

Farm woodlots in northern New England, USA: Characteristics, management, and contributions to the whole farm system

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Abstract

Farms and forests dominate the rural landscape of the northern New England states of Maine, New Hampshire and Vermont, among the most heavily forested states in the US. However, we know little about the stewardship of farm woodlots and their contributions to the whole farm system, despite region-wide increases in farm forest acreage. Using a mail survey, this study found that almost half of respondents had a written management plan for their forestland, most of which had been written by a forester, and approximately three-quarters took an active role in the management of their woodlots. Farm woodlot harvesting and management contributed over 7% of total farm income. Variables such as respondent's state of residence, age, education and type of farm were investigated in order to better understand farmers' forest stewardship behavior. Implications for effective outreach to farm forest owners are offered.

Key words: farm woodlot, farm forest, forest stewardship

Introduction

The states of northern New England are among the most heavily forested in the United States: Maine is the most heavily forested state in the country (90% of the state's total land area is forested), and the land areas of New Hampshire (84%), and Vermont (78%) are predominantly forested^{1,2}. New Hampshire was the only state in northern New England in which the number of forestland owners and the amount of forest acreage have decreased during the period 1978–1994³ (Table 1), and the amount of forestland area in that state appears to continue to erode, primarily due to development².

Farms often combine with forests to characterize the region's rural landscapes, especially in areas of more productive soils, and farm woodlots represent a significant forest resource. Farmers in the region own over 3 million acres of land, approximately 10% of the total land area in the region, and approximately 49% (1,492,227 acres) of the total farmland in the region is woodland⁴. While total farmland acreage in northern New England decreased between 1997 and 2002, farm woodland acreage in the region increased during the same period. The 2002 Census of Agriculture found that 47% of Maine's farm acreage is

woodland, while 60% of New Hampshire's farm acreage and 42% of Vermont's farm acreage are woodland, an increase in all three states since the 1997 census. However, both the total number of farms and the number of farms with woodland decreased in all three states during the same period⁴. The amount of total farmland per farm and the amount of woodland per farm have remained virtually unchanged in Vermont between 1997 and 2002, while farms in Maine and New Hampshire have shown increases in both attributes during the same period. In addition, available data from Maine indicate that, for the total acreage enrolled in that state's current use assessment program for farmland in 2004, 53% of the total farmland was farm woodland, and the value of enrolled farm woodland was \$58,135,96 versus \$33,242,461 for enrolled agricultural land⁵.

Despite their regional and local importance, the stewardship of farm woodlots has rarely been a primary focus of research on non-industrial private forests (NIPFs) in the US. This study was designed to characterize the stewardship behavior, including management and harvesting activity, on farm forests in northern New England, a forest ownership type that is increasing in size even as farmland acreage and the number of farms in the region are

Table 1. Changes in the number of forest owners and amount of forest acreage in northern New England between 1978 and 1994 (from Birch³).

State	1978 number		1994 number	
	Owners (thousands)	Acres (millions)	Owners (thousands)	Acres (millions)
ME	241.4	15.698	255.6	17.060
NH	122.3	4.307	83.7	4.144
VT	53.3	3.926	80.5	3.993
Total	416.7	23.931	419.8	25.197

decreasing. Attributes related to forest stewardship, including the presence of a forest management plan, professional forester involvement in the execution of the plan and active landowner participation in forest management⁶, were among the key attributes used to better understand farm forest management.

Moreover, this study attempted to understand the contributions of farm woodlots to farm economies and the sustainability of farm woodlots in the region. In addition to comparing forest ownership and management among farmers from the three states studied, this research also compares these attributes between dairy and non-dairy farmers, hypothesizing that dairy farmers are more engaged in farming activity as a full-time, year-round occupation and, therefore, may have less time to dedicate to farm woodlot management. The relevance of results to the future of farm woodlots and implications for effective outreach to farm woodlot owners are discussed.

Background

Previous studies of NIPFs have helped to develop baseline information for understanding private forest ownership in the northeast US. For example, Birch³ found that approximately 42% of the private forest landowners in the northeast US owned forestland primarily because it was 'part of the farm' or 'residence'. These ownerships were generally smaller than 30 acres. An additional 10% of the landowners indicated that farm or domestic use (e.g., fence posts, fuel wood) was the most important reason for owning forestland. In Maine, approximately 25% of the state's forest is held either primarily or secondarily for farm or domestic use or because the land was part of the farm³.

Although much of the scientific literature on NIPFs in the US up to 1995 has been summarized⁷, most of these studies lump non-industrial and non-public forest ownership into the broad NIPF category, and there is little published research that has focused specifically on farm woodland ownership and management. Yet, as described by Moser et al.⁸ in their recent study of farm forest management in three midwestern states, farm woodlands, in particular, are important 'islands of biodiversity in the agricultural landscape' (p. 1), and farmers are more likely than other NIPF owners to maintain a utilitarian view of forest

ownership. Forty percent of farmers in their study cited 'part of the farm' as the primary reason for owning forestland. Other reasons included pasture (8%), enjoying the woods (8%), hunting (7%), and investment (5%). Approximately two-thirds of the 152 survey respondents indicated that they had conducted some form of timber harvesting during their ownership of the farm woodlot.

The environmental, social and economic importance of farm forests have also been discussed elsewhere. A conference focusing on *Farm Forests for the Future*, held in the UK in 1999, for example, identified gaps in information about farm woodlands there, including the quantification of the social, economic and environmental benefits of farm forests and the evaluation of the best approaches to providing appropriate outreach to farm forest owners^{9,10}. In Germany, Brandl and Schanz¹¹ reported that 38% of the land associated with a network of farm enterprises in the state of Baden-Württemberg was forest. Brandl¹² found that forestry contributed approximately 28% to 'traditional' farm income among farm enterprises in the Southern Black Forest. Similar studies of the contributions of farm forests to the farm economy do not appear to exist in the forest science literature in the US.

Methods

A mail survey of farmers in northern New England was conducted. Since there is no comprehensive mailing list available for farmers in the region, lists of farmers were gathered from Departments of Agriculture in each of the three northern New England states who maintained lists of farmers for newsletter mailings. The combined list of farmers in the region contained 700 farmers from New Hampshire (11% of the total number of farmer contacts), 2738 from Maine (44%) and 2825 from Vermont (45%). Before conducting the survey, a test survey was mailed to a random sample of 100 farmers in the region in order to both refine the survey instrument and anticipate the response rate for the subsequent main survey. The main survey was then mailed to a random sample of 3000 farmers in the region using multiple mailings¹³: a survey mailing followed by a reminder postcard and then a final survey mailing to those who had not yet responded. The number of farmers receiving the survey in each state was proportional to the number of farmers from each state on our contact lists. As a result, 330 farmers from New Hampshire (11% of 3000) were mailed the survey, as were 1320 from Maine and 1350 from Vermont.

Appropriate linear and non-linear statistical analyses were performed, including analysis of variance (AOV), contingency table analysis and logistic regression analysis. For some analyses, data were also partitioned by state of residence of the respondent and the type of farm (i.e., dairy versus non-dairy) in order to both refine analyses and to detect differences in farm woodlot ownership and management among these subpopulations. Survey non-response bias was estimated by comparing survey responses of early

Table 2. Background information for farmers in northern New England, overall and by state. USDA National Agricultural Statistics Service (2002) estimates for age are reported after those found by this study. Standard errors for our estimates are in parentheses.

	Overall	ME	NH	VT
Age (years) ($F = 3.27$; $P = 0.04$)	54.8 (0.45)	56.2/53.7 (0.68)	54.7/54.1 (0.96)	53.7/53.9 (0.71)
Years farming ($F = 0.56$; $P = 0.57$)	28.1 (0.57)	27.3 (0.88)	28.3 (1.37)	28.6 (0.89)
Weeks farming per year ($F = 25.60$; $P < 0.01$)	43.9 (0.56)	39.0 (1.06)	44.6 (1.31)	47.5 (0.67)
Hours farming per week ($F = 31.36$; $P < 0.01$)	49.3 (1.14)	38.3 (1.66)	50.3 (2.70)	57.3 (1.69)
Years education ($F = 14.62$; $P < 0.01$)	13.8 (0.10)	14.3 (0.28)	14.5 (0.12)	13.3 (0.35)
Generations of farmers preceding respondents ($F = 1.56$; $P = 0.21$)	2.2 (0.09)	2.3 (0.16)	1.8 (0.22)	2.3 (0.17)
Type of farm (percent of respondents) ($\chi^2 = 122.42$; $P < 0.01$)				
Dairy	20	2	14	37
Non-dairy	80	46	16	37
Encourage son/daughter to farm (% YES) ($\chi^2 = 8.67$; $P = 0.07$)	37.9	37.7	47.4	34.9
Expect to farm in 5 years (% YES) ($\chi^2 = 18.58$; $P < 0.01$)	61.3	66.8	71.1	53.8
Total farmland acres owned ($F = 5.04$; $P = 0.01$)	220 (10.9)	259 (24.8)	161 (19.7)	209 (9.7)
Enrolled in current use assessment for forested land (% YES) ($\chi^2 = 88.73$; $P < 0.01$)	57	37	96	62
Own at least 10 acres of forest (% YES) ($\chi^2 = 11.00$; $P < 0.01$)	77	84	72	74
Total farmland acres owned by those who own farm woodlots ($F = 54.58$; $P < 0.01$)	266 (13.4)	303 (29.0)	215 (24.7)	249 (11.3)
Forest acres owned by those who own forest ($F = 4.67$; $P = 0.01$)	150 (9.4)	181 (19.2)	159 (24.0)	120 (8.4)
Percent farm income from forest for those who own forest ($F = 0.69$; $P = 0.50$)	7.4 (0.8)	6.4 (1.1)	6.8 (2.1)	8.3 (1.2)

respondents with those of late respondents¹⁴. Analyses were conducted at $\alpha = 0.05$.

Results

A total of 1101 farmers responded to the survey: 30 farmers responded to the test survey (response rate = 33%), and 1071 (approximately 36%) farmers responded to the main survey mailings. Non-response bias was not found when responses from early survey participants (those who had responded to the survey by January 31, the first month of the survey) were compared with those of late survey participants (those who had responded during the months of February and March, the final month of the survey), suggesting that farmers who completed and returned the survey were from the same population as those that did not¹⁴. For example, whether respondents indicated that they had a forest management plan ($\chi^2 = 0.06$; $P = 0.81$), were active forest managers ($\chi^2 = 0.95$; $P = 0.33$), or had harvested timber on their woodland ($\chi^2 = 1.79$; $P = 0.18$) was not dependent on whether they were early or late survey respondents.

Respondent background

The average age of respondents was approximately 55 years, while the average number of years of formal

education was approximately 14 years (Table 2). Respondents had been farming an average of 28 years, and were preceded by over two generations of farmers. Over one-third would encourage a son or daughter to farm. The largest category of farmer-respondent was dairy farmer: approximately 20% of respondents who responded to the question *What type of farming do you do?* identified themselves as dairy farmers ($n = 150$), while the rest ($n = 588$) indicated that they were engaged in some other type of farming, such as field crops, sheep or poultry. This response depended on the state of residence of the respondent: approximately 86% of those respondents who identified themselves as dairy farmers were from Vermont.

Farmers in the region worked 44 weeks per year and 49 h per week, and these means were significantly different among states. For example, Vermont farmers worked more weeks per year and more hours per week than their counterparts in Maine and New Hampshire. These differences may be attributed to the proportion of dairy farmers among the general farming public in each state. While 37% of respondents from Vermont said that they were dairy farmers, less than 2% of Maine farmers and 14% of New Hampshire farmers identified themselves as dairy farmers. There was a significant difference between dairy and non-dairy farmers in the mean number of weeks that respondents engaged in farming per year ($F = 30.72$;

$P < 0.01$): dairy farmers worked an average of 50 weeks per year, while non-dairy farmers worked 42 weeks per year. In addition, dairy farmers reported working 73 h per week, while non-dairy farmers worked 43 h per week ($F = 138.58$; $P < 0.01$).

While approximately 60% of farmers in the region said that they intended to be farming in 5 years, just over half of the farmers in Vermont, the youngest group surveyed, indicated that they would be farming in 5 years. Overall in the region, farmers owned an average of 220 acres, although this estimate varied among the three states studied (Table 2). Mean farm acreage was not significantly different between dairy farms (241 acres) and non-dairy farms (217 acres) ($F = 0.77$; $P = 0.38$).

Farm woodlot ownership

Although there is some variability among respondents by state, over three-quarters of farmers in the region owned at least 10 acres of forestland (Table 2), agreeing with USDA estimates that showed that of the 17,130 farms in the region, 12,786 (75%) included woodlands as part of their overall farmland⁴. When partitioned by type of farm (dairy versus non-dairy), approximately 70% of dairy farmers said that they owned woodland, while 79% of respondents who indicated that they engaged in some other type of farming said that they owned woodland ($\chi^2 = 5.90$; $P = 0.02$). The average farm woodlot size in the region was 150 acres, with Maine farmers reporting the largest farm woodlots and Vermont farmers the smallest. There was no significant difference in farm forest size between dairy farm woodlots (126 acres) and non-dairy farm woodlots (155 acres) ($F = 1.44$; $P = 0.23$).

The enrollment of farm forest acreage in current use assessment programs designed specifically for forestland varied widely among the three states studied, from 96% of farm forest ownerships in New Hampshire to only 37% in Maine. In addition, enrollment in current use assessment was dependent on the type of farm: 68% of dairy farmers enrolled their farm woodland acreage, while 54% of non-dairy farmers did so ($\chi^2 = 6.58$; $P = 0.01$). However, it is not known from our data whether some Maine farmers, for example, had enrolled their farm and forest acreage together under the state's Farm and Open Space program instead of enrolling their forestland separately in the state's Tree Growth program¹⁵.

Only 28 respondents indicated that they used to own forest as part of the farmland, but no longer did. Of these, six (21%) sold the forestland for development; nine (32%) sold the forestland 'as is'; seven (28%) passed the forestland on to heirs; and six (21%) described other reasons for no longer owning forestland (e.g., forest was cleared for a field or converted to pasture).

Over a third of respondents indicated that the primary reason for owning forestland was that it was part of the farm, while 10% indicated that the primary reason was investment. However, only 5% of Vermont farmers

Table 3. Primary reason for owning forestland according to farm woodlot owners in northern New England.

	Overall	ME	NH	VT
	------(%)-----			
Part of the farm	35	32	38	37
Investment	10	12	15	5
Farm/domestic use	7	8	6	7
Timber	7	6	10	6
Aesthetics	3	2	2	3
Sugaring	2	1	0	4

Table 4. Responses from farm woodlot owners in northern New England to the question: *Which best characterizes your future plans for your forestland?*

	Overall	ME	NH	VT
	------(%)-----			
Continue owning	49	49	43	51
Pass down to heirs	39	40	48	36
Sell as is	4	4	3	4
Harvest, then sell	3	3	3	2
Subdivide	2	2	2	1
Other (includes: sugaring, clearing for fields/pasture, harvest, conservation, sell with the farm, unsure) ($\chi^2 = 6.993$; $P = 0.73$)	4	2	2	6

cited investment as a primary reason, while 15% of New Hampshire farmers cited investment. Farm/domestic use and timber were cited by 7% of respondents (Table 3). These results differ somewhat from those of Butler and Leatherberry¹⁶, who surveyed 6352 family forest owners (both farmers and non-farmers) in the midwestern US. They found that the most common reasons for owning forestland were enjoyment of beauty and scenery, privacy, protection of nature and biological diversity. In contrast, aesthetics was cited by only 3% of farmers in our study.

Approximately half of the respondents indicated that they intended to continue owning their farm woodland, while 39% said that would pass the woodland to their heirs. Four percent or fewer indicated that they would sell their woodland as is, harvest and then sell, or subdivide their forestland (Table 4). There appeared to be no association between farmers' future plans for the woodlots and their state of residence.

Farm woodlot management

Almost half of the respondents in this study said that they had a written management plan for their forestland, most of which had been written by a forester (Table 5). In addition, approximately three-quarters took an active role in the management of their woodlots, and 84% said that they had harvested timber on their land (Table 6). Again, there are

Table 5. Forest management activity engaged in by farm woodlot owners in northern New England.

	Overall	ME	NH	VT
	------(%)-----			
Written management plan (% YES) ($\chi^2 = 3.95$; $P = 0.14$)	47	42	49	51
Plan written by a forester ($\chi^2 = 6.943$; $P = 0.049$)	93	92	83	96
Farmer takes an active role in forest management ($\chi^2 = 2.57$; $P = 0.28$)	73	70	69	76

Table 6. Forest harvesting behavior of farm woodlot owners in northern New England.

	Overall	ME	NH	VT
	------(%)-----			
Have you harvested your woodlot (% YES) ($\chi^2 = 0.21$; $P = 0.90$)	84	84	83	85
Who designated trees for harvest? ($\chi^2 = 31.24$; $P < 0.01$)				
Landowner	48	43	24	59
Forester	34	31	63	29
Logger	17	25	13	12
How were trees designated for harvest? ($\chi^2 = 26.34$; $P < 0.01$)				
Marked by forester	20	15	41	17
No marking by a forester (includes land clearing, ice damage salvage)	55	58	48	56
Diameter limit	14	12	10	16
Species	11	15	2	11
Who harvested timber? ($\chi^2 = 22.02$; $P < 0.01$)				
Landowner	38	33	19	47
Logger	36	36	52	30
Landowner + logger	26	31	29	22
Equipment used when landowner logs				
Farm tractor	87	79	87	93
Skidder	6	10	6	4
Animals	2	2	6	1
Other, including dozer, ATV, pick-up truck	5	9	0	1

differences between these results and those of a recent study conducted by Butler and Leatherberry¹⁶, who found that among NIPF owners in the midwestern US whom they surveyed, 27% had harvested in the past 5 years, 4% had written management plans, and 13% had sought management advice. Of the respondent background variables studied, logistic regression analysis found that respondents' education ($P < 0.01$) was associated with whether they had a written forest management plan, while age and years of farming experience were not significant variables. Respondents with management plans had a mean education of 14.6 years; those who did not have a plan had a mean education of 13.4 years. In addition, education was the only one of the three variables that was associated with whether the respondent was an active forest manager ($P < 0.01$), although age ($P = 0.06$) and years farming ($P = 0.06$) were 'near' significant. Again, farmers with more education (14.2 years versus 13.5 years) were associated with being active forest managers.

Respondents who said that they were active forest managers reported spending an average of 134 h per year in the management of their forest, while those who said that they were not active forest managers spent an average of 14 h per year in the management of their forest ($F = 24.21$;

$P < 0.01$). Cutting firewood was the most often reported type of forest management activity. Although non-dairy farmers spent more time each year managing their woodlot (106 h) than did dairy farmers (66 h), this difference was not statistically significant ($F = 1.80$; $P = 0.18$). However, responses to the question *Do you take an active part in the management and/or harvesting of your forestland?* were dependent on whether the respondent was a dairy farmer or not, with 76% of non-dairy farmer responding *yes* and 62% of dairy farmers responding *yes* ($\chi^2 = 9.13$; $P < 0.01$).

Farmers designated trees for harvest in almost half the cases studied, and engaged a forester for this activity in approximately one-third of the cases. When a forester was not involved in the marking of timber, harvests often took the form of land clearing, salvage, species removal, or some form of diameter limit harvest (Table 6). New Hampshire farmers reported with greater frequency than farmers from Maine and Vermont that they engaged both a forester to mark their timber and a logger to harvest their timber.

In over half of the cases in this study, farmers either did the logging alone or in combination with a logger (Table 6). When logging themselves, farmers generally used a farm tractor to yard harvested wood. When asked how they learned to log, half the farmers responded that relatives

contributed to their knowledge of logging skills, while 31% said that they were self-taught. Some (7%) said that a logger taught them, while the rest indicated that there were several things that contributed to their knowledge of logging, including friends, neighbors, courses, extension publications and books.

In addition, farm woodlots contributed over 7% of total farm income for farmers who owned forestland. However, those respondents who indicated that they were dairy farmers reported a contribution to the farm economy from woodlot management of less than 3%, while those who said that they were not dairy farmers reported a contribution of slightly more than 8% ($F = 7.48$; $P < 0.01$).

Conclusions and Implications

Differences in reported forest ownership objectives and forest stewardship behavior between farm woodlot owners in northern New England and the broader NIPF owning public suggest the need for focused outreach efforts. The reasons for forest ownership cited by farmers may be quite different from those cited by other NIPF owners, and the uses of farm woodlots may be quite different from those of other NIPFs. Outreach programs aimed at the sustainability of NIPFs, including those related to the education of forest owners and the subsidization of their forestry activity, may benefit from more targeted efforts that recognize the diversity and specific needs of subpopulations of the forest owning public, including farmers. For example, a DVD and fact sheet have been developed from this research and distributed to outreach professionals in northern New England to provide them with additional tools for focusing their efforts on farm forest owners. The messages developed and delivered by the DVD, for example, suggest that farm forest stewardship involves developing a forest management plan and hiring a professional forester to help execute the plan. While these messages are not new in outreach efforts to NIPF owners generally, the DVD summarizes data from research that is specific to farm forest management and involves on-camera interviews of farmers, perhaps helping the farmer-recipient of the information better identify with the messages being conveyed.

The proportion of farmers in northern New England who have indicated that they have management plans for their woodlot that have been written by a forester may be encouraging when these results are compared with those from other studies of NIPF owners^{16,17}. However, the number of farmers directly engaged in designating trees for harvest and firewood and timber removal, coupled with an apparent lack of formal training in these areas, suggests an outreach need focusing on harvesting and silviculture education for many of the region's farmers. The quality of the stewardship on farm woodlots versus other NIPFs, as well as the stewardship of dairy farm forests versus that on woodlots associated with other types of farming is not

known from this study and may be a fruitful direction for future field and social science research.

That approximately 7% of total farm income in the region derives from some form of farm woodlot management raises questions about the significance of the farm forest to the farm economy, particularly for non-dairy farmers. Is 7% a significant proportion of income for farms in the region? In addition, the precise nature and disposition of this forest-generated income requires further elaboration in order to better understand the monetary contributions of farm woodlots to farm economies. However, since recent census data have shown that the amount of farm woodlot acreage in the region is increasing while both total farmland and the number of farms is decreasing, one might anticipate that, for those remaining farmers who own forestland, the potential contribution of farm woodlot management to the farm economy will increase. Dairy farmers who own woodland appear to be less active forest managers and derive a smaller proportion of their total farm income from farm woodlot management. This is likely due, in part, to the full-time, year-round nature of dairy farm work compared to the work associated with many other farm systems.

Land use conversions, including those related to urbanization and exurbanization¹⁸, suggest challenges to maintaining working farms and farm forests in the region. Farmland in the region may be particularly vulnerable since it generally occupies the most productive land, which in many cases is also the most accessible and developable land. This phenomenon appears to be particularly acute in New Hampshire, where forestland and 'high quality' farmland are being rapidly developed². Perhaps consistent with this, our study showed that while only 5% of Vermont farmers cited investment as a primary reason, 15% of New Hampshire farmers cited investment. However, this study also found that approximately 88% of farmers who own woodland intended to either continue owning it or pass it to heirs. The degree to which this translates to behavior and the intentions of heirs is not known.

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