# CREATING DEFENSIBLE SPACE IN THE WILDLAND-URBAN INTERFACE: THE ROLE OF BASIC BELIEFS ABOUT FOREST AND WILDFIRE MANAGEMENT

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## Abstract

We examined the effect that basic beliefs about natural resources and fire management have on an individual's decision to create defensible space around his or her residence in the urban—wildland interface. Using data from a mailback questionnaire, respondents in north central Minnesota were clustered by basic value—laden beliefs toward forest and fire management and compared across a number of perceptions and behaviors related to creating defensible space around residences. Clusters differed in attitudes, subjective norms, and perceived behavioral control as they relate to creating defensible space in the urban—wildland interface. In addition, relative effects of these perceptions on behavior intention and behavior differed across cluster. Implications lie in understanding differences in motivations and reasons for support of strategies for managing fires near the urban—wildland interface which will contribute to an improved integration of land management and public concerns and interests.

## 1.0 Introduction

For several decades, residents of urban areas in America have been moving into rural areas located in or near natural areas such as forests, parks, and other open space. According to the U.S. Census, populations of rural counties around wildland areas increased 23 percent, compared to an 11 percent growth nationwide between 1970 and 1988 (Bailey 1991). This has occurred to such an extent that not only has there been an increase in population and development growth in rural areas near wildlands and other open space, but the growth in primary residences, vacation homes, and commercial development has resulted in many of these areas losing the characteristics of rural America and becoming categorized as urban (Gardner et al. 1985).

With this migration and increased private and commercial development near wildlands, dangers from wildland fire become more complex. The dynamics of forest fire fuels, changing wind conditions, humidity, fuel type, etc. present unique problems to community firefighters trained to deal primarily with structural fires. As a result of the large number of fires around the country recently and fears that such fires will continue, there are concerns regarding the safety of people as well as private and public property located in or near the urban - wildland interface.

While federal agencies and local governments are often viewed as best equipped to conduct fire prevention/protection activities, there is interest in the role that the general public can play in addressing fire management problems in the wildland - urban interface. According to Cortner (1991; Cortner et al. 1990), it is important to maintain an integrated effort between civic agencies and private citizens to address fire management problems. Well-conducted public involvement activities help keep private citizens informed of the dangers of wildland fire and policies maintained by public agencies. Public involvement efforts also keep public agencies abreast of the public's perceptions of fire policies and strategies.

In addition to public involvement processes that facilitate two-way communication between land management agencies and the public, more direct roles of the public in fire protection are desirable. One fire protection alternative is the creation of "defensible space" around one's residence that may be vulnerable to wildland fire. This approach has been found to be successful in a number of locations (Bailey 1991). Creating "defensible space" involves many activities that property owners or managers may do to provide protection of a property from a fire. Some of these activities are the removal or reduction of plants, trees, and shrubs around vulnerable sites as well as the use of special fire resistant materials in buildings. These activities create transition zones designed to slow or stop fire movement prior to reaching

private homes or other structures (Carree, Schnepf, & Colt 1998).

Homeowners' decisions to create defensible space around their home may be influenced by many factors. Perceptions of the risks of wildfire to homes, the potential outcomes of creating defensible space, and barriers to doing so are among the most apparent of these influential factors. Considering that one household's decision to create defensible space may influence the safety of other households nearby suggests that normative expectations may also influence that decision. Perceived outcomes, norms, and barriers directly address some aspect of behavior. Other factors have indirect effects on behavior by directly impacting those factors that directly impact behavior. These factors include more value-laden basic beliefs that people hold about the issue surrounding the behavior in question. This study examines the role of basic beliefs in influencing more specific perceptions of, and behavior regarding the creation of defensible space around one's residence in the wildland-urban interface.

## 2.0 Theoretical Background

The examination of value-laden basic beliefs as a basis for more specific attitudes and behaviors has been applied to social aspects of natural resources and the environment. Paul Stern and Thomas Dietz have explored the connection between values and more specific cognitions such as attitudes and beliefs regarding environmental concern and behaviors that reflect that concern. Applying Schwartz' (1992) work on the structure and content of human values, these researchers found that environmental concern and associated behavioral indicators were related to certain basic human values (Dietz et al. 1998; Stern & Dietz 1994; Stern et al. 1995). Fulton et al. (1996) developed an extensive scale of basic beliefs toward wildlife management. These researchers showed that the pattern with which people responded to basic belief items on a survey (defined as their value orientation) was predictive of their support of a number of wildlife management strategies as well as participation in hunting and angling.

### 2.1 Conceptual Model

One theoretical framework that addresses the relationship between values and behavior is the Cognitive Hierarchy. The Cognitive Hierarchy (Fulton et al. 1996; Homer & Kahle 1988; Rokeach 1979) suggests that behavior, while directly influenced by specific perceptions related to that behavior, may ultimately be connected with the values people hold.

Forming the foundation of the cognitive hierarchy are first-order cognitions called *fundamental values*. They are not focused on specific objects or behaviors but are more abstract thoughts that represent desirable end-states and modes of conduct (Fulton et al. 1996) such as freedom, responsibility, and trust (Rokeach 1979). *Basic beliefs* are second order cognitions that represent a domain of interest; in this study, natural resource and fire management. To the extent that an individual holds a general pattern of basic beliefs, they serve to orient one's fundamental values toward an individual's specific perceptions about an issue or behavior, creating defensible space around one's residence.

Above the lower order value-laden basic beliefs are higher order cognitions that represent perceptions related directly to creating defensible space. We based this portion of our conceptual framework on a popular model of attitudes and behavior, the Theory of Planned Behavior (TPB) (Ajzen 1991). Our model suggests that three factors from TPB would be directly influenced by one's basic beliefs toward natural resource and fire management. *Attitudes* are made up of one's belief that certain salient outcomes to creating defensible space would occur as well as an evaluation of those outcomes. *Subjective norms* are the strength of beliefs that certain referents would want the individual to conduct defensible space activities around his or her home as well as the individual's motivation to comply with those referents. *Perceived behavioral control* consists of constraints to conducting defensible space activities and their perceived effectiveness. These three factors, in turn, are proposed to directly influence one's intention to create defensible space. At the top of the framework is behavior related to creating defensible space around ones residence in the wildland-urban interface and is directly influenced by one's intention to create defensible space. Consistent with TPB, our model hypothesizes that perceived barriers and constraints would have a direct impact on behavior.

This study examined how basic beliefs related to natural resource and fire management influence how people perceive the behavior of creating defensible space around one's residence and the decision to engage in such behavior. Objectives for the study were as follows.

Objective 1. To identify groups of respondents based on their basic beliefs about natural resource and fire management.

Objective 2. To measure behavior, behavior intention, attitudes, subjective norms, and perceived barriers and constraints related to creating defensible space around one's residence in the wildland-urban interface.

Objective 3. To determine if basic belief-based respondent groups differed on perceptions/behavior related to defensible space.

Objective 4. To determine if the effects of perceptions about creating defensible space on behavior differed across basic belief-based respondent groups.

## 3.0 Methods

### 3.1 Sampling and Data Collection

Two thousand households were selected at random from property tax information for Hubbard, Cass, Itasca and Crow Wing counties in north central Minnesota and stratified by full-time versus seasonal residence. An introductory postcard, two survey mailings, and reminder postcard were used in this study. A response rate of 54% was achieved (897 returned/1,673 deliverable; full-time residents, 47%, 403/857; seasonal residents, 60%, 494/816). To test for non-response bias, a one-page survey containing three questions regarding one's attitude toward defensible space activities was sent to a random sample of 250 non-respondents (127 returned/250, 51%). No non-response bias was identified.

### 3.2 Questionnaire Items Used to Measure Model Components

To develop survey items, 50 residents of the Minnesota counties were contacted by telephone and asked: What are advantages and disadvantages of creating defensible space around one's residence? What individuals or groups would be interested in whether or not you create defensible space around your home? What barriers would prevent you from creating defensible space around your home? Responses to these inquiries were used to develop specific items in the mail survey.

To measure *basic beliefs*, respondents were asked the extent to which they agreed or disagreed with 25 statements about forest and wildland fire management on 7-point Likert type scales. The items were adopted from work on forest and wildland fire management by Bright et al. (2003). From these items, indices of six basic belief dimensions were created biocentricism, anthropocentrism, freedom, government responsibility, personal responsibility, and artificial management.

*Attitudes toward creating defensible space* was measured consistent with the *theory of planned behavior*. The most often mentioned advantages (four of them) and disadvantages (also four) identified in the telephone elicitation study were treated as salient beliefs about outcomes to creating defensible space in the mail survey. Using 7-point Likert-type scales (coded -3 to +3 with a 0 midpoint), respondents (a) indicated the "likelihood" that each outcome would occur as a result of doing defensible space activities, and (b) evaluated how "good or bad" each outcome would be. The likelihood and evaluation scores were multiplied together for each outcome. The resulting eight "likelihood x evaluation" products were then summed, resulting in an overall attitude toward creating defensible space around one's home.

From the telephone elicitation study, the five most often mentioned individuals or groups with an interest in whether an individual would create defensible space around his or her home were included on the survey. Using 7-point Likert-type scales (-3 to +3, with a 0 midpoint), respondents were asked whether each referent would "approve or disapprove" of them creating defensible space around their home and how important it was to the individual to comply with the desires of that referent group. The approval and compliance scores were multiplied together for each referent group. The resulting five "approval x compliance" products were then summed, resulting in an overall *subjective norm regarding creating defensible space* around one's home.

*Perceived behavioral control regarding creating defensible space* was measured in two ways. One operationalization of this factor related to "barriers to creating defensible space", identified in the telephone elicitation study. The eight barriers most often mentioned were included on the mail survey. Using a 7-point unipolar scale (1 to 7), respondents were asked how important each barrier was in influencing their decision to create defensible space around their home. "Perceived behavior control - barriers" was the mean score of these eight items. The second operationalization of behavioral control regarding

defensible space activities related to the perceived effectiveness of engaging in the activities. Through discussions with Forest Service personnel and literature review, we selected 12 common activities that reflected the creation of defensible space. Using a 7-point unipolar scale (1 to 7), respondents indicated how "effective" each of the 12 activities would be in protecting their home from wildland fire. "Perceived behavior control — effectiveness" was the mean score of these 12 items.

Using a 7-point unipolar scale (1 to 7), respondents were asked how likely it was that they would do each of 12 activities around their home in the future. *Behavioral intention* was the mean of these 12 items.

Respondents were asked, in a "yes/no" format, if they currently engage in each of the 12 defensible space activities. The measure of *behavior* was the sum of activities for which respondents answered in the affirmative. Although this measure technically addresses past behavior, it is assumed that engaging in volitional activities is relatively stable over time and that reports of current behavior are reliable indicators of future behavior (Hrubes et al. 2001; Mannell & Kleiber 1997).

### 3.3 Analyses

Confirmatory factor analysis (Amos 4.0) revealed the goodness of fit of the basic beliefs dimensions. Non-hierarchical cluster analysis categorized respondents based on responses to these basic beliefs. The groups were compared on attitudes, subjective norms, perceived behavioral control, and behavior using independent samples t-tests and chi-square procedures. Regression analyses conducted for each group determined if relationships among perceptions and behavior were influenced by the basic beliefs toward natural resource and fire management.

## 4.0 Results

### 4.1 Measurement and Identification of Basic Belief Groups

Confirmatory factor analysis showed that the theoretical structure of the basic belief dimensions was a good fit of the data. Cronbach's alphas ranged from .685 to .914, and were deemed adequate for the creation of study indices. Below is a description of each of the basic belief dimensions measured and used in this study.

- *Biocentric* — The extent to which an individual views nature and its components as being on equal footing, or having similar rights to existence, as humans.
- *Anthropocentric* — The extent to which an individual holds a utilitarian view toward forests and nature. That is, their primary use lies in their value to humans.
- *Freedom* — The extent to which people should be allowed to build homes near the wildland - urban interface with little or no government restrictions.
- *Artificial Management* — The extent to which it is appropriate to take artificial steps to manipulate and manage a forest.
- *Government Responsibility* — The extent to which primary responsibility for protecting homes in the wildland - urban interface lies with the government.
- *Personal Responsibility* — The extent to which primary responsibility for protecting homes in the wildland - urban interface lies with the property owner.

After confirming the fit of the data and creating basic belief dimensions as the mean of items within a dimension, we clustered respondents based on responses to the basic belief dimensions. Following procedures outlined by Beaman & Vaske (1995) and Romesburg (1990), a random sample of 200 respondents were selected from the data file from which hierarchical cluster analysis identified the existence of two clusters. Then, non-hierarchical cluster analysis was used, requesting SPSS to create two clusters from the entire data file (n = 897). This method is appropriate since (a) hierarchical cluster analysis is generally limited to 200 cases, and (b) when variable scales used for clustering have a restricted range of values, the non-hierarchical cluster method results will not differ substantially from the hierarchical method. Ninety-nine percent of the cases were classified and placed in one of two cluster groups for further analyses.

The primary distinction that we identified between the clusters was their orientations toward biocentric and anthropocentric beliefs. Below is a brief description of the two clusters based on the basic belief dimension.

Cluster 1 (hereinafter referred to as the *anthropocentric group*): This group was identified with a high anthropocentric orientation toward forests and nature and a low biocentric orientation. This group agreed with freedom to build private residences near the urban - wildland interface with little or no government intervention. They agreed that the primary responsibility for protecting homes was with the property owner and not the government. They supported artificial means of managing forests where necessary.

Cluster 2 (hereinafter referred to as the *biocentric group)*: This group was identified with a high biocentric orientation toward forests and nature and a low anthropocentric orientation. They disagreed in the notion of freedom to build in the urban - wildland interface with little or no government intervention. They agreed with the notion of government responsibility for protecting private residences from wildland fire and slightly disagreed that responsibility lies primarily with the homeowner. This group supported artificial means of managing forests where necessary.

The groups differed on a several sociodemographic characteristics. The anthropocentric group had a higher proportion of males than the biocentric group (73.8% versus 53.3%), generally lived closer to a forest area (54.9% of anthropocentric group lived within one mile of a forest area versus 41.2% of biocentric group), and was slightly more likely to have a timber-related occupation (14.9% versus 8.6%). Both groups had a median education level of some college (with no college degree), a median household income of $50,000 to $74,999, and a mean age of just over 58 years old, not surprising since a population of property owners that includes seasonal, fulltime, and second home owners are likely to be older than the general population.

### 4.2 Comparison of Anthropocentric and Biocentric Groups on Perceptions and Behavior

We compared the anthropocentric and biocentric groups on the likelihood and evaluation of outcomes to creating defensible space (our measure of attitude), normative beliefs and motivation to comply with those beliefs (our measure of subjective norms), perceived barrier control (both effectiveness of and barriers to creating defensible space), behavior intention, and behavior.

Independent samples t-tests found a number of significant differences between the anthropocentric and biocentric groups on their perceptions of outcomes to creating defensible space around their homes. The biocentric group was more likely to agree that creating defensible space would create a nice looking neighborhood, improve the appearance of their property, reduce damage to a home due to wildland fire, and make firefighters' jobs easier. This group was also more likely to evaluate these as positive outcomes. There were no instances where the perceived likelihood and evaluation of outcomes were a different direction between the two groups. The biocentric group, however, felt stronger about the likelihood and evaluation of outcomes to creating defensible space.

Independent sample t-tests found similar relationships for the subjective norms variables as for the attitude variables. The biocentric group believed more strongly than the anthropocentric group that family, neighbors, the Forest Service, and the local fire department would be more likely to approve of them creating defensible space and was more likely to comply with the wishes of referent individuals and groups. The anthropocentric group was unlikely to create defensible space simply because neighbors, community leaders and the Forest Service wanted them to.

Independent samples t-tests found only two significant differences between the two groups on perceived barriers to creating defensible space. The anthropocentric group was least likely to indicate that they did not have the physical ability to do the work and to feel it is the fire department's responsibility to do the activities. Both groups similarly rated all other barriers as relatively unimportant to creating defensible space. There were significant differences in the perceived effectiveness of defensible space activities between the two groups, although both clusters found all activities potentially effective. The biocentric group found all activities but maintaining irrigated green space and reducing tree density to be potentially more effective than did the anthropocentric group.

Independent samples t-tests found a number of significant differences between the two groups in their intention to engage in defensible space activities. The biocentric group indicated a greater likelihood of removing branches within 10 feet of

their roof, maintaining an irrigated green area, and planning an evacuation route from home than did the anthropocentric group, though both groups indicated some likelihood of doing these activities. The anthropocentric group was less likely to plant fire resistant plants and serve on a committee for fire-related issues. Finally, while the biocentric group was slightly likely to plant trees and shrubs 15 feet apart, the anthropocentric group was unlikely to do so.

Chi square analysis found only one significant difference between the groups on the performance of an activity. A higher proportion of the biocentric group maintains an irrigated green area. It should be noted that about one-half or more of the respondents in both clusters engaged in all the activities except for using nonflammable building materials, planting trees and shrubs at least 15 feet apart, planting fire resistant plants such as ivy, and serving on a committee of residents.

### 4.3 Comparing Groups on the Relationships Among Study Variables

Two regressions sets for each group were conducted. In the first regression set, behavior was regressed on behavior intention, attitude, subjective norms, and the perceived behavioral control. In the second regression set, behavior intention was regressed on attitude, subjective norms, and the perceived behavioral control variables.

For both the anthropocentric and biocentric groups, the strongest predictor of doing defensible space activities was the intention to do them. None of the other factors were significant predictors of behavior. While the high predictive power of behavioral intention was expected, the posited direct effect of perceived behavioral control on behavior was not statistically significant.

For the anthropocentric group, the strongest predictor of intention to create defensible space around one's home was perceived behavioral control - effectiveness. Attitude toward these activities was also a significant predictor of behavior intention. Finally, perceived behavioral control - barriers was a significant but weak predictor of behavioral intention. Subjective norms did not significantly predict behavior intention for the anthropocentric group. Results were different for the biocentric group. The strongest predictor of behavioral intention for this group was perceived behavior control - barriers. Subjective norms and attitude were the next strongest predictors of behavioral intention. Perceived behavioral control - effectiveness did not significantly predict behavior intention for cluster 2.

## 5.0 Discussion

This study examined the role that basic beliefs play in influencing specific perceptions and behaviors related to creating defensible space around one's home in the urban-wildland interface. Prior to discussion of the results, some considerations related to the validity of the results should be addressed. First, while the results are representative of residents of the four counties in Minnesota that were part of the study, care should be taken before assuming the results can be applied to other areas of the country that have different wildland fire problems and histories. Second, social desirability bias may result in over-reported behaviors of creating defensible space. However, the ability to predict specific perceptions and behaviors through a value-based model found in this study was consistent with previous research supporting the predictive validity of value-laden basic beliefs.

### 5.1 Categorization of Respondents on Basic Belief Dimensions

Confirmatory factor analysis on the basic belief dimensions supported the theoretical structure of the items, identifying six basic belief dimensions related to forest and wildland fire management. These were *biocentric*, *anthropocentric*, *freedom*, *artificial management*, *government responsibility*, and *personal responsibility* dimensions. While not exhaustive of the dimensions that might exist regarding values related to forest and wildland fire management, these represent key value - based dimensions that might influence more specific attitudes toward wildland fire issues. This is supportive of other research that suggests that the orientation of value - based beliefs can influence more specific perceptions and behaviors (Dietz et al. 1998; Fulton et al. 1996; Homer & Kahle 1988; McFarlane & Boxall 2000; Stern & Dietz 1994; Stern et al. 1995).

### 5.2 Attitudes, Subjective Norms, and Perceived Behavioral Control toward Defensible Space

While support for conducting defensible space activities around one's home in the urban - wildland interface was high for both clusters, differences were found in the strength of specific perceptions that underlie willingness to engage in those activities. The relative effects of

perceptions on behavior were related to one's basic value - laden beliefs. For example, respondents in the biocentric group had more extreme attitudes toward engaging in defensible space activities as noted by the perceived higher likelihood of positive outcomes such as reducing fire damage to homes, enhanced aesthetic benefits of defensible space, and making firefighters' jobs easier.

In addition to more extreme positive attitudes toward engaging in defensible space activities, the biocentric group placed greater weight on the perceptions of important referents in their decision to engage in defensible space activities than did the anthropocentric group. In fact, while the biocentric group was inclined to indicate compliance with what community leaders, the Forest Service, and the local fire department would want them to do, the anthropocentric group indicated that they would not be inclined to comply with community leaders and the Forest Service and significantly less likely to comply with the local fire department. The biocentric group saw nearly all of the specific defensible space activities as potentially more effective than did the anthropocentric group and were also more likely to actually engage in those activities.

It is also instructive to examine the relative effects of these factors on the intention to created defensible space. While the biocentric group held more extreme attitudes toward engaging in defensible space activities, their attitudes toward the activities were less likely to drive their intention to do the activities than were the wishes of other individuals and groups. In fact, the strongest factor that influenced the biocentric groups' intention to do defensible space activities were the barriers and constraints that the individual might run into and have little control over. If barriers and constraints to creating defensible space can be effectively addressed, the likelihood of this group to creating defensible space is strong, as long as the benefits of such behavior is effectively communicated. While the anthropocentric group saw defensible space activities as less effective than did the biocentric group, the behavioral control - effectiveness factor was the strongest predictor of their intention to engage in the activities. Their perceptions of the outcomes of doing the activities (their attitude) was also a strong predictor of behavior intention and much stronger than for the biocentric group. Barriers, or constraints, were relatively weak predictors of intention to do the activities and the desires of others (subjective norms) had no effect on whether this group created defensible space.

### 5.3 Conclusion

We identified two groups in the north central counties of Minnesota based on value - laden beliefs about forests and wildland fire management. While a generalization about characteristics of these groups is difficult based solely on responses to our survey, the pattern of basic beliefs of one group appeared to reflect more conservative values. These individuals placed more emphasis on an anthropocentric use of nature, greater freedom to build where the individual wanted, less involvement by government and greater personal responsibility. The second group, on the other hand, placed a significantly higher value on a biocentric focus for nature, as well as greater government intervention and responsibility, arguably a more liberal viewpoint. These differences appeared to find their influence in the motivations, or reasons, underlying the decision to create defensible space around private residences. While general support for creating defensible space in north central Minnesota was strong for both groups, this may or may not be the case in other parts of the country with similar, or greater, urban - wildland problems related to forest and wildland fire management. Also, differences in the urban-rural makeup of a region may imply differences in how residents respond to management issues (Howell & Laska 1992; Steel, List, & Shindler 1997). That different motivations appeared to drive the decision to do defensible space activities suggests that managers in areas with a diverse population may need to consider several approaches to encourage desired behaviors on the part of homeowners. Providing information about how the Forest Service, fire department, or community perceived the development of defensible space might be less effective for individuals with an anthropocentric focus toward natural resource and fire management since this group was significantly less motivated to comply with the opinions of other individuals or groups. On the other hand, information about what is considered appropriate normative behavior might be effective for individuals with a biocentric value orientation. Addressing barriers to creating defensible space would also have varying levels of influence across value-based groups, since they systematically differed in their assessment of the effectiveness of the activities. However, where barriers do exist, information about how such barriers may be overcome might be effective.

Implications of this research lie in a greater understanding of the values that individuals hold toward natural resource and fire management. A number of related benefits can be obtained through obtaining this value information. First, gathering such broad based value information can provide an efficient summary of the diversity of values toward natural resource and fire management that exist in this society. Second, understanding the diversity of values that exist can help managers make educated assessments of how different segments of the public may feel about specific issues such as creation of defensible space and other fire management strategies. Third, such value information can help managers develop more efficient communication programs. Messages can be developed that effectively target specific groups of people that hold similar values about a natural resource or fire management issue. Understanding constituent perceptions through research such as this is one component of improved integration between managers and the public called for by Cortner (1991) and associates (Cortner et al. 1990).

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