United States
Department of
Agriculture

Forest Service

**Northeastern Forest
Experiment Station**

Research Paper NE-624

Fuel Supply Structure of Wood-Fired Power Plants in the Northeast: Loggers' Perspective

Neil K. Huyler

Abstract

This study gauges loggers' perceptions of the impact of large biomass demand centers (electrical power generation) on the forest resource base in the Northeast. The loggers who supply these demand centers are business people with large capital investments in highly mechanized harvesting systems. Most of the loggers surveyed strongly believed that the post-harvest stand has improved as a result of fuelwood chipping; however, the impact of chip harvesting on the forest resource base was not clear.

The Author

NEIL K. HUYLER, research forester, is engaged in research on the economics of fuelwood harvesting at the George D. Aiken Sugar Maple Laboratory, Northeastern Forest Experiment Station, Burlington, Vermont. He received B.S. and M.S. degrees in wood industry from West Virginia University. He began his career with the Forest Service in 1963.

Manuscript received for publication 28 December 1988

Northeastern Forest Experiment Station
370 Reed Road, Broomall, PA 19008

July 1989

Introduction

The demand for whole-tree chips for the production of electricity increased dramatically in the late 1970's and early 1980's. Two large consumers of whole-tree chips for electrical power generation and cogeneration of power during this period were S. D. Warren in Westbrook, Maine, and Burlington Electric Department (BED) in Burlington, Vermont, respectively a private corporation and a municipal utility. Also during this period, additional wood-fired power plants were proposed in New Hampshire, Maine, New York, and Vermont. Many of the plants have since come on line, with the regional consumption of wood chips supplying them measuring in the millions of tons annually (Vt. Dep. For. and Parks 1987).

The implication of such demand on the forest resource in the region is not clear. Many foresters felt that the demand could improve both the quality and intensity of forest management practices in the Northeast. Others were critical of the potential reduction of forest quality because the demand would encourage more clearcutting and conversion of sawlogs and potential sawlogs into wood chips (Donovan and Huyler 1986).

To assess the impact of large demand centers on the forest resource base, a study was initiated in 1985-86 in the Northeast. Funded by the U.S. Department of Energy and the Coalition of Northeastern Governors, the study was conducted by Associates in Rural Development cooperating with the Northeastern Forest Experiment Station. The objective was to clarify the impact of four large wood-fired power generation plants on the forest resource base and wood suppliers. This objective was addressed through a three-phase interrelated research approach consisting of:

1. Case studies of four wood-fired power plants in Maine, Vermont, New York, and Maryland.
2. Surveys of loggers, foresters, chip suppliers, and landowners directly involved in fuelwood chipping operations.
3. On-site, post-harvest examinations of forest stands in northern New England that provided chips for wood-fired power plants (Assoc. Rural Dev., Inc. 1986).

This report addresses the second phase of the master study which deals specifically with a formal telephone survey of 20 loggers who had supplied, or are presently supplying, whole-tree chips primarily to the S. D. Warren plant in Maine and BED in Vermont. The Procter and Gamble plants, one in Baltimore, Maryland, and one in Staten Island, New York, had only one logger included in the survey. In addition, 5 more loggers supplying the S. D. Warren plant were included in the original survey of 20 loggers, resulting in a total of 25 loggers surveyed.

Objectives

The objectives of the survey were to:

1. Assess loggers' perceptions of the effects of large biomass demand centers on the forest resource.
2. Determine the predominant harvesting methods for wood-chip production.

Survey Methods

Lists of logging contractors supplying S. D. Warren, BED, and Procter and Gamble were provided by plant management personnel. The names of 32 logging contractors were provided by the demand centers. Twenty-five were interviewed by telephone in late 1985, early 1986 to gauge perceptions of the centers' impact on the forest resource base. The 25 represented 78 percent of the loggers supplying the centers during this time.

The interview required about 30 minutes. An experienced social scientist edited the questionnaire. It was pretested for clarity and completion time needed as well as to enhance the interviewer's skills. The survey addressed the logging operation in eight categories:

1. Background of operation.
2. Production and type of operation.
3. Equipment mix.
4. Economics and financial structure.
5. Logging contract specifications.
6. Site protection measures.
7. Regulations and monitoring.
8. Future involvement of the operation.

The responses, tabulated as a percentage of total, were used to assess the objectives and gain insight into the loggers' perspectives of impact on the forest resource.

Results

The survey questions and the frequency and percentage of response, are shown in Tables 1 through 8 in the Appendix. In certain questions, there was either more than one response to the question or no response. Therefore, the total percentage may be more than or less than 100 percent.

Background of Operations

Although logging operations were reported to be conducted in nine northeastern states, the primary locations were in Maine, Vermont, and New York, about 32, 28, 24, percent

in each state (Table 1, questions 1 and 2). The remaining primary locations were in New Hampshire and Massachusetts, each with 12 and 4 percent, respectively. See Figure 1.

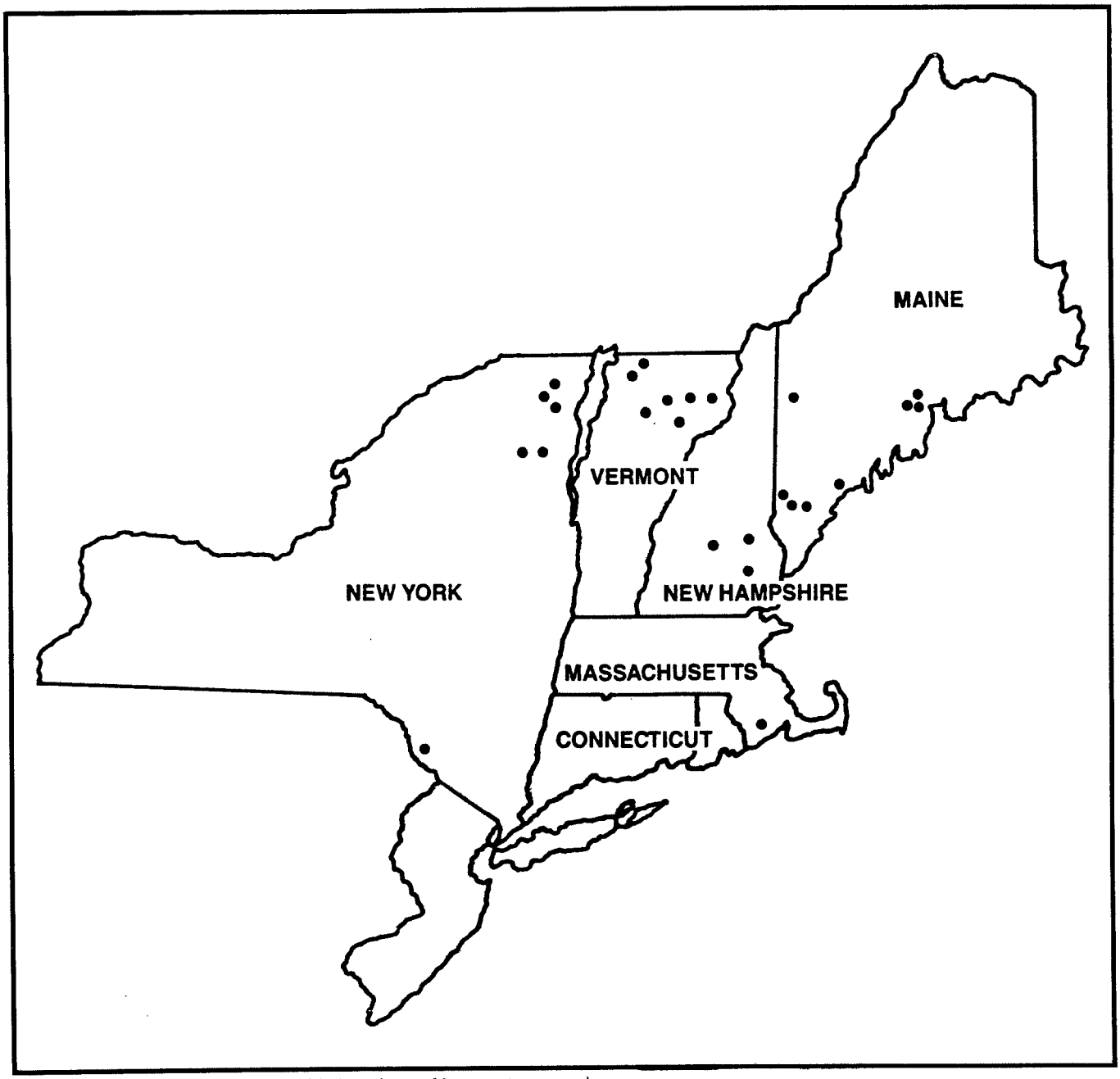

Figure 1.—Approximate geographic locations of loggers surveyed.

The majority of the loggers surveyed, 56 percent, supplied BED with chips. Forty percent supplied S. D. Warren, and one logger (4 percent) indicated that he occasionally supplied the Baltimore, Maryland plant of Procter and Gamble with small amounts of whole-tree chips (Table 1, question 3). Contact with Procter and Gamble personnel indicated that few forestry logging operations were involved in their wood-chip procurement system, especially the Staten Island plant. The Staten Island plant used no whole-tree chips as a fuel source except in the initial startup phase. Most of the chip supplies came from processed and unprocessed waste wood.

Sixty-five percent of the loggers had been harvesting more than 10 years, 28 percent between 6 to 10 years, and 8 percent between 1 and 5 years (Table 1, question 4).

Sixty-four percent of the loggers said that they had been supplying chips for over 2 years; 12 percent, 1 to 2 years, and 16 percent, 6 to 12 months. One logger (4 percent) supplied chips for less than 6 months, and one (4 percent) didn't know how long he had been supplying chips (Table 1, question 5).

The reason for getting into the chip harvesting business, stated by 32 percent of the loggers, was to remain competitive; whereas 20 percent indicated that timber stand improvement was the principal reason. Other reasons were: to increase product markets (12 percent), chipping was easier and faster with more mechanization (12 percent), and more profit potential (12 percent). The remainder did not know why or indicated they tried it because other loggers were getting involved (Table 1, question 6).

When asked about training in chip harvesting, 72 percent said on-the-job training was the only training they had received. The next most important source of training given was equipment manufacturers (20 percent). One logger (4 percent) said training was received through "workshops, field seminars, or short courses." Also, 4 percent said credited university course work was a source of training. About 75 percent of the loggers felt the training was at least fairly-to-totally adequate, and 12 percent could use more training (Table 1, questions 7 and 8).

Production and Operating Methods

Most of the loggers (64 percent) operate between 201 and 250 days of chipping per year. Twenty-four percent operate over 250 days. The remainder (12 percent) operate between 151 to 200 days (Table 2, question 1).

Fifty-two percent of the loggers said chipping made up more than one-half of their logging activities during the year. About 25 percent engaged in chip harvesting 26 to 50 percent of the time, and about 8 percent spent 25 percent or less of their time harvesting chips. One logger did not know his percentage of chipping activity (Table 2, question 2).

Other than fuelwood chips, forest products produced were sawlogs (92 percent), pulpwood and tree-length wood (56 percent each), and chunk fuelwood (36 percent). Five percent of production was other forest products (Table 2, question 3).

About 66 percent of the loggers always separate their product, 20 percent often separate products; one logger (4 percent) almost never separates products; and one logger (4 percent) never separates products at the landing (Table 2, question 4).

Clearcutting comprised 5 to 10 percent of the total annual harvesting operations for over 37 percent of the loggers. About 20 percent said 11 to 50 percent of their jobs were clearcuts. About 20 percent said clearcuts made up 66 to 90 percent of their jobs, and about 20 percent said that 1 percent or less was clearcut sales for chips (Table 2, question 5a).

Partial cuts (primarily commercial thinning) were carried out by almost all of the loggers. From 90 to 100 percent of the harvesting contracts were partial cuts according to 58 percent of the loggers. Twenty-one percent of the loggers classified 50 to 80 percent of the logging jobs as partial cuts, and 21 percent said 34 percent or less were partial cuttings (Table 2, question 5b).

Forty-five percent of the loggers surveyed said the average size of the clearcuts harvested for fuelwood chips was less than 5 acres. Thirty-five percent had clearcuts on 5- to 10-acre logging jobs. About 10 percent of clearcut jobs were on sites of 11 to 20 acres. One logger did not know the size of the clearcut he had operated, and five loggers did not respond to the question (Table 2, question 6).

Thirty percent said that all (100 percent) of the clearcuts were land clearings for agriculture or development. Thirty-five percent said 50 to 99 percent of the clearcuts were for agriculture or development. Fifteen percent said that less than 50 percent of the clearcuts was land clearings for agriculture or development, and about 20 percent said none of the clearcuts were for land clearing purposes. Five loggers did not respond to the question (Table 2, question 7).

Forty-four percent of the loggers felt that a minimum yield of 21 to 50 tons per acre in partial cuts was necessary for profit. Sixteen percent said that less than 14 tons per acre was needed to be considered profitable. And 36 percent did not know the minimum yield per acre needed to make their operations profitable (Table 2, question 8).

Fifty-two percent of the loggers did their own preharvest volume estimates of fuelwood on the site. Forester cruise estimates were used by 20 percent of the loggers. Twenty-eight percent used no volume estimates or did not know the volume estimate before harvesting (Table 2, question 9).

Accessibility, volume per acre, and distance from the demand center were the most important factors in determining stumpage price, according to the loggers surveyed. Timber type and site conditions were the next most important factors mentioned. The going stumpage rate, distance from home and business, and size of harvesting site were the least important factors (Table 2, question 10).

Equipment Mix

The typical inventory of equipment in whole-tree chip harvesting consisted of one or two feller-bunchers; one or two grapple or cable skidders; a chipper, a dozer, and up to 10 chain saws. A few loggers did not have a chipper on site, but subcontracted for a chipper. Grapple skidders were used more than cable skidders (76 and 64 percent, respectively). None of the loggers used forwarders, farm tractors, draft animals, or cable yarders in their whole-tree chipping operations (Table 3, questions 1 through 8).

Financial arrangements reported by the loggers who responded varied. Approximately 40 percent owned their feller-bunchers and 40 percent were making payments. The remaining 20 percent were making payments or had a rent-lease arrangement. The other major piece of equipment, the chipper, was owned by 55 percent of the loggers. Thirty percent said they were making payments, and the remaining 10 percent said they had rent-lease arrangements (Table 3, question 6).

Of the loggers using skidders, a greater percentage (56 percent) owned cable skidders than grapple skidders (42 percent). Most loggers who used dozers owned them (75 percent). Others were making payments on dozers or had rented one (Table 3, questions 4 and 9).

Seventy-five percent of the loggers owned at least some, if not all, of their transportation equipment. Of the six loggers who did not own the equipment, five subcontracted for the hauling of chips to the plant site, and one said he made other arrangements (Table 3, question 10).

The loggers were asked the round-trip distance of the chip delivery. Most loggers, 64 percent, said their longest haul was from 76 to 200 miles. Twenty percent said they hauled chips between 25 and 75 miles and 12 percent hauled chips over 200 miles round trip (Table 3, question 11).

Economics and Financial Structure

The 1986 fair market value of the chipping operation was substantial. Over 25 percent of the loggers estimated the value of their equipment at more than $750,000. Approximately 20 percent estimated the value from $500,000 to $750,000; over 34 percent estimated $250,000 to $500,000; and about 9 percent estimated $150,000 to $250,000. One logger said the fair market value was less than $150,000, while another did not know the value (Table 4, question 1).

The approximate cost to produce fuelwood chips at the landing was between $8 and $10 per green ton according to over 34 percent of the loggers. For approximately 26 percent the cost of production was between $13 and $14 per green ton. Approximately 9 percent said it cost between $11 and $12 per green ton and for 13 percent the cost was less than $8 per green ton. Approximately 17 percent were not able to give the cost of production (Table 4, question 2).

The maximum price loggers can afford to pay for stumpage ranged from a low of $0.50 to a high of more than $1.50 per green ton. Over 50 percent could afford to pay between $0.76 and $1.50 per green ton; 24 percent said they could afford to pay more than $1.50, while only 4 percent could pay a maximum of less than $0.50 per green ton. Sixteen percent were not able to estimate the maximum they could afford to pay for stumpage (Table 4, question 3).

Skid distance was the principal factor related to profitability, according to 84 percent of the loggers surveyed. Distance from access roads was the next most important factor, for about 76 percent of the loggers. Topography and d.b.h. were factors also mentioned by over 66 percent of the respondents. Tree height was mentioned by about 64 percent. The size of the woodlot and distance from demand centers were cited by approximately 60 percent of the loggers as factors that always affect profit. Number of trees per acre was the factor least often cited by 56 percent of the respondents (Table 4, question 4).

Most, about 64 percent of the loggers, agreed that they needed to produce a product mix to make the operation profitable. Twenty-four percent did not agree that a product mix was needed and twelve percent did not know if the mix was needed at the landing (Table 4, question 5).

Logging Contract Specifications and Markets

Most loggers (68 percent) said that 76 to 100 percent of their chip harvesting activities involved a forester. In addition, 84 percent of the loggers indicated that less than 10 percent of the stands cut were "logger choice" (Table 5, questions 1 and 2).

The lack of a guaranteed chip market was the biggest problem facing loggers who practiced fuelwood chipping, according to 80 percent of those surveyed. Also, most loggers (56 percent) said that their operations have changed since they began selling chips. The three changes most often cited were the number of operating days increased per year; an increased number of contracts; and more purchases of equipment (Table 5, questions 3 and 4).

Site Protection

One of the principal concerns with fuelwood chip harvesting has centered on the forest site environment. To gauge the loggers' perceptions of how sites are being protected from harvesting damage, the logger survey included a series of questions concerning site protection measures. Loggers were asked to consider all of the fuelwood-chip harvesting operations they had been involved with and respond "always/frequently/sometimes/never" for how often various site measures were used. Most said that water bars were always used in their operations, buffer strips were frequently used, and wildlife habitat protection was frequently or sometimes used (Table 6, question 1).

Loggers cited esthetics as the main reason most landowners choose to have fuelwood chipping operations on their land. Short-term financial return was cited as the second most important reason. Loggers believed that landowners worry most about forest management practices when chipping occurs on their woodlots (Table 6, question 2).

The busiest chip harvesting time was December through March, with December the busiest and March the fourth busiest month. The majority of loggers produced more than 4,000 tons of fuelwood chips during December. During the slack months, more than 2,000 tons of fuelwood chips were produced per month (Table 6, questions 3 and 4).

Regulations and Chip Harvesting Monitoring

According to most loggers interviewed, chip harvesting regulations by the state government or the demand center existed in the harvesting areas. Most said the regulations were strictly enforced but had no real impact on operations. A significant number (46 percent) said chip harvesting should be regulated by the state government. Approximately 14 percent thought the demand center should regulate the harvesting. The regulations most reasonable to the loggers governed limitation of clearcut size, protection of wildlife habitat, water quality and soil conservation, and forest management (Table 7, questions 2, 3, and 4).

Contract Negotiations

Slightly less than 50 percent of the loggers were completely satisfied with their demand center contracts; none received subsidies or financial support from the demand centers (Table 7, questions 5 and 6).

Future Involvement

The whole-tree chip market had not changed their logging businesses in the last 5 years, according to most of the loggers surveyed. The majority (76 percent) felt there was enough wood supply to chip for the next 30 years and were not worried about supply of stumpage in their area (Table 8, questions 1 and 2).

The interview ended with a short set of questions on the loggers' perceptions of the effects of fuelwood chip harvesting on the residual stand and its overall impact on the forest stands in their areas. Most loggers strongly disagreed that fuelwood chip harvesting increases residual stand damage and soil erosion in comparison with traditional or conventional harvesting methods. Also, most of the loggers strongly agreed that the post-harvest quality of stands improves with fuelwood chip harvesting, that integrated harvests (multi-product) were the rule, and that fuelwood chip harvesting left the highest quality trees and removed the low grade or weed trees (Table 8, questions 3 through 7).

Summary

From the survey several key points emerged on the loggers' perception of the demand centers' impact on the forest resource. Also, the data revealed trends in harvesting and forest management practices in the supply of whole-tree chips. The key conclusions are:

- Nonindustrial, private woodlands are the principal source of wood chips.
- Some clearcutting is taking place, but only on a small proportion of the harvest (up to one-tenth of total harvesting operations). Approximately 20 percent of the loggers said that clearcuts comprised 66 to 90 percent of their logging jobs. These clearcuts were usually 20 acres or less, and most were for site conversion or for agricultural or development purposes.
- Integrated harvesting techniques are practiced by most loggers with product separation occurring at the landing. Sawlogs and fuelwood are the principal products separated from whole-tree chips. This is not a new trend, since most loggers practiced product separation before whole-tree chipping was started.

- A trend that seems to be practiced by more and more loggers is a change from "hot-yarding," in which trees are chipped upon arrival at the landing, to "cold-decking," in which stems are stock-piled at the landing and chipped later.
- Loggers who supply the demand centers have been harvesting forest products for more than 10 years and supplying the centers more than 2 years. Most feel that there is enough low-value raw material to last for the next 30 years.
- The loggers entered the chip market to remain competitive in the industry. They felt that the new market for chips created more opportunity for silvicultural treatment of forest stands that were otherwise uneconomical for harvest. This new market increased the number of logging contracts available for bid.
- Most logging systems are fully mechanized. Mechanized systems require skilled labor, and most loggers have difficulty locating skilled labor.
- The fair market value of the chip harvesting equipment is estimated at greater than $500,000 per operator. The estimated cost to produce whole-tree chips ranged from $8 to $14 per green ton at the landing. And the most the loggers could pay for stumpage ranged from $0.76 to $1.50 per green ton.
- Most harvested sites had a professional forester in the operation at some level. Less than 10 percent of the sites harvested used "logger choice."
- Most whole-tree chip harvesting had some site protection incorporated into the harvest; for example, water bars, buffer strips, and wildlife habitat protection.
- Esthetics was the major reason given that landowners have concern about a fuelwood chipping job on their land. The loggers are aware of this concern.
- A major concern expressed by the loggers, is a stable chip market. Power plant electrical demands fluctuate and therefore the demand for chip supply is unstable.
- The predominant method for harvesting fuelwood chips used a fully mechanized, single-entry, integrated system. In certain situations, multiple-entry harvesting was used when topwood of sawlogs, weed trees, and other debris were removed after the primary product was harvested.
- Most loggers strongly believed that the post-harvest stand is improved as a result of fuelwood chipping.

The impact of biomass harvesting versus conventional harvesting on the forest resource base was not clear from the logger survey. The overall indication was that there have been no significant changes in the principles of forestry practice and business methods on the operation of forest lands since the market for whole-tree chips for power generation was developed. In general, biomass harvesting has opened up forest stands that once were not commercially harvestable because of physical or economic constraints. Since most cuts are classified as intermediate and regeneration cuts, the survey indicates that a certain level of timber stand improvement cuttings is taking place within the wood procurement area of the demand centers. The involvement of a professional forester has increased, and consumer-mandated, whole-tree chip harvesting standards are positive changes.

Acknowledgment

The author acknowledges the Associates in Rural Development, Inc. (ARD), for the opportunity to participate in this study, and especially acknowledges Richard Donovan for his contribution as Project Director and editor of the original manuscript.

Literature Cited

Associates in Rural Development, Inc. 1986. **Impact of large biomass centers on the forest resouce base.** Burlington, VT: Associates in Rural Development. 163 p.

Donovan, Richard Z.; Huyler, Neil. 1986. **Impact of large demand centers on the forest resource base.** In: Smith, C. Tattersall; Martin, C. Wayne; Tritton, Louise M., eds. Proceedings of the 1986 symposium on the productivity of northern forests following biomass harvesting. Gen. Tech. Rep. NE-115. Broomall, PA; U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station: 17-22.

Vermont Department of Forests and Parks. 1987. **Fuel chip market about to explode.** Vermont Forest Exchange and Information Bulletin. March: 1-3.

Appendix—Loggers' Telephone Survey Questionnaire

Table 1.—Response to questions on background of logging operation, by question, number, and percent

Response	Number	Percent
1. In which states or Canadian provinces do you have logging operations?		
Vermont	7	28.0
New Hampshire	10	40.0
Maine	12	48.0
Rhode Island	1	4.0
Massachusetts	4	16.0
Connecticut	1	4.0
New York	10	40.0
New Jersey	1	4.0
Pennsylvania	1	4.0
Maryland	0	—
Delaware	0	—
West Virginia	0	—
Quebec	0	—
Ontario	0	—
New Brunswick	0	—
Other	0	—
None	0	—
Dk/na/inap[a]	0	—
2. Which one of these states or provinces is the primary location for your logging operations?		
Maine	8	32.0
Vermont	7	28.0
New York	6	24.0
New Hampshire	3	12.0
Massachusetts	1	4.0
3. Which one of these power plants do you work with primarily?		
BED	14	56.0
S. D. Warren	10	40.0
P & G/New York	1	4.0
4. How many years have you been a full- or part-time logger?		
1 to 5 years	2	8.0
6 to 10 years	7	28.0
More than 10 years	16	64.0

Table 1.—(Cont'd.)

Response	Number	Percent
5. How many years have you been supplying fuelwood chips to a wood-fired power plant?		
Less than 6 months	1	4.0
6 to 12 months	4	16.0
1 to 2 years	3	12.0
Over 2 years	16	64.0
Dk/na/inap[a]	1	4.0
6. What were the most important reasons why you got involved in fuelwood chip harvesting?		
Remain competitive	8	32.0
Timber stand improvement (TSI)	5	20.0
Increased markets	3	12.0
More profitable	3	12.0
Easier, faster/mechanization	3	12.0
Everyone doing it	1	4.0
Dk/na/inap[a]	2	8.0
7. Which of the following types of specialized training, if any, have you had concerning fuelwood chip-harvesting operations?		
Workshops, field seminar short course	1	4.0
University course work	1	4.0
Equipment manufacturer	5	20.0
On-the-job	18	72.0
8. Has your experience or training for dealing with chip harvesting operations been. . .?		
Totally adequate	11	44.0
Fairly adequate	8	32.0
Use more training	3	12.0
Dk/na/inap[a]	3	12.0

[a]Dk/na/inap = Don't know; not applicable; inappropriate.

Table 2.—Production and operating methods

Response	Number	Percent
1. How many days do you operate per year?		
151 to 200	3	12.0
201 to 250	16	64.0
Over 250	6	24.0
2. What percentage of your logging activities is devoted to chip harvesting operations for the power plant?		
5 or less	3	12.0
11 to 25	2	8.0
26 to 50	6	24.0
51 or more	13	52.0
Dk/na/inap[a]	1	4.0
3. In addition to fuelwood chips do you produce . . . ?		
Sawlogs	23	92.0
Pulpwood	14	56.0
Chunk fuelwood	9	36.0
Tree/log-length wood	14	56.0
Other	2	8.0
4. At your chip harvesting operations, would you say you separate different products from each other?		
Always	16	66.7
Often	5	20.8
Almost never	1	4.2
Never	1	4.2
Dk/na/inap[a]	1	4.2
5a. What percentage of your logging operations are clearcuts?		
0	4	16.7
1	1	4.2
5	5	20.8
10	4	16.7
20	1	4.2
30	1	4.2
35	1	4.2
50	2	8.3
66	1	4.2
80	1	4.2
85	1	4.2
90	2	8.3

Table 2.—(Cont'd.)

Response	Number	Percent
5b. What percentage of your logging operations are partial cuts?		
10	2	8.3
15	1	4.2
20	1	4.2
34	1	4.2
50	2	8.3
65	1	4.2
70	1	4.2
80	1	4.2
90	4	16.7
95	5	20.8
96	1	4.2
100	4	16.7
6. What is the smallest size clearcut, in acres, that you have operated on for fuelwood chips?		
0	1	5.0
Less than 5	9	45.0
5 to 10	7	35.0
11 to 20	2	10.0
Dk/na/inap[a]	1	5.0
7. What percentage of your clearcut operations is for land clearing for either agricultural or development purposes?		
0	4	20.0
1	1	5.0
4	1	5.0
5	1	5.0
50	1	5.0
60	2	10.0
85	1	5.0
90	2	10.0
99	1	5.0
100	6	30.0
8. For a partial cut, what is the minimum quantity of chips in tons per acre you would consider economical for a fuelwood chipping operation?		
Less than 14	4	16.0
15 to 20	1	4.0
21 to 50	11	44.0
Dk/na/inap[a]	9	36.0

Table 2.—(Cont'd.)

Response	Number	Peccent
9. When you go out to set up a logging job, how do you determine the amount of fuelwood chips on a particular site?		
Pre-harvest loggers' estimate	13	52.0
Pre-harvest foresters' tally	5	20.0
No volume estimate	2	8.0
Dk/na/inap[a]	5	20.0
10. What are the most important factors in determining what you pay for fuelwood chips at the stump?		
Volume/per acre	7	28.0
Accessibility	13	52.0
Distance from home/business	2	8.0
Current chip prices	5	20.0
Distance from demand center	7	28.0
Going stumpage rate	1	4.0
Site conditions	3	12.0
Size of site	1	4.0

[a]Dk/na/inap = Don't know; not applicable; inappropriate.

Table 3.—Equipment mix

Response	Number	Percent
1. First, do you use a feller-buncher?		
Yes	20	80.0
No	3	12.0
Dk/na/inap[a]	2	8.0
2. Do you . . . ?		
Own it	8	40.0
Make payments	8	40.0
Payments and own	2	10.0
Payments and rent	1	5.0
Rent/lease	1	5.0

Table 3.—(Cont'd.)

Response	Number	Percent
3. Do you use a grapple skidder?		
Yes	9	76.0
No	4	16.0
Dk/na/inap[a]	2	8.0
4. Do you . . . ?		
Own	8	42.1
Make payments	5	26.3
Payment and own	3	15.8
Rent/lease	2	10.5
Own and rent	1	5.3
5. Do you use a chipper?		
Yes	20	80.0
No	4	16.0
Dk/na/inap[a]	1	4.0
6. Do you . . ?		
Own	11	55.0
Make payments	6	30.0
Payment and own	1	5.0
Rent/lease	1	5.0
7. Do you use a cable skidder?		
Yes	16	64.0
No	7	28.0
Dk/na/inap[a]	2	8.0
8. How many cable skidders do you use?		
1	6	40.0
2	5	33.3
3	1	6.7
4	2	13.3
25	1	6.7
9. Do you . . . ?		
Own	9	56.3
Make payments	4	25.0
Own and rent	2	12.5
Tent/lease	1	6.3

Table 3.—(Cont'd.)

Response	Number	Percent
10. Do you own your chip transportation equipment?		
Yes	13	54.2
No	4	16.7
Some of it	5	20.8
Dk/na/inap[a]	2	8.3
11. What is the longest round-trip hauling distance you or the contractor have made, in miles, to the wood-fired power plant?		
25 to 75	5	20.0
76 to 100	2	8.0
101 to 125	2	8.0
126 to 150	5	20.0
151 to 175	3	12.0
176 to 200	4	16.0
Over 200	3	12.0
Dk/na/inap[a]	1	4.0

[a]Dk/na/inap = Don't know; not applicable; inappropriate.

Table 4.—Economics and financial structure

Response	Number	Percent
1. In all, how much would you say the machinery and equipment you use in your chipping operations is worth today or its "fair market value"?		
Less than $150,000	1	4.3
$150,001 to $250,000	2	8.7
$250,001 to $500,000	8	34.8
$500,001 to $750,000	5	21.7
More than $750,000	6	26.1
Dk/na/inap[a]	1	4.3
2. What is the approximate cost for you to produce a ton of fuelwood chips at the landing, including stumpage?		
Less than $8	3	13.0
$8 to $10	8	34.8
$11 to $12	2	8.7
$13 to $14	6	26.1
Dk/na/inap[a]	4	17.4

Table 4.—(Cont'd.)

Response	Number	Percent
3. What is the maximum price you can afford to pay for stumpage in dollars per ton?		
Less than $0.50	1	4.0
$0.76 to $1.00	7	28.0
$1.01 to $1.50	7	28.0
More than $1.50	6	24.0
Dk/na/inap[a]	4	16.0
4. Which of the following factors are important in making a decision on whether you can operate profitably at a given site?		
Factors always affecting profitability:		
Number of trees	14	56.0
Tree height	16	64.0
D.b.h. of trees	17	68.0
Size of woodlot	15	60.0
Topography	18	72.0
Skid distance	21	84.0
Distance from access roads	19	76.0
Distance from demand center	15	60.0
Other	5	20.0
Factors sometimes affecting profitability:		
Number of trees	4	16.0
Tree height	4	16.0
D.b.h. of trees	2	8.0
Size of woodlot	5	20.0
Topography	2	8.0
Skid distance	1	4.0
Distance from access roads	3	12.0
Distance from demand center	2	8.0
Other	0	—
5. Do you have to produce multiple products to be a profitable operation?		
Yes	16	64.0
No	6	24.0
Dk/na/inap[a]	3	12.0

[a]Dk/na/inap = Don't know; not applicable; inappropriate.

Table 5.—Logging contract specifications

Response	Number	Percent
1. What percentage of your chip-related logging contracts involve a forester?		
Less than 10	3	12.0
26 to 50	3	12.0
51 to 75	1	4.0
76 to 100	17	68.0
Dk/na/inap[a]	1	4.0
2. What percentage of the stands that you cut are loggers' choice?		
Less than 10	11	44.0
11 to 25	1	4.0
26 to 50	5	20.0
76 to 100	7	28.0
Dk/na/inap[a]	1	4.0
3. What are the biggest problems you have faced or are now facing with fuelwood chipping?		
Problem:		
Finding stumpage	0	—
Landowners' attitudes	0	—
Regulations	0	—
Labor	0	—
Cash flow	0	—
Lack of training	0	—
Seasonal variation	1	4.0
Guaranteed chip market	20	80.0
Subcontracting	0	—
Transportation	1	4.0
Equipment maintenance	1	4.0
4. Has the production of fuelwood chips changed your operation since you started selling to the demand center? How has it changed?		
Change in operation:		
Increase in operating days	4	26.7
Decrease in operating days	0	—
Increase in profits	1	6.7
Decrease in profits	0	—
Increase in number of contracts	2	13.3
Decrease in number of contracts	0	—
Increase in available woodlot	1	6.7
Bought more equipment	3	20.0
Increase in marketing outlet	1	6.7
Other	2	13.3

[a]Dk/na/inap = Don't know; not applicable; inappropriate.

Table 6.—Site protection

Response	Number	Percent
1. Consider all of the fuelwood chip harvesting operations you are involved in. I will read various site protection measures that you may use in these operations. As I read each measure, tell me it if applies . . . ?		
Site protection:		
Water bars/culverts		
Always	11	44.0
Frequently	7	28.0
Sometimes	4	16.0
Never	2	8.0
Dk/na/inap[a]	1	4.0
Site protection:		
Buffer strips		
Always	8	32.0
Frequently	9	36.0
Sometimes	5	20.0
Never	1	4.0
Dk/na/inap[a]	2	8.0
Site protection:		
Wildlife protection		
Always	9	36.0
Frequently	1	4.0
Sometimes	9	36.0
Never	5	20.0
Dk/na/inap[a]	1	4.0
2. What do you think is the main reason, or motivation, that landowners choose to have fuelwood chipping done on their land?		
Esthetics	15	60.0
Short-term financial return	5	20.0
Silviculture improvement/TSI	3	12.0
Dk/na/inap[a]	2	8.0
3. I would like to know the four busiest months of the year for you. First, tell me the busiest month of the year for your chip harvesting operations.		
Busiest month:		
December	10	43.5
January	5	21.7
June	3	13.0
March	2	8.7
May	1	4.3
October	1	4.3
September	1	4.3

Table 6.—(Cont'd.)

Response	Number	Percent
Fourth busiest month:		
March	10	45.5
April	3	13.6
December	3	13.6
February	2	9.1
July	2	9.1
January	1	4.5
June	1	4.5
4. During your busiest months, how many tons per month of fuelwood does your operation produce?		
Less than 400	2	8.0
401 to 800	2	8.0
801 to 1,200	1	4.0
1,201 to 1,600	2	8.0
1,601 to 2,000	2	8.0
2,001 to 3,000	4	16.0
3,001 to 4,000	3	12.0
More than 4,000	8	32.0
Dk/na/inap[a]	1	4.0
5. During your slack months, how many tons per month of fuelwood chips does your business produce?		
Less than 100	5	20.0
101 to 200	2	8.0
201 to 400	1	4.0
401 to 800	1	4.0
801 to 1,200	4	16.0
1,201 to 1,600	1	4.0
1,601 to 2,000	4	16.0
More than 2,000	6	24.0
Dk/na/inap[a]	1	4.0

[a]Dk/na/inap = Don't know; not applicable; inappropriate.

Table 7.—Regulations and chip harvesting monitoring

Response	Number	Percent
1a. Are there regulations on chip harvesting in your primary area of operation?		
Yes	11	44.0
No	13	52.0
Dk/na/inap[a]	1	4.0
1b. Are these regulations set up by . . . ?		
State	5	50.0
State/demand center	5	50.0
2. What impacts do chipping regulations have on your logging operations?		
None	7	38.9
Change in operating procedure	3	16.7
Increase in operating costs	2	11.1
More work	1	5.6
Dk/na/inap[a]	5	27.8
3. Do you feel that chip harvesting operations should be regulated?		
Yes	20	80.0
No	4	16.0
Dk/na/inap[a]	1	4.0
4a. Which one of the following should regulate chip harvesting . . . ?		
Federal	1	4.0
State	13	46.0
County	1	4.0
Town/local	1	4.0
Power plant	4	14.0
Dk/na/inap[a]	8	29.0
4b. Which of the following types of regulations make sense . . . ?		
Regulations:		
Size limitations on clearcuts	15	75.0
Wildlife habitat protection	15	75.0
Mandatory forester supervision	11	55.0
Transportation limitations	9	45.0

Table 7.—(Cont'd.)

Response	Number	Percent
Forest practices	17	85.0
Water quality and soil conservation	18	90.0
Other	2	10.0
5. Are you satisfied with the contract you have with the demand center?		
Yes	12	48.0
No	9	36.0
Dk/na/inap[a]	4	16.0
6. Does the power plant specifically subsidize or support your operations?		
Yes	0	—
No	24	96.0
Dk/na/inap[a]	1	4.0

[a]Dk/na/inap = Don't know; not applicable; inappropriate.

Table 8.—Future involvement

Response	Number	Percent
1. How has the chip market changed your logging business in the last 5 years?		
Big increase	5	20.0
Big decrease	1	4.0
Slight increase	3	12.0
No change	6	24.0
Dk/na/inap[a]	10	40.0
2. With the current number of operations, do you think there is sufficient timber in your working area to sustain fuelwood chipping operations over a 30-year period?		
Yes	19	76.0
No	1	4.0
Can't predict	1	4.0
Dk/na/inap[a]	4	16.0

Table 8.—(Cont'd.)

Response	Number	Percent
3. With chipping operations, there is a noticeable increase in residual stand damage, compared to traditional, whole-wood harvesting operations.		
Strongly disagree	15	60.0
Mildly disagree	3	12.0
Mildly agree	5	20.0
Strongly agree	1	4.0
No opinion	1	4.0
4. With chipping operations, there is a noticeable increase in soil erosion, compared to traditional, whole-wood harvesting operations.		
Strongly disagree	17	68.0
Mildly disagree	2	8.0
Mildly agree	1	4.0
Strongly agree	2	8.0
No opinion	3	12.0
5. The overall post-harvest quality of stands entered has improved significantly as a result of fuelwood chipping operations.		
Strongly disagree	1	4.0
Mildly agree	5	20.0
Strongly agree	18	72.0
No opinion	1	4.0
6. Integrated harvests, involving product separation into sawlogs, pulpwood, pulp chips or roundwood, are the rule in most fuelwood chip-harvesting operations.		
Strongly disagree	2	8.0
Mildly disagree	4	16.0
Mildly agree	6	24.0
Strongly agree	11	44.0
No opinion	2	8.0
7. Whole-tree chipping is encouraging the retention of high-quality crop trees and utilization of low-grade, "rough and rotten" material.		
Strongly disagree	2	8.0
Mildly agree	4	16.0
Strongly agree	18	72.0
No opinion	1	4.0

[a]Dk/na/inap = Don't know; not applicable; inappropriate.

Huyler, Neil K. 1989. **Fuel supply structure of wood-fired power plants in the Northeast: Loggers' perspectives.** Res. Pap. NE-624. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 19 p.

A study of loggers' perceptions of the impact of large biomass demand centers on the forest resource base in the Northeast indicated that most loggers strongly believe that the post-harvest stand has improved. However, the impact of whole-tree chipping on the forest resource base was not made clear from the loggers' survey.

ODC 831.1

Keywords: Loggers' survey, wood-fired power plants, fuel supply

Headquarters of the Northeastern Forest Experiment Station are in Broomall, Pa. Field laboratories are maintained at:

- Amherst, Massachusetts, in cooperation with the University of Massachusetts.
- Berea, Kentucky, in cooperation with Berea College.
- Burlington, Vermont, in cooperation with the University of Vermont.
- Delaware, Ohio.
- Durham, New Hampshire, in cooperation with the University of New Hampshire.
- Hamden, Connecticut, in cooperation with Yale University.
- Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
- Orono, Maine, in cooperation with the University of Maine, Orono.
- Parsons, West Virginia.
- Princeton, West Virginia.
- Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
- University Park, Pennsylvania, in cooperation with the Pennsylvania State University.
- Warren, Pennsylvania.