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Controlling the Southern Pine Beetle:

Small Landowner Perceptions and Practices

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On the cover, photo credits: Andrew J. Boone, S.C. Forestry Commission (aerial photo of damage); Terry Price, Ga. Forestry Commission (photo of galleries); Ronald F. Billings, Texas Forest Service (close-up of southern pine beetle).

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CONTROLLING THE SOUTHERN PINE BEETLE: SMALL LANDOWNER PERCEPTIONS AND PRACTICES

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INTRODUCTION

The southern pine beetle, *Dendroctonus frontalis* (Zimmermann) (Coleoptera: Scolytidae) is one of the most serious threats to pine forest health in the South *(4,24,29,30)*. Once a forest stand is infested, there are few options for immediate elimination and isolation of infested trees. The most effective approach to preventing losses from the southern pine beetle (SPB) is through traditional timber management, including thinning and prescribed burning. Nevertheless, many landowners do not undertake these measures *(28)*.

Nonindustrial private forests (NIPFs) comprise more than two-thirds of the forestland east of the Mississippi. Rapid population growth and urban/suburban expansion in the South are resulting in land fragmentation (division of forest landholdings into increasingly smaller sized parcels) and resulting in many new landowners *(14,27)*. Previous studies have found that NIPF landowners are a diverse group, with great variance in landowning objectives, use of professional forestry assistance, and forest management strategies *(9,10,11,18,22,23)*. The purpose of this study is to examine SPB prevention and control practices among NIPF landowners in the South.

There are a number of possible reasons why forest landowners might not engage in practices known to be effective in prevention or control of SPB infestations *(2,3,5,25)*. These include the following: (1) Landowners may be unaware of the SPB, its impact, and the practices for preventing or controlling it. The broad and diverse population of NIPF owners does not have a regular and consistent set of communication ties with the public agencies designed to pro-

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mote forest health that might otherwise alert owners to SPB problems and guide their response. (2) Landowners may not be generally involved in active forest management, with reasons ranging from lack of knowledge, different land ownership objectives, and perceived conflicts between forest management and other values. (3) Landowners may be aware of the SPB problem, but not take appropriate steps due to cost, lack of access to prevention and control measures, or other constraints. These potential reasons fit well into a model of landowner behavior that focuses on awareness, interest, desire, and actions (AIDA) in understanding landholder practice adoption.

The objectives of the study were as follows:

1. To profile the characteristics of NIPF landowners and their holdings in 12 southern states.

2. To determine the management objectives NIPF owners have for their holdings.

3. To measure the nature and kind of management strategies NIPF owners use for their holdings.

4. To determine levels of awareness, interest, desire, and actions taken by NIPF owners to prevent and control SPB infestations.

5. To assess the information sources NIPF owners use to make management decisions about their holdings.

NIPF Lands and Owners

NIPF landowners do not own or operate wood processing facilities. This target population includes farmers, miscellaneous individuals, and non-forest industry corporations. There are 9.8 million NIPF landowners in the United States, five times more than the number of farmers. Half own land in the South where they hold 70 percent of the timberland. Most own tracts of less than 100 acres and the average size of holdings is only 17 acres. Furthermore the number of landowners with fewer than 100 acres has increased 29 percent since 1979 and is expected to increase by another 50 percent in the next decade. Surveys indicate that NIPF owners acquired land for a variety of objectives, including investment, recreation, wildlife management, aesthetic enjoyment, as part of a farm, or for timber production. There is a wide range of variety in who they are and their objectives *(13,15)*.

Birch *(6,7,8)* shows that 30 percent are retired, 20 percent are full- or part-time farmers, and the remainder are a mixture of blue-collar and white-collar workers. Most are absentee landlords. They are not wealthy, as only 20 percent report annual incomes in excess of $60,000. About 90 percent of the NIPF owners hold less than 100 acres. These small parcels account for 30 percent of NIPF acreage. Just 3 percent of private owners hold about 29 percent of the private forest acreage in parcels greater than 1,000 acres. This includes forest products companies and some large NIPF. A large and diverse

group with widely different objectives, NIPF owners are critical to the future of sustainable forestry in the South *(13)*.

Landowner Objectives

Recent public interest in ecosystem or landscape level management has raised the issue of private landowner management for outputs other than timber *(32)*. Sustainability issues such as green certification, resource accounting, and sustainable forest management have also heightened interest in private landowner's management for amenity values *(31)*. As early as the 1950s, researchers noted that landowners might have alternative objectives *(34),* although a more common characterization of NIPF landowners was that they did not know how to correctly manage their land for profit. Clawson *(12)* found that NIPF landowners were not substantially different from profit maximizing industrial landowners, implying that alternative objectives were not an issue. Even among those who viewed NIPF management as less than optimal, the fault was attributed to lack of information, not alternative objectives.

The number of NIPF owners is growing, increasing by 27 percent from 1978 to 1994 *(7)*. More than 40 percent of current NIPF owners acquired their property since 1978. However, during the same period there was a drop in the number of large tracts, more than 1,000 acres, which indicates that private forestlands are becoming increasingly fragmented. Smaller parcels cannot be managed as efficiently as large ones. Small forest tracts produce less timber, which can force heavier cutting in the short term to meet immediate financial needs *(15)*.

Birch (1996) found that NIPF owners who have acquired land since 1978 are younger, better educated, and have a higher income than the average owner of 1978. Yet the proportion of retired owners also has increased to about 20 percent, raising questions about the continuity of management philosophy and the need for estate planning. The disposition of lands to several heirs or the outright sale to pay estate taxes are major contributors to the fragmentation of forestlands, and the parceling of larger tracts into smaller ones *(27)*.

NIPF owners hold their land for a variety of reasons. About 40 percent cite recreation or hunting as the primary reason for owning forestland, according to Birch *(7)* and Jones et al. *(21)*. Ownership may be incidental to other uses. For example, forestland may be part of the farm. In suburban areas, forests are often conveyed with homes as part of subdivisions. For many, however, their ownership is by design. Nine percent of NIPF owners (10 percent of the NIPF acreage) purchased their land as an investment *(7)*. The reason for ownership plays a critical role in landowners' forest management decisions, but landowner behavior is not always consistent with their attitudes *(15)*.

NIPF owners often are not well informed about the economic value of their resource or the importance of consulting professionals when making man-

agement decisions. Knowledgeable landowners, and those who use natural resource professionals when making decisions, tend to make decisions more consistent with principles of sustainable forestry *(35)*.

The term *Volvo harvest* was coined by Johansson and Lofgren *(20)*. It describes NIPF landowners who harvest when they need an infusion of cash to pay for a large purchase such as a car or college or a boat. Thus the forest is being used as a savings account, and management behavior may not be related to actual forest characteristics.

The second issue is that some landowners do not realize how much money they could be making from their timber. Infrequent participation in timber sales may cause landowners to be concerned about being exploited in such transactions. They even may be uncertain about who might be interested in buying their timber. Egan and Jones *(17)* found that landowners' forestry decisions vary directly with their knowledge of forests and forestry.

The AIDA Model

A number of models in the social sciences endeavor to summarize the process of how people reach decisions. For example, Rogers *(26)* presents the adoption-diffusion perspective as one means for describing and understanding the diffusion of innovations, particularly those that have relative advantages in terms of profit-making or laborsaving for the adopter.

Other frameworks may be more useful for a public resource manager agency endeavoring to understand landowner responses to forest health problems. One of the most important of these is the AIDA model (awareness, interest, desire, action), which suggests that when considering making decisions, human thought processes go through four stages *(33)*. In 1898, St. Elmo Lewis presented this framework to describe the decision to make a consumer purchase. The model, AIDA, laid out a sequence of stages, which describe the stages a consumer follows, and seller must facilitate in order to achieve a sale. The stages—awareness, interest, desire, and action—form a linear hierarchy. We consider this model in the context of a public agency endeavoring to promote forest health.

Simply put, in order to be motivated to actually make a timber management choice that promotes forest health (or control pine beetles), land owners must (1) be aware of a management strategy's existence, (2) be interested enough to pay attention to the strategy's features or benefits, (3) have a desire to benefit from the outcome of the strategy for their own trees and those of their neighbors, and (4) take action by adopting or complying with recommended practices.

Lewis believed that the fourth stage—action—would come as a natural result of movement through the first three stages; that is, desire leads to action. The model is commonly used in designing advertising and promotions, and ad-

vertisers try to develop material that stimulates as many stages as possible in response to a single communication. AIDA may be productively applied to understanding prosocial compliance processes, such as pine beetle management, where the actions being promoted benefit the neighbors, nature, and society in general as much or more than they benefit the practicing landowner.

The AIDA model is simple and direct, which partly explains its longevity and widespread use. To begin with, before the landowner will make a utilization decision, the individual must be aware that they have a problem, that a solution or management strategy exists, what it is, what it does, and perhaps also where and when the components of the solution and advice on how to implement them are available.

The model asserts that landowners need to be stimulated to take some interest in the solution or management strategy. What special features does the approach have? What benefits does it offer to the landowner? How might it satisfy any one of a variety of needs and wants that the consumer might have? During this stage the landowner develops an attitude or disposition toward the management strategy, usually either favorable or unfavorable.

If the response is favorable and the communication is successful in awakening interest, it then attempts to create in the landowner's mind a desire to implement the management strategy. It does this by successfully connecting the benefits of the solution with the landowner's needs and wants. This is often the most difficult aspect of program design. It is one thing to portray a forest management solution in an attractive manner that stimulates interest in landowners, it is quite another to persuade them that they actually need to implement it.

The desire phase of communication has to show landowners that there is an item or strategy available which will realistically meet a significant need. If the need is not perceived, or a realistic remedy not perceived as available, action will not occur. Communications must show landowners that they can solve or avoid forest health problems—perhaps linked to other desirable outcomes like income protection, environmental stewardship, and being a good neighbor—by implementing a forest management strategy that incorporates SPB prevention and control. This leads to the final stage, action, where landowners actually implement the prevention and control measures on their lands.

As noted, the model is fairly simple, but writing communications that appeal to all four stages may not be as straightforward. Information about landowner perceptions of SPB problems can help structure efforts to promote forest management by anticipating the objections and sources of indifference that inhibit landowner responses to forest health problems. SPB control communications then may reflect the barriers actually perceived by landowners, while enhancing the benefit streams that NIPF owners seek to obtain from their holdings.

The AIDA model and similar frameworks are widely employed by practitioners of applied social change. A series of approaches based on Lewis' AIDA

are chronologically listed in some detail by Barry *(1)*. While there were differences of opinion as to the exact order, number, and naming of the stages leading towards adherence to recommended practices, all of the models identified a focal behavioral stage — action (prevention and control steps) — which in this case is to be the primary goal of forest health education. We take the singular focus on implementation of recommended practices as the central issue in efforts to promote better forest management. Specifically, SPB prevention and control is one central objective of forest health education.

METHODS

Data were obtained from mail questionnaires completed by 210 nonindustrial private landowners in 12 southern U.S. states. A list of 1,300 nonindustrial private landowners with timber holdings less than 400 acres was obtained from a commercial sampling firm. Accounting for bad addresses, deceased respondents, and those who did not currently own forestland, the sample represents a 29 percent completion rate. Statistics from samples of this size estimate population parameters with an approximate accuracy of +/-7 percent.

A ten-page draft instrument examining SPB management practices was developed and circulated for comment among forest-health extension and research personnel. The instrument was pretested in a group setting and responses used to revise the instrument. Following procedures outlined by Dillman *(16)* a pre-contact letter was sent in early February 2002. The survey instrument and first cover letter were mailed about 10 days later. A week later a reminder postcard was sent. A week later a questionnaire and second cover letter were sent to remaining nonrespondents. Three weeks later, a questionnaire and third cover letter were sent to remaining nonrespondents.

The data were tabulated by size of forestland holding. Three categories were employed: less than 15 acres, 15 to 84 acres, and 85 or more acres. These intervals divided the sample into relatively equal groupings and reflect an important dimension of difference in the population of nonindustrial private landowners in the region.

Characteristics of sample respondents were examined first. Then the analysis treated three broad categories of information from the survey: pine beetle experiences and actions, patterns of technical assistance and information preferences, and finally, forest uses and ownership circumstances.

RESULTS

Household and Personal Characteristics

Table 1 tabulates selected household and personal characteristics by the number of acres owned in three categories. The chi-square tests indicate that landowners were relatively similar across the three sizes of forestland holdings; that is, the differences were not statistically significant.

Most of the respondents were men, but twice as many women had 15 acres of forestland or less. Most respondents were white, but 5 percent were not. More than half the sample had a college degree or more education.

TABLE 1. SELECTED HOUSEHOLD AND PERSONAL CHARACTERISTICS BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Gender	%	%	%	%	
Female	21	16	10	15	3.1
Male	79	84	90	85	
number	***68***	***58***	***63***	***189***	
Ethnicity					
Black or African American	0	2	2	1	8.5
Asian or Pacific	0	2	0	1	
White or Caucasian	97	90	98	95	
Native American	3	5	0	3	
American	0	2	0	1	
number	***65***	***59***	***61***	***185***	
Education					
Some high school	6	5	11	7	15.8*
High school graduate	26	27	11	21	
Trade or some college	20	18	14	17	
College graduate	32	33	38	34	
Some graduate school	3	5	0	3	
Masters degree and more	12	12	27	17	
number	***65***	***60***	***64***	***189***	
Household income					
Less than $20,000	7	8	5	7	5.8
$20,000-30,000	7	8	2	5	
$30,000-40,000	12	13	13	13	
$40,000-59,000	25	21	16	21	
$60,000-99,000	18	19	31	23	
More than $100,000		32	31	33	32.0
number	***57***	***52***	***55***	***164***	

continued

TABLE 1, CONTINUED. SELECTED HOUSEHOLD AND PERSONAL CHARACTERISTICS BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Age					
Under 30	2	2	2	2	8.8
31-40	16	9	5	10	
41-50	22	21	32	25	
51-60	20	25	24	23	
61-70	25	23	21	23	
71-80	13	12	13	13	
Over 81	3	9	3	5	
number	***64***	***57***	***62***	***183***	

*p < .05

Seventy-six percent of the sample had household incomes greater than $40,000. Almost 70 percent were between ages 40 to 70, and few were under age 30. Almost 41 percent were over age 60.

Education was the only characteristic significantly related to holding size. The levels of schooling among larger landowners were most diverse, as twice as many owners of smaller holdings had less than high school education, and twice as many had graduate degrees.

Awareness and Loss Experiences

Table 2 shows the self-rated awareness of landowners about the SPB problem. About a third were very aware of SPB as a source of timber losses. There were large differences in the level of awareness of SPB as a source of timber losses. Many more large landowners rated themselves as very aware of SPB than small holders (60 versus 16 percent).

We asked if SPB was a cause of timber losses in the county where their largest timber tract is located. Overall, 42 percent of the landowners did not know if SPB was a cause of timber losses in their county. Almost a third of the larger tract owners said that there were large losses in their county.

More small holders (31 percent) did not know if they had lost any trees due to SPB on their lands, but 8 percent of the largest land owners did not know either. Owners of larger parcels were more likely to have experienced losses at some level of severity.

TABLE 2. AWARENESS OF LOSSES DUE TO THE SOUTHERN PINE BEETLE[b] BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Please rate your level of awareness of the SPB as a source of timber losses from forestland.					
	%	%	%	%	
Not aware	31	10	5	16	41.2*
Slightly	28	23	15	22	
Somewhat	26	35	20	27	
Very aware	15	32	60	35	
number	***68***	***60***	***65***	***193***	
Is the SPB a cause of timber losses in the county where your largest tract of forested land is located?					
Do not know	57	48	22	42	25.4*
No losses	0	2	5	2	
Slight losses	36	30	42	36	
Large losses	7	20	32	20	
number	***67***	***60***	***65***	***192***	
Have you lost any trees due to the Southern Pine Beetle?					
Do not know	31	17	8	19	MR
No pine trees on land	1	2	2	2	
Minor losses from SPB	29	28	47	35	
No losses from SPB	24	25	14	21	
Moderate loss from SPB	10	22	25	19	
Major losses from SPB	4	7	5	5	
number	***61***	***55***	***59***	***175***	

*p < .05 (MR = multiple responses possible)

Interest and Surveillance to Limit SPB Losses

More than 90 percent said they were interested in limiting the SPB as a source of timber losses (Table 3). The smallest forestland owners who had taken no control steps were the least interested. Larger forestland owners were the most committed. Larger forestland owners rated themselves as very interested in limiting SPB (57 versus 13 percent).

Landowners were asked how they looked for SPB damage on the lands. Seventy-seven percent said they looked for damage when they visited the land, but nearly all the larger owners did so, compared to 61 percent of the small holders.

About a third of the small holders said they do not watch for problems. Larger landowners were more likely to rely on other parties to report SPB damage. Employees, consultants, and leaseholders were each mentioned by 11 percent or more of the larger landowners.

TABLE 3. INTEREST IN CONTROL AND SURVEILLANCE OF THE SOUTHERN PINE BEETLE BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Please rate your level of interest in limiting the SPB as a source of timber losses from forestland.					
	%	%	%	%	
No interest	9	8	0	6	37.4*
Slight interest	42	20	11	24	
Interested	36	37	32	35	
Very interested	13	35	57	35	
number	***67***	***60***	***65***	***192***	
How do you look for pine beetle damage on your land?					
Do not watch for SPB problems	39	24	5	23	MR
I look for damage when I visit the land	61	73	97	77	
State forestry agents look	4	7	26	13	
Instruct employees to look for damage	1	2	12	5	
Consultants look	3	2	11	5	
Hunting leaseholders look	1	3	11	5	
Other actions	1	2	0	1	
number	***67***	***59***	***65***	***191***	

*p < .05 (MR = multiple responses possible)

Desire and Orientations to Limit Losses

When asked to rate their desire to take action about SPB problems, about 92 percent of the landowners said they wanted to do something (Table 4). In terms of desire to take control actions, more large owners wanted to something about SPB. About 56 percent of the larger owners said they had a great desire to take action to limit damage compared to 17 percent of the small holders.

TABLE 4. DESIRE TO PREVENT AND CONTROL THE SOUTHERN PINE BEETLE BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Please rate your desire to take action to limit damage from the spread of the SPB on your lands.					
	%	%	%	%	
No desire	14	7	3	8	26.0*
Slight	38	25	14	26	
Somewhat	32	28	27	29	
Great desire	17	40	56	37	
number	***66***	***60***	***64***	***190***	
If wise use of forestland means doing regular thinning, cutting, and replanting of tree stands to maximize their economic productivity, to what extent do you take this approach to using your forestland?					
Not at all	56	25	13	32	53.5**
Slightly	22	27	10	19	
Somewhat	22	25	37	28	
Great extent	0	23	41	21	
number	***64***	***60***	***63***	***187***	
If conservation of forestland means managing tree stands to sustain timber yield as well as offer wildlife habitat, protect water quality, and provide recreation, to what extent do your take this approach to using your forestland?					
Not at all	30	15	5	17	34.6**
Slightly	23	18	5	15	
Somewhat	32	32	38	34	
Great extent	15	35	52	34	
number	***66***	***60***	***65***	***191***	
If preservation of forestland means protecting tree stands primarily for recreation, wildlife, or environmental benefits, to what extent do your take this approach to using your forestland?					
Not at all	21	10	14	15	4.5
Slightly	18	20	25	21	
Somewhat	33	33	29	32	
Great extent	27	37	32	32	
number	***66***	***60***	***65***	***191***	

*p < .05 **p < .01

Forestland owners were asked three broad questions about their forest management orientations, which may bear on the desire to prevent and control the SPB. The wise-use orientation refers to regular thinning, cutting, and replanting of tree stands to maximize their economic productivity. Almost a third of the sample said that this approach did not at all characterize their strategy for using their land, but 56 percent of the small holders said that it did not at all fit their strategy. None of the small holders said that wise-use characterized their strategy to a great extent.

This pattern is significant for two reasons. First, it represents a low level of endorsement of the dominant management paradigm extended by public and private foresters. Second, it reveals very weak adherence to recommended practices among small holders. In terms of AIDA, this finding suggests a low level of direct interest in economic use of forestland among NIPF.

The third item in the table presented conservation as a means to sustain timber yield as well as realize wildlife habitat, water quality, and recreation benefits. About 68 percent of the sample said that this statement somewhat or greatly characterized their approach to forest management. Ninety percent of the large holders said so. More than half of the small holders said that a conservation approach not at all or slightly described their forest management practices.

More than 60 percent of forestland owners described their orientation to forest management as one involving preservation of forestland for recreation, wildlife, and environment benefits to a somewhat or great extent. There were no significant differences by holding size. Thus, preservation seems to be a commonly shared forest value across landowner size categories.

Actions Taken to Limit SPB Losses

Respondents were asked to indicate what action, if any, they had taken to respond to SPB problems (Table 5). Some selected more than one item. When asked about steps they had taken in response to SPB damage, about a fourth said they had no damage on their lands. Almost half the large holders said they cut and removed infested trees. Letting outbreaks go inactive on their own was the most common response. More than half the sample said they cut trees in response to SPB damage, but just over a fourth of each size category said they let outbreaks go inactive on their own.

TABLE 5. ACTIONS TAKEN TO PREVENT AND CONTROL SOUTHERN PINE BEETLE DAMAGE BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
What actions have you taken to limit or prevent SPB problems?					
	%	%	%	%	
Take no action to prevent SPB problems	85	75	44	68	MR
Thin stands to avoid infestations	13	24	53	30	
Plant fewer trees per acre	0	4	5	3	
Plant other tree species	5	4	10	6	
Other actions	0	2	7	3	
number	***61***	***55***	***59***	***175***	
What happens when you have SPB damage on your forestlands?					
No SPB damage on my land	35	34	16	28	MR
Let beetle outbreaks go inactive on their own	29	29	27	28	
Cut and remove infested trees (sell or give away timber)	9	19	48	26	
Cut, pile, and burn infested trees	20	16	22	19	
Cut-and-leave infested trees	7	3	21	11	
Spray infested trees with insecticides	4	3	3	3	
Other actions	0	2	2	1	
number	***55***	***58***	***63***	***176***	

(MR = multiple responses)

More than half of the small holders had taken no action, but only a quarter of the larger landowners gave this response. Overall, 28 percent said they had no SPB damage, but twice as many small and middle-size landowners said they had no SPB damage. Larger parcel owners were more likely to be aware of SPB damage.

About 28 percent of the sample said that they let outbreaks go inactive on their own. Almost half the larger owners said they cut and removed trees, but only 9 percent of the small holders said so. Nineteen percent said they cut and burned infested trees. Larger landowners were more likely to have thinned stands to avoid infestations, but there were few respondents of any size holding who had planted less densely, used other planted tree species, or taken other measures.

About 62 percent of the sample had taken no actions to limit or prevent SPB problems. Thinning the density of tree stands was the most frequently employed practice. About 10 percent mentioned other practices. Larger landowners were more likely to plant other species or use other measures to limit or prevent SPB.

Innovativeness

Table 6 shows how landowners rated themselves in terms of their tendency to adopt new ideas. None of the small holders described themselves as innovators.

Small holders were less likely to describe themselves as early adopters and more likely to characterize themselves as one of the last to try new things. More large holders described themselves as not among the first to try new things, but rather part of the early majority to use new practices. Only 14 percent of the largest size category said they were among the last to try new things, compared to 41 percent of the smallest size category. Holding size was clearly related to self-rated innovativeness. The relatively greater financial returns and risks associated with larger land holding connect fairly directly to AIDA process with SPB control.

TABLE 6. SELF-RATED INNOVATIVENESS BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
In terms of using new forest management practices and technologies, how would you describe yourself?					
	%	%	%	%	
An innovator often trying new approaches before anyone else	0	6	7	4	14.9*
Early adopter	16	9	17	14	
Not the first, but part of the early majority	22	31	41	32	
Part of the later majority of users of new ideas	20	22	21	21	
Often one of the last to try new things	41	31	14	28	
number	***49***	***54***	***58***	***161***	

*p < .05

Prevention and Control Effort Conditions

Respondents were asked to rate a series of circumstances that might influence their efforts to prevent and control SPB (Table 7). The items are ordered according to the percent rating the condition as having a high level of influence on their efforts.

Lack of knowledge about SPB was the most influential condition on efforts to prevent and control the pest. Overall, 28 percent rated this as high influence, but 43 percent of the small holders rated it as a high influence on their efforts. Respondents thus expressed a clear need for more information on SPB prevention and management.

Cost of control measures was the next most influential condition. Overall, similar proportions rated it as influential, but much less so among the small holders.

Low timber prices were highly influential for about 14 percent of the sample, but they were rated as significantly more so by the middle-size land owners, and much less so by the small holders. This was the only statistical difference by size among this set of survey items.

Similarly, lack of a timber market was a highly influential condition for about 14 percent of the sample, but somewhat less so for the small holders. Lack of cost share funds were influential for 13 percent of the sample, somewhat more so for the middle-size producers. Lack of cooperation from neighbors and distance to forestland were each influential for less than 7 percent of the sample.

TABLE 7. LEVEL OF INFLUENCE OF SELECTED CONDITIONS ON EFFORTS TO CONTROL THE SOUTHERN PINE BEETLE BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
How much influence has each of the following conditions had on your efforts to control the SPB?					
	%	%	%	%	
Don't know best way to control					
Low	37	51	62	52	7.1
Some	27	35	38	21	
High	43	31	26	28	
number	***35***	***41***	***50***	***126***	
Cost of control measures					
Low	72	42	47	51	6.2
Some	16	28	27	25	
High	12	31	25	24	
number	***25***	***36***	***51***	***112***	
Low timber prices					
Low	96	55	67	71	13.6*
Some	0	24	18	15	
High	4	21	16	14	
number	***28***	***33***	***51***	***112***	
Lack of timber market					
Low	81	64	68	70	2.8
Some	7	21	17	16	
High	11	15	15	14	
number	***27***	***33***	***47***	***107***	
Lack of cost-share funds					
Low	88	64	64	70	5.7
Some	8	18	22	17	
High	4	18	13	13	
number	**25**	**33**	**45**	**103**	
Lack of access to infestations					
Low	80	79	74	77	0.7
Some	12	12	17	14	
High	8	9	9	9	
number	***25***	***34***	***46***	***105***	
Neighbors won't cooperate					
Low	81	65	84	77	7.5
Some	7	29	14	17	
High	11	6	2	6	
number	***27***	***31***	***43***	***101***	
Distance to forestland					
Low	96	81	82	85	4.4
Some	0	16	16	12	
High	4	3	2	3	
number	***24***	***32***	***44***	***100***	

*p < .05

Information Sources

Respondents were asked to rate a series of information sources they might use to make forest management decisions (Table 8). The table presents the sources in order of the proportion giving a high importance rating to the source. No source was rated high in importance by more than 50 percent of the sample.

State or county foresters were the single most highly rated information source for respondents in our sample. About 32 percent of the sample rated them as highly important for their decisions about how to manage forestland.

Forest Service personnel were the next most important information sources closely followed county extension agents. Private and industry consultants were next most highly rated. There were significant differences by holding size on the latter two information sources. Larger landowners were significantly more likely to place more importance on private sector consultants, industry foresters, and the county forestry committee.

TABLE 8. LEVEL OF IMPORTANCE OF INFORMATION SOURCE FOR DECISIONS ABOUT HOW TO MANAGE FORESTLAND BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
How important is each source of information for making decisions about how you manage your forestland?					
	%	%	%	%	
State or county forester					
Low importance	47	33	36	39	3.8
Some	28	35	26	29	
High	25	33	38	32	
number	***53***	***46***	***58***	***157***	
Extension Service county agent					
Low importance	44	36	49	44	1.8
Some	32	34	30	32	
High	24	30	21	24	
number	***50***	***44***	***53***	***147***	
USDA Forest Service personnel					
Low importance	61	47	58	55	3.6
Some	22	29	16	22	
High	17	24	26	23	
number	***46***	***45***	***50***	***141***	
Private consulting forester					
Low importance	80	67	50	65	16.2**
Some	18	19	19	18	
High	2	14	31	17	
number	***45***	***43***	***54***	***142***	

continued

TABLE 8, CONTINUED. LEVEL OF IMPORTANCE OF INFORMATION SOURCE FOR DECISIONS ABOUT HOW TO MANAGE FORESTLAND BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Industry forester					
Low importance	78	53	47	59	11.2*
Some	17	28	29	25	
High	4	19	22	15	
number	***46***	***43***	***50***	***139***	
A family member					
Low importance	60	57	57	58	0.6
Some	28	30	25	27	
High	13	14	18	15	
number	***47***	***44***	***51***	***142***	
USDA Natural Resources Conservation Service (NRCS)					
Low importance	73	48	58	60	8.6
Some	22	36	23	27	
High	4	17	19	14	
number	***45***	***42***	***52***	***139***	
County forestry committee					
Low importance	87	56	48	63	16.8**
Some	9	35	40	28	
High	4	9	12	9	
number	***45***	***43***	***50***	***138***	
Another landowner					
Low importance	67	60	55	61	1.9
Some	26	35	39	33	
High	7	5	6	6	
number	***46***	***43***	***49***	***138***	
Pesticide company rep or dealer					
Low importance	89	83	70	80	9.0
Some	9	17	20	15	
High	2	0	10	4	
number	***45***	***42***	***50***	***137***	

*p < .05 **p < .01

Information Preferences

Respondents were asked how they preferred to receive forest management information. Printed reports were preferred by two-thirds of the sample, and by 78 percent of the large tract holders (Table 9). Private industry foresters were the least preferred by all categories of ownership.

A third of the small holders said they did not want or need information, suggesting a low level of interest in forest health management. After printed materials (57 percent), no forest management information source was selected by more than 8 percent of the small holders.

Overall, large holders selected more information sources, but 42 percent expressed a preference for direct contact with public agency foresters. No source was selected by less than 22 percent of the large holders. Only 16 percent of the large forest tract owners said they did not want or need forest management information.

TABLE 9. PREFERENCES FOR RECEIVING FOREST MANAGEMENT INFORMATION BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
How do you prefer receiving forest managment information?					
	%	%	%	%	
Printed materials such as bulletins, newsletters, etc	57	67	78	67	MR
Do not want or need information	37	24	16	26	
Direct contact with public agency foresters	8	26	42	25	
Direct contact with county forestry planning committee	5	17	33	18	
Group meetings or seminars	2	9	33	14	
Direct contact with private consulting foresters	2	10	28	13	
From other landowners like myself	2	7	27	12	
Direct contact with wood buyers	3	5	25	11	
Direct contact with private industry foresters	2	5	22	10	
number	***65***	***58***	***64***	***187***	

(MR = multiple responses possible)

Financial and Technical Assistance

Respondents were asked to rate their familiarity with public agency programs that assisted forestland owners (Table 10). More than 80 percent of the small holders said they were not familiar with the public programs, but only a third of the large tract holders said they were not aware. None of the small holders said they were very familiar, but a fifth of the large holders were.

TABLE 10. ASSISTANCE AND PARTICIPATION IN PUBLIC AGENCY PROGRAMS BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
How familiar are you with public agency programs that provide assistance to forest landowners?					
	%	%	%	%	
Not familiar	81	65	35	60	38.84*
Slightly	13	18	18	17	
Somewhat	6	12	26	15	
Very familiar	0	5	20	8	
number	***67***	***60***	***65***	***192***	
Have you ever sought advice or assistance in managing your forestland from any of the following sources?					
Never asked for or received assistance	*82*	*48*	*27*	*54*	MR
State employee (county forester or wildlife biologist)	7	21	42	23	
Private consulting forester or wildlife biologist	1	12	37	16	
Extension service county agent	7	12	14	11	
Wood buyer	3	14	12	9	
Industry forester	0	7	22	9	
USDA-NRCS county office	0	5	17	7	
Other	0	2	2	1	
number	***68***	***58***	***59***	***185***	
In the past 10 years, have you received financial assistance (grant or cost-sharing) for:					
No financial assistance	*97*	*93*	*63*	*85*	MR
Tree planting, including site preparation	1	5	27	11	
Conservation measures	1	2	8	4	
Pond construction	0	0	6	2	
SPB infested tree removal	0	0	3	1	
Other	0	0	3	1	
number	***69***	***59***	***63***	***191***	

continued

TABLE 10, CONTINUED. ASSISTANCE AND PARTICIPATION IN PUBLIC AGENCY PROGRAMS BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Do you have a written management plan for your property? If yes, who prepared it?					
No written management plan	99	84	60	82	MR
State or county forester	1	5	18	8	
Private consultant forester or wildlife biologist	0	5	18	7	
Industry forester	0	3	7	3	
Extension service county agent	0	2	4	2	
Wood buyer	0	0	2	1	
USDA-NRCS county office	0	0	2	1	
Other	0	0	2	1	
number	***68***	***58***	***57***	***183***	

(MR = multiple responses possible)

About half the sample never asked for or received assistance, but 82 percent of the small holders never received guidance in managing forestland. About 27 percent of the larger landowners had not. County foresters, private foresters, and county extension agents were the three next most frequently utilized assistance sources. Small holders were more likely to use extension over most of the other sources, but the country forester was the most important source for the larger tract holders.

State employees were the most frequently mentioned, particularly among the larger landowners. Large owners were more likely to call each of the management assistance sources that were presented. Industry foresters, USDA-Natural Resources Conservation Services personnel, and extension were most used by the larger landowners. More middle-size landowners used wood buyers for management assistance than small or larger owners

Forest landowners were asked to indicate which kinds of financial assistance they had received in the past 10 years. Most had received none. About a third of the large holders had received some sort of assistance. Overall, 11 percent indicated tree planting as the purpose for the financial assistance, but 27 percent of the large holders said so.

Most respondents did not have a written management plan. Only 1 percent of the small holders had a written management plan for their property. Often, the county forester prepares such plans. About 18 percent of the large holders used private consultants, and the same proportion worked with county foresters.

Benefits

Respondents were asked to rate the importance of benefits they might expect from their forestland (Table 11). The table presents the benefits as ranked by respondents from high to low importance. Enjoyment of woods, wildlife, and space was cited by 74 percent of the sample as a highly important benefit of forestland ownership. Preservation from development was the next most im-

TABLE 11. LEVEL OF IMPORTANCE OF BENEFITS EXPECTED FROM FORESTLAND DURING THE NEXT 10 YEARS BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Please rate the importance of the benefits you expect from your forestland during the next 10 years.					
	%	%	%	%	
Enjoyment (woods, wildlife, space)					
Low importance	6	7	3	5	1.2
Some	19	20	23	21	
High	75	73	74	74	
number	***63***	***56***	***61***	***180***	
Preservation from development					
Low importance	16	15	25	19	2.9
Some	32	28	25	28	
High	52	57	49	53	
number	***56***	***54***	***59***	***169***	
Recreation (hunting, camping, birding)					
Low importance	42	17	15	24	22.2*
Some	31	46	25	34	
High	27	37	60	42	
number	***55***	***54***	***60***	***169***	
Investment (increase in land value)					
Low importance	42	22	11	24	19.0
Some	36	34	31	34	
High	23	43	57	42	
number	***53***	***58***	***61***	***172***	
Products (wood, posts, straw, etc.)					
Low importance	80	45	28	51	34.0*
Some	20	36	43	33	
High	0	19	30	16	
number	***54***	***53***	***54***	***161***	
Income (cash, tax benefits, etc.)					
Low importance	83	45	23	70	44.1*
Some	15	30	38	28	
High	2	25	39	2	
number	***27***	***33***	***47***	***107***	

*p < .01

portant benefit. Neither of these benefits differed by size of holdings. More large holders than small landowners (60 versus 27 percent) rated recreation as of high importance.

Investment was fourth in overall ranking of importance. More large holders rated this as high importance. Similarly, income was rated as of high importance for more large holders, but no small holders said it was of high importance. Similarly, more large holders indicated wood products and income were important benefits, but these were the lowest rated benefits of the set.

Forest Cutting

Landowners were asked if they had cut trees or taken other wood products from their property. Overall about a fourth had not, but nearly half the small holders had not harvested any products (Table 12). Fuel wood was the most commonly taken product, but 75 percent of the large holders had taken pulpwood and slightly less, saw logs, from their lands.

About two-thirds of the small holders had not cut or thinned their forestlands in 10 years. About 17 percent of the large holders had not done any cutting.

A third of the small holders never planned to cut trees from their land. About 11 percent of the large holders never planned to cut their lands.

TABLE 12. FOREST USE EXPERIENCES AND PLANS BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Have you ever cut trees or taken other wood products from your forestland? What was harvested?	%	%	%	%	
No products were harvested	49	17	11	26	MR
Fuel wood for your own use or for the use of friends	44	52	52	49	
Sawlogs for sale	9	40	72	40	
Pulpwood for sale	10	33	75	39	
Other products for personal use	15	25	32	24	
Posts, poles and pilings for sale	0	2	18	7	
Fuel wood for sale	1	7	11	6	
Other products	1	2	3	2	
Christmas trees for sale	0	2	0	1	
number	***68***	***60***	***65***	***193***	
How much forestland have you cut or thinned in the last 10 years?					
None	65	42	17	42	117.5*
Under 1 acre	8	3	0	4	
2 to 5 acres	23	17	5	15	
6 to 25 acres	5	22	22	15	
26 to 100 acres	0	15	29	15	
Over 100 acres	0	0	31	8	
number	***66***	***59***	***63***	***188***	
Do you plan to cut trees from your land for personal use—firewood, fence poles, construction, etc?					
Yes definitely	25	35	42	34	13.0*
Possibly in the future	40	47	48	45	
Never intend to cut	35	18	11	22	
number	***68***	***60***	***65***	***193***	

(MR = multiple responses possible) *p < .05

Ownership Reasons

Respondents were asked why they owned forestland and could select multiple answers (Table 13). Nonpecuniary reasons were most frequently cited in the list presented to respondents. Residence was the most frequently cited reason among small holders (84 percent), but only 44 percent of the large holders cited residence as the reason for owning forestland.

For the middle-size landowner, residence was most often selected (75 percent), followed by "green space," recreation, and the fact that the forest was part of the farm. Among the large holders, recreation was the most cited reason (78 percent).

TABLE 13. FOREST OWNERSHIP REASONS BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
Why do you own forestland?					
Forestland is part of my residence	84	75	44	68	MR
Enjoyment of owning "green space"	57	60	59	59	
Recreation (hunting, camping, fishing, birdwatching)	37	58	78	57	
For an estate to pass on to others	34	43	59	45	
Part of the farm (untillable part)	28	58	50	45	
Income from timber sales	4	42	70	38	
Farm or domestic use (firewood, fence posts, etc)	31	40	36	35	
Land investment	15	25	34	24	
Use water resources on land (pond, lake, or river)	6	25	30	20	
Income from nontimber uses (hunting leases)	0	5	22	9	
number	***68***	***60***	***64***	***192***	

(MR = multiple responses possible)

Forest Tenure

Table 14 describes the circumstances surrounding the ownership of forestland. Most respondents had individual title to their forestland. More of the middle and large size holdings were in partnerships or other types or arrangements.

Respondents were asked to indicate their relationship to the forest owner. Most of the middle size category were owners, but more spouses of small holders and more business colleagues of larger owners completed the survey. The distribution of the sample by state is provided.

TABLE 14. TENURE OF LAND OWNERSHIP BY ACERAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
How is most of your land owned?					
	%	%	%	%	
Individual title	97	90	77	88	20.4*
Partnership	1	10	15	9	
Limited liability	0	0	3	1	
Corporation	0	0	5	2	
In probate	1	0	0	1	
number	***61***	***55***	***59***	***175***	
What best describes your relationship to the forestland owner?					
I am the forest owner	88	97	83	89	31.8*
Spouse of the owner	12	3	0	5	
Employee of landowner	0	0	3	1	
Relative of the owner	0	0	5	2	
Business partner or co-owner	0	0	6	2	
Other	0	0	2	1	
Manager	0	0	2	1	
number	***67***	***60***	***65***	***192***	
In what states do you own forestland?					
Alabama	1	7	32	13	MR
Arkansas	0	3	3	2	
Florida	23	12	8	14	
Georgia	15	8	6	10	
Kentucky	1	0	0	1	
Louisiana	1	3	3	3	
Tennessee	12	18	9	13	
Virginia	15	3	3	7	
North Carolina	19	18	6	14	
Texas	0	2	5	2	
South Carolina	16	13	12	14	
Mississippi	1	10	23	11	
number	***69***	***60***	***65***	***194***	

*p < .05 (MR = multiple responses possible)

Connections to Forestland

Most small holders had but one tract of forestland. Almost 75 percent of the large holders had more than one tract (Table 15). Ninety-one percent of the small holders lived on their tract of forestland, but only half the large holders did so.

More of the large holders lived more than 25 miles from their largest tract. Nonetheless, 91 percent of large holders indicated that they visited their largest tract several times a year or more often. In contrast, only 84 percent of the small holders did so.

Large holders visited their land more often. About 11 percent of the small holders never visited their forest property, compared to 3 percent of the large holders. Large landowners had more parcels, but nearly all small holder parcels were residential sites or close by.

Table 15. Relationship to and Experiences with Forestland, Southeastern U.S. Landowners, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
How many tracts or parcels of forestland do you own?					
	%	%	%	%	
1 tract or parcel	81	47	27	52	73.2*
2 tracts or parcels	13	39	21	23	
3 tracts or parcels	3	9	17	10	
4 tracts or parcels	0	2	19	7	
5 tracts or more	3	4	17	9	
number	***63***	***57***	***63***	***183***	
How far is it from your home to your nearest tract of forestland?					
Live on land	91	76	50	72	54.2*
Under 1 mile	3	3	9	5	
Less than 10 miles	3	9	8	6	
11 to 25 miles	0	5	11	5	
More than 25 miles	4	7	22	11	
number	***66***	***58***	***64***	***188***	
How often do you personally visit your largest tract of forestland?					
Never	11	2	3	6	13.8*
Rarely	5	11	2	6	
Yearly	0	4	5	3	
Several times a year or more often	84	83	91	86	
number	***61***	***53***	***65***	***179***	

*p < .05

Links to Business and Associations

Table 16 shows that 9 percent of the small holders had businesses linked to their forestlands, but nearly half the large holders did so. About a third of the large holders had farms, followed by recreation and forest product businesses.

Most respondents were not members of any forestland owner association, but about a third of the large holders were. State-level associations were the most frequent membership type, but no small holders belonged to these. Some larger holders reported belonging to county associations (16 percent), but none of the others did.

TABLE 16. LINKED FOREST BUSINESSES AND ASSOCIATION MEMBERSHIP BY ACREAGE OWNED, SOUTHEASTERN U.S. LANDOWNERS, 2002

Item	Acres owned: Less than 15	15 to 84	85 or more	Total	*Chi square*
If your forestland has a business linked to it, what is the nature of the activity?					
	%	%	%	%	
No business linked to forestland	91	69	52	71	MR
Farm	11	28	34	24	
Recreation (hunting leases, fishing, camping, etc)	2	7	15	8	
Forest products (sawmill, pine straw, etc)	0	2	13	5	
Non-timber business (retail, sales, service industry)	2	0	2	1	
Sport or recreation club	0	0	2	1	
Other	0	0	2	1	
number	***66***	***58***	***62***	***186***	
Are you a member of any forest landowner association?					
None	97	97	64	86	MR
State forest land owner association	0	2	30	11	
National forest landowner association	3	2	13	6	
County forest landowner association	0	0	16	5	
number	***65***	***60***	***64***	***189***	

(MR = multiple responses possible)

CONCLUSION

The NIPF landowner is a focal target group in efforts to prevent and control the SPB and other threats to forest health. Untreated infestations can create problems for neighboring landowners, who otherwise promptly respond and control beetles that infest their own forests.

We employed a mail survey of 210 NIPF landowners in 12 Southern states to determine what landowners were doing about SPB, who was helping them, and what their plans were for forest management. We measured landowner attitudes toward SPB prevention and control in terms of a simple, yet well-established and practical model of response to appeals for compliance with forest management recommendations. These data suggest that most nonindustrial private landowners are aware of pine beetle problems, many are interested in preventing the pest, and some express a desire to accomplish control measures. The segment actually taking regular actions to manage the health of their forest is small.

We found important differences by size of forest holding. Larger holders expressed greater levels of activation on each of the AIDA dimensions. Larger owners had some prior experience with SPB problems and had taken steps to control infestations.

One of the central findings of this study is the markedly lower level of awareness, surveillance, and prevention activity undertaken by small holders. The three categories of landowners in our sample did not differ by gender, ethnicity, income, nor age. Yet there was marked difference by holding size on each of the AIDA dimensions, and on a number of other aspects of forest management orientations and plans that were measured by the study.

Larger landowners exerted much higher levels of surveillance efforts and took more actions to respond to SPB damage when it happened on their lands. Large landowners were also more likely to indicate that they were highly influenced by timber prices in their efforts to control SPB. Small holders were most likely to indicate that lack of knowledge about the best way to control outbreaks as highly influential in shaping their efforts.

In our study, no small holder said they were very familiar with public agency programs that provide assistance to landowners. Overall, they had much lower levels of utilization of the various public and private sources of financial and technical assistance that are available. Small holders did not use many information sources, though they did more often rate county foresters, extension agents, other landowners, and a family member as of some importance. Small holders were more likely to indicate that they did not want or need information about forest management.

One central implication of our study is the tenuous and uncertain connections that many nonindustrial private landowners have to larger systems of in-

formation and technical assistance for forest management. Efforts to promote forest health rely on these connections to communicate recommendations and strategies to landowners. Forest decision makers not connected to the knowledge networks will not likely receive messages about SPB prevention and management let alone implement the necessary steps that will control outbreaks and limit damage to surrounding lands.

We offer a number of possible reasons why forest landowners might not engage in practices known to be effective in prevention of SPB infestations.

(1) Landowners may be unaware of the SPB, its impact, and the practices for preventing and controlling it. Our data do not suggest that is the case. Most respondents seemed aware of the SPB and it consequences, but seemed to lack a clear conception of what courses of action were necessary to counter the spread and impact of the insect.

(2) Landowners may not be generally involved in active forest management, with reasons ranging from lack of knowledge, different land ownership objectives, and perceived conflict of forest management with other values. The results do not indicate a lack of involvement in forest management, but some of the values that landowners — large and small — have for their forestland may provide less than compelling motivations for SPB management and control. Recreation and enjoyment of the outdoors—relatively passive values and use objectives—were important for landowners of all size. Because the consequences of inaction or neglect of SPB infestations are sometimes delayed or hidden, many landowners seem to be less than fully attentive to the issue.

(3) Landowners may be aware of SPB prevention and control measures, but not take appropriate steps due to cost, lack of access to measures, or other reasons. The results of this study suggest that lack of cogent, compelling, and unambiguous prevention and control strategies seem to be one circumstance undermining landowner motivation to respond to SPB problems. There is some technical uncertainty about some aspects of the SPB. As a natural phenomenon, there are times when infestations seems to subside with little human intervention. At other times, extensive damage is inflicted on forestlands despite a broadly activated and otherwise compliant set of landowners.

The AIDA model, which focuses on awareness, interest, desire, and actions in understanding landholder compliance with SPB prevention and control strategies, is premised on regular communication of useful content to a population of forestland decision makers. Efforts to prevent and control the SPB will increase their effectiveness when consistent messages reach the broad and diverse set of nonindustrial private landowners in cogent and compelling ways.

NIPF landowners may be more receptive to such messages if tax incentives and cost-sharing programs were better crafted to increase interest in forest health management. Nonetheless, there will continue to be a segment of landowners who do not respond to incentives because their reasons and rationale for

owning land do not lead them to undertake interventions to prevent and control SPB outbreaks. Prevention measures may not be perceived as cost-effective, or this set of owners simply may have land use objectives that are incompatible with traditional forestry. For example, a NIPF owner with scattered pines on a small parcel managed for wildlife may not be responsive to a small number of diseased trees.

Our results show that larger landowners tend to engage in more of the practices appropriate to SPB prevention and control. Traditional forestry extension programs are likely to be effective with this group, although there are certainly some things that could be done to augment landowner education programs (both in quality and quantity).

The case of small landowners is different. They have a wide diversity and land management objectives, and are less likely to engage in traditional forestry or to participate in forestry-related networks. Yet an effective SPB prevention and control program cannot be implemented without their participation.

Pine beetle prevention and control, and other forest health programs, must be implemented evenly and diligently across forest landscapes to be effective. A key hindrance to comprehensive prevention and control in the South is the fact that forest landscapes are held in a mosaic of private ownerships. People who have objectives other than wood and fiber production from their property hold a growing number of ownerships. If a significant segment of forest landholders lacks awareness of, interest in, and desire to prevent and control SPB, then the related forest management actions are unlikely to be implemented across the forested landscape. Therefore, a key question is how to develop a set of appropriate communication strategies to reach landowners across the various segments of holding sizes, time horizons, and management objectives.

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