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Changes in Volunteer Knowledge and Attitudes as a Result of Texas Master Naturalist Training

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Since 1998, the Texas Master Naturalist (TMN) program has trained more than 4,500 volunteers in natural resource ecology, management, and interpretation. In this study, we evaluated changes in knowledge and attitudes about ecology, management, and consumptive uses of wildlife as a result of TMN training; motivation for involvement; and post-training volunteer activities of 227 TMN. Participants received a pre-test prior to training, a post-test following training, and a second post-test eight months after completion of training. Knowledge scores increased from 57% correct on the pre-test to 72% correct on the first post-test ($p < .001$*) and 74% on the second post-test. Attitudes changed on 14 out of 26 attitude statements from pre-test to first post-test, with participants becoming more supportive of management of wildlife habitat and populations (*$p < .05$*). Eighty-two percent of second post-test respondents (*$n = 125$*) reported participation in nature-based volunteer activities following training.*

Keywords Master Naturalist, volunteer, attitudes, program evaluation, Texas

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Introduction

Increasing population growth and the trend toward urbanization have separated the public from natural habitats and created additional need to inform the public about natural resources and resource management. "Master Naturalist" programs (i.e., adult environmental education programs) were created to address this need and as a source of natural resource knowledge and volunteerism. State-level programs were first created in Texas and Florida, and programs now exist in more than 25 states (Mazzacano, 2007).

The Texas Master Naturalist (TMN) program began in 1998 as a partnership between Texas Parks and Wildlife Department, Texas AgriLife Extension Service, and numerous local sponsors. Its mission was to create a group of volunteers who would reach out to their communities through natural resource education and service. Volunteers must complete 40 hours of basic field and classroom training, 8 hours of advanced training, and 40 hours of community service addressing the program's mission. All requirements must be met within one year of completion of the initial 40 hour basic training. Master Naturalists must also complete a re-certification process each year, which requires an additional eight hours advanced training and 40 hours community service (Texas Master Naturalist Program, 2000, Chapter Management Guidelines, College Station, Texas, USA). At the time this study was conducted, each local TMN chapter had developed its own curriculum, focused on both common ecological principles and interpretive topics as well as local ecology.

The objectives of this study were to evaluate the effectiveness of TMN training in changing participants' knowledge of ecological concepts and natural resource management, to determine whether attitudes regarding natural resource management changed as a result of the program, and to assess participants' demographics, motivations, and volunteer activities following training.

Background Information

Volunteer Studies: Demographics and Motivations

The TMN program is one of the many service organizations worldwide powered by citizens willing to volunteer their time and effort. Understanding the demographics of individuals involved in the TMN program, as well as their reasons for involvement, provides TMN sponsors and funding agencies with valuable information regarding its success in reaching a representative segment of the state's population and should be beneficial in influencing program marketing and outreach decisions. Abundant social research has focused on demographic and motivational factors related to volunteerism. Some studies found that volunteerism may begin early, peak around middle age, and then begin declining due to barriers such as poor health, lack of transportation, and income level (Fischer & Schaffer, 1993; Payne, Payne, & Reddy, 1972). Others suggested that age was not a determining factor (Cohen-Mansfeld, 1989), and some organizations actively recruited retired volunteers (Rouse & Clawson, 1992). Women were more likely than men to be involved in service organizations (Payne et al., 1972).

Studies of resource-based volunteer organizations were more limited. A study of Oregon Extension volunteers, including Master Gardeners, 4-H, Master Recylers, and other groups, showed that 80% of volunteers were female (Braker, Leno, Pratt, & Grobe, 2000). Schrock, Meyer, Ascher, and Snyder (1999) conducted a survey on active and inactive Master Gardeners in Missouri, and found the majority of the Master Gardeners were female, and 60% were 50 years of age or older.

Fischer and Schaffer (1993) gathered information from multiple studies and divided volunteer motivation into eight categories: altruistic (most common), ideological, egoistic, material/reward, status/reward, social relationship, leisure time, and personal growth motivations. Kidd and Kidd (1997) conducted a study to determine characteristics and motivations of wildlife education docents at a museum in California, and found that docents cited several motivations for volunteering in wildlife education, including positive childhood experiences with animals (pets), family encouragement in valuing wildlife, and peer support from fellow volunteers and museum employees. Most docents were trained educators and wanted to work with people and teach children about wildlife. Participants' reasons for volunteering often changed to more closely match those of the program over time (Ilsley, 1990).

Attitudes About Natural Resource Management

The Texas Master Naturalist program was designed to produce ecologically knowledgeable individuals, not to change participants' attitudes. However, Texas Parks and Wildlife and Texas AgriLife Extension, both state sponsors for the program, have natural resource management–related goals and objectives. Individuals who complete Master Naturalist training are often involved in outreach and community activities, and therefore it is important to understand their attitudes concerning natural resource management.

To make educated decisions about natural resource issues, individuals must be provided with both accurate information and an understanding of ecological principles (Mankin, Warner, & Anderson, 1999). Numerous studies have been conducted to determine individuals' attitudes and beliefs about natural resource management issues and consumptive uses of wildlife, specifically prescribed burning, hunting, predator control and trapping, grazing, and forest management.

The public has mixed feelings about fire, particularly prescribed burning, but over time, attitudes are becoming increasingly supportive, especially among individuals who have experience with or live in areas that are affected by fire (Cortner, Zwolinski, Carpenter, & Taylor, 1984; Jacobson, Monroe, & Marynowski, 2001; Manfredo, Fishbein, Haas, & Watson, 1990). Studies also suggested that individuals who have been exposed to education programs about the benefits of fire are much more likely to support the use of prescribed fire as a tool for resource management (Jacobson et al., 2001; Loomis, Blair, & Gonzales-Caban, 2001).

Attitudes about hunting tend to depend on the reason given for hunting. Kellert (1980) found that 82% of respondents to a nationwide survey supported traditional native subsistence hunting, but that 62% disapproved of big game hunting for sport and 80% disapproved of hunting for trophies. Sixty-four percent, however, supported sport hunting if the meat was used. Thomas and Adams (1989) found that Texans approved of hunting for food, game management, or predator control, but disapproved of hunting for a profit or to collect trophies. Duda and Young (1998) found that 73% of respondents to a nationwide survey supported legal hunting but, as in other studies, were not as supportive of hunting for recreation or trophies. In a study of Illinois residents, Mankin et al. (1999) found fairly low approval of hunting: 20% for sport only, 54% for food, 48% for population control, and 51% to reduce the risk of diseases.

Predator control and trapping also receive mixed support from the public. Kellert (1980) found that 70% of respondents to a nationwide study supported killing individual coyotes known to have preyed on livestock, but 70% disagreed with the use of steel leghold traps. In general, the public preferred non-lethal methods of removal. Duda and

Young (1998) suggested that 59% of Americans disapproved of legal trapping. Manfredo, Pierce, Fulton, Pate, and Gill (1999) found that 61% of Colorado residents would vote to ban trapping, although 58% of those who voted for the ban agreed that trapping to protect livestock and property was acceptable. Other studies found that people accept trapping to protect declining wildlife populations, but that agreement depended on the species being removed (Messmer, Brunson, Reiter, & Hewitt, 1999; Reiter, Brunson, & Schmidt, 1999).

Kellert (1980) stated that 60% of respondents to a nationwide survey favored restricting livestock grazing on public lands even if it meant higher beef prices, and that 76% favored forest cutting practices that protected wildlife even if higher lumber prices resulted. McNabb and Bliss (1994) found that 52% of private forest landowners in Alabama agreed that clearcutting was an acceptable management practice, and Kearney (2001) suggested that after educational intervention, individuals were more likely to support clearcutting.

Justification of Research and Program Evaluation

Program evaluation can be used as a decision-making tool to measure the implementation and outcome of a program (Rossi, Freeman, & Lipsey, 1999; Rutman, 1984). Evaluation benefits program participants, its sponsors, the educational community, and the community at large; can provide program sponsors with information about direct and secondary program outcomes; and may provide sponsors with information about current and emerging problems (Bennett, 1988-1989; Jacobson, 1987; Jacobson, 1991; Nowak, 1984). On a larger scale, evaluating conservation education programs may enhance the accountability of such programs to the educational community and the community at large (Bennett, 1988–89; Jacobson, 1987; Jacobson, 1991). Norris and Jacobson (1998) demonstrated that the use of evaluation in conservation education programs was positively correlated with program success. The TMN program is used as a model by states implementing Master Naturalist programs, and this study should provide them, as well as TMN sponsors, with valuable information about program volunteers and training strengths, weaknesses, and impact.

Methods

Study Design

We conducted this TMN evaluation study using a quasi-experimental, pre- and post-test design with a nonequivalent comparison group (Weiss, 1998). Based on availability and time of year in which they conducted training, 10 of the 12 existing TMN chapters were evaluated in fall 2001 and spring 2002. Three chapters were evaluated both fall 2001 and spring 2002, while seven chapters were evaluated only during fall or spring. The treatment group was composed of TMN volunteers (n = 227) who received training beginning in fall 2001 or spring 2002.

The TMN program involved voluntary enrollment by individuals interested in enhancing their knowledge and skills concerning natural resources. Because the group was self-selecting, it was impossible to randomly assign individuals to treatment and control groups. A comparison group was included in the study to increase internal validity and account for the possibility that changes in TMN knowledge and attitudes resulted from sources outside program training (Weiss, 1998). Texas Master Gardener (TMG) volunteers (n = 80) from the same approximate geographic areas as TMN participants were used as the non-equivalent comparison group because of similar demographics,

interest in natural resources, and similarites between Master Naturalist and Master Gardener program structure. Mailing lists were obtained from TMG chapter sponsors and individuals were randomly chosen to participate in the study.

Pre-tests included four sections: attitude statements regarding natural resources and resource management, motivations for involvement in the TMN program and how they found out about it, an ecological concepts knowledge test, and sociodemographic questions. The first post-test questionnaire included knowledge and attitude questions identical to those on the pre-test, along with questions about the participants' opinions on effectiveness of TMN training and volunteer activities in which they intended to participate following training.

The second post-test questionnaire included identical knowledge and attitude questions from the pre- and first post-tests, as well as a section determining activities in which volunteers had participated since TMN training, and hours spent on each activity.

TMG comparison group pre-test surveys did not include motivations and expectations, and demographic questions were reduced. The comparison group post-test included only the knowledge and attitude sections. Their survey questions did not include those specifically relevant to TMN training.

Survey Implementation

Pre-test surveys were administered to TMN groups by program leaders or researchers on the first day of their training class before program instruction began, and all TMN participants received the first post-test on their final day of training. Second post-tests were mailed to participants approximately eight months after training. Reminder postcards were mailed two weeks later, and a second survey was mailed to non-respondents approximately one month after the first mailing (Salant & Dillman, 1994). The pre-test and first post-test were mailed to the comparison group at the same time surveys were administered to TMN groups. No follow-up surveys were mailed to the comparison group. The purpose of the second post-test was to examine retention of knowledge and attitudes after TMN training, so the comparison group was not included.

Variables and Data Analysis

Descriptive analyses were run on standard demographic variables, and Chi-Square tests were used to compare demographics of TMN and TMG. Motivational statements were scored from 1 (Not at all important) to 4 (Very Important). Participants were also asked how they found out about the TMN program, and could mark all applicable choices. Mean responses were calculated to determine the most important motivational factor.

Knowledge scores were based on percentage of correct answers. Paired-samples *t*-tests were used to compare scores between treatment pre-test, first post-test, and second post-test scores, and independent samples *t*-tests were used to compare treatment versus comparison knowledge scores. Attitude statements were modeled after questions included in attitudinal and knowledge studies concerning ecology and natural resource management (Hooper, 1988; Manfredo et al., 1990; Munson, 1994; Reiter et al., 1999). Attitude statements focused on natural resource management, wildlife and property ownership, fire and prescribed burning, hunting, trapping, grazing, and timber management.

To determine changes in overall attitudes toward natural resource management, a summated rating index was created for each of the three tests. Scale responses from 1 (Strongly Agree) to 4 (Strongly Disagree) for 24 out of the 26 attitude statements were

summed. Negative (anti-management) statements were reverse coded during index analysis so that all attitude scale changes reflected movement in the same attitudinal direction. The two attitude statements concerning wildlife ownership and access to private property were not included in the attitude index because they did not deal specifically with resource management practices. Possible scores ranged from 24 to 96. Movement toward lower scores on the index suggested that respondents became more supportive of human intervention in wildlife and habitat, while movement toward higher scores suggested more preservationist attitudes, or support of nature taking its course without human intervention.

Paired-samples *t*-tests were used to compare responses to attitude statements between treatment pre-test, first post-test, and second post-test, and independent samples *t*-tests were used to compare treatment versus comparison attitudes on the pre- and first post-test. Due to the nonlinear nature of the variables, Kendall's *tau-b* tests were used to determine whether a correlation existed between change in overall knowledge score from pre- to first post-test (percent gained) and change in attitude on each of the 26 attitude statements.

Paired-samples *t*-tests were used to analyze differences between pre- and first and second post-test attitude scale scores. Exploratory factor analysis of the 26 attitude statements revealed consistent results on all three tests. Because it was the culminating survey in the set of three, only the second post-test was utilized for data reduction purposes. Second post-test attitude statements were subjected to principle component analysis using a varimax rotation and an inclusion threshold value of .60 for factor loading. A threshold eigenvalue of 1.0 was used to determine inclusion of factors in the final solution.

TMN were asked on the second post-test whether they had participated in any of 11 specific volunteer activities, including an open-ended "other" category, and multiple responses were allowed. Descriptive analyses were run to determine most common activities completed.

Results

Demographics

While 18% (n = 41) of TMN respondents were currently taking or had previously taken TMG training, only 10% (n = 22) were certified TMG. Ten percent (n = 8) of TMG had previously taken TMN training, and 4% (n = 3) were certified TMN. Differences between TMN and TMG were found only in age, retirement status, and race/ethnicity (Table 1). TMN were a younger, less likely to be retired, and slightly more ethnically diverse group than TMG.

Motivations for Involvement in and Sources of Information About the TMN Program

TMN ranked "to learn more about nature" as the most important reason to participate in the program (Table 2). The next four most important reasons were, in descending order: concerned about nature in my community, increase my awareness of current issues, sense of personal responsibility, and interaction with resource professionals. Standard deviations for the top 5 motivations were much lower than those for the remaining 12 motivations, which suggests most participants felt very strongly about why they chose to become involved with the program.

More participants found out about the TMN program from a friend or relative (n = 71) than from any other source. The second most common information source was the newspaper

Table 1
Demographic information collected from TMN and TMG study participants

Demographic variable	TMN		TMG			
	Frequency	Percent*	Frequency	Percent*	Chi-square	*p*-value
Gender					2.851	.091
Female	129	57	53	68		
Male	97	43	25	31		
Total	227	100	78	100		
Age					53.792	.001
18–29	22	10	0	0		
30–39	30	13	7	9		
40–49	61	27	10	13		
50–59	75	33	24	31		
60–69	35	16	20	26		
70+	3	1	17	22		
Total	226	100	78	100		
Race/Ethnicity					6.224	.013
White (non-Hispanic)	192	88	76	97		
Hispanic or Non-white	27	12	2	2		
Total	219	100	78	100		
Highest degree					6.752	.150
High school	24	11	14	18		
Associate	28	12	10	13		
Bachelor's	86	38	33	42		
Master's	62	27	18	23		
Doctorate	26	12	3	4		
Total	226	100	78	100		
Retired					44.389	.001
No	174	77	27	35		
Yes	53	23	50	65		
Total	227	100	77	100		

*Total percent may not equal 100 due to rounding error.

(n = 64), followed by "other" (n = 61). Examples of "other" sources included various nature centers, refuges, and wildlife festivals.

Ecological Knowledge Scores

The TMN mean ecological knowledge score on the pre-test was 57% correct. Post-test scores averaged 73%, and second post-test scores averaged 74% correct. TMG averaged 50% correct on the pre-test and 50% correct on the post-test. Significant differences were found between the two groups on the pre-test (t = 2.86, p = .005), first post-test (t = 9.93,

Table 2
Motivations for involvement in the Texas Master Naturalist (TMN) program as reported by TMN study participants

Motivation	Mean*	*n*	*SD*
To learn more about nature	3.85	227	0.358
Concerned about nature in my community	3.61	226	0.565
Increase my awareness of current issues	3.44	227	0.638
Sense of personal responsibility	3.19	224	0.760
Interaction with resource professionals	3.14	226	0.770
Enhance my ability to influence others	3.01	226	0.902
Pass knowledge on to my children and grandchildren	2.89	227	1.111
Opportunity to volunteer	2.86	226	0.756
To meet people with similar interests	2.79	226	0.848
Childhood experiences with nature	2.75	226	0.998
Opportunity to work with adults	2.73	226	0.851
To learn how to manage my land	2.61	224	1.066
Opportunity to work with youth	2.59	226	0.976
Something fun to do with my spare time	2.50	226	0.994
Interested in an environmental career	2.30	223	1.199
Relates to present career	2.03	222	1.209
To accompany my spouse	1.47	217	0.918

*Participants could mark multiple responses, and rated choices as follows: 1 = Not at all Important, 2 = Slightly Important, 3 = Important, 4 = Very Important.

$p = .001$), and percent gain ($t = 8.40$, $p = .001$). TMN scores increased significantly from pre- to first post-test on 19 of 23 individual knowledge questions, and participants improved their scores on all questions (Table 3).

Attitudes About Resource Management and Consumptive Uses of Wildlife

TMN attitudes changed on 14 out of 26 attitude statements from pre- to first post-test (Table 4), and on only 1 out of 26 statements from the first to second post-test ($t = 2.72$, $p < .001$). A Cronbach's Alpha reliability index of .797 was recorded for responses to the pre-test, .751 for the first post-test, and .636 for the second post-test.

TMN averaged attitude scores of 59.2 on the pre-test, 53.1 on the first post-test, and 52.5 on the second post-test. Differences were found between pre- and first post-test attitude scores ($t = 8.96$, $p < .001$) and pre- and second post-test attitude scores ($t = 5.22$, $p < .001$). In general, TMN became more supportive of human intervention in wildlife and habitats as a result of training and throughout their continued involvement with the program.

Multivariate Analysis of Attitude Statements

When principle component analyses was conducted on the second post-test attitude statements, eight factors displayed eigenvalues of 1.0 or greater, and items loading at greater than .6 were included. This combination of factors accounted for 66% of total variance of

Table 3
TMN Answers to knowledge questions on pre- and first post-test

Concept/Question	Pre-test*	1st post-test*	*t*	*df*	*P*
Living and non-living features in a given area:	83.7	86.8	–1.021	226	.308
Group of individuals of same species occupying given area at same time:	60.8	70.9	–2.811	226	.005
Factors limiting existence, growth, abundance, distribution of organism:	52.9	72.0	–5.412	226	.001
Greatest stored energy in food chain:	32.7	56.7	–5.964	226	.001
Edge is:	40.5	80.0	–11.162	226	.001
Study of relationship between organisms and environment:	79.6	88.0	–2.477	226	.014
Communities replaced over time:	68.7	84.6	–4.788	226	.001
Use of limited resource by two or more individuals results in:	75.2	87.7	–4.208	226	.001
Biome distribution determined by:	47.8	65.5	–4.550	226	.001
Organism's unique role in the environment:	52.0	67.0	–4.851	226	.001
Effect of predators depends on:	89.9	95.2	–2.056	226	.041
Maximum number of species a habitat can sustain indefinitely:	41.6	70.0	–8.488	226	.001
Climax community is:	59.5	89.5	–7.936	226	.001
Factors in prairie maintenance:	63.9	87.2	–7.028	226	.001
Example of point-source pollution:	30.8	38.8	–2.405	226	.017
Function of wetland systems:	80.0	92.5	–4.503	226	.001
Methods to control weeds and woody vegetation:	84.0	89.3	–1.725	226	.086
Unsuited for cultivation; best as habitat for free-ranging domestic and native animals:	66.8	70.9	–0.927	226	.355
Primary focus of Best Management Practices in forested ecosystems:	1.3	3.2	–1.639	226	.103
Undesirable trees removed to allow healthier trees to grow:	69.0	82.7	–4.429	226	.001
Group of trees in forest of approximately same age:	63.3	74.3	–3.162	226	.002
Most important consideration in livestock management on rangelands:	45.1	65.2	–5.600	226	.001
Privately owned land in Texas:	35.4	64.4	–8.488	226	.001

*Percentage of respondents who answered question correctly.

responses to attitude statements. The following three statements did not load into any of the eight factors and were not included in the final solution: (a) With respect to natural resources, nature should be allowed to take its course without human interference; (b) Landowners should be able to control access to wildlife on their land; and (c) It is important to have a variety of successional stages in a forest.

Table 4
TMN responses to attitude statements on pre- and first post-test

Attitude statement	Pre-test mean	1st post-test mean	Change	Direction of change	*t*	*df*	*P*
Nature should be allowed to take its course.*	2.50	2.72	–0.22	Disagree	–3.191	214	.002
Natural resources must be managed.	1.51	1.48	0.03	Agree	0.652	219	.515
Property owners should own wildlife on their land.	2.89	2.72	0.16	Agree	1.735	148	.085
Landowners control access to wildlife on their land.	2.25	2.11	0.14	Agree	1.518	150	.131
The benefits of fire outweigh the risks.	2.36	1.76	0.60	Agree	7.600	222	.001
Prescribed fire destroys natural habitats.*	3.07	3.18	–0.11	Disagree	–1.501	221	.135
Prescribed fire causes a threat to human life.*	3.09	3.21	–0.12	Disagree	–1.747	219	.082
Prescribed fire improves conditions for wildlife.	1.95	1.46	0.49	Agree	–6.801	222	.741
Hunting wild game for trophies is acceptable.	3.02	3.00	0.02	Agree	2.205	220	.001
Hunting wild game for meat is acceptable.	2.02	1.90	0.13	Agree	2.205	222	.028
Sport or recreational hunting is acceptable.	2.49	2.28	0.21	Agree	3.380	220	.001
It is acceptable to eliminate individual predators that prey on livestock.	2.77	2.65	0.12	Agree	1.887	217	.060
It is acceptable to eliminate predators that prey on threatened and endangered species.	2.75	2.58	0.17	Agree	2.555	219	.011
It is acceptable to eliminate predators that prey on game species.	3.24	3.19	0.04	Agree	0.717	215	.474
Livestock grazing is detrimental to rangelands.*	2.75	2.58	0.16	Agree	1.959	218	.051
Grazing is destructive to natural vegetation.*	2.71	2.44	0.27	Agree	3.173	217	.002

(*Continued*)

Table 4
(*Continued*)

Attitude statement	Pre-test mean	1st post-test mean	Change	Direction of change	*t*	*df*	*P*
Grazing can be used to enhance wildlife habitat.	2.75	2.26	0.49	Agree	5.708	222	.001
Public forests should be managed for multiple uses.	1.97	1.89	0.08	Agree	1.220	222	.224
It is important to have a variety of successional stages in a forest.	1.75	1.52	0.24	Agree	3.192	223	.002
It is possible to manage for both wildlife and timber in forest communities.	2.01	1.88	0.13	Agree	1.895	222	.059
Harvesting timber permanently harms forests.*	3.02	2.94	0.08	Agree	1.173	220	.242
Clearcutting is an acceptable practice.	3.53	3.39	0.13	Agree	2.138	222	.034
Trapping is an acceptable practice.	2.67	2.53	0.14	Agree	2.045	220	.042
Hunting is an acceptable practice.	2.28	2.14	0.14	Agree	2.440	223	.015
Grazing is an acceptable practice.	2.50	2.25	0.25	Agree	3.388	222	.001
Prescribed burning is an acceptable practice.	2.07	1.69	0.38	Agree	5.466	223	.001

Possible responses were 1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree.
*Items were reverse coded when calculating attitude scale score.

The first five factors split the attitude statements into their respective subject areas (hunting, grazing, prescribed fire, forest management, and predator control). Factor 6 (management) included a general statement about the need for natural resource management and a statement about prescribed burning as a management tool to improve habitat conditions. Factor 7 (consumptive) included two strongly consumptive uses of natural resources, clearcutting and trapping. Factor 8 (landowners) combined ownership of wildlife and elimination of game predators (Table 5).

Treatment versus Comparison Group Attitudes

TMG averaged 59.31 on the pre-test attitude scale and 59.94 on the post-test scale. TMG and TMN attitude scores were similar on the pre-test, but differed on the post-test ($t = –5.00$, $p < .001$). Overall, TMG attitudes did not change from pre- to post-test.

Table 5
Components resulting from exploratory factor analysis of attitude statements on second post-test

	Component							
Attitude statement	1	2	3	4	5	6	7	8
Hunting wild game for trophies is an acceptable practice.	0.665							
Hunting wild game for meat is an acceptable practice.	0.758							
Sport or recreational hunting is an acceptable practice.	0.722							
Hunting is an acceptable natural resource management practice.	0.691							
Livestock grazing is detrimental to rangelands.		0.803						
Grazing is destructive to natural vegetation.		0.900						
Grazing can be used to enhance wildlife habitat.		0.670						
Grazing is an acceptable natural resource management practice.		0.781						
The benefits of fire in forest and rangeland ecosystems outweigh the risks.			0.646					
Prescribed fire destroys natural habitats.			0.801					
Prescribed fire causes a threat to human life.			0.752					
Prescribed burning is an acceptable natural resource management practice.			0.676					
Public forests should be managed for multiple uses (wildlife, timber, recreation, etc.)				0.622				
It is possible to manage for both wildlife and timber in forest communities.				0.791				
Harvesting timber permanently harms forests.				0.768				
It is acceptable to eliminate individual predators that prey on livestock.					0.634			
It is acceptable to eliminate predators that prey on threatened and endangered species.					0.768			
Natural resources must be managed to ensure their availability for future generations.						0.638		
Prescribed fire can improve habitat conditions for wildlife.						0.669		
Clearcutting is an acceptable natural resource management practice.							0.710	
Trapping is an acceptable natural resource management practice.							0.671	
Property owners should be able to own wildlife on their land.								0.861
It is acceptable to eliminate predators that prey on game species.								0.608

Knowledge and Attitude Correlations

Only five attitude statements correlated with knowledge gain. A negative correlation existed between the statement "prescribed fire destroys natural habitats" and knowledge gain (*Tau-b* = –.13, $p = .015$). Attitudes about "prescribed fire improves habitat conditions for wildlife" were also weakly correlated with knowledge gain (*Tau-b* = –.16, $p = .003$), as were "livestock grazing is detrimental to rangelands" attitudes (*Tau-b* = –.11, $p = .042$). Weak negative correlations also existed between "grazing can be used to enhance wildlife habitat" and knowledge gain (*Tau-b* = –.15, $p = .004$) and "clearcutting is an acceptable management practice" and knowledge gain (*Tau-b* = –.16, $p = .003$). As knowledge increased, participants were more likely to agree with these statements.

Volunteer Activities Following Training

Of the 152 respondents (67% return) to the second post-test, 82% ($n = 125$) reported that they had participated in volunteer activities since their training ended. The five most common volunteer activities reported were: indirect outreach (working at booths or displays; $n = 67$); wildscape maintenance and demonstration (including schoolyard habitats; $n = 65$); fish, wildlife, and/or plant inventories ($n = 52$); habitat management and/or restoration (i.e., prescribed burns, pest, brush, or exotic species control; $n = 49$); and direct outreach to youth (presentations; $n = 47$).

Discussion

Resource professionals can no longer make management decisions based on biological data alone; opinions and concerns of the public must also be considered (Czech, Devers, & Krausman, 2001; Duda & Young 1998). To make educated decisions about natural resource issues, individuals must be provided with both accurate information and an understanding of ecological principles (Mankin et al., 1999, p. 471). Texas Master Naturalist volunteers are an important element of this process, both through their own interest and involvement in natural resource issues and in their community outreach and volunteer activities. Perhaps one of the greatest strengths of the program is that it creates individuals outside of the resource professional community who are knowledgeable about ecology and supportive of the need for conservation and resource management, thus providing a broader base of conservationists to interact with the public.

Knowledge gain demonstrated by TMN suggests that the program was successful at increasing participants' natural resource knowledge. TMN scores improved over time while TMG scores did not, suggesting that changes in TMN knowledge resulted from program training and not from outside influences. Most importantly, while TMN scores only increased slightly from the first to second TMN post-test, the knowledge that was gained during training was retained. Participation in volunteer activities and advanced training opportunities might have led to knowledge retention, or individuals' interest may have sufficiently stimulated a desire for continued learning.

It is important to note that while knowledge increased over time and was retained by participants, the average final post-test knowledge score was still fairly low. One possible explanation is that some of the questions covered on the knowledge portion of the survey were not included in all chapters' training curricula. Development of a standardized state-wide curriculum may lead to more consistent knowledge scores between chapters, and restructuring of the knowledge portion of the evaluation tool may be necessary.

In general, TMN tended to agree with the need for resource management versus "letting nature take its course" both before and after training. However, attitudes about different management practices varied. Support of prescribed burning was not unexpected; the benefits of fire have been reported widely by the media and natural resource agencies (Jacobson et al., 2001; Loomis et al., 2001; Manfredo et al., 1990). Attitudes about hunting differed based on the reasons for hunting (Duda & Young, 1998; Kellert, 1980; Mankin et al., 1999; Thomas & Adams, 1998). TMN typically approved of hunting for meat and sport, seeing it as an acceptable natural resource management practice. However, hunting for trophies was considered unacceptable. Approval for sport or trophy hunting might have been stronger had the participants been assured the meat would be used (Kellert, 1980). Attitudes about predator control and trapping differed from those found in previous studies that have suggested public disapproval of trapping (Duda & Young, 1998; Kellert, 1980; Manfredo et al., 1999). TMN approved of trapping as a management tool. However, they were not as approving of predator control. Acceptance of predator control also may have depended on the species being protected (Messmer et al., 1999). Kearney (2001) suggested explaining how wildlife benefits from clearcutting could positively influence individuals' attitudes.

While TMN attitudes changed significantly following training, changes in attitudes were, for the most part, not correlated with knowledge gain. Bright and Manfredo (1997) suggested that extremity of attitudes can be influenced by the extent of an individual's knowledge about the subject before educational intervention, but that while introduction of balanced information may strengthen an individual's attitudes about a particular subject, it does not affect attitudinal direction. Personal experience with natural resources, including interaction with resource professionals and opportunities to volunteer in nature-based activities, may have been responsible for changes in TMN attitudes (Cortner et al., 1984; Jacobson et al., 2001; Manfredo et al., 1990; Newhouse, 1990).

While TMN demographics tended to coincide with those of other volunteer organizations, one shortfall of the program was its lack of racial or ethnic diversity. Minority populations in the United States continue to grow, and are expected to comprise 47% of the country's population by 2050, compared to 24% in 1990 (Murdock, Loomis, Ditton, & Hoque, 1996). Two chapters, the Rio Grande Valley and Trans-Pecos, had a slightly higher proportion of Hispanic individuals, but otherwise minority participation in the program was low. Research by Caron (1989) suggests that African-American individuals are more likely to be concerned about environmental issues if they understand the interrelatedness of the environment and other social issues, such as health threats and decreased land values as a result of pollution. Access to training outside of ethnic communities may be a limiting factor in volunteering (Rideout & Legg, 2000), and advertisements and programs in Spanish may increase involvement by Latino individuals (Hong & Anderson, 2006). Program marketing strategies for urban residents, particularly inner-city residents, should be designed differently than those for more rural communities. Perhaps Spanish-speaking members of current TMN chapters could be encouraged to earn volunteer hours by recruiting or working with individuals for whom English is a second language.

Personal growth and learning opportunities, community service opportunities, and the chance to be involved with resource professionals were viewed as definite program benefits and should be stressed in marketing materials. Two out of the top three motivations for involvement with the TMN program were self-related. While studies indicate volunteers tend to cite altruistic reasons when asked why they want to become involved with a volunteer organization (Fischer & Schaffer, 1993), Master Naturalists were more concerned with personal reasons. This may have been because Master Naturalists were surveyed at the

beginning of training, when emphasis was on personal learning. They may have anticipated learning, not considering the more altruistic volunteer portion of the program, which most often occurred after the 40-hour training program was completed.

TMN appeared to be motivated to join the program for personal growth reasons, and gained ecological knowledge and developed more positive attitudes about natural resource management as a result of their program involvement. The fact that most TMN not only are taking the classes but that the large majority of them are also involved in volunteer activities suggests that the program was successful at its mission, not at only producing informed citizens but also promoting community involvement in natural resource education and activities. As the TMN program continues to grow, and as new Master Naturalist programs continue to develop across the country, this TMN program evaluation should serve not only as a tool for baseline evaluation of programs but also as an instrument for long-term program assessment.

References

Bennett, D. B. (1988–1989). Four steps to evaluating environmental education learning experiences. *Journal of Environmental Education*, *20*, 14–21.

Braker, M. J., Leno, J. R., Pratt, C. C., & Grobe, D. (2000). Oregon extension volunteers: Partners in action. *Journal of Extension*, *38*. Retrieved October 6, 2008 from http://www.joe.org/joe/2000 april/rb3.html

Bright, A. D., & Manfredo, M. J. (1997). The influence of balanced information on attitudes toward natural resource issues. *Society and Natural Resources*, *10*(5), 469–483.

Caron, J. A. (1989). Environmental perspectives of blacks: Acceptance of the "New Environmental Paradigm." *Journal of Environmental Education*, *20*, 21–26.

Cohen-Mansfeld, J. (1989). Employment and volunteering roles for the elderly: Characteristics, attributions, and strategies. *Journal of Leisure Research*, *21*, 214–227.

Cortner, H. J., Zwolinski, M. J., Carpenter, E. H., & Taylor, J. G. (1984). Public support for fire-management policies. *Journal of Forestry*, *82*, 359–361.

Czech, B., Devers, P. K., & Krausman, P. R. (2001). The relationship of gender to species conservation attitudes. *Wildlife Society Bulletin*, *29*(1), 187–194.

Duda, M. D., & Young, K. C. (1998). American attitudes toward scientific wildlife management and human use of fish and wildlife: Implications for effective public relations and communications strategies. *Transactions of the 63rd North American Wildlife and Natural Resources Conference*, 589–603.

Fischer, L. R., & Schaffer, K. B. (1993). *Older volunteers: A guide to research and practice*. Newbury Park, CA: Sage.

Hong, A., & Anderson, D. H. (2006). Barriers to participation for Latino people at Dodge Nature Center. *Journal of Environmental Education*, *37*(4), 33–44.

Hooper, J. K. (1988). Teacher cognitions of wildlife management concepts. *Journal of Environmental Education*, *19*, 15–18.

Ilsley, P. J. (1990). *Enhancing the volunteer experience*. San Francisco: Jossey-Bass Publishers.

Jacobson, S. K. (1987). Conservation education programmes: Evaluate and improve them. *Environmental Conservation*, *14*, 201–206.

Jacobson, S. K. (1991). Evaluation model for developing, implementing, and assessing conservation education programs: Examples from Belize and Costa Rica. *Environmental Management*, *15*, 143–150.

Jacobson, S. K., Monroe, M. C., & Marynowski, S. (2001). Fire at the wildland interface: The influence of experience and mass media on public knowledge, attitudes, and behavioral intentions. *Wildlife Society Bulletin*, *29*, 929–937.

Kearney, A. R. (2001). Effects of an informational intervention on public reactions to clear-cutting. *Society and Natural Resources*, *14*, 777–790.

Kellert, S. R. (1980). Americans' attitudes and knowledge of animals. *Transactions of the North American Wildlife and Natural Resources Conference*, *45*, 111–124.

Kidd, A. H., & Kidd, R. M. (1997). Characteristics and motivations of docents in wildlife education. *Pyschological Reports*, *81*, 383–386.

Loomis, J. B., Blair, L. S., & Gonzales-Caban, A. (2001). Prescribed fire and public support: Knowledge gained, attitudes changed in Florida. *Journal of Forestry*, *19*, 18–22.

Manfredo, M., Fishbein, M., Haas, G. E., & Watson, A. E. (1990). Attitudes toward prescribed fire policies. *Journal of Forestry*, *88*, 19–23.

Manfredo, M. J., Pierce, C. L., Fulton, D., Pate, J., & Gill, B. R. (1999). Public acceptance of wildlife trapping in Colorado. *Wildlife Society Bulletin*, *27*(2), 499–508.

Mankin, P. C., Warner, R. E., & Anderson, W. L. (1999). Wildlife and the Illinois public: A benchmark study of attitudes and perceptions. *Wildlife Society Bulletin*, *27*, 465–472.

Mazzacano, C. (2007) "Master Naturalists" certifies trainers in 25 states. *National Conservation Training Center Journal*, Spring/Summer, 4.

McNabb, K., & Bliss, J. C. (1994). Nonindustrial private forest owner attitudes toward the use of silvicultural herbicides. *Journal of Natural Resources and Life Sciences Education*, *23*, 46–50.

Messmer, T. A., Brunson, M. W., Reiter, D., & Hewitt, D. G. (1999).United States public attitudes regarding predators and their management to enhance avian recruitment. *Wildlife Society Bulletin*, *27*(2), 75–85.

Murdock, S. H., Loomis, D. K., Ditton, R. B., & Hoque, M. N. (1996). The implications of demographic change for recreational fisheries management in the United States. *Human Dimensions of Wildlife*, *1*(4), 14–37.

Munson, B. H. (1994). Ecological misconceptions. *Journal of Environmental Education*, *25*, 30–34.

Newhouse, N. (1990). Implications of attitude and behavior research for environmental conservation. *Journal of Environmental Education*, *22*, 26–32.

Norris, K. S., & Jacobson, S. K. (1998). Content analysis of tropical conservation programs: Elements of success. *Journal of Environmental Education*, *22*, 26–32.

Nowak, P. F. (1984). Direct evaluation: A management tool for program justification, evolution, and modification. *Journal of Environmental Education*, *15*, 27–30.

Payne, R., Payne, B. P., & Reddy, R. D. (1972). Social background and role determinants of individual participation in organized voluntary action. In D. H. Smith, R. D. Reddy, & B. R. Baldwin (Eds.), *Voluntary action research* (pp. 207–250). Lexington, MA: D. C. Heath and Company.

Reiter, D. K., Brunson, M. W., & R. H. Schmidt. (1999). Public attitudes toward wildlife damage management and policy. *Wildlife Society Bulletin*, *27*, 746–758.

Rideout, S., & Legg, M. H. (2000). Perceived barriers by minorities to participation in nature based recreation. *Journal of Interpretation Research*, *5*(1), 53–58.

Rossi, P. H., Freeman, H. E., & Lipsey, M. W. (1999). *Evaluation: A systematic approach* (6th ed.). Thousand Oaks, CA: Sage Publications.

Rouse, S. B., & Clawson, B. (1992). Motives and incentives of older adult volunteers. *Journal of Extension*, *30*, 9–12.

Rutman, L. (1984). *Evaluation research methods: A basic guide*. Beverly Hills, CA: Sage Publications.

Salant, P., & Dillman, D. A. (1994). *How to conduct your own survey*. New York: John Wiley and Sons, Inc.

Schrock, D. S., Meyer, M., Ascher, P., & Snyder, M. (1999). Missouri master gardener demographics. *Journal of Extension*, *37*. Retrieved October 6, 2008 from http://www.joe.org/joe/2000february/rb2.html.

Thomas, J. K., & Adams, C. E. (1989). *The public and Texas wildlife*. College Station: Texas Agricultural Experiment Station.

Weiss, C. H. (1998). *Evaluation methods for studying programs and policies*. Upper Saddle River, NJ: Prentice Hall.