

SCI
MAS

Thesis

PINE PROTECTION PLAN

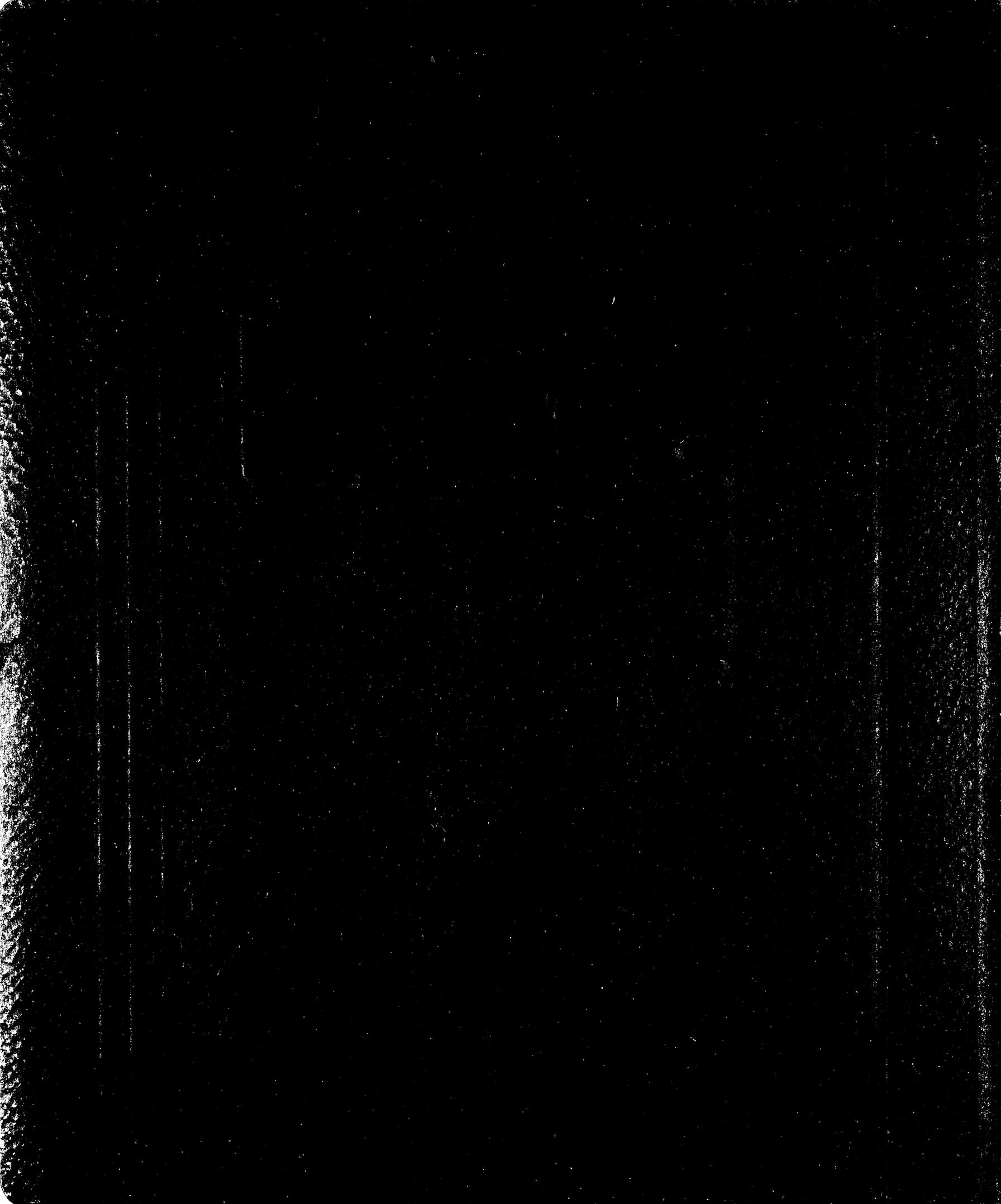
for

ISLE ROYALE NATIONAL PARK

Norman W. Smith

February 6, 1957

Smith, N.W.

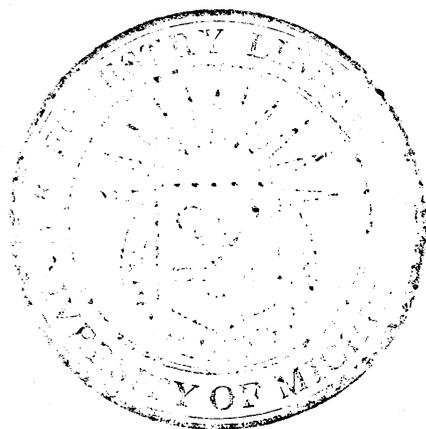


PROPERTY OF

*The
University of
Michigan
Libraries*

1817

ARTES SCIENTIA VERITAS



A FIRE PROTECTION PLAN
for
ISLE ROYALE NATIONAL PARK

X Norman F. Smith

February 6, 1937

This thesis is submitted in partial fulfillment of the requirements for the degree of Master of Forestry in Forest and Park Administration.

Norman F. Smith

TABLE OF CONTENTS

	Page
Introduction-----	1
Description of Isle Royale-----	2
Obstacles to Fire Protection-----	4
Nature of the Soil-----	5
Topography-----	5
Wind-----	6
Transportation-----	7
Wilderness Standards-----	8
The Fire of 1936-----	9
Fire Prevention-----	11
Fire Hazard Reduction-----	12
Rules for Park Visitors-----	17
Education-----	19
Fire Presuppression-----	20
Detection System -----	20
Communication-----	26
Organization of Personnel-----	27
Training of Personnel-----	29
Tools and Equipment-----	31
Transportation-----	33
General Information Needed in the Presuppression Plan-----	34
Fire Suppression-----	37
Detection-----	38
Speed of Attack-----	38
Methods of Attack-----	39
Mopping Up-----	42
Final Mopping Up-----	43
Patrol-----	44
Abandonment-----	44
Summary of Specific Recommendations-----	45
Appendices-----	48
Maps	

A FIRE PROTECTION PLAN
for
ISLE ROYALE NATIONAL PARK

It is recognized that any fire protection program adopted for Isle Royale as a National Park must be compatible with recreational, landscape, forestry, and wild-life interests. At the same time it must consider the many obstacles presented by the rugged wilderness character of the island, its isolated position, and the increased risks which will follow its opening as a National Park. The purpose of this report is to present a workable fire protection plan for Isle Royale National Park, keeping in mind these facts.

Material for this report is based, for the most part, on personal experience and observation obtained by the writer during the summer of 1936 while employed by the National Park Service (ECW) as Student Forestry Technician for Isle Royale National Park Project. Other material was obtained from the Fire Handbook of Region 7, the Western Fire Fighter's Manual, the ECW Handbook for the National Parks and Monuments, and various National Park Service Publications.

Considerable space is first given to the discussion of the conditions and the problems existing on the island, as they affect efficient fire protection,

and the future use of the island as a public park. The plan is then presented under three distinct headings: Fire Prevention, which includes those activities designed to prevent fire from starting; Fire Presuppression, preparation for the quick suppression of those fires which are going to start; and Fire Suppression, those activities which occur from the time a fire is reported until it is completely out and abandoned.

CONDITIONS AFFECTING FIRE PROTECTION

In order to give a better understanding of the problems with which fire protection on Isle Royale is faced, it is necessary to present first a picture of the island, and the obstacles which exist to the operation of any plan for fire protection, as shown by the disastrous fire of 1936.

Description of Isle Royale.

Isle Royale is an elongated, rugged island, lying approximately north-east and south-west, in the northern part of Lake Superior, 17 miles from Canada, 20 miles from Minnesota, and about 45 miles from the Keweenaw Peninsula of Michigan. The island is 44 miles long; 52 miles if Passage Island and Rock of Ages are included. It ranges in width up to $8\frac{1}{2}$ miles at the end of Siskiwit Bay, and has an area of 205 square miles,

or about 132,000 acres. The rocky shoreline is indented with numerous bays and coves, and paralleled by groups of small islands and rocks.

The central ridge, the Greenstone Ridge, runs parallel to the long axis of the island its entire length, reaching a height near Lake Desor of about 780 feet above the level of Lake Superior. Other smaller ridges run in the same direction. The slopes of the ridges are gentle on the south-east, and very steep on the north-west. Thirty-five lakes ranging from $\frac{1}{4}$ mile to 7 miles in length lie between the ridges, with the greater number of them occurring in the north-east end of the island. Swamps are commonly found at the north-east, and south-west ends of the lakes, and at the ends of the bays and harbors. Many streams occur, some of considerable size, but most of them small, frequently drying up during the summer.

On many of the ridges and along the shore slopes, bare rock is exposed, while on the lower ground and in the bogs, some earth occurs, frequently under thick mats of duff and moss. For the most part, however, the soil is of a very shallow, gravelly nature, frequently covered by an accumulation of leaf mould and litter supporting a vegetative cover.

The tree growth may be classified into several main types which conform more or less to the topography.

In the swamps white cedar is the predominating species. On the low, drier sites white spruce and balsam occur, and these mixed with poplar and paper birch cover the lower slopes and ridges on the north-east end of the island. On the Greenstone ridge in the central and south-west parts of the island, open groves of large sugar maples and yellow birches occur. A few stands of large white pine, as well as some white pine reproduction, are to be found here and there. Several scattered patches of pure poplar and paper birch occur marking areas of old burns. Some of these types, as observed by the writer, and supplemented by information taken from Cooper's report,* are shown in Map II.

According to the 1930 census there are twenty-three registered voters on Isle Royale. Most of these are fishermen and their families, and are there only from May to November. There are five summer resorts on the island as well as many privately owned cottages, as indicated on Map I. Most of the resort business is confined to the north-east end of the island, since this end is the more attractive.

Obstacles To Fire Protection.

The natural features of the island combined with certain standards which must be considered in the

*Cooper, Wm. S., The Climax Forest of Isle Royale, Reprinted from Botanical Gazette, 1913.

development of a wilderness park present very definite obstacles to fire protection on Isle Royale. These various obstacles are discussed separately.

Nature of the Soil: One of the most important fire-fighting weapons in ordinary forest protection is earth. Where earth or sand are present to any depth, plows and shovels can be used to great advantage. On Isle Royale, however, the use of heavy plows is prohibited by the solid rock structure which lies so close to the surface. During the recent fire, shovels proved to be of little use in most places, particularly in the swamps and lower ground where thick covers of moss and roots were encountered. On the ridges their use was likewise made impractical by the rocky, shallow soil. The mattock proved to be the most effective tool for digging shallow trenches, and making lines, the sharp blade being used to cut roots and the hoe to strip off the moss and duff. Even sand in usable quantities is seldom found outside the swamps and river beds, and on certain shores, and in these places it is least needed. The absence of this important weapon is a distinct obstacle to fire suppression.

Topography: The rough, rugged surface of the island makes the use of trucks or tractors impossible except in certain limited areas. Tractors themselves

could climb a great many of the steep slopes, it is true, but they would not be able to haul supplies or equipment over the rocks. This does not mean that trucks or tractors can not be used at all on the island, for there are many places level enough for their use. The Siskiwit swamp region is already cut up with logging roads a few of which are capable of supporting both trucks and tractors, and both were used to a limited extent during the fire of the past summer. The tote road is very solid, running along an old shore line. Most of the other roads, however, would be too soft for use during the greater part of the summer. This system of roads is shown on Map III at the end of this report.

The topography limits the size of the load which can be carried by an individual, since many steep slopes are encountered which are difficult to climb even without a load. This makes it necessary to travel with as little equipment as possible.

The steep slopes and deep valleys offer still another obstacle. Fires travel very rapidly up steep slopes, and peculiar drafts are caused by the presence of the narrow valleys. These two facts were well demonstrated in the fire last summer.

Wind: The problem of the wind is one which must be continually faced on the Isle Royale. It proved

to be one of the greatest obstacles to the suppression work during last summer's fire. The position of the island, in one of the stormiest bodies of water in the world, naturally brings about this condition. The direction of the wind cannot be depended upon, but its presence can. At night the wind is usually low, but it rises steadily from about 8 A.M. until 2 P.M., continues strongly until about 4 P.M., then falls gradually until night-time when it again becomes quiet. Strong winds or storms may come up suddenly, any hour of the day or night, and last for several days. Changes in the direction of the wind may occur two or three times a day, and cannot be anticipated. Along the shores and outside slopes, and high up on the ridges the winds are the strongest. In the protected valleys little direct wind is felt, but drafts and air currents are known to occur.

Transportation: There are many obstacles to adequate transportation for fire protection. The rugged nature of the island, and the wilderness standards set up by the Park Service permit only foot travel on the island. Travel by truck or tractor is confined to such a limited area that it has no place in the transportation system. The limiting of the land travel to foot necessarily means the consumption of considerable time and energy in getting to a fire. Travel to different parts

of the island by boat can be accomplished safely only if regular landing docks or breakwaters are constructed, for the rocky shores make it very difficult to land even the smallest boats if there is much wave action. Rough water may even prohibit entirely the use of the smaller boats. The use of airplanes on the island would be quite a satisfactory means of transportation, and might be used in the detection system as well as in emergency suppression work, the many protected harbors and lakes on the island being used for taking off and landing. However, weather may prohibit the use of planes as well as boats; and, except in cases of emergency, their use would be a distraction from wilderness appreciation and enjoyment.

Wilderness Standards: Were it not for the fact that Isle Royale is to be left as near as possible in its primitive, wilderness condition, the fire protection problem would be greatly simplified. Wide fire lanes could be placed at intervals across the island, an extensive program of fire hazard reduction could be undertaken, fire look-out towers could be erected in the center of the island, truck and tractor roads could be developed, pack horses could be used. But the wilderness standards which prohibit the employment of these measures must naturally be observed in so far as

checking the actual work

There seems to be something missing. Descriptions or analyses should be given indicating what the interests are that are mentioned in the first paragraph on page 1. Considerable could be said about the moose and their environment and how we can enjoy them.

*home trail
upset out*

is reasonable, since it is upon these very standards that the development and use of the wilderness park are based.

The Fire of 1936.

A brief account of the fire of 1936 will serve to illustrate the importance of many of the obstacles mentioned in the preceding section.

The fire was discovered from the Siskiwit camp dock at 5:30 P.M. on Thursday, July 23, in the slash left from the pulp-wood operations. Boats with men and equipment were immediately dispatched to the lumber camp. The fire was reached by following one of the logging roads. It was about five miles from the camp, burning vigorously in the slash and crowns, and had covered about four or five acres when the first crew arrived. A line was immediately started at the head of the fire and its advance was finally checked. About 8:30 P.M. it was reported under control. Little trouble was encountered during the night, and the men were kept busy putting out flares and burning stumps near the edges. Since the fire was in a swamp, some water was made available by digging holes and using pails, but it was not plentiful.

Caused by?

The situation looked extremely favorable the following morning as work progressed on the lines, but towards noon a strong wind whipped the flames up again

and it was soon out of control. Help was summoned from the Rock Harbor Camp and the lumber camp, and later from the mainland.

From then on the story of the fire is one of long discouraging battles under extremely difficult conditions. Great distances had to be traveled on foot, and it was often hard to keep the morale of the men up when they were faced with a walk of five or six miles to begin and end hours of hard work on the fire lines. Two new fires were discovered from a plane on Sunday, August 2, on opposite sides of Lake Desor, apparently independent of each other, and independent of the first fire, being over 7 miles away from it. More help was summoned, and side-camps were set up at Hay Bay and Gull Rocks, and later at Todd Harbor and Chippewa Harbor. On several occasions the fires seemed to be under control, but the extreme and continued dryness of the fuel and the inevitable daily winds caused them to keep spreading. Spot fires, scattered far in advance of the main fires were an important factor in the spread. Moss and duff often burning to a depth of two and three feet constituted another difficulty in keeping the fires within the lines.

Men, tools, and supplies kept pouring in, until on August 14, there were close to 1600 men on the fire, representing CCC camps as far away as Milwaukee. By

Sunday, August 23, the fires had reached their greatest acreage, a total of approximately 34,000 acres. This total was divided as follows:

Siskiwit River fire-----	6,400	acres
North shore fire-----	2,600	"
Greenstone Ridge fire---	25,000	"
	<u>34,000</u>	

The fire was not definitely out until the second week in September after several days of rain.

The actual fire fighting, as it applies to *out clean* Isle Royale, cannot be greatly controlled. After all, it is a matter of deciding what can be done and how it shall be done under the circumstances, and is based on the judgement and ability of the man in charge. However, fire prevention, and preparedness for fires are things which can definitely be controlled and planned. Their efficiency will determine the amount of suppression work necessary. *200?*

FIRE PREVENTION

All the combined activities designed to keep fires from starting are included under the head of fire prevention. The fire prevention activities are the most important part of a fire protection program, and the efficiency of the work carried on under this head will largely determine the amount of suppression work necessary. On the Isle Royale these activities should include fire

*And when number with
plenty of "loaders" in it to
my eyes can go on Isle Royal
and under what circumstances.
themselves responsible people only should
be permitted there! E. O.*

hazard reduction, education, and rules for park visitors.

Fire Hazard Reduction.

The work of reducing fire hazards should continue to be carried on by the CCC boys under the direction of the National Park Service. Since the type and degree of reduction work to be employed in many instances will vary with existing conditions, the decision as to just what procedure should be followed should not rest upon the judgement of one man, but should represent the opinions of several who have observed the situation. This will avoid the danger of one interest only being considered.

Following are the methods of fire hazard reduction which may be applied:

1. Removal
2. Flattening
3. Combination of removal and flattening

The method to be employed and the severity of use depend upon the following conditions:*

1. Aesthetic and use requirements in the vicinity of trails, campgrounds and other developed centers.
2. Retention of material for soil replenishment.
3. Severity of hazard.

*Miscellaneous Circular No. 16 for Eastern Parks and Monuments, 1936. pp. 15 (Conditions not applicable to Isle Royale omitted).

4. Severity of risk.
5. Degree of controlability.
6. Degree of liability.
7. Size of area, cost, and practicability of the treatment.

With these factors in mind each of the types of fire hazard areas on Isle Royale will be discussed, with specific recommendations as to the methods to be employed.

Burned-Over Areas: The burned-over areas constitute, for the most part, a dangerous fire hazard. Where the fire has burned the surface of the ground, and the foliage of the trees, as in certain parts of the cedar swamps, leaving the trees standing, the hazard is not so serious. Where the fire, on the other hand, has gone deep into the ground, and burned off the shallow root systems of the trees, causing them to fall in a jack-straw mass, the hazard is definitely a bad one, since the tops of the trees and the foliage were often not burned. The removal method of fire hazard reduction should be used when this condition exists near trails and developed areas, the material being removed for a distance of 50 feet on either side of the trail, and 100 feet from the developed area. Wherever the removal method is used the material should be piled in preparation for winter burning. Further back from the trails where

the aesthetic value is not so great, and where the risk is likewise reduced, a combination of removal and flattening should be used. Were the flattening method to be used entirely, there would, in many cases, not be enough room on the ground to lay all the poles without having them touch one another, unless they were placed parallel to each other, and this is not desirable. Close to trails and developed areas those trees which were weakened at the base by the fire, but still standing should be removed as a protective measure against human injury from wind-fall.

In places where the fire has burned off the "soil", leaving bare rock or earth exposed, it will be a good plan to leave some of the fallen material including logs, twigs, and leaves, well flattened on the ground. This will aid in checking erosion, and will hasten the return of the soil.

In the Siskiwit River area where the pulp-wood operations were carried on, as shown on Map III, the fire created a new hazard to take the place of the one burned. The hazard reduction work done in this area previous to the fire consisted of clearing the main and side logging roads of the heavy slash. No attempt was made to construct definite fire breaks, but rather to reduce the hazard in these places and to make a line

from which a fire could be attacked. Since it would be too expensive a proposition to clean up the whole logged-over area, these same logging roads should again be made use of, but they should be cleaned more thoroughly of burned and dead material so that they may serve to check the spread of a fire, as well as a place from which an attack could be made. This clean-up may be accomplished without widening the lanes, or cutting any live trees.

The abandoned pulp-wood piles and sound, fire-killed trees in this region should be salvaged for fuel-wood purposes. The wood could easily be skidded in the winter by tractor on the existing logging roads to the clearing by the lumber camp at the end of Siskiwit Bay. Here it should be cut and piled, ready for distribution in the summer by boat to parts of the island where it is needed. The supply is large enough to furnish the needs of the island for several years, there being nearly 2,000 cords of abandoned pulp-wood, in addition to the fire-killed timber and usable slash.

Burned-over areas far away from trails or camp-sites, and hence where little risk exists need not be touched yet, but the protection of the localities where the element of risk occurs must be taken care of as soon as possible.

In order to facilitate and speed up this work

of fire-hazard reduction, camps should be located on the sites of some of the side camps established during the fire. In addition to the two main camps at Senter Point and Rock Harbor, there should be, therefore, camps at Gull Rocks, Todd Harbor, and Chippewa Harbor, as indicated on Map.I. Having camps thus spread over the island the efficiency of fire suppression work would also be greatly increased.

Trailside Fire Hazard Reduction: With the exception of those running through the burned-over areas, little fire-hazard reduction along the trails need be done. Inflammable material exists, but to clean it up would present a very unnatural condition. Fire prevention along the trails outside the burned areas must come from another source--the users of the trails.

Camp-Sites: Care should be taken in the selection of camping sites. Places where low trees, dry brush or leaves exist should be avoided. Likewise places where fire is likely to get into the moss between rocks should not be used. The site should be open, or among large trees, surrounded by plenty of clear space. These sites should be designated by the Park Superintendent and frequently inspected by the rangers.

Simple fire places should always be constructed,

*any necessity for
spark arrestors - screens?*

in accordance with park rules, to keep the fire within bounds. A shallow pit about three feet in diameter with rocks around the rim makes an excellent and easily constructed fireplace for cooking. All inflammable material should be scraped away from the edge of the pit, leaving a safe border outside the rock rim. All debris should be burned.

Administration Areas: The grounds around the administration headquarters should be left as natural as possible, and fire prevention must come from the users of the area. The buildings in the administration areas, and in fact all buildings should be roofed with fire-proof material. If stone buildings are to be used, slate shingles would be best. If wooden frame or log buildings are to be constructed, creosoted wooden shingles would be safe, and in harmony with the wooden structure. All chimneys should be screened, and where possible, should be so designed as to prevent sparks and burning ashes from reaching the top.

Rules For Park Visitors.

The conduct of park visitors is the most important factor in the fire prevention system, since the hazard cannot be completely removed. Without the reasonable cooperation of every visitor a more elaborate plan than is here proposed would have to be adopted.

There are many ways of bringing the importance of fire prevention to the attention of the visitors.

Registration: Every visitor to Isle Royale should be required to register at one of the administration headquarters. The use of the registration causes the visitor to appreciate that he is assuming some responsibility in the matter of fire prevention. He has the feeling that he must be doubly careful since his actions are being checked, and he will spread this influence, since he does not want to run the chance of being held responsible for a fire which he did not start. At the time he registers the visitor should be given a printed folder on which, in addition to other information, are briefly stated the rules and regulations governing smoking and the use of fire, and the penalties for their violation. He should be asked to read this material carefully, and to kindly observe the simple rules set forth. He should understand that it is to his advantage to become familiar with them.

Rules and Penalties: The regulations with regard to the use of fires which apply generally within the national parks and monuments should apply likewise on Isle Royale. These rules are found in Appendix A. They should be supplemented by others as conditions demand. Every effort should be made to determine the cause of any fires which

start, and if man caused, the person should be apprehended whether it was intentional or not. "Park officers should use tact and judgement in the enforcement of the regulations, and where slight unintentional violations have occurred that have not resulted in damage or expense, first offenders could properly be handled with tactfull warning and instructions as to the rules and the necessity therefore."*

Education.

The registered residents of the island are very careful in the use of fire, and most of them have at one time or another fought fires on the island, therefore the educational program does not directly concern them. Their cooperation, however, is desired in fire prevention and detection, and they should be contacted and shown their part in the protection system. The main program of education, however, concerns the park visitors. A section on fire protection should be included as a definite part of the general educational program offered by the Park Service. This section should include a brief history of the recent fire, discussion of the obstacles which have to be faced in fire fighting on Isle Royale, and a discussion of the responsibility of each visitor in the protection system. Instructions should be given as to what to do in case of fire, how

*National Park Service, Manual of the Branch of Forestry, pp. 17.

to attack small ones, and where and to whom to report all fires. Since personal contact through the educational program will be the method of securing public cooperation, posters and signs regarding fire prevention may be entirely eliminated from the park. Their use as "decorative" material in the buildings and lodges may likewise be done away with.

An educational program similar to that offered the visitors should be extended to the CCC boys. All rules and regulations will likewise apply to them. In their case, however, penalties for violation, will be imposed by the army officer in charge of the company.

FIRE PRESUPPRESSION

No matter how much a fire hazard is reduced, short of cleaning an area down to mineral soil, if any hazard remains, and the public is admitted, accidental fires are bound to occur. Assuming this, the next step in a protection plan is the preparation for the quick suppression of these fires when they start. The various activities in the preparation for fires are included in the "fire presuppression" plan.

Detection System.

The first and most important step in a fire presuppression plan is the establishment of a system

of fire detection. A system which provides for the most constant watch is the most desirable on any area, and especially on Isle Royale where adverse wind conditions and the necessity for traveling over the island on foot make quick fire detection imperative. The increased risks brought to the island as a national park by careless and thoughtless smokers and campers, and the employment of 300 CCC boys cannot be overlooked. These risks are the natural consequences of opening any forested area "for the use and enjoyment of the people," and must be adequately provided for by an efficient system of forest fire detection.

There are five possible methods of fire detection which could be applied on Isle Royale:

1. Foot Patrol
2. Water Patrol
3. Air Patrol
4. Fire Look-out Towers
5. Combinations of these

Foot Patrol: If absolute wilderness standards are to be adhered to, the use of a foot patrol as the means of fire detection on the island should be employed. Its advantages are found in the fact that fire detection would be supplied directly to the areas with which the public is in contact, namely, along trails and shores, and on camp sites. In addition to supplying detection,

this ground force, by finding fires in early stages, could frequently suppress them without summoning additional aid.

One of the disadvantages to this system is that it would be impossible to cover adequately at any one time more than a very small part of the trails and other places open to park visitors without the use of a large force employed to do nothing but patrol. Another disadvantage is that the reporting of fires, and summoning aid by foot would, in many cases, be slow and costly. For these reasons, the employment of this system alone would be unsatisfactory.

Water Patrol: This method of detection likewise would conform to wilderness standards. There are, however, many spots on the island which cannot be seen from a boat. The shores, outside slopes and ridges could be watched closely, but the valleys in between the ridges would not be seen, and smoke from these would have to gain considerable volume before being detected. The factor of weather is also important in the use of boats for patrolling. On many occasions they would be prevented from venturing out due to the rough seas; and it is frequently on these days of high wind that camp fires get out of control, and burning cigarettes dropped in the dry duff are fanned into flame.

Air Patrol: The use of airplanes has been advocated as a method of fire detection for Isle Royale. Under this system a plane would make regular scheduled patrols of the island every day at, for example, 8 A.M., 12 noon, 4 P.M., and 8 P.M. All parts of the island can be seen from the air, and any fire can be very accurately located. The three main criticisms of this system are; that a constant watch is not maintained; that airplanes are distracting to wilderness appreciation; and that bad weather is an obstacle to their use.

Not enough protection for money limited must use planes more

Fire Tower System: The use of fire towers has proven to be the most efficient method of forest fire detection. Weather is no obstacle to their use, and a constant watch can be maintained. Locations and approximate sizes of fires can be sent to headquarters with both speed and accuracy. The main disadvantage or criticism to the use of fire towers on Isle Royale is that they will be an "eyesore", and not in keeping with the plan of minimum wilderness developments. Their advantages, however, far outweigh this disadvantage.

What about capture balloons with automatic photography equipment? Would this be instead of and necessary? etc?

Recommended System: The detection system recommended for Isle Royale is a combination of a modified tower system, and foot patrol. Since it is especially desired that developments be excluded from the interior of the island, it is believed that a

A wilderness must be protected. It may be that a few so-called eyesores are necessary.

tower system, confined to the shores, together with foot patrolling along the trails in the interior, will provide adequate detection, and will not interfere materially with the development already proposed in the Master Plan for the National Park.

As a part of this development plan, a certain number of beacon lights and light houses, to supplement those already in existence, are to be constructed at various points around the edge of the island. It is recommended, therefore, that these towers serve the dual function of beacon lights at night, and fire look-out towers during the day. Most of the outer slopes and shore lines will be visible from these points. However, it may be found necessary to erect additional towers, when a more complete study of the visibility and the dangers is undertaken. The type of structure to be erected for use as combination fire-tower and light-house will determine whether or not the system will be an "eye-sore". Naturally, they should be appropriate structures, consistent with the surroundings. The existing and proposed lights are shown on Map I. Since the location of these towers will frequently make cross-shots from two-look-outs impossible, it will be necessary at times for one tower alone to provide all the information for headquarters. The

naming, at least for fire detection use, of all points of topography such as ridges, high points, valleys, etc., is therefore very important; and it is likewise important that each towerman become exceedingly familiar with the points within his range of vision. For this purpose, a set of panoramic pictures with these points marked should be provided for each tower. The base map of the fire-finder should be marked off in $\frac{1}{4}$ miles circles around the point marking the location of the tower. By sighting through the fire-finder, the line on which the fire occurs can be marked on the map. Then, with the aid of the graduated base map and panoramic pictures, a sufficiently accurate location can be plotted and sent to headquarters. Equipment for look-out towers and instructions to look-outs are found in Appendix C.

The foot patrol, as a part of this system, should be flexible, its size depending on the number of people in the park, and upon fire conditions. It must be composed of conscientious, well-trained men. They should know their instructions and maps thoroughly. If the patrolmen are taken from the CCC ranks, special compensation may be an inducement to good work. Schedules and shifts will have to be arranged, as in the case of the towermen. By working in pairs, with a small amount of equipment, small fires could easily

be suppressed, or held in check by one while the other summoned aid. They should each be equipped with a light chemical fire extinguisher and an axe.

Communication.

The fire communication system recommended for Isle Royale consists of radio exclusively. Not only does the radio do away with the stringing of lines required for a telephone system which would definitely be out of place on Isle Royale, but the cost of installing and maintaining a radio system is considerably less. According to W. C. Hilgedick, Park Service Communications Engineer, the cost of a complete radio system is about one tenth that of a telephone system.

Trained radio operators are not necessary, except at the main headquarters, since all the sets are equipped with voice transmitters. At the main headquarters a 50 watt transmitter should be used, while at the other camps and administration areas the 10 watt sets will be sufficient. Where the camp is not provided with an electric system, a small gasoline generator will supply the power for a 10 watt set. For use in tower, on the trails, and at fires, the small portable three watt battery sets should be used. These have a total weight of 37 pounds, including batteries and

antenna reel. At intervals, not exceeding 4 miles, along the trails three watt sets should be placed in small concealed shelters, not visible from the trails. These are to be used by the patrolmen. Communication with headquarters should be established daily from each of these sets, and from each of the camps and towers.

Organization of Personnel.

The next step in the plan of fire presuppression is the organization of the fire fighting personnel. For Isle Royale such personnel must be provided for both mainland, and island.

Mainland: It is to be hoped that no future fire on Isle Royale will ever reach proportions where it is necessary to send for help on the mainland. However, it is not an impossibility, and for this reason an organization on the mainland is necessary. This should consist of emergency foremen living in or near Houghton, and CCC camps located in the vicinity of Houghton. Arrangements should be made at the beginning of each summer with the foremen and the camps, and the lists of available men should be kept on file in the Houghton office to be notified when needed. The force employed in the mainland office is also part of this land organization, and should cooperate in sending supplies and

equipment when needed.

Island: It will first of all be the duty of every person on the island to cooperate in fire prevention, and to report immediately any fires which are discovered. The organization on the island should consist of National Park Service employees, CCC enrollees, visitors, and residents.

The various members of these groups, and their places in the organization are as follows:

1. Park Superintendent, who shall be the field coordinator.
2. Chief Ranger, who shall be the fire boss.
3. Rangers, who will take over the duties of foremen, and shall take charge in the absence of the fire boss.
4. Towermen, who shall keep constant watch from the towers for fires.
5. Patrolmen, who will keep watch from the ground of trails and camp-sites.
6. CCC enrollees, who will make up the main fire fighting forces. Rules governing the use of the CCC's in the fire protection program are found in Appendix G.
7. Visitors, who will aid in fire prevention, detection, and the suppression of small fires, and larger ones if needed in emergency.
8. Residents, who will aid in fire prevention and detection, and in case of necessity, will be employed to provide extra boats for transportation purposes.

Training of Personnel.

The training of the fire fighting personnel is an important step in efficient fire suppression work. At the beginning of each summer meetings of the rangers, towermen, and other regular employees of the park should be called by the superintendent for the purpose of discussing and revising the fire plan, and to give specific instructions and practice in fire suppression methods. Further suggestions concerning the training course are founds in Appendix B.

This training should include the following:

1. Proper care and use of all equipment.
2. Reporting of fires.
3. Speed of attack.
4. Plan of attack.
5. Looking for clues as to the cause of fires.
6. Constructing lines around fires.
7. Mopping up.
8. Patrol.

These same instructions should also be given to the foremen in the CCC camps, and instructions of a more general nature given to all the CCC enrollees. Those enrollees making up the patrols or the emergency suppression crews should have very intensive training

in fire suppression, so that they can work rapidly and effectively, and even independent of supervision.

More detailed training along various lines for park rangers, foot patrolmen, and towermen should include the following:*

1. Instructions in the set-up and use of field radios.
2. Law enforcement.
3. Training in keeping records, diary, fire reports, making out camping permits, and writing informal narratives of fires.
4. Training in map reading.
5. Training in interpreting weather data.
6. Instructions as to how to handle crews, and how to distribute the men.
7. Reviews of past fires, showing weak and strong points in the suppression work.
8. Training in the operating of marine pumps, pointing out the most common reasons for their not working, and the ways of remedying the trouble.
9. Instructions for installation and use of the Osborne fire-finder.
10. Training in the use of panoramic photos with the Osborne fire finder.

*Suggestions 1, 2, 3, 9 and 10 are taken from the Report on the Fire Control Training Conference, Great Smokey Mountains National Park, June 4-6, 1936.

The person most familiar with the subject under consideration should be the instructor.

Tools and Equipment.

All fire tools should be properly marked, as indicated in Appendix D, and kept sharpened and in good repair at all times. Following is a suggested list of tools to be kept on hand in all camps for fire suppression work:

- Back-pack Pumps
- Axes, SB and DB
- Mattocks
- Shovels, LH
- Water buckets, canvas
- Water pails
- 2-man cross-cuts
- Fire rakes
- Pack baskets (for lunches)
- 1-gal. canteens
- 5-gal. water bags
- First aid kits
- Electric lanterns
- Kerosene lanterns
- Flash lights
- Files
- Stretcher
- Portable pumps, Evenrude, or Pacific Marine
- Linen Hose

The numbers of these tools to be distributed to the various camps will depend on the size of the suppression organization in that camp. A system of checking out the tools by the use of slips retained by the tool-man, and destroyed when the tools are returned is recommended. All the fire tools not in use should be kept in one place.

Emergency sets of tools should be set up and

kept in a designated, permanent place. These may be taken out on quick notice without having to be signed for. Time is also saved by not having to decide what should be taken and how many, since the sets will be made up for a specified number of men. The use of heavy, portable tool-caches is of course impractical on the island. However, caches of a permanent nature should be built in the camps and equipped with the necessary tools.

Following is the equipment suggested for a 15-man tool cache:

- 3 Shovels, LH
- 5 Axes, DB
- 4 Back-pack pumps
- 6 Mattocks
- 2 Rakes
- 6 Canvas buckets
- 5 Kerosene lanterns
- 2 Electric lanterns
- 5 1-gal. Canteens
- 1 First aid kit

Two such outfits should be sufficient in each camp. By the time the crews using these are on the way to the fire, tools from the regular supplies could be distributed without much confusion should there be need. The caches should never be locked, but should be sealed with a breakable wire seal. A list of the tools, and a record of their use should be kept on the inside.

Equipment for the protection of buildings in administration areas should include the following items:

Pressure water system
 Hose
 Chemical fire-extinguishers
 Fireman's axes
 Water pails

Transportation.

The problem of transportation on Isle Royale, as has been shown, presents one of the greatest obstacles to quick fire suppression. The provision for the most rapid transportation possible is ordinarily one of the most important items in the pre-suppression program. On Isle Royale, however, little can be done to improve the transportation conditions. Certain points regarding the use of the different forms should nevertheless be kept in mind.

Land:

1. Individual loads should be kept light.
2. Crews should keep to the main trails when possible.

Water:

1. Boats should be used whenever it will save time.
2. Light, out-boards are excellent for use in the protected harbors.
3. A pair of hip-boots should be in every boat so someone can hop in the water and pull the boat to shore.

Air:

1. Useful in large fires for mapping.

2. Not practical for transporting crews.
3. Indispensible in case of emergency sickness or injury.
4. Except when needed, the plane should be kept in Houghton, where proper care will be insured.

General Information Needed in the Presuppression Plan.

There are many maps which must be prepared, and much information which must be recorded if conditions are to be interpreted correctly, and the future predicted in the light of past occurrences. Some information may require a few years to gather and tabulate before any correlation or analysis may be made, but much of it will be a definite aid in planning future fire protection.

Maps: The various maps which should be included in the Fire Atlas, and many of which may be combined, are:

1. Topographic map.
2. Cover-type map, showing the location of the various types of cover. The types should be colored.
3. Fire Hazard-Risk map, showing the locations of various types of hazards, as burned-over areas, logging slash; and the areas of high risk as trails, camp-sites, etc.
4. Fire Location map, for the purpose of locating by letter A. B. or C. (depending of the size of the fire) the starting point, and for marking

the boundaries, of all fires which occur. This may be combined with the fire hazard-risk map.

5. Tower map, showing the exact location of the towers and the visibility and blind areas of each. This map should be equipped with strings to be extended from tower locations for the purpose of locating cross shots.
6. Visibility map, showing visibility from lookout towers, and classifying the visibility of the areas covered by each tower as direct, indirect (seen from some point near the tower), and blind.
7. Physical map, showing the location of all trails, camps, resorts, homes, and other developments; and all lakes and streams where water is available for fire fighting.
8. Hour Control map, showing time required to travel from one point to another on the island by foot, or around the shore by boat.
9. Personnel location map, showing the number and distribution of man-power, including employees, fisherman, and resorters.

Statistical Records: The collection of statistical data should cover weather, and fire statistics, and these should be assembled in the form of graphs or tables, and included in the Fire Atlas.

The careful recording, correlation, and analysis of weather data collected from day to day and from year to year will aid materially in determining

weather conditions and hence fire conditions which may be expected from time to time during the season. This data should include the following:

1. Daily relative humidity readings.
2. Daily temperature, seasonal range, and mean.
3. Rainfall.
4. Direction of the prevailing winds.
5. Evaporation rates.

Weather conditions will not vary from one place to another on the island, with the exception of wind direction, so the conditions present in one place may be considered to be present elsewhere. For this reason, weather data need only be taken at one place, preferably at the main headquarters. Equipment necessary for the collecting of accurate weather data is to be found in Appendix E.

In a similar manner, the collection and analysis of fire data will show where the efficiency of the protection system might be improved, and where further hazard reduction work should be carried on. Records for this purpose should be kept of the following things:

1. Fire detection, speed and methods.
2. Causes of fires.
3. Sizes and costs of fires.

4. Individual fire reports.

Very extensive studies in connection with travel time should be made. Rangers and foremen should be requested to note and record the time required to travel from one point to another under varying loads and conditions of cover on land, and in different kinds of boats on water. These times should be averaged and indicated on a map. The correlation of this data with the various sizes of fires which occur, will show where changes in the location of fire-fighting personnel or patrols may have to be made. A few travel times noted by the writer are found in Appendix F.

FIRE SUPPRESSION

"The suppression of fires takes precedence over any other park activities, except the safeguarding of human life."* This statement will serve to show the importance of fire fighting among the various park activities.

The nature and purposes of the national parks make fire suppression in them a difficult task. The areas burned should naturally be kept as small as possible, and at the same time the amount of permanent damage done in the suppression work should be kept down.

*National Park Service, supplementary publication form 102401, pp. 4.

Therefore the cutting of **wide** lanes, and the digging of trenches is to be avoided unless absolutely necessary. These methods of attack often leave scars as bad or worse than those left by the fires; and frequently they are often more difficult, or even impossible, to obliterate. Every precaution must be taken to avoid the necessity of employing such extreme measures to bring a fire under control.

Whether or not a fire is kept to a small size is dependent primarily upon the speed and accuracy of detection, and the speed of attack.

Detection.

Detection is the first step in fire suppression. The fire must be accurately located; otherwise crews may be misguided, and considerable time wasted. The towerman should be familiar with all the landmarks around him. He should record the information he obtains on the fire as to direction or azimuth, distance, apparent size, wind conditions, and reference to topography, so that these things may be read when he ~~sends~~ the report. Patrolmen should record the location, size, wind direction, and type of cover in which the fire is burning.

Speed of Attack.

Immediately upon receipt of a fire call the location of the fire should be plotted on the map in the

camp office. The type of cover, and best available source of water should be determined and the best route located. The foreman or ranger in charge of the emergency crew should be provided with a map containing this information. Tools from the emergency cache should be distributed, and the emergency crew dispatched immediately. Preparations should then be made for the "follow-up", which will be provided in all cases, whether actually needed or not, and this crew will be dispatched as soon as possible. Its size will be determined by the size of the fire as indicated in the initial report. Further crews may be sent upon word from the fire line.

Upon arrival at the fire the first duty of the foreman is to detail someone to look for the cause of the fire before the evidence is obliterated. The plan of attack should then be decided upon, and the crew immediately set to work. The most dangerous part of the fire should be attacked first. This may be a section about to enter brush or slash, or one approaching a steep incline.

Methods of Attack.

The method of attack chosen will naturally depend on the size of the fire, and the rate of spread.

Small Fires: The best method of attack for small fires where the rate of spread is slow is the

"direct method", in which the work is done on the edge of the fire.

It is outlined as follows for application on Isle Royale:

1. Beat the flames down with shovels, rakes, or the use of water, and keep them down.
2. Clear a walkable path around the edge of the fire by removing or cutting brush, sticks and logs. Avoid cutting live trees if possible.
3. Cut a line around the fire, stripping off the inflammable top-surface with the use of mattocks. This line should be about 18" wide, and as close to the edge of the fire as possible.
4. Starting with the burning spots closest to the line, dig these out with mattocks, throwing the burning material toward the center of the fire. Care should be taken not to scatter sparks outside the line.
5. Keep working from the edges toward the center.
6. Do not expect to put out fires burning deep in the duff or moss with water. These must be dug out.
7. Watch for smouldering places which may burn under the line.
8. Watch for spot-fires outside the line.
9. With small fires feel around the burned edge with the bare fingers to see that all the fire is out

before it is abandoned. Moss and duff may hold fire for a long time with no visible smoke arising.

10. When the fire has been worked well back from the edge, water should be applied to the coals. When water is not available, the coals should be raked over and spread, and allowed to burn themselves out.
11. Where dirt is available, use it. Do not throw wet or damp moss on the fire thinking it will be smothered.
12. Be sure fire around the bases or roots of trees is completely extinguished.
13. A watch of at least 12 hours should be provided, after the fire has been left by the foreman and crew.

Large Fires: For large, hot fires, which are spreading rapidly one of the "indirect" methods may have to be used. These are very destructive methods to use in parks, since they involve the ripping of wide lines through the woods, and should be resorted to only when it can be seen that the direct method is hopeless. The fire boss should be responsible for locating the lines.

The size, shape, and rate of spread of the fire will determine which of the possible standard indirect methods should be used.

1. The Parallel Method can be used on fires with a more or less uniform outline, and burning

in all directions. It involves the cutting of a line around the fire parallel to the edge. The distance of this line from the fire will depend on the rate of spread.

2. The Oblique Method is employed against fires advancing rapidly with a uniform front. A line is cut on an angle across the front of the fire, a safe distance ahead. The object is to avoid the danger of having the wide fire front hit the whole line at about the same time. With the oblique line the fire hits it at successive points. The ends of the line should be eventually closed around the whole fire.

3. The Frontal Method involves the construction of a line at right angles to the direction of the spread of the fire, and eventually surrounding the fire. It is especially useful in the case of long narrow fires.

4. The Point and Cut-off Method is used when the outline of the fire has many branches or fingers. Lines are cut across the ends of the fingers, and the attacks concentrated there. The line should later be drawn around the whole fire.

Mopping Up.

Once the fire has reached the fire line, the work of mopping up begins. This important function

involves the holding of the fire after it is once brought under control. This part of the suppression work on Isle Royale is as important as the actual control of the fire, since brisk daily winds may be depended upon to make it exceedingly difficult to keep the fire under control and within the lines.

The following points should be remembered in mopping up.

1. Work on the most dangerous spots first.
2. Have enough men on the line so that all of it is being watched.
3. Keep sharp lookouts outside the line for spot-fires. These should be extinguished immediately by the direct method.
4. Double the forces between 10 A.M. and 5 P.M. This is the period of greatest wind activity on Isle Royale.
5. Where possible use the power pumps and hose. Keep the back-pack pumps working constantly.

Final Mopping Up.

Final mopping up begins when the spread of the fire has been definitely checked. Its purpose is to make the fire permanently safe. Much of this work can be accomplished at night when glowing embers and sparks can be easily seen.

Patrol.

The patrol is established as a check on the mopping up job. The crew, usually small, looks for all possibilities of fire within a certain distance of the line. Only those sparks within sight, or blowing distance of the line need be extinguished.

Abandonment.

After the burned area has been closely inspected by the fire boss, and definitely pronounced "out", it is abandoned.

SUMMARY
OF
SPECIFIC RECOMMENDATIONS

In view of the fact that this plan has been discussed in such detail, a summary of the specific recommendations contained in it is here presented.

Fire Prevention.

1. Use of removal method of slash disposal close to trails in the burned areas.
2. Use of combination of removal and flattening farther away from the trails.
3. Removal of unstable trees near trails.
4. Piling of removed material for winter burning.
5. Retention of flattened slash where needed to check erosion and aid return of soil.
6. More thorough clean-up of logging roads in the logged-over area.
7. Salvaging for fuel-wood of abandoned pulpwood and usable fire-killed timber in the logged-over area.
8. Fire-proof roofing on all buildings.
9. Spark arresters or screens on all chimneys.
10. Registration for park visitors.
11. Distribution of a pamphlet containing rules for use of fire, and penalties for violation thereof.
12. A section on fire protection should be included as part of the general educational program.

13. Elimination of fire prevention posters and signs.
14. Restricting or prohibiting the use of fire during dangerous periods.

Fire Presuppression.

1. Use of combination light-house and look-out towers located near the shore of the island.
2. Foot patrol of the trails and camp areas in the interior of the island.
3. Special compensation for CCC patrol men.
4. Maintenance in the mainland headquarters of lists of available emergency foremen and CCC crews.
5. Retaining of a small emergency crew of CCC boys in camp during dangerous periods.
6. Establishment of a general training period at the beginning of the summer.
7. Intensive training of patrolmen and emergency suppression crews.
8. Establishment in all camps of at least two complete, permanent 15-man tool caches.
9. Equipping all small boats with a pair of hip-boots for landing purposes.
10. Extensive travel-time studies for land and water.
11. Use of radio exclusively as the system of fire communication.
12. Collection, recording, and analysis of accurate weather and fire statistics.

Fire Suppression.

1. Reporting of all fires to the main headquarters on the island.
2. "Follow-up" crews should always be sent.
3. Detailing of a member of crew to look for clues as to cause of fire immediately upon arrival at fire.
4. The cutting of live trees should be avoided when possible.
5. The indirect methods of fighting should be resorted to only when the use of the direct method is hopeless.
6. The use of airplanes in the case of large fires for mapping, and for human emergency.

It is believed that the observance of this plan, with adjustments and expansion to meet certain needs and conditions unforeseen at present, will provide adequate fire protection for Isle Royale National Park, and at the same time will not unnecessarily encroach upon the wilderness which it endeavors to preserve and protect.

APPENDICES

	Page
Appendix A. Rules And Regulations Regarding The Use Of Fire-----	49
Appendix B. Annual Training Course-----	51
Appendix C. A. Equipment For Lookout Stations-----	54
B. Instructions To Lookouts-----	54
Appendix D. Marking Of Tools-----	56
Appendix E. Equipment For Headquarters-----	58
Appendix F. Travel Time-----	59
Appendix G. Rules Governing CCC's In Fire Protection-----	60

APPENDIX A

RULES AND REGULATIONS REGARDING THE USE OF FIRE. (From NPS Manual of the Branch of Forestry, pp. 16).

The following regulations with regard to fires apply generally within the national parks and monuments:

Fires shall not be kindled near trees, deadwood, moss, dry leaves, forest mold, or other vegetable refuse, but in some open space on rocks or earth. On public camp grounds the regular fireplaces constructed for the convenience of visitors should be used. Should camp be made in a locality where no such open space exists or is provided, the deadwood, moss, dry leaves, etc., shall be scraped away to the rock or earth over an area considerably larger than that required for the fire.

Fires shall be lighted only when necessary, and when no longer needed shall be completely extinguished, and all embers and beds smothered with earth or water, so that there remains no possibility of re-ignition.

Permission to burn on any cleanup operation within the parks or monuments must first be obtained from the office of the superintendent or custodian, and in such cases as are deemed advisable, such burning will be under Government supervision. All costs of suppression and all damage caused by reason of loss of

control of such burning operations shall be paid by the person or persons to whom such permit has been granted.

No lighted cigarette, cigar, match, or other burning material shall be thrown or dropped into any leaves, grass, twigs, tree mold, or other combustible matter.

Smoking or the building of fires on any lands within the parks or monuments may be prohibited by the superintendent or custodian when, in his judgement, the hazard makes such action necessary.

All persons making trips away from established camps are required to obtain fire permits from the nearest ranger before building camp fires.

The use of fireworks or firecrackers in the parks and monuments is prohibited except with the written permission of the superintendent or custodian.

APPENDIX B

ANNUAL TRAINING COURSE (The following suggestions are taken from the Report on the Fire Control Training Conference held in the Great Smoky Mountains National Park, June 4-6, 1936).

Purposes of training camp personnel in fire prevention and control:

1. To increase the understanding of fire prevention and control objectives, of values at stake, and of methods, equipment, and facilities for fire prevention and control.
2. To develop skill and dexterity through practice in the use of fire prevention and control equipment and fire control strategy.
3. To increase and maintain efficiency of law enforcement through better knowledge of laws, regulations, limitations, and methods, and through obtaining convictions.
4. To promote esprit de corps.
5. To bring about a militant attitude of mind in the effort to achieve fire control objectives.

Methods of teaching:

1. Demonstration
2. Practice
3. Conference
4. Lecture

Of these methods of teaching, demonstration and practice will be used most of all. The other two methods assume some experience, and will not be generally resorted to.

Examples of What to teach, and How to teach:

Use of Council Fire Rake.

1. What the tool can be used for.
2. Most effective strokes and blows for each function.
3. How to avoid dulling on stones.

Demonstration and practice. Impress the men with possibilities of this tool when properly held and used. Small groups of not more than four should be taught at one time.

Use and Care of Back Pack Pumps.

1. Show how apparatus is put together.
2. How filled most efficiently.
3. Most efficient use.
4. Precautions necessary to keep in working order.

Demonstration and practice. Emphasize the need for using clean water, and for making every bit of water count, especially in the initial attack. One pump for each instructor and two learners.

(The proper use of these two instruments should be taught to the men in the suppression crews as well as to

rangers and foremen)

Absence from, or non-participation in the activities of the training period will not be tolerated. Every learner should be given the opportunity to actually do every operation which is being taught.

APPENDIX CA. EQUIPMENT FOR LOOKOUT STATIONS (taken from various sources).

1. Osborne-Fire-finder, and all accessories and extra supplies. (Detailed instructions for the installation and operation of this instrument are found in the Western Fire Fighter's Manual, pp. 15-36).
2. Radio and equipment.
3. Binoculars or a telescope.
4. A set of graduated panoramic pictures.
5. Colored glasses, and celluloid eyeshade.
6. Alarm clock.
7. Diary.
8. Forms, notebooks, pencils, etc.
9. Maps
 - a. Visibility
 - b. Physical improvement
 - c. Cover type
10. Set of written instructions.
11. Other necessities such as stool, map board, etc.

B. INSTRUCTIONS TO LOOKOUTS (taken from various sources).

1. Keep vigilant watch.

2. Obtain relative humidity and fuel moisture content readings and other information from headquarters daily.
3. Inform headquarters when leaving post, and upon return.
4. Learn maps and landscape.
5. Keep fire-finding instrument oriented and in working conditions at all times.
6. In reporting fires, the information should be recorded so that it can be read over the radio.
 - a. Show or furnish data for determining a precise platted location of the fire.
 - b. Furnish all information which will help crews in finding the fire.
 - c. Give all additional information which will be of assistance in determining the size of the fire and the number of men and type of equipment needed.

APPENDIX D

MARKING OF TOOLS (NPS Manual of the Branch of Forestry, pp. 9).

All tools and equipment purchased for forest protection shall be specially marked to identify them as such and to prevent loss by theft or use for other purposes.

As a permanent mark of identification, all metal parts of fire tools are to be stamped "USNPS" and their handles are to be given a coat of red paint beginning where the wood joins the metal and extending up six inches. The red band should become the trademark of fire equipment. Wooden handles should also be branded. The following system of placing the letters "USNPS" will be considered standard:

Axes, D. B., either side, middle of eye
 Axes, S. B., right-hand side, middle of eye
 Hoes, stamp right-hand side
 Lanterns, gasoline, stamp on hem on bottom
 Mattocks, either side, middle of eye
 Saws, two-man either or both ends nearest
 to handle
 Saws, one-man, right-side close to handle
 near top.
 Shovels, stamp on inside of right-hand corner
 Tools, McLeod, or Kortick, inside of blade
 near center
 Other tools should be stamped on a suitable
 face.

The founts or tanks of oil and gasoline lanterns

should be painted red. Flash lights, cross-cut saw handles, etc., should be banded with red paint.

In painting the handles of fire tools, care should be taken not to cover that portion of the handle that ordinarily comes in contact with the hands when the tool is in use.

Canvas goods should be stenciled with "USNPS" as should also metal equipment, such as back pack pump cans. Each length of fire hose should be stenciled at each end close to the coupling, and the year in which the hose was purchased should be included.

APPENDIX EEQUIPMENT FOR HEADQUARTERS

1. Radio and supplies.
2. Fire Atlas.
3. Files containing forms, records, etc.
4. Atmometer (for measuring evaporation rates).
5. Rain guage and measuring stick.
6. Hydrothermograph (for continuous automatic recording of relative humidity and temperature).
7. Barograph (for continuous barometric records).

sp

APPENDIX FTRAVEL TIME.

The following travel times were noted by
the writer:

1. Camp Siskiwit to the intersection on the Greenstone Ridge Trail, 4 miles--1 hr. 20 min. No pack.
2. The above intersection on the Greenstone Ridge Trail to Washington Harbor; 6.5 miles--1 hr. 50 min. No pack.
3. Intersection on the Greenstone Ridge Trail to Lake Desor: 4 miles--1 hr. 10 min. No pack.
4. Camp Siskiwit to Gull Rocks, via Greenstone Ridge and east end of Lake Desor; 13 miles--6 hrs. 15 min. 30 pound pack.
5. Camp Rock Harbor to top of ridge, via Daisy Farm Trail; 2 miles--50 min. Light pack.

after

APPENDIX G

RULES GOVERNING CCC'S IN FIRE PROTECTION. (From NPS Handbook of Emergency Conservation Work, Chapter IX).

PAR. 1. FIGHTING AND PREVENTING FOREST FIRES:

During the fire season each ECW Camp will be the principal source of fire suppression labor within its territory and, in case of need, men should be sent to any part of the park or adjacent areas where fires may be threatening the park. Fire fighting shall be recognized as emergency work and shall take precedence over anything else, except the safeguarding of human life. All resources of the camp will be used regardless of regular hours or interruption of other work.

During the fire season, fire suppression crews of appropriate size as determined locally may be held in camps for emergency use.

During the unusually dangerous fire weather, enrolled men may be used for several days or weeks to man emergency lookout or guard stations; or such manning of regular stations by enrolled men for considerable periods may be necessary this year because of severe cuts in regular appropriations. Men experienced in this type of work should be selected wherever possible.

PAR. 2. TRAINING MEN:

All men in the camp from the Camp Superintendent down, will be trained in the methods of fighting fire by the Park Officer in charge of fire suppression.

The training will stress:

1. Detection and Reporting of Fires.
2. Speed of Attack.
3. Plan of Attack.
4. How to Build Fire Lanes.
5. Mopping Up.
6. Patrol, etc.

Many of the steps can be demonstrated as part of their training. The men shall build fire lanes, use hand pumps, cut snags, mop up, etc., as well as listen to explanations and instructions. The Camp Superintendent and the Crew Foremen, many of whom have had fire fighting experience, shall qualify to lead crews in fighting fire, and should learn as rapidly as possible the methods which are best adapted to local conditions.

PAR. 4. RATIONS FOR FIRE FIGHTERS:

The War Department has authorized all Corps Area Commanders to increase the rations allowance by one-third for personnel engaged in combatting forest fires away from the base camp.

In case of shortage in ECW supplies or disagreement on the part of the Camp Commander, no delay should be permitted in procurement of the necessary food supplies in the usual National Park method, but report should be made of any lack of cooperation. Where other than enrolled men are included in the fire-fighting crew, their share of the food supplies should be financed in the usual manner from fire-fighting funds.

PAR. 6. HOURS OF WORK:

The men will be subject to emergency calls by the Camp Superintendent of the work agency on any day at any hour of the day or night for the purpose of fighting forest fires, or in similar emergencies affecting life or property. While such emergency lasts the daily hours of work will be determined by the Federal or State Officer in charge of the crew on the emergency work, in consultation with the Company Commander, with a view to the preservation of the health of the enrolled personnel.

During the periods of critical forest-fire danger as determined by the Park Superintendent, all or part of the men will be held in camp on non-working days or after regular work hours at the request of the Camp Superintendent, in order to be immediately available for forest-fire control services.

PAR. 7. FIRE PREVENTION:

The protection of the camps is the responsibility of the Camp Commander and the concern of the Parks is to avoid having fires start from the camp. Camp Commanders shall be urged to remove all inflammable debris for at least fifty feet around any camp building. Lunch fires, where used, smoking in the field, and other fires required in connection with field work are the responsibility of the Camp Superintendent under the instructions of the Park Superintendent. The Park Fire Chief, or in those parks where there is no regular appointed Fire Chief, the Camp Superintendent shall determine where and when it is safe to burn debris in connection with fire hazard removal work; when smoking in the field shall be allowed, and when restricted; when and where lunch fires and other fires outside of camp shall be permitted.

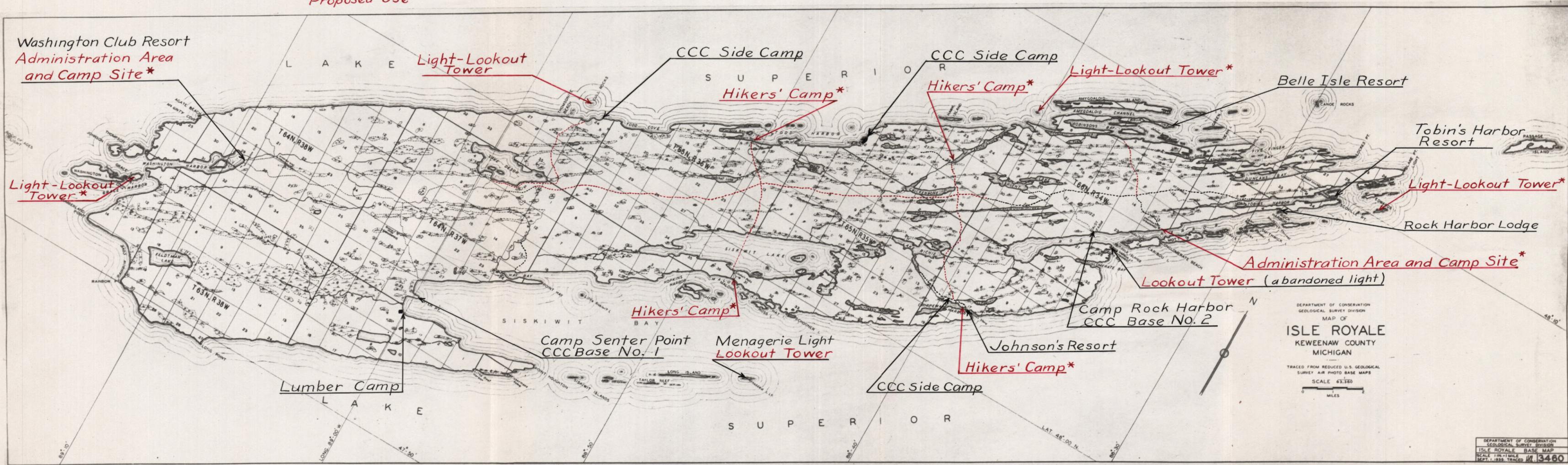
NOTE

The proposed trails correspond closely to those suggested in the Master Plan. Sites marked * are proposed in the Master Plan.

KEY

Existing Trails -----
 Proposed Trails - - - - -
 Existing Sites →
 Proposed Sites →
 Proposed Use →

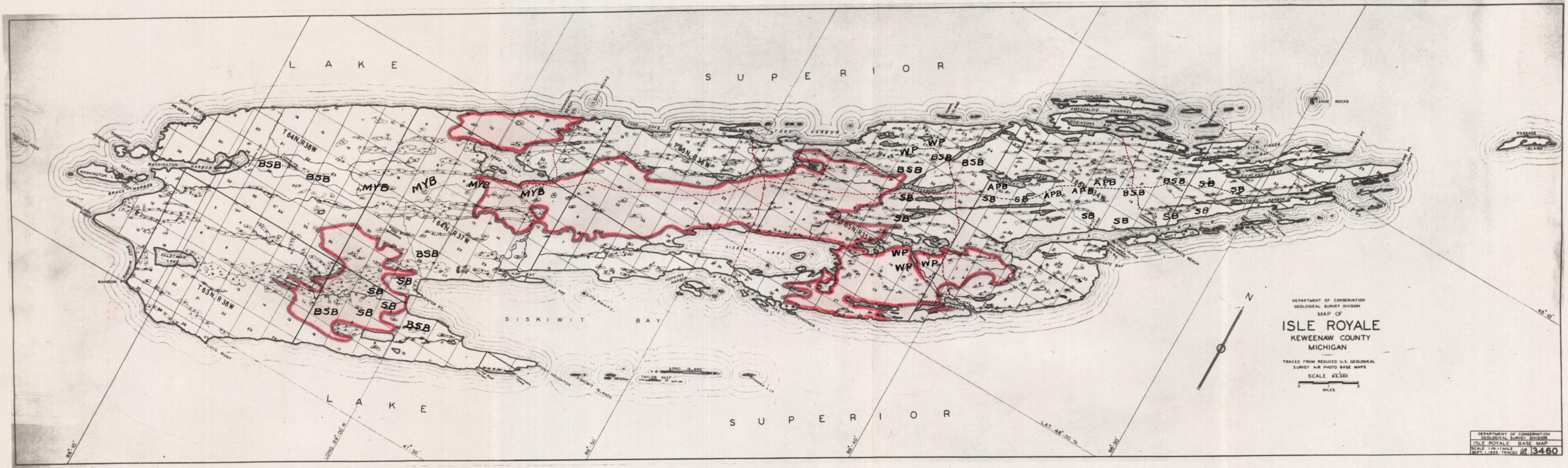
**MAP OF
 EXISTING AND PROPOSED DEVELOPMENTS**



MAP I

KEY TO TYPES
 BSB - Balsam-Spruce-Paper birch
 APB - Aspen-Paper birch
 MYB - Maple-Yellow birch
 SB - Spruce-Balsam
 WP - White pine

MAP OF
 BURNED-OVER AREAS
 AND
 OBSERVED COVER TYPES

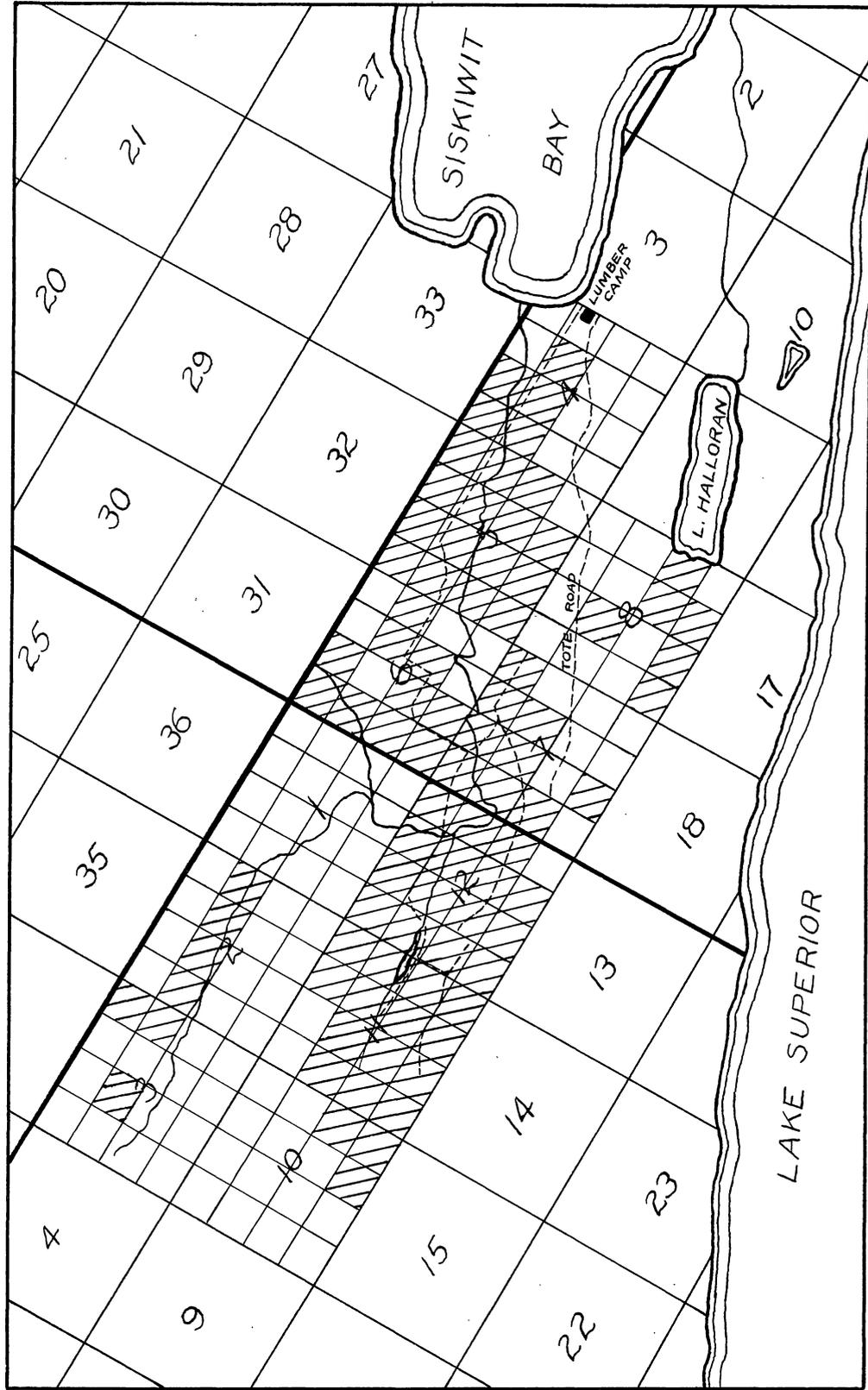


DEPARTMENT OF CONSERVATION
 GEOLOGICAL SURVEY DIVISION
 MAP OF
ISLE ROYALE
 KEWEENAW COUNTY
 MICHIGAN
 TRACED FROM REDUCED U.S. GEOLOGICAL
 SURVEY AIR PHOTO BASE MAPS
 SCALE 63,360
 0 1 2
 MILES

DEPARTMENT OF CONSERVATION
 GEOLOGICAL SURVEY DIVISION
 ISLE ROYALE BASE MAP
 SCALE 1 IN. = 1 MILE
 REPT. L. 1939, TRACED IN 1946

MAPII

MAP OF
LOGGED AREA IN THE SISKIWIT SWAMP



----- Main Logging Roads
▨ Forties on Which Pulpwood was Cut

Handwritten signature

UNIVERSITY OF MICHIGAN

3 9015 00327 2179

THE UNIVERSITY OF MICHIGAN ✓

TO RENEW PHONE 764-1494
DATE DUE

--	--



