRE.**
- **Current Fire Conditions... There is a HIGH or LOW LIKELIHOOD OF A FOREST FIRE IN THE NEAR FUTURE.**

Following each scenario is a list of 3 management strategies that forest managers have at their disposal related to fire management. These include:

- **PRESCRIBED BURNING**
- **MECHANICAL THINNING**
- **NO ARTIFICIAL TREATMENTS (that is, no prescribed burning, mechanical thinning, or any other management actions designed to manipulate the forest)**

Please read each scenario and answer the 3 questions that follow it.

Scenario 1. Consider a National Forest that has the following characteristics:

- Location: **NEAR A HIGHLY POPULATED URBAN AREA**
- Primary Use: **OUTDOOR RECREATION (backpacking, viewing scenery, hiking, camping, etc.)**
- Fire History: **LITTLE OR NO HISTORY OF FOREST FIRE**
- Current Fire Conditions: **LOW LIKELIHOOD OF A FOREST FIRE IN THE NEAR FUTURE**

Considering the characteristics described in scenario 1 above, how acceptable or unacceptable do you think the following management actions are in that National Forest? ***Circle one number for each action.***

Management Action	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neutral or No Opinion	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
• Prescribed Burning	1	2	3	4	5	6	7
• Mechanical Thinning	1	2	3	4	5	6	7
• NO artificial treatments	1	2	3	4	5	6	7

Scenario 2. Consider a National Forest that has the following characteristics:

- Location: **IN A REMOTE UNPOPULATED RURAL AREA**
- Primary Use: **COMMERCIAL ACTIVITIES (e.g., logging or mining)**
- Fire History: **LITTLE OR NO HISTORY OF FOREST FIRE**
- Current Fire Conditions: **HIGH LIKELIHOOD OF A FOREST FIRE IN THE NEAR FUTURE**

Considering the characteristics described in scenario 2 above, how acceptable or unacceptable do you think the following management actions are in that National Forest? ***Circle one number for each action.***

Management Action	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neutral or No Opinion	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
• Prescribed Burning	1	2	3	4	5	6	7
• Mechanical Thinning	1	2	3	4	5	6	7
• NO artificial treatments	1	2	3	4	5	6	7

Scenario 3. Consider a National Forest that has the following characteristics:

- Location: **NEAR A HIGHLY POPULATED URBAN AREA**
- Primary Use: **OUTDOOR RECREATION (backpacking, viewing scenery, hiking, camping, etc.)**
- Fire History: **LITTLE OR NO HISTORY OF FOREST FIRE**
- Current Fire Conditions: **HIGH LIKELIHOOD OF A FOREST FIRE IN THE NEAR FUTURE**

Considering the characteristics described in scenario 3 above, how acceptable or unacceptable do you think the following management actions are in that National Forest? ***Circle one number for each action.***

Management Action	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neutral or No Opinion	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
• Prescribed Burning	1	2	3	4	5	6	7
• Mechanical Thinning	1	2	3	4	5	6	7
• NO artificial treatments	1	2	3	4	5	6	7

Scenario 4. Consider a National Forest that has the following characteristics:

- Location: **NEAR A HIGHLY POPULATED URBAN AREA**
- Primary Use: **COMMERCIAL ACTIVITIES (e.g., logging or mining)**
- Fire History: **RECENT HISTORY OF FOREST FIRE**
- Current Fire Conditions: **HIGH LIKELIHOOD OF A FOREST FIRE IN THE NEAR FUTURE**

Considering the characteristics described in scenario 4 above, how acceptable or unacceptable do you think the following management actions are in that National Forest? ***Circle one number for each action.***

Management Action	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neutral or No Opinion	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
• Prescribed Burning	1	2	3	4	5	6	7
• Mechanical Thinning	1	2	3	4	5	6	7
• NO artificial treatments	1	2	3	4	5	6	7

Scenario 5. Consider a National Forest that has the following characteristics:

- Location: **IN A REMOTE UNPOPULATED RURAL AREA**
- Primary Use: **COMMERCIAL ACTIVITIES (e.g., logging or mining)**
- Fire History: **LITTLE OR NO HISTORY OF FOREST FIRE**
- Current Fire Conditions: **LOW LIKELIHOOD OF A FOREST FIRE IN THE NEAR FUTURE**

Considering the characteristics described in scenario 5 above, how acceptable or unacceptable do you think the following management actions are in that National Forest? ***Circle one number for each action.***

Management Action	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neutral or No Opinion	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
• Prescribed Burning	1	2	3	4	5	6	7
• Mechanical Thinning	1	2	3	4	5	6	7
• NO artificial treatments	1	2	3	4	5	6	7

Scenario 6. Consider a National Forest that has the following characteristics:

- Location: **IN A REMOTE UNPOPULATED RURAL AREA**
- Primary Use: **OUTDOOR RECREATION (backpacking, viewing scenery, hiking, camping, etc.)**
- Fire History: **RECENT HISTORY OF FOREST FIRE**
- Current Fire Conditions: **HIGH LIKELIHOOD OF A FOREST FIRE IN THE NEAR FUTURE**

Considering the characteristics described in scenario 6 above, how acceptable or unacceptable do you think the following management actions are in that National Forest? ***Circle one number for each action.***

Management Action	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neutral or No Opinion	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
• Prescribed Burning	1	2	3	4	5	6	7
• Mechanical Thinning	1	2	3	4	5	6	7
• NO artificial treatments	1	2	3	4	5	6	7

Scenario 7. Consider a National Forest that has the following characteristics:

- Location: **NEAR A HIGHLY POPULATED URBAN AREA**
- Primary Use: **COMMERCIAL ACTIVITIES (e.g., logging or mining)**
- Fire History: **RECENT HISTORY OF FOREST FIRE**
- Current Fire Conditions: **LOW LIKELIHOOD OF FOREST FIRE IN THE NEAR FUTURE**

Considering the characteristics described in scenario 7 above, how acceptable or unacceptable do you think the following management actions are in that National Forest? ***Circle one number for each action.***

Management Action	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neutral or No Opinion	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
• Prescribed Burning	1	2	3	4	5	6	7
• Mechanical Thinning	1	2	3	4	5	6	7
• NO artificial treatments	1	2	3	4	5	6	7

Scenario 8. Consider a National Forest that has the following characteristics:

- Location: **IN A REMOTE UNPOPULATED RURAL AREA**
- Primary Use: **OUTDOOR RECREATION (backpacking, viewing scenery, hiking, camping, etc.)**
- Fire History: **RECENT HISTORY OF FOREST FIRE**
- Current Fire Conditions: **LOW LIKELIHOOD OF A FOREST FIRE IN THE NEAR FUTURE**

Considering the characteristics described in scenario 8 above, how acceptable or unacceptable do you think the following management actions are in that National Forest? ***Circle one number for each action.***

Management Action	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neutral or No Opinion	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
• Prescribed Burning	1	2	3	4	5	6	7
• Mechanical Thinning	1	2	3	4	5	6	7
• NO artificial treatments	1	2	3	4	5	6	7

The previous 8 scenarios varied the level of 4 factors; the LOCATION of the forest, the PRIMARY USE of the forest, FIRE HISTORY, and CURRENT FIRE CONDITIONS.

Now, rank each of the 4 factors in terms of how important of a consideration YOU think it is in determining the acceptability of both prescribed burning (column A) and mechanical thinning (column B), *SEPARATELY.* Use the following ranking scheme.

1 = the 1st most important factor
2 = the 2nd most important factor
3 = the 3rd most important factor
4 = the 4th most important factor

How important are the following four factors in determining the acceptability of each of the two forest management strategies, prescribed burning and mechanical thinning?	Ranks (1 through 4); Rank both columns separately Column A Prescribed Burning Strategy	Column B Mechanical Thinning Strategy
♦ The **LOCATION** of the forest	_____	_____
♦ The **PRIMARY USE** of the forest	_____	_____
♦ The **FIRE HISTORY** of the forest	_____	_____
♦ The **CURRENT FIRE CONDITIONS** in the forest	_____	_____

Section V. About Yourself

We would like to know a little about you. This information will remain completely confidential.

1. Are you? (√) ___ Male ___ Female

2. How old are you? _____ Years

3. What is the highest level of education that you have achieved? (√)

___ Less than high school diploma
___ High school diploma or GED
___ Technical/vocational degree
___ Some college but no degree
___ 4-year college degree
___ Advanced degree beyond 4-year college degree

4. How far do you live from a forested area (e.g., State or National Forest; State or National Park, etc.)? (√)

____ Less than 1 mile away
____ 1 – 10 miles away
____ 11 – 20 miles away
____ 21 – 50 miles away
____ 51 – 100 miles away
____ More than 100 miles away

5. How would you describe your current residence or community? (√)

____a large city with 250,000 or more people
____a city with 100,000 to 249,999 people
____a small city with 50,000 to 99,999 people
____a town with 10,000 to 49,999 people
____a small town/village with less than 10,000 people
____a farm or rural area

6. How would you describe the community in which you were raised?
***If more than one, check off the type of place you feel was most influential to you.* (√)**

___ a large city with 250,000 or more people
___ a city with 100,000 to 249,999 people
___ a small city with 50,000 to 99,999 people
___ a town with 10,000 to 49,999 people
___ a small town/village with less than 10,000 people
___ a farm or rural area

Thank you very much for participating in this study!

APPENDIX D: INTRODUCTORY LETTER

March 28, 2003

Dear Sir or Madam:

Recent fire events throughout the United States have emphasized the importance of fire management in this country's National Forests and other natural areas where Americans recreate. In addition, these events have enhanced the public's interest in how natural and prescribed fires are managed. Colorado State University, in cooperation with the USDA Forest Service, is interested in examining the perceptions that the public has about fire management policies.

Enclosed is a questionnaire designed to obtain your perceptions of fire management. We understand that you are very busy. However, you are one of a select group of people we are requesting information from, therefore, you answers are very important in insuring a valid study. Please take some time to complete the enclosed questionnaire and return it in the self-addressed, stamped envelope we have provided you. The questionnaire should take you about 15 - 20 minutes to complete.

Please note that your participation in this study is voluntary, will remain completely confidential, and result in neither harm nor direct benefits to people who respond to the questionnaire. You may skip any question you feel uncomfortable answering. The questionnaire has an identification number for mailing purposes only. This is so we may check your name off the list when your questionnaire is returned. Your name will never be placed on the questionnaire, nor ever associated with your responses. Record of your participation in this study will be destroyed as soon as data collection is completed.

The Colorado State University Human Research Committee has reviewed and approved this study. If you have questions about your rights as a participant in this research, you may contact Celia S. Walker of the CSU Human Research Committee at (970) 491-1563. I would also be most happy to answer any questions you might have regarding this study. Feel free to write to the above address or call. You may receive a summary of results by writing "copy of results requested" on the back of the return envelope, and printing your name and address below it. Please do not put this information on the questionnaire itself.

Thank you very much for your help in our study.

Sincerely,

Alan D. Bright, Ph.D.
Principal Investigator

APPENDIX E: POSTCARD REMINDER

Dear Sir or Madam:

Last week a questionnaire designed to learn about public perceptions and opinion about how wildfires are managed in Forests was mailed to you. If you have already completed and returned it please accept my sincere thanks. If not, please do so today. It has been sent to only a small sample of households and it is extremely important that yours be included if the results are to accurately represent the opinions of the public. If you did not receive the questionnaire, or it got misplaced, please call me at (970) 491-5487 and I will get another one in the mail today. Your participation in this study is voluntary and will remain completely confidential. Thank you very much.

Sincerely,

Alan D. Bright, Ph.D.
Department of Natural Resource Recreation and Tourism
Colorado State University, Fort Collins, CO 80523-1480

APPENDIX F: FOLLOWUP LETTER

April 25, 2003

Dear Sir or Madam:

Not long ago, we mailed you a questionnaire designed to obtain your perceptions of fire management. We have yet to receive the questionnaire from you. It has been sent to only a small sample of households and it is extremely important that yours be included if the results of the study are to be valid. We understand that you are very busy. However, you are one of a select group of people we are requesting information from, therefore, you answers are very important in insuring a valid study. Please take some time to complete the enclosed questionnaire and return it in the self-addressed, stamped envelope we have provided you. The questionnaire should take you about 15 - 20 minutes to complete.

Please note that your participation in this study is voluntary, will remain completely confidential, and result in neither harm nor direct benefits to people who respond to the questionnaire. You may skip any question you feel uncomfortable answering. The questionnaire has an identification number for mailing purposes only. This is so we may check your name off the list when your questionnaire is returned. Your name will never be placed on the questionnaire, nor ever associated with your responses. Record of your participation in this study will be destroyed as soon as data collection is completed.

The Colorado State University Human Research Committee has reviewed and approved this study. If you have questions about your rights as a participant in this research, you may contact Celia S. Walker of the CSU Human Research Committee at (970) 491-1563. I would also be most happy to answer any questions you might have regarding this study. Feel free to write to the above address or call. You may receive a summary of results by writing "copy of results requested" on the back of the return envelope, and printing your name and address below it. Please do not put this information on the questionnaire itself.

Thank you very much for your help in our study.

Sincerely,

Alan D. Bright, Ph.D.
Principal Investigator

APPENDIX G: NON RESPONSE SURVEY/INTORDUCTORY LETTER

Public Perceptions of Fire Management

Abbreviated Survey

Dear Respondent:

Earlier this spring we sent you a questionnaire designed to obtain detailed perceptions you may have about fires in natural areas and their management. This survey was sent to several regions of the country whether they were close to natural lands or not.

I understand that you are very busy and may not have had the time or inclination to complete a long survey. Because it is important that we receive information from a large number of people, I have enclosed here a brief 1-page survey that will provide some basic information about how you feel about wildfire and its management. It would be very helpful if you could take just 5 minutes of your time and complete this survey and return it to us in the postage paid envelope we have provided you.

Again, please note that completion of this survey is voluntary and you will remain completely confidential. If you have already returned the survey, disregard this letter and accept our sincere thanks.

This will be the last time we contact you about this.

Thank you very much for your help on this survey.

Sincerely,

Alan D. Bright, Ph.D.
Assistant Professor and Principle Investigator
College of Natural Resources
Colorado State University
Fort Collins, CO 80523

Read the descriptions about mechanical thinning and prescribed fires and answer the questions that follow.

Mechanical thinning is a fire policy alternative that reduces the amount of vegetation in the forest by mechanically removing some trees and plants. The purpose of mechanical thinning is to decrease the likelihood of large, potentially uncontrollable wildfire. Typically, a fire management crew enters a forest with bulldozers, chainsaws, and other heavy equipment to cut and remove selected trees in order to thin out the forest.

Do you think that using MECHANICAL THINNING in a forest is *(please circle the number that represents your response)* ...

	Extremely Foolish	Moderately Foolish	Slightly Foolish	Neutral or No Opinion	Slightly Wise	Moderately Wise	Extremely Wise
A FOOLISH or WISE strategy?	1	2	3	4	5	6	7
	Extremely Ineffective	**Moderately Ineffective**	**Slightly Ineffective**	**Neutral or No Opinion**	**Slightly Effective**	**Moderately Effective**	**Extremely Effective**
INEFFECTIVE or EFFECTIVE at reducing the dangers of wildfire?	1	2	3	4	5	6	7
	Extremely Harmful	**Moderately Harmful**	**Slightly Harmful**	**Neutral or No Opinion**	**Slightly Beneficial**	**Moderately Beneficial**	**Extremely Beneficial**
HARMFUL or BENEFICIAL to the health of the forest?	1	2	3	4	5	6	7

Prescribed burning is a fire policy alternative that involves the intentional lighting of fire by forest managers. It is used in specific locations in the forest and under selected weather conditions. The purpose of prescribed burning is to decrease the likelihood of large, potentially uncontrollable wildfire by systematically burning off excess vegetation in a forest.

Do you think that using PRESCRIBED BURNING in a forest is *(please circle the number that represents your response)* ...

	Extremely Foolish	Moderately Foolish	Slightly Foolish	Neutral or No Opinion	Slightly Wise	Moderately Wise	Extremely Wise
A FOOLISH or WISE strategy?	1	2	3	4	5	6	7
	Extremely Ineffective	**Moderately Ineffective**	**Slightly Ineffective**	**Neutral or No Opinion**	**Slightly Effective**	**Moderately Effective**	**Extremely Effective**
INEFFECTIVE or EFFECTIVE at reducing the dangers of wildfire?	1	2	3	4	5	6	7
	Extremely Harmful	**Moderately Harmful**	**Slightly Harmful**	**Neutral or No Opinion**	**Slightly Beneficial**	**Moderately Beneficial**	**Extremely Beneficial**
HARMFUL or BENEFICIAL to the health of the forest?	1	2	3	4	5	6	7

We would like to know a little about you. This information will remain completely confidential.

1. Are you? (√) ___ Male ___ Female **2. How old are you?** _____ Years

3. What is the highest level of education that you have achieved? (√)

___ Less than high school diploma
___ High school diploma or GED
___ Technical/vocational degree
___ Some college but no degree
___ 4-year college degree
___ Advanced degree beyond 4-year college degree

4. How far do you live from a forested area (e.g., State or National Forest; State or National Park, etc.)? (√)

____ Less than 1 mile away
____ 1 – 10 miles away
____ 11 – 20 miles away
____ 21 – 50 miles away
____ 51 – 100 miles away
____ More than 100 miles away

5. How would you describe your current residence or community? (√)

____a large city with 250,000 or more people
____a city with 100,000 to 249,999 people
____a small city with 50,000 to 99,999 people
____a town with 10,000 to 49,999 people
____a small town/village with less than 10,000 people
____a farm or rural area

6. How would you describe the community in which you were raised?
***If more than one, check off the type of place you feel was most influential to you.* (√)**

___ a large city with 250,000 or more people
___ a city with 100,000 to 249,999 people
___ a small city with 50,000 to 99,999 people
___ a town with 10,000 to 49,999 people
___ a small town/village with less than 10,000 people
___ a farm or rural area

Thank you very much for participating in this study!