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Explaining the Forest Product Selling Behavior of Private Woodland Owners

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ABSTRACT

A multiple-variable screening technique, AID, was used to explain the forest-product-sales behavior of private woodland owners. Results provide a basis for policy-related inferences and suggest an optimal strategy for encouraging sales of forest products.

FARMERS, small businessmen, laborers, professionals, clerks, retirees and other private noncorporate owners collectively own about 80 percent of the commercial forest land in the 14 Northeastern States. Consequently, the decisions they make about the use of their woodlands have a major impact on the future availability of forest products and services in the region. Yet little is known about the forest-related behavior of this significant group of decision-makers. We have used a multiple-variable screening procedure to explain their forest-product-selling behavior in terms of characteristics of ownership.

APPROACH

Two dependent variables of sales behavior and several independent variables of ownership were selected for analysis. Our data were derived from a recent study describing the characteristics, attitudes, and actions of 394 private noncorporate woodland owners in Pennsylvania *(Larsen and Gansner 1972)*.

Variables

Dependent variables.—Recent sales of forest products and intent to sell forest products in the future were the dependent behavior variables. Sample owners were split on each variable. Owners who sold forest products in the past 5 years were classified as *sellers*. The rest were labeled *nonsellers*. Owners who definitely intended to sell forest products in the next 5 years were classified as *owners who plan to sell*. The rest were labeled *owners who do not plan to sell or are not certain*.

Independent variables.—Ownership characteristics hypothesized to reflect recent forest-product sales and sales intent were the independent variables. Twelve ownership variables were used to analyze recent forest-product sales and thirteen ownership variables were used to analyze sales intent (table 1).

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Table 1.—*Statistical relationships between selected ownership characteristics and forest-product-sales behavior*

Ownership characteristics	Chi-square significance level	
	Recent sales	Sales intent
	Pct.	*Pct.*
1. Acreage of woodland owned	0.1	0.1
2. Duration of woodland ownership	2.0	(a)
3. Type of ownership	(a)	(a)
4. Distance from residence to woodland	(a)	(a)
5. Encumbered status of woodland	(a)	(a)
6. Age	(a)	(a)
7. Formal education	(a)	(a)
8. Occupation	.1	.5
9. Income	1.0	2.0
10. Use of forest-management practices[b]	.1	.1
11. Participation in formal government programs[b]	(a)	(a)
12. Receipt of forest-management or timber-marketing information[b]	.1	.1
13. Recent sales of forest products[b]	(c)	.1

[a]Not significant at the 5.0-percent level.
[b]During the past 5 years.
[c]Not applicable.

Contingency Analysis

We used simple bivariate contingency analysis to test the relationships between the dependent variables and each of the selected ownership characteristics (table 1). Test results showed a highly significant dependence (at the 0.1-percent level) between recent product sales and four ownership characteristics: acreage of woodland owned, occupation, use of forest-management practices, and receipt of information about forest management or marketing. Income and duration of ownership were also related to recent sales, but at lower levels of significance.

Intent to sell forest products was significantly related (at the 0.1-percent level) with four ownership variables: acreage of woodland owned, use of forest-management practices, receipt of information about forest management or marketing, and recent forest-product sales. Occupation and income were also related to sales intent but at lower levels of significance.

The contingency analysis identified several variables for explaining sales behavior. However, it did not indicate what combination of ownership variables best explains sales behavior.

Multiple Variable Analysis

What combination of ownership variables best explains recent forest-product sales and sales intent? To answer this question we turned to an iterative variance classification scheme called AID—Automatic Interaction Detector *(Sonquist and Morgan 1964)*. AID, a nonsymmetrical binary branching process, was used to subdivide the sample of woodland owners into a series of subgroups. These subgroups maximized our ability to explain forest-product-sales behavior.

The AID technique has distinct advantages over conventional multiple-regression techniques. It can accommodate classification (dummy) variables, and it requires no specification of a general linear model.

We set the following splitting constraints appropriate for our study:

1. The best split of any candidate group had to reduce the unexplained sum of squares by at least 1.0 percent of the total sum of squares (around the grand mean).

2. Each of the resultant groups of a split had to contain a minimum of 30 observations.

3. Independent variables (acreage, duration of ownership, age, education, and income) that were expected to have a monotonic effect on each dependent variable were assigned a monotonic splitting constraint.

RESULTS

Two *dependent* behavior variables were subjected to AID analysis. The output of each analysis is presented as a tree of binary splits (fig. 1 and fig. 2). A detailed analysis of the development of one of these trees—the one used to explain recent forest-product sales activity—helps to understand and interpret the study results.

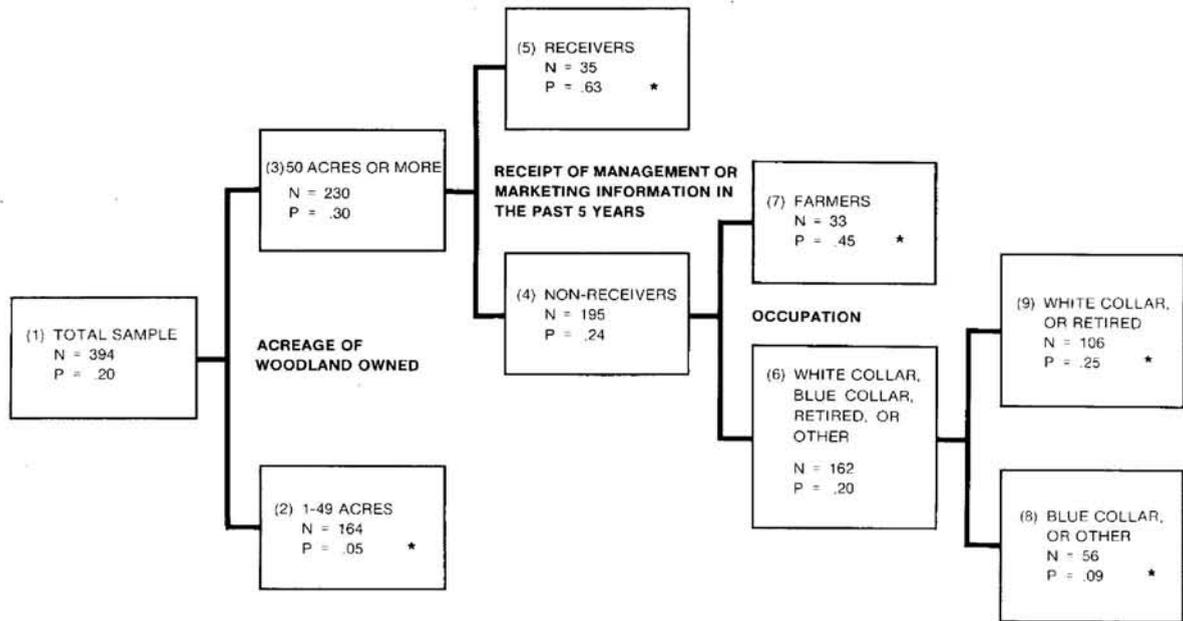Group 1 in figure 1 represents the total sample of 394 woodland owners. Twenty

Figure 1.—Variables explaining recent sales of forest products. N = group size; P = proportion of owners in a group who sold forest products during the past 5 years; and * = final group. "Other occupations" include service workers, housewives, and disabled and unemployed individuals.

Figure 2.—Variables explaining intent to sell forest products in the future. N = group size; P = proportion of owners in a group who plan to sell forest products in the next 5 years; and * = final group. "Encumbered woodlands" are mortgaged, used for collateral, or leased.
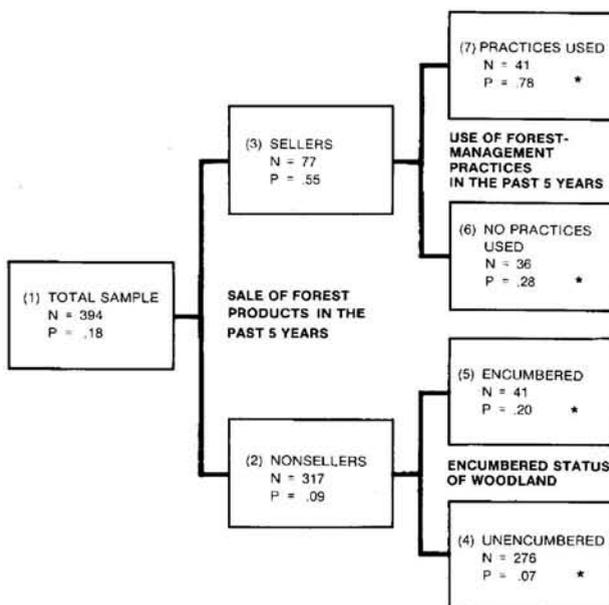
percent of these owners sold forest products in the past 5 years. Our goal was to find the combination of variables that best explains recent product sales. Group 1 was split into two groups on the variable that maximizes the reduction in the unexplained sum of squares. The best variable for splitting group 1 was *acreage of woodland owned.*

The resulting groups were group 2, *owners of 1 to 49 acres of woodland;* and group 3, *owners of 50 acres or more of woodland.* Similarly, group 3 was divided into group 4, *non-receivers;* and group 5, *receivers* of information about forest-product management or marketing during the past 5 years. The same procedure was followed to split group 4, and so on.

N denotes the number of sample owners in each group, and *P* is the proportion of owners in that group who sold forest products in the past 5 years. A group that cannot be split further (see three splitting constraints) is marked with an asterisk and constitutes a final group. Group 7, for example constitutes a final group of 33 owners. Each member of this

group is a farmer who owns 50 acres or more of woodland and has not received information about management or marketing in the past 5 years. Forty-five percent of these individuals sold forest products.

Key groups for explaining owner behavior are those with the highest and lowest P values in each tree of binary splits. These groups characterize behavioral extremes. Groups 2 and 5 (fig. 1) are good examples. According to our analysis, forest-product sellers were least prevalent among members of group 2 and most prevalent among members of group 5.

Recent Forest Product Sales

Twenty percent of the original sample of 394 woodland owners sold forest products during the past 5 years (group 1, fig. 1). Splitting the sample on two key variables substantially improved, our ability to explain their recent sales behavior. If an individual owns less than 50 acres of woodland, chances are very slim that he sold forest products during the past 5 years. Only 1 in 20 of these small tract owners did (group 2, fig. 1). If, on the other hand, he owns at least 50 acres of woodland and has received information about the management and marketing of forest products in the recent past, chances are relatively good (63 out of 100) that he sold forest products (group 5, fig. 1).

Though these results do not prove cause and effect relationships, they do provide a basis for policy-related inferences. It appears that owners of large timber tracts are more willing and better able to satisfy current demands for forest commodities. One way to effectively stimulate the selling activity of these owners is to provide more of them with information about the management and marketing of forest products.

Intent to Sell
Forest Products in Future

Eighteen percent of the original sample of owners definitely intend to sell forest products in the next 5 years (group 1, fig. 2). The rest either do not plan sales or are certain of their selling plans.

The inclination to sell is greatest among those individuals who have sold forest products and have practiced some form of forest management on their woodland in the recent past. Nearly four-fifths of these owners plan to make future sales (group 7, fig. 2). Owners who have not experienced recent sales and whose woodlands are not encumbered (not mortgaged, used for collateral, or leased) tend to have very little interest in future sales (group 4, fig. 2).

The highly significant relationship between past selling behavior and future sales intent was surprising. Apparently many of the owners who recently sold forest products considered it a rewarding experience—so much so that they fully intend to try it again. Recent use of forest-management practices apparently strengthens the urge to make future sales and perhaps reflects a desire to recover funds invested in forestry.

IMPLICATIONS

Our study has demonstrated the usefulness of a multiple-variable screening technique, AID, to explain the behavior of an important group of decision-makers. Results provide a basis for policy-related inferences and indicate optimal strategies for program orientation.

Suppose, for example, our objective were to encourage the sale of forest products from privately owned woodlands in Pennsylvania. The behavior patterns revealed by this study suggest that we should provide information about the management and marketing of forest products to more owners of large wooded tracts (50 acres or more). Owners who have sold forest products and practiced some form of forest management on their woodlands in the recent past should prove most receptive to sales promotion.

REFERENCES

Larsen, David N., and David A. Gansner.
1972. PENNSYLVANIA'S PRIVATE WOODLAND OWNERS —A STUDY OF THE CHARACTERISTICS, ATTITUDES, AND ACTIONS OF AN IMPORTANT GROUP OF DECISION-MAKERS. USDA Forest Serv. Res. Paper NE-219, 17 p., NE. Forest Exp. Sta., Upper Darby, Pa.
Sonquist, John A., and James N. Morgan.
1964. THE DETECTION OF INTERACTION EFFECTS. Univ. Mich. Surv. Res. Cent. Monog. 35. 296 p. Ann Arbor.

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