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Forestry Extension Participation and Written Forest Management Plan Use in New York City's Water Supply System

Abstract

The management of New York City's surface water supply system entails sustaining a working landscape that balances economic development with water quality conservation. Forestry Extension plays a vital role in this approach, particularly with nonindustrial private forestland owners, by serving as a resource for information and technical assistance, promoting forest stewardship, and encouraging the use of written forest management plans. The article presents findings from a recent survey that suggests there is a relationship between the participation rates in forestry Extension and written forest management plan use among New York City nonindustrial private forestland owners.

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Introduction

New York City's (NYC) water supply system is the largest unfiltered surface storage and supply system in the United States. Comprised of two watersheds, the entire system provides drinking water to roughly 9 million people in the greater NYC area. The Catskill/Delaware watershed, located in the Catskill Mountain region of New York State, comprises nearly 1,625 square miles and supplies approximately 90% of the city's water. The older and suburbanized 375-square mile Croton watershed, 40 miles north of Manhattan, supplies about 10% of NYC's water. Forests cover approximately 75% of the 2,000 square-mile system, with about 90% of the forest area owned by nonindustrial private forestland (NIPF) owners (Watershed Forestry Task Force, 1996; NYC DEP, 2002).

Throughout most of the 20th century, NYC residents have benefited from some of the purest drinking water in the nation. As we enter the 21st century, changes in land use and development threaten the quality of NYC's water supply (NYC DEP, 2002). Worldwide, large cities and rural communities are striving to balance economic development and long-term prosperity with environmental quality and protection. The NYC water supply system is a high-profile example of a working forested landscape where NIPF owners hold the key to water quality.

Objectives

This article analyzes data extracted from a recent mail survey of Catskill/Delaware watershed NIPF owners. (The suburbanized Croton watershed was not included in the study due to its proximity to NYC and lack of a working forested landscape.)

We use the data to:

1. Identify the percentage of Catskill/Delaware watershed NIPF owners with a written forest

management plan;

2. Evaluate the frequency of participation in forestry extension among NIPF owners;
3. Determine if there is a relationship between NIPF owners' participation in forestry extension and their use of written forest management plans.

Rationale

Forestry extension programs targeting Catskill/Delaware watershed NIPF owners are designed to increase NIPF stewardship through education and application (Watershed Forestry Task Force, 1996). Forestry extension workshops and technical assistance programs, in particular, afford NIPF owners the opportunity to gain intimate knowledge of (1) sustainable forestry and its role in watershed management, and (2) the benefits of a written forest management plan in practicing sustainable forestry.

Background

In 1989, the United States Environmental Protection Agency promulgated the Surface Water Treatment Rule, which stated that all surface drinking water sources must undergo filtration unless managers can control human activities within the watershed. In order to avoid building and operating an extremely expensive filtration system in the Catskill/Delaware watershed, NYC sought to control human activities and released a draft watershed protection plan in September 1990 that included revised watershed regulations not updated since 1953.

The draft regulations sparked considerable opposition from local watershed communities, especially farmers and the local forest industry, who asserted that they would jeopardize their economic viability (Watershed Forestry Task Force, 1996). The 1997 signing of the NYC Watershed Memorandum of Agreement (MOA) by NYC, state, and federal agencies; watershed communities; and environmental groups concluded 7 years of negotiations between upstate watershed communities and NYC regarding the city's long-range watershed protection plans. The agreement enabled NYC Department of Environmental Protection to receive a long-term waiver regarding the federal requirement for a filtration plant in the Catskill/Delaware watershed (NYCDEP, 2002).

The watershed management approach outlined in the MOA entails a non-regulatory method that, among other things, seeks to expand the stewardship values of watershed landowners. The amount of NIPF and its importance in watershed management make NIPF owner stewardship a top priority in this endeavor.

Several dimensions of forestry Extension in the Catskill/Delaware watershed specifically seek to heighten forest stewardship among NIPF owners. To do this, Extension organizations employ a wide variety of programs and activities such as workshops and forest management technical assistance programs. Among the core messages communicated at these programs and activities is the benefits of a written forest management plan.

Written forest management plans have long been viewed as a promising vehicle for building stewardship among NIPF owners. Not only do plans foster sustainable forestry, but they also serve to educate and engage NIPF owners. When NIPF owners better understand their forests and are active in management, they are more apt to become better stewards (Best & Wayburn, 2001). Esseks and Moulton (2000) found that over three-quarters of NIPF owners implement their respective plans. Consequently, written forest management plans stand as a practical tool for forestry Extension organizations promoting sustainable forestry in the Catskill/Delaware watershed.

Methods

A mail survey was conducted in Spring 2002 for a larger study of NIPF owners in the Catskill/Delaware watershed. The NIPF owner population was identified for the study using the following criteria:

- Private family ownership;
- 10 or more acres of land;
- Forested land present on the property.

Private family ownerships were targeted because relating survey responses to behavior is more precise when dealing with a single family versus, for instance, a hunting club or corporation. The 10-acre threshold was based on management plan eligibility criteria from the National Tree Farm Program and the Watershed Forestry Program.

A survey was mailed to a random sample of 700 NIPF owners selected from a population of 3,995. The sample size was determined by using the response rate from a pilot study and the formulas for estimating a proportion based on a known sample size (Cochran, 1977). The following two survey questions were used for this article:

1. Do you have a written management plan for your forestland?

- Yes
- No

2. In the past year, how many times have you participated in forestry public outreach or education programs (i.e., workshops or symposiums), or used their services (i.e., management plan development or BMP subsidies)?

- Never
- Once
- 2-4 Times
- More Than 4 Times

The wording of these questions created limitations in the analysis:

1. A "written management plan" was not defined in the survey. Because of this, the question was open to interpretation by the respondent;

2. Participation responses pertained only to the year prior to receiving the survey. Therefore, the analysis was limited to using the question as a general indicator of extension participation.

Surveys containing usable responses for both questions were combined in a cross-tabulation and analyzed to identify trends in Extension program participation vis-à-vis written forest management plan use. Furthermore, chi-square tests and a t-test were administered to test for statistical significance between the responses.

Results

Of the 700 surveys mailed, 646 were successfully delivered, 54 were unsuccessfully delivered (erroneous address, deceased respondent, no longer owned forestland, etc.), and 274 were completed and returned, for an adjusted response rate of 42%. This response rate compared favorably with other landowner survey response rates.

Forest Management Plans

Of the 252 usable responses for this question, 21% (53) of the respondents indicated that they had a written forest management plan.

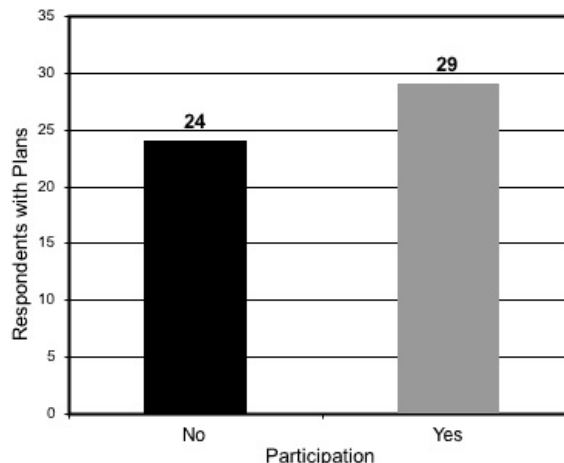
Program Participation

There were 255 usable responses regarding the level of Extension program participation. In the year prior to receiving the survey, 84% (214) indicated that they did not participate in any program. Overall, 16% (41) of the respondents participated in programs during the year prior to the mail survey. Eight percent (20) indicated that they participated "Once" in a workshop or technical service program during the previous year. Respondents participating "2 to 4 times" totaled 4% (14). Last, 3% (7) marked that they participated "More than 4 times."

Program Participation Vis-à-Vis Forest Management Plans

There were 251 surveys containing usable responses for both questions. Of the 210 respondents that marked "Never" regarding Extension workshop or technical service program participation in the previous year, 11% (24) indicated they had a written management plan. Of the 41 respondents that participated during the year, regardless of the frequency, 71% (29) indicated they had a written management plan (Figure 1).

Figure 1.
Extension Program Participation ("Yes", "No") Vis-à-vis Written Management Plan Use Among Survey Respondents



Specifically, 55% (11) of the 20 respondents that marked "Once" regarding Extension workshop or technical service program participation in the previous year indicated they had a written forest management plan. Of the 14 respondents that marked "2 to 4 times", 79% (11) had written forest management plans. Finally, 100% of the 7 respondents that indicated they participated "More than 4" times in the previous year had a written forest management plan (Table 1).

Table 1.
Extension Program Participation ("Never", "Once", "2 to 4 times", "More than 4") Vis-à-Vis Written Management Plan Use Among Survey Respondents

	Program Participation Response			
	"Never"	"Once"	"2 to 4 times"	"More than 4"
Plan	n = 23 (11%)	n = 11 (55%)	n = 11 (79%)	n = 7 (100%)
No plan	n = 187 (89%)	n = 9 (45%)	n = 3 (21%)	n = 0 (0%)
Total n	n = 210	n = 20	n = 14	n = 7

Statistical Analysis

The first chi-square test indicated that the observed number of written forest management plans for those respondents who participated in Extension programs was significantly higher than expected (Table 2). The results of the second test indicated that the observed number of plans was significantly higher at varying intensities of participation--"Once", "2 to 4 times", or "More than 4 times" (Table 3). The results in the second test, however, included three expected values less than 5. Nonetheless, both chi-square tests produced significant results.

Table 2.
Chi-Square Test Results of Survey Respondent's Management Plan Use and Extension Program Participation ("Yes", "No")

	Plan		
	Yes	No	Total
"Yes"			
Count	29	12	41
Expected Count	8.5	32.5	
Residual	20.5	-20.5	
"No"			
Count	23	187	210
Expected Count	43.5	166.5	
Residual	-20.5	20.5	

Total Count	52	199	251
$\chi^2 = 74.224, df = 1, p < .0001$			

Table 3.

Chi-Square Test Results of Survey Respondent's Management Plan Use and Extension Program Participation ("Never", "Once", "2 to 4 times", "More than 4")

	Plan		
Participation	Yes	No	Total
"Never"			
Count	23	187	210
Expected Count	43.5	166.5	
Residual	-20.5	20.5	
"Once"			
Count	11	9	20
Expected Count	4.1	15.9	
Residual	6.9	-6.9	
"2 to 4 times"			
Count	11	3	14
Expected Count	2.9	11.1	
Residual	8.1	-8.1	
"More than 4"			
Count	7	0	7
Expected Count	1.5	5.5	
Residual	5.5	-5.5	
Total Count	52	199	251

$$\chi^2 = 81.820^a, df = 3, p < .0001$$

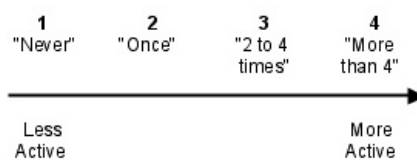
^aThree cells (37.5%) had an expected frequency less than five.

The results of the t-test indicated that respondents with a written forest management plan participated in forestry extension with greater frequency (Table 4). The means for the test were derived using a "participation continuum" (Figure 2).

Table 4.
T-test Results of Survey Respondent's Participation Based on Use of a Written Forest Management Plan

	n	Participation Mean	SE
Plan	52	2.04 ^a	.0225
No Plan	199	1.08 ^b	.15
Means with the same letter are not significantly different ($\alpha = .05$).			

Figure 2.
Participation Continuum



Discussion and Implications

The Catskill/Delaware watershed provides a valuable service for NYC. Protecting the quality of water that flows from the system is imperative. The capacity of a sustainable forest to naturally protect water quality makes it an important vehicle for realizing this necessity. NIPF owner stewardship is an important component of sustainable forestry in the Catskill/Delaware watershed, and written management plans are an effective tool in fostering sustainable forestry and stewardship.

Mail survey results suggest that 21% of Catskill/Delaware watershed NIPF owners have a written forest management plan. This rate far exceeds the estimated average of 6% for New York State and 5% for the Northern Forest Region (Birch, 1994; 1996).

On top of this, results of the cross-tabular analysis, chi-square tests, and t-test indicate that participation in forestry Extension and the use of written forest management plans are related. It is not possible, however, to determine from the data collected whether or not there is a causal relationship between the two. The data does suggest that NIPF owners active in forestry extension are more likely to have a forest management plan and that the likelihood increases with greater participation.

The association discovered between Extension program participation and written forest management plans is especially important in the pursuit of increased stewardship and sustainable forest management in the Catskill/Delaware watershed. Extension programs transfer stewardship values and sustainable forest management information, and, in turn, written management plans increase the frequency and likelihood of implementation.

On the other hand, the results indicate that the work for forestry Extension in the Catskill/Delaware watershed is far from complete. Almost 84% of the respondents did not participate in any Extension workshop or technical service during the year prior to receiving the survey, and 79% did not have a written forest management plan.

The NIPF management situation in NYC's water supply system presents great challenges. Thousands of NIPF owners are responsible for the management decisions and actions taken on about 90% of the water supply's forestland. It is the responsibility of forestry Extension to help meet this challenge by expanding NIPF owner stewardship.

The results discussed in this article indicate that the more often NIPF owners participate in watershed forestry Extension programs, the more likely they are to have a written forest

management plan. However, the majority of NIPF owners are not actively participating.

In order to continue substantively improving the management of forestland in the NYC water supply system, future strategies for forestry Extension organizations need to include multi-faceted programs designed to increase NIPF owner participation by first capturing their attention using innovative means, followed by encouraging program participation. Improving NIPF owner participation must remain a primary pursuit in the management of NYC's water supply system because its link to the use of written forest management is too valuable in sustaining clean drinking water.

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