

MEMORANDUM OF UNDERSTANDING

FOREST MANAGEMENT DIVISION

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

and

FORESTRY DEPARTMENT-MICHIGAN STATE UNIVERSITY

(JACK PINE REGENERATION)

- - - -

THIS AGREEMENT is by and between the Forest Management Division, Michigan Department of Natural Resources (hereinafter called the Forest Management Division) and Michigan State University.

WHEREAS, the Forest Management Division has received an appropriation of funds to be used for the cultivation and management of forest stands located on dedicated State Forest lands for the purpose of maximizing the growth and continuing productivity of timber products, and

WHEREAS, the efficient and effective use of these funds requires the application of practices in conformance with methods determined through research to have the highest degree of effectiveness, and the scientific analysis and evaluation of the results of practices installed, and

WHEREAS, the Michigan State University Department of Forestry has conducted research, and has the capability for performance of this function, and

WHEREAS, the performance of such functions by the Department of Forestry will fulfill Forest Management Division needs not presently within its capability, and at the same time further the forestry education and research program of the Department of Forestry.

June/1979

NOW THEREFORE, the parties herto mutually agree:

The Michigan State University, Department of Forestry will:

1. Conduct a comprehensive literature review on the regeneration of jack pine, the factors that may be limiting regeneration of jack pine, and the management techniques which can be implemented to overcome the limiting factors.
2. Develop criteria to determine which sites should be direct-seeded with jack pine, and which sites should be planted to jack pine. These criterias will be formulated as guidelines that can be easily learned and used by field personnel.
3. Determine the factors relating to success and failures of jack pine regeneration efforts throughout the Grayling/Roscommon area.
4. Assume responsibility, costs, damages, or expense arising out of death or injury to any person or damage to property caused or occasioned by the performance of services herein contracted for, and further shall protect and defend the State of Michigan or any of its authorized agents against all claims whatsoever, and to hold the State of Michigan or its agents harmless from any loss or damage resulting therefrom. This provision should not be construed as being applicable to liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence of the State, its agents or employees.

The Forest Management Division will:

1. Provide records of past planting and seeding areas.
2. Permit destructive stem analysis in selected stands.
3. Pay to the Department of Forestry the amount of \$18,150 upon submission of a final report satisfactorily fulfilling the above provisions.

The amount of \$8,450 shall be advanced upon execution of this agreement, and the balance upon receipt of the final report documenting findings and accomplishments.

4. Provide an interim progress report on or about September 30, 1979.

Unless otherwise extended, this agreement shall terminate September 30, 1980. This agreement or any modification thereto may be terminated by either party upon thirty (30) days written notice to the other. In this event, payment shall be based on actual expenditures as of the date of termination.

IN WITNESS THEREOF, the parties have executed the Agreement as of the date shown below.

FOREST MANAGEMENT DIVISION
MICHIGAN DEPARTMENT OF NATURAL RESOURCES

by Henry H. Webster
Chief, Forest Management Division

6-5-79
(date)

DEPARTMENT OF FORESTRY
MICHIGAN STATE UNIVERSITY

by Stephen H. Terry
STEPHEN H. TERRY
Assistant Vice President for Finance

JUN 14 1979
(date)

List below: Title, Location, Background, Objective, Approach, Methods and Materials, Statistical Analysis, Time schedule, Manpower, Responsibilities, Literature cited. (If necessary continue on back of form.)

TITLE: Jack Pine Regeneration in the Northern Lower Peninsula

COOPERATORS: Forest Management Division, DNR and Department of Forestry, MSU.

PROJECT LEADER: James B. Hart, Assistant Professor, Department of Forestry

GRADUATE STUDENT: John D. Marshall, Department of Forestry

LOCATION: Northern portion of the lower peninsula of Michigan

BACKGROUND: In recent years there has been renewed activity in the regeneration of Jack Pine in the Northern Lower Peninsula of Michigan and throughout the Lake States. The reasons for increased regeneration of Jack Pine include development of habitat for the Kirtlands warbler and the establishment of plantations on clearcut areas with the objective of timber production. Additional values will be derived from the habitat values for other wildlife and recreational values.

Particular attention has been drawn to the regeneration activities on the sand plains of the Grayling-Roscommon area; regeneration in this area has been unsatisfactory in many instances, and the reasons for the failures are not well known. The overall objectives of this study are to evaluate the Jack Pine regeneration in this area, determine the factors limiting regeneration, and make recommendations for treatments that can be used to increase the survival and early growth of Jack pi

The factors and activities relating to field regeneration success are portrayed in enclosure 1. The major interactions and timing sequences are indicated. It is within the frame-work of these factors and activities that Jack pine regeneration research will be conducted. The first decision in a Jack pine regeneration program is whether to use artificial regeneration methods, such as planting of bareroot seedlings, or natural regeneration systems, which would probably include direct seeding. This decision must be based upon the weather, soil properties, regeneration potential of Jack pine, soil moisture conditions, and competing vegetation and disease potentials of the particular site (Carmean, 1971; Stoeckeler, 1942; and Stiell, 1959). Soil moisture is often referred to as the "most limiting factor in achieving successful regeneration" (White, 1958). Soil moisture is in turn dependent upon many site factors. Surface soil properties such as texture, organic matter content, litter cover, and shading effects are

Research Area	<u>Forest Soils</u>	Prepared by	<u>James B. Hart John Marshall</u>	Date	<u>4/30/79</u>
	<u>and Regeneration Ecology</u>	Reviewed by	_____	Date	_____
Project/Grant/Funds	_____			Date	_____
Distribution	<u>Dr. H. D. Webster (DNR), Mr. Michael Moore (DNR), Mr. William Botti (DNR), Dr. Larry Tombaugh (DF)</u>				

important. The presence, depth to, or absence of a ground water table is also important (Anon, 1938; Stoeckeler, 1949). Soil moisture is also related to the water use of competing vegetation (Stoeckeler, 1942). Site preparation activities are used in both artificial and natural regeneration systems with the general purposes of soil amelioration, weed control, and overstory removal to control shading (Cooley, 1972; Cayford, 1959a; Nelson, 1977).

When a decision has been made to plant Jack pine, the regeneration success is also dependent upon the quality of the planting stock, the planting quality, and the number of trees planted (Curtis, 1955; Carmean, 1971). During the 1930's a great deal of Red pine and Jack pine regeneration activity took place in Michigan and throughout the Lake states. This activity consisted primarily of planting old fields which were being abandoned from agriculture. Technology from this period of planting activity can be drawn upon by a thorough evaluation of the literature and discussions with individuals who were active during that period (Schreck, 1928). However, there are several important aspects of conifer regeneration that warrant new research. Availability of new chemicals (including fertilizer, insecticide, fungicides, herbicides and other pesticides) has increased potential for management in nurseries as well as in the field. New innovations in seedling transportation and refrigeration storage can result in significantly better quality seedlings to be planted. New equipment and practices have been developed for preparing planting sites and for the planting operations. Advances in seed storage, treatment, handling and dispersal have also occurred. Most importantly, socio-economic and forest management practices have improved to the point where these new innovations can be done before, during, and after planting of the trees. It is important to note that much of the Jack pine regeneration being done today involves planting of harvested areas and areas where hardwood sites are being converted to conifers. This distinct difference results in many subtle differences in the factors limiting regeneration and in the management techniques that will be necessary to improve regeneration success.

Over the past several months, discussions between the Department of Forestry and the Forest Cultivation Section of the Michigan Department of Natural Resources Forest Management Division have identified the potential for dramatic increases in regeneration success with Jack pine in the Grayling-Roscommon area. The figure on "Factors and activities relating to field regeneration success" (Enclosure 1) was used to prepare a list of "DNR-MSU Cooperative Research Opportunities" (Enclosure 2). Subsequent discussions have identified specific research priorities which have lead to this proposal for cooperative research.

OBJECTIVES: This cooperative research project will involve regeneration of Jack pine in the Grayling-Roscommon area of Michigan. Emphasis is to be placed on improving the success of regeneration in those site-soil-planting situations where survival and early growth are below optimum. This species and zone represent an extensive area where regeneration is being attempted by the Department of Natural Resources, and in the future will be increasingly attempted by other land management agencies.

Specific objectives of this research proposal include:

1. A comprehensive literature review will be conducted on the regeneration of Jack pine, the factors that may be limiting regeneration of Jack pine, and the management techniques which can be implemented to overcome the limiting factors. This review will include information on Jack pine and similar species on similar sites throughout the Lake states and other areas of the world. Interviews with knowledgeable field personnel will also be conducted to determine the factors associated with regeneration failures and successes in the Grayling and Roscommon area.
2. Criteria will be developed to determine which sites should be direct-seeded with Jack pine, and which sites should be planted to Jack pine. These criteria will be formulated as guidelines that can be easily learned and used by field personnel.
3. The factors relating to regeneration failures, and successes, throughout the Grayling-Roscommon area will be determined. Techniques will be evaluated and recommendations developed to improve Jack pine regeneration success.

APPROACH:

This study will be conducted in three phases. The first phase will consist of a literature review and interviews. The second phase will be field data collection. The third phase will involve analysis of results and formulation of recommendations. The literature review is currently underway, and it is anticipated that the field evaluation can be initiated in the summer of 1979.

The field data collection, phase two of the study will involve a survey of Jack pine regeneration sites in the Grayling-Roscommon area and collection of data on regeneration success, vegetation competition, soils properties and other site factors which may be related to regeneration success. This survey will involve temporary plots in planted and direct seeded stands of Jack pine. The general specifications for useable stands are as follows:

1. Age three through age of crown closure.
2. Area of approximately three acres, or more.
3. Knowledge of the previous treatment and regeneration history of the area.

Allow for Disturbance - 1975

Plot will be located on soils throughout the Grayling-Roscommon area. Stratification techniques will be utilized to insure that the full range of soils and other regeneration factors in the area are sampled. Stratification will be based upon the following characteristics:

1. Forest floor characteristics
2. Texture, thickness and organic matter content of the surface horizon.
3. Thickness and properties of the subsurface horizon.
4. Depth to B horizon, or least permeable layer.
5. Texture, structure, and consistence of B Horizon.
6. Slope, aspect and other topographic features.
7. Depth to ground water table and drainage class.

Stratification will also be used to insure that an appropriate number of plots are installed on planted areas and on direct seeded areas.

Measurements to be collected from the temporary plots include:

1. Stand measurements
 - a. age
 - b. trees per acre and spacing
 - c. height of dominants and height intercept information
 - d. percent survival
 - e. regeneration history
 - f. tree vigor and nutrient status
2. Measurements on soils
 - a. landform
 - b. slope
 - c. aspect
 - d. slope position
 - e. depth to mottles and drainage class
 - f. depth and presence of ground water table
 - g. field description of soil horizons
 - h. effective soil depth and depth to C horizon
 - i. soil texture, structure and colors from 3 feet to effective depth
 - j. plant material (root distribution)
3. Laboratory measurements
 - a. foliar analysis of plant tissue samples collected in September
 - b. soil analysis of horizons to depth of three feet

The current plan is to locate the plots throughout the summer of 1979 and collect basic data as the plots are located. At the end of the 1979 growing season, all plots will be revisited and samples of foliage and soils to a depth of three feet will be collected. This technique will insure the season and biological state of plant development will not cause differences in foliage and soil results.

Soils and tissue analysis will be done using standard techniques.

Analysis will be done at the Plant and Soil Analytical Laboratory of the Department of Forestry at Michigan State University. This laboratory is in the development phase and the facilities should be prepared by the end of 1979 summer sampling season. In the event these lab facilities are not available, analysis will be contracted to outside laboratories.

The results from field data collection and laboratory analysis will be analyzed using standard statistical techniques and the CDC 6500 computer system of Michigan State University.

TIME SCHEDULE, MANPOWER AND RESPONSIBILITIES:

The major tasks are listed below with the time schedule, manpower requirements and specific individual responsibilities for each:

<u>Task</u>	<u>Time schedule</u>	<u>Manpower</u>	<u>Responsibility</u>
Preliminary literature review	April and May 1979	1 man Mo.	Marshall, Hart
Consult with individuals active and knowledgeable in Jack pine regeneration	Summer	1 man mo.	Marshall, Hart
Design specifics of Field survey	June 15	2 man weeks	Marshall, Hart, Ramm
Locate temporary plots and collect preliminary data	Summer	3 man Mo.	Marshall, Hart, with student help
Collect soil and foliar samples	September	3 man weeks	Marshall, Hart with student help
Sample analysis	Fall 1979	2 man Mo.	Marshall, student help
Computer and statistical analysis	Fall 1979, Winter 1980	4 man weeks	Marshall, Hart, Ramm
Supplemental literature review	Fall 1979, Winter 1980	1 man Mo.	Marshall
Report writing and presentations	Spring 1980	2 man Mo.	Marshall (Thesis) Marshall, Hart (paper)

BUDGET:

The total proposed budget for the cooperative research is ~~\$16,600~~ ^{15,200}.
Of this total budget, ~~\$8,500~~ will be required at initiation
and the remaining \$8,100 will be required after October 1, 1979.

<u>Budget item</u>	<u>Amount</u>	<u>Remarks</u>
Salary		
Graduate assistantships and student labor	8,600	sp '79 through sp '80
	3,200	2 mo summer, field work
		2 mo fall, laboratory analysis
Travel		
mileage, lodging and meals	3,400 2,000	assumes use can be made of DNR lodging facilities in Gaylord
Contractual Services		
Computer Analysis	1,000	includes computer analysis costs, reproduction and visual aids costs and communication costs
Reproduction and visual aids		
Communication costs		
Supplies and Materials	400	
	<hr/>	
	\$16,600	
	15,200	

*1/2 of content
30% left upon receipt
1 month remaining
11/20/79*

LITERATURE CITED:

- Anon. 1938. Water tables and survival. USDA For. Serv. Lake States For. Expt Sta., Tech. Note No. 139, 1 p.
- Carmean, Willard H. 1971. Large, well balanced stock and control of grass competition needed for Red pine plantings on sandy soils, USDA For. Serv., Tree Planters' Notes 22:8-10.
- Cayford, J. H. 1959a. Germination and survival of jack pine and red pine after scarification in southeastern Manitoba. Can. Dept. North. Affairs and Nat. Res., Forestry Br., For. Res. Div., Tech. Note 78, 14 pp.
- Cayford, J. H. 1959b. Seeding jack pine on the Sandilands Forest Reserve, Manitoba, 1925 to 1955. Can. Dept. North. Affairs and Nat. Res., Forestry Br., For. Res. Div., Tech. Note 79, 16 pp.
- Cooley, J. H. 1972. Site preparation for jack pine on Grayling sands. USDA For. Serv. Res. Note, North Central For. Expt. Sta. #NC-138.
- Curtis, R. O. 1955. Use of graded nursery stock for red pine plantations. J. For. 53:171-173.
- Nelson, David E. 1977. Jack pine seeding on a Wisconsin forest. J. For. 75(2):91-9
- Schreck, P. G. 1928. Seedlings versus transplants on the Michigan sand plains. J. For. 26:906-908.
- Stiell, W. M. 1959. Seeding and planting red and white pine. Can. Dept. North. Affairs and Nat. Res., For. Br., For. Res. Div., Tech. Note 80, 18 pp.
- Stoeckeler, J. H. and A. W. Sump. 1940. Successful direct seeding of northern conifers on shallow-water-table areas. J. For. 38:572-577.
- Stoeckeler, J. H. and G. A. Limstrom. 1942. A site classification for reforestation on the National Forests of Wisconsin. J. For. 40:308-315.
- White, Donald P. 1958. Available water: the key to forest site evaluation. For. Soils Conf., Sept. 8-11, p. 6-11.