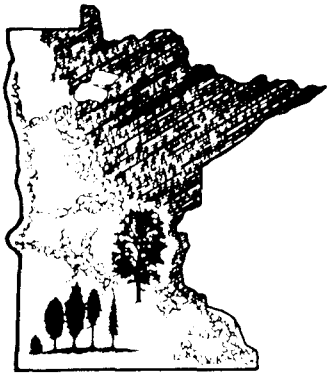

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BURIED SEED IN PRESCRIBE-BURNED JACK PINE FOREST SOILS, NORTHEASTERN MINNESOTA

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ABSTRACT

Seed was extracted from soils beneath cut and burned, cut and unburned, and uncut portions of jack pine forest. Seed quantities varied with disturbance. Seeds of species characteristic of recently burned land were found in all three forest conditions. Species occurrence was similar to that on naturally disturbed areas.

INTRODUCTION

Soils of the pine forests within the Boundary Waters Canoe Area (BWCA) wilderness of northeastern Minnesota contain seeds of a number of species which are important parts of the first vegetation to develop when land is released by natural disturbance (Ahlgren 1979). To determine whether seed stored in the soil are important in lands managed for timber production, investigations were initiated on cut and prescribe-burned jack pine (*Pinus banksiana* Lamb.) lands. Length of time since disturbance was approximately the same as for some of the sites studied in the BWCA.

STUDY AREAS

The study areas are located in a mature jack pine stand in the Superior National Forest. Descriptions of the areas, forest regeneration, and details of vegetation study methods have been reported previously (Ahlgren 1970). Three 4-ha tracts are included. One tract was clearcut leaving 23 jack pine seed trees per hectare. The slash was evenly scattered, and the tract was prescribe-burned in June 1961. A second tract was similarly cut and left unburned, and a third tract was left uncut and unburned. Before treatment, litter depth was five to eight cm on all areas. Burning reduced litter depth to about 2 cm.

METHODS

Twelve years after burning, in 1973, soil samples were obtained with a metal cylinder, 13.2 cm in diameter, sampling from the surface litter to a depth of 2.5 cm into mineral soil. For each area, a composite sample of three cores was combined, sieved, and the seed extracted by hand. Seed were identified by comparison with known samples, and the number of seeds per hectare determined.

Seed from these areas were combined with seed from areas reported elsewhere (Ahlgren 1979) to obtain a sample large enough for germination tests. The seed were stratified at 4.4°C for 3 months, planted in sterile soil, and grown in a greenhouse until large enough to identify. The soils remaining after seed extraction were placed in cold storage for three months, put in flats, and kept moist in a greenhouse to determine if any seed were overlooked during seed extraction. In soil from the cut area, grass (*Gramineae* spp.) and bush honeysuckle (*Diervilla lonicera* Mill.) seedlings

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appeared. Soil from the other two areas produced no seedlings. The seeds and seedlings reported do not represent total viable seed content of the soil samples, since ideal growth and germination conditions for all species could not be supplied, and smaller seed could not be extracted. However, the species found are among the common vegetation of the area.

RESULTS

More than twice as much seed was found in soil from the cut-unburned and cut-burned areas than in that from the uncut-unburned area, indicating that much of the seed in the first two areas was of post-disturbance origin (Table 1). However, species of the extracted seed were very similar in all areas. For the most prevalent species, seed quantity was independent of plant frequency (Table 1). Since seed from these areas were combined with those from areas reported elsewhere (Ahlgren 1979) for viability tests, seed viability on any particular site is unknown. Some seed of all species except white spruce (*Picea glauca* (Moench) Voss) germinated.

Seed of cranesbill (*Geranium bicknellii* Britt.) were present in all three areas. Cranesbill plants were not present in either the cut-unburned or uncut-unburned areas, and very few were found on the cut-burned area. No cranesbill plants had been found on either of the unburned areas six years previously. Thus, the seed extracted is probably more than six years old. Since seed is aerially dispersed less than a meter and animal transport probably would not result in the widespread distribution of such large quantities of seed.

While sedge (*Carex* spp.) seed were found in all areas, no plants were present in the uncut forest. Markedly higher numbers of sedge and grass seed were found on the burned site; these plants are known to reproduce abundantly in the stage of post-fire succession still evident 12 years after burning. Similarly, the higher numbers of red raspberry (*Rubus idaeus* L.) seed on both cut sites is the effect of release by cutting or cutting and burning. The increased light and undisturbed ground cover is undoubtedly responsible for the higher number of seeds of dwarf raspberry (*R. pubescens* Raf.) found on the cut-unburned area since plants of this species are frequent but do not fruit heavily in the shaded, uncut area.

Tree seed were a relatively insignificant part of the total seed in the forest floor. Seed of most tree species have been reported to survive poorly in forest soil (Frank and Safford 1970). Viable seed were probably freshly shed from mature trees on or near the study areas.

CONCLUSION

Seed of some typical post-fire species, especially cranesbill and sedge, were found in the forest floor and may have contributed to the early post-fire vegetation. Although the quantities vary, the species represented in the forest floor seed are essentially the same regardless of time since burning. These results are very similar to those reported for lands disturbed by wildfire and insect defoliation (Ahlgren 1979).

LITERATURE CITED

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Table 1. Seed density and plant frequency from cut-burned, cut-unburned, and uncut-unburned jack pine forest soils 12 years after disturbance.

	Cut-burned Tract		Cut-unburned Tract		Uncut-unburned Tract	
	Plant frequency (percent)*	Seed/ha (thousands)**	Plant frequency (percent)	Seed/ha (thousands)	Plant frequency (percent)	Seed/ha (thousands)
Geranium bicknellii	3	2,904	0	2,420	0	4,356
Carex spp.	7	6,776	3	2,178	0	2,178
Rubus idaeus	97	4,356	87	10,890	60	242
Rubus pubescens	20	968	30	8,228	83	484
Gramineae spp.	100	11,858	90	726	93	242
Fragaria spp.	7	484	0	0	0	0
Cornus canadensis	0	0	0	0	97	484
Aralia nudicaulis	0	0	53	726	0	0
Lathyrus ochroleucus	0	0	90	484	0	0
Abies balsamea	0	0	7	2,420	43	242
Betula papyrifera	0	0	0	1,452	10	1,452
Picea glauca	0	726	0	0	80	242
Pinus strobus	0	0	7	242	3	242
TOTAL		28,072		29,766		10,164

* Figures are based on 30 plots.
** Each seed found is equal to 242,000 seed per hectare.

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