

MONITORING REPORT
INCREASING ASPEN PRODUCTION THROUGH
MECHANICAL STRIP-THINNING

Grant No. GR 91-00044

By

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Period Covered:
June 1, 1994 - November 30, 1994
NRRRI/TR-94/20B

Prepared For:
Blandin Foundation

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SUMMARY

This project has five primary research tasks related to the determination of growth and yield of aspen in response to mechanical strip-thinning; analysis of disease incidence in thinned and unthinned stands, and determination of the costs and economic feasibility of mechanical strip-thinning of aspen. All data collection activities for the 1994 growing season are complete and data are currently being entered into computer format in preparation for statistical analysis. Annual incremental basal area growth over the past four years is 15 percent higher on average in thinned stands compared to unthinned stands in the network of experiments established at the start of this project. Tree growth data collected on older previously-thinned stands on the Chippewa National Forest show that thinned stands have approximately 20 merchantable cords standing volume per acre compared to an adjacent unthinned area which has 11 cords per acre. Disease incidence data were collected on all of the research sites during 1994. No difference in the incidence of Hypoxylon, Nectria, Cytospora, and Saperda was observed between thinned and unthinned treatments. Economic analyses (Task V) were done using a range of aspen stumpage prices currently received at auctions in the region. These analyses show that absolute financial returns and differences in returns between thinned and unthinned scenarios continue to increase, primarily a result of increasing stumpage prices.

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

All tree growth data for the 1994 season were collected during the months of October through December. Over 20,000 trees are included in this dataset. The process of entering tree growth data into database format is currently underway. Error-checking and preparation of preliminary stand summaries is being done for each study site as the data are entered. Permanent measurement plots were re-marked during the summer months to allow immediate location for next year's measurements.

PLANS FOR NEXT REPORTING PERIOD

All data will be analyzed for inclusion in the final report. Analyses will show total growth rates since thinning for both thinned and unthinned stands as well as the site-to-site variation in the response to thinning.

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

Data on light penetration through canopies of thinned and unthinned stands were collected. Also, databases on soil texture and organic matter content were constructed to allow analysis of the 1994 growth data as a function of soil and stand characteristics. Analysis of growth response to thinning treatments and other stand and site characteristics were done during the reporting period. Our analysis have shown that, on average, light attenuation through canopies of thinned stands is approximately 38 percent compared to 10 percent in unthinned stands. This is an indication of the relative amount of space remaining in thinned stands for tree canopies to expand. We expect that thinned stands will eventually fill in the available space and light readings will be similar in both stands. Statistical analysis of annual incremental tree basal area growth shows a 15 percent increase in growth during the period 1991 through 1994. Plans are being made to begin a research project on these sites in 1995 in cooperation with the Department of Forest Resources (Dr. Klaus Puettmann) to evaluate under story composition and growth.

PLANS FOR NEXT REPORTING PERIOD

All data on stand and site characteristics collected to date including soils, leaf morphology, and canopy density will be merged to allow analysis of growth response among sites. Tree growth data collected as part of Task I will be integrated with these data. Statistical analysis of the effects of thinning and variation in growth response among sites will be done accounting for differences in stand and site characteristics. Based on these analyses, management recommendations for stand and site selection will be developed.

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

Measurement of tree growth on both Stand 3 and Stand 7 were done during the month of October. These data were entered into database programs during the fall and stand summaries prepared. Analysis showed that Stand 3 has approximately 20 merchantable (4" top specification) cords per acre in thinned stands compared to 11 in the unthinned portions of Stand 3. Analysis of similar data collected in Stand 7 shows that merchantable volume is 7.6 and 4.8 cords per acre in thinned and unthinned stands, respectively. These stands, although not formally designed experiments, demonstrate the potential to increase merchantable volumes over time through thinning. All measurement plots were marked during the summer to allow location of plots in future years.

PLANS FOR NEXT REPORTING PERIOD

Analysis of incremental tree growth during the past five years will be done. These data will be used to prepare detailed stand summaries for inclusion in the final report. All work done on these sites included annual growth measurement and development of volume estimation equations on thinned and unthinned stands will be incorporated in the final report.

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

Disease incidence data were collected on all of the research sites during 1994. Data collected included damage and mortality resulting from biotic and abiotic causes. External damage to trees caused by insects, pathogens, and equipment from the thinning operation were photographed. Generally, trees in the control plots were more often subject to animal damage and suppression than trees in thinned plots. Evidence of damage to trees in thinned plots were most often associated with *Agrilus* and equipment from the thinning operation. No difference in the incidence of *Hypoxylon*, *Nectria*, *Cytospora*, and *Saperda* was observed between thinned and unthinned treatments.

PLANS FOR NEXT REPORTING PERIOD

All trees exhibiting injuries will be destructively sampled outside the plots to examine internal defect and potential decay problems. These effects will be rated and examples of damage photographed. All data collected from the 1994 season are currently being analyzed and will be included in the final report.

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

Analysis done during the reporting period show that absolute financial returns and differences in returns between thinned and unthinned scenarios continue to increase. This is due to continuing increases in aspen stumpage prices. Using recent auction sale information obtained from the St. Louis County Land Department, stumpage prices are approaching, and at time, surpassing the \$30 per cord mark. The NPV of thinned aspen is approximately \$680 per acre versus \$286 for a no-thinning option using current auction sale prices in the cash flow model.

PLANS FOR NEXT REPORTING PERIOD

Summaries of the economic analyses and the impacts of thinning on economic feasibility and financial returns will be prepared. Costs of thinning equipment and the operating conditions under which the various machines can be used will be explained in the final report. Growth response data evident to date will be integrated with the cash flow models to show sensitivity of the financial returns to varying assumptions of growth response.

REPORTS/PRESENTATIONS

Meetings were held in the summer with the foresters at the Blandin Woodlands Division and Boise Cascade Corporation. A presentation was given outlining results of the research project to date. Meetings are planned for January 1995 to discuss the impacts of results of this research on future management on industrial forest lands owned by Blandin Paper Company and Boise Cascade Corporation.

BUDGET STATUS

A budget report will be forwarded to the Foundation by the Office of Research and Technology Transfer Administration, Twin Cities Campus.