Reimagining Family Forest Conservation: Estimating Landowner Awareness and Their Preparedness to Act with the Conservation Awareness Index

Tyler E. Van Fleet, David B. Kittredge, Brett J. Butler, and Paul F. Catanzaro

ABSTRACT

The Conservation Awareness Index (CAI) is a new, necessary survey instrument designed to assess family forest conservation progress. This article describes the rationale, development, and pilot testing of the CAI, which estimates family forest owner awareness (including familiarity, knowledge, and experience) of forest conservation options and sources of information. Administered to 500 randomly selected Massachusetts family forest owners and 64 benchmark landowners, results indicated instrument validity and revealed low conservation awareness among random respondents, especially regarding estate planning and conservation easements. Distance from land, education level, ownership size, and location were related to conservation awareness. Applications of the CAI include understanding family forest owner preparedness to make informed decisions about their land, improving outreach interventions, and measuring the spatial and social dynamics of conservation awareness over time.

Keywords: family forest owner, forest conservation, awareness, assessment

American forests are vast and diverse, driving powerful natural cycles and supporting myriad life forms and livelihoods. Fifty-six percent of all forests in the United States are privately owned by an estimated 11 million private forest owners, 92% of which are family forest owners (Butler 2008). Family forest owners (individuals, families, and trusts owning 10–999 ac) control 62% of private forestland or 35% (262 million ac) of all US forests and their collective, uncoordinated decisions will determine the future condition and persistence this land. Our research generates new information about the conservation awareness of family forest owners to help increase private forest conservation.

Forest Benefits under Threat

Private forests provide vital ecosystem services related to water (Robles et al. 2008, Stein et al. 2009), air (Woodbury et al. 2007), and wildlife (Stein et al. 2009), and provision consumptive and nonconsumptive human benefits, including wood products (Smith et al. 2004), nontimber forest products (Butler 2008), recreation (Butler 2008), health, and well-being (Frumkin 2001, Chang et al. 2007). Accelerating rates of parcellation and conversion threaten the future of private forests and their benefits. Between 1993 and 2006 average family forest parcel size shrank from 25 to 20 ac in the northern United States (a 20-state region defined by the USDA Forest Service) and the number of family forest owners grew 19%, from 3.8 to 4.7 million (Butler and Ma 2011). In recent decades, US forest loss has increasingly been driven by conversion to developed uses (Alig 2007), with over 17 million forested ac converted to developed

Tyler E. Van Fleet (Tyler.Vanfleet@gmail.com) is research assistant, USDA Forest Service/University of Massachusetts Amherst Family Forest Research Center, 160 Holdsworth Way, Amherst, MA 01003, and David B. Kittredge (dbk@eco.umass.edu) is professor and extension forester, Department of Environmental Conservation, University of Massachusetts–Amherst, 160 Holdsworth Way, Amherst, MA 01003. Brett J. Butler (bbutler01@fs.fed.us) is research forester, USDA Forest Service, Northern Research Station, 160 Holdsworth Way, Amherst, MA 01003. Paul F. Catanzaro (cat@umext.umass.edu) is extension assistant professor, Department of Environmental Conservation, University of Massachusetts–Amherst, 160 Holdsworth Way, Amherst, MA 01003. This material is based on work supported by the National Institute of Food and Agriculture, USDA, the Massachusetts Agricultural Experiment Station, and the Department of Environmental Conservation under Project No. MAS0011. This project has greatly benefited from information and guidance from Charles M. Schweik, Family Forest Research Center members, 2010 Keystone Project cooperators, and the many landowners and forest conservation experts who participated in the study.

land between 1982 and 2007 (USDA 2009a).

As average parcel size shrinks and development pressure increases land values, timber harvesting revenues alone can not keep up with the costs (i.e., property taxes) of family forest ownership (D'Amato et al. 2010) and selling all or part of one's land becomes the primary way to generate income from it (Finley and Kittredge 2006). Forty-four percent of family forests are owned by people 65 years of age or older and 23% of family forests are owned by people who say they intend to sell or transfer their land in the next 5 years (Butler 2008). With a significant proportion of forestland poised to change hands in the near future, a growing number of family forest owners will decide whether or not it stays forested.

Conventional Metrics of Private Forest Conservation

Commonly, private forest conservation progress is estimated by tracking the number of acres and landowners with forest management plans (USDA 2009b) because it is assumed that owners with plans for their properties are prepared to make informed land decisions. Despite decades of program promotion, only 4% of US family forest owners have written forest management plans (Butler 2008) and the Forest Service reports that just 2% of the 130 million ac of private forests in the northern United States have plans (USDA 2009b). At this rate of adoption it will take 144 years for all private forest owners in this region to have plans (Kittredge 2009). Such low participation suggests a disconnect between formal management programs and most landowners' interests, raising doubts about the effectiveness of management plans at informing most landowner decisions and estimating broadscale conservation progress.

Survey research indicates that for most landowners, their land meets their needs by providing privacy, scenery, and recreation, without active planning or management (Jones et al. 1995, Finley and Kittredge 2006, Bengston et al. 2009). Plans that include or emphasize active management are misaligned with these nonconsumptive values. Most family forest owners choose to forgo formal land planning because of its perceived irrelevance to their interests and instead only think about their land reactively when a decision needs to be made (Kittredge 2004). Consequently, these decisions are often made without adequate information or professional advice. In Massachusetts, e.g., 85% of landowners owning 79% of private forests are making critical land decisions without the guidance of management plans (Kittredge et al. 2008). We have developed a new tool for assessing landowners' awareness of land options that offers an alternative way to measure forest conservation progress.

Foundations of a New Forest Conservation Metric

The Conservation Awareness Index (CAI), measures family forest owner familiarity with land options and estimates their preparedness to make informed decisions about their land. Other research has focused on landowner attitudes and motivations to predict participation in conservation programs (Mercker and Hodges 2007, Fletcher et al. 2009) and policies (Janota and Broussard 2008), but no prior research has quantified private landowner awareness of available conservation tools, practices, and sources of information. The CAI is designed to measure awareness as a behavioral precursor rather than to directly report or predict proconservation behavior.

Behavioral theory supports the role of awareness and knowledge in producing behavioral change. According to the theory of bounded rationality (Simon 1991) and knowledge deficit theory (Schultz 2002), behavioral decisions are limited by information and knowledge. Consequently, acquiring knowledge about why or how to do something may compel behavioral change. Although most researchers agree that other factors influence behavior, such as intention, self-efficacy, emotion, and social context (Schneider and Cheslock 2003), awareness and knowledge remain foundational to decisionmaking. The awareness, knowledge, attitude, and practice behavioral change ladder (Anyaegbunam et al. 2004) and the theory of planned behavior (Ajzen 1991) outline how basic awareness of a behavior leads to acquiring more knowledge about it, which may improve one's attitude toward it and ultimately lead to its adoption. Rogers' (2003) diffusion of innovations theory explains how new ideas and technologies spread through society when individuals first gain knowledge of the innovation, and then gather information about it, evaluate its merits, and finally implement and confirm it. Importantly, this theory stresses the influence of social norms and opinion leaders on innovation adoption. By assessing different components of conservation awareness, including elements of peer influence, the CAI is constructed to discern meaningful intermediate steps toward proconservation behavior and serves as an indicator of decision-making preparedness.

Methods

Study Area

The CAI was developed in central and western Massachusetts where most of the state's forestland is located and was pilot tested in six contiguous western Massachusetts towns recognized by organizations and government agencies for their large intact forests and high conservation value (Howell and Weinberg 2005; Figure 1).

Instrument Development

Structured interviews with key informants, including family forest owners ($n = 7$), conservation professionals ($n = 10$), and foresters ($n = 3$), helped identify essential conservation knowledge related to family forest owner decisions about the management and future of their land. Multiple sets of questions were drafted based on interview data and literature review and were then tested in a focus group environment. Four focus groups were held with 31 total family forest owners who collectively owned over 1,700 ac. Participants individually answered written trial questions and provided feedback during 90-minute discussion periods. Participants were randomly recruited from a mailing list of landowners ($\geq$10 ac of forest) generated from property tax records and were compensated $50/household.

The CAI

Designed to function like the Consumer Confidence Index (Ludvigson 2004), the CAI synthesizes responses to a small number of questions into a single indicator value that summarizes a complex concept. The CAI survey instrument comprises 16 questions that capture respondent awareness of forest conservation options and resources and indicates preparedness to make informed land decisions. Four subject categories represent key conservation decisions owners may likely face: (1) current use property tax reduction programs (CUTPs), (2) conservation easements (CEs), (3) timber harvest-
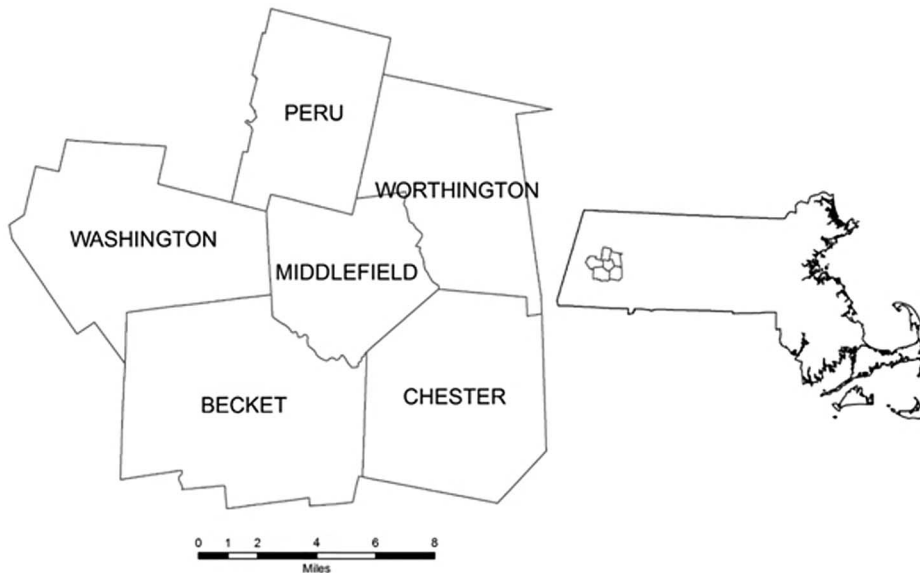
Figure 1. CAI pilot study area. The CAI was administered to 500 randomly selected landowners who owned at least 10 ac of land in six western Massachusetts towns.

ing (TH), and (4) estate planning (EP). Seven demographic questions are also included.

Within each subject category, four questions assess different components of awareness, including familiarity (How much would you say you know about . . .), knowledge (Indicate whether the following statements are true or false . . .), first- and secondhand experience (Have you or someone you know considered or completed . . .), and acquaintance with important sources of information (Do you know a . . . if you do, specify the name, if not, how would you find out about one). The CAI TH section shows instrument structure (Figure 2). Designed as a flexible, scalable tool, the CAI may be adapted to different places (e.g., town, state, or region) by changing specific content while retaining its basic structure and question types.

Pilot Testing the CAI

In spring 2010, the CAI was mailed to 500 randomly selected family forest owners (≥10 ac of forest) in six contiguous towns following a modified, two-wave Dillman (2000) total design method. To minimize bias, landowners were sampled proportionately within towns based on total number of landowners and ownership acreage distributions. The survey response rate was 53% ($n = 267$) and respondents represented, on average, 27% of each town's family forest owner population (≥10 ac of forest). These study participants are referred to as random respondents.

Validating the CAI

The CAI was administered to a subpopulation of landowners believed to have exceptional conservation awareness to establish an empirically based CAI score benchmark. The Keystone Project is a University of Massachusetts Extension initiative that has trained community opinion leaders in forest conservation since 1988. Applicants are competitively selected to participate in 3 days of intensive training in forest ecology, management, and conservation and then return home to assist with local conservation activity. Landowning Keystone graduates were expected to have higher conservation awareness than random landowners because of their training, prior experience, and community leadership. The CAI was administered to 64 Keystone graduates (≥10 ac of forest) using the same methods described previously and had a response rate of 58% ($n = 37$). These study participants are referred to as benchmark respondents.

Analysis

Scoring the CAI

CAI response analysis indicated that no questions were answered universally correctly or incorrectly and that questions and subject categories were not redundant. Respondent self-reported familiarity was generally consistent with knowledge level and incorrect answers were extremely rare (<5% total responses). First, CAI responses were scored with four different expert-derived algorithms. Analysis of these trial algorithm response distributions informed the development of a final algorithm that awarded up to 4 points for each of the 16 questions and gave equal weight to all subject categories and question types.

Figure 2. Example section of the CAI instrument. The TH section of the CAI shows the structure of the instrument, including the four question types designed to investigate different components of awareness: familiarity (question 9), knowledge (question 10), experience (question 11), and acquaintance with sources of information (question 12).

Table 1. Random respondent and nonrespondent responses to select CAI questions.

| | Question 1. How many acres of woodland do you own in Massachusetts? (ac) | | Question 2. Do you know someone who is or has been enrolled in a Chapter 61 current use program in Massachusetts? | | Question 3. Do you know a local land trust? | |
	Mean ± SD	Median	Yes	No/don't know	Yes	No
Respondents (%)	54.6 ± 73.8	28	43.7	56.3	36.3	63.7
Nonrespondents (%)	47.3 ± 37.7	31	50.0	50.0	37.5	62.5

Familiarity responses were awarded from 0 (for "not heard of") to 4 (for "a great deal") points. Knowledge responses were awarded 1 point for every correct true/false answer, 0 points for "don't know," and −1 point for every incorrect answer. Experience responses were awarded 2 points for first- and secondhand completion of a conservation option, 1 point for first- and secondhand consideration of an option, and 0 points for "don't know." If a respondent indicated they or someone they knew had both considered and completed an option, 2 points, not 3, were awarded. Acquaintance with sources of information responses were awarded 4 points for indicating "yes" and providing an accurate name, 3 points for indicating "yes" and providing a nearly accurate name, 2 points for indicating "yes" and providing no name, 1 point for indicating "no" and providing a lead, 0 points for indicating "no" and providing no lead, and −1 point for indicating "yes" and providing an inaccurate name (e.g., naming a logger and assuming they were a forester). Name accuracy was determined based on expert knowledge. All blank responses received 0 points. This scoring algorithm produced maximum and minimum CAI scores of 64 and −20. A single CAI total score was generated for each respondent, along with four subject category subscores.

Demographic questions obtained respondent ownership acreage and tenure, proximity of residence to ownership, age, education level, and gender. A single open-ended question obtained the primary reason respondents owned their land and responses were coded and sorted into six landowner objective categories: Family, home, environment, noninstrumental (e.g., aesthetics and enjoyment), recreation, and investment.

Nonresponse Bias Analysis

Twenty-six randomly selected nonrespondents (equivalent to 10% of random respondents) were contacted via telephone and asked three CAI questions. Acreages of random respondents and nonrespondents were compared using the nonparametric Wilcoxon's rank-sum test (Wilcoxon) for two independent samples (Corder and Foreman 2009). The binomial proportions test was used to compare responses with the other questions.

Analyzing CAI Responses

The Shapiro-Wilk test was used to determine whether the CAI score data came from a normal distribution. Correlations between CAI scores and random respondent acreage (log transformed) and tenure were analyzed using the nonparametric, rank-based Spearman's rho-statistic (Corder and Foreman 2009). Two nonparametric tests for independent samples were used to analyze differences in CAI scores among respondent samples, subject categories, and demographic classes. The Wilcoxon test compared mean score values and the Kolmogorov-Smirnov (KS) test compared score distributions (Corder and Foreman 2009). All reported percentages exclude respondents who did not answer the specific question, i.e., item nonresponse.

Results

Response Bias

No response bias was detected. Responses to the three selected CAI questions were not significantly different between the random respondent and nonrespondent samples (Table 1).

Respondent Demographics and Ownership Characteristics

Random and benchmark respondent demographics were similar, but benchmark respondents tended to own larger acreages (Table 2). The average random respondent owned 54.6 forest ac (range, 10–530 ac) for 19.7 years (range, 1–63 years), was 51–65 years old and male, had completed education beyond college, and lived on his/her land. By comparison, the average benchmark respondent owned 156.7 forest ac (range, 15–650 ac) for 24.4 years (range, 4–49 years), was 51–65 years old and male, had completed education beyond college, and lived on his/her land. Larger proportions of benchmark respondents lived on their land and had completed education beyond college.

The most commonly reported primary ownership objective was related to owning forestland as part of one's home site. Forty-three percent of random respondents stated they own forestland because it is part of their home, farm, or vacation home, or because it provides privacy. Noninstrumental objectives, such as natural setting characteristics, affection, and enjoyment were the next most common (19%) ownership objectives.

The CAI captured variation in conservation awareness within both samples (Figure 3), with random respondents earning a mean CAI total score of 20.4 ± 12.6 points (range, 0–55 points) and benchmark respondents earning 46.7 ± 6.8 points (range, 27–60 points). Random respondent mean scores were significantly lower than corresponding benchmark mean scores (Wilcoxon, $P < 0.001$), and the samples' score distributions were significantly different (Figure 4). Within the random respondent sample, subscore distributions were significantly different from one another except for CEs and EP (KS, $D = 0.0787$ and $P = 0.466$).

Random respondent familiarity with conservation options tended to be low (Figure 5). Most random respondents had either "not heard of" or reported "knowing nothing" about EP (61%), while nearly one-half of respondents had either "not heard of" or reported "knowing nothing" about CUTPs (42%) and CEs (45%). Familiarity with TH was greatest but 40% of random respondents still reported they had either "not heard of" or "knew nothing" about it.

Few random respondents answered the knowledge questions incorrectly (Figure 6).

Table. 2. Random and benchmark respondent ownership and demographic characteristics.

	Random respondents (n = 267)	Benchmark respondents (n = 37)
Size (ac)		
Minimum	10	15
Maximum	530	650
Median	28	112
Mean	54.6	156.7
SD	73.8	151.8
Tenure (yr)		
Minimum	1	4
Maximum	63	49
Median	18	21
Mean	19.7	24.4
SD	12.8	12.9
	Random respondents (%)	Benchmark respondents (%)
Proximity (mi)		
Resident	53.7	78.8
<10	4.9	9.1
10–100	25	12.1
>100	16.4	0
Age (yr)		
<30	<1	0
30–50	21.6	14.3
51–65	49.4	45.7
66–80	24.9	40
>80	3.7	0
Education (highest level achieved)		
Some high school	1.7	0
High school graduate	16.9	2.9
Some college	15.3	2.9
College graduate	27.3	23.5
Education beyond college	38.8	70.6
Gender		
Female	33.9	42.9
Male	59.6	57.1
Multiple respondents	6.5	0

Instead, "don't know" was the most common response to questions about CUTPs (52%), CEs (58%), and EP (51%). By contrast, more than one-half of the TH questions were answered correctly (53%).

Random respondents reported little first- or secondhand experience with the conservation options (Figure 7). Most respondents indicated no personal experience considering or completing CEs (90%), EP (84%), CUTPs (75%), and TH (71%). Although it was more common for random respondents to know someone else who had considered or completed conservation options, most respondents still reported no secondhand experience with EP (83%), CEs (77%), CUTPs (60%), and TH (54%).

Few random respondents were acquainted with sources of conservation information (Figure 8). Small proportions of respondents named an estate planner familiar with land conservation (1%), a state service forester (7%), a private forester (22%), or a local land trust (29%). The largest proportions of random respondents neither identified a source of information nor indicated how they would find out about one. Of those who did indicate how they would find out about one, the most common lead was the Internet, followed by local and state government, and then personal acquaintances.

Some random respondent characteristics appeared to relate to CAI score, including distance from land and education level (Figure 9). Resident owner CAI total scores were on average higher and ranged more widely than those of absentee owners. Pairwise comparisons between landowner distance classes revealed that CAI score differences were attributable to particular subject category subscores. Resident owners had significantly greater awareness of CEs and TH than owners who lived 10–100 mi from their land (Wilcoxon, $W = 5338.5$ and $P < 0.001$ and $W = 5297$ and $P < 0.001$, respectively). Random respondents with education beyond college had somewhat significantly higher CAI total scores than high school graduates (Wilcoxon, $W = 1428$ and $P = 0.056$), which was largely attributable to their greater awareness of CEs and EP (Wilcoxon, $W = 1148.5$ and $P < 0.001$ and $W = 1071.5$ and $P < 0.001$, respectively).

Ownership acreage and location were related to random respondent CAI score. A moderate positive correlation between CAI total score and acreage was detected (Spearman's rho = 0.462; $P < 0.001$), largely because of TH and CUTP subscores (Spearman's rho = 0.484 and $P < 0.001$ and Spearman's rho = 0.450 and $P < 0.001$, respectively). CAI total scores also varied significantly between some towns. For example, random respondents with land in Becket had significantly lower mean CAI total scores than those with land in either Middlefield or Worthington (Wilcoxon, $W = 706.5$ and $P < 0.001$ and $W = 1820.5$ and $P < 0.001$, respectively).
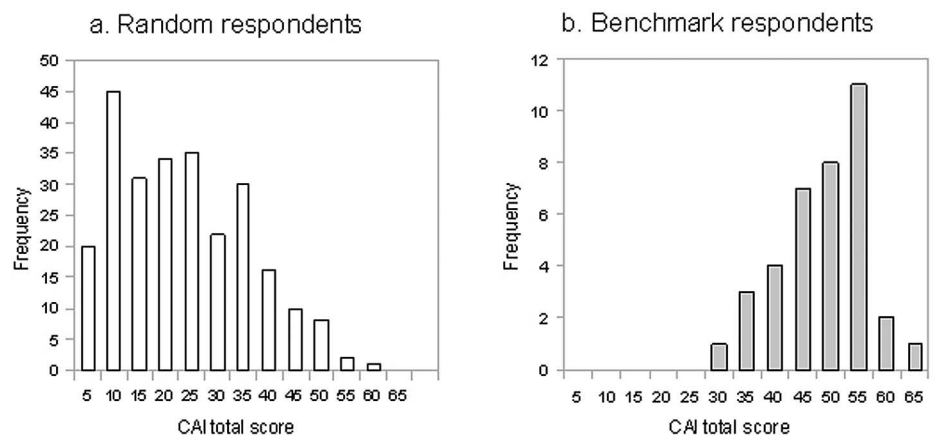

Figure 3. Random and benchmark respondent CAI total scores. The CAI captured variation in conservation awareness within both the random and the benchmark respondent samples. The distributions of total CAI scores were significantly different between the two samples (KS test, $D = 0.816$ and $P < 0.001$).
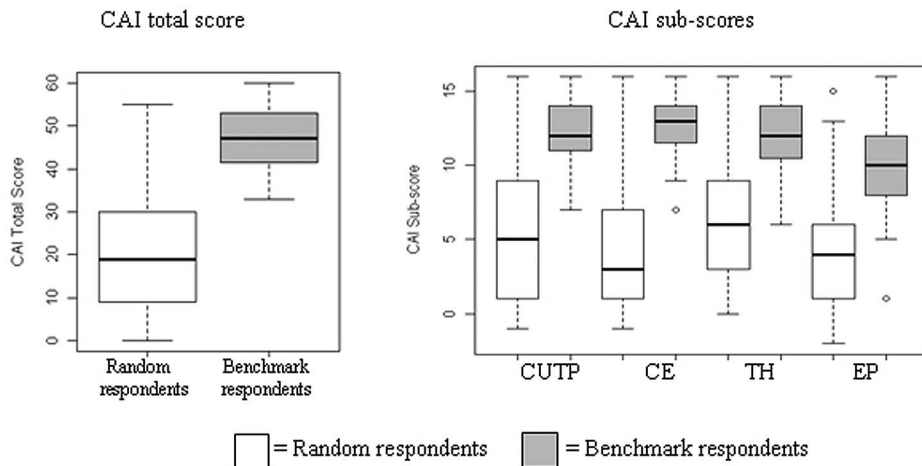
Figure 4. CAI scores differed significantly between samples. CAI total score and subscore means and distributions were significantly different between the random respondent and benchmark samples (Wilcoxon test, $P < 0.001$; KS test, $P < 0.001$). Subscore categories included CUTPs, CEs, TH, and EP.

Figure 6. Random respondent knowledge of conservation options. Random respondent factual knowledge of conservation options was generally low. "Don't know" and incorrect responses outnumbered correct responses for CUTP, CEs, and EP, but more than one-half the TH questions were answered correctly.

Discussion

Instrument Validation

The CAI instrument captured variation in conservation awareness among individuals and between benchmark and random respondent samples. Variability was detected with every question, suggesting the usefulness of all questions in the instrument. Benchmark respondents scored significantly higher on the CAI; however, no one achieved a maximum score, indicating the CAI's accuracy and appropriate scaling. Random respondent CAI total scores and subscores varied widely and most respondents had relatively low CAI scores. Random respondents exhibited significantly different awareness levels for most CAI subject categories (only CE and EP subscore distributions were similar), suggesting the subject categories are discrete and represent distinct topics of awareness.

Exploring Differences in Awareness

The CAI instrument detected widespread unawareness of the most important conservation options and resources available to family forest owners in Massachusetts.
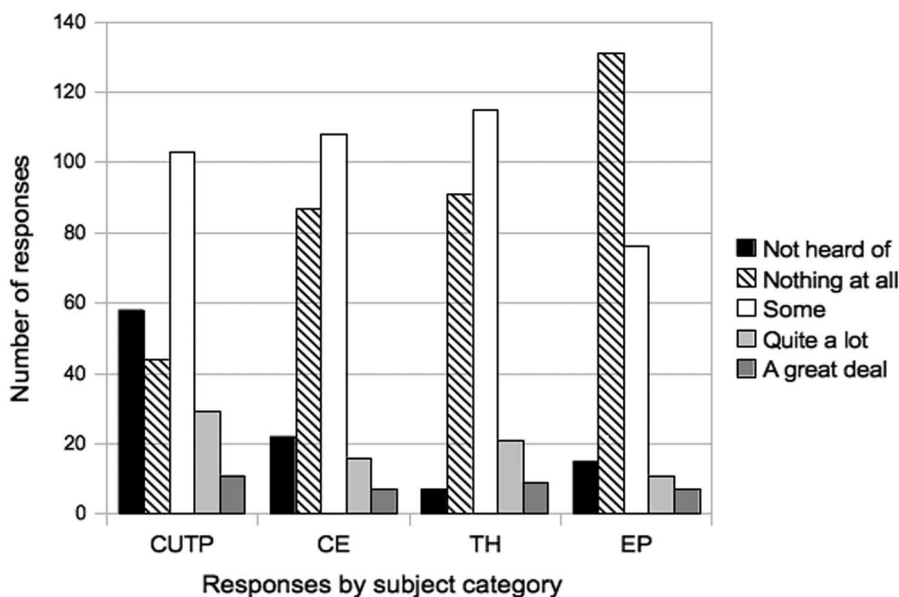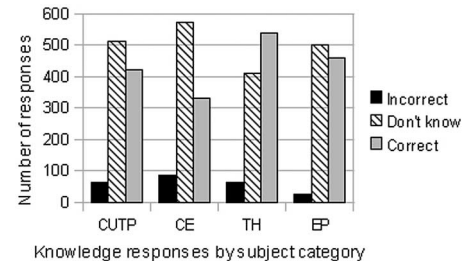

Figure 5. Random respondent familiarity with conservation options. Random respondent familiarity with conservation options was low. Close to one-half of all random respondents reported they had either "not heard of" or knew "nothing at all" about CUTPs (42%), CEs (45%), TH (40%), and EP (61%).

Random respondents were more uninformed than misinformed, with "don't know" responses far outnumbering incorrect responses. Awareness was highest for CUTPs and TH. CUTPs and TH represent relatively low-stakes decisions that may be made multiple times over the course of one's ownership and neither decision is necessarily permanent. Enrollment in a CUTP may be terminated and reinitiated and trees cut during timber harvest grow back. Both decisions produce immediate financial benefits (through tax savings or direct profit) compared with the uncertain or longer-term payback associated with CEs and EP. Harvesting timber and enrolling in CUTPs may be more visible decisions because timber harvests are posted and conspicuous and CUTPs yield attractive annual tax savings that may be discussed readily among landowners.

Some shared characteristics of CEs and EP may explain their similar CAI subscore distributions. Both are complex decisions involving long-term financial, family, and legal planning, as well as the expertise of multiple professionals. These decisions are made infrequently (often just once in a lifetime) and their details are typically kept private between individuals involved.

Low levels of conservation familiarity and knowledge are likely tied to low levels of experience. Few random respondents reported having any firsthand experience considering or completing the conservation options and only a modest increase in secondhand experience was detected. For example, 10% of random respondents had considered or completed a CE, while 24% knew someone else who had considered or completed one, indicating that landowners
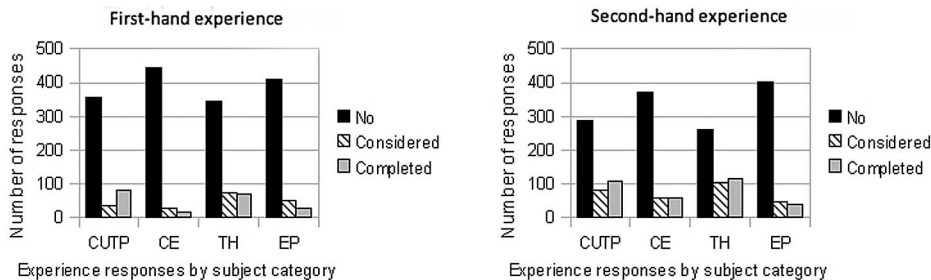
Figure 7. Random respondent experience with conservation options. Most random respondents reported having no firsthand experience with CUTPs (75%), CEs (90%), TH (71%), and EP (84%). Secondhand experience was slightly more common.

talk to one another about their land decisions. However, the dearth of experienced landowners limits the potential for inter-landowner communication. Notably, more random respondents reported first- or secondhand experience completing rather than just considering a CUTP, suggesting the program is appealing to landowners once they become aware of it.

Most alarming was the low level of acquaintance with sources of conservation information among random respondents. Because land decisions tend to be complex, lengthy, and infrequent, we might not expect most landowners to know detailed facts or have firsthand experience; however, it is paramount that landowners know where to turn for accurate information when a decision needs to be made. Our results suggest most do not have this awareness.

Respondent Characteristics Related to Conservation Awareness

Resident random respondents tended to have higher conservation awareness than absentee owners. Resident landowners may give more attention to the management and future planning of their land. We know many landowners primarily consider their forests as part of their home sites and resident landowners are daily reminded of the pleasures and responsibilities of their ownerships. Absentee owners may tend to be wealthier than resident owners, relieving some of the financial need driving some residents to consider TH or enrolling in CUTPs. Resident owners may know their neighbors and communities better than absentee owners, increasing their likelihood of knowing about conservation options through more robust local social networks.

Participant demographics revealed some important conservation awareness patterns. Neither age nor gender was associated with random respondent conservation awareness, but education level was positively associated with it. Significant differences in awareness (especially of CEs and EP) were detected between high school graduates and people who had graduated college or obtained education beyond college. Landowners with more formal education may be more familiar and comfortable with legal professionals who craft CEs and estate plans. These landowners may earn higher incomes, reducing their household's employment burden and freeing up hours and/or individuals to explore complex conservation options. Higher household income may also increase one's ability to pursue potentially costly conservation options, such as donating land or a CE or hiring an estate planner.

Land Characteristics Related to Conservation Awareness

The moderate positive association with CAI total score and acreage may be explained by the fact that larger acreages yield greater profits from TH, procure greater tax savings through CUTPs, and likely constitute more substantial family assets that motivate planning for future generations. This correlation was fairly weak, however, and it can not be assumed that large acreage owners are sufficiently aware of their options. Our results challenge the assumption that private forests will persist because the large acreage owners who control most of the forested landscape are especially well informed. In fact, many random respondents with large acreages were quite unaware of their conservation options. Increasing parcellation of large ownerships underscores the importance of educating owners of all acreages, especially small ones. Smaller acreages have fewer management options (fewer access options, less viable commercial timber volume, and diminished recreational values) and therefore edge closer to the ultimate decision to develop and convert from forest forever.

Our study indicates that land location may be relevant to conservation awareness level, with some towns having significantly higher mean conservation awareness than others. Spatially, CAI may relate to proximity to conservation activity (e.g., nearby CEs or TH) or amount of conservation land in a given area (e.g., number of acres in private easement or public conservation). The spa-
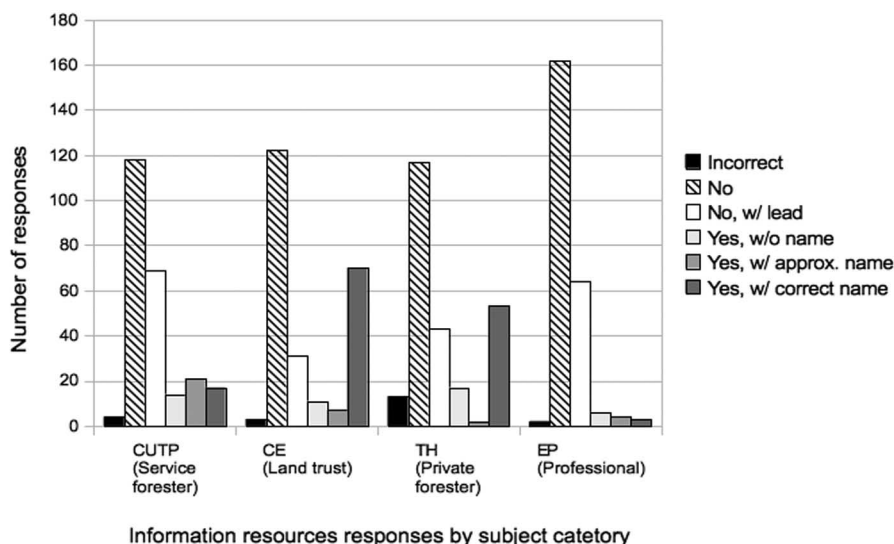

Figure 8. Random respondent acquaintance with sources of conservation information. Most random respondents were unacquainted with sources of information related to CUTPs (a service forester), CEs (a local land trust), TH (a private forester) and EP (an estate planner familiar with land conservation), and many did not indicate how they would find out about one ("no" versus "no, with lead").
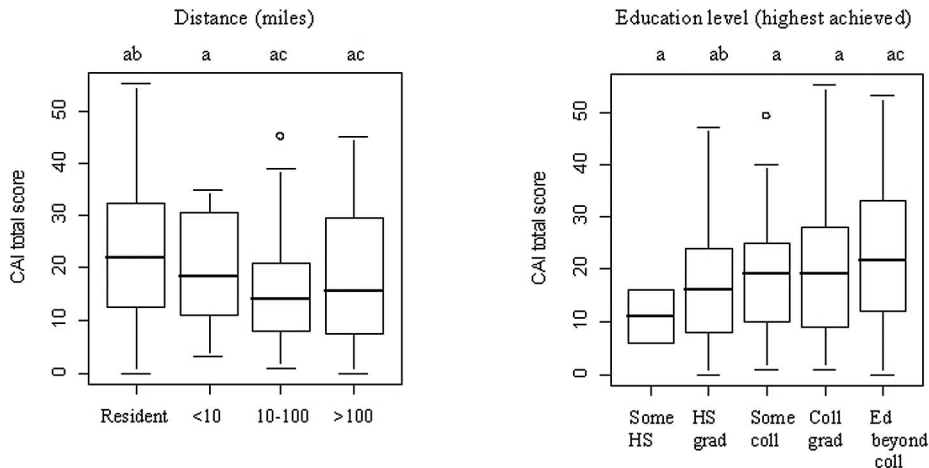
Figure 9. Random respondent characteristics related to conservation awareness. Living on one's land (resident) and achieving higher levels of education were associated with higher CAI total scores. Means with different letters are significantly different (Wilcoxon rank-sum test, *P* < 0.05).

tial relevance of CAI warrants much more investigation.

Study Implications and Future Applications

The CAI pilot deployment produced new, necessary information about family forest owner conservation awareness. Results indicate landowner conservation awareness is low, with the majority of random respondents in a fog about their land options. We have exposed critical information gaps (especially regarding CEs and EP) and discovered that acquaintance with sources of information is poor (especially with state service foresters and estate planners).

Our results suggest conservation awareness is not randomly distributed across the landscape. Future research should explore potential drivers of awareness, including spatial, social, economic, and political variables. Our CAI deployment illuminated landowner segments with especially low awareness, including absentee, small acreage, and less formally educated owners. These results may guide the development of targeted outreach to address the specific information needs of different landowner segments.

According to our results, private landowner outreach should incorporate peer learning, the Internet, and the interests of home-oriented landowners. Fewer than one-quarter of random respondents knew someone who had completed each conservation option and most did not know sources of information. Because landowners talk

with one another about land, periodic discussion forums should be organized to facilitate their exchange of experiences, questions, and concerns. In this setting, landowners become sources of information and support for one another (Snyder and Broderick 1992, Ma et al. in press). Random respondents indicated they would look for conservation information on the Internet, but very few provided specific websites. Web-based landownership resources should be developed to meet landowners where they are inclined to seek information. Because many random respondents considered their forests as features of their homes, more effective conservation outreach should appeal to homeowner interests and relate land care with home care information.

In the future, the CAI may be used to evaluate outreach outcomes and impacts. Assessing participant CAI before and after an outreach intervention may produce valuable data on program effectiveness and investment return. A fascinating extension of this application will be to investigate the diffusion of conservation awareness across the landscape and through social networks over time. Relating an individual or community's awareness level to behavior is a long-term research goal requiring longitudinal study. Although proconservation behavior is desirable, the more proximate objective is to empower informed decisionmaking among family forest owners.

This study confirms an urgent reality: family forest owners are largely unaware of conservation options that can assist them.

Although focusing a conservation message for landowners on the production of management plans may be effective for a documented small minority (Butler 2008), our results suggest that decades of prioritizing this approach through financial subsidies, cost sharing, and tax advantages is not effective at assisting most landowners. Too many of them neither have professionally prepared plans nor know where to turn for advice when faced with decisions about the future of their land. The CAI aligns with the interests and decisionmaking of most landowners and has the potential to improve how we understand and reach family forest owners across the United States. With the fate of forests and their benefits inextricably tied to the people who own them, estimating conservation awareness and responding strategically will be essential for achieving conservation success.

Literature Cited

AJZEN, I. 1991. The theory of planned behavior. *Organ. Behav. Hum. Dec. Process.* 50:179–211.

ALIG, R. 2007. A United States view on changes in land use and land values affecting sustainable forest management. *J. Sustain. For.* 24(2/3):209–227.

ANYAEGBUNAM, C., P. MEFALOPULOS, AND T. MOETSABI. 2004. *Participatory rural communication appraisal: Starting with the people.* 2nd ed. Food and Agriculture Organization of the United Nations (FAO) and Southern African Development Community (SADC), Rome, Italy. 160 p.

BENGSTON, D.N., B.J. BUTLER, AND S.T. ASAH. 2009. Values and motivations of private forest owners in the United States: A framework based on open-ended responses in the national woodland owner survey. P. 60–66 in *Proc. of the 2008 Northeastern recreation research symp.*, Klenosky, D.B., and C.L. Fisher, Bolton Landing, NY, March 30–April 1, 2008. Gen. Tech. Rep. NRS-P-42, Newtown Square, PA. 356 p.

BUTLER, B.J. 2008. *Family forest owners of the United States, 2006.* US For. Serv. Gen. Tech. Rep. NRS-27, North. Res. Stn., Newtown Square, PA. 72 p.

BUTLER, B.J., AND Z. MA. 2011. Family forest owner trends in the northern United States. *North. J. Appl. For.* 18(1):13–18.

CHANG, C., W. HAMMITT, P. CHEN, L. MACHNIK, AND W. SU. 2007. Psychophysiological responses and restorative values of natural environments in Taiwan. *Landsc. Urban Plann.* 85(2):79–84.

CORDER, G.W., AND D.I. FOREMAN. 2009. *Nonparametric statistics for non-statisticians: A step-by-step approach.* John Wiley & Sons, Hoboken, NJ. 264 p.

D'AMATO, A.W., P.F. CATANZARO, AND D.T. DAMERY. 2010. Are family forest owners facing

a future in which forest management is not enough? *J. For.* 108(1):32–38.

DILLMAN, D.A. 2000. *Mail and internet surveys: The tailored design method,* 2nd ed. John Wiley & Sons, New York.

FINLEY, A.O., AND D.B. KITTREDGE. 2006. Thoreau, Muir, and Jane Doe: Different types of private forest owners need different kinds of forest management. *North. J. Appl. For.* 23(1): 27:28–34.

FLETCHER, L.S., D. KITTREDGE, AND T. STEVENS. 2009. Forest landowners' willingness to sell carbon credits: A pilot study. *North. J. Appl. For.* 26(1): 35:36–37.

FRUMKIN, H. 2001. Beyond toxicity: Human health and the natural environment. *Am. J. Prev. Med.* 20(3):234–240.

HOWELL, P., AND A. WEINBERG. 2005. *Western Massachusetts: Assessing the conservation opportunity.* Available online at www.osiny.org/site/PageServer?pagename_Program_Institute_LeveragingCapital_WesternMassAssessment#mass; last accessed Mar. 20, 2012. 79 p.

JANOTA, J.J., AND S.R. BROUSSARD. 2008. Examining private forest policy preferences. *For. Policy Econ.* 10:89–97.

JONES, S.B., A.E. LULOFF, AND J.C. FINLEY. 1995. Another look at NIPFs: Facing our "myths." *J. For.* 93(9):41–44.

KITTREDGE, D.B. 2004. Extension/outreach implications for America's family forest owners. *J. For.* 102(7):15–18.

KITTREDGE, D.B. 2009. Fire in the east. *J. For.* 107(3):162–163.

KITTREDGE, D.B., A. D'AMATO, P. CATANZARO, J. FISH, AND B. BUTLER. 2008. Estimating ownerships and parcels of non-industrial private forest in Massachusetts. *North. J. Appl. For.* 25(2):93–98.

LUDVIGSON, S.C. 2004. Consumer confidence and consumer spending. *J. Econ Perspect.* 18(2):29–50.

MA, Z., D.B. KITTREDGE, AND P. CATANZARO. 2011. Challenging the traditional forestry extension model: Insights from the Woods Forum program in Massachusetts. *Small Scale For.* May 7, 2011:1–14.

MERCKER, D.C., AND D.G. HODGES. 2007. Forest certification and nonindustrial private forest landowners: Who will consider certifying and why? *J. Extension* 45(4) Article 1RIB6, Available online at www.joe.org/joe/2007august/rb6.shtml; last accessed Mar. 20, 2012.

ROBLES, M.D., C.H. FLATHER, S.M. STEIN, M.D. NELSON, AND A. CUTKO. 2008. The geographyof private forests that support at-risk species in the conterminous United States. *Front. Ecol. Environ* 6(6):301–307. Available online at www.esajournals.org/doi/pdf/10.1890/070106; last accessed Oct. 15, 2010.

ROGERS, E.M. 2003. *Diffusion of innovations,* 5th ed. Free Press, New York. 576 p.

SCHNEIDER, B., AND N. CHESLOCK. 2003. *Measuring results: Gaining insight on behavior change strategies and evaluation methods for environmental education, museum, health, and social marketing programs.* CoEvolution Institute, San Francisco, CA. 136 p.

SCHULTZ, P.W. 2002. Knowledge, information, and household recycling: Examining the knowledge-deficit model of behavior change. P. 67–82 in *New tools for environmental protection: Education, information, and voluntary measures,* Dietz, T., and P.C. Stern (eds.). The National Academic Press, Washington, DC.

SIMON, H. 1991. Bounded rationality and organizational learning. *Organ. Sci.* 2(1):125–134.

SMITH, W.B., P.D. MILES, J.S. VISSAGE, AND S.A. PUGH. 2004. *Forest resources of the United States, 2002.* US For. Serv. Gen. Tech. Rep. NC-241, North Cent. Res. Stn., St. Paul, MN. 137 p. Available online at www.ncrs.fs.fed.us/pubs/gtr/gtr_nc241.pdf; last accessed Oct. 15, 2010.

SNYDER, L.B., AND S.H. BRODERICK. 1992. Communicating with woodland owners. *J. For.* 90(3):33–37.

STEIN, S.M., R.E. MCROBERTS, L.G. MAHAL, M.A. CARR, R.J. ALIG, S.J. COMAS, D.M. THEOBALD, AND A. CUNDIFF. 2009. *Private forests, public benefits: Increased housing density and other pressures on private forest contributions.* US For. Serv. Gen. Tech. Rep. PNW-GTR-795, Pac. Northw. Res. Stn, Portland, OR. 74 p.

USDA. 2009a. *Summary Report: 2007 National Resources Inventory.* Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, IA. 123 p.

USDA. 2009b. *The year in forestry: State and private forestry in the Northeast, and Midwest, fiscal year 2008.* US For. Serv. Northe. Area State and Private For. NA-IN-05-09, Newtown Square, PA. 18 p.

WOODBURY, P.B., J.E. SMITH, AND L.S. HEATH. 2007. Carbon sequestration in the U.S. forest sector from 1990 to 2010. *For. Ecol. Manag.* 241:14–27.