MONITORING REPORT

INCREASING ASPEN PRODUCTION THROUGH MECHANICAL STRIP-THINNING

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By

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SUMMARY

Progress on five major research tasks is highlighted including studies of the effects of strip-thinning of aspen on growth and disease. Economic analyses and collection of cost data are also a part of this project. Recently-established field tests of strip-thinning show that stands respond relatively quickly to strip-thinning. Average growth rates increased by approximately 15 percent over unthinned stands in the two years following thinning. Measurement plots in these studies were permanently-monumented during the reporting period to allow relocation of plots after the project is completed.

Studies done as part of Task II show that a significant relationship exists between the average tree size and stand density in the aspen stands in our experiment network. This relationship provides a practical means to quantify stand density relative to that of the average aspen stand and will be used in the formulation of management recommendations. These studies also showed a significant relationship between the average stocking density in our stands and the density inherent in the published normal yield table for aspen. This relationship provides a basis from which to project wood yields through time. In cooperation with Boise Cascade and Blandin Paper Company, Division of Lands and Forestry, plans are being made to develop a more accurate tool to assess site productivity for aspen.

Measurements of previously-thinned stands on the Chippewa National Forest showed variation in the response to thinning. One stand has more than two times the merchantable volume in a thinned area compared to an unthinned area while the other shows little response to thinning.

Disease analyses have included notation of disease and stand condition on all sites. No difference in disease incidence is evident between thinned and unthinned stands at this time.

Cost data recently collected from an operational-scale thinning trial showed costs ranging from $6.75 to $8.90 per acre with an average cost of approximately $8.00 per acre. Due to optimal site conditions, these costs are likely near the low end of the cost range for strip-thinning.

Technical assistance was provided to the Blandin Paper Company, Division of Lands and Forestry during the reporting period. Current research status and economic analyses were provided to assist in future land management planning.

PROGRESS DESCRIPTION BY RESEARCH TASK

TASK I. DETERMINE THE EFFECT OF MECHANICAL STRIP-THINNING ON GROWTH AND YIELD ON RECENTLY ESTABLISHED STUDY SITES

OBJECTIVE

To evaluate the effectiveness of strip-thinning of aspen in operational-scale field trials under controlled conditions.

BACKGROUND

Past research on strip-thinning in Minnesota has shown the potential to greatly accelerate growth of aspen stands. This research was based on stands on the Chippewa National Forest that had been previously thinned. However, because of a lack of unthinned areas near thinned areas, these stands do not allow the statistical evaluation of thinning over a variety of strip widths and site conditions. The purpose of Task I is to establish field tests to evaluate strip-thinning over a range of site conditions and accurately evaluate the response of aspen to thinning over time.

PROGRESS

Tree growth data have been collected and analyzed at all study sites. A detailed summary of growth in these experiments is available upon request. The average growth response to thinning of the 600 largest trees per acre is 15 percent over unthinned control stands. In the majority of stands, the largest trees (200 largest/acre) exhibit the greatest response to thinning with an average of 30 percent faster growth than unthinned plots. Given the relatively short time since thinning (average of two years), this response is encouraging.

The location of all measurement plots in the thinning experiments were monumented with marked pipe to provide a more durable method of monumenting. Although plots are continually marked during the period of active research (through 1995), we feel it is important to provide a means to precisely locate measurement plots in the future. This will allow researchers to determine long-term changes in the forest due to thinning after the current project is completed.

PLANS FOR NEXT REPORTING PERIOD

All experiments will be remeasured after the 1992 growing season. Once analysis of these data are completed, a paper will be prepared which will summarize research results to date. Due to the interest in strip-thinning expressed by land managers, we feel it is important to disseminate information on the project in a more widely-distributed form.

TASK II. CONDUCT DETAILED STAND AND SITE ASSESSMENTS TO DETERMINE REASONS FOR VARIATION IN YIELD RESPONSE BETWEEN SITES

OBJECTIVE

To formulate practical management guidelines for aspen strip-thinning through detailed assessment of thinning experiments.

BACKGROUND

In order for strip-thinning to become a practical silvicultural tool, guidelines must be developed to assist land managers in selecting stands most likely to respond to thinning. The response of a stand to thinning will be directly influenced by soil and stand characteristics. The goal of this work is to quantify differences between stands and relate these differences to growth response. This work is considered necessary before strip-thinning of aspen can be applied on an operational scale.

PROGRESS

A detailed analysis of stand density and tree size was completed during the reporting period. These analyses showed a statistically significant relationship exists between average tree size and stand density within our experiments. The size-density relationship evident in our stands was compared to those derived from published yield tables for aspen. This analysis showed a statistically significant relationship between our experiments and the normal yield table. This result has two practical implications. First, the size-density relationship can be used to assess relative density in a stand and determine the likelihood that a particular stand will respond to thinning. Second, the demonstration of a link between our stands and the normal aspen yield table is valuable because it provides a basis from which to project future wood volumes.

Using the size-density relationship developed from our stands, we compared stocking of individual stands to the average stocking density across the network of experiments. This comparison produced an index of stand density, which we refer to as a "relative stocking index." The relative stocking index was compared to the growth response to thinning. At this time, no statistically significant relationship is evident between the relative stocking index and response to thinning. This technique will be tested on growth data in the future to determine the potential to use the relative stocking index to predict growth response to thinning.

In cooperation with the Blandin Paper Company, Division of Lands and Forestry and Boise Cascade Woodlands Division, sampling will begin on regenerated aspen stands to investigate the possibility to develop more accurate methods to assess stand productivity. This information will be valuable in the future to allow a determination of the growth potential of a site, and recommendations for thinning. Soil texture, site drainage, stand stocking and parent-stand site index will be used to predict average crop tree diameter increment and volume increment. Sampling plans have been developed and we are in the process of locating stands that fit the sampling criteria.

PLANS FOR NEXT REPORTING PERIOD

Data will be collected and samples analyzed through the summer and fall to investigate development of improved aspen productivity indicators. Statistical analyses of these data will be done during the fall and reported in the next progress report.

Based on past studies, the growth response from thinning is directly affected by the width of the unthinned strip. Because our experiments are operational in nature and done by machine, actual strip widths on a given plot will vary due to differences in terrain and operator variation. All strip widths will be measured on the remeasurement plots during the next reporting period. These data will be used to relate to current and future growth response.

TASK III. LOCATE PREVIOUSLY THINNED STANDS THROUGHOUT THE STATE AND ESTABLISH PERMANENT PLOTS TO MEASURE THE EFFECTS OF THINNING ON GROWTH AND MECHANISMS INFLUENCING STAND GROWTH

OBJECTIVE

To analyze the growth response of older strip-thinned stands and determine changes in stand volume through time.

BACKGROUND

Previous research done at the NRRI has concentrated on the analysis of growth responses of strip-thinned aspen stands on the Chippewa National Forest. Although these stands were not designed as formal experiments, they provide valuable information on the influence of thinning on stand growth rates over an extended period of time. Efforts are underway to collect data from selected stands and locate other stands for potential growth analysis.

PROGRESS

Tree diameters were measured on two strip-thinned stands located on the Chippewa National Forest. The older stand of these two, referred to as Stand 3, continues to show a response to strip-thinning. Merchantable volume of thinned and unthinned stands are 12.6 and 5.2 cords per acre, respectively; roughly a 7 cord difference between thinned and unthinned stands. Growth data from the 1991 season suggest that growth rates may be leveling off in the thinned areas within Stand 3.

Similar data were collected for Stand 7. This stand is three years younger than Stand 3 and as such is smaller in average diameter and has lower cordage. At this time, growth in the thinned areas of Stand 7 has not accelerated enough to account for losses incurred by the thinning process. The average total cordage in the thinned areas of Stand 7 is 11.9 versus 14.0 in unthinned stands. Studies will be done this summer to determine differences in site characteristics between Stands 3 and 7.

In addition to strip-thinned stands, measurements were done on a hand-thinning experiment originally established by the United States Forest Service (USFS) (Dr. Don Perala). This experiment, located near Greaney, Minnesota, is situated in a highly productive aspen stand. Thinned stands continue to show a response with merchantable cordage being 12.2 and 4.0 in thinned and unthinned stands, respectively.

PLANS FOR NEXT REPORTING PERIOD

Thinned stands on the Chippewa National Forest will be remeasured and data analyzed during the next reporting period. Complete measurement of the Greaney hand-thinning study will be done in cooperation with Dr. Don Perala of the USFS.

TASK IV. CONDUCT DISEASE ASSESSMENTS (COOPERATIVE WITH THE USFS, NORTH CENTRAL EXPERIMENT STATION)

OBJECTIVE

Determine the effect of strip-thinning on the incidence and severity of disease in aspen stands.

BACKGROUND

A potential negative effect of thinning is an increased incidence of Hypoxylon canker and other diseases. Annual assessments of disease in thinned and unthinned aspen stands are being done on recently established experiments across the state and older stands on the Chippewa National Forest. Data are being collected to evaluate the impact of fungal and insect pathogens on strip-thinned aspen.

PROGRESS

During 1991 all but one study site was visited to become familiar with the study design and take notes on stand and tree conditions. Data being collected include the cause of all types of stem damage. Notes are taken on the severity and location of injuries on the individual trees. This provides background information for future comparison. Damage will be compared among thinned and unthinned plots by examining the incidence and severity of each type of injury. A photo record is being compiled of all injury classes at each site visit. This will be used to follow the injury through time and determine its ultimate impact on survival and quality of affected trees. Data have been summarized for the sites. As expected, these data show no difference between thinned and unthinned trees at this time. Effects of thinning, if any, will likely become evident over time.

PLANS FOR NEXT REPORTING PERIOD

All plots will be visited in the spring and fall in order to assess damage. Clone boundaries will be delineated when possible, using various morphological characteristics such as crown shape, bark texture, and phenological traits such as timing of leaf flush and fall color. All insects and pathogens will be identified to species. Detailed descriptions, including measurements of all major wounds and cankers will be made.

TASK V. ANALYZE THE ECONOMIC FEASIBILITY OF THINNING

OBJECTIVE

To accurately determine cost inputs and evaluate the economic feasibility of mechanical strip-thinning of aspen.

BACKGROUND

The primary advantage of mechanical strip-thinning compared to hand-thinning is obviously reduced cost. Because investments in forest management typically require a long time before a return is realized, relatively small changes in up-front costs have the potential to greatly affect the economic viability of a silvicultural operation. An accurate assessment of costs input is necessary before large scale investment in aspen strip-thinning will be considered. Along with this, changes in stand volume over time will greatly affect the economic feasibility of aspen thinning. The purpose of these studies is to construct cash flow models based on thinning costs and projections of future volume.

PROGRESS

Additional cost data were obtained from operational thinning tests on cooperator's lands. The study site was relatively level with little residual trees left on the site. As a result, thinning costs are likely to be less than average. Time-efficiency data were also collected. Thinning costs ranged from a low of $6.75 to a high of $8.90 with an average of approximately $8.00 per acre. This result further verifies the fact that costs of strip-thinning are quite low compared to other silvicultural treatments. Productivity rates per machine hour (continuously running) ranged from four to five acres per hour.

PLANS FOR NEXT REPORTING PERIOD

Growth data gathered from aspen productivity studies will be used as input for economic analyses to more accurately assess the economic returns that could be expected from an investment in aspen thinning. These analyses will be done using the range of growth rates and thinning costs shown in our research to date.

REPORTS/PRESENTATIONS

ASSISTANCE TO BLANDIN DIVISION OF LANDS AND FORESTRY

Technical assistance was provided to the Blandin Division of Lands and Forestry during the past six months. Information on mechanical strip-thinning and research status was provided. This information is to be used in formulation of management plans and assessment of the potential role of aspen thinning in future management.

A tour of strip-thinning research sites near Grand Rapids was given to personnel from the Itasca County Land Department during early May.

Interest in strip-thinning research has been expressed by forestry organizations outside of Minnesota. These include Mead Paper Company of Escanaba, Michigan, and Weyerhauser Corporation in British Columbia. Research reports were sent to these organizations.

BUDGET STATUS

The attached budget status report is a record of expenditures through April 30, 1992, as recorded at the NRRI. The purpose of this status report is to provide Foundation personnel with an indication of budget status prior to submission by the University. A full budget report will be forwarded to the Foundation by the Office of Research and Technology Transfer Administration.

NRRI Budget Status Report Through May 31, 1992

Increasing Aspen Production Through Mechanical Strip Thinning (541602)
PI: William Berguson

CATEGORY	ALLOTMENT	EXPENSES TO DATE	PROJECT BALANCE
01 Salaries	$154,408	$42,195	$112,213
02 Supplies	$11,524	$4,896	$6,628
04 Indirect	$0	$0	$0
06 Equipment	$0	$0	$0
07 Travel	$37,249	$2,973	$34,276
08 Misc	$360	$0	$360
10 Subcontract	$12,379	$3,981	$8,398
12 Fringes	$44,080	$8,831	$35,249
24 Consultant	$0	$0	$0
TOTAL	$260,000	$53,876	$206,124