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RESEARCH PROPOSALS AND REPORTS ON ECOLOGY AND MANAGEMENT OF ITASCA STATE PARK FOREST FROM 1956-1978

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A Report on the Itasca State Park Forest

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Itasca State Park is an area of very special interest and concern to the people of Minnesota. It contains a number of outstanding attractions which serve as the basis for its popularity not only to the people of Minnesota but to thousands of out-of-state visitors as well. Important among these attractions is the presence of beautiful stands of primeval Norway and white pine forest in admixture with other forest types and in a setting of numerous lakes and ponds.

While different individuals may have different relative interests in these and other Park attractions, it is obvious from the great number of expressions of interest by Park visitors that most of them are particularly impressed by the beauty and inspiration of the virgin pine forests present at such spots as Preachers' Grove, the east side of Mary Lake, the main Park entrance road, Elk Springs, and elsewhere throughout the Park.

The primary function of Itasca Park is to furnish recreational opportunities appropriate to its special attractions. Among the more important are simple enjoyment of peaceful and beautiful surroundings, camping, hiking, exploring, picnicking, photography, nature study, fishing, boating, and swimming. In addition, however, it provides unusual and increasingly significant educational and research opportunities in the general area of natural resources, forest biology and conservation. A fine program of natural history education is currently provided through the Park Naturalist. The University of Minnesota Forestry and Biological Station is maintained in the Park and provides summer field training for foresters and biologists in general. A considerable program of research is conducted by both students and staff of the University as well as by visiting scientists from other educational institutions.

The Forest of Itasca Park - Types and Condition

The great popularity and wide usage of Itasca Park as a recreational center, and the critical importance of the Park forest, particularly the old growth pine stands, focuses attention on the present condition of the forest vegetation and what is happening to it. Furthermore, the Law of 1907, Chapter 90, which provides for the care and management of the Park makes special reference to the preservation of the "primeval pine forest." The welfare of this forest is therefore both an official responsibility of the State Department of Conservation and also a matter in which the general public is seriously concerned.

This report contains selected information obtained both by observation over a 56 year period during which the School of Forestry has conducted a program of summer field instruction for its students and as a result of research aimed at problems having a direct bearing on the welfare of the Itasca Park forest.

A survey conducted in 1952 by the School of Forestry in cooperation with the State Conservation Department furnishes the data for the general summary in Table I of acreages present in the different forest types.

Table I

Type Acreages in Itasca State Park

Forest Type	Total Acreage
Aspen	13,268
Norway Pine	5,738
Jack Pine	1,898
Spruce-balsam	1,637
Marsh and bog	1,563
Northern hardwoods	1,513
White pine	847
Lowland brush	579
Lowland hardwoods	374
Upland brush	370
Tamarack	306
Spruce	201
Lakes	3,114
Fields and roads	205
Total	31,586

From this table it appears that the total area of Norway and white pine, the forest types of critical importance as a basic attraction in the Park, is approximately 6,586 acres or less than 20 per cent of the total area. It is also pertinent to note the condition of these acres devoted to the Norway and white pine types as shown in Table II.

Table II

Area in Acres by Condition Classes

Forest Type	Overmature 1/	Mature 2/	Young 3/	Total
Norway pine	2537	2908	293	5738
White pine	739	108	---	847

1/ Trees over 200 years old with an average life expectancy of 25 years.
2/ Trees mostly 90 to 150 years old.
3/ Trees mostly 50 to 75 years old.

These data indicate a serious absence of the younger age classes in the forest and a disturbing concentration of overmature trees, many of which cannot be expected to last more than about 25 years. As theee acres revert to other less desirable forest types such as mixed hardwoods, brush, and balsam, the value of Itasca Park as a tourist attraction will suffer greatly unless there is a sufficient acreage of young pine growth to replace it.

The Old-Growth Pine - Its Attrition and Inadequate Regeneration

Some idea of the rate at which this old growth pine is being lost to insects, disease and especially to windthrow is shown in the following official record of old growth pine timber salvaged as dead or windthrown trees during a period from 1940-1955.

Table III

Summary of Volumes of Old-growth Pine Timber Sold as Salvage of Dead or Down Trees at Itasca Park from 1941 to 1955

Period	Volumes (bd.ft.)
1941-43 inclusive	470,780
1944-46 inclusive	848,320
1947-49 inclusive	823,880
1950-52 inclusive	1,053,597
1953-55 inclusive	1,224,880

It is obvious from those data that the rate of mortality in this forest type is very serious. There is a very sharp increase in the rate of salvage since 1940. With the passage of time and the increasing over-maturity of the trees there is every reason to expect this general trend to continue.

The reasons for the almost complete absence of young pine stands are several. The origin of the present stands was largely associated with fire. Because of the inherent regeneration characteristics of Norway pine it appears to restock itself best following certain types of burning. Since fires have been controlled for obvious reasons since the creation of the Park in 1891, optimum regeneration conditions have not existed.

Some of our early research was focused on the intricate but definite relationships between the presence of our present pine stands and the occurrence of early fires. We have documented the occurrence of fires within the present Itasca Park boundaries as early as 1714 with subsequent fires about 1772, 1803, 1811, 1820, and 1865 in addition to several within more historic times. We are now trying to chart the ancient boundaries of these fires in an effort to reconstruct the forest conditions of pre-whiteman days.

A second factor accounting for the almost complete absence of young pine for a period of about 25-30 years preceding 1945 was the excessive deer population which existed during that time. Browse damage was so heavy that no pine seedlings were able to survive. This condition was relieved in 1945 by action of the legislature in making an open season on deer possible in Itasca Park.

A third major reason for the scarcity of pine regeneration, especially Norway pine, is the great abundance of upland brush present on almost all of the acreage in the aspen type, on most of the Norway and white pine acreage, and on much of the jack pine area as well as that covered by mixed hardwoods and other minor types. The history of this brush population build-up and the factors affecting it are not entirely clear and are now the subject of special investigation by a School of Forestry research team.

Finally, the chances for successful white pine regeneration have been seriously jeopardized by the ravates of the white pine blister rust, a disease affecting only the white pines, and which is particularly damaging to young seedling and sapling size trees.

Research is now underway to assess more accurately the present situation of regeneration in the Park and to determine what successional trends are evident in the various forest types. When this research is completed, I am sure that we will be able to predict with considerable certainty what the Itasca Park forest will look like 25 to 50 years from now.

Preliminary information already documents the serious absence of pine regeneration under almost all forest conditions prevailing in the Park. It appears that unless steps are taken to prevent it, the high scenic value pine forest will be gradually replaced by less desirable hardwoods, balsam fir, and upland brush.

The Pine Forest as the Major Park Attraction

The seriousness of any reduction in acreage of the pine types in the future may be judged from the very high value attached by the park-using public to this attraction. During the past summer a School of Forestry graduate student research assistant conducted a study to assess the interests of park-users in the various attractions to be found in Itasca State Park. The results of his studies which bear upon the values attached to the pine forest are summarized in the attached three tables.

The essential results of these studies document the following conclusions:

1. Most users rate the forest vegetation and its natural beauty as the major attraction in Itasca Park.

2. Park users spend far more time in sightseeing in their leisure than in any other form of activity or combination of activities.

3. Park users have a greater preference for the old growth pine stands, and especially the Norway pine, than for any other forest type.

It has been pointed out that the pine forest is a major attraction in Itasca Park, that the old growth trees are subject to heavy attrition by blowdown, disease, and other agencies, and that there is an inadequate regeneration of young pine in almost all of the major forest types in the Park.

This raises the obvious question of what should be done. Because our research on this question is not complete, I am not prepared to make detailed recommendations at this time. We are interested in testing the use of fire, of cutting, of brush removal by hand tools and chemicals, of tree planting, and any other methods which show some promise of establishing young pine successfully and at a minimum of cost.

We are reasonably sure that on a substantial acreage in the Park, successful pine regeneration can be secured merely by temporarily reducing the density of the understory layer of brush. Evidence for this has been accumulated on research plots over the past 15 years. One of the most striking demonstrations of the effectiveness of brush control in encouraging pine seedlings to establish pine regeneration is on the vista areas cleared of brush by Park personnel to open up views of Lake Itasca and subsequently sprayed bo prefent too rapid a regrowth of the brush. In these areas and where the trees shade is not too heavy a find crop of young pine seedlings has been established. An expansion of this type of action is strongly recommended.

We feel that carefully controlled use of fire may be needed in some areas to reproduce as nearly as possible the conditions that prevailed when our present old red pine stands were established. Research on these techniques has been conducted by the Forest Service for a number of years on the Chippewa National Forest under conditions similar ecologically to those in Itasca Park. We hope to profit by some of this experience in our research program.

Similarly, some cutting of decadent aspen, probably followed by careful burning or chemical treatment, may be needed along with planting to secure the pine reproduction on some of the forest types. We hope to try all these techniques in an expanded research program over the coming years and to be in a position to make sound management recommendations to the State Conservation Department for its use in the Itasca Park forest.

Table 1 Itasca Park's major attractions as seen by interviewees

Attraction	First Choice N = 600	Second Choice N = 600	Third Choice N = 600
Forest Vegetation and Natural Beauty	39.2	31.8	9.5
Headwaters of Mississippi	36.5	14.0	2.8
Park Facilities	18.0	24.7	10.2
Lake Scenery	2.0	9.2	1.3
Nature Study Activities	3.3	4.5	2.0
Other	1.0	1.8	1.0
No response	---	14.0	73.2
Totals	100.0	100.0	100.0

This information was obtained by a study of vegetational preferences among Itasca Park visitors conducted by R. W. Klukas from July 1 through September 15, 1965.

Table 2 Allocation of leisure time to various activities by Itasca Park visitors.

Activity	Per cent of Total Number Most Important N = 600	 2nd Importance N = 600	 3rd Importance N = 600
Sightseeing	75.7	10.5	3.7
Swimming	3.3	14.7	8.0
Fishing	7.8	8.3	3.5
Hiking	4.8	8.8	3.8
Picnicking	1.8	11.3	2.7
Canoeing Boating	1.7	3.8	2.3
Other	4.9	42.6	76.0
Totals	100.0	100.0	100.0

This information was obtained by a study of vegetational preferences among Itasca Park visitors conducted by R. W. Klukas from July 1 through September 15, 1965.

Table 3 Vegetational preferences of Itasca Park visitors

Species	First Choice	Second Choice	Third Choice
	Per cent of Total Number		
Red Pine	36	10	2
White Pine	7	26	3
Red and White Pine	24	4	1
Birch	3	16	14
Spruce Fir	3	6	5
Other	4	8	7
No Response	23	30	68
Totals	100	100	100

This information was obtained by a study of vegetational preferences among Itasca Park visitors conducted by R. W. Klukas from July 1 through September 15, 1965.

FOREST REGENERATION SURVEY - ITASCA STATE PARK

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A survey of the forest regeneration in Itasca State Park was conducted by students of the University of Minnesota's School of Forestry during September, 1956. The major objectives of this survey were several including:

1. The collection of information as to the extent to which young pine is becoming re-established in Itasca State Park following its complete absence prior to 1945. Up to that time the Park had been maintained in a "no-hunting" status.

2. The collection of data indicative of the successional trends of the various forest types. The question of whether or not Norway and white pines are successfully perpetuating was considered of special significance.

3. Determining the average size, especially of the coniferous regeneration so as to get an idea of susceptibility to damage by browsing.

For purposes of this project four major groups of types were recognized as being of special concern either because of their high aesthetic and recreational value or because of their large acreage. These type groups and their approximate acreages within the Park are given in Table 1.

Table 1

Forest Type Group	Total Acreage
Aspen	13,268
Old growth Norway and white pine	6,585
Jack pine	1,898
Spruce - balsam fir	1,637

Methods used were similar to those commonly used in making regeneration surveys on forest properties for the preparation of management plans. Forest stands were sampled by running a compass line and taking data on milacre plots every half chain. All regeneration up to two inches in diameter at breast height was tallied by species and height classes.

From the field records and for each forest type group an analysis was made of the average number of young trees per acre by species and height classes and of the average height of each species. Stocking percentages were also determined for each type group. Stocking per cent is computed by dividing the total number of plots examined in a type group by the number of those plots which contain young trees. This was done for all species of pine, for spruce and balsam, and for the various hardwoods. These figures are considered to be more meaningful in terms of indicating the "effective amount" of regeneration than are the per acre abundance figures because they reflect both abundance and distribution of regeneration. An area to have a 100 per cent stocking figure would have to have at least 1000 young trees on each acre so distributed that if each acre were divided into 1000 parts, each part (mil-acre) would have at least one young tree on it. Stocking figures above about 70 per cent are considered good if the species present are the ones desired. The stocking data are summarized in Table 2.

Table 2

Forest type group	Per cent of plots stocked with:			Total No. of plots
	Pine	Spruce or balsam	Hardwoods	
Red pine - White pine	17	13	24	1149
Jack pine	14	1	5	590
Spruce - Balsam fir	5	72 1/	21	511
Aspen	4	0	55 2/	766
Total	10	17	28	3016

1/ predominantly balsam fir

2/ maple, aspen, oak, birch, basswood, ironwood, elm, ash.

It is obvious from these data that stocking to pine species even on existing pine types is very low. It is also evident that stocking of all conifers in general is very low except for the spruce - balsam type group which appears well stocked with young balsam and spruce (mostly balsam) seedlings. The existing aspen types are also reasonably well stocked with hardwoods including mostly various species of maples, aspen, oaks, and birch. These figures give some idea of what successional trends are operating to produce the forests of the next generation at Itasca Park.

Finally, the height data obtained are summarized in Table 3.

Table 3

Forest type group	Ave. total height of regeneration (feet) 1/		
	Pine	Spruce - balsam	Hardwoods
Red pine - White pine	1	1	2
Jack pine	1	2	4
Spruce - balsam	1	1	3
Aspen	1	4	3

1/ includes all trees up to 2" in diameter at breast height.

These figures indicate that the trees, especially the conifers, are far too small to escape being browsed both by deer and by hares. More detailed analyses were made of the rates of height growth of the various coniferous species. These studies show that as a result of excessive shade and suppression by brush and because of browsing by hares and deer, the pine seedling growth rate is abnormally slow.

It appears evident from these studies that if excessive deer and hare populations are permitted to develop and if no method of brush control is initiated on at least portions of the Park Forest, the relatively small amount of pine regeneration now present will be in serious jeopardy.

Project No. ________

Date ______ Jan. 1964

PROJECT OUTLINE
MINNESOTA AGRICULTURAL EXPERIMENT STATION

PROJECT TITLE: Some Ecological Implications of the Management of Itasca State Park to Meet Recreational Objectives.

OBJECTIVES: The widely publicized Leopold Committee report (Leopold, et al., 1963) prepared for the Secretary of the Interior relating to the management of National Parks has been rather generally approved and accepted. A basic tenet of this report is "that the biotic associations within each park be maintained, or where necessary recreated, as nearly as possible in the condition that prevailed when the area was first visited by the white man". This project proposes to address itself to the effects resulting from management directed toward this objective at a major state park, Itasca. It adopts the premise that some kind of management or manipulation is necessary in "wildland" areas reserved for recreational use and will attempt to evaluate the ecological effects resulting from particular forms of manipulation.

Specifically the objectives are:
1. To define (through investigation of the historical and ecological evidence) the characteristics of the Itasca vegetation in the mid-1800's prior to the commencement of logging, its characteristics at the time of logging cessation (in the early 1900's), and its present characteristics (1960's) under conditions of protection-management.
2. To determine what changes will take place with time in the park forests as a result of ecological succession under the present protection-management policy.
3. To investigate the possibilities of manipulating the vegetation (including the use of controlled fire, tree cutting, tree planting, and herbicides) to recreate the forest cover situation of the mid-1800's.
4. To evaluate (a) preferences and reactions of recreational users of Itasca to proposed manipulations and (b) the administrative problems posed by such manipulations, in an effort to define the desirability and the feasibility of specified management activities.
5. The integration and evaluation of the research data as ~~it~~ they pertains to management recommendations (including zoning, control burning, cutting, planting, herbicide application, and others) which could be implemented at Itasca or at other similar "wildland" recreational areas.

JUSTIFICATION: Recreational use of forested lands in the United States is rapidly increasing, doubling at about 10 year intervals (Clawson, 1958) and is expected to continue to increase although at a somewhat lower rate (ORRRC, 1962). Thus far, little research on vegetative manipulation of public parks has been undertaken because such manipulation generally has been regarded as unnecessary. However, it has become increasingly apparent to all those directly concerned that the effects of increasing human use and of protection against fire will destroy the attractions inherent in recreational lands unless active management (Duncan, 1963) is undertaken to preserve quality.

Previous work at Itasca (Hansen, Duncan, 1954) indicates that this outstanding state park is deteriorating in recreational quality because of undesirable vegetational changes following a hands-off policy. Similar policy of non-intervention characterizes state and national parks throughout the United States. Park managers, and others concerned with the administration of recreational lands in a more or less natural state, are confronted with an immediate problem. How is it possible to accommodate increasing use while at the same time preserving outstanding recreational values? In addition, there is the problem which has become apparent over time, that the existing management philosophy of fire protection without other forms of intervention by man is not adequate. Action is required; but if it is to be the best possible, antecedent research is necessary. The proposed project will evaluate several possible management approaches directed toward retaining a desirable recreational vegetation, in terms of the ecological effects of such management. It will also attempt to assess the validity and the possibility of implementing a basic premise of the Leopold report, namely that restoration of conditions at the time of white man's arrival should be undertaken.

No study of the type herein suggested has been undertaken to the knowledge of those proposing it. Such a study would be unique and will have implications for similar recreational research elsewhere in the United States.

Objective 1: To define (through investigation of the historical and ecological evidence) the characteristics of the Itasca vegetation in the mid-1800's prior to the commencement of logging, its characteristics at the time of logging cessation (in the early 1900's), and its present characteristics (1960's) under conditions of protection-management.

PREVIOUS WORK AND PRESENT OUTLOOK: The Itasca State Park area has been a fertile field for historical research. Records of Schoolcraft's discovery of the source of the Mississippi River in Lake Itasca and numerous later explorations and study expeditions provide fragments of information on the natural features of the area and its forests. Schoolcraft himself (1834 and 1855) has recorded some observations of the flora of Itasca from his very brief stay in the area. Nicollet (1843) in 1836 conducted a survey to chart the hydrographic features of the Itasca basin. Chamber's descriptions (1910) of the area as he saw it in 1871 made frequent reference to the occurrence of various kinds of forest stands in specific locations. The reports of Brower (1893, 1900, 1904), the first commissioner of the park, are also a source of much descriptive information.

In 1875 the General Land Office Survey of the Lake Itasca area was conducted by a party under the supervision of E. S. Hill. The official records of this survey including statements of the species and sizes of trees blazed as monuments and bearing trees furnish further evidence of the forest condition in the pre-logging period.

Some of this historical information has been reviewed by Spurr (1954) and Dobie (1959). The former did much to establish the fire history and its effects on the forest stands. The latter author amassed a great deal of information on early Itasca Park conditions from the records of early commissioners, from logging records of the late 1800's and early 1900's, and from interviews with those who had early contact with the area.

Deer have had an important influence on the Itasca Park forest especially during the period of their extreme abundance culminating in 1945 when the park was opened to legal hunting. Information on this relationship of deer to the forest has been collected by interviews with interested observers (Dobie, 1959), by the establishment of deer exclosures and subsequent comparisons of conditions within and outside of them over a period of years (Marshall, 1955; Hansen and Bakuzis, 1952), by browse surveys conducted by state and federal wildlife agencies, and by various other means.

A number of recent and current research studies (Spurr and Allison, 1952; Hansen and McAndrews, 1960) have given more intensive study to the history of several individual stands. This research has included both fire history and compositional changes of the stands.

A considerable source of information about the present forest type acreages, stand volumes, and type distribution is available as a result of an earlier project undertaken by the School of Forestry in cooperation with the Minnesota Conservation Department (Spurr, Meyer, Brown, 1952). Some intensive ecological information about stand composition, structure, subordinate vegetation, and other stand characteristics has been collected on several stands in current research activities.

In order to more accurately determine the forest condition as of the mid-1830's and as of the time following the period of virgin timber logging, it will be necessary to broaden the search for historical evidence to document the early forest condition and to intensify the examinations of present stands as biological sources of similar information.

Additional information is needed to extend the ecological descriptions to cover all major forest types and to obtain more intensive ecological data. Special attention should be given to the nature and extent of regeneration, the role of brush canopies in hindering natural regeneration, and the rate of attrition of the old trees through blowdown or breakage by wind. In this connection studies of natural regeneration currently taking place in all upland types and dealing with hazel brush as an ecological component of pine stands in the area have already been initiated.

PROCEDURE: Two main lines of investigation will be followed.

1. Historical research. Information ~~already~~ collected by Spurr (1952) and Dobie (1959) was ~~will be~~ reviewed. Additional sources of information included timber company records, the archives of the Forest History Society, the Hill Reference Library, and the University Library. ~~From these sources information will be pooled to chart the changes in the forests beginning with the first white man contacts.~~ Land survey records, explorer's diaries, and

2. Ecological investigations. Four major upland forest type-complexes will be studied including aspen-birch, jack pine, red and white pines, and northern hardwoods. In each of these types at least three individual forest stands will be given an intensive analysis. Data will be collected on such items as species composition, age distribution, soil characteristics, subordinate vegetation, fire history, blowdown, stump ages, and wind breakage. From such information the past history of the forest can be probed and its earlier condition reconstructed. The cooperation of the Minnesota Conservation Department will be solicited to enable cutting of sufficient trees in the sample stand to accurately interpret fire history, stand compositional changes, and other trends.

Historical research should be initiated in advance of the 1964 field season, and preliminary findings will help provide a background of information for the field studies.

Objective 2: To determine what changes will take place with time in the park forests as a result of ecological succession under the present protection-management policy.

PREVIOUS WORK AND PRESENT OUTLOOK: For many years the relatively undisturbed conditions at Itasca Park and the presence of rather extensive areas of virgin timber stands has made the area a favorite center for studies of ecological succession. Several attempts have been made (Lee, 1924; Kell, 1938) to study the factors influencing successional development. Other efforts have been directed toward such specific objectives as the relative permanence and competitive interactions of balsam fir with the tolerant hardwood components of the climax vegetation (Buell and Gordon, 1945; Buell and Niering, 1953).

The importance of wind damage and particularly its role in limiting the longevity of the virgin pine stands in the park have been studied under current School of Forestry projects. Hansen and Duncan (1954) made provisional estimates that most of the existing acreage of old pine had a life expectance of 25-50 years. Further unreported data document a selective effect of wind in influencing the species composition changes taking place in some of the forest types.

Some idea of the successional trends can be gained from a study of the regeneration currently present under mature stands. Extensive regeneration surveys have been conducted for several years in forest ecology classes during the forestry summer sessions. While such data are not considered acceptable for research use, considerable information has resulted which is useful in providing guides for sampling and other procedural problems, as well as furnishing background information on the regeneration situation.

In order to more accurately predict what will happen to the present forest stands in Itasca Park under the existing protection-management policy, it will be necessary to compile, review, and interpret all the fragments of knowledge contributed by past and current research, to determine serious gaps of knowledge, and to initiate research to acquire the information needed.

Factors playing an especially significant role in determining successional trends for any specific forest stand in the park are considered to include:

1. The species composition of the mature stand and its current condition.
2. The relative competitive ability of the various associated tree species and their synecological requirements.
3. The rate of blowdown and wind breakage and its selective influence on stand composition.
4. The normal longevity of the various tree species present.
5. The effect of various significant causes of seedling mortality on the success of regeneration. Past and current research indicate that brush, fire or its absence, deer and hare, and white pine blister rust are especially important.

While some information is available from published reports or unpublished data on all of the listed points, the information on all points is inadequate. The problems most urgently in need of supplemental information include:

1. wind as a factor of forest attrition.
2. the brush canopy as a deterrent to regeneration.
3. The current regeneration condition in the various forest types in the park.

PROCEDURE: The following lines of investigation will be followed:

1. Wind damage study. Two main kinds of data will be acquired; quantitative information on the extent of blowdown and breakage from wind in the four main upland type-complexes, and age data which will enable determinations

of the average longevity of the various tree species. This will be obtained from a survey designed to sample these four type-complexes plus age determinations from cross sections or increment cores taken from wind-damaged trees. This study can be initiated in the first or second year depending on the availability of support.

2. Regeneration study. A regeneration survey will be conducted in the same four type-complexes. This will be designed to determine the abundance, frequency of occurrence, and stock percents of the different species, size, and age classes of reproduction.

A more intensive study will be made of the ecological relationships of pine regeneration. This study will focus special attention on red pine and white pine as the species assumed to be most critically involved in the aesthetic values of the park. Present pine stands will be sampled to determine the extent to which they can be expected to reproduce to pine and to assess the ecological relationships that are known to deter such reproduction.

The regeneration survey can be initiated the second year. The ecological study of pine regeneration will be an expansion of a study already underway in preliminary form.

3. Information from ecological research already completed and published plus preliminary or fragmentary data from current research and class data will be collected, summarized, and reviewed for integration with new data from (1) and (2) to enable a more reliable prediction of changes to be expected in the Itasca Park forest stands. This activity should begin as soon as possible, preferably in the first year.

Objective 3: To investigate the possibilities of manipulating the vegetation (including the use of controlled fire, tree cutting, tree planting, and herbicides) to recreate the forest cover situation of the mid-1800's.

PREVIOUS WORK AND PRESENT OUTLOOK: Present policies for Itasca Park restrict management to protection of the forest from fire, to reduction of the danger from white pine blister rust by partial eradication of alternate host species, to salvage logging of trees blown down or broken by wind, and to control of the deer population by alternate year hunting. In the past a limited amount of tree planting has also been done, an experimental cutting to release pine seedlings has been made, there has been a considerable amount of experimental use of herbicides to encourage conifer reproduction (Hansen, 1956; Hansen and Johnson, 1957), and the effects of fire have been studied on an extensive basis.

The School of Forestry staff has done considerable research on the fire history and subsequent ecological development at Itasca. Some of this information is presently unpublished although some has been made available (Spurr, 1954). The evidence clearly indicates that fire was a part of the normal scene in the presettlement forest. If pine is to be maintained as an importan[t] component of the forest, fire must be intentionally used under controlled conditions or other more artificial methods must be instituted. Direct seedi[ng] following fire may be required to assure adequate pine reproduction.

In addition to research and management activities conducted within the park, considerable other research related to techniques of silvicultural management of possible use in manipulating the park forest toward recreating earlier conditions has been conducted elsewhere in Minnesota and can be related to the problems at Itasca Park. A large source of such information has been accumulated especially as related to the effects of fire; the use of herbicides; the various silvicultural systems of cuttings, thinnings, and release; and the planting of trees or use of direct seeding measures.

PROCEDURE: Once the vegetational characteristics in the mid-1800's, the early 1900's and the 1960's have been defined and the differences assessed, several management techniques may be needed to recreate conditions prior to the white man's arrival. Controlled burning, cutting, planting, and the use of herbicides are the most promising techniques for this purpose. Ideally all should be tried on a scale sufficiently broad to give meaningful results. For practical reasons it is felt that maximum use should be made of information on these techniques collected from research done elsewhere.

However, some carefully controlled burning should be conducted to test the possible use of this technique to establish red and white pine reproduction. Small areas of 3-5 acres located where they will not be visible to park visitors should be burned in an attempt to reduce ground cover competition and to create favorable seedbed conditions for pine regeneration. To eliminate the uncertainty of doing this when seed from the parent stand is not present, the burned areas will be direct seeded using seed of red, white, and jack pines, white spruce, and balsam fir. Seed for this use will be collected from local sources.

Full cooperation from the Minnesota Conservation Department is essential in the conduct of the entire sub project and maximum precautions must be taken in the experimental burning. The fires will have to be carefully confined by fire breaks and adequate standby equipment to be provided by the State Division of Forestry. Proper fuel moisture conditions are essential. The addition of fuel oils to the area to be burned may be necessary (Hilliker, 1962). Research in this area now in progress at the School of Forestry and by the Lake States Forest Experiment Station will be most helpful in completing these burns. The effectiveness of pine reproduction establishment will be evaluated as to species, number of trees, size of seedlings, and the effect of fire on competing plants.

A limited amount of experimental cutting is proposed. This should be done in the aspen and jack pine types to test possible means of converting these large-acreage types to conifers having greater aesthetic appeal. Stands having existing conifer reproduction will be given first priority in these tests. Past studies have shown that there is a considerable amount of white pine reproduction under many of these stands that never survives because of shade and competition from brush and the overhead tree canopy. Small plots of 3-5 acres are adequate for these trials and can be located where they are not generally visible from traveled roads.

Planting using hand methods and random distribution of native stock (or stock grown from local seed) may prove effective at other locations and will be instituted on several feasible sites where the method has prospects of success and where such establishment might accord with early vegetative cover conditions. Knowledge gained through planting experience elsewhere in the State will be useful here.

Herbicide applications to encourage pine establishment have already been demonstrated to be effective in encouraging white pine regeneration (Hansen, 1956) at Itasca. The use of chemicals in combination with cutting, however, needs further exploration. In the tests involving burning and cutting, herbicide applications may be needed to successfully establish desirable conifer reproduction. Tests will be designed to release conifer seedlings from brush and ground cover competition. Split-plot comparisons of herbicide and non-treated plots will be superimposed on cut and burned areas to provide statistical comparisons.

Because these tests of silvicultural techniques require relatively long periods for meaningful evaluation, they should be initiated as early as possible. The burning and cutting tests should be conducted in the second project year and the herbicidal tests should follow in the third and fourth years.

Objective 4: To evaluate (a) preferences and reactions of recreational users of Itasca to proposed manipulations and (2) the administrative problems posed by such manipulations, in an effort to define the desirability and the feasibility of specified management activities.

PREVIOUS WORK AND PRESENT OUTLOOK: Consumer preferences have been widely studied as an aid to more effective marketing of commercial products of many kinds (Duncan et al, 1960, others). Techniques have been reasonably well defined (Kiehl and Rhodes, 1956). In the area of recreational preferences in wild land areas, however, little has been done. The Outdoor Recreation Resource Review Commission did make a survey of users in an effort to evaluate the variables affecting quality and demand (Mueller and Gurin, 1962; Reid and Barlowe, 1962). While they indicate that user preference cannot be employed alone to guide management policy, Mueller and Gurin do state that visitor opinion "properly elicited and evaluated, can be extremely useful".

Prospective administrative problems are of several types but to a considerable degree are affected by the opinion of the public and of individuals who are strongly interested in what is done (or not done) at Itasca. These kinds of problems along with those of a financial nature must be evaluated if certain management practices are to be implemented. Some desirable practices may be prohibited by these considerations, and less desirable alternative solutions may have to be suggested.

PROCEDURE: In the area of determining recreational preferences, the plan is to explore the following questions with a carefully selected sample of visitors to Itasca State Park.

a. Why do recreational visitors come to Itasca?
b. What types of forest cover are preferred?
c. What are the reactions of visitors to manipulation by man including:
   (1) controlled burning
   (2) cutting
   (3) planting
   (4) the use of herbicides
   (On these questions, visitors will be shown areas treated by the above techniques.)
d. Do visitors accept the management objective that parks should be placed in the condition in which they were found at the time of white man's arrival, or do they consider some alternative objective preferable?

These questions and others of a similar kind having implications for management will be explored with three randomly selected classes of visitors.

1. A group (the control) not subjected to any attempt to educate them.
2. A group exposed to a half hour explanation of the reasons for and the objectives of management at Itasca.
3. A group, each of whom will be provided at each location with a card which explains very briefly the reason for the manipulation displayed. The card will provide the kind of information which could be placed on a rustic sign of explanation such as now is used in many National Forests.

Differences among the three groups will be analyzed statistically to determine whether the proposed kinds of education affect outdoor recreation participants.

An evaluation also will be made of the philosophy of state and national park management. Much of this is now in the literature (Ise, 1961; National Conference on State Parks, 1959) but the concepts are under major reconsideration at the present time as shown by the Leopold report and other evidence. Through interview with state park planners and directors, personnel of the National Park Service, the Bureau of Outdoor Recreation, University biologists and others, an effort will be made to assess potential problems resulting from philosophical diversity. The restraints imposed upon management as a result of these philosophies will be clearly defined and stated. Alternative solutions (management techniques) which might be applied, assuming certain underlying objectives, will be provided.

<u>Objective 5</u>: The integration and evaluation of the research data as it pertains to management recommendations (including zoning, control burning, cutting, planting, herbicide application, and others) which could be implemented at Itasca or at other similar "wildland" recreational areas.

<u>PREVIOUS WORK AND PRESENT OUTLOOK</u>: Hansen and Duncan (1954) and Duncan (1956) have suggested certain management policies which might be adopted at Itasca and at other state parks. These, however, were not based on as much research data as might have been desirable and were tentative in nature. With the changes in philosophical approach to park management now apparent, the additional research and revised and expanded recommendations are timely and appropriate.

PROCEDURE: The recommendations to be proposed will be derived directly from the foregoing described research. They will represent an effort on the part of the research personnel to integrate all of the findings in terms of their application at Itasca.

PROBABLE DURATION: It is estimated that the proposed research will require eight years to complete. The timetable presently envisioned is as follows:

1.2.3.	Historical Study and Current Situation (writeup incl.)
2.	Initiation of experimental burns and cuttings.
3.	Initiation of Planting.
3.4.	Herbidide applications.
3.4.5.	Study of recreationist's preferences, administrative problems.
6.7.	Evaluation of results of treatments.
7.8.	Total analysis, writeup, and publication.

FINANCIAL SUPPORT:

	Total	Support	McIntire-Stennis
		1963-64	
H. L. Hansen	2,000	2,000	
D. P. Duncan	1,000	1,000	
E. V. Bakuzis	500	500	
Research Assistants	5,808		5,808
Supplies & Expenses	1,233	———	1,233
Total	10,541	3,500	7,041
		1964-65	
H. L. Hansen	2,000	2,000	
D. P. Duncan	1,000	1,000	
E. V. Bakuzis	500	500	
Irving	500	500	
Research Assistants	10,000		10,000
Supplies	2,500	———	2,500
Total	16,500	4,000	12,500
		1965-66	
H. L. Hansen	2,000	2,000	
D. P. Duncan	1,000	1,000	
E. V. Bakuzis	500	500	
F. D. Irving	500	500	
Research Assistants	10,000		10,000
Supplies	2,500	———	2,500
Total	16,500	4,000	12,500

As presently planned the project will run for eight years with the following amounts of McIntire-Stennis funds:

1966-67 = $6,000
1967-68 = 3,500
1968-69 = 3,000
1969-70 = 3,000
1970-71 = 1,000

PERSONNEL:

Henry L. Hansen
Donald P. Duncan
Egolfs V. Bakuzis
Frank D. Irving
Richard A. Skok
Research Assistants

INSTITUTIONAL UNITS INVOLVED:

School of Forestry, University of Minnesota

COOPERATION:

Minnesota Division of Parks
Minnesota Division of Forestry
Lake States Forest Experiment Station

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A PROPOSAL FOR RESEARCH ON THE ECOLOGY AND MANAGEMENT OF MINNESOTA STATE PARKS

This proposal provides for a continuation and extension of the research now being conducted at Itasca and St. Croix State Parks under the supervision of Dr. Henry L. Hansen. The School of Forestry has had a long history of interest and research in Itasca State Park. Studies have been completed or are underway on the influence of fires, logging, and other historical events on the forest; on its natural successional trends, on the interactions of deer and the forest vegetation, on the patterns of visitor use and their aesthetic preferences, and on the application of techniques and methods for perpetuating the essential features for which Itasca Park was created.

These studies are of necessity long-term in nature. In part they will be completed in 1969. During 1970 it will be possible to provide the Minnesota Division of Parks and Recreation a report detailing the basic documentary data, an analysis of the implications in terms of management policies, and recommendations for future policy and management decisions.

Until 1967 this research had been supported only by University funds (Minnesota Agricultural Experiment Station and Graduate School Grants) and federal sources (McIntire-Stennis Act). In 1967, MORRC (now Minnesota Natural Resources Commission) provided additional funds to support the Itasca Park research and to extend it to other state parks.

This proposal would provide for the completion of the Itasca Park research and its final report to the State Conservation Department, for the continuation of similar research already initiated in St. Croix State Park, and for an extension of research to a third park, such as Whitewater State Park, where use patterns and ecological conditions are different from those already studied.

OBJECTIVES

The specific objectives of this proposed study are:

1. To investigate and define the historical events which have influenced the vegetation. Special attention will be given to fire, logging and wildlife in this connection.

2. To determine what changes in vegetation will take place in the future as a result of increased use pressures, management policies, and natural successional trends.

3. To identify features of special significance for protection in natural areas, scenic landscapes, or other appropriate forms.

4. To provide ecological information which will be useful to the nature interpretation programs underway in these parks and which will help coordinate the diverse aspects of many activities on such areas.

5. To evaluate the research data as they pertain to management decisions relative to zoning, vegetational manipulation, and use regulation.

6. To evaluate the educational and recreational potentials and present patterns of public use as they affect the general ecology of the park.

JUSTIFICATION

Recreational use of forested lands in the United States is rapidly increasing, doubling at about 10-year intervals. Special attention must be given to the impact of such use on the vegetation and other aspects of the recreation resource, the deterioration of scenic and other features, and to the need for basic information on vegetational changes to guide long-term management and planning.

The need for greatly intensified and expanded research and the general seriousness of the problems have become apparent to administrators and managers of recreational resource areas - national, state, and local. It has become increasingly evident that the effects of increasing use of outdoor recreational areas, the deleterious effects of excessive deer populations, the complete elimination of fires, and other events may destroy or reduce the attractions inherent in recreational lands in the absence of active management to preserve their quality. At the same time research has seldom been adequate to produce the basic information needed for the development of sound management plans with long range goals.

GENERAL PLAN

Financial assistance is sought to complete the research now underway at Itasca Park and to prepare a model park management guide in 1970. The research at St. Croix State Park initiated on a reconnaissance basis in 1967 will be intensified. In addition, similar studies will be started at another state park such as Whitewater where ecological conditions and use patterns are quite different. Four main lines of investigation emphasize:

1. Historical research. This will emphasize the effects of fire, logging and wildlife on the vegetation, as well as the legislative

1. (Cont'd)
   and other items associated with the creation of the specific park and affecting its present and future management.

2. Ecological studies. The vegetation will be studied to determine natural successional tendencies and the impact of various kinds of public use and wildlife pressures. Areas having unusual scenic and scientific values requiring special protection or management will be identified. Measures needed to restore original or desired biotic associations will be assessed.

3. Recreational use. The impact on the recreation resource of present use patterns will be analyzed and user preferences evaluated. Features of unique and appropriate recreational value will be identified.

4. Management problems and policies. The research data collected will be evaluated in terms of management policies for zoning of public use to protect areas of unique scientific value, to maximize educational and recreational potentials, and to perpetuate or restore original or desired natural features.

NEEDS

While some aspects of this research will not be completed, it is proposed that the present study be continued for two years and that future research be projected as necessary after the evaluation of the results. This will enable completion of the Itasca Park and St. Croix research projects.

The School of Forestry will continue to provide the salary of the project leader. Under his supervision graduate students will integrate work on the project with their academic program. They will concentrate full time on the project during the field season and part time during the school year and will be hired as half-time research assistants.

Funds are needed to support these part-time research assistants together with necessary equipment and expenses for each of the two years as itemized. The availability of these funds is especially critical to the continuation of this research because the federal McIntyre-Stennis funds which have been the major support for this research in past years will terminate or be greatly reduced in 1969.

	Estimated Annual Cost	2-year Cost
Research leader (Dr. H. L. Hansen)	No charge	No charge
6 half-time research assistants @ $3500*	$21,000	$42,000
Laboratory and computer charges, equipment	3,500	7,000
Transportation and expenses	3,000	6,000
Total	$27,500	$55,000

*Estimated salary level - 1969

OTHER SUPPORT

The funds requested above are to enable continuation and extension of research on the problems discussed. The current research program has been supported through the School of Forestry by University funds and by grants and allocations from several federal sources as listed below for the academic year 1967-68.

University support:

$3,500 for partial salary of Dr. H. L. Hansen as research project leader.

Federal and State funds (channeled through the Minnesota Agricultural Experiment Station):

$3,500 - General Agricultural Research

$9,720 - McIntire-Stennis Act funds for research assistants.

$2,863 - McIntire-Stennis Act funds for transportation, equipment, and supplies.

The $12,583 of McIntire-Stennis funds will not be available beyond 1968. The availability of the GAR funds for 1968-69 is as yet not resolved.

In 1967, at the recommendation of MORRC and the Minnesota Division of State Parks, the Minnesota State Legislature appropriated $30,960 for the 1967-68 biennium in support of this project.

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1968

THE ECOLOGY AND MANAGEMENT OF STATE PARKS AND RECREATIONAL AREAS
A Progress Report to the Minnesota Resources Commission

Henry L. Hansen, University of Minnesota, School of Forestry

SUMMARY AND RECOMMENDATIONS

The School of Forestry has conducted a program of research on the ecology and recreational use of Itasca Park for the past six years and has recently initiated a similar program in St. Croix State Park. It is proposed that these studies be continued and extended to include an additional park such as Whitewater where different vegetation and recreational use patterns prevail.

Studies of visitor reactions and patterns of activity indicate that the natural beauty of the Norway pine stands is a principal attraction in Itasca Park. Other studies document the total lack of reproduction of this species and the rate at which it is being converted to brush and other less desirable types.

Research on the aspen type which covers over a third of the total park area indicates that it is similarly converting to aesthetically low value species and an increasing preponderance of brush.

Because of this it is recommended that (1) the present pine stands be protected to prolong their life and that appropriate silviculture be applied to perpetuate this preferred species, and (2) that treatments be developed and applied to convert a portion of the aspen type each year to Norway pine and other preferred conifers to recreate the conditions prevailing in the Park at the time of its creation.

It is recommended that the position of park ecologist be created within the Division of Parks and Recreation to implement action programs based on this research and to deal with other pressing problems.

An analysis of activities within Itasca and St. Croix Parks indicates the great variety of uses they serve. These may be grouped as recreational, educational, and research. Similarly, the intensity of use on different portions of these parks varies from very intensive to almost none. Therefore, it must be recognized that a zonation of use and a flexibility in management is necessary. Where possible every park should have a designated "natural area" on which man's activities are greatly restricted. Conversely on recreational areas various management activities must be conducted. Funds are needed to strengthen the planning activities within the Division of Parks and Recreation and to make possible the development of master plans to guide future activities on these two highly important parks as well as others in the system.

There is urgent need for a vegetation map of St. Croix State Park. This is needed not only as the basis for research but also for administrative and management purposes.

PROJECT HISTORY

The School of Forestry has had a long history of interest in and research on the problems relating to the use of wilderness, parks, and recreational areas. The roots of this interest trace back to the period from 1907-1909 when forestry students working under the supervision of Professor E. G. Cheyney in Itasca Park assisted early park authorities in running boundary lines, laying out roads and trails, and constructing facilities, and when the University under the leadership of Professor Samuel B. Green established a field forestry training center in the Park which has been in continuous existence to the present time.

In post-World War II years studies have been completed or are underway on the influence of fires, logging, and other historical events on the forest; on its natural successional trends, on the interactions of deer and the forest vegetation, on the patterns of visitor use and their aesthetic preferences, and on the application of techniques and methods for perpetuating the essential features for which Itasca Park was created.

Support

Until 1967 this research had been supported only by University funds (Minnesota Agricultural Experiment Station and Graduate School Grants) and federal sources (McIntire-Stennis Act). In 1967, MORRC (now Minnesota Natural Resources Commission) provided additional funds to support the Itasca Park research and to extend it to other state parks.

Scope and Objectives

In general, research has been directed; (1) to identify problems relating particularly to the vegetation as a natural feature and a recreational resource on parks; (2) to acquire the basic ecological, management, and other information needed to develop solutions; and (3) to predict the consequences of various management practices.

Most of the emphasis has been on Itasca State Park where a very considerable mass of research information has been accumulated. It is planned that with a season of field study in 1969 most of this research can be completed and a final report prepared for submission.

In 1967 and 1968 similar kinds of studies were initiated at St. Croix State Park where somewhat different vegetation, recreational use patterns, and other conditions prevail. Studies in this park have been at a reconnaissance and survey level, and it will require at least two more field seasons to complete this phase of the project. In 1969 it is hoped that an extension of the study might be made to include one of the parks, such as Whitewater, where the forest types are hardwoods and ecologically different problems are involved.

REVIEW OF PROGRESS - ITASCA PARK PROJECTS

Forest Ecological Studies

Research under this subproject provides the core of ecological knowledge basic to the study. A total of 130 different forest stands scattered throughout Itasca Park and covering the total range of upland conditions was examined in the reconnaissance phase of the study. From these, a representative selection of 36 stands was made on which intensive vegetational and soil data were taken on 264 plots. These 264 plots have been permanently identified by aluminum plot stakes and photographed so that they can provide a beginning point from which long term changes can be recorded in future years. Collection of field data on these plots is complete. Some unit analyses have been completed, and final reports on this phase of the project will be available in 1969.

Data from these studies makes it possible to describe the character and features of the different forest types in Itasca Park, to compute the success of natural regeneration under these types, and to predict the nature of the future forests.

Forest Types and Condition

In 1965 a report on the Itasca Park Forest was presented to MORRC containing a list of forest types, their areas, and a breakdown of the Norway and white pine types by maturity condition. These data are repeated as Tables 1 and 2 in the Appendix of this report because of their significance.

It is important to note (Table 1) that the largest type in the Park is aspen with over 13,000 acres and that the aesthetically preferred Norway (red) pine occupies less than 6,000 acres in total. Furthermore, the pine stands are largely mature or overmature, with less than 300 acres of forest under 100 years of age(Table 2).

Forest Succession

The study of the dynamics of forest succession is not complete. Final field studies have been made, and the data are in process of final analysis. Fig. 6 is included in the Appendix although it is only provisional. This figure delineates the channels of natural succession which will be followed when the present forest stands die or are blown down and if man does not interfere in any way.

Two predominant and serious trends are apparent. One is the gradual disappearance of pine, and the other is an increased abundance of brush in the future forest types. Both trends are natural phenomena and can be checked only by suitable silvicultural procedures.

Forest Regeneration

The current study documents the complete inadequacy of pine regeneration under present pine stands (see Fig. 1, Appendix), aspen-birch stands (Fig. 2), or northern hardwood stands (Fig. 3). In the present pine and aspen-birch stands there is a dense shrub canopy averaging over 30,000 stems per acre making regeneration totally impossible under natural conditions of ecological succession and in the absence of fire or management assistance. While several species of hardwoods are better able than pine to compete with this brush canopy, the data indicate that the success of these species is also limited. In the northern hardwood type (sugar maple, basswood, ironwood) these shade tolerant species are more successful in competing with the brush, and the study indicates that this type will perpetuate itself easily without man's help.

One reason for the difficulty in regenerating trees in competition with brush is the generally faster rate of growth of brush sprouts or suckers. A study was made of the juvenile growth characteristics of the more common tree and shrub species. The results of this study for white pine, red maple, and hazel brush are given in Fig. 4. Results of a 10-year case history study of the patterns of regeneration under an old pine-balsam fir overstory are given in Fig. 5. In this stand the conifer (pine and balsam fir) seedlings which were present in 1953 succumbed to the brush and faster growing hardwoods, with the Norway pine disappearing completely.

Tree Longevity

Information on the longevity of the various tree species obtained by the use of an increment borer on trees in the sample stands has been summarized in Fig. 6. While occasional trees are found older than these, the figures in the table are the maximum ages which the species may normally be expected to reach. Average life expectancy is considerably less than these ages. For example, while the oldest aspen found on the plots was 112 years old, most aspen die or are blown down by 80 years. This age information is needed to predict how long the present Itasca Park stands will last.

Salvage of Dead or Down Pine

The salvage of dead or down trees on Itasca Park is permitted under regulation by the State Division of Lands and Forestry. Information on the extent of this salvage is given in Tables 5 and 6, and was furnished by the Itasca Ranger Station.

The figures do not include any salvage of pulpwood size trees. It should be noted that only a small fraction of the total of dead trees is salvaged. Except for occasional large pines which are lightning struck, blown down, or which die otherwise, there is little economic incentive to salvage other trees. Therefore, the volumes of trees salvaged is a conservative index of the rate at which the old pine stands are deteriorating.

In the 22 years from 1955 to 1968 slightly more than 3 million board feet have been salvaged. This volume is approximately equivalent to 6000 large virgin Norway pine which have been lost during this period.

Fire History

A very important aspect of the research on this project has led to a reconstruction of the fire history of the area back to 1650. Table 4 contains a list of dates of fires which burned somewhere within the present Itasca Park area. This fire dating has been done by checking fire scars on old living trees, usually Norway pine. Because these early fires often created seedbed conditions favorable to the regeneration of Norway pine, trees of this species often coincide in age with the fire scar dates. Similarly, but for different ecological reasons, jack pine and aspen are typically post-fire species and their ages indicate the occurrence of past fires.

Because not every fire was followed by moisture conditions favorable for tree regeneration, only a fraction of the fires were successfully followed by such regeneration. The incidence of fire and tree regeneration and early weather records have been studied to determine the inter-relationships involved.

Recreational Use Patterns and Preferences

Statistics on visitor use of Itasca Park have been provided by the Park Manager's office and are given in Table 6. These indicate an increasing number of total visitations more than doubling from 1956 to 1967. A levelling off or slight downward trend in the numbers of day visitors is recorded for the last several years. Because of some difficulty in the use of traffic counters, the exact year this downward trend began is uncertain but was sometime from 1963 to 1965. During this same period (1956-1967) the number of campers using campground facilities almost tripled (34,397 in 1956 to 101,428 in 1967). This trend continues upward. Further increase in park use, especially by campers, puts added strains on facilities, parking areas, roads, and campground sites. Deterioration of the natural resource features of the park is now a matter of real concern. Itasca State Park faces the same problem as exists in some of the mroe popular national parks, increased use pressures are threatening the very values the parks were created to protect.

A report of the results of a 1965 study of visitor use preferences conducted as part of this project was made to MORRC in 1967. The relevant conclusions of this study were:

1. Of all the attractions in the park, visitors rated "forest and natural vegetation" as the most popular.

2. The most popular leisure time activity for visitors was "sightseeing".

3. Visitors rated Norway pine as their first preference of all vegetational types in the park.

In 1967 a study was made of park visitors' reactions to vistas which had been created by cutting down the brush at several points along the lakeshore drive. Visitors' responses were enthusiastically for the vistas and favored a continuation of the present openings with a moderate expansion of their area.

Silvicultural Research - The Norway pine and aspen types

The historical and ecological research previously cited has identified the Norway pine and aspen forest types as "problem types" in Itasca Park. The Norway pine is aesthetically preferred above all others by almost all park visitors. Because of early logging activities and changed ecological conditions introduced after the Park was created, this species is no longer regenerating itself, and natural mortality is seriously diminishing its present abundance.

By contrast aspen, a species which established readily after fires, logging, and other early disturbances, and which is not eliminated by heavy deer browsing, is presently the largest type in area in the park. This type rates low on any beauty-rating scale and is present on several millions of acres elsewhere in the state.

The major problem in dealing with the forest types of Itasca Park are thus identified as (1) retaining the present Norway pine trees and forest stands as long as possible, and (2) converting some of the present aspen type back to pine as much of it was before the park was created.

Four stands have been set aside in which experimental treatments have been initiated to accomplish this. These treatments involve singly or in combination controlled burning, overstory removal, brush control, and seeding. These are of necessity long term studies and will have to be continued for at least five more years.

RESEARCH PROGRESS - ST. CROIX STATE PARK

In 1967 studies were initiated at St. Croix Park. Work to this date has been primarily a survey to determine the range of ecological conditions, the nature and condition of the present forest types, and the acquisition of historic and other information which will help identify the problems and provide a background for their resolution.

Progress on this work has been slowed by the absence of a vegetational type map. Such a map is urgently needed not only for the research work but also for the administration and management of the park.

A total of 127 different stands have been examined to determine the general nature and condition of the range of forest and soil types. From the 127 stands 31 were selected to represent the range of vegetation and environment. On these, intensive vegetation and soil data have been collected which will make possible detailed descriptions of the present vegetation, analysis of the regeneration patterns, and predictions of successional trends. We are now in the process of summarizing and analyzing this information.

The study has also identified an area suitable for reservation as a natural area within the park. It is felt that where possible the state parks should contain such natural areas on which research dependent on the exclusion of man's activities can be centered. Such an area will also serve as a control with which comparisons can be made with disturbed or managed areas. Negotiations are underway with the Division of Parks and Recreation in this connection.

TABLE 1

Type acreages in Itasca State Park

Forest Type	Total Acreage
Aspen	13,268
Norway pine	5,738
Jack pine	1,898
Spruce-balsam	1,637
Marsh and bog	1,563
Northern hardwoods	1,513
White pine	847
Lowland brush	579
Lowland hardwoods	374
Upland brush	370
Tamarack	306
Spruce	201
Lakes	3,114
Fields and roads	205
Total	31,586

From this table it appears that the total area of Norway and white pine, the forest types of critical importance as a basic attraction in the Park, is approximately 6,586 acres or less than 20 percent of the total area. It is also pertinent to note the condition of these acres devoted to the Norway and white pine types as shown in TABLE 2.

TABLE 2

Area in acres by condition classes

Forest Type	Overmature[1/]	Mature[2/]	Young[3/]	Total
Norway pine	2537	2908	293	5738
White pine	739	108	---	847

[1/] Trees over 200 years old.
[2/] Trees 100 to 200 years old.
[3/] Trees 60 to 100 years old.

These data indicate a serious absence of the younger age classes in the forest and a disturbing concentration of overmature trees which cannot be expected to last much more than about 25 years. As these acres revert to other less desirable forest types such as mixed hardwoods, brush and balsam, the value of Itasca Park as a tourist attraction will suffer greatly unless there is a sufficient acreage of young pine growth to replace it.

Some idea of the rate at which this old growth pine is being lost to insects, disease and especially to windthrow is shown in Table 4.

TABLE 3

Dates of fires as determined from fire scars and other information in Itasca State Park[1/]

Fire Data	Years before 1968	Fire Data	Years before 1968
1922	46	1843	125
1918	50	1838	130
1913	55	1820	148
1911	57	1811	157
1909	59	1803	165
1907	61	1796	172
1905	63	1787	181
1898	70	1772	196
1895	73	1759	209
1891	77	1742	226
1889	79	1728	240
1887	81	1714	254
1884	84	1702	266
1875	93	1670	298
1871	97	1661	307
1864	104	1650	313

[1/] This information is provisional and part of an ongoing research program. Publication or citation in published documents will not be permitted without consent. H. L. Hansen, School of Forestry, University of Minnesota.

TABLE 4

Summary of volumes of old-growth pine timber sold as salvage of dead and down trees at Itasca State Park from 1941 to 1968

Period		Volumes (bd. ft.)
1941-43	inclusive	470,780
1944-46	"	848,320
1947-49	"	823,880
1950-52	"	1,053,600
1953-55	"	1,224,880
1956-58	"	841,040
1959-61	"	623,690
1962-64	"	483,230
1965-67	"	212,580 *
1968		31,000 *

*Dead and dying trees throughout the park only partly salvaged.

ITASCA STATE PARK VISITOR USE SUMMARY1/

TABLE 5

Total Day Visitors & Guests	
1956 -	259,405
1957 -	362,528
1958 -	419,920
1959 -	437,314
1960 -	501,604
1961 -	471,048
1962 -	541,203
1963 -	576,372
*1964 -	365,022
1965 -	608,742
1966 -	502,121
1967 -	520,763

*Records indicate counters were broken down a portion of year.

TABLE 6

Total Campgrounds Guests	
1956 -	34,397
1957 -	36,174
1958 -	39,703
1959 -	41,919
1960 -	48,202
1961 -	55,911
1962 -	70,684
1963 -	93,937
1964 -	87,083
1965 -	79,312
1966 -	90,146
1967 -	101,428

1/ Figures obtained from the Itasca State Park Superintendent's office.

Figure 1

Relative Abundance of Pine and Hardwood Seedlings and Shrubs in Pine Stands in Itasca State Park, Minnesota

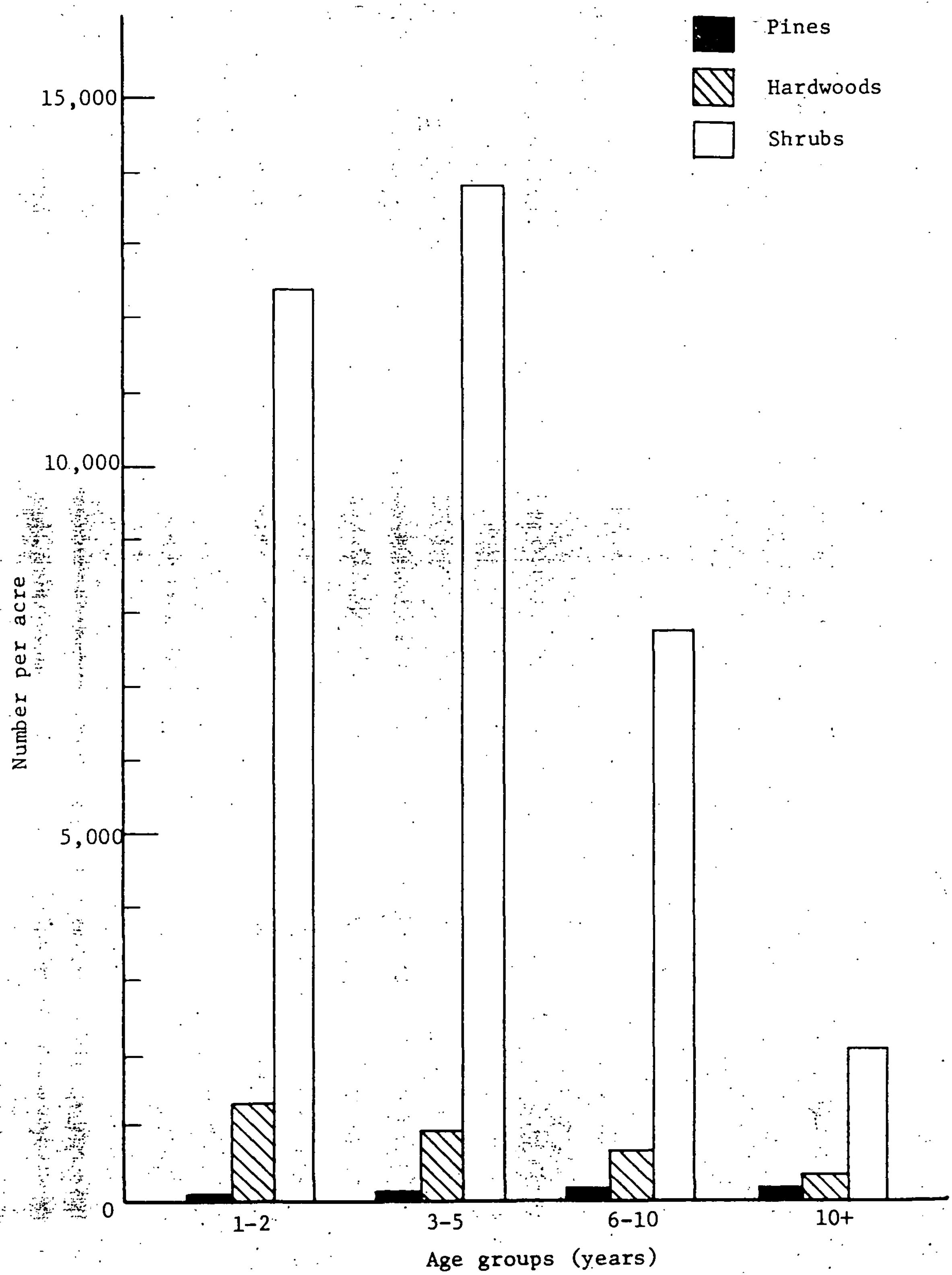


Figure 2

Relative Abundance of Pine and Hardwood Seedlings and Shrubs in Aspen-Birch Stands in Itasca State Park, Minnesota.

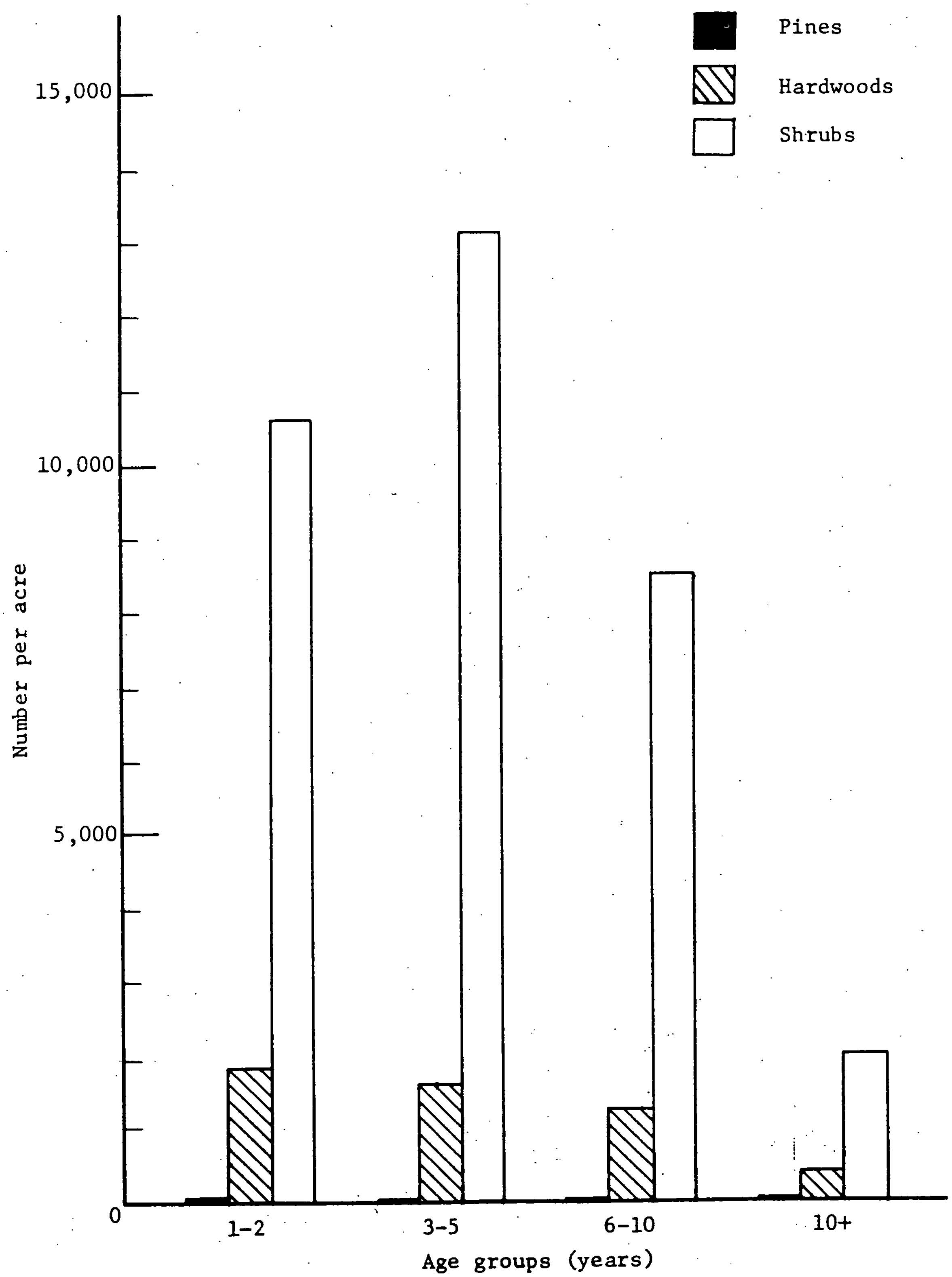


Figure 3

Relative Abundance of Pine and Hardwood Seedlings and Shrubs in Northern Hardwood Stands in Itasca State Park, Minnesota.

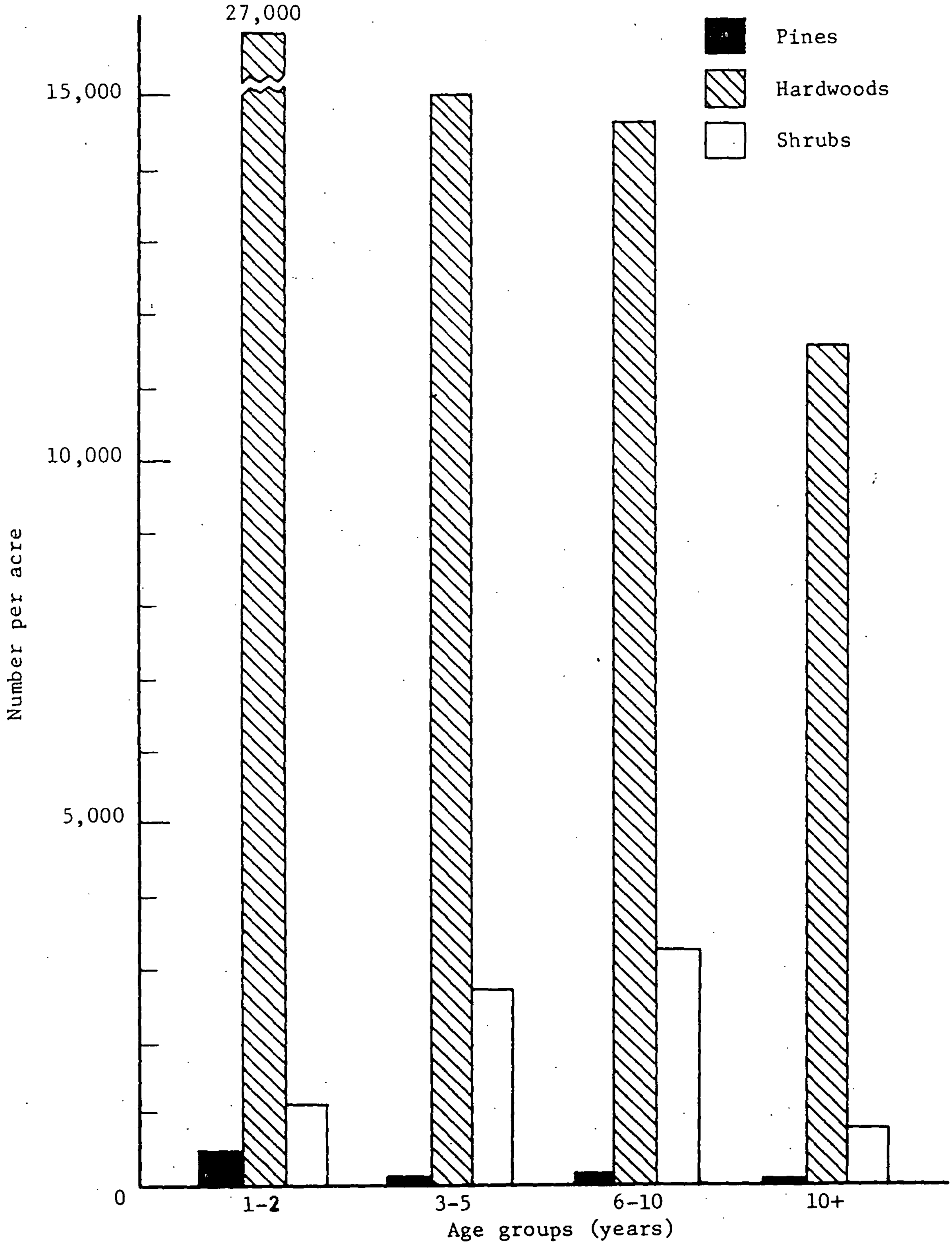


Figure 4

Early Growth Rate of White Pine and Red Maple Seedlings and Hazel in Pine Stands in Itasca State Park, Minnesota.

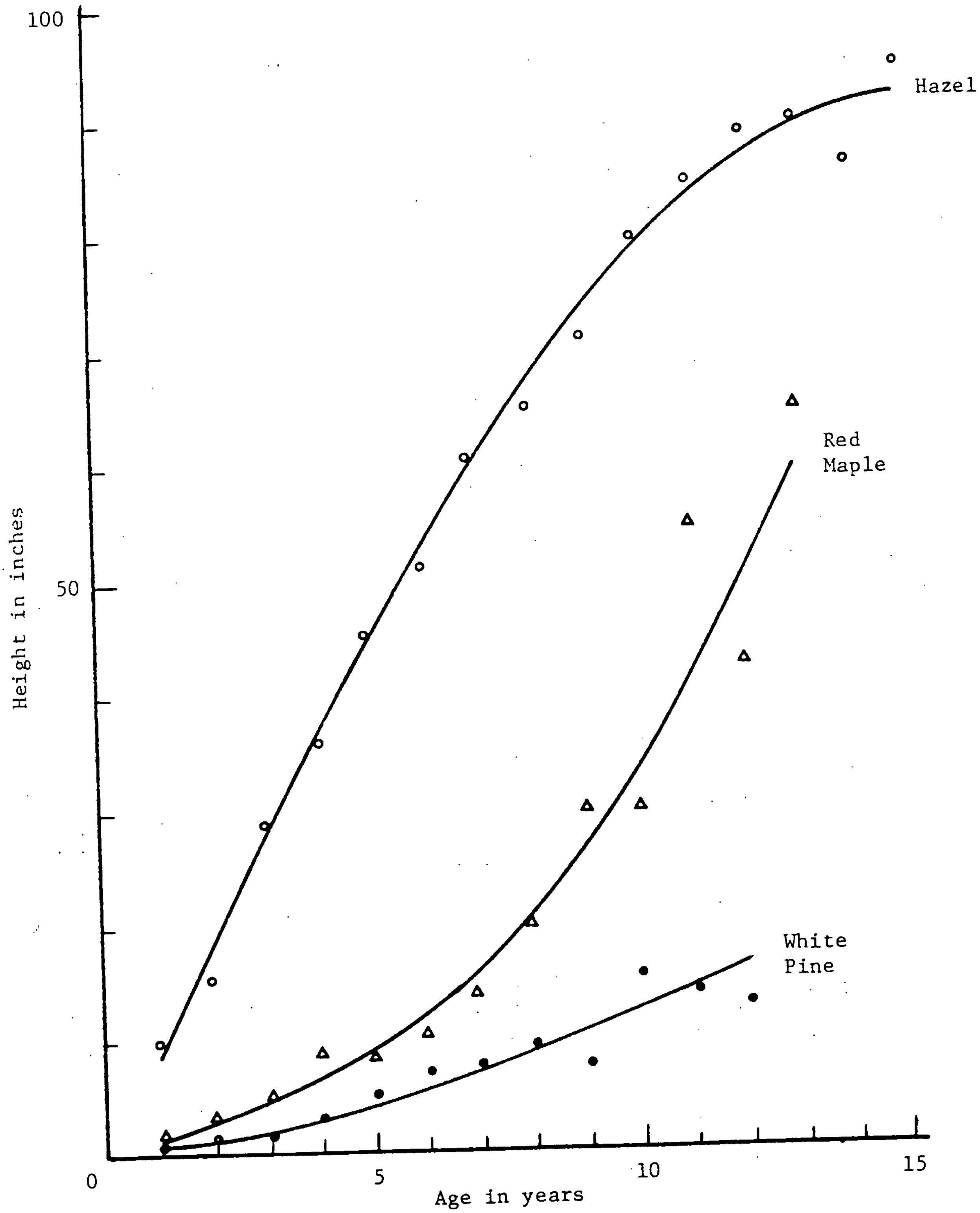


Figure 5

REPRODUCTION PATTERNS UNDER PINE - FIR OVERSTORY

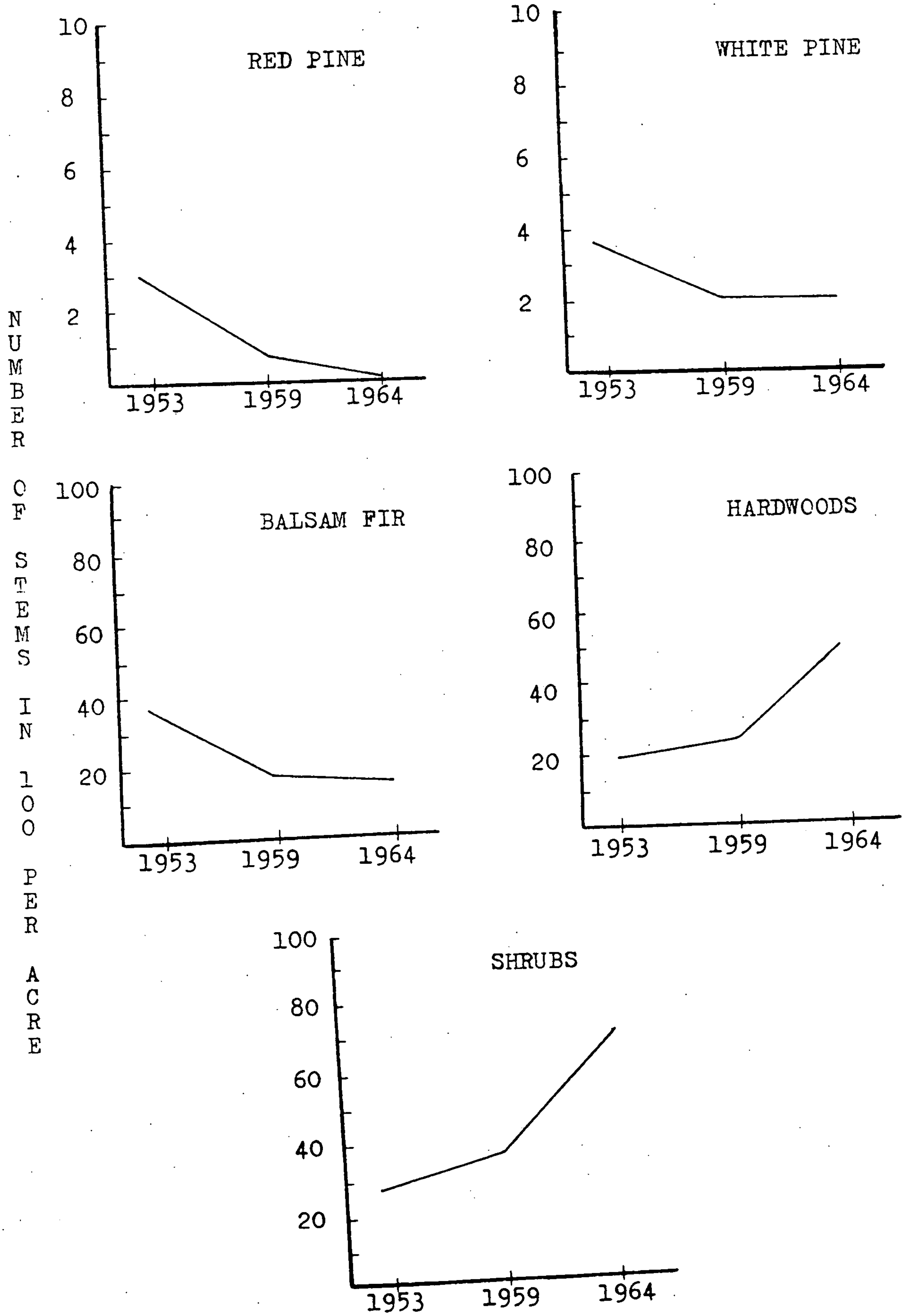
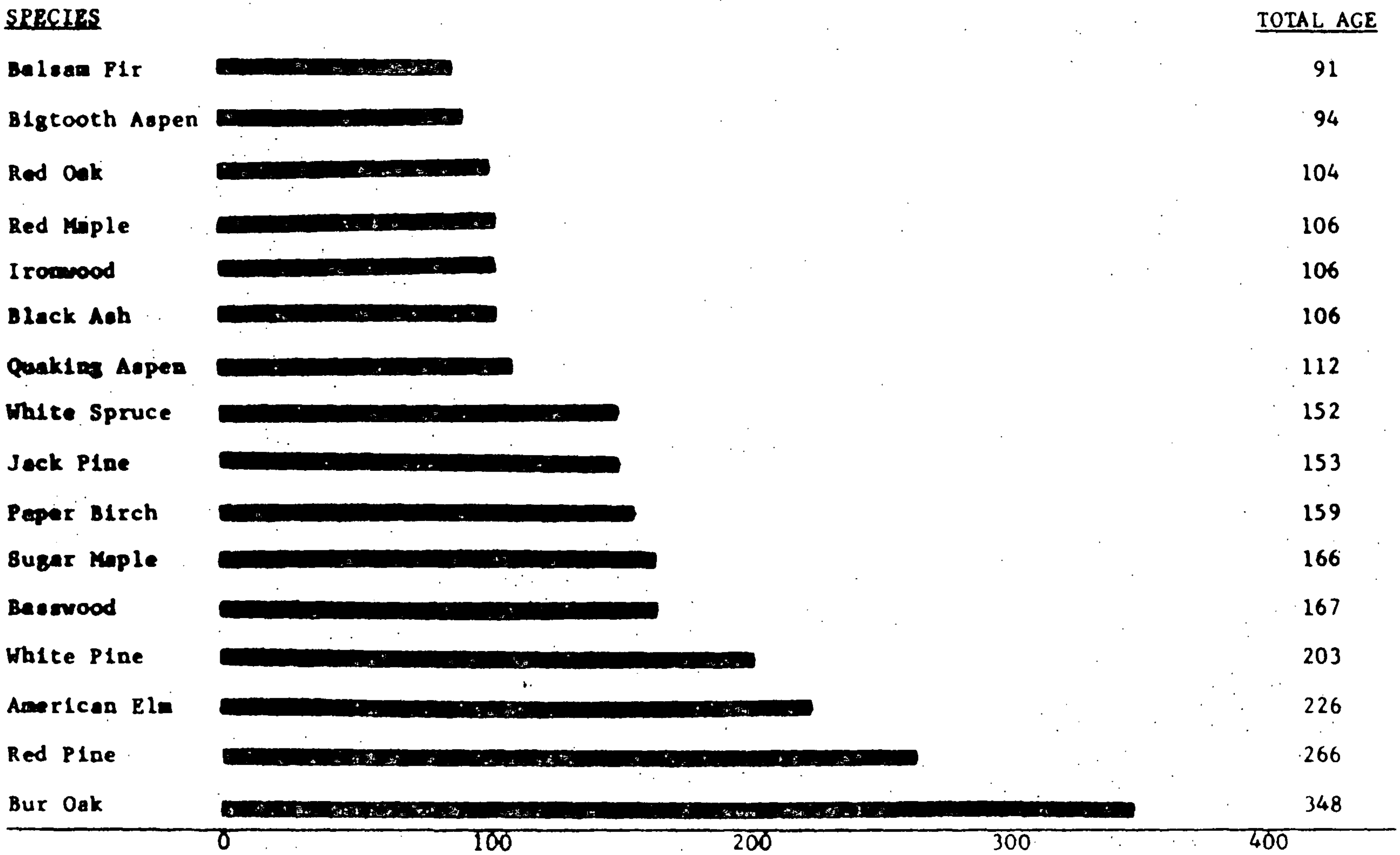


Figure 6

COMPARATIVE LONGEVITIES OF UPLAND FOREST TREE SPECIES

ITASCA STATE PARK, MINNESOTA



The age figure indicated for the various species represents an estimate of the longevity of the oldest living specimen observed in sampling thirty-three upland forest stands. The sample stands were selected so as to represent the total range of prevailing ecological conditions. Preliminary age data were obtained from increment cores extracted from ten inches above the base of the tree. Increment readings were adjusted by data derived from seedling growth curves to obtain total age of the tree.

Recent Project Publications

Hansen, H.L. Ecological and Silvicultural Research on Forest Recreational Areas. Minnesota Science Vol. 23, No. 3, pp. 42-43. April 1967.

Hansen, H.L. Ecological Implications of the Management of Itasca State Park to Meet Recreational Objectives. Forestry Research Progress in 1967. Mc-Intire-Stennis Cooperative Forestry Research Program, Cooperative Research Service, U.S. Dept. Agriculture. pp. 63-65. April 1968.

Hansen, H.L., and A.C. Hodson. Tree Suppression and Prediction of Mortality in an Aspen Stand in Itasca State Park. Minn. Forestry Notes No. 198. Oct. 1968. 4 pp.

Klukas, R.W., and D.P. Duncan. Vegetational Preferences among Itasca Park Visitors. Journal of Forestry. pp. 18-21. Jan. 1967.

Potton, J.E., H.L. Hansen, and L.C. Merriam Jr. Visitor Reactions to Vista Clearings in Itasca State Park, Minnesota. Minn. Forestry Notes No. 197 Oct. 1968. 4 pp.

West, P.C., L.C. Merriam Jr., and H.L. Hansen. An Exploratory Study of Selected Attitudes and Perceptions of Itasca State Park Users. Minn. Forestry Notes No. 188. 4 pp. Jan. 1968.

UNIVERSITY OF *Minnesota*

SCHOOL OF FORESTRY · 110 GREEN HALL · ST. PAUL, MINNESOTA 55101

August 11, 1969

To: State Conservation Department, Division of Lands and Forestry:

John Childs — William Berndt
Arthur Keenan — R. R. Elliott
Vernon Miller

State Conservation Department, Division of Parks and Recreation:

Milton Krona — Joe Ludwig
Waino Kontola — Ben Thoma

State Conservation Department, Division of Game and Fish:

Vern Gunvalson — Maynard Nelson

University of Minnesota

Donald B. Lawrence — William H. Marshall
Vilis Kurmis✓ — Myron Grafstrom

From: Henry L. Hansen

Subject: The initiation of vegetational management activities in Itasca State Park.

At the last session of the legislature an appropriation was made to the State Conservation Department for the initiation of vegetational management activities in Itasca State Park. These are to be oriented to a restoration of the park forest to more nearly approximate its pre white man condition particularly with reference to bringing about a conversion of some of the present area of aspen to red pine and other conifers and to insure their perpetuation.

This action by the legislature was taken as the culmination of a long period of research by the School of Forestry designed to acquire the necessary ecological information and to reconstruct the fire and logging history as a guide to determining what management needs exist.

Responsibility for the expenditure of the funds provided lies with the Division of Lands and Forestry working in close collaboration with the Division of Parks and Recreation. Mr. John Childs of the Division of Lands and Forestry in charge of the project. Dr. Vilis Kurmis who is intimately acquainted with the Park forest and its ecology has been employed as a consultant to the Conservation Department to advise and to conduct further studies of the effects of any treatments initiated.

The management of Itasca State Park is the direct or indirect responsibility of a number of public agencies. In addition, many individuals because of their research or other considerations have a keen interest in the Park. Because of this, Mr. Childs has asked me, on behalf of the Division of Lands and Forestry, to assemble a group which would review the general plans being prepared. We would like to meet at

To: State Conservation Department

Div. Lands and Forestry
Div. Parks and Recreation
Div. Game and Fish

University of Minnesota

From: Henry L. Hansen

10:00 a.m. on Wednesday, August 20 in Itasca Park. Assuming that arrangements can be made through Dr. Marshall, we will meet at the office of the University's Forestry and Biological Station. In the event this is not possible, you will be notified as to the change of place.

I hope I have not excluded anyone from this mailing list who should be invited. With this in mind I have included extra copies of the notice to several of you who are in a position to know who else should be included. Please distribute these as you feel appropriate.

HLH:ee

PROPOSED MANAGEMENT PROGRAM

FOR THE ITASCA STATE PARK FOREST - JULY, 1969

In October 1968 the Minnesota Resources Commission proposed that recommendations made in connection with the School of Forestry research report on the ecology and management of the Itasca Park forest be implemented by a plan of action to be funded through the Division of Lands and Forestry for the State Conservation Department. Funds for the 1969-71 biennium were made available for this purpose by the legislature.

The attached proposed program was prepared by joint consultation of the Divisions of Lands and Forestry and Parks and Recreation and the School of Forestry. The activities outlined have been described in rather general terms with many of the details left to be developed. The timing of some action such as burning cannot be projected exactly because of obvious dependence on weather, hazards, and other considerations.

The general objectives background to this management proposals are the restoration to the extent feasible of the conditions prevailing in the park before the era of large scale logging. In this connection it is a matter of rather general knowledge which has been fully documented by research that the present pine stands occupy only a small portion of the original pine acreage and that even this reduced pine acreage is not being regenerated. By contrast, the acreage of aspen has greatly increased following the early logging.

It is also recognized that the aesthetic qualities of the park are a major concern to the hundreds of thousands of people who visit the area each year. While any steps taken to restore the early vegetation will result in temporary disturbance of the natural appearance of the treated areas, these areas will be selected and treatments timed to minimize such disturbance as much as possible and to consider aesthetic objectives.

Treatment Area 1A Lake Alice Trail

A. Treatment objectives

1. To perpetuate white and red pine under and adjacent to the scattered old pines in portions of this area before they are lost as a seed source. These pine represent three of the age classes present in the park and have been subject to increasing blowdown in the last 10-15 years.
2. To convert the predominantly aspen type in much of this area to a mixture of pine, oak, birch and aspen. The aspen is in the 80-90 year age class and is very decadent. Natural regeneration of pine and other tree species is prevented by a dense shrub canopy averaging 33,000 stems per acre of which about 77% is hazel.
3. To test and compare on a management area scale the feasibility and effectiveness of burning, logging, herbicides, seeding, and planting, alone and in combination, in attaining these objectives. Six permanent tenth-acre plots have already been located in this area and a pre-treatment inventory has been taken of the trees, shrubs, and ground cover.

B. Proposed treatment schedule

1. Spray shrubs (2,4-D + 2,4,5-T mixture) in an area about 50' wide along each side of Lake Alice trail using a power sprayer along the trail rather than aerial spraying to eliminate drift to nearby areas. Time: August, 1969 or 1970.
2. Removal of all aspen south of the trail (about 50 acres). The scattered birch, oak, and red maple to be left. Slash to be lopped and scattered.
3. Area south of trail to be burned as soon after the cutting as it dries enough to burn. A repeat burn may be necessary to get the area in a plantable condition and to induce natural seeding in the area near pine seed sources.
4. Direct seeding of red pine on a selected portion of the area. Spring 1971 or 1972.
5. Planting of red pine and white spruce. Hand planting will be done at the rate of about 600 trees per acre. Spring 1971 or 1972.

Treatment Area 1B - Lake Alice Trail

A. Treatment objectives

Similar to those tested under area 1A except that logging and burning will be excluded from the methods tested. A special objective in this area is the release of scattered existing white pine regeneration from the suppression effects of the heavy brush canopy.

B. Proposed treatment schedule

1. Spray shrubs along Lake Alice Trail as described in area 1A.
2. Repeat spraying as needed.

Treatment Area 1C - North side of Lake Alice Trail

A. Treatment objectives

1. Release of red pine and white spruce seedlings planted in 1957 following an experimental cutting of aspen. Aspen suckers coming in after the 1956 cut are seriously suppressing the remaining seedlings and have caused considerable mortality.

B. Proposed Treatment Schedule

1. To be sprayed by helicopter in August, 1969, using a 2,4-D and 2,4,5-T mixture.

Treatment Area #2 - North of Squaw Lake Road

A. Treatment objectives

Conversion of the present aspen-birch-oak stand to a pine-spruce-aspen-birch-oak stand. This area has a larger component of birch and oak in the present stand than do areas 1A and 1B. These tend to occur in clumps and carefully applied treatment can leave existing birch and oak & reduce the aspen component while reintroducing red pine and white spruce.

B. Proposed treatment schedule

1. Logging the aspen. Lop and scatter slash.
2. Spray the brush and aspen sprouting following logging.
3. Planting red pine and white spruce.

Treatment Area #3 - West of Park Drive

A. Treatment Objectives

Conversion of the present pure aspen stand to a mixed red pine-white spruce=aspen mixture. This stand is between 50-60 years old and typical of much of the upland forest west of the main park drive and which was the last major area to be added to the park in the 1920's. Almost no pine is present in this portion of the park.

B. Proposed treatment schedule

Similar to that in area #2.

Figure 1. Treatment Area 1A – Lake Alice Trail
Location: T143N, R36W, Sec. 1, SE¼
Size: 50 acres
Cover: Aspen, with scattered old growth white and red pine, paper birch, and oak.

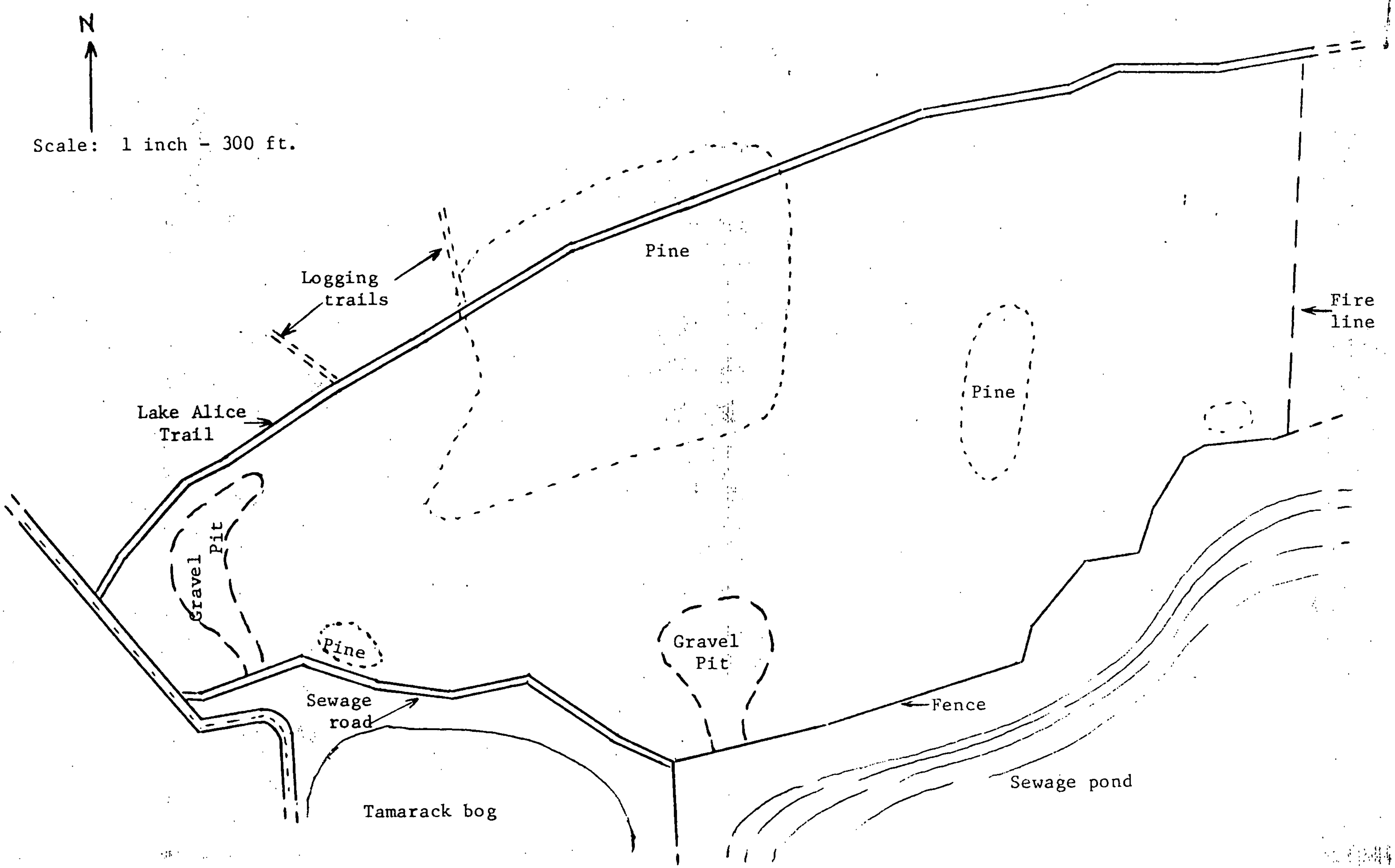


Figure 2. Treatment Areas 1B and 1C - Lake Alice Trail
Location: T143N, R35W, Sec. 6, SW¼
Size: 7 acres in area 1B, 3 acres in 1A
Cover: old growth white, red, and jack pines

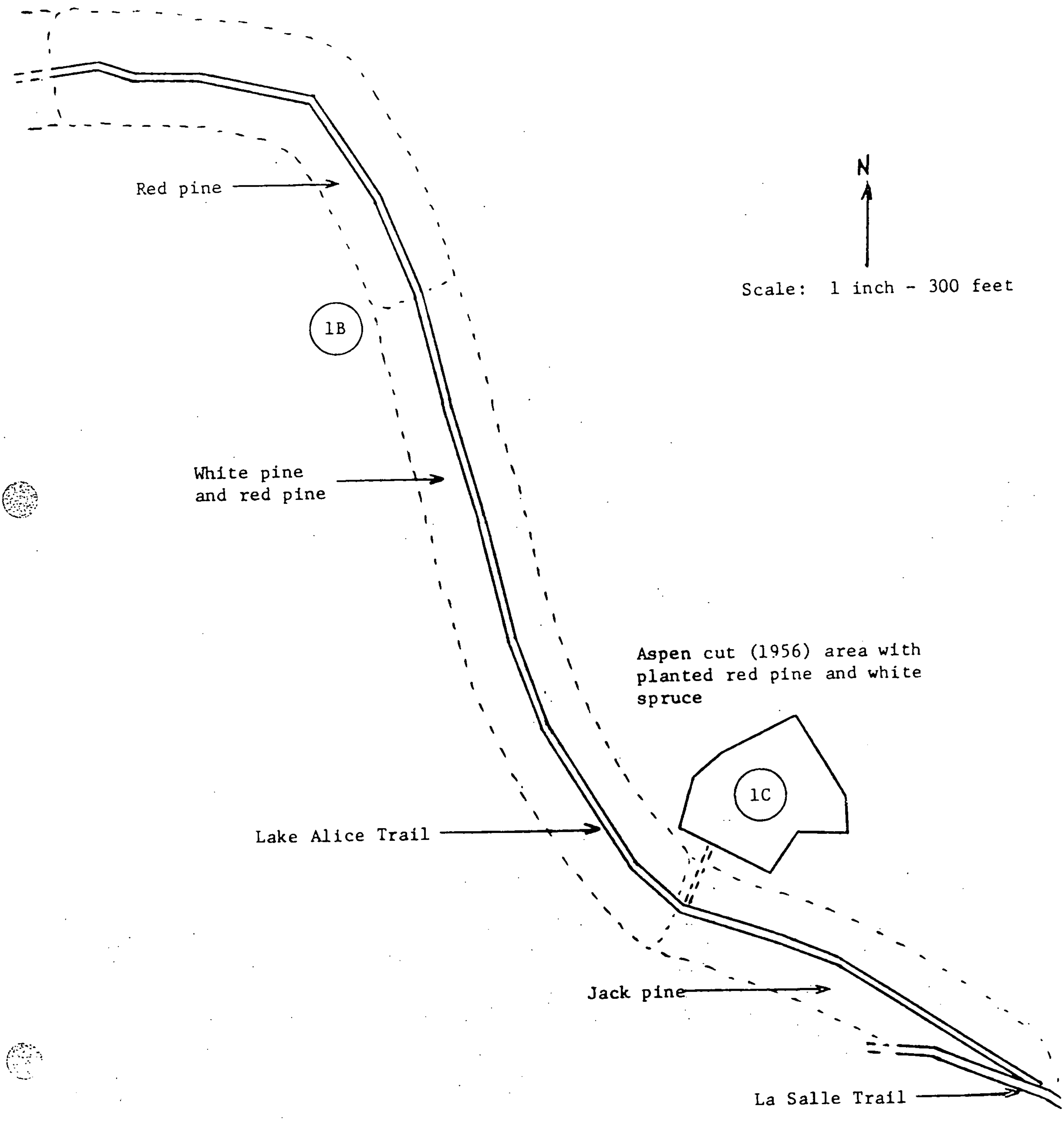


Figure 3. Treatment Area #2 - Squaw Lake
Location: T143N, R36W, Sec. 5, E½
Size: 40 acres
Cover: Aspen, plus birch and oak

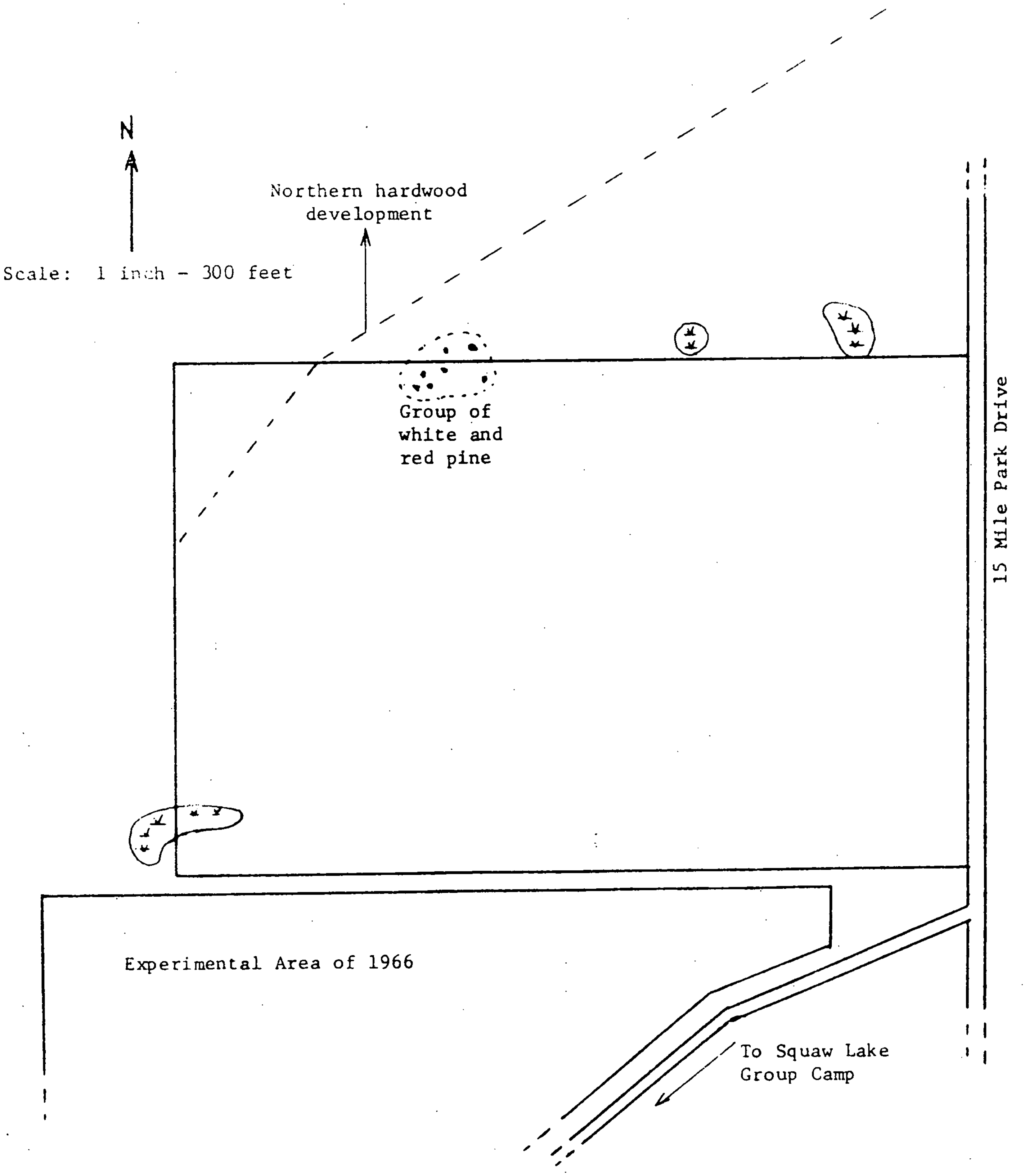
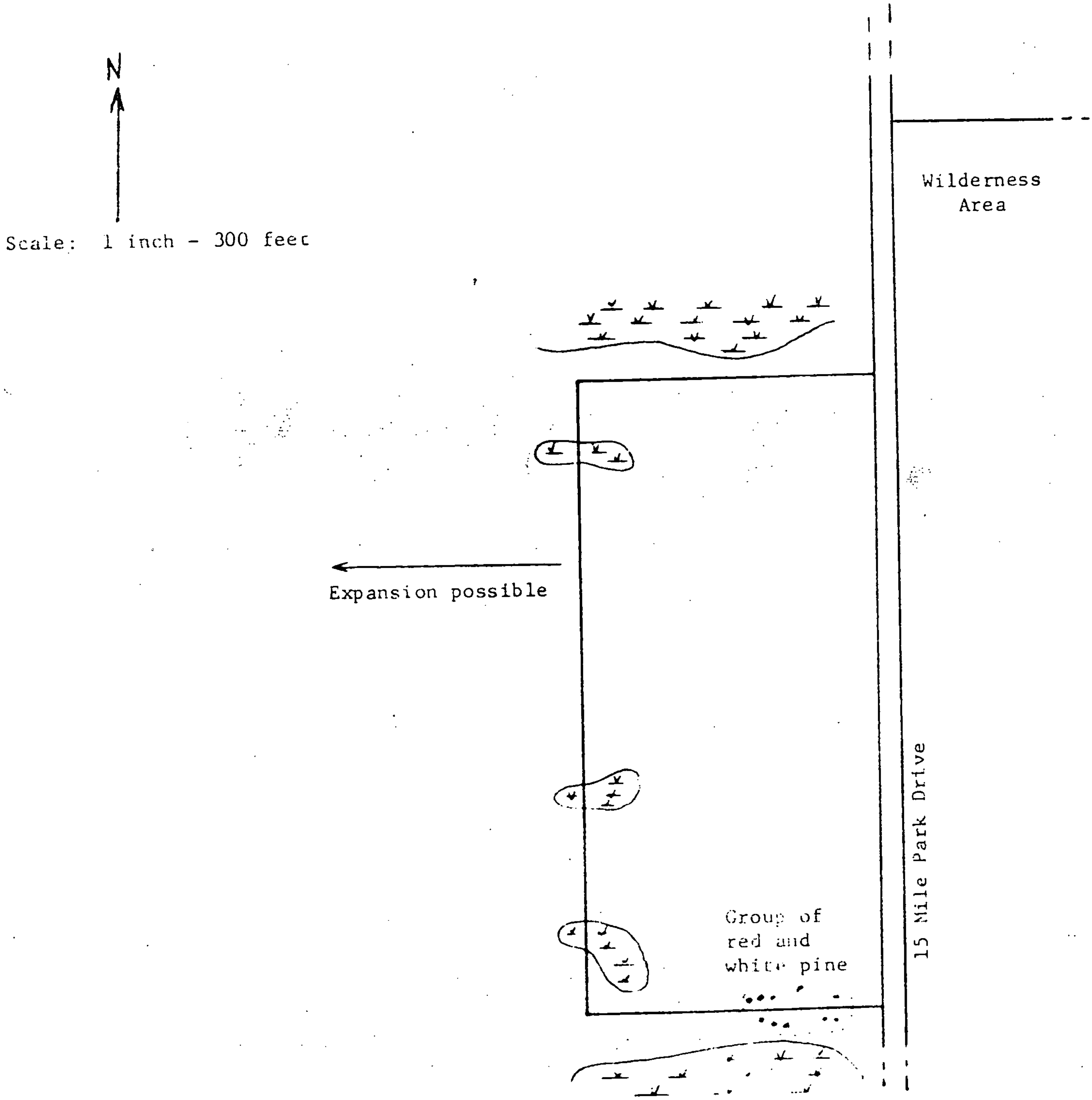


Figure 4. Treatment Area #3 - West Park Drive
Location: T143N, R36W, Sec. 8, NE¼
Size: 18 acres
Cover: Aspen



(2)

A Proposal for Research by the University of Minnesota School of Forestry on Research in Vegetation Management in State Parks and Recreation Areas

It is a matter of common knowledge that the use of national and state parks and other outdoor recreational areas is increasing at a rate even exceeding our rate of population increase. This increasing use pressure makes it urgent that the information needed as a basis for intelligent management decisions be acquired to prevent the deterioration or loss of the quality of the resource itself.

In Itasca State Park previous research has documented the need for steps to be taken to assure the regeneration and perpetuation of the pine stands which constitute one of the most valuable of the natural and recreational features of this important park. Because of the wealth of background research and management experience available in Itasca Park, it was selected as the area in which a model research plan could be developed for the acquisition of ecological information needed for management planning in recreational areas.

During the 1969-1971 biennium this research was partly supported by a $35,000 grant made from the Natural Resources Fund for the biennium. A detailed report on the progress of this research is appended. In brief the status of this investigation is as follows:

<u>Itasca State Park</u>: Basic ecological studies have been essentially completed leading to the identification of the need for obtaining regeneration of the old stands of red (Norway) and white pines as the major and critical management problem pertaining to this park. A program of testing 11 different management techniques on a pilot-scale basis was instituted with the close cooperation of the Conservation Department. These tests relate to the problems of encouraging pine regeneration.

<u>St. Croix State Park</u>: The acquisition of necessary background ecological information was initiated during the current legislative biennium and is now actively underway.

<u>Maplewood State Park</u>: A small ecological study of the regeneration of basswood, the most important component of the forest of this park was initiated and permanent plots established for continued, long period observation. Assistance was also given to park and forestry personnel in establishing a hardwood forest demonstration area in this park.

<u>Whitewater State Park</u>: Several reconnaissance trips have been made to this park to explore its suitability as an area for future research in forest types and recreational use patterns different from those already studied.

Research Needs

Itasca State Park: In order to assess the value of the 11 treatments already instituted, it will be necessary to continue the observations and data taking for several years and to summarize and evaluate the responses analytically. In addition, there are several areas which will require further study. For example, the recent ban on the use of 2,4,5-T, the most effective brush controlling silvicide available, has made it necessary to consider other means of controlling competition to tree seedlings from brush than were originally planned.

An important aspect of any future study in this park should be the refinement of the use-zones plan now in initial stages of development.

St. Croix State Park: Ecological studies will be largely completed in 1971. The research data will then be analyzed and the management-treatment testing phase of the research should be initiated focusing on the problems as identified by the background research. A unique aspect of the management treatments which should be tested here is the need for developing ways by which a substantial number of deer can be supported in the park with protection of the young pine seedlings from overbrowsing.

Because of the research experience acquired in Itasca State Park, it will be possible to reduce the time needed to initiate management tests and relate the study to the development of a use-zone plan for this park. It is visualized that if research is funded through the 1971-73 biennium a management plan can be developed in that period.

Maplewood State Park: The study of basswood regeneration should be continued and an ecological inventory should be taken of the vegetational in this park.

Whitewater State Park: Because this park is representative of the vegetation and use patterns prevailing over many of the southeastern Minnesota parks and the Memorial Hardwood Forest, it is hoped that research can be expanded into this area. The major objective of this research would be to learn how to protect and perpetuate the excellent recreational and natural resources in this part of Minnesota.

Summary of Support Requested for the 1971-73 Biennium

The research staff of the School of Forestry would propose to continue its close cooperation with the Conservation Department in the conduct of research and its extension into new areas and subjects of special needs as have been outlined.

General plan and needs:

1. Terminate the ecological studies in Itasca Park and prepare for the Conservation Department a summary of all pertinent data together with recommendations for managing the forests stands.

2. Work with the Conservation Department in testing on a pilot scale various forest treatments designed to re-establish pine in the park and keep such research records as are needed.

3. Complete the ecological studies including a vegetation type map and a soils study in St. Croix State Park.

4. Initiate together with state park and forestry staff a number of tests of fencing to prevent deer damage to pine seedlings in both Itasca and St. Croix parks.

5. Initiate studies of the use of large tree transplanters for moving sapling pine to improve the aesthetics of the park and to move shade trees to denuded camping and picnicking areas.

6. Expand ecological studies into Whitewater or other state parks where ecological and visitor use patterns are different from those already studied.

Funds needed:

	Biennium 1971-73
Research leader (Dr. H. L. Hansen)	none
Four half-time graduate research assistants	29,600
Lab and computer charges	2,000
Transportation and expenses	5,000
Total	$36,600

It is recommended that the State Division of Forestry be given continued support ($25,000 for the biennium) to carry out pilot scale tests of pine regeneration treatments working closely with the School of Forestry and its research program.

It is also recommended that the State Division of Parks and Recreation be allotted a special item of $20,000 for the biennium to purchase such equipment and material as is necessary to carry on tests of fencing against deer and special techniques of transplanting of tree saplings also working closely with the School of Forestry in the conduct of its research.

1971

A Proposal for Research on the Ecology and Management of Parks and Recreational Areas

Henry L. Hansen, Professor
College of Forestry
University of Minnesota

This is a proposal to continue the research currently being supported by the Natural Resources Fund. The details of this proposal as well as a report of progress during the current biennium have been made and distributed to members of the Minnesota Resources Commission by Vice President Wenberg's office.

The background of need for the research proposed lies in the greatly increased demand for recreational areas and facilities and the public's growing concern for quality in environment and for the protection of the natural resources involved.

With the passage of time there will of necessity be a change in emphasis by public agencies, state and federal, from land acquisition per se to the more intensive management of lands already acquired for recreational use. This project attempts to anticipate the problems that will need to be solved and to develop and initiate management solutions.

The research has 4 main aspects as follows:

1. Acquisition of a data base through research on the history and ecology of the area.
2. An inventory of present conditions and situations.
3. Identification of problems related to the protection of the environmental values and the natural resources involved.
4. The development of management solutions to these problems.

In our research we started using Itasca Park as a model because we have had a long history of research and interest in this fine area. We have had the satisfaction of carrying the research to its conclusion, namely the testing of management solutions. We have visualized our role as that of bridging the gap between the basic research process and the management function on areas administered by the Department of Natural Resources. In this we have enjoyed the close cooperation of both the Division of Parks and Recreation and the Division of Lands and Forestry.

In brief, the status of the research under this project is as follows:

1. In Itasca Park the basic studies are essentially complete. On the basis of the data accumulated certain major problems have been identified especially relating to the need for perpetuating the pine stands which are disappearing from the park. A number of treatments are being tested for regenerating pine. These are being tried on a pilot scale by the Division of Lands and Forestry cooperating with the Division of Parks and Recreation personnel with the College of Forestry aiding in maintaining records and evaluating the results. This activity is being conducted at the suggestion of the Minnesota Resources Commission in 1969 and is supported by a $25,000 item allocated to the Division of Lands and Forestry for the current biennium. We urge the continued support of this action program into the coming biennium.

2. In St. Croix State Park a similar project was initiated to study a different set of vegetation and recreational use patterns. We feel the necessary background of research data can be obtained during the projected biennium and that tests of management recommendations can then be initiated as in Itasca Park.

3. In Maplewood Park near the prairie in the Pelican Rapids area a small project was initiated to study the regeneration of basswood and other species in that area. We are also assisting the Division of Parks and Recreation and the Division of Lands and Forestry in setting up a demonstration forestry area for use by park visitors and local groups as a field laboratory for educational purposes.

4. We would like to extend our research to another area such as Whitewater Park where the vegetation of the area is either broadleaf forest or prairie and where visitor use patterns differ from those in the northern parks.

Progress Report

The Ecology and Management of Forest Recreational Areas Project

School of Forestry, University of Minnesota

January 15, 1970

1. In consultation with state forestry and park personnel a tentative management program was developed for field testing a number of silvicultural treatments to regenerate pine in Itasca State Park. Copies of this proposed program were distributed to representatives of the Minnesota Conservation Department and the University of Minnesota.

2. Three areas suitable for silvicultural treatments to induce pine regeneration were selected in the park in July 1969. The fourth area, an old growth jack pine stand near the east end of the Two Spot Trail, was added in November 1969.

3. Pre-treatment inventory data on trees, reproduction, shrubs, and ground cover were collected on 24 sets of plots in the proposed treatment areas, except the later added old growth jack pine stand. Tree plots were permanently established. A brief soil examination was made on each vegetation study plot and soil samples were collected.

4. Lake Alice Trail Treatment Area 1-A (see map in Proposed Management Program - July 1969) was subdivided into two parts. The western portion of this area with extensive scattering of old red and white pines, was set aside for burning. In the eastern portion of the area, aspen cutting was initiated in November 1969. This will be followed by site preparation (rolling) and planting of red pine and white spruce.

5. An aspen stand cut experimentally in 1956 (area 1-C) and about two acres in size, was planted to red pine and white spruce in 1957 and given an herbicide treatment on August 1969 to release the suppressed conifer seedlings from the dense overstory of aspen suckers.

6. Two aspen stands (about five acres each) east of Hwys. 31 and 71 were included in the treatment areas. These stands were selected for the 1966 research project and pre-treated by cutting aspen in 1968-69. On these two areas pre-planting site preparation was carried out: (a) herbicide treatment - August 1969 and (b) rolling - October 1969. Planting red pine plus white spruce is planned in those two areas in spring 1970.

7. Discussions of selected areas and proposed silvicultural treatments were held at Itasca Forestry and Biological Station on August 20, 1969 and in the Conservation Department, St. Paul on December 17, 1969 with participation of representatives from Parks and Recreation, Lands and Forestry, and the University of Minnesota.

8. On the basis of these discussions some modifications of the proposed plan are being considered.

Progress Report on Activities during 1969-70 in Itasca State Park under the Project "The Ecology and Management of Forest Recreational Areas"

School of Forestry, University of Minnesota

December 1, 1970

This project is supported by a fund of $25,000 allocated to the Minnesota State Conservation Department for the 1969-71 biennium to test various methods for perpetuating pine stands in Itasca State Park. The School of Forestry cooperates and assists with this project under the terms of a Memorandum of Agreement of July 7, 1969.

The following is a brief report of the accomplishments during 1969-71 listed by the various treatment areas. These areas are numbered and located on the attached map.

Lake Alice Trail treatment area (1).

The eastern portion of this area (34 acres) was planted with 21,000 Norway pine 3:0 and 2,800 white spruce 3:0 seedlings in May, 1970 after cutting the aspen in the winter of 1969-70 and mechanically rolling the area in March, 1970. A deer exclosure of about 2 acres was fenced to determine the effect of deer browsing on planted seedlings and other vegetation. Permanent plots were established to compare seedling survival, shrub resprouting, and aspen suckering.

The western portion of this area (26 acres) with scattered old Norway and white pine will be burned after cutting the aspen as soon as favorable weather conditions will permit to test the possibility of getting natural pine regeneration.

Aspen conversion areas east of Hwy. 200 (2A) and Hwy. 71 (2B).

The area east of Hwy. 200 (about 6 acres) was planted with 4,000 Norway pine 3:0 and 1,000 white spruce 3:0 seedlings. The area east of Hwy. 71 was planted with 4,000 Norway pine 3:0 and 700 white spruce 3:0 seedlings. Site preparation had been made by cutting the aspen in 1968-69, by herbicide treatment in August 1969, and by mechanical rolling in October 1969. Twenty permanent plots in each area were established to assess seedling survival and hardwood recovery.

Two Spot Trail burn area (3).

An old growth jack pine stand with some Norway and white pines and with a portion of adjacent aspen-birch forest (about 30 acres) was selected for burning. Fire lines were made around the area and pre-burn vegetation data collected in July, 1970. Three unsuccessful attempts at prescribed burning were made in the summer of 1970. The area will be burned in 1971 as weather conditions permit.

The 1956 aspen conversion area (4).

An aspen stand of about 2 acres (north of Lake Alice Trail) which had been cut in 1956 and planted to Norway pine, jack pine, and white spruce in the spring of 1957, was given an herbicide treatment in August 1969 to release the suppressed conifer seedlings from the dense overstory of aspen suckers. This treatment resulted in only a partial kill of the aspen. Release of conifers was completed by cutting the remaining aspen suckers in July, 1970.

The 1946 park entrance Norway pine plantation (5).

This plantation had been established in 1946 following a small fire east of the main park entrance. Suppressed and crowded Norway pines were released by cutting overtopping aspen and some badly leaning Norway pine in June, 1970.

Old CCC pine-spruce plantation (6).

At the suggestion of the Park Naturalist this plantation (1937-40) was delineated as one in which the results of various forest stand treatments could be observed by park visitors and compared with untreated conditions. Suppressed Norway pines were released by removing overtopping aspen in part of the plantation in June, 1970. Pure Norway pine and a mixture of Norway pine and white spruce stands (about one acre each) were selected and delineated October, 1970 and thinning, pruning, and cleaning activities completed in November. A foot trail is planned to guide park visitors through treated and untreated portions of the plantation as well as the adjacent forest.

Squaw Lake aspen conversion area (7).

Treatments in this area have been delayed because the poor pulpwood market situation precluded the disposition of any trees cut in the area.

Controlled burning sites.

Exploration was conducted in the summer of 1970 to locate potential burn areas in the park. This was done in consultation with Itasca Park and Division of Lands and Forestry personnel and considering a number of suggestions made by others strongly interested in the use of fire as a management tool in the park. Accessibility of the areas and establishment of firebreaks are factors being considered as well as the nature of the forest vegetation itself.

Itasca Park use zonation plan.

As a result of the research conducted in Itasca Park it is apparent that there are various ecological conditions as well as several levels of use intensity which are prevalent and proper in different parts of the park. In addition, because of the multiple uses being made of the park (camping, hiking, nature interpretation, picnicking, etc.) it is necessary to recognize different kinds of management activities appropriate for different parts of the park.

Accordingly, a map was prepared delineating four levels of use intensity and delineating such use-zones within the park. These levels were described and related to the kinds of management activities considered appropriate. This plan was further discussed with the Natural and Scientific Area Advisory Committee and a more detailed plan was developed and recommended to the Division of Parks and Recreation for their consideration.

Progress Report on Activities during 1971-72 in Itasca and St. Croix State Parks under the Project "The Ecology and Management of Forest Recreational Areas"

Dr. Henry L. Hansen, Project Leader
Dr. Vilis Kurmis, Field Supervisor

College of Forestry, University of Minnesota

June 8, 1972

This project is supported in part by a fund of $25,000 allocated to the Minnesota Department of Natural Resources and administered by the Division of Lands and Forestry in cooperation with the Division of Parks and Recreation. The College of Forestry cooperates and assists primarily by conducting research on the problems involved, by recommending vegetational management procedures, and by maintaining detailed records that will help evaluate the results of the vegetational treatments being tested. A fund of $5,400 is made available annually to the College of Forestry from the $25,000 to help support this activity. The conduct of the work at Itasca Park including tree planting, seeding, burning, logging, spraying, and other related treatments are done under the supervision of Mr. Vernon Miller, District Forester under the Bemidji Area office, coordinating with Mr. Waino Kontola, Itasca Park Manager. Activity at St. Croix State Park up to the present has consisted entirely of research by the College of Forestry with the cooperation of Mr. Norman Reitan, Park Manager. During the coming year management related activities will be undertaken which will also involve appropriate personnel of the Division of Lands and Forestry.

An extension of the Memorandum of Agreement originally made July 1, 1969, has been consumated providing for a continuation of this cooperative arrangement until July 1, 1973.

The College of Forestry considers this project to be an excellent example of how basic ecological research information can be translated into an active management program. We value this working arrangement with the Department of Natural Resources and the Divisions of Lands and Forestry and Parks and Recreation and look forward to its continuation.

Itasca State Park

Following is a brief report of the accomplishments during 1971 and the first part of 1972 listed by the various areas. The initial work in several of these areas was covered in the progress report of December 1, 1970. These areas are numbered as in the previous report and, with the additional treatment areas, are shown on the attached map.

Lagoon area (referred to as Lake Alice Trail area in previous reports) (1)

The eastern portion of this area (34 acres) was planted with Norway pine and white spruce in May 1970. Aspen had previously been cut from the area in the winter of 1969-70. In this area Norway pine seedlings suffered heavily from the exceptionally dry summer in 1970, extensive deer browse, and aspen suckering. Survival counts and estimates on deer damage to pine seedlings were made in April 1971 and May 1972, and the competing vegetation such as hardwood reproduction, shrubs, and herbs were evaluated on permanently established plots in July 1971. Aspen suckers were sprayed with 2, 4-D in August 1971. About 1000 white spruce seedlings were planted in the area by forestry students in September 1971. In May 1972, an additional 22,000 Norway pine, 8,000 jack pine, and 1,000 white spruce seedlings were planted in the area to fill in where seedlings had died or were browsed. The planting stock was obtained from the Badoura Nursery using seed collected from local Itasca Park sources.

The western portion of this area (26 acres) with scattered old Norway and white pine was burned on May 17, 1972 after cutting the aspen in 1970-71. Seeding of Norway pine (7 lbs.) and jack pine (3 lbs.) is planned in the burned area to supplement natural seeding from the old growth pines.

Aspen conversion areas east of Hwy. 200 (2A) and Hwy. 71 (2B).

These areas (each 6 acres in size) were planted with Norway pine and white spruce on May 1970 after cutting the aspen in 1968-69 and preparing site by herbicide treatment and mechanical rolling to reduce aspen suckering. Survival counts of planted seedlings in April 1971 and May 1972 indicated that drought and deer damage was less in these areas, especially in the area east of Hwy. 71 which is farther away from conifer cover used by deer in the winter, than in the Lake Alice treatment area. Competing hardwood, shrub and herb growth was also evaluated on permanently established plots in July 1971. An additional 3,000 and 1,000 Norway pine seedlings were planted in areas east of Hwy. 200 and Hwy. 71 in May 1972, respectively.

Two Spot Trail burn area (3).

An old growth jack pine stand with some Norway and white pines and with a portion of adjacent aspen-birch forest (about 30 acres) was burned in May 1971. Preburn vegetative conditions had been recorded in plots established in 1970. The data collected in the burn area in July 1971 shows the elimination of shrub aerial stems, however, resprouting is vigorous. Jack pine reproduction was not initiated in appreciable numbers. Repeated burning is planned for 1973. The primary objective on this area is to test the possibilities for reestablishing pine stands by using repeated burns and supplementing natural seeding by sowing pine seeds collected from local sources.

The 1956 aspen conversion area (4).

An aspen stand of about 2 acres in size was clearcut in 1956 and planted to Norway pine, jack pine, and white spruce in the spring of 1957. The planted conifers were released from aspen competition in 1969-70. Measurements on Norway pine and white spruce response to the removal of aspen suckers will be carried out in late summer 1972 and 1973. Detailed records have been kept of the treatments and vegetational changes on this area for the 16-year period involved. This test area has demonstrated that it is possible to restore the early pine stands in the park.

The 1946 park entrance Norway pine plantation (5).

Work is completed in this area and is additional proof that pine stands can be re-established in Itasca Park given proper cultural treatment.

Old CCC pine-spruce plantation (6).

The work in establishing a forestry demonstration area for park visitors was completed in 1971. This was done at the request of Mr. Ben Thoma, Park Naturalist. The planned foot trail was established with stations at different parts of the treated and untreated portions of the plantation. Written explanations were provided to the visitors for each station. A complete report on this demonstration area project was prepared by Dr. Vilis Kurmis and copies submitted to Park Naturalist, Ben Thoma, District Forester, Vernon Miller, and Park Manager, Waino Kontola.

Squaw Lake aspen conversion area I (7).

The area east of Squaw Lake (15 acres) was planted with 15,000 Norway pine, 2,000 jack pine, and 1,000 white spruce seedlings in May 1972 after cutting the aspen in the winter of 1971-72 and mechanically rolling the area in February 1972. Patches of paper birch and oak in the northern portion of the area were left uncut to provide variety in the future stand composition for aesthetic purposes.

The northern portion (2 acres) of an adjacent aspen cutting area (1967-68) was planted with 2,000 Norway pine and 1,000 jack pine seedlings in May 1972 after spraying the aspen suckers and shrubs in August 1970. The southern portion of this area (6 acres in total) was used for experimental purposes in the past years.

Squaw Lake aspen conversion area II (8).

An area (about 40 acres) between the above mentioned 15-acre treatment area and Squaw Lake is being prepared for conversion to pine. The aspen overstory will be removed and the slash allowed to dry to provide a hot enough fire to help kill resulting aspen suckers. Repeated burn, if needed, is planned in this area preceding pine planting.

Old Bemidji Road jack pine area (9).

The area west of Hwy. 200 (3 acres) was planted with 2,000 Norway pine in May 1971 after cutting the old growth jack pine in February 1971, mechanically rolling and burning the slash in March and April 1971. In May 1972, the plantation was filled in with an additional 500 Norway pine and 500 jack pine seedlings. This plantation may serve as the source of Norway pine transplants in later years for transplanting large stock using the Vermeer or other tree movers.

Aspen survey in Itasca Park.

This survey was made to determine the range of site variation on which aspen is present in this area, its association with other species, age range, reproduction conditions, and successional stages. This type of data will help to classify aspen sites and give better understanding about their ecological relationships and possibilities for conversion to pine with the least interference to natural conditions. Results of this survey will be presented in an aspen symposium to be held in Duluth in August 1972.

Controlled burning sites.

An area west of Squaw Lake (about 200 acres) consisting of jack pine and aspen types is considered and has been given a reconnaissance survey for burning. Partial cutting of jack pine and aspen is planned to increase the fuel on the ground. This burn will be coupled with a basic study of nutrient movements in litter and surface mineral soil layers of forest ecosystems and the influence on eutrophication of adjacent lakes and ponds.

St. Croix State Park

Basic studies of the ecology of this park were initiated by a reconnaissance survey of the forest stands in 1967. Subsequently permanent plots were established on 31 selected forest stands characterizing the range of ecological conditions within the park. Intensive studies were made of the vegetation and soils in these forest stands.

Tree plantings made in the park in the spring of 1968 have been examined annually by Mr. Fedkenheuer of the College of Forestry to evaluate mortality and deer browse effects.

Because of the importance of the deer herd as a park attraction and the relationship to pine regeneration of excessive deer browsing, a study of the use of various forest stands in winter conditions was made in 1970. Further data were collected in 1972. The results of the 1970 study and an evaluation of their significance to the management of the park vegetation is contained in Minnesota Forestry Research Notes No. 223.

During 1971 a reconnaissance of several areas was made to determine their suitability for testing the use of burning to prepare sites for restoring Norway pine stands to the park. Two areas were selected and plots were established on which the present vegetative conditions have been documented. Arrangements will be made with forestry and park personnel for burning these areas during the coming year.

The following publications have been prepared in connection with research conducted in Itasca and St. Croix State Parks by the College of Forestry supported in part by funds from the Minnesota Resources Commission:

Fedkenheuer, A. W. and H. L. Hansen. 1971. Winter Cover Type Use by White-tailed deer (Odocoileus virginianus) in St. Croix State Park, Minnesota. Minnesota Forestry Research Notes No. 223. 4 pp.

Frissell, Sidney S., Jr. 1968. A Fire Chronology for Itasca State Park, Minnesota. Minnesota Forestry Research Notes No. 196. 2 pp.

Hansen, H. L. 1967. Ecological and Silvicultural Research on Forest Recreational Areas. Minnesota Science 23(3):42-43.

Hansen, H. L. 1969. Our Parks in Profile and Ecology as our Management Guide. Conservation Volunteer. pp. 36-45.

Hansen, H. L. and A. C. Hodson. 1968. Tree Suppression and Prediction of Mortality in an Aspen Stand in Itasca State Park. Minnesota Forestry Research Notes No. 198. 4 pp.

Hansen, H. L. and V. Kurmis. 1972. Natural Succession of Aspen Stands in North-central Minnesota. Aspen Symposium in Duluth (1972). U.S.D.A. For. Serv., North Central For. Exp. Sta. (In press).

Klukas, R. W. and D. P. Duncan. 1967. Vegetational preferences among Itasca Park Visitors. Journal of Forestry. pp. 18-21.

Kurmis, V., A. Fedkenheuer, M. Grafstrom and R. A. Hesse. 1970. Tree Reproduction and Shrubs in Relation to Stand and Site Conditions in St. Croix State Park, Minnesota. Minnesota Forestry Research Notes No. 217. 4 pp.

Kurmis, V. and H. L. Hansen. 1969. Occurrence and Distribution of Pine Reproduction in Itasca State Park, Minnesota. Minnesota Forestry Research Notes No. 210. 4 pp.

Kurmis, V. and H. L. Hansen. 1969. Reproduction Characteristics of Upland Forest Communities in Itasca State Park, Minnesota. Minnesota Forestry Research Notes No. 209. 4 pp.

Kurmis, V., D. D. Ness and H. L. Hansen. 1970. Characteristics of Forest Stands in Relation to Edaphic Conditions in St. Croix State Park, Minnesota. Minnesota Forestry Notes No. 216. 4 pp.

Kurmis, V. and H. L. Hansen. 1972. Pine Reproduction in Itasca State Park, Minnesota: An Analysis in Moisture-Nutrient Coordinates. J. Minnesota Acad. Sci. (In press).

Potton, J. E., H. L. Hansen and L. C. Merriam, Jr. 1968. Visitor Reactions to Vista Clearings in Itasca State Park, Minnesota. Minnesota Forestry Research Notes No. 197. 4 pp.

West, P. C., L. C. Merriam, Jr. and H. L. Hansen. 1968. An Exploratory Study of Selected Attitudes and Perceptions of Itasca State Park Users. Minnesota Forestry Research Notes No. 188. 4 pp.

The Ecology and Management of State
Parks and Recreational Areas 1/

A Report on the Progress of Research Conducted by the University of Minnesota School of Forestry Cooperatively with the Minnesota State Conservation Department 1969-71.

Studies under this project are underway in Itasca, St. Croix, and Maplewood State Parks and have been made possible through state funds from the Natural Resources Act 2/.

Results of the ecological studies in Itasca Park indicate that the highly prized old growth red (Norway) pine stands that are lost through blowdown and other factors related to their great age are not being replaced by young pine. As a result of these studies the School of Forestry is cooperating with the Conservation Department in the pilot scale testing of various management techniques to regenerate these pine stands 3/.

Itasca State Park

During the previous (1967-69) biennium research on the basic ecology of the forests in this park demonstrated clearly that:

(1) The pre-settlement forests of this area had considerably more white pine and red pine than is now present.

(2) There is an almost complete absence of young pine in the park to replace the old pine stands which are being lost by old age and windthrow.

(3) The failure of pine to regenerate is related to natural ecological succession from pine to hardwood species in the absence of fire or other major disturbance, to the heavy browsing by deer particularly before the park was opened to hunting in 1945, and to the suppression of pine seedlings by the dense brush canopies now present in these forest stands.

(4) Former pine stands have been replaced in large measure by aspen, a species with relatively low aesthetic appeal and one which dominates several millions of acres elsewhere in Minnesota.

(5) Based on the trends of ecological succession of most of the upland forest stands in the park, the present old growth pine stands will not be replaced by young pine when they die and much of the present aspen acreage is dying.

1/ Prepared by Dr. H. L. Hansen, Research Project Leader, School of Forestry, Univ. of Minn., St. Paul.

2/ An appropriation of $35,000 was made by the 1969 State Legislature to the School of Forestry for the biennium to conduct this research. Because of the long term character of the project, its completion is dependent on continued state support.

3/ The 1969 State Legislature appropriated $25,000 for the biennium to the Conservation Department for these management tests. The School of Forestry is assisting in the research and record keeping aspects of this project.

Because of the above, it is felt that the major vegetational management problem centers on the coversion of some of the present aspen acreage back to its pre-settlement pine composition. Accordingly, pilot scale testing of a number of stand conversion methods was begun under this project as follows:

1. Clearcutting the aspen overstory trees, mechanically rolling the area to reduce the slash, followed by hand planting about 500 trees per acre of white spruce and red pine.

2. Precutting, rolling, and planting as in (1) followed by controlling competition from aspen suckers and brush arising after planting by spraying with herbicides.

3. Planting white spruce and red pine under the shade of existing aspen overstory.

4. Seeding in prepared seed spots using white spruce and red pine seed under aspen overstory trees.

5. Burning under controlled conditions areas within natural seeding distance of old pine trees.

6. Seeding of burned areas using red pine and white pine seed.

7. Logging aspen followed by controlled burning to reduce the slash and to prepare a seedbed for the seeding of white spruce and red pine.

8. Spraying brush with herbicides prior to logging the overstory trees and planting with white spruce and red pine.

9. Treatment (8) followed by a second spraying to reduce competition from aspen suckers and brush several years after the tree planting.

10. The use of electric shock fencing on several of the above treatment areas to minimize deer browsing of the tree seedlings.

11. The use of conventional fencing to minimize deer browsing.

Of the above listed treatments (1), (2), (3), (4), (8), and (9) have been initiated. In addition, (5), (6), (7), (10), and (11) are expected to be initiated during the current year (1970). The use of prescribed burning is contingent upon favorable weather conditions. Areas have been selected, firebreaks established, and pre-burning vegetation inventories have been made so that burning can proceed as conditions permit.

In order to carry out the 11 kinds of vegetational management procedures, 7 separate areas have been selected varying in size from about 5 to 50 acres.

Most of the planting, spraying, logging, and other mechanical treatment has been done under the direct supervision of Mr. Vernon Miller of the State Division of Lands and Forestry at Itasca Park and with the cooperation of Mr. Waino Kontola of the State Division of Parks and Recreation at Itasca Park. The prescribed burns will also be made under this arrangement. The Division of Lands and Forestry was funded by the 1969 legislature upon recommendation of the Minnesota Resources Commission to cooperate in carrying out these tests.

During the biennium discussions of the nature, progress, and results of the studies have been held with Conservation Department staff and University researchers and with the advisory committee on Natural and Scientific Areas. In addition, some of the research findings have been reported to the Minnesota Council on State Parks and to the Minnesota Academy of Science. An official report of earlier findings was made to the Minnesota Resources Commission in October, 1968.

One of the results of this research has been the development of a tentative plan of use zoning for Itasca Park prepared in discussions with Conservation Department staff. This plan defines and delineates four zones in which differing levels of use intensity are permitted and appropriate management activities related to them. These patterns of zonation are currently being considered for more detailed definition.

St. Croix State Park

Research in this park was initiated later than in Itasca Park, and the primary emphasis is still on acquiring the basic ecological information together with some visitor use data upon which management recommendations can be made later. St. Croix Park was selected because it is a major state park in which both the vegetation and the visitor use patterns differ from those in Itasca Park.

Because St. Croix Park does not have either a vegetation or a soils map, both of which are needed as a basis for ecological studies, considerable time has been spent on acquiring vegetation and soil information. These studies are still underway. To date, information has been obtained on these features from an examination of 130 forest stands representative of the total range of conditions in the park.

Because deer are both an important recreational resource and a threat to young pine on which they browse in the winter, a study was made of where deer concentrate when snow covers the ground. Two airplane surveys and several road and trail surveys by truck and snowmobile were made in March and April of 1970. These surveys revealed that the deer concentrated almost exclusively in coniferous stands and in those portions of the park where such stands occur.

In 1968 trial plantings were made by park and forest personnel in an attempt to improve the aesthetics of the entrance area in the park. The success of the plantings has been assessed by the research crew, and it is obvious that they have been almost decimated by deer browsing.

Information collected in the study of the vegetation in the park led to the establishment in 1969 of the first "Natural Area" to be created under the provisions of the legislative authorization of a state natural area system in 1969.

During the summer of 1969 a study of visitor use of this park was conducted. This provided data on the visitors using the park, where they came from, what they were interested in doing, how long they stayed, what parts of the park they used, and much other information needed for management decisions and planning. These data are now being summarized and will be reviewed with staff of the State Department of Parks and Recreation.

Maplewood State Park

This park is located in the transitional zone between the forest and the prairie and is of special ecological interest. It contains some well preserved stands of northern hardwood forest with sugar maples, basswood, oaks, and ironwood in close proximity to prairie vegetation. It has a different pattern of use from Itasca Park.

Because basswood is an important constituent of the forest of this area and because little is known of its juvenile life stages, and of factors affecting its regeneration, a set of permanent plots was established on which annual records are being kept of the germination and development of tree seedlings under a variety of conditions. This is being done together with the State Division of Lands and Forestry, Park Rapids Supervisor's Office.

The School of Forestry assisted the Division of Lands and Forestry and the Division of Parks and Recreation in setting aside of a tract of 40 acres within the park as a hardwood demonstration area and helped plan a series of appropriate treatments which could be used to demonstrate how such stands could best be managed on private farm lands in this area.

Whitewater State Park

A reconnaissance survey was made of this park in Winona County anticipating that more detailed studies could be initiated during the coming biennium (1971-73). The Whitewater Park forest is representative of the forest that occurs on much of southeastern Minnesota where several other parks and the Memorial Hardwood Forest occur. Any ecological and management information obtained from research in this park can have wide application to these other areas. It is hoped that research funds can be made available for this purpose for the 1971-73 biennium.

Recent Project Publications

Frissell, Sidney S., Jr. A Fire Chronology for Itasca State Park, Minnesota. Minnesota Forestry Research Notes No. 196. 2 pp. October 1968.

Hansen, H. L. Ecological and Silvicultural Research on Forest Recreational Areas. Minnesota Science 23(3):42-43. April 1967.

Hansen, H. L. Ecological Implications of the Management of Itasca State Park to Meet Recreational Objectives. Forestry Research Progress in 1967. Mc-Intire-Stennis Cooperative Forestry Research Program, Cooperative Research Service, U.S. Dept. of Agriculture. pp. 63-65. April 1968.

Hansen, H. L. Our Parks in Profile and Ecology as our Management Guide. Conservation Volunteer. pp. 36-45. May-June 1969.

Hansen, H. L. and A. C. Hodson. Tree Suppression and Prediction of Mortality in an Aspen Stand in Itasca State Park. Minnesota Forestry Research Notes No. 198. 4 pp. October 1968.

Klukas, R. W. and D. P. Duncan. Vegetational Preferences among Itasca Park Visitors. Journal of Forestry. pp. 18-21. January 1967.

Kurmis, V., A. Fedkenheuer, M. Grafstrom and R. A. Hesse. Tree Reproduction and Shrubs in Relation to Stand and Site Conditions in St. Croix State Park, Minnesota. Minnesota Forestry Research Notes No. 217. 4 pp. April 1970.

Kurmis, V. and H. L. Hansen. Occurrence and Distribution of Pine Reproduction in Itasca State Park, Minnesota. Minnesota Forestry Research Notes No. 210. 4 pp. October 1969.

Kurmis, V. and H. L. Hansen. Reproduction Characteristics of Upland Forest Communities in Itasca State Park, Minnesota. Minnesota Forestry Research Notes No. 209. 4 pp. October 1969.

Kurmis, V., D. D. Ness and H. L. Hansen. Characteristics of Forest Stands in Relation to Edaphic Conditions in St. Croix State Park, Minnesota. Minnesota Forestry Research Notes No. 216. 4 pp. April 1970.

Potton, J. E., H. L. Hansen and L. C. Merriam, Jr. Visitor Reactions to Vista Clearings in Itasca State Park, Minnesota. Minnesota Forestry Research Notes No. 197. 4 pp. October 1968.

West, P. C., L. C. Merriam, Jr. and H. L. Hansen. An Exploratory Study of Selected Attitudes and Perceptions of Itasca State Park Users. Minnesota Forestry Research Notes No. 188. 4 pp. January 1968.

A Proposal for an Experimental Burn
in Itasca State Park

Beginning with the research of Mr. Clifford Ahlgren in early 1950's at the Quetico-Superior Wilderness Research Center increasing interest has been given to the use of controlled or prescribed burning to attain various forest management objectives. Since that time a considerable amount of research and experience derived information has accumulated dealing with the techniques of conducting such fires, the conditions necessary for successful burning, and the effects of fire ecologically. However, much remains to be learned about the effects of fire on specific forest stands, on the nutrient cycling in forest ecosystems, and on the general effects on watersheds and lake eutrophication processes.

At the recommendation of the Minnesota Resources Commission the Department of Natural Resources has been allocated funds for the perpetuation of pine and for the restoration of forest conditions of pre white-man times in Itasca Park. The College of Forestry has been commissioned to cooperate with the Department of Natural Resources in the research and record keeping aspects of this project. In this connection and relative to the current proposal a number of projects have been underway at Itasca Park during the past several years including an experimental burn of about 30 acres on the Two Spot Trail in 1971 and another burn of 26 acres near the sewage lagoon in May 1972.

An additional burn is now proposed in the northwest corner of the park. The primary purpose of this burn would be consistent with the purposes of the MRC to encourage the restoration of pine types in Itasca Park. The jack pine type now occupies only about 1800 of the 32,000 acres in the park. There is ample evidence that the park area had a considerably greater jack pine acreage in pre park years. This fire dependent species is definitely disappearing in the absence of wild forest fires.

The area proposed for burning contains a substantial acreage of the jack pine type. It is composed of old decadent jack pine suffering heavy attrition by wind damage. The burn area would include this stand and attempt to regenerate it by running a fire through it of sufficient intensity to open the cones for reseeding in the natural process. Some pre cutting would be done to provide a slash fuel supply to insure a hot enough fire. Supplemental seeding would be done if and where needed to ensure regeneration.

The proposed project has been discussed with and the area visited by forestry and park personnel most closely involved with Itasca Park who have indicated their support and willingness to cooperate. Because of the unique opportunities which such a burn would provide for research on the effects of forest fires on watersheds, water quality, and lake eutrophication processes, the College of Forestry would invite the research cooperation of other environmental specialists especially those in soil and water related areas.

Following is a description of the proposal:

1. Objectives:

   a. To test the use of fire with and without supplemental measures to regenerate jack and red pines.

   b. To study the effects of forest fires on the flow of nutrients in forest litter and in mineral soils.

   c. To study the general effects of forest fires on watersheds and on the eutrophication of ponds and lakes.

2. The area: Approximately 200 acres in sections 5 and 6, T143N, R36W, west of Squaw Lake (see attached map). Several forest cover types occur in this area including aspen stands of several densities and with varying understories, old growth jack pine stands, and upland and lowland brush types.

Drainage from the area is primarily via two intermittent streams to Squaw Lake. These provide many micro and macro relief conditions in which nutrient movements can be studied in relation to watersheds and lakes.

3. Research outline. Following are the general steps planned in a time sequence:

   a. Reconnaissance of the area to determine fireline locations which will include the desired types and site conditions. This has already been done. The availability of water for fire fighting and the accessibility for fire fighting equipment has also been considered.

   b. The area will be sampled by permanent plots so as to document its preburned condition as a reference point for future studies.

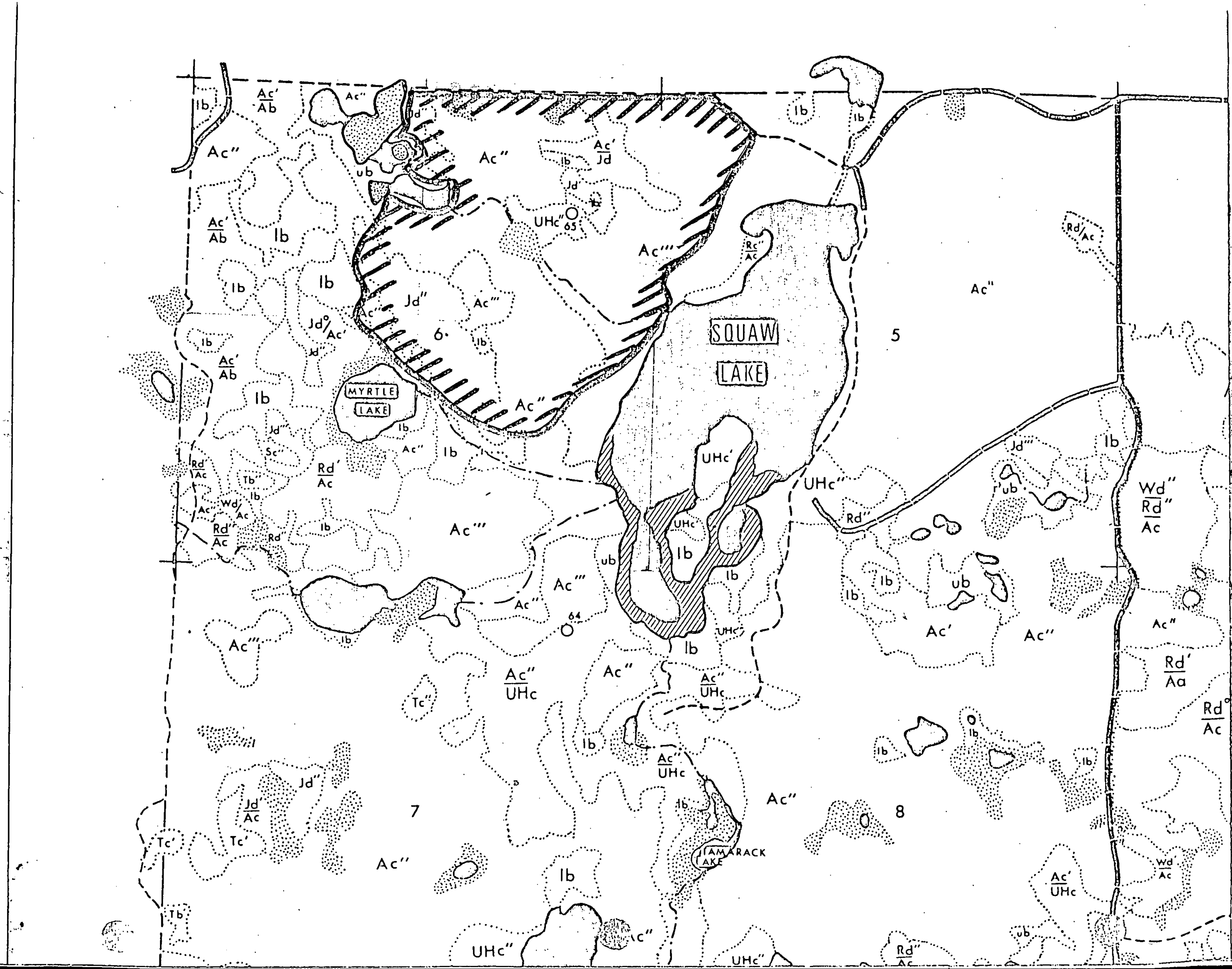
   c. Portions of the area will be partially pre-logged to provide sufficient fuel on the ground to insure a fire of sufficient intensity to open jack pine cones and to kill the brush as much as possible.

   d. After the slash has dried, the area will be burned.

   e. Supplemental seeding using jack and red pine seed of local origin and where needed will be made on selected areas.

   f. Using the permanent plots, lysimeters, and equipment for sampling the soil and water the effects of the fire will be followed and documented.

   g. The documentation will be continued long enough to assess the full effects and responses to the fire.



SQUAW
LAKE
MYRTLE
LAKE
TAMARACK
LAKE
5
6
7
8
65
64
Ac''
Ac'
Ac'''
Ib
ub
Jd''
Jd'
Jd'''
UHc'
UHc''
UHc
Ac'/Ab
Ac'/Jd
Jd°/Ac'
Rc'/Ac
Rd/Ac
Rd'/Ac
Rd''/Ac
Rd''
Rd'
Wd/Ac
Wd''/Rd''/Ac
Rd'/Aa
Rd°/Ac
Ac''/UHc
Ac'/UHc
Jd/Ac
Sc''
Tb''
Tb
Tc''
Tc'

The following changes or additions are made to the research outline (item 3) in " A Proposal for an Experimental Burn in Itasca State Park."

1. Some pre-burn experimental data were obtained from the area in the 1972 field season. From an initial selection of 15 possible sample sites, 6 were finally selected representing the following cover types:

    red pine
    jack pine (2 stands of different densities)
    lowland hardwood
    upland hardwood (aspen, birch, some oak)

    Sampling was conducted at intervals during the summer to determine seasonal variations as follows:

    Terrestrial Sampling

    a. Through fall (quantity and concentration of nitrate, ammonium, ortho phosphate; total P, K, Mg, Mn, Ca, Bo, Ca, Fe, Na, Mo, Al, Zn) sampled on a monthly basis.
    b. Total litter accumulation - to be determined annually and analyzed for the 12 elements in (a). Collected monthly.
    c. Litter leachate (quantity and analysis for items in (a)).
    d. Extractable organic soil items (a) using soil columns removed on a monthly basis.
    e. Precipitation. Collected monthly from 5 sampling points in open areas within the tract. Analyzed for items in (a).

    Stream Sampling

    a. Runoff. A flume was installed in a stream bisecting the area and an automatic water sampler will be functional for the spring runoff of 1973. Total discharge and the items in (a) will be obtained.
    b. Three Sutro weirs and automatic water samplers will also be installed on intermittent streams for heavy spring and storm runoff measurements.

    Aquatic Sampling

    Squaw Lake, Myrtle Lake, and two small ponds were sampled monthly (and will also be in 1973) for:

    Temperature profile
    dissolved oxygen
    turbidity (Secci disk)
    depth
    concentration of particulate organic and inorganic matter
    concentration of Chlorophylla and Pheo pigments
    minerals outlined in (a)

2. Proposed sampling for 1973

Monthly sampling for items outlined with modifications during winter months. Vegetation descriptions from permanently located plots from which post fire changes can be recorded. Soil sampling and profile descriptions.

From the above data it is hoped to document the effects of various management practices (fire, partial cutting) on the cycling of nutrients in forest ecosystems and possible effects on aquatic systems.

Proposal for a Study of the Historical Aspects of Logging in Itasca State Park

Studies over the past several years have identified disturbance as a major factor in determining the characteristics of the pre-white man vegetation of Itasca State Park. Studies in the 1950's by Spurr (1954) and Hansen and Duncan (1954) linked the occurrence of pine stands in the Park to past fire history. More intensive studies during the 1960's examined the historical aspects of burning in the Park and the effects of disturbance (and more recently the lack of disturbance) on the dynamics of upland forest succession and the status of advanced regeneration.

Frissel (1968, 1973) determined the frequency of pre-white man fire, provided dates for the major fires, identified pine stands regenerated as a direct result of given fires, and estimated the distribution of selected fires. Ness (1971) has shown that most pine (and hardwood) stands in the park date from specific disturbances. Studies by Kurmis (1969) and Ness (1971) indicate that the lack of disturbance within the Park over the last 50 to 60 years is resulting in a significant alteration in the Park's vegetation. Pine stands are being replaced by shorter lived hardwood species.

While considerable emphasis has been placed on the study of pre-white-man fire, logging and associated slash fires during the period 1900 to 1920 were the most recent disturbances to have occurred in the Park. Extensive logging and burning in the western one-third of the Park resulted in what may be the most significant alteration in the species composition of these forests in the past several thousand years. Removal of seed sources by logging, and the subsequent destruction, by fire, of any regeneration which may have occurred, resulted in a conversion of much of the area from pine to aspen and birch.

These last disturbances apparently differed significantly from earlier disturbances with respect to their effect upon plant community development. Post logging communities have not been studied extensively, however. The effects of early logging and slash burning have received relatively little study and current studies by W. A. Patterson are hampered by a lack of historical data on the extent and nature of the logging operations. In a survey of early logging records, Dobie (1959) found that data was incomplete and difficult to interpret. Written records, in many cases, have been destroyed. Vegetation studies currently under way in logged areas indicate that the direct effects of logging are often masked by subsequent slash fires. Thus few stands in the park can be traced directly to logging.

Despite the difficulties encountered, some information does exist, both in the written records and on the landscape. Current studies indicate that, in the area of Squaw Lake especially, old logging railroad grades, the remains of structures, and even some artifacts can be located and traced directly to known logging operations in the period 1904 to 1918. The Squaw Lake watershed differs from the areas logged around Lake Itasca in that subsequent modifications to the landscape have not obliterated the logging record.

It is proposed that the following studies be undertaken.

1. A review of historical records including historical society materials, newspaper files, photographs, and conversations with people having information on the history of the Park from 1900 to 1920. This would be more intensive than the review by Dobie (1959) and concentrate on activities in the Squaw Lake area.

2. Location of logging railway grades, sled roads, and logging camps in the area of Squaw Lake. In some areas the evidence appears sufficient for the reconstruction of some old structures and trails.
3. Sections of trees cut during both early and current logging operations will be examined in order to verify or add to information gathered under land 2 above.

W. A. Patterson is presently attempting to interpret the effects of current management west of Squaw Lake with respect to past disturbances in the watershed. Combining the above records with information which is being gathered from existing or recently cut stands as well as a sediment core from Squaw Lake may give insights into the effects of early logging on both the composition of upland communities and the productivity of Squaw Lake.

In order to add the data which could be obtained from an intensive study of historical records and field evidence in the Squaw Lake area to that being obtained by W. A. Patterson, the assistance of a graduate student for 3 months of field working on a half time basis is needed. It is estimated that this could be done with an addition of $1500 to the project now supporting the broader research program on which Mr. Patterson and others are working.

FORESTRY DEMONSTRATION AREA IN ITASCA STATE PARK

Planting History

During the C.C.C. days (Civilian Conservation Corps) of pre-World War II, there were 3 camps in the Itasca Park area. It was recognized even then that with the heavy overpopulation of deer and the dense shrub growth pine was not regenerating in the park. A number of attempts were made to secure this by planting in the park. Most were failures because the deer browsed on them so heavily and brush control was inadequate. This planting was one of the few which survived.

There were 18,000 2 year-old red pine seedlings planted on 18 acres during April 27-30, 1937. The planting was only partially successful probably due to deer browse or drought conditions or both, because it was supplemented by planting 3000 red pine (4 year-old transplants) on 15 acres on May 15, 1939, and 5500 white spruce seedlings on 7 acres on September 19, 1940. The area was protected by eight-foot high mesh-wire fence.

Stop 1. Thinning and Pruning of Red Pine

This red pine stand is about 35 years old. Originally it was planted with 1000 seedlings per acre. The first thinning was carried out in the fall of 1970 to improve the growing conditions of the trees. The basal area of red pine was reduced from 170 to 134 square feet per acre and about 4 square feet of other species such as jack pine, aspen, birch, and oak was removed. Before thinning there were 848 red pines per acre. In the thinning process 310 red pines were removed leaving 538 trees per acre. Additionally, six jack pines, six aspen, six birches, and five oaks per acre were cut. The treated area is 0.85 acres in size. Attached diagram shows the diameter distribution of red pine before and after thinning. It can be seen that primarily the smaller (suppressed, intermediate) trees were removed, except for larger trees with crooked stems or otherwise defective. In open spots in the stand smaller diameter trees were left to reduce the incoming light and prevent shrub development.

All trees in this area were pruned to a height of about eight feet. In addition, those trees selected to be left in the stand were pruned up to about 17 feet. Pruning assures a production of knot-free wood earlier in the tree age where timber production is a goal. An average of five years is required for pruned red pine to heal over.

The dominant trees are on the average 45 feet in height. Knowledge of stand age and height gives an estimate about site quality. According to site index curve for red pine in Minnesota, the site index for this stand is 62 (height at age of 50 years) indicating a good red pine site.

From this time until the trees are about 80 to 100 years old further intermediate cuttings at 10 to 15 year intervals should be made to reduce the number of trees per acre to about 100. Beginning at about age 120 consideration should be given to reproducing the stand.

Stop 2. Untreated Pine Area

This portion of the red pine stand approximates the overall conditions which existed before thinning and pruning and serves for the purpose of comparison. It shows the original density of the stand and the process of natural pruning of red pine under existing light conditions.

Stop 3. Release of Red Pine

These red pines are of the same age as red pines in the adjacent area at Stops 1 and 2. They were overtopped by aspen which partially covered the shade-intolerant red pines. The growth development of these pine trees shows a sharp contrast to those growing without hardwood interference. Growth response of released pines will be noticeable in future years. Release work was done in June 1970 cutting only those hardwoods directly overtopping conifers.

Stop 4. Hardwood Competition

White spruce is considered to be a shade-tolerant species, but it is not able to compete successfully in the early stage of life with dense growth of shrubs and overtopping hardwoods. White spruce is difficult to maintain where it is growing in mixture with hardwoods. The stunted size of white spruce in this area shows distinctly the effect of hardwood competition.

Stop 5. Protection Fence

The area was fenced in to protect planted seedlings from deer browse. There was an overpopulation of deer until 1945 when the park was first opened to deer hunting. Prior to this time reliable counts showed an average of about 75 deer per section, far in excess of the carrying capacity of this forest type.

Stop 6. Upland Hardwoods

There is a definite change in site conditions going in a westerly direction through the plantation and outside it towards the ridge. It is reflected in the vegetation favoring more demanding species such as oaks, maples, and ironwood. The stunted height growth of planted spruce at Stop 4 was a good indication of increased hardwood abundance and vigor.

Stop 7. Pruning and Release of White Spruce

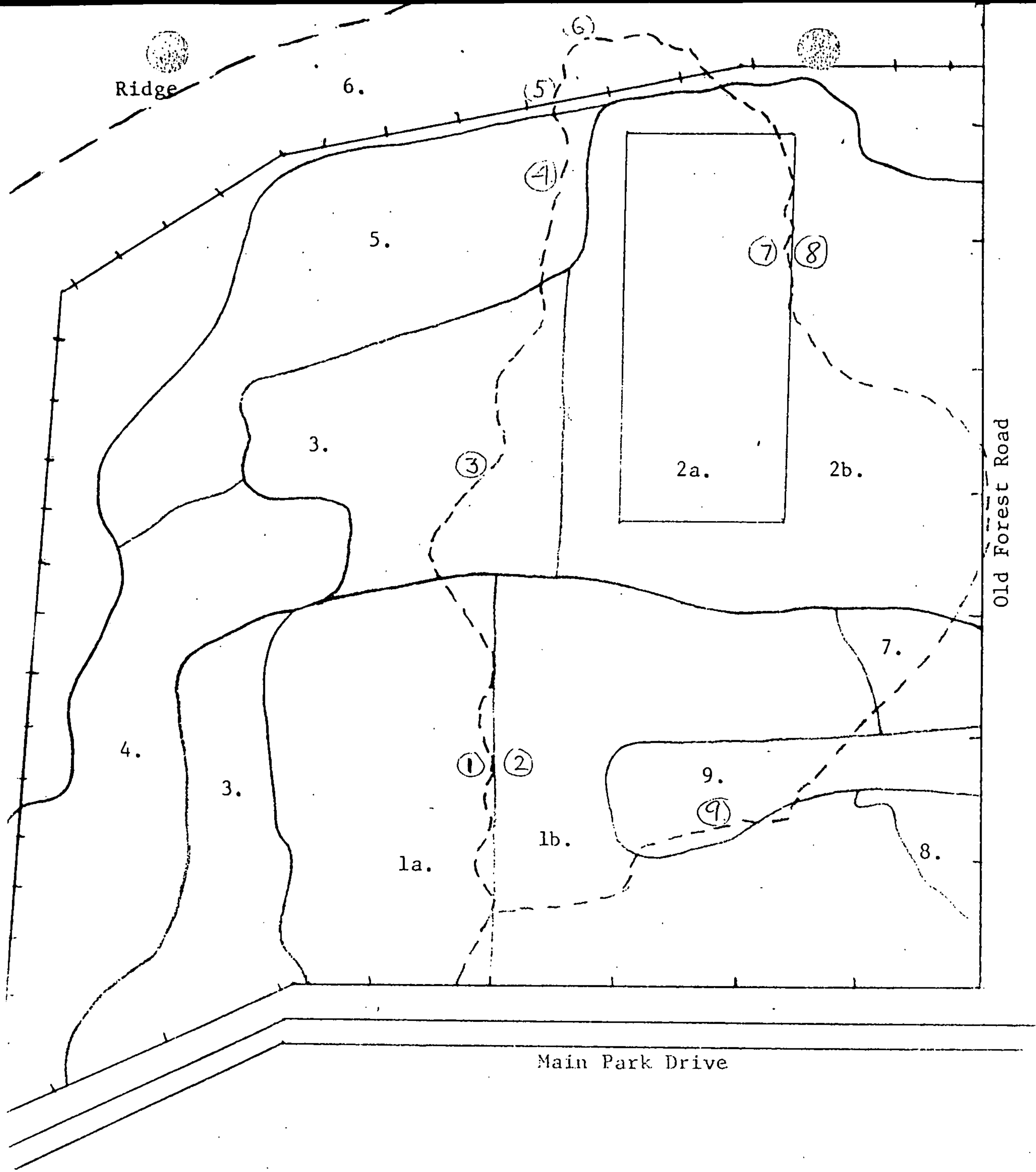
White spruce is the major species in this portion of the plantation. The treatment was limited primarily to pruning lower dead branches of spruce and releasing spruce and pine from overtopping aspen and birch. No actual thinning was done. The porcupine have girdled red oak probably as a supplementary food in combination with use of pines and spruces. Outside the plantation the porcupine damage on oak is rare.

<u>Stop 8</u>. Untreated Spruce Area

This portion of the white spruce stand focuses on conditions which existed before the cleaning work was done across the trail. In future years comparison can be made on the effect of natural and artificial pruning.

<u>Stop 9</u>. Scotch Pine

The reason for planting Scotch pine in the park is unknown. However, in earlier years there was considerable interest in comparing the growth of this European species with native pines. Porcupine damage is considerable, and deer have shown a great preference for this species in plantings elsewhere.



FORESTRY DEMONSTRATION AREA IN

ITASCA STATE PARK

N (7° E)

100'

Scale

Plantation boundary as indicated by old fence

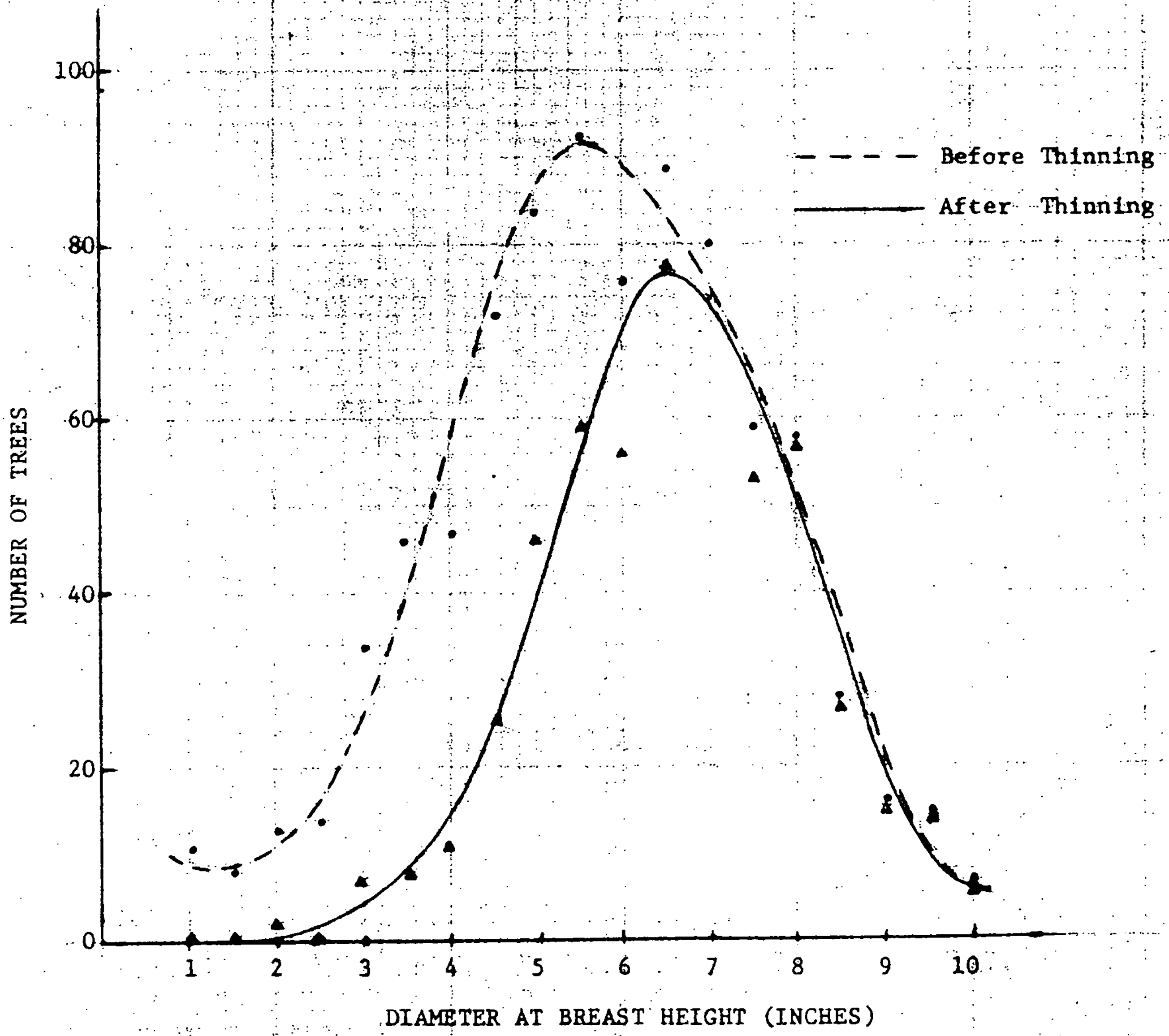
Cover type and treatment area lines

Foot trail

Location: NE¼ NE¼ sec. 17-143-36

1a. Red pine thinned and pruned.
1b. Red pine not treated.
2a. White spruce released and pruned.
2b. White spruce not treated.
3. Scattered red pine released
4. Aspen type, scattered spruce and pine released.
5. Aspen type, scattered spruce and small spruce.
6. Mixed upland hardwoods.
7. Aspen, scattered red and jack pines.
8. Aspen, birch and jack pine.
9. Scotch pine.

RED PINE DIAMETER DISTRIBUTION BEFORE AND AFTER THINNING
IN A 35-YEAR OLD PLANTATION IN ITASCA STATE PARK, MINNESOTA.



PART II - Research Studies Under the Supervision of the College of Forestry, University of Minnesota.

Research Study #1

Purpose: A broad study of upland forest ecosystems with emphasis on the present conditions, changes in forest composition, and forest regeneration processes.

Expected Results: The information acquired enables the prediction of successional trends and future consequences of various use and management patterns.

Location: The location of 32 stands is marked on the Map I.

Duration: The data were collected in 1965 and 1970, and collection will be continued at five-year intervals.

Persons Involved: This work is being conducted under the direction of Dr. Henry L. Hansen.

Equipment and Installations: None. The centers of eight plots in each area are marked with aluminum stakes and designated (K & N 60-1, as an example).

General Description: A reconnaissance survey was made in 1963 and 1964 of 130 stands covering the full range of upland site conditions in the park. For intensive study 32 stands were selected to represent variations in tree composition, age, and soil moisture and nutrient conditions. Plots in these stands will be maintained as long as possible to provide a basis for evaluating future changes. Each study area is approximately 2 acres in size.

Research Study #2

Purpose: Study of tree regeneration in a jack pine stand.

Expected Results: Information on the trends in species composition of the regeneration and in the abundance and height growth of white pine seedlings under an old-growth jack pine canopy over a 20-year period following the opening of the park to deer hunting in 1945.

Location: Indicated on the map I as #3.

Duration: Commenced in 1957: terminated in 1967.

Persons Involved: Dr. Henry L. Hansen.

Equipment and Installations: None

General Description:

Research Study #3

Purpose: Study of ecological trends in a red pine-balsam fir forest.

Expected Results: Information on change in abundance and composition of tree reproduction, shrubs, and ground cover species as related to stand and site characteristics.

Location: The general area in which 40 plots are located is indicated by the capital letter A on the map I.

Duration: Data were collected in 1953, 1959, 1964, 1968 and 1970; the study will be continued.

Persons Involved: The study is under the direction of Dr. Egolfs V. Bakuzis.

Equipment and Installations: The centers of 40 consecutive plots are identified by wooden or aluminum stakes.

General Description: This study is a part of a larger project on the characteristics of forest ecosystems in Minnesota. The synecological coordinate trends are studied as they relate to changes in moisture, nutrient, heat and light regimes in the area.

Research Study #4

Purpose: Study of a mature red pine stand development.

Expected Results: Information on the growth and development of red pine and mortality of jack pine and other minor species as stand components.

Location: Designated on the map I as #38 (Allison Plots).

Duration: Established in 1923. Detailed records have been maintained since then at intervals.

Persons Involved: Staff members of the College of Forestry.

Equipment and Installations: None

General Description: These plots, because of their time span, have considerable ecological-historical value, and should not be disturbed. The size of the area is 5 acres.

Research Study #5

Purpose: Pilot scale tests of securing pine regeneration by applying various silvicultural methods.

Expected Results: Information on establishment and development of planted red pine and white spruce seedlings and natural pine regeneration.

Location: Designated as area 1 on map II.

Duration: This study was begun in 1969 and will be continued.

Persons Involved: Supervision, Dr. Henry L. Hansen.

Equipment and Installations: Deer exclosure of approximately 2 acres in size.

General Description: Thirty-four acres were planted with 21,000 red pine and 2,800 white spruce seedlings in spring, 1970 after cutting the old aspen and preparing the site. An adjacent 26-acre area, with scattered old white and red pine, will be burned to initiate pine regeneration.

Research Study #6

Purpose: Study of forest plantings following removal of the old aspen and application of various site treatments.

Expected Results: Information on growth and survival of planted red pine and white spruce seedlings.

Location: Three areas: designated on the map II as 2A east of highway 200; 2B, east of highway 71; and 7, Squaw Lake area.

Duration: Preparation for this study began in 1967; the study is continuing.

Persons Involved: Directed by Dr. Henry L. Hansen.

Equipment and Installations: None.

General Description: Area 2A, six acres in size, was planted with 4,000 red pine and 1,000 white spruce seedlings. Area 2B, about the same size, was planted with 4,000 red pine and 700 white spruce seedlings. In area 7, an experimental seeding and planting of pine and spruce was made.

Research Study #7

Purpose: Study of natural jack pine regeneration.

Expected Results: Information on pine establishment and hardwood recovery after controlled burning.

Location: Designated on map II as area 3, about 30 acres.

Duration: The study was started 1970 and will continue.

Persons Involved: Supervised by Dr. Henry L. Hansen.

Equipment and Installations: Fire line.

General Description: This is an experiment in burning an area which contains jack pine and some red and white pine with a portion of adjacent aspen-birch forest. The area will be burned in 1971 as weather conditions permit.

Research Study #8

Purpose: Growth evaluation of earlier conifer plantations.

Expected Results: Information on growth response after release from hardwood competition.

Location: Designated as areas 4 and 5 on map II.

Duration: Long-term.

Persons Involved. Supervised by Dr. Henry L. Hansen.

Equipment and Installations: None.

General Description: In area 4 (about 2 acres) old aspen was cut in 1956 followed by planting of red pine, jack pine and white spruce. In 1969, conifers were released from overtopping aspen suckers by spraying and cutting. Partial release work was carried out in area 5.

Research Study #9

Purpose: Establishment of forestry demonstration area.

Expected Results: Information on growth and development of planted conifers. Exposure to park visitors of various forestry practices used in forest management for wood and fiber production.

Location: Designated as area 6 on map II.

Duration: Long-term.

Persons Involved: Supervised by Dr. Henry L. Hansen

Equipment and Installations: Foot trail and signs.

General Description: In an old CCC pine and spruce plantation (1937-40) partial thinning, pruning, and release work was carried out in 1970. A foot trail with signs will guide park visitors through the area.

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A RESUME OF RESEARCH IN AND AROUND ITASCA STATE PARK BY THE COLLEGE OF FORESTRY

Henry L. Hansen, Professor

GENERAL BACKGROUND:

Faculty in the college have had an early interest in the research potential of Itasca Park. While much of the early research was fragmental and poorly supported financially, it did provide a partial background of biological knowledge and historical perspective which is valuable now because of the time lapse and it helps document ecological changes and trends. Two examples are the "Allison plots" established in 1923 and the "LaSalle Trail plots" established in 1947 by the writer. In both cases records have been maintained of vegetational changes on an annual or periodic basis.

During the past World War II period up to 1964, a considerable amount of descriptive information about the park was obtained using students in class projects and in connection with a state supported project to aerially map and type the park vegetation and to make an assessment of the acreages and volumes in the various forest types. During that period much attention was focused on the fire history and ecological consequences of fire exclusion in the park, on the absence of pine regeneration and attrition to old growth stands, on the dynamics of the deer population and vegetational interactions, and related questions many of which had management policy implications.

In 1964 an organized project was developed which was generously funded from a number of University, Department of Natural Resources, and federal sources. The broad goals of this research were to document the past, describe the present, and predict the future of the park vegetation.

SUBJECT AREAS:

Historical:

A fire chronology based on fire scarred red pines and other information has been documented back to 1650.

A history of the logging operations in the park since its creation has been reconstructed. Data included are year of cutting, approximate volume of cut on individual tract, and name of company plus some other related information.

A study of lake bottom sediments has been made to supplement several other pollen stratigraphic studies in the park made to reconstruct post-glacial vegetation changes. This study pays special attention to fires and other major disturbance factors as possibly related to lake sediments. An ongoing aspect of this study will attempt to determine if logging and fire conducted under experimental conditions influences local pollen rain.

A map of the forest types and their distribution as of the 1870's has been reconstructed from field notes of the original land survey and other records.

Ecological-Silvical:

The contemporary ecological state of the upland forest communities has been given intensive study. The forest cover has been typed, described as to species composition, stand structure, and other parameters. In addition, the ecological types and cover types of the park were fit into a bivariate edaphic scheme to provide a framework for studying forest succession, predicting future park conditions, and other ecological relationships.

Silvical characteristics of many of the tree and shrub species of the area have been researched. Ultimate size and age data and regeneration characteristics have been studied, and 5 years of phenological records have been accumulated.

As a culmination of the ecological research a predictive model was developed projecting successional trends of the upland forest types for 200 years into the future.

Manipulative-Silvicultural:

A major phase of the research has been vegetation manipulation. Early historical research has documented the effects of logging and the greatly increased incidence of fires during the years of agricultural settlement. The present forest within the park has much less pine than did the presettlement forest. It was largely replaced by aspen following logging and frequent fires. This was particularly true in the western two mile strip of the park, parts of which were not acquired until as recently as 1920.

Restoration of the park vegetation to approximate prewhite man conditions was considered to be an appropriate management goal consistent with the laws and regulations creating the park originally. Accordingly, a number of tests were initiated to determine the effectiveness and appropriateness of using fire, herbicides, logging, seeding, and planting to convert aspen areas to their original pine composition.

As early as 1948, herbicides such as 2,4-D were tested to determine their utility in releasing white pine seedings from brush competition. The selective effect on the variety of shrub species present in north central Minnesota was determined and its implications for wildlife habitat, particularly white-tailed deer, studied.

Pilot scale test areas of 4-6 acres were set aside beginning in 1956. On these, removal of the aspen overstory and a variety of combinations of mechanical and chemical brush control, seeding and planting have been tested. Beginning in 1971 the use of fire to simulate the natural fire history of the area was tested on a series of areas from 30 to 200 acres in size.

FUNDING SOURCES FOR PAST RESEARCH:

Previous to 1964, research was fragmental in nature and funded largely from a number of graduate school research grants, varying from $1,000-$5,000 in size. In addition, the Minnesota Agricultural Experiment Station provided enough funding to support 2 or 3 part time research assistants to assist in field and laboratory work.

During all these years a close cooperative relationship with the Divisions of Forestry and Parks and Recreation in the Minnesota State Department of Natural Resources was maintained. In 1950-52 the state cooperated with the College of Forestry in a substantial project to inventory and map the park. This resulted in a map of the vegetation and other data basic to future studies and a reference point for later inventories.

Beginning in 1964, generous support for the College of Forestry research has been provided from a variety of sources. From the state, funding has been provided by the former Minnesota Resources Commission and the Divisions of Lands and Forestry and Parks and Recreation. This has varied from $5,000 to $10,000 annually. Federal support has come through the Minnesota Agriculture Experiment Station, particularly from McIntire-Stennis, GAR, and Hatch Act funds. These have approximated $10,000 to $15,000 annually.

CURRENT RESEARCH EMPHASIS AND POTENTIALS:

As a culmination of this substantial background of research the state has initiated an operational scale plan to reconstruct the pre-white man forest on an area of about 8 square miles. This will involve manipulating the vegetation over the next 15 years on about 3,000 acres within the total area. This provides an unusual opportunity to apply on a large scale the various treatments tested over the past 25 years. It also creates a unique potential for research on the consequences of the major changes that will be made in the various ecosystems that are involved. There is an unusual background of knowledge of the history and ecology of the area acquired by previous research as already reviewed. There are few areas with such an extensive basis of knowledge useful to future research.

It is our hope that full use might be made of the unique opportunities to relate research of a variety of kinds to this project. In cooperation with the state agencies we are advising as to the nature and extent of treatments to be made. We hope to document the resultant changes in vegetation. We also have initiated a study of the effect of the future changes on pollen rain in the local area. The state has also taken initial steps to document future changes in wildlife populations.

However, it would be unfortunate if such a unique opportunity for general ecological research on a wide variety of problems is not more fully utilized than is possible now within the present limitations of funding. The Lake Itasca Forestry and Biological Station has an excellent summer staffing of scientists with a broad array of expertise and research interests. With adequate funding it would be possible to utilize some of the unique research opportunities available.

Itasca State Park Information for Director Davison

There has been a long history of research cooperation centered in Itasca Park between the College of Forestry and the Minnesota Department of Natural Resources. This has led to the joint development of a proposal to restore pine forest to some of the areas on which it originally occurred before the early logging days.

As early as 1947 several fragmented efforts were made to study the ecology of the park forest, especially the pine systems. In 1964 these were incorporated into a formalized project. The project has been variously supported by federal funds through the Minnesota Agricultural Experiment Station and through the University of Minnesota College of Forestry.

In 1967, recognizing the significance of the research results to the management of the park, a research grant was provided from the Minnesota Natural Resources Fund by recommendation of the Minnesota Resources Commission. Among the important findings of this research was the fact that of the park's approximately 32,000 acres only about 8,000 acres are in pine forests while the original acreage of pine had been vastly greater. Apparently the logging of pine in the pre-park years followed by excessive burning had encouraged conversion to aspen, ~~beech~~ birch, brush, and other transient types. Furthermore, studies of the age of the remaining pine stands indicated that only a few hundred acres could be classed as young forest - the rest was mature or over-mature and subject to heavy losses to disease, insects and windthrow.

In 1969 an initial fund of $25,000 was made available through the DNR to institute a program of pine restoration working closely with the University forest research team. Since then on a model pilot scale basis, 14 experimental areas varying from ~~fair~~ four to over 200 acres in size have been set aside and a variety of tests initiated. Some have been successful in converting second-growth aspen and brush to young stands of pine or pine mixtures with various hardwoods. Others have failed. By these tests much has been learned to guide future practices in the management of the park forest stands. This park project has also been a model of cooperation with individuals from the DNR (both the Division of Forestry and the Division of Parks and Recreation) working with University personnel on problems of common interest and concern for Itasca State Park's natural resources.

The research has also stimulated broad discussions between the DNR personnel charged with the park's management, citizen interest representatives, and University researchers as to what kinds of policies should guide park management. A product of these discussions has been the identification of a system of 6 management zones which recognize that there are varying levels of intensity of use appropriate to different parts of the park - the intensively used picnic ground vs. the wilderness sanctuary for example. (slide available)

The Division of Parks and Recreation has currently hired 2 College of Forestry research assistants for the summer to assist in the development of a large scale plan for restoring pine to former pine sites in about eight square miles in the southwest corner of the park. This area was selected as the most badly disturbed and least "natural" portion of the park. It was not added to the original park until the 1920's after all the virgin pine had been removed. This project is planned for completion in 15 years. We are working closely with the Division of Forestry on this project using their expertise in planning for the logging of some areas preliminary to planting, in the burning for brush control and site preparation, and in other ways. An extensive inventory is now underway mapping all forest stands and locating items of special interest and ecological sensitivity such as eagle and osprey nests, scenic views, etc. Two wildlife biologists have also been engaged for the summer to inventory the wildlife on the project area so as to make it possible to study changes in species or abundance which will follow the forest reconstruction processes. While the production of income from the logging of parts of this area is not a primary goal, it is hoped that at least some of the costs of the project will be offset by pulpwood sales.

An intensive study of the logging history of the entire park has been conducted by Research Assistant Norman Aaseng of the College of Forestry. This fascinating study has documented on a 40 by 40-acre basis when, by whom, and how much pine was logged from each 40 acres in the park.