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Herbicides for Forest Weed Control in the Inland Northwest:

A Summary of Effects on Weeds and Conifers

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INTRODUCTION

Successful silvicultural weed control (the suppression of vegetation that competes with or otherwise interferes with the survival and growth of "crop" trees) with herbicides depends on applying an appropriate chemical to susceptible vegetation in a formulation that maximizes the ratio of plant kill to economics of spray application. Planning of effective herbicide spray programs in the Inland Northwest is hindered by the complexity of a large variety of "weed" species, variable efficacy of numerous herbicides, and highly variable environmental conditions. This report is an up-to-date compilation of results from previous herbicide applications in this region. Included are chemical formulations, rate of active ingredient, carrier, adjuvants, total mix rate, timing of application, weed control, and conifer injury resulting from sprays. All reports of treatments are included regardless of effectiveness in weed control. This data base was designed to assist in spray project planning. Data are stratified by weed and conifer species, chemical, season of application, and active ingredient rate.

This publication is the third in a series first published by Potlatch Corporation as "Shrub Control in the Inland Northwest - A Summary of Herbicide Test Results," RN-83-4, in February of 1983 and revised in December 1983. In this version, information from the Intermountain Research Station has been merged with data summarized in the original Potlatch reports. Results include data from the Research Station's own research as well as information obtained from Inland Northwest land managers with experience in the use of herbicides. The title of the publication has been modified to reflect the large amount of additional information on herbicide control of herbaceous forest weeds. In addition, some salient features of the most useful herbicides are emphasized. A general reference figure (fig. 1) has been added to facilitate a preliminary search for herbicides and their relative effects on important forest weed species and conifers in the Inland Northwest. We have added a table (table 1) of herbicides registered for forest weed control in the Inland Northwest (Washington, Oregon, Idaho, and Montana), including chemical, product, formulation, active ingredient per unit of product, manufacturer, cost, and labeled use.

Writing efficient weed control prescriptions requires that information be compiled in a form where various treatments can be easily compared. Miller and Kidd (21) have described one process for screening treatments to select the optimum chemical brush control prescription. This report should aid silviculturists in preparing prescriptions for chemical site preparation and conifer release treatments.

DESCRIPTION OF DATA FORMAT

Vegetation control summaries for Inland Northwest situations have been written by numerous authors, have appeared in scattered publications, and have used a variety of formats to describe treatment effectiveness. This report is a compilation of data from these publications and from unpublished sources. The majority of the data come from the Northern Rocky Mountains, but several reports are from west of the Cascade Mountains. The herbicides listed generally are registered for forestry use in Idaho, Oregon, Washington, and Montana. However, because many of the results reported are from experimental applications, they may or may not be in accordance with label information or State restrictions. Before using any herbicide, check for label compliance and current State Department of Agriculture registration.

To overcome the fragmented nature of existing herbicide information, we have indexed data in this report by variables crucial to the success of a spray operation. Each item in the data format will be discussed.

Test Results by Species and Herbicide

Herbicide information is arranged alphabetically by shrub species, followed by herbaceous species or species groups, and finally by conifer species. Within species, data are grouped by herbicide treatment. Tank mixes (combinations of herbicides) are indicated by including the respective herbicides within parentheses (), and results must be considered in response to the combination of chemicals, not to any one alone. Herbicide trade names are listed as reported in supporting references. A check with the cited publication or with the office supplying the unpublished data should provide information not included in the tables. While some inferences can be drawn for weed control of similar species in other areas, we do not advocate these data for control recommendations outside the Inland Northwest.

There are no data in this report on the response of crop conifers other than injury by herbicide treatment.

Information on posttreatment tree survival and growth is not as readily available as the data presented on plant injury. The user is cautioned that weed control may not always equate with better crop performance in a complex forest ecosystem. Various side effects of an herbicide treatment can result in counterproductive changes in plant and animal communities. Treatment-induced changes in animal, insect, and disease populations should also be considered. Changes in the availability of the basic growth factors—water, nutrients, light, and heat—may be both beneficial and detrimental.

Application Rate and Mix

Most treatment rates are described in pounds active ingredient per acre. Some ground sprays are listed as LBHG for pounds active ingredient per hundred gallons of spray mix per acre. These are usually applied as high-volume ground sprays. Several herbicides and mixtures are listed by volume. For instance, Tordon 101 is a mixture of picloram and 2,4-D, and the rate is listed as gallons of product per acre.

The total spray volume per acre is listed for aerial applications. Some data are from ground (backpack) applications. Ground sprays are coded differently in the "Gal/Acre" column. The codes are as follows:

G—Ground broadcast spray. Total gallons per acre may also be specified (such as G20 for 20 gallons per acre).

GDP—Hand-sprayed to the drip point. The drip point occurs when spray is applied to individual plants until it first begins to run off foliage surfaces.

S—Spot treatment where spray application is restricted to a localized area (such as a 4- by 4-ft square). Total gallons per acre may also be specified.

D—Shrub and soil drench around individual plants as was often done in ground-applied *Ribes* control sprays.

Ground application generally produces better control than aerial spraying because of more complete coverage. Therefore, if ground results are used per-acre rates should be increased for aerial application.

Treatment Season

Timing of herbicide application is dependent upon several interrelated factors such as brush phenology, localized environmental conditions, and mode of action of specific herbicides. While the tables include a spray season related to dates, these are only approximately related to the phenology of treated plants. For example, most forbs and grasses will cure earlier on dry sites than on more mesic sites. A useful discussion of these considerations was provided by Gratkowski (9). His terminology of seasons of application is used:

Dormant or budbreak—Late winter or early spring at beginning of spring flush of growth. Buds on conifers swelling or bursting; buds on shrubs bursting or new leaves unfolding.

Early foliar—Period of active growth; approximately three-fourths of new leaves on shrubs full size. Period of maximum susceptibility to herbicides.

Late foliar—During midsummer, usually mid-July to early August, after cessation of growth on conifers and shrubs. All leaves full size and hardened. New terminal buds well developed on conifers.

Late summer—Usually late August to early September, long after cessation of spring flush of growth.

Fall—Late September to November, after leaf fall; conifers usually dormant.

Weed Control Data

Weed control is reported as percentage top kill and percentage plant kill in the first, second, or third year. First-year control data were collected during the same growing season as herbicide application. Second-year data were collected during the growing season following spraying, and so forth. Percentage top kill refers to percentage crown volume reduction or percentage crown cover reduction. In either case, the top-kill data are a reasonable estimate of competition reduction. Where references reported control data on other than a percentage basis, percentage control estimates were calculated from original data to present a uniform control scale. Some references reported top-kill data for more than 1 year. Comparing these figures gives an estimate of rapidity of shrub recovery. Percentage plant kill (percentage of examined shrubs that were completely killed) is reported where available.

Careful comparison of study results will reveal many inconsistencies and even contradictions in the results. Tests were installed in different years, at different phenological stages, on different sites, and under different weather conditions. These and other factors produced variation in results. More research and greater experience with the materials should reduce this variation and produce more predictable results. A complete reading of the original reference or contact with the reporter may explain the variation.

Tree Injury

Conifer injury caused by spraying is reported where available. The following codes describe injury:

0 - No effect.

1 - 0 to 10 percent defoliation, no bud injury.

2 - 0 to 10 percent defoliation, slight tip curl, no bud injury.

3 - 11 to 40 percent defoliation, slight bud kill.

4 - 40+ percent defoliation, moderate bud kill.

5 - Slight to moderate top kill, 50+ percent defoliation.

6 - Trees killed.

P - Follows numerical injury code when trees were protected from chemical spray.

Defoliation refers to foliage present when sprayed. Bud injury includes both laterals and terminals produced during the spray season.

A note of caution is appropriate concerning tree damage ratings. Conifers suppressed by an overtopping canopy of competing vegetation are screened from a full herbicide application. Many of the reported damage ratings to conifers may be confounded by this complication.

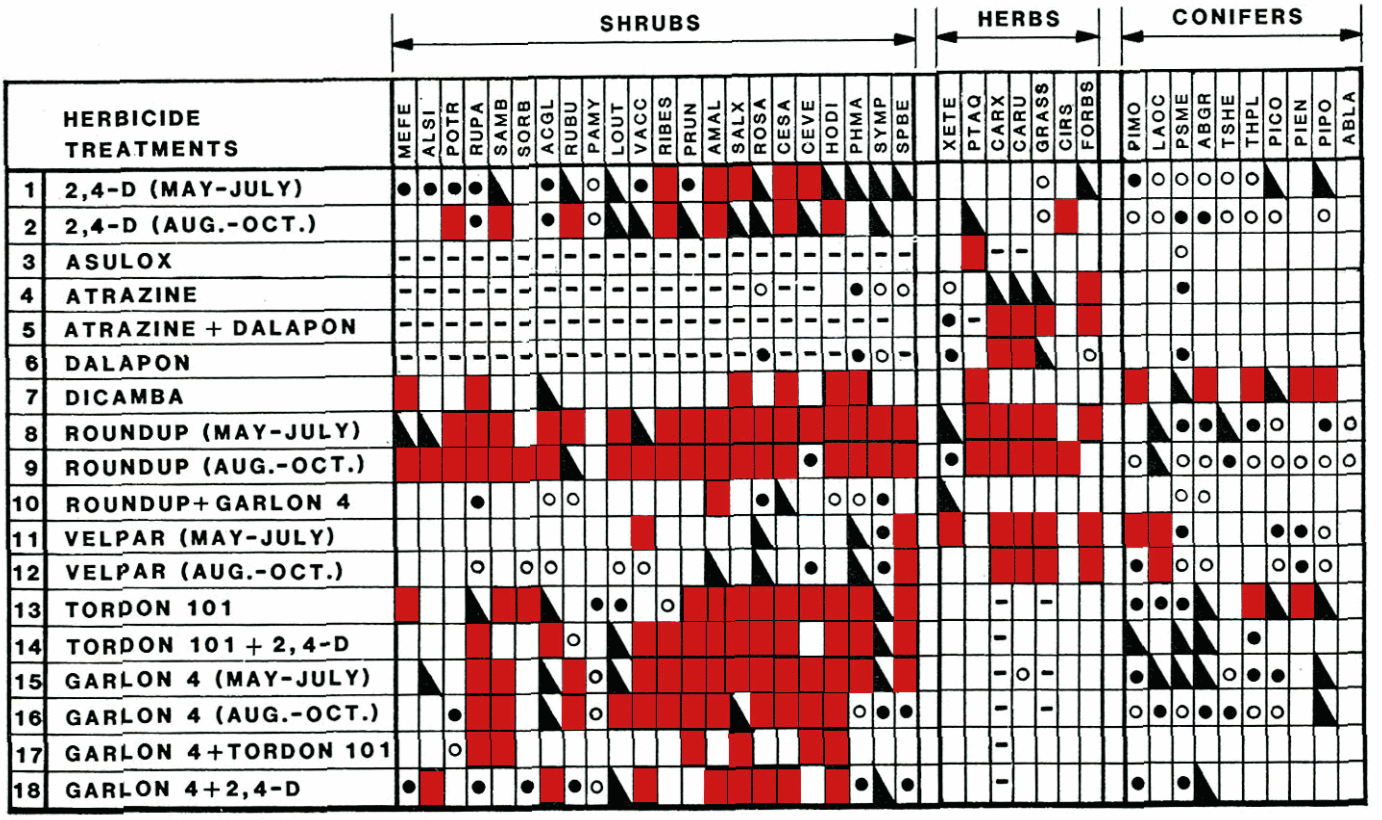
TREATMENT SELECTION

All treatment recommendations must be based on some form of site-specific data on the weed species present, their competitive ranking, and the crop to be benefited. The data presented here permit selection of the most effective **candidate** treatments by weed and crop species. Figure 1 provides the first "rough cut" on candidate treatments for a given competitor or group of competitors and an estimate of crop tree injury that might be expected. It is presented as a quick preliminary survey, but **no prescriptions should be made solely on the basis of this table.**

The species-by-species summary tables of herbicide treatment effects, beginning on page 7, will provide important specifics on rates of application, carriers, adjuvants, timing, tree injury, and the source of data.

While costs of treatments are extremely variable, some comparative herbicide cost data are presented in table 1. Other than this, it is beyond the scope of this paper to estimate total treatment expenses. Users are encouraged to consult the chemical distributors, technical representatives, or the original data source for details.

Finally, prior to deciding on the treatment, the label should be thoroughly scrutinized for compliance with legal restrictions and State registration verified with State agricultural authorities.



KEY :

- VERY SEVERE INJURY OR KILL
- SERIOUS INJURY
- MODERATE INJURY
- LITTLE OR NO INJURY
- NO LOCAL DATA- BUT NOT KNOWN TO INJURE
- INADEQUATE INFORMATION

- The ratings for weeds represent the most severe effects derived from trial compilations.
- Conifer ratings represent the average damage ratings derived from test compilations (see text page 14 concerning conifer ratings).
- All plants rated without reference to rate, adjuvants, or application method.
- Since the effectiveness of many herbicides depend upon the stage of plant development (phenology), calendar dates in this table are only approximate.
- Species & genera codes identified in appendix species list.

Figure 1.—Susceptibility of inland Northwest forest species to herbicides—1984.

COMMENTS ON SELECTED HERBICIDES

Some extra information is warranted for selected herbicides in this report. More information on these or the other herbicides can be obtained from the sources cited in the summary tables or from the manufacturer.

Atrazine

While atrazine has not been consistently effective in controlling pinegrass and elk sedge in the Inland Northwest, it has on occasion been effective. On an assortment of other grasses, mostly annual grasses, it has done well. Its cost advantage makes it a prime candidate for more detailed studies to improve its consistency.

Dalapon

Dalapon is generally quite effective on grasses, but results in the Northern Rocky Mountains have been inconsistent. As with atrazine, it is inexpensive and a candidate for study to improve its reliability. Studies in the Northern Rocky Mountains tend to weakly confirm the contention that a mix of dalapon and atrazine offers a broader spectrum of weed control and protection of some conifers from dalapon damage.

Garlon

Of the two Garlon formulations, Garlon 4 is more effective as a foliar spray on shrubs. Applications during the foliar season generally produce good control. Dormant applications in oil have proven effective west of the Cascades. Garlon 4 is labeled for conifer release sprays except over pines. Ponderosa and lodgepole pine are easily injured by foliar sprays. Western white pine appears more tolerant. Directed sprays should be used to prevent overspraying and injuring pines. Garlon 4 is effective on evergreen shrubs, especially if oil is added to the spray mixture. The oil-in-water emulsion readily penetrates the leathery perennial leaves producing good control of such species as *Ceanothus velutinus*. Garlon 4 is also effective as a basal spray on hardwood clumps.

The short residual toxicity provided by Garlon, plus its broad spectrum effectiveness on shrub species, makes Garlon a somewhat superior product for site preparation in some shrub communities.

As with Tordon, 2,4-D, and 2,4-DP, the tolerant grasses and sedges will occupy the holes created by Garlon control of the woody vegetation.

Garlon 3A is effective as a cut-stump treatment on hardwoods and is also effective for stem injection on hardwoods and conifers.

Roundup

Roundup is a broad-spectrum herbicide of considerable utility in both site preparation and conifer release. Evergreen plants, including conifers, are tolerant of Roundup except during the flushes of new growth when foliage is succulent and readily absorbs the chemical. It is strictly a foliage-active herbicide with little if any root absorption. Healthy active foliage is required to absorb enough chemical for translocation to all parts of the plant at toxic levels. Treatment of sprouting-established plants soon after burning or cutting will probably not be effective due to the dilution of a relatively small amount of absorbed chemical in a large root system. Results will also be poor on plants that are stressed or damaged.

Although Roundup is only marginally effective on evergreen plants, it may prove effective when applied during the spring growth flush if the proportion of new succulent to old, hardened foliage is relatively high, as with 1- to 3-year-old plants. When new, unhardened foliage is a small percentage of the total, damage will be restricted to the new growth. The addition of extra surfactant will often improve treatment effectiveness, especially on evergreen plants.

Although Roundup is a relatively broad-spectrum herbicide, in competitive communities with species in different phenological stages of development it may be difficult to treat at a time when all species are vulnerable or at a time when the competition is vulnerable and the crop is not. Late-season flushes of conifer growth may be damaged by Roundup application. Treating over crop trees during active growth requires shielding the trees from direct herbicide contact.

When used as a conifer release treatment with the chemical applied over unshielded trees, make sure that the new foliage has hardened (that is, has taken on the same color as older foliage) and that late-season growth flushes are not occurring. (These recommendations do not apply to western larch and may also be risky on western redcedar.) Foliage condition is a better indicator of the safe phenological stage than is bud set.

Because the effectiveness of Roundup varies inversely with the amount of water with which it is mixed, it should be applied with as little water as possible consistent with equipment capabilities and label restrictions. The standard for aerial spraying of shrub communities is 7.5 to 10 gal/acre total mix. Scattered low shrubs and grass and forb communities may be treated at lower total mix rates. Ultralow volume applications with spinning disk or wiper-type applicators are effective in many situations.

The high probability of rain during late May, June, and early July in the Inland Northwest makes treatments risky and difficult to schedule when herbaceous vegetation is most vulnerable.

While Roundup seems to have performed well for most users, for some it has been inconsistent under essentially identical conditions of application, vegetation, and weather.

Tordon Products

Tordon 101 and other Tordon products (products containing picloram) are effective in controlling a wide assortment of woody vegetation in site preparation treatments. Tordon's long soil residual toxicity requires that reforestation efforts not be undertaken within 7 to 8 months of application. Label-recommended waiting periods should be strictly adhered to. Grasses and sedges, if present on the treated site, will quickly fill the

gaps in the ecosystem created by the demise of the shrubs. Tordon cannot be used for conifer release.

Velpar and Pronone

Pronone, while not featured in any of the studies reported here, is similar to DuPont's gridballs and their DPX 3674−2-G, which have been used in several of the reported results.

Hexazinone, the active ingredient in both Velpar and Pronone (granular 5 or 10 percent) has proven particularly effective on Inland Northwest herbaceous vegetation. It acts both as a foliage and soil-active herbicide in the liquid formulation (Velpar L) and strictly as a soil-active chemical in the granular formulation. It has a moderately long soil residual. Both formulations have been applied to ponderosa pine throughout the growing season with little damage. Other species are less tolerant, especially to application during the spring growth flush. Western white pine and western larch are susceptible at any time of year.

These products have an advantage over chemicals that depend upon foliar absorption in that they can be applied at any time of the year (except on frozen ground or snow) or in any weather. Posttreatment precipitation is necessary to "activate" the soil-active action. Photo decomposition will tend to deactivate material that remains on the surface of soil or foliage for an extended period. This is probably more of a problem with the liquid formulation than with the granular one. Vegetation treated in late summer or fall will "green up" normally in the spring, then will die as the chemical is absorbed by the root system and translocated to the site of action in the foliage. Like its triazine relative atrazine, hexazinone appears to have a growth-stimulating effect beyond that provided by strict weed control.

On moderate to steeply sloping ground, the chemical has a pronounced tendency to move by gravity in the soil, thus displacing the treatment effect downslope when applied as spots or bands.

Hexazinone products have not controlled hardwood competition as well in the Inland Northwest as they have apparently done in the Southern States. However, due to their mode of action (root absorption and translocation to their site of activity in the photosynthetic system), they may be effective on sprouting plants.

2,4-D

The oldest and one of the most used of the modern synthetic herbicides, 2,4-D is available as either the ester or amine formulation. The ester formulation generally produces better shrub control. For best results, it is most often used in combination with Garlon 4, picloram (as Tordon 101), dicamba, or other herbicides. 2,4-D now seems best suited for situations where, following harvest and site preparation, there is a rapid invasion of forbs such as fireweed (*Epilobium* spp.), astragulus, antennaria, and so forth. Its cost, in comparison to newer herbicides, makes it an attractive alternative where conditions warrant its use.

The low volatile ester formulation will volatilize and move off site if subjected to high temperatures (>90 °F, 32 °C). This can occur during midsummer applications. 2,4-D can volatilize from leaf surfaces and move off site on air currents even when ambient air temperatures are <90 °F due to the thermal characteristics of target surfaces. Injury to adjacent conifers may be insignificant, but agricultural and garden crops may be severely damaged. Grapes and tomatoes are sensitive to 2,4-D and are easily damaged by drift and vapors from nearby spraying. Extreme caution must be used when spraying 2,4-D ester near agricultural lands and homesites.

HOW TO HELP IN UPDATING INFORMATION

Recipients of this report who have additional information concerning the subject that they feel should be included are encouraged to make copies of, and fill out, the enclosed form on pages 64−66. Please return the form to the authors for incorporation into a future, updated report.

We are also investigating the feasibility of establishing accessible computer data sets at USDA Forest Service Fort Collins Computer Center and on AgNet for those having access to these systems.

SUMMARY TABLES OF HERBICIDE EFFECTS

Key to abbreviations:

"NT" under ADJUVANTS = Nalco-trol

"TV" under ADJUVANTS = Transvert

"SURFACT" under ADJUVANTS = Surfactant

"*" under % TOP-KILL YR 3 = TOP-KILL YEAR 4

In the following tables, the letters A through Z following reference numbers indicate separate study sites within the scope of the reference.

For a more detailed explanation of information in the tables, refer to the previous sections in this publication.

Date: 1 April 1985

Reseacher/s: Ray Boyd (USFS) and

Project Title: The Effects of Herbicide on Seedling Survival and Growth in a Pinegrass Community (Study 1)

Subject: reforestation - site prep
Keywords: herbicide, site preparation, seedling survival, growth, bareroot stock
Abstract: Herbicide was applied around ponderosa pine seedlings planted in a clearcut that was broadcast burned. Measurements of survival, vigor, height and diameter were taken in each of the following four years. Three different herbicides were used and a control group established. Gopher activity was also noted.

Location:
Unit of the Forest Flat Creek
T 40N R 3W S 5 SE¼ NW¼
Stand 1-05-10 Size of Area
General Description of Area Clearcut, 44 acres, cut and burned 1980, planted to 2-0 bareroot PP 1981.

Plot or Area Designation: Generally marked with a stake or post. Further info can be obtained from the principal researcher.

Date Begun: April 1981 Completion date (expected)
Papers or Thesis Resulting:

Funding Source: Experimental Forest, USFS

Future Plans:

Date: 1 April 1985

Reseacher/s: Ray Boyd (USFS)

Project Title: Roundup as a concurrent and chemical Fallow treatment herbicide. (Study 2)

Subject: reforestation - site prep
Keywords: Herbicide, site preparation, seedling survival & growth
Abstract: These plots were planted with containerized PP stock, a) a previously established control plot, b) a plot treated with Roundup the previous year but left Fallow, and c) a new plot, which was the ~~the~~ spot treated with Roundup. Survival, vigor, height and diameter was recorded in the succeeding 2 years. Pocket gopher activity was also noted.

Location:
Unit of the Forest Flat Creek
T ~~40~~ N R 3 W S ~~33~~ 5 ~~NE¼ SW¼~~ SE¼ NW¼
Stand 1-05-10 Size of Area
General Description of Area Clearcut, 44 acres, cut 1980, burned 1980, planted to 2-0 bareroot PP 1981.

Plot or Area Designation: Generally marked with a stake or post. Further info can be obtained from the principal researcher.

Date Begun: May 1982 Completion date (expected)
Papers or Thesis Resulting:

Funding Source: Experimental Forest, USFS Intermountain Experiment Station

Future Plans:

Date: 1 April 1985

Reseacher/s: Ray Boyd (USFS)

Project Title: Effects of Herbicides (including granular Velpar) on Seedling Survival and Growth (Study 3)

Subject: reforestation - site prep

Keywords: herbicide, site preparation, seedling survival and growth

Abstract: Ponderosa pine and Douglas-fir seedlings (container stock) planted in a clearcut that was broadcast burned, were treated with three different herbicides (including granular Velpar). Survival, vigor, percent live vegetation, height and diameter were measured over the next three years on trees which received each of the three treatments. Measurements were also made on a control trees which received no treatment. Some problems were encountered with misapplication of the granular Velpar.

Location:

Unit of the Forest East Hatter Creek Unit

T 40 N R 7 W S 1 NE¼ NE¼

Stand 2-05-01 Size of Area

General Description of Area Clearcut on NE side of Basalt Hill, cut and burned 1981, planted '82, N & S aspect

Plot or Area Designation: C

Date Begun: April 1982 Completion date (expected)

Papers or Thesis Resulting:

Funding Source: Experimental Forest, USFS Intermountain Experiment Station

Future Plans:

Date: 15 April 1985

Reseacher/s: Ray Boyd

Project Title: Velpar versus Pronone as spot and broadcast treatments. (Study 6)

Subject: Site preparation
Keywords: herbicides, site preparation
Abstract: The two herbicides were applied at the same rate as a spot treatment and as a broadcast treatment to plot trees ~~and~~ or plots (respectively). Measurements were made of tree survival, height and stem diameter.

Location:
Unit of the Forest East Hatter Creek
T T4ON R R4W S 1 NE¼ W½
Stand 2-52 Size of Area 17 acres
General Description of Area Clearcut on Basalt Hill, N-NE aspects, cut 1982 burned 1982, planted to containerized PP 1983

Plot or Area Designation:

Date Begun: June 1984 Completion date (expected)
Papers or Thesis Resulting:

Funding Source: Experimental Forest, USFS Intermountain Experiment Station.

Future Plans:

Date: 25 March 1985

Reseacher/s: Harold Osborne, Ray Boyd (USFS)

Project Title: ~~Herbicide Effects~~ The Effects of Herbicide Site Preparation on Hybrid Poplar Cuttings
~~determine the effects of herbicide site~~

Subject: reforestation - plantation
Keywords: herbicide, site preparation, hybrid poplar
Abstract: Hybrid poplar cuttings (UI source) were planted in a fenced bottomland site. Competing grasses were then sprayed treated with herbicides (several were used). ~~Site~~ Work will be continued (new planting - more treatments).

Location:
Unit of the Forest Flat Creek
T 41N R 3W S 33 (NW¼ SW¼)
Stand none Size of Area 200' x 500' = 100,000 sq ft ≈ 2A.
General Description of Area meadow just before 3 on the Brown's Meadow Road (on the right) - creek runs through meadow (across from DeVaults house)
Plot or Area Designation:
Fenced (barbed wire - 3 strands) - rows are staked, each cutting flagged

Date Begun: May 1984 Completion date (expected) in progress (1988)
Papers or Thesis Resulting:

Funding Source: Experimental Forest, USFS Experiment Station (Intermountain)

Future Plans: ~~prelim trial~~ demo area, poplar stand development study

Date: 26 March 1985

Reseacher/s: Harold Osborne, Ray Boyd (USFS)

Project Title: Comparison of foliage active vs. soil active herbicides on sprouting residual shrubs following broadcast burning. (Study 5)

Subject: reforestation - site prep

Keywords: herbicide, site preparation, broadcast burning, shrubs

Abstract: Herbicide was applied to individual shrub sprouts in a clearcut (cut and ~~broadcast~~ broadcast burned in 1982 and planted with DF and PP in spring 1983). Applications were also made to unburned shrubs in an adjacent stand. ~~Seven~~ Four different herbicides and ~~seven~~ four different application rates for each were used. Primary species tested was ninebark.

Location:

Unit of the Forest East Hatter Creek

T 40N R 4W S 1 ~~[redacted]~~ NE¼ W½

Stand 2-5-2 Size of Area 17 Acres

General Description of Area Clearcut on Basalt Hill (NE side), N-NE aspects, cut 1982

Plot or Area Designation:

Date Begun: 1984 Completion date (expected)

Papers or Thesis Resulting:

Funding Source: Experimental Forest, USFS Intermountain Experiment Station

Future Plans:

Date:

Reseacher/s: Ray Boyd (USFS)

Project Title: Effects of herbicide treatment on soil moisture and available nitrogen in recently disturbed and undisturbed microsites. (Study 4)

Subject:

Keywords: Herbicide, soil

Abstract: Two plots, one treated with herbicide and one control, were established in an undisturbed older-growth Douglas-fir stand and in a stand recently clearcut and burned. Soil samples were taken on each plot at each of the sites on several different dates over the next two years. Samples were analyzed for available nitrogen content and soil moisture.

Location:

Unit of the Forest East Hatter Creek

T 40N R 4W S 1 NE¼NE¼

Stand 2-05-01 Size of Area

General Description of Area Clearcut, access, cut 1981, burned Fall 1981, planted with 1-0 containerized PP and DF stock 1982.

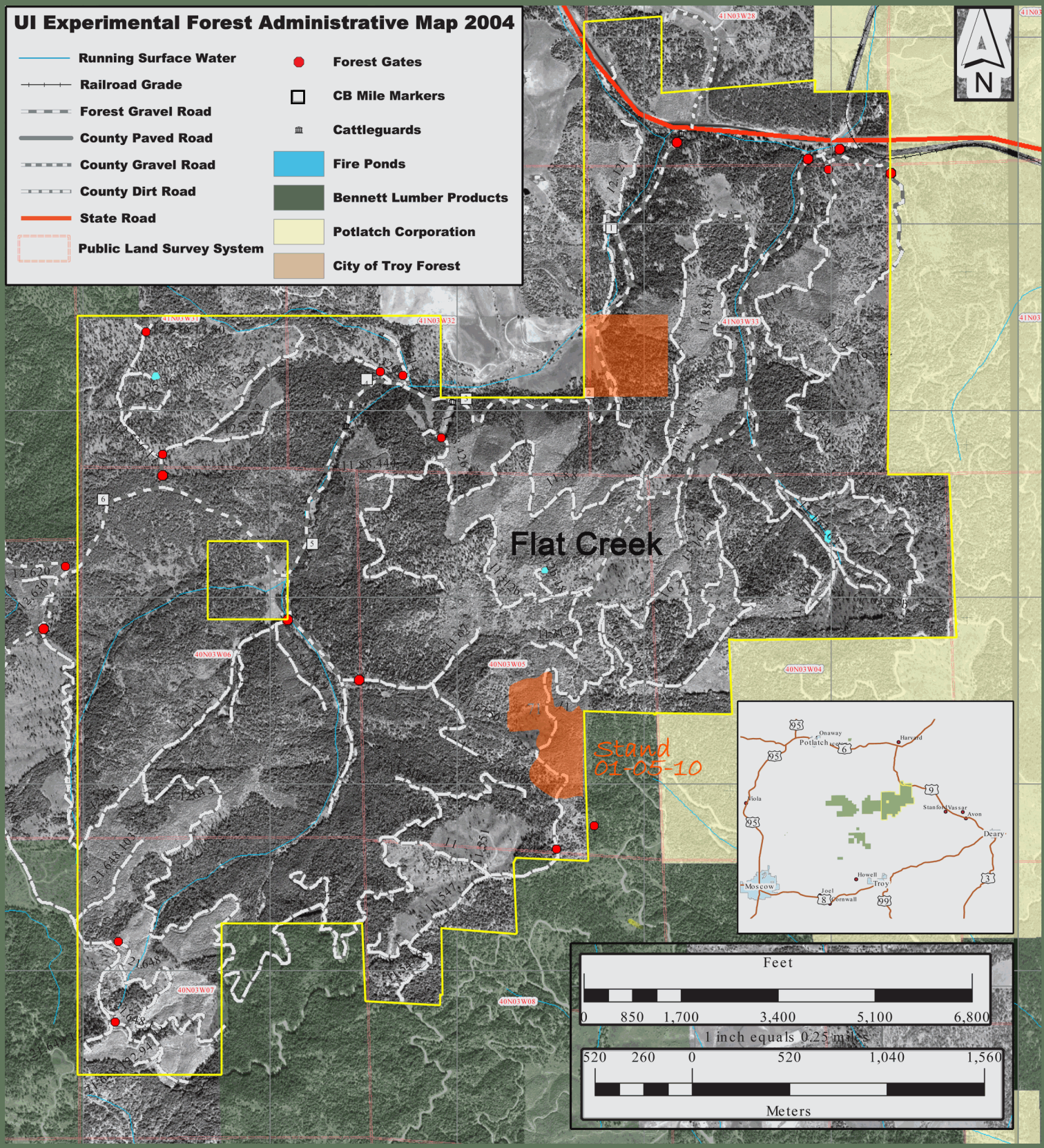
Plot or Area Designation: Generally marked with stake or post. Further info can be obtained from the principal researcher

Date Begun: June 1982 Completion date (expected)

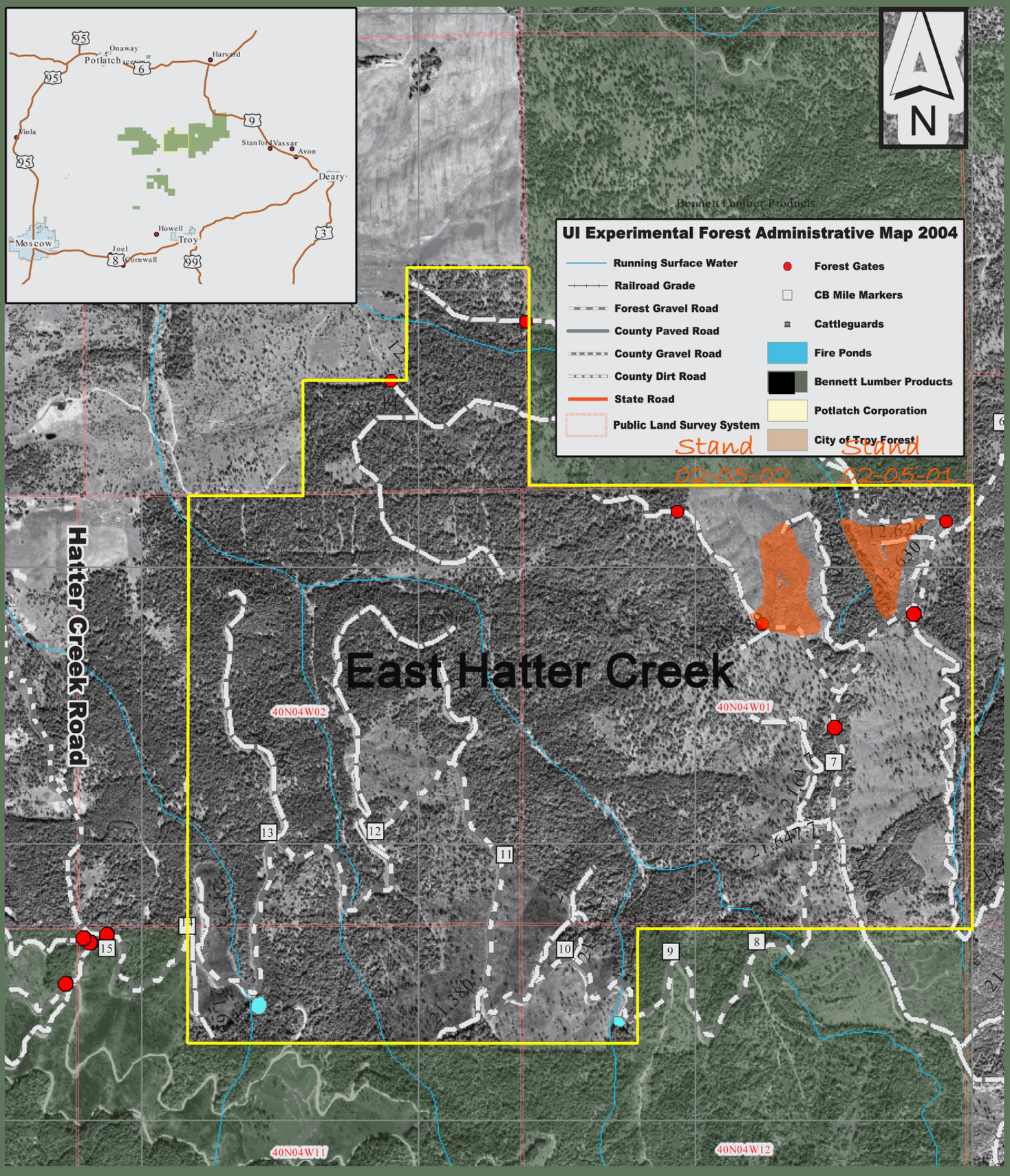
Papers or Thesis Resulting:

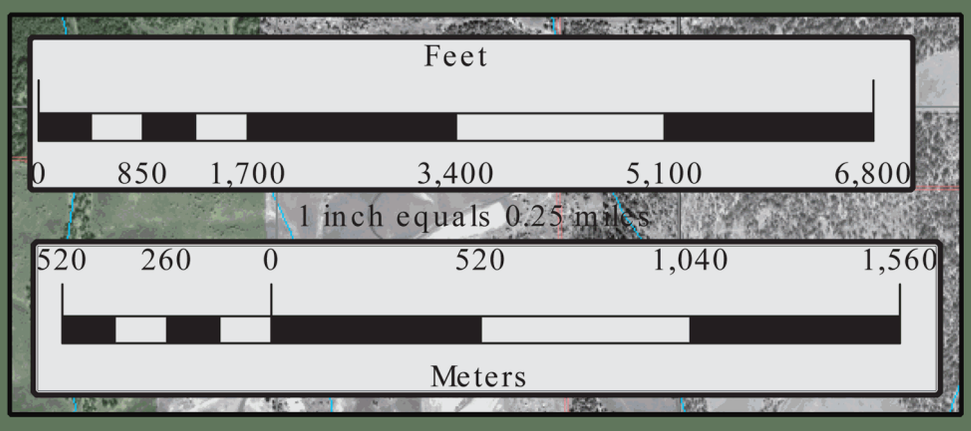
Funding Source: Experimental Forest, USFS Intermountain Experiment Station

Future Plans:


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
N
Flat Creek
Stand
01-05-10
41N03W28
41N03W31
41N03W32
41N03W33
40N03W06
40N03W05
40N03W04
40N03W07
40N03W08
Onaway
Potlatch
Harvard
Viola
Stanford
Vassar
Avon
Deary
Moscow
Howell
Troy
Joel
Cornwall
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

Flat Creek





East Hatter Creek

Location of Complete Research:

Author & Title: Boyd, Raymond J.
Herbicides for Forest Weed Control in the Inland Northwest:
A Summary of Effects on Weeds and Conifers

University of Idaho Library:

Call Number- DAY-NW SB 763 N67 B692 1985

College of Natural Resources:

Department- Forest Resources

Other Sources: