DIRECT SEEDING IN THE NORTHERN ROCKY MOUNTAINS

A Thesis

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Selden Lee Tinsley

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INTRODUCTION

The vast acreage of logged-over and burned-over forest land in the United States has created a problem in reforestation which has thus far baffled foresters for an adequate solution. At the present time planting of nursery grown seedlings and transplants is the accepted method of reforestation. Planting, however, is an expensive and slow operation. At the present rate and cost of planting it will require approximately one hundred and thirty years and an expenditure of one and one half billion dollars to reforest the ninety-one-million acres of now denuded forest land.

In addition to the financial drawbacks and the time element involved, the accepted methods of planting are far from ideal from a silvicultural standpoint. Stands regenerated by planting lack the deep normally distributed root systems of natural stands, and since the spacing is generally wide natural selection and pruning do not play their vital roles in producing a healthy vigorous forest with clean straight boles.

It is apparent that if the problem of reforesting this vast acreage of denuded land is to be adequately solved, certainly cheaper and preferably silviculturally more desirable methods must be developed. In casting about for such a method these possibilities are suggested: the field planting of seedlings contained in soil briquettes--a method which is too costly for practical use (Heiberg, 1934); the field planting of germinated seeds

contained in pellets or fertilizer cartridges--a technique which as yet is undeveloped (Hatch, 1937); and direct seeding. Direct seeding when successful not only is considerably cheaper than planting, but in addition possesses the silvicultural advantages of natural reproduction.

But the mere suggestion of direct seeding is rather like rattling the bones of an old skeleton in the forestry closet for during the early part of this century the method was extensively tried, and because of almost universal failure was discarded. At the time of these early direct seeding activities, however, little information of a scientific nature on the factors of success and failure of direct seeding was available. Viewed in the light of our present knowledge on seed germination, rodent behavior, mycorrhizal associations, and other factors of germination and survival it is easy to understand the failure of many of these early direct seeding efforts and to marvel at the few outstanding successes which did occur. In the words of Greeley (1913), these early direct seeding attempts were "not unlike ordering a thousand flying ships before being sure the model would fly."

Since at the present time there seems to be no possible answer to the reforestation problem other than planting or direct seeding; and since direct seeding, when successful, is both economically and silviculturally superior to planting; it would seem only logical that further research be dedicated to this method. From our vantage point of back sight on the early direct seeding efforts and in the light of our present knowledge of the factors of success and failure it is highly possible that a practical method of reforestation by direct seeding may be found.

PURPOSE

The purpose of this study is to analyze the factors concerned in the success and failure of direct seeding with ponderosa pine and western white pine, and by amending these factors in so far as is economically feasible attempt to develop methods of reforestation by direct seeding which will be practical for the Northern Rocky Mountain Region.

LITERATURE SURVEY

HISTORY

Prior to the beginning of the present centurly little effort in the way of reforestation had been made in the United States. In the early nineteen hundreds a rather small amount of planting on the very worst types of land such as the sand hills of Nebraska and the chaparral type of California was attempted. This planting, however, was of a more or less experimental nature and in total area of forest established was insignificant. The futility of attempting to establish forests on areas ecologically unsuited to forest growth was soon recognized and this policy of afforestation was abandoned. Then followed what may be termed a direct seeding boom. It became the policy of the Forest Service to reforest by direct seeding the entire area of demuded land at a rate of forty to fifty thousand acres per year. Difficulties in obtaining seed reduced the actual program somewhat below the set policy, but in spite of this by 1913 81,740 acres of denuded land had been reforested, of which 65,740 acres were by direct seeding. Of this 65,740 acres of direct seeding Greeley (1913) estimates that at the most only 20 per cent was successful. In the Northern Rocky Mountain Region Wahlenberg (1925) reports the success from fifteen thousand acres

prairie and non-forested soils as a serious limiting factor in the artificial extension of forests. (Samuels, 1926; Kessell, 1927; Roeloffs, 1930; Oliveros, 1932; Rayner, 1934) Recently Hatch (1936, 1937) and Mitchell, et al (1937) have demonstrated through pure culture inoculations and other experimental techniques with the fungi that trees are indeed dependent on the fungi for their nutrients in all but the most fertile agricultural soils. Hatch (1937) suggests that the success of direct seeding on prairie regions and on areas of long denuded forest land is precluded by the lack of these fungi. He interprets the almost complete failure of the Timber Culture Act of 1873 as having been caused by the lack of mycorrhizal fungi on our midwestern prairie soils.

Stevens (1934) states that with Corsican pine success with direct seeding is impossible after the site has been cleared for a few years and no longer remains forestal. On the basis of Hatch's (1937) findings it is highly probable that the presence or absence of mycorrhizal fungi is the predominating factor in determining whether or not the site is "forestal".

Other factors

Besides the factors previously discussed Haig (1936) lists damping off, cutworms, insolation, soil moisture, and light as the important agents of mortality after germination. He considers light as not important for first year survival directly, but because of its effect on root penetration he classes it as an important indirect factor. Greeley (1913) suggests that care be exercised in the placement of seed spots taking advantage of the shade offered by down logs, stumps, etc. to lessen losses from insolation and drought.

CONCLUSIONS

A rather complete survey of the literature on direct seeding has revealed

a few experimental studies and a host of opinions and observations. Excepting those studies dealing with the factors of germination and survival, the literature of direct seeding is mainly of interest and value only from a historical standpoint and has offered little toward the development of practical methods of reforestation.

EXPERIMENTAL METHODS USED

DESCRIPTION OF THE AREA

The field experiments in direct seeding were carried out at the Miller Experimental Forest of the University of Idaho during the fall of 1936 and through the summer of 1937. Four areas were selected, three being steep north slopes for the western white pine and one a gentle southwest slope for the ponderosa pine. (Plates I, II, III, IV.) The approximate elevation of all four areas is twenty-eight hundred feet.

Both the western white pine areas and the ponderosa pine area originally supported a good forest cover typical of their site. A severe fire in 1930, however, killed all the trees except a few on area three, resulting in the present ground cover of grasses, bracken fern, and numerous shrubs including Ceanothus sanguienus, Amelanchier florida, Pachystima myrsinites, Opulaster pauciflora, Philadelphus lewisii, Holodiscus discolor, and salix sp. On the western white pine areas scattered reproductions of Pinus monticola, Larix occidentalis, Pseudotsuga taxifolia, and Thuja plicata are occuring.

The soil on all four areas is Helmer silt loam, which except for the vegetational influence is identical in origin to the highly productive Palouse series. (Table I and II.) The Helmer series is well described by Agee, Graves, and Micklewaite (1915) and Peterson (1918).

PLATE I

Area one, direct seeded to western white pine. Slope approximately 40 per cent; exposure northeast; soil type Helmer.

PLATE II

Area two, direct seeded to western white pine. Slope approximately 60 per cent; exposure north; soil type Helmer.

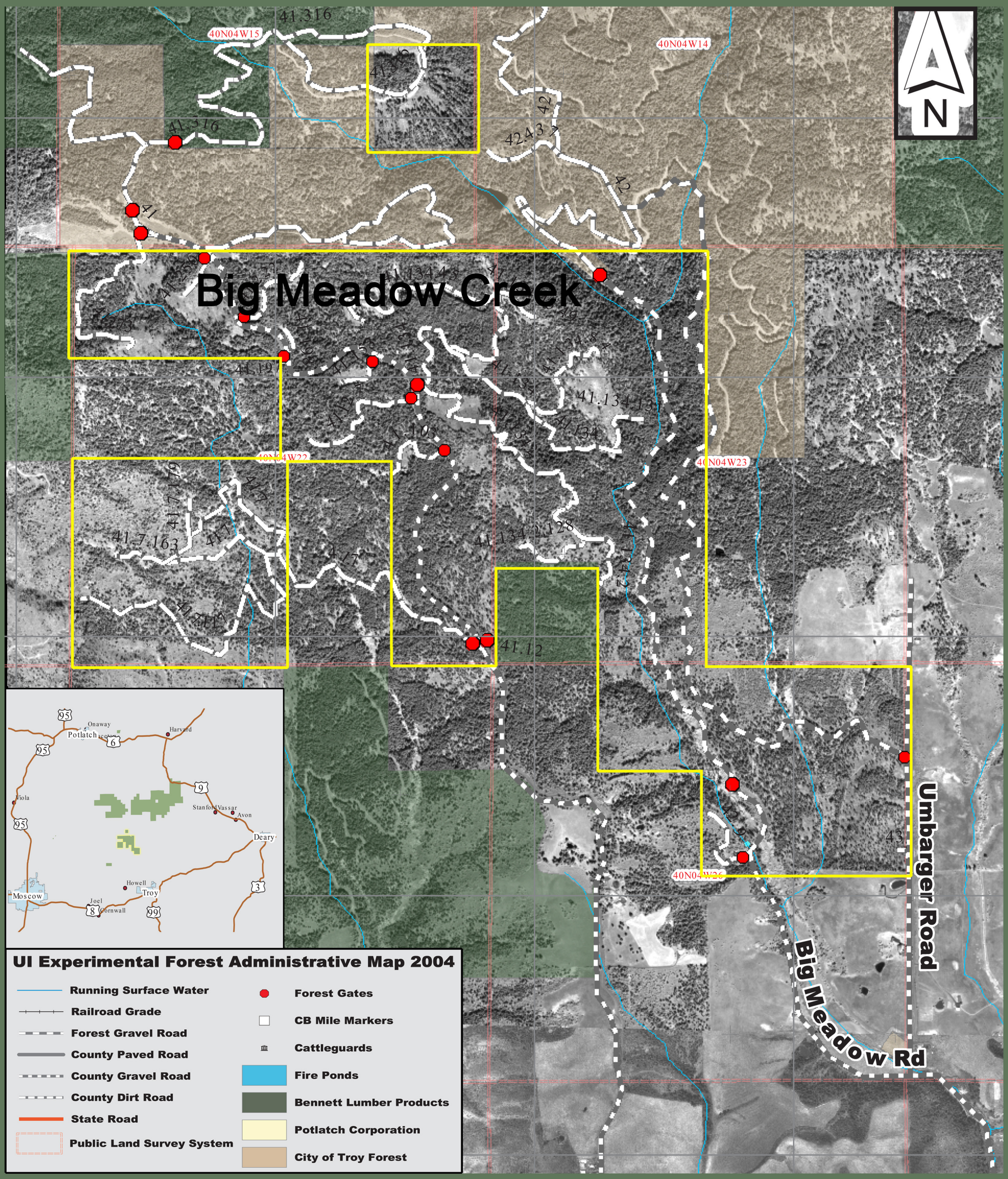
PLATE III

Area three, direct seeded to western white pine. Slope approximately 30 per cent; exposure north by northeast; soil type Helmer.

PLATE IV

Area four, direct seeded to ponderosa pine. Slope approximately 7 per cent; exposure southwest; soil type Helmer.

Big Meadow Creek



UI Experimental Forest Administrative Map 2004

- Running Surface Water
- Railroad Grade
- Forest Gravel Road
- County Paved Road
- County Gravel Road
- County Dirt Road
- State Road
- Public Land Survey System
- Forest Gates
- CB Mile Markers
- Cattleguards
- Fire Ponds
- Bennett Lumber Products
- Potlatch Corporation
- City of Troy Forest

Feet

0 850 1,700 3,400 5,100 6,800

1 inch equals 0.25 miles

520 260 0 520 1,040 1,560

Meters

Location of Complete Research:

Author & Title: Tinsley, Selden Lee
Direct Seeding in the Northern Rocky Mountains

University of Idaho Library:

Call Number- SD409.T5

College of Natural Resources:

Department- Forest Resources

Other Sources: