O.D.C.(436)

PLANNING FOR PRESCRIBED BURNING

in Manitoba & Saskatchewan

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Forest Research Laboratory, Winnipeg, Manitoba ● Liaison & Services Note MS-L-9 ● Canada Department of Fisheries and Forestry

introduction

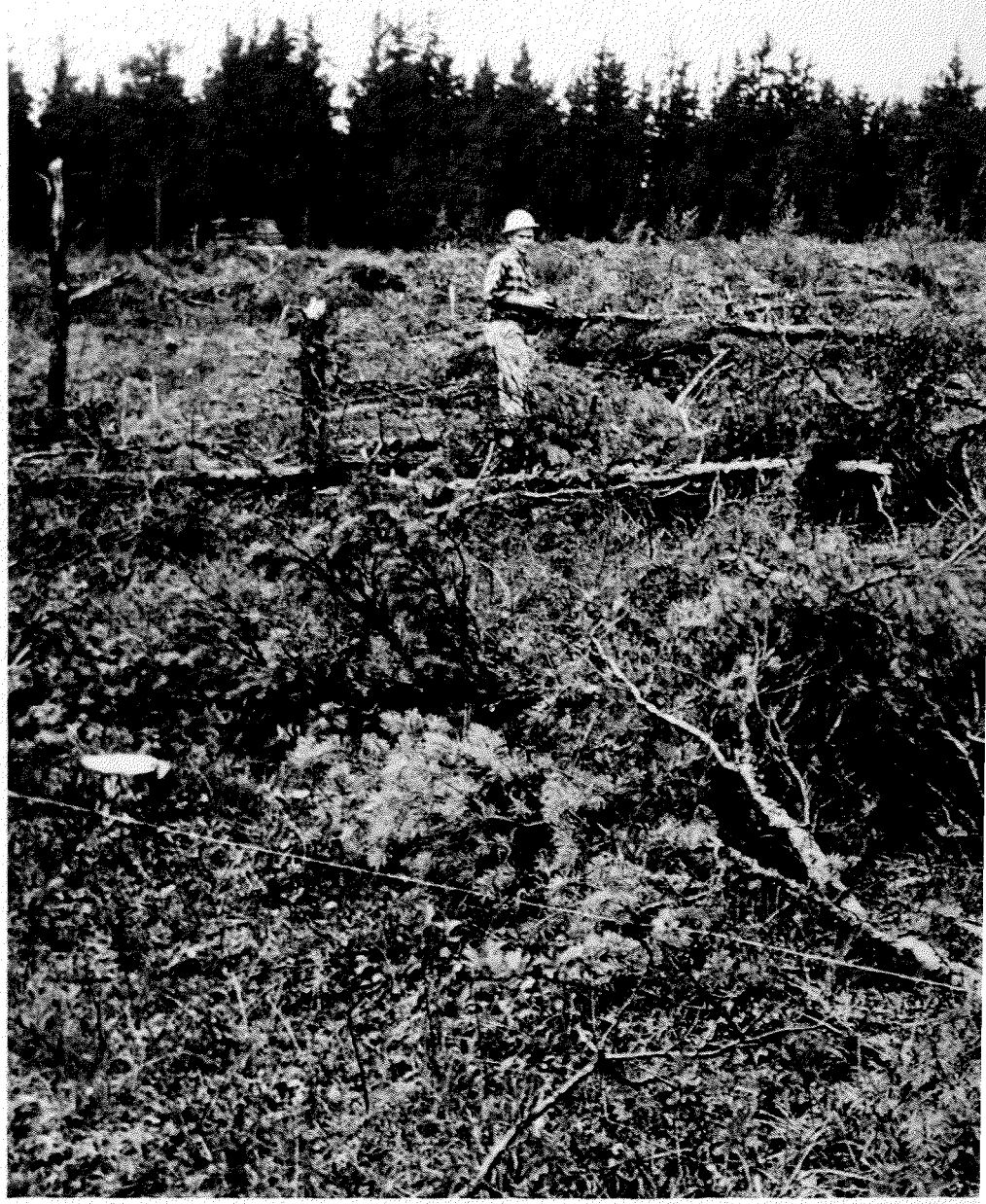
In Manitoba and Saskatchewan where forest stands are now being harvested in large clearcut blocks, there is need for extensive, low-cost methods of regenerating and managing the forest resource. Prescribed burning can be a powerful tool for the forester as he endeavours to implement sound, economical management policies.

When prescribed burning is carried out under strict supervision and planning, with adherence to the basic guidelines given here, little real danger or risk is involved, while the rewards can be substantial.

The technique has been practised elsewhere in Canada and in many regions of the United States with considerable success. A growing number of foresters and other resource managers are staunch advocates of the use of this silvicultural tool.

It is only recently, however, that prescribed burning has been introduced in Manitoba and Saskatchewan and, consequently, relatively few people in these provinces are experienced in its use. It is for this reason that this note has been prepared—to serve as a general guide in the planning and execution of prescribed burning in the forests of Manitoba and Saskatchewan.

The general information contained herein will apply to most prescribed burning operations. Actual burning pre-



Frontispiece — Prescribed burning following a seed-tree cut in jack pine.

scriptions are not given here; these can only be derived by applying general principles, tempered by experience, to each prospective burning situation.

glossary

BACKFIRE - A prescribed fire set to burn against the wind.

DROUGHT INDEX - A numerical rating, based on number of days since precipitation, which indicates the relative dryness of heavier forest fuels.

FIRE BEHAVIOR - The manner in which a fire starts, develops, spreads and exhibits other phenomena.

FIRE DANGER INDEX - A numerical rating, based on meteorological measurements, which indicates the ease of ignition and probable behavior of fires within a specified area.

FIREGUARD - A man-made barrier intended to stop an advancing fire. A fireguard may provide a control line from which to start a backfire or to carry out fire suppression action.

HANG-FIRE (Same as hangover fire) - A fire that starts up again after appearing to be extinguished.

HAZARD - The threat of ignition, spread and potential control difficulties presented by fuel types, based on their composition, arrangement, volume, condition and location.

HEADFIRE - A prescribed fire set to burn with the wind.

HOT SPOT - A particularly active part of a fire.

MOP-UP - The act of making a fire safe after it has been brought under control by extinguishing or removing burning material.

PRESCRIBED BURNING - The burning of forest fuels on a predetermined area under prescribed conditions so that the fire is confined to that area to fulfill silvicultural, wildlife-management, sanitary or hazard-reduction objectives.

SPOT-FIRE - A fire started outside the burning area by burning sparks or embers.

WILDFIRE - An unplanned fire requiring suppression action, as contrasted with a prescribed fire.

Quoted or paraphrased from: GLOSSARY OF FOREST FIRE CONTROL TERMS issued by The Associate Committee on Forest Fire Protection, National Research Council, Ottawa. Jan. 1963.

purposes

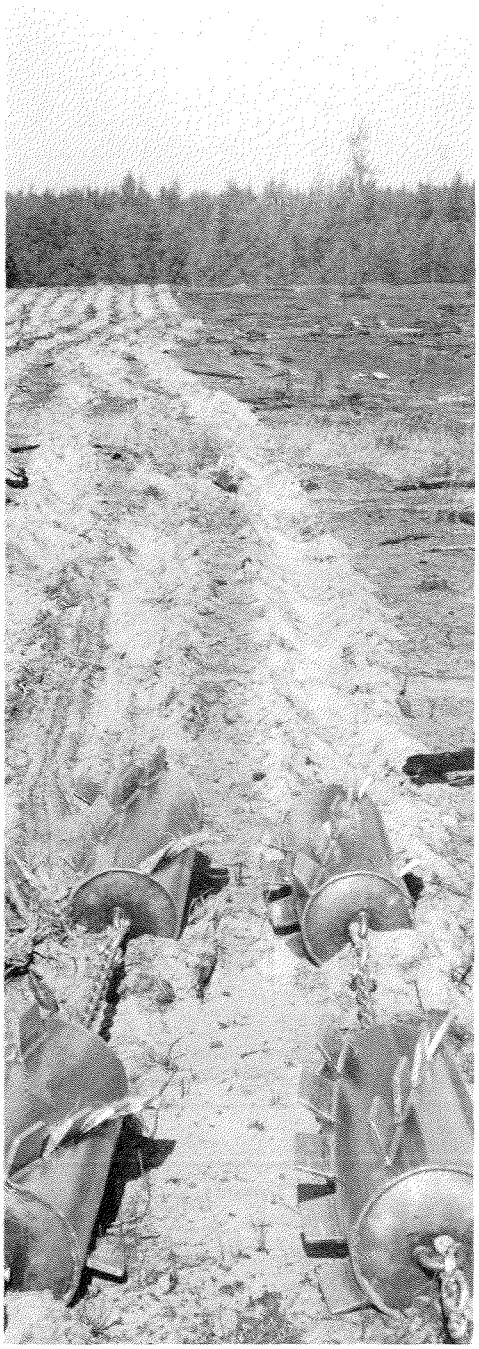
HAZARD REDUCTION

Wildfires starting in slash left from clear-cutting operations can be a serious threat to surrounding uncut stands. These large, continuous slash areas may be fire hazards for up to 10 years following the harvesting operation.

Prescribed burning, carried out at low to moderate levels of fire danger, can effectively reduce the fire hazard of cutover areas and render them relatively safe from wildfires. Timber stands adjacent to large meadows and marshes can be effectively protected from wildfire by burning the grass fuels in the early spring before snow in the forest stands has melted. Special hazards along roadsides may also be eliminated in the same manner.

PLANTING SITE PREPARATION

Site preparation for reforestation of harvested areas is often costly and in some cases difficult because of the slash which remains after logging operations. On some of the more productive sites, slash is so great that it must be windrowed before further site preparation can be carried out. Not only are such operations expensive, but there is often considerable loss in usable land. The cost of removing slash by fire is often more than repaid by the reduction in subsequent machine and planting costs.



Prescribed burning also reduces vegetative competition and releases from the slash valuable nutrients which are immediately available to the new crop. These benefits are short-term but they apply through the critical period during which the transplants are becoming established.

PURPOSES

- Hazard reduction
- Planting site preparation
- Seedbed preparation
- Wildlife habitat improvement
- Insect and disease control
- Training fire control personnel

SEEDBED PREPARATION

Forest floors commonly have thick organic layers (duff) that must be removed before successful seeding can be accomplished. Mechanical methods, although successful, are often expensive. Prescribed burning, however, can remove the organic mantle exposing mineral soil seedbeds at low cost compared to that of machine preparation.

Burning for seedbed preparation requires long periods of drying weather to sufficiently reduce the moisture content of the organic layer. Burning under these dry conditions therefore requires careful preparation and a knowledge of expected fire behavior. Well-prepared plans and preburning improvements can greatly aid in the safe and efficient execution of such burns. Prescribed burning for seedbed preparation has been successful in pine types; it has not yet proven reliable in preparing seedbeds in hardwood or mixedwood stands.

WILDLIFE HABITAT IMPROVEMENT

Fire has always played a major role in Canadian forests, and most upland wildlife species are dependent on fire-created habitat. Fires open up the forest canopy and stimulate the production of food plants. In many cases, prescribed burning may be a feasible and economic means of improving wildlife habitat.

◀◀ WHITE SPRUCE-TREMBLING ASPEN
◀ BLACK SPRUCE

INSECT AND DISEASE CONTROL

Fire has not often been used for this type of work but there is increasing evidence that it can be employed to successfully control some insect and disease problems.

For example, mistletoe, a common problem in Manitoba and Saskatchewan forests, is not easily controlled by other silvicultural techniques. Prescribed burning, however, can be used as a sanitation tool to remove infection centers from residual trees in logged areas. Unless such sanitation is carried out, subsequent regeneration may be infected and lost.

Fires can also be used to aid the control of specific insect problems, as in the case of burning slash to prevent the buildup of certain species of bark and wood-boring beetles on logged areas. Insects that spend a portion of their life cycle in the duff and litter layer may be controlled by a low-intensity fire without damaging overstory trees.

TRAINING FIRE CONTROL PERSONNEL

Prescribed burning can also serve as a valuable aid for training fire fighting personnel. Many new fire fighters are unfamiliar with fire control methods and need training in fire suppression.

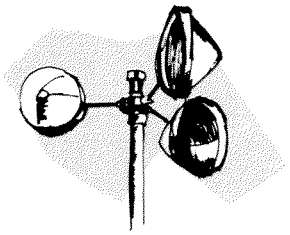
Prescribed burns can provide an excellent opportunity to learn about fire behavior, equipment operation, and suppression crew organization. Mopping-

up after prescribed burns is essentially the same as after wildfires, so new personnel can be made familiar with problems before their first wildfire by using them on prescribed burning operations.

Such training should probably be viewed as a secondary objective of all prescribed burns but it may be the primary objective.

weather

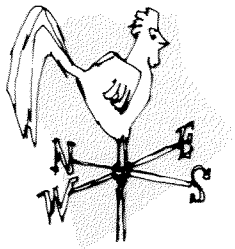
Fire behavior is dependent on weather both prior to and during the execution of the burn. Rate of spread and fire intensity are greatly influenced by windspeed and moisture content of the fuel, the latter being determined by temperature, relative humidity, wind, and precipitation. Heavy fuels and duff (other than surface litter) require several days of drying weather to reduce their moisture content to the point where they will be consumed. Fine fuels (surface litter, needles and twigs on slash, etc.) dry out much faster and may require only one or two drying days for a successful burn.



WIND

The most important weather variable to consider during prescribed burning operations is wind. Fire behavior is greatly influenced by windspeed and abrupt changes in the wind direction can cause serious problems.

Burning should be avoided at high windspeeds. On the other hand, burning with extremely low winds may cause the fire to be ineffective. The optimum



windspeed is generally between 5 and 15 m.p.h.

When radical changes in wind direction are anticipated burning should be avoided if possible. Such changes are generally the result of a frontal movement and can usually be predicted well in advance. Winds greater than 10 m.p.h. are generally quite persistent and are less likely to change directions than low-speed winds which are generally forecast as light and variable. Extra care should be used when burning operations are carried out under these conditions.

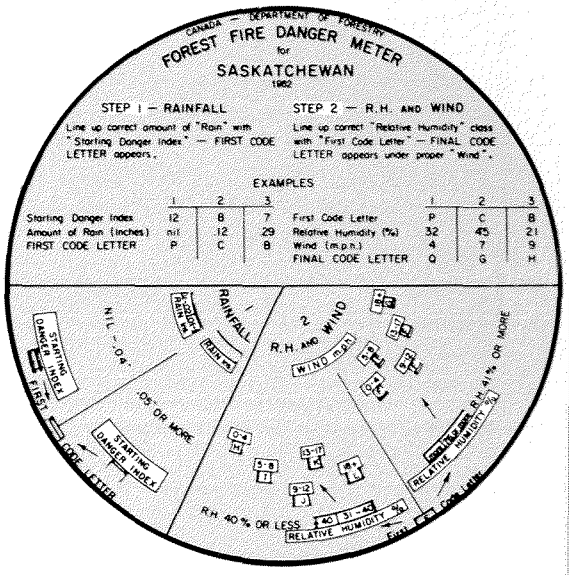
TEMPERATURE AND RELATIVE HUMIDITY

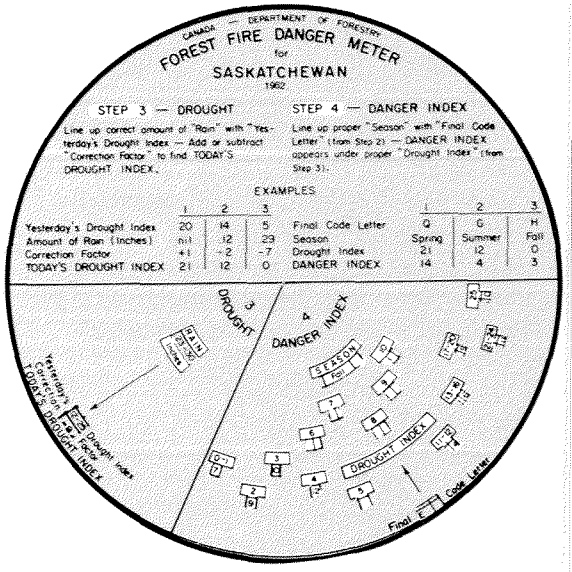
Temperature and relative humidity are important variables because of their impact on the moisture content of forest fuels. Fine fuel moisture content is readily influenced by the amount of water vapor in the air and will change greatly within relatively short time periods. Fine fuels will be much drier on a hot day than on a cool day with the same relative humidity.

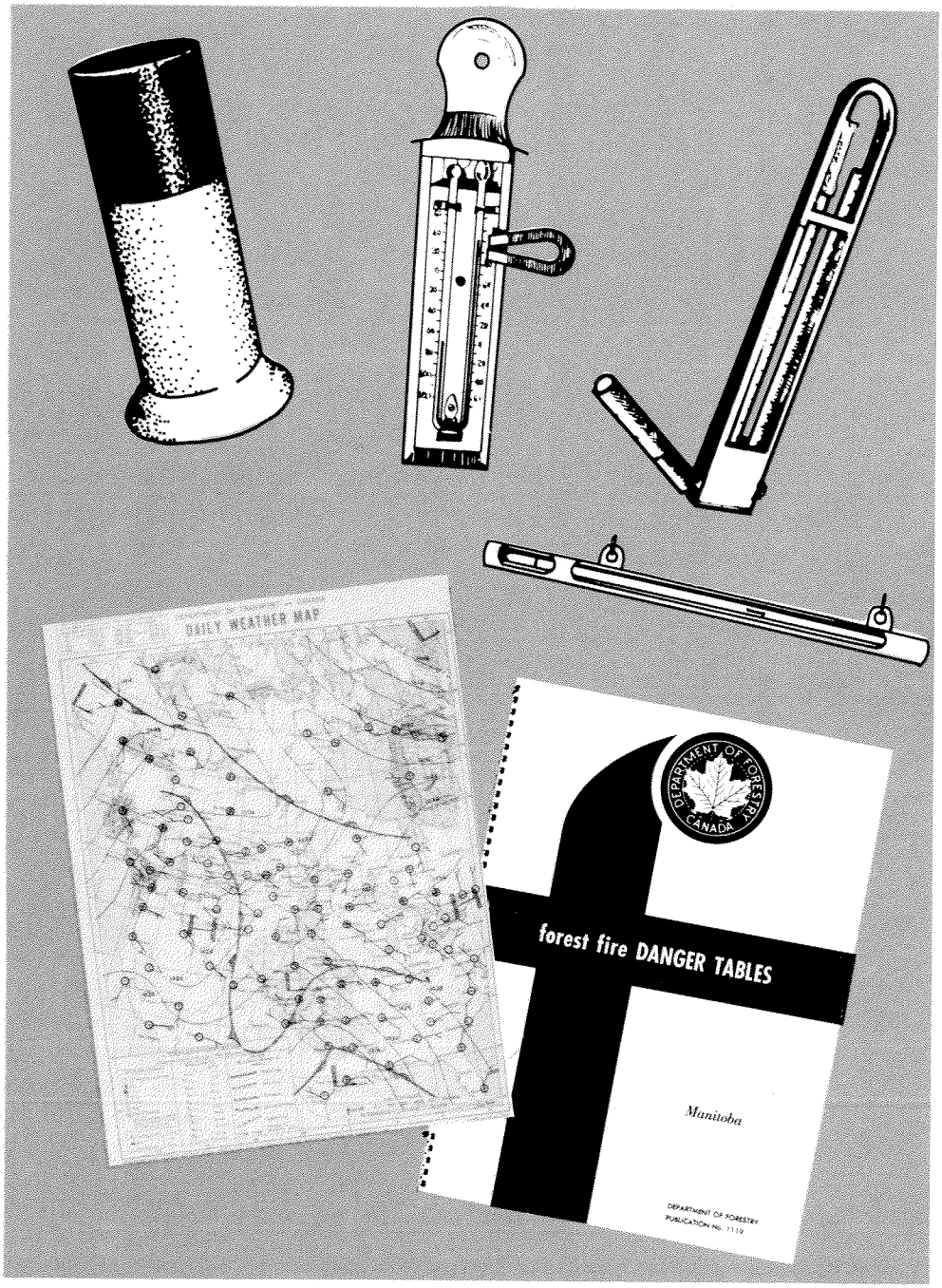
Fine fuel moisture content will influence fire behavior, particularly rate of spread and spotting activity. Consequently, extra precautions should be taken when the fine fuel moisture is low.

PRECIPITATION

Precipitation will affect prescribed burning because of its impact on the moisture content of fuels. Heavy fuels (logs, duff, etc.) will become dry enough to burn only after extended periods without rainfall, and if the removal of such fuels is an objective of a prescribed burn the number of days without rain will be an important part of the burning prescription.







WEATHER FORECASTS AND OBSERVATIONS

Accurate weather forecasts are, of course, vital. The Department of Transport, Meteorological Branch, through its fire weather forecasting service is able to provide predictions for such variables as windspeed and direction, temperature, and relative humidity for most of the commercial forest areas of Canada. Such forecasts are invaluable to the fire foreman and should be obtained for every proposed burn. A final decision to burn should be based on the expected weather conditions for the day of the burn and for one or two days following the burning operation. If dangerous conditions are expected within this period, burning should be postponed.

In addition to weather forecasts, weather observations taken at the nearest fire danger rating station serve as important aids to prescribed burning operations. The Drought and Fire Danger Indexes[1] are useful guides for determining when to carry out the burn. These indexes are good integrated measures of past and present weather and will serve as indicators of expected fire behavior and the success of the burn.

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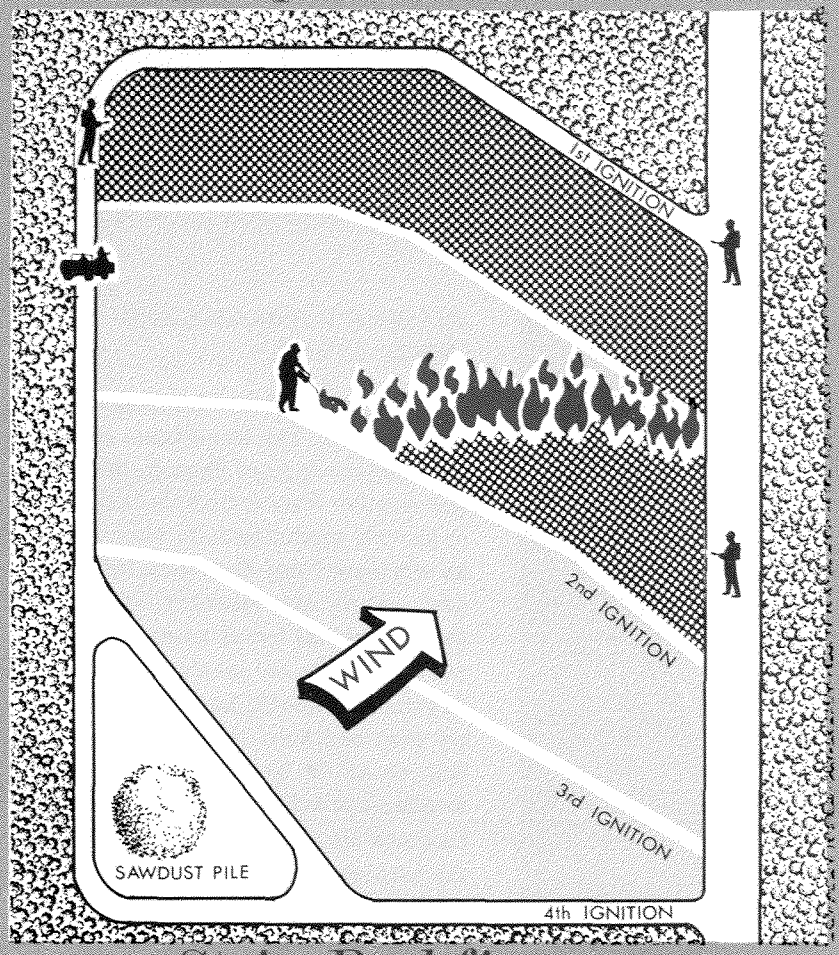
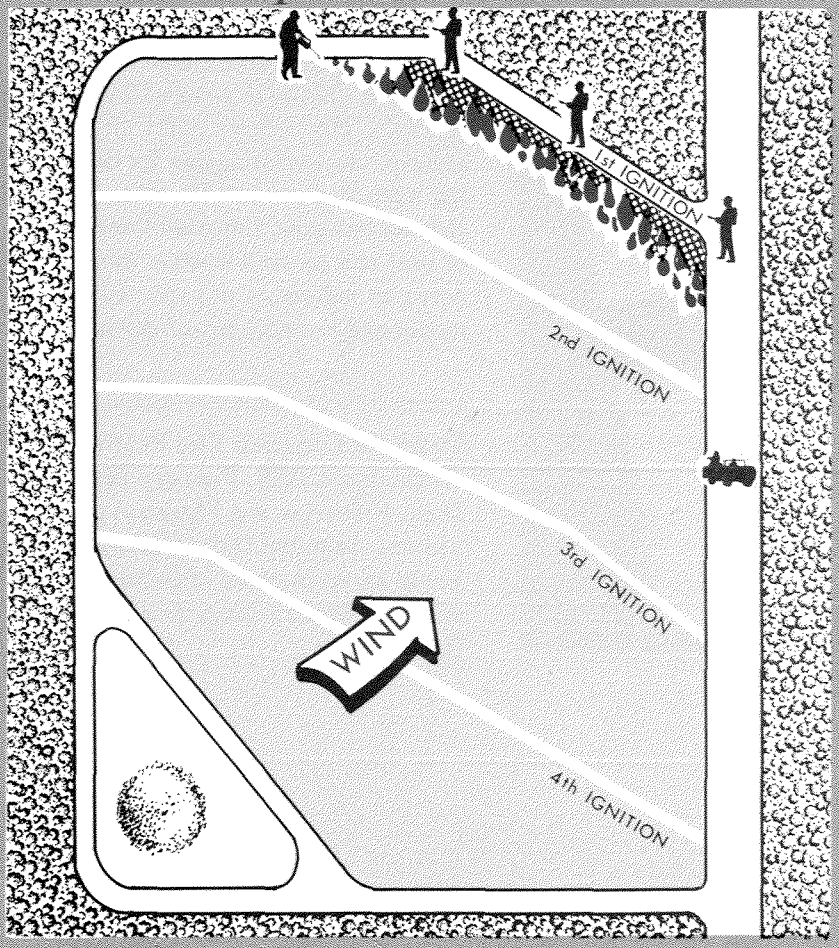
[1]Under the Canadian Fire Weather Index (Provisional 1969, Forestry Branch, Dept. Fisheries and Forestry) rating system, Adjusted Duff Moisture Code would serve in place of Drought Index and Fire Weather Index in place of Fire Danger Index.

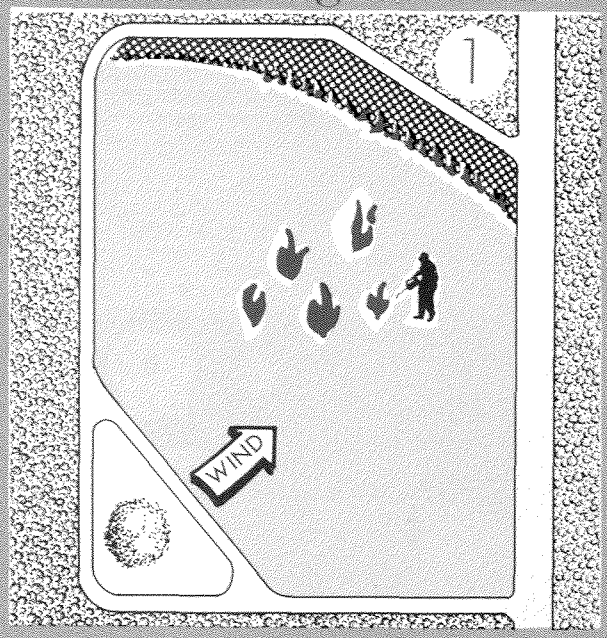
Strip Headfire

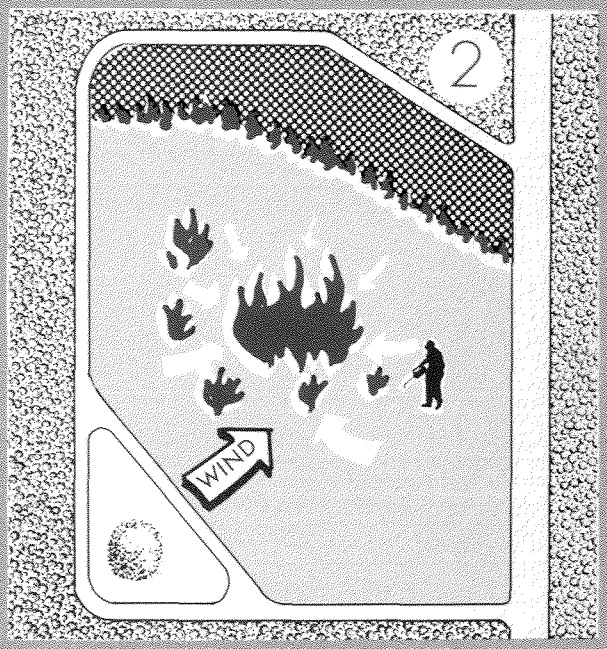


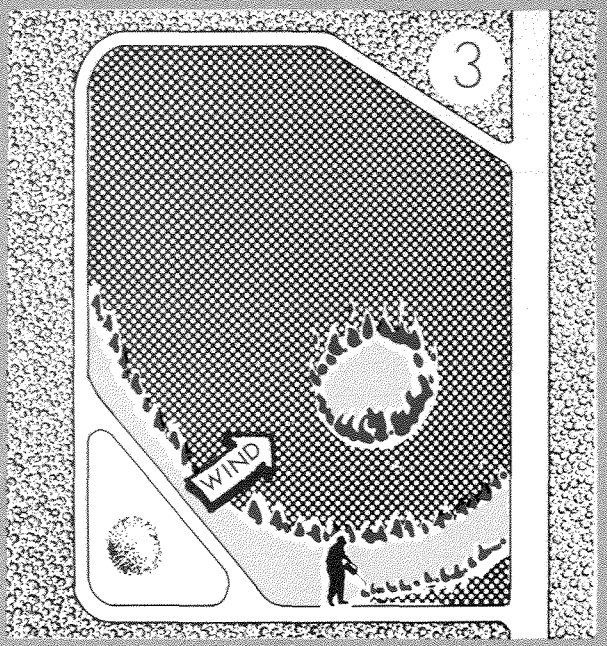
Strip Backfire



Area Ignition







techniques

STRIP HEADFIRE

The strip headfire technique consists of lighting a strip of fire and allowing it to spread with the wind until the fire is stopped by a previously-burned safety strip or a prepared fireguard. This technique is used when it is desired to burn large areas in a short time.

In order to burn out a safety strip, a backfire should be started on the extreme downwind side before the ignition of the first strip headfire. The burning of the safety strip can be greatly speeded up by successively burning very narrow (5 to 10 feet) headfire strips until the desired width has been reached. After the safety strip is prepared, headfire strips are usually about 2 to 4 chains wide but the optimum distance will vary according to local conditions.

Headfires release the heat energy in the fuels at a faster rate and are more likely to scorch tree crowns or cause spot fires than are backfires. They can be used when high humidities or high fuel moisture levels prohibit the efficient use of a backfire. Headfires are also useful in discontinuous fuels or where fuels are sparse.

The strip headfire technique is very flexible because it requires few pre-burn preparations and can be used with any wind direction with a minimum of preplanning.

STRIP BACKFIRE

The backfire technique consists of lighting the downwind side of an area to be burned and allowing the fire to progress into the wind. Backfires advance at an average rate of about 1 chain per hour in most slash fuels.

Because of its slow rate of advance, a backfire is relatively easy to control and can be more safely executed during periods of high winds and dry conditions. On the other hand, for the same reason they cannot be used to burn large areas rapidly.

Large areas can be burned with backfire if several interior fireguards from which the backfire strips can be started are constructed prior to the burn. Such preparations are costly, however, and may not often be economically feasible.

AREA IGNITION

This technique requires considerable knowledge of fire behavior. When used properly, it can be the most reliable and effective method to employ. It is particularly useful for burning heavy slash when the windspeed is low.

Area ignition consists of simultaneously lighting several fires in the center of the area to be burned. When it is evident that air is being drawn inward, the outer portions of the area to be burned (but still well inside the perimeter) are ignited, followed by ignition of the perimeter. As these small fires become larger they create strong updrafts that add to the vigor of the fire. A strong convection column is built up and fuel is consumed very rapidly. Large areas can be burned in a very short time using this technique.

planning & preparing for the burn

PLANNING

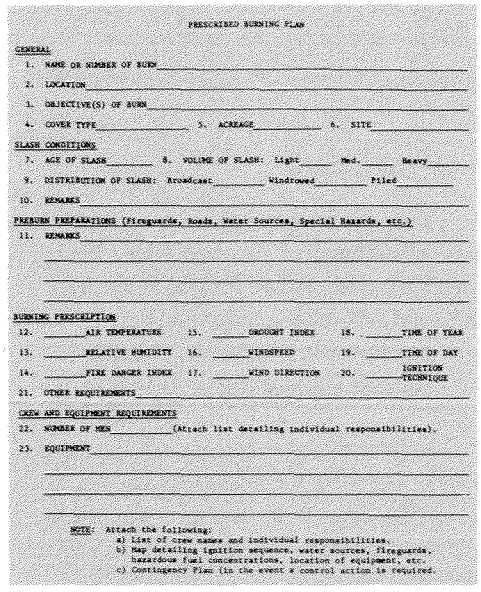
Fire must be used with caution or wildfires may occur. Careful planning will result in a safer, smoother operation and will ensure that the desired objective is realized. The plan should be flexible enough to compensate for any unexpected developments but must also set definite conditions under which the burning will take place. The methods and responsibilities of personnel for ignition and control must be specified.

Initial planning for burning should begin before the harvesting operation is started. Economies are realized by keeping the boundaries of the burn area straight, by keeping slash concentrations away from adjacent timber, and by locating logging roads and skidding trails where they can be used as fireguards.

The specific objective of the burn and the weather conditions under which the burn is to be carried out must both be specified in the plan. The burning prescription should specify appropriate levels of Drought Index and Fire Danger Index as well as specific limits for relative humidity, windspeed, and temperature on the day of the burn. Include also the season and time of day when the burn will be conducted.

A good plan will state what method of ignition is to be used and will briefly outline the ignition sequence. Duty assignments to personnel conducting the burn are clearly spelled out. In addition, the plan must outline the duties of the crew in the event that a major fire control action is needed. The number and location of men and equipment that could be called if needed should be listed to aid in expediting a control effort.

A map of the area showing the fireguards and other pertinent features such as water sources, hazardous fuel concentrations, roads, etc. is very important. The location of equipment should be identified on the map so that when the decision is made to burn, the operation can proceed with as little confusion as possible.



PRESCRIBED BURNING PLAN

GENERAL
1. NAME OR NUMBER OF BURN
2. LOCATION
3. OBJECTIVE(S) OF BURN
4. COVER TYPE 5. ACREAGE 6. SITE

SLASH CONDITIONS
7. AGE OF SLASH 8. VOLUME OF SLASH: Light Med. Heavy
9. DISTRIBUTION OF SLASH: Broadcast Windrowed Piled
10. REMARKS

PREBURN PREPARATIONS (Fireguards, Roads, Water Sources, Special Hazards, etc.)
11. REMARKS

BURNING PRESCRIPTION
12. AIR TEMPERATURE 13. DROUGHT INDEX 18. TIME OF YEAR
13. RELATIVE HUMIDITY 16. WINDSPEED 19. TIME OF DAY
14. FIRE DANGER INDEX 17. WIND DIRECTION 20. IGNITION TECHNIQUE
21. OTHER REQUIREMENTS

CREW AND EQUIPMENT REQUIREMENTS
22. NUMBER OF MEN (Attach list detailing individual responsibilities).
23. EQUIPMENT

NOTE: Attach the following:
a) List of crew names and individual responsibilities.
b) Map detailing ignition sequence, water sources, fireguards, hazardous fuel concentrations, location of equipment, etc.
c) Contingency Plan in the event a control action is required.

PREPARING THE AREA TO BE BURNED

Substantial preparation is needed before the fire. Fireguards must be located and constructed according to the specifications outlined in the plan. Obstacles and potential hazards must be removed, and any fuel modifications (e.g. cutting snags or residual trees) specified in the plan must be carried out.

Exterior fireguards should be constructed so that they are passable by vehicle. Interior fireguards do not have this requirement and often a single plow line will be sufficient. Existing roads or natural barriers may be used for fireguards and advantage may be taken of any breaks in fuel continuity

to construct interior fireguards. Large tracts should be broken into blocks of 40 to 60 acres by driveable fireguards. These precautions will enable the burning to be stopped in the event of sudden weather changes.

When preparing fireguards, avoid mixing the fuel with mineral soil. Concentrations of this type of fuel-soil mixture are able to hold fire for several days and are extremely difficult to mop-up. It is advisable to fell all dead snags within 100 feet of exterior fireguards before the burn is carried out. In addition, any live trees that are potential hazards should be cut before the area can be considered ready to burn. Fireguards should be kept as straight as possible with gentle curves and no sharp corners. If potentially hazardous concentrations of fuel cannot be removed or modified, they must be excluded from the area to be burned.

COMMUNICATIONS

It is extremely important that the fire boss be able to contact key members of his crew at all times. Smoke, heat, and noise can make this virtually impossible unless radio communication is employed. Small, compact citizen's band walkie talkies are excellent for this and are relatively inexpensive.

PUBLICITY

Before the burn is started, local residents and the general public should be advised. These people should be told when and where the burning will take place, what is being accomplished by the burning, and why prescribed burning is a useful tool in resource management. This will ensure that the public is aware of the reasons for burning and will help in their understanding of why their continued cooperation in the control of wildfires is needed.

execution of burn

If planning and preburn preparations have been adequate, the burning operation should progress smoothly and rapidly. When the prescribed conditions are anticipated, preplanned operations should be set in motion. Each person in a supervisory capacity should be clearly briefed on his duties and responsibilities before the burning starts.

The burning plan and the map of the area are used to fully orient the crew at the site of the fire. Before ignition starts, a reliable weather forecast must be obtained so that the behavior of the fire may be reasonably predicted.

A small test fire (a few square yards) should be set. By observing its behavior, the fire boss can decide to proceed or to postpone the burn. If he decides to proceed, ignition should follow the methods as outlined in the plan.

Possible spot fires outside the burn area can often be prevented by wetting down the surrounding fuels. Slash concentrations within 100 feet of the downwind side of the burn area are particularly troublesome but can be rendered relatively safe from ignition by the application of water immediately before or during the hazardous time of the burn in sufficient quantities to ensure wetting of the fuels.

As the burning continues, patrols for hot spots and spot fires outside the line must be undertaken to quickly eliminate potentially troublesome situations.

Mop-up should begin soon after the area has been burned. This quickly eliminates hazardous areas and prevents serious hang-fire problems.

appraisal & report

Every burn should be evaluated objectively, and the accomplishment of the burning objectives determined for future reference. This report should include weather conditions before and during the burn, an estimate of the amount of fuel before and after the burn, an estimate of the size of the area burned, the number of men used in the operation, the length of time required to complete the burn, and the costs per acre incurred in the burning operation. Fire behavior observations should include estimates of the rate of spread and the incidence of spot fires outside the control lines. These data will help in determining the correct prescription for future burns.

PRESCRIBED BURN REPORT
(Instructions on Reverse)

GENERAL

1. NAME AND LOCAL ADDRESS OF LAND-OWNER_____
2. LEGAL DESCRIPTION_____
   Sec._____ Twp._____ Rge._____
3. BURN AREA (ACRES)_____
4. DATE_____
5. TIME START_____
6. HOURS TO COMPLETE_____
7. SIZE OF CREW_____
8. EQUIPMENT ON BURN
   Pumpers_____
   Dozers_____
   Other_____

WEATHER

(If no measurement taken, show N.M.)

9. FIRE DANGER INDEX (AT NEAREST STATION)_____
10. DROUGHT INDEX (AT NEAREST STATION)_____
11. SPECIAL FIRE WEATHER FORECAST REQUESTED? ____Yes ____No
12. MIN. R.H. % DURING DAY_____
13. R.H. % AT FIRE START_____
14. WIND DIRECTION_____
15. MAX. WIND DURING BURNING_____
16. MAXIMUM AIR TEMP._____

FUELS

17. TIMBER TYPES_____
18. AGE OR CONDITION OF SLASH_____
    ___Current (cut since 1/1)
    ___1 year (before 1/1, over winter)
    ___2 years (over winter 2 years)
    ___Other (specify)_____
    _____
19. REMARKS_____
    _____
    _____

IGNITION AND BURNING TECHNIQUES

20. IGNITION DEVICES_____
    ___Drip torches
    ___Propane torches
    ___Other (specify)_____
    _____
21. BURNING TECHNIQUES_____
    ___Strip backfire
    ___Strip headfire
    ___Flank fire
    ___Area ignition
    ___Other (specify)_____
    _____
    Width of strips_____chains

FIRE BEHAVIOR

22. RATE OF SPREAD_____
    _____chains per hour
23. SPOTTING_____
    ___None observed
    ___Few
    ___Many
24. CONTROL DIFFICULTY_____
    ___Yes
    ___No
25. REMARKS_____
    _____

ACCOMPLISHMENTS

26. PURPOSE OF BURN_____
    ___Planting site preparation
    ___Natural or artificial seeding
    ___Wildlife habitat
    ___Hazard reduction
    ___Other (specify)_____
    _____
27. DEGREE OF SUCCESS_____
    ___Accomplished primary purpose
    ___Partial success
    ___Did not accomplish purpose
28. COST PER ACRE_____

selected reading

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acknowledgement

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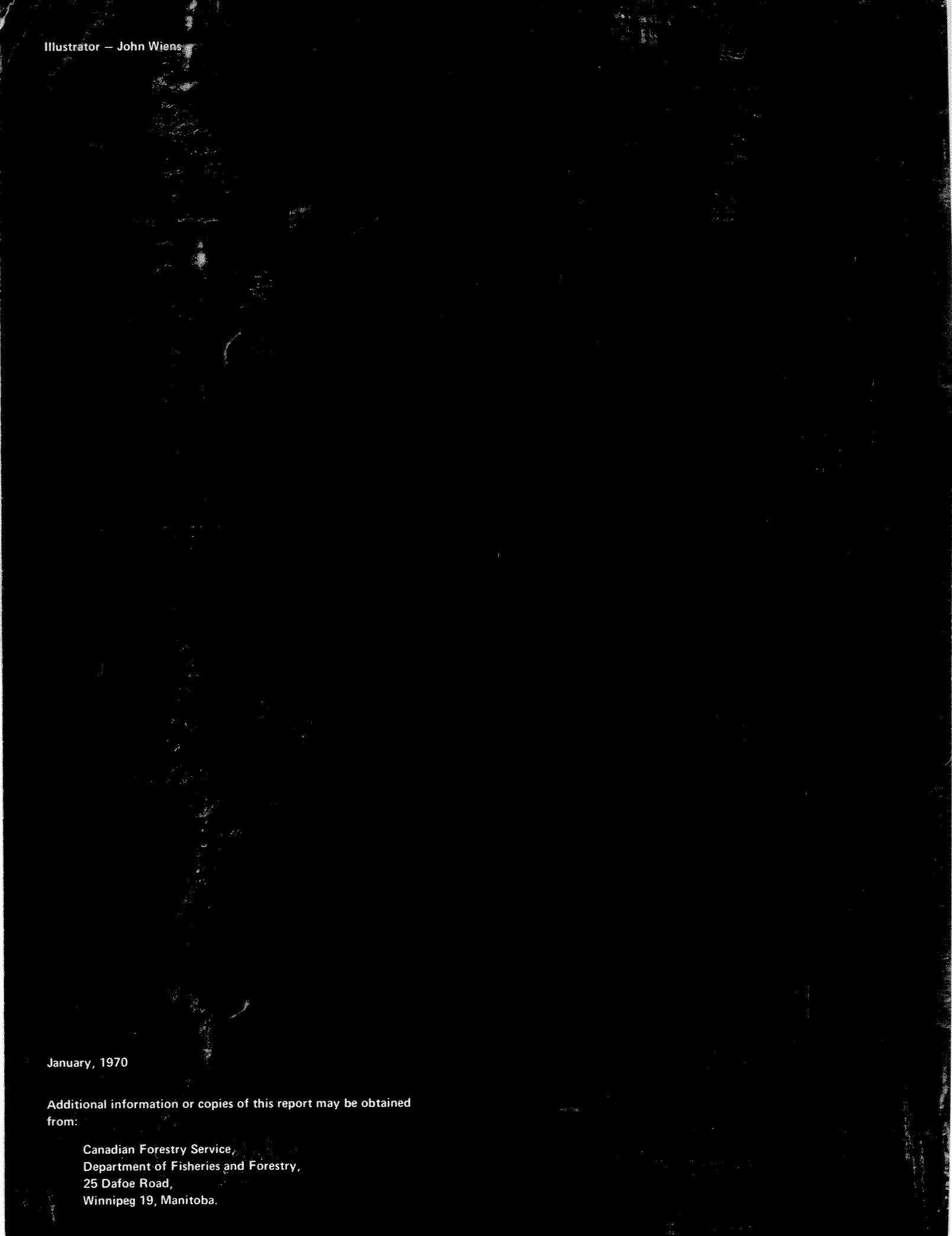

Illustrator – John Wiens

January, 1970

Additional information or copies of this report may be obtained from:

Canadian Forestry Service,
Department of Fisheries and Forestry,
25 Dafoe Road,
Winnipeg 19, Manitoba.