MODELING LANDOWNER BEHAVIOR REGARDING FOREST CERTIFICATION

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Abstract.—Nonindustrial private forest owners in western Tennessee were surveyed to assess their awareness, acceptance, and perceived benefits of forest certification. More than 80 percent of the landowners indicated a willingness to consider certification for their lands. A model was created to explain landowner behavior regarding their willingness to consider certification. Landowners who would consider certifying their forest would do so to satisfy both their monetary and non-monetary utility. They felt very strongly that certification would improve forest management and that it would reduce the need for regulation. They also were more likely to consider certification if they had previously received advice about forestry.

INTRODUCTION

Most consumers are vaguely familiar with the concept of an objective third party certifying products to assure a high standard, or consistency, in product quality. The certification label that is affixed to electrical appliances by the Underwriters Laboratory, thereby assuring that appliances meet or exceed standards of quality and safety, is an example (Maser and Smith 2001). The USDA Certified Organic label associated with certain fruits and vegetables at grocery stores is another, as are Quality Beef and Quality Pork Assurance Programs. Certification has evolved in a number of industrial sectors, including automobiles, chemicals, footwear, apparel, and fisheries (Sasser 2001). These sectors are often certified under the International Standards Organization with the ISO-system.

Forest certification is a relatively new development and does not deal with the product. Instead it addresses the practice of forestry, the growth and harvesting of trees, and the ecological impact after the trees have been removed from the site (Klingberg 2003). Traditionally there have been few calls for certifying forests, but that situation is changing. Forest certification is now gaining widespread attention from a variety of stakeholders, including environmentalists, policy makers, professional foresters, social activists, loggers, and the public (Viana and others 1996, Mater 1999).

Forest certification in the United States is in a somewhat unusual position when compared to the global picture because a large percentage of total forest area in the United States is under nonindustrial private forest (NIPF) ownership. In 2003, more than 10.3 million NIPF landowners in the U.S. controlled 42 percent (262 million acres) of the nation's forests. The largest portion of the nation's forest lands are located east of the Mississippi River, where 88 percent of all NIPF owners are located (Butler and Leatherberry 2004). Even more significant is the strong regional identity of the 13 southeastern states. NIPF landowners in this region number 5 million and control 89 percent of the forest area (Wear and Greis 2002). Further, nearly 60 percent of the nation's timber is produced by these 13 states, with a striking 18 percent of the world's industrial timber products originating from the South (Prestemon and Abt 2002). Wood production in the Southeast is expected to increase by more than 50 percent between 1995 and 2040, or an average of 1.6 percent per year (Prestemon and Abt 2002, Wear and Greis 2002).

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The timber resources of the southeastern region of the United States are clearly essential to both regional and global economies. Prestemon and Abt (2002) project for the foreseeable future this region will retain the distinction as the single largest producer of timber products in the world. These lands are principally owned, controlled, managed, purchased, and sold by NIPF landowners. How will this important group fit into the forest certification arena?

NIPFs are particularly important in Tennessee, where they comprise 79 percent of the state's 14.4 million acres. Moreover, these forests contribute more than 84 percent of the State's annual hardwood removal volume (Schweitzer 2000). NIPFs are also vital for the protection of the state's soil, water, and wildlife resources and for the production of non-timber goods and services.

OBJECTIVES

Some stakeholders are beginning to debate the necessity of implementing forest certification on NIPFs. If NIPF landowners are to participate in certification, a better understanding of forest landowner behavior regarding certification is needed. This study was designed to model 12 variables that could be related to landowners' willingness to consider certification.

STUDY AREA

The study focuses on West Tennessee and looks at nine counties within the 18-county U.S. Forest Service's Forest Inventory and Analysis West Tennessee Region. The nine counties were selected as they represent 70 percent of the total forest area in the region (Schweitzer 2000). Three counties were randomly selected from the list of nine for survey purposes: Carroll, Hardeman, and Weakley Counties. The three counties contain 564,300 acres of total forest land (223,369 hectares).

METHODS

Landowners were surveyed with a mail questionnaire following Dillman (2000). The original database of landowners was obtained from the Tennessee State Division of Property Assessment. Only landowners controlling 40 acres or more of forest land were targeted. A 50-percent random sample was drawn from the landowner list for the three counties. Duplicates, trusts, businesses, partnerships, sawmills, and pulp mills were removed, eliminating 77 names and resulting in a potential sample of 1,153 landowners (Carroll County 413, Hardeman County 546, and Weakley County 194). The number of landowners sampled in each county was proportional to each county's contribution to the total number of landowners in the survey.

A draft version of the survey questionnaire was developed and pretested. Landowners were assured that the information would be kept confidential. One hundred and three of the individuals were omitted (25 indicated they did not own forest land, 26 owned less than the required 40-acre minimum, 12 were deceased, one was out of the country, one was not mentally capable, six had sold their land, and 32 were undeliverable as addressed). These exclusions brought the number of surveys mailed to 1,050. A total of 532 individuals returned questionnaires for a response rate of 50.7 percent.

Telephone surveys were conducted to test for nonresponse bias. Data for the following variables were collected: size and tenure of ownership, harvest history, familiarity with certification, occupation, and age. Using the Wilcoxon rank sum two-sample test, we found that none of the variables for the nonrespondents showed a significant difference between the respondents (α=0.05).

With this project 12 variables were identified, each falling within one of three vectors: sociodemographics, monetary utility, and nonmonetary utility. The general model for landowner behavior regarding forest certification is described as,

$Y = f(D, M, N)$

where,

Y represents NIPF landowner willingness to consider forest certification;

D represents the sociodemographics vector and is further delineated by the variables: SI = size of forest ownership, YR = years of forest ownership, AD = had the landowner received advice about forest land, UP = importance of landowner staying up to date with new forestry practices and programs, ED = owner's level of education, and AG = age of owner.

M represents the monetary utility vector and is further delineated by the variables: IP = certification will increase my profits from tree farming, LR = certification will lessen the need for forestry regulation, and NT = certification will be necessary for the U.S. timber growers to compete in the international market.

N represents the nonmonetary utility vector and is further delineated by the variables: IM = certification will improve forest management, SC = certification will satisfy consumers that their wood purchases are supporting good forestry, and GR = certification will give recognition for the good forestry that is already being practiced.

The variable AD was the only dichotomous variable. The variables UP, ED, and AG were ordinal scale. The remaining eight variables were interval scale.

RESULTS

Participants were given the following definition of certification, then were asked a binary (yes/no) question of whether they would be willing to consider certification:

"Forest certification means that forests are managed in a sustainable manner and that trees are harvested with environmentally sound practices. These management practices are certified by objective third parties. Landowner participation is voluntary."

Eighty-one percent indicated "yes" they would consider certifying their forest. Willingness to consider certification became the dependent variable in the model. The model then attempted to evaluate a landowner's willingness to certify based on characteristics of sociodemographics, and on monetary and nonmonetary utility about what they believed certification would accomplish.

Model

The experimental model in this study is specified as:

$$CERTIFY = \beta o + \beta_1 SI + \beta_2 YR + \beta_3 AD + \beta_4 UP + \beta_5 ED + \beta_6 AG + \beta_7 IP + \beta_8 LR + \beta_9 NT + \beta_{10} IM + \beta_{11} SC + \beta_{12} GR + \varepsilon,$$

Table 1.—Analysis of maximum likelihood estimates for the full model

Parameter	PR > ChiSq	Odds Ratio
Intercept	0.018	0.002
IM	0.007	4.112
IP	0.162	0.365
SC	0.888	0.923
LR	0.016	3.242
GR	0.964	1.033
NT	0.487	1.399
SI	0.858	1.000
YR	0.963	1.001
AD	0.109	2.950
UP	0.049	2.005
ED	0.104	1.453
AG	0.408	0.970

where βs are model coefficients and ε is the error term. CERTIFY was the dependent variable in the model and consisted of those participants that had indicated "yes" to willingness to consider certification.

Model Estimation

The logit form of probability is preferred when analyzing dichotomous (binary) dependent variables (Menard 2000). The probabilities for logistic regression outcomes are thus specified as:

$$\Pr ob(\mathrm{Y} = j) = \mathrm{P}_i = \frac{e^{\mathrm{B}_j \mathrm{X}_i}}{1 + \sum_{k=1}^{J} e^{\mathrm{B}_j \mathrm{X}_i}} \quad j = 1,2,...,J \text{ for } j = 1,2,...,J$$

$$\Pr ob(\mathrm{Y} = 0) = 1 - \mathrm{P} = \frac{1}{1 + \sum_{k=1}^{J} e^{\mathrm{B'}_k \mathrm{X}_i}}$$

This can be simplified as:

$$\log \frac{\mathrm{P}_i}{1 - \mathrm{P}_i} = a + Bi\mathrm{X}_\mathrm{i}$$

where: P_i = probability that a particular action will be made; $\mathrm{B}i$ = model coefficients.

A test with the full model (retaining all 12 variables), was conducted to assess the odds ratio for individual variables. Initially this analysis revealed nine variables that met the minimum odds ratio requirement of ≥1.0 (Table 1). The remaining three variables (dummy set) were eliminated from the model. Follow-up iterations were conducted, eliminating variables not meeting the odds ratio minimum requirement of ≥1.0 until only six variables remained (IM, LR, SI, AD, UP, and ED). Further reductions in the model eliminated variables with the highest chi-square values that exceeded the significance (α = 0.05)

Table 2.—Analysis of maximum likelihood estimates for the reduced model

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr >ChiSq	Odds Ratio
Intercept	1	-5.049	1.180	18.319	<.0001	0.006
IM	1	1.223	0.300	16.623	<.0001	3.396
LR	1	0.699	0.246	8.095	0.0044	2.012
AD	1	1.171	0.465	6.347	0.0118	3.224

requirement. The variables remaining following these reductions were IM, LR, and AD (Table 2). The model was reduced to:

CERTIFY = -5.049 + 1.2227IM + 0.6994LR + 1.1705UP
where,

IM = certification will improve forest management,
LR = certification will lessen the need for forestry regulation, and
AD = had the landowner received advice about his or her forest land ($\tilde{R}^2$ = .3722).

DISCUSSION

The regression model was significant at $\alpha = 0.05$, with the highest chi-square value of the three independent variables being 0.0118. Variables in the final model represented each of the three vectors. The sociodemographics vector (D) was represented by independent variable AD (had the landowner received advice about their forest land); the monetary vector (M) was represented by independent variable IM (certification will improve forest management); and the nonmonetary vector (N) was represented by LR (certification will lessen the need for forestry regulation).

Landowners who would consider forest certification sincerely felt that certification would improve forest management. With an odds ratio of 3.396, this independent variable carried considerable explanatory power and was of highest importance to the participants.

One of the most interesting results was that landowners felt strongly that certification would lessen the need for forestry regulation. This variable was placed into the monetary vector because regulations most generally seek to place restrictions on harvesting or other profit-motive land uses. Apparently landowners in the study area have some concern over this issue, enough that this variable had more explanatory power than 10 others.

Only one of the six demographic variables tested (AD) was strong enough to retain in the model. Having previously received advice or information about their forest land was a strong determinant for willingness to certify.

CONCLUSION

This model confirms the conclusion of Newsome and others (2001) that landowners rate monetary and nonmonetary reasoning for certification nearly equally important. Landowners who would consider certifying their forest would do so to satisfy both their monetary and nonmonetary utility. They felt very strongly that certification would improve forest management and that it would decrease the need for

forestry regulation. They were more likely to consider certification if they had previously received advice about forestry.

The three predictor variables in the model offer some insight into landowner concerns and motives. Landowners were more likely to consider certification if it would improve forest management or lessen the need for forestry regulation. Exactly how it might improve forest management or affect regulation was not clear. Follow-up research is needed to elucidate landowner concerns over these issues.

Landowners receive information and advice regarding their forest land for a number of reasons and through a number of sources. The state division of forestry and consulting foresters were the two most common sources of forestry advice. However, 91 percent of the respondents were either not at all or only a little familiar with certification, a finding that suggests a large information gap. Perhaps the professional foresters providing the advice are not advocating or suggesting certification; perhaps they are not aware (or even aware) of the benefits and the process. Before forest certification can expand on any measurable scale, state foresters and professional consulting foresters must be better informed and involved in information dissemination.

To date, there has been limited research on private landowners and forest certification. This important and sizable ownership category should be given more serious attention as certification momentum continues to build, especially considering how important NIPFs are to regional timber supplies. The model created by this study explains a portion of landowner behavior regarding willingness to consider forest certification. Future research should focus on methods of transforming landowner willingness to certify into actual certifications and indentificaqtion of the factors most influential in this decision.

Finally, landowner costs of entering certification were omitted from the study because it has been determined that few would pay for certification and that it should be free (Vlosky 2000, Newsome 2001). A comprehensive plan that suggests how to operationalize free or low-cost forest certification on NIPF lands on a much broader scale should be examined.

LITERATURE CITED

Butler, B.J.; Leatherberry, E.C. 2004. **American's family forest owners.** Journal of Forestry. 102(7): 4-9.

Dillman, D.A. 2000. **Mail and internet surveys: the tailored design method.** Second edition. New York, NY: John Wiley & Sons, Inc. 464 p.

Klingberg, T. 2003. **Certification of forestry: a small-scale forester perspective.** Small-scale Forest Economics, Management and Policy. 2(3): 409-421.

Menard, S. 2000. **Applied logistic regression analysis.** Series: Quantitative applications in the social sciences. Second edition. Thousand Oaks, IA: Sage Publications. 111 p.

Newsom, D.; Cashore, B.; Auld, G.; Granskog, J.E. 2003. **Forest certification in the heart of Dixie: a survey of Alabama landowners.** New Haven, CT: Yale Program on Forest Certification. [online]. Available: http://environment.yale.edu/cashore/pdfs/2002/02_teetercash_rtifica_27.pdf.

Maser, C.; Smith, W. 2001. **Forest certification in sustainable development.** Boca Raton, FL: CRC Press. 235 p.

Mater, C. 1999. **Understanding forest certification: answers to key questions.** Pinchot Institute for Conservation. Alexandria, VA: Charter Printing. 50 p.

Prestemon, J.P.; Abt, R.C. 2002. **The southern timber market to 2040.** Journal of Forestry 100(7): 16-22.

Rana, N.; Price, W.; Block, N. 2003. **Forest management certification on private forestlands in the U.S.** Pinchot Institute for Conservation. Alexandria, VA: Charter Printing. 46p.

Rosenberger, R.S.; Huff, J.S. 2001. **Economic thresholds in forest certification for West Virginia NIPFs: a simulation model.** [online]. Available: www.rri.wvu.edu/pdffiles/ForCert%20Summary%20WVU.pdf.

Sasser, E. 2001. **Gaining leverage: NGO influence on certification institutions in the forest products sector.** Paper presented at Forest Policy Center's global initiatives and public policies: first international conference on private forestry in the 21st Century; 2001 March 25-27; Atlanta, GA. 2001. Abstract available at: http://forestry.msu.edu/hardwood/economic%20links/final-program.pdf

Schweitzer, C.J. 2000. **Forest statistics for West Tennessee, 1997.** Resour. Bull. SRS-41. Asheville, NC: U. S. Department of Agriculture, Forest Service, Southern Research Station. 60 p.

Viana, V.M.; Jamison, E.; Donovan, R.Z.; Elliot, C.; Gholz, H. 1996. **Certification of forest products: issues and perspectives.** Washington, DC: Island Press. 261 p.

Vlosky, R. P. 2000. **Certification: perceptions of non-industrial private forestland owners in Louisiana.** Working Paper #41. Baton Rouge, LA: Louisiana State University Agricultural Center.

Wear, D.N.; Greis, J.G. 2002. **The southern forest resource assessment summary report.** Gen. Tech. Rep. SRS-54. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 103 p.