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Barndt

Reply to: 3250 Forest Soil and Water Management
3230 Forestation and Tree Improvement

Date: MAY 24 1984
May 24, 1984

Subject: Mullan Gulch Plantation

To: District Ranger, Superior RD

A field review was conducted by Doug Berglund, Debbie Reynolds, Skip Barndt, and Joni Sasich on March 30, in a regeneration unit where insects identified as the pitch midge and western pine tree borer have infested the plantation saplings. Poor soil condition was considered during this review as a possible contributing factor which may be causing the trees to be more susceptible to insect infestation.

The plantation is located approximately 1 mile up Road No. 1198 (southern portion of NW¼ and northern portion of SW¼ section 11, T. 18 N., R. 28 W.). Soils were assessed for soil compaction and nutrient loss.

I. OBSERVATIONS

We observed a very significant amount of topsoil displacement as a result of dozer slash piling in windrows. Soils in areas between windrows no longer have pure surface soils; they are mixed with the very cobbly subsoils. Large amounts of topsoil were pushed into the windrows and mixed with slash. There is an immediate visual difference in tree heights between these two areas. Trees growing in the windrows are taller and appear more vigorous than those growing in the areas between windrows.

Soils in this area have a natural capping of a silty material derived from windblown volcanic ash. Nutrient holding capacity and plant available water are relatively high in this ash surface. When removed from the site or mixed with less fertile subsoils, soil productivity is lowered.

Soil Compaction

Small areas devoid of regeneration occur in the unit and appear to be associated with areas of greatest disturbance. Several areas were observed to have indications of severely compacted soils, i.e., large platy soil structure, lack of macropores, dense peds, and inhibited infiltration.

II. ANALYSIS

Soil samples were taken from a slash windrow - Site 1, a severely compacted area - Site 2, and an adjacent natural, undisturbed site with similar soils - Site 3 (control).

Locations are plotted on the enclosed map. Soils samples from each site were tested for 16 elemental nutrients, nitrogen, and organic matter percentage by Nellie Stark's Forest Soils Laboratory at the University of Montana. Bulk density determinations (Ped Method) were obtained with the help of University of Idaho's Forest Soils Laboratory.

III. RESULTS

Chemical Analysis

The following discussion of chemical analysis must be qualified by saying that we know very little about the nutrient requirements of western conifers. The comparisons are somewhat subjective, but are based on research results from Nellie Stark's forestry research conducted in western Montana. From research conducted to this date, we can make conclusions on gross deficiencies. Also, relative comparisons can be made between the affected sites and the natural site (control).

Overall, analysis shows no gross deficiencies in the 16 elements plus nitrogen in any of the soils sampled. The only significant reduction from the control is in aluminum (AL) in both the windrow and compacted sites.

Slight differences in other nutrients in the plantation soils from the control soil (Site 3) are differences expected as a result of harvest. Harvest causes mixing of the mineral soil surface and organic surface layers which releases nutrients, either to become more available or leached from the soil.

Evidence of displacement is confirmed by this soil analysis. Site 2 results show indications of the deep mixing that has taken place as a result of dozer piling this unit. Both surface and subsoil samples have very similar nutrient contents. Site 1 shows a more natural distribution of elements from the surface and subsoil. Unlike most of our forest soils, displacement of the surface soil on this site appears to have not affected soil nutrients to a large degree. Subsoils at this site appear to be relatively fertile so nutrient loss was small when topsoil was displaced and mixed.

Soil pH has been affected. Site 1 has a pH of 7.0 which is similar to Site 3. Site 2 has a pH of 6.3 which is similar to the subsoil pH. Nutrients are generally less available for plants at pH's of less than 6.5. Differences are small and alone would not contribute significantly to stress put on the trees.

Soil Compaction

Site 2 has a bulk density of 1.26 gm/cm3 which in ash-influenced soils may be high enough to cause reduced root penetrability. Compared with the undisturbed site which has a bulk density of .80 gm/cm3, the compacted site shows a 37 percent increase in density. Compaction of this degree should be broken up by grass and shrub roots and freeze/thaw over time. Effects of compaction should be reduced in 15 to 25 years, but until that time soil quality is expected to reduce vigor in the plantation.

Site 1 has a bulk density of 1.09 gm/cm3 which is higher than I expected. This density is on the margin of possibly affecting root penetrability. Upon observing soil structure in the field, I would say root penetration is not significantly affected at Site 1.

IV. CONCLUSIONS

Soil compaction may be causing some stress on the plantation saplings, and effects are apparent in the differences in tree height between Site 1 and 2. The degree of compaction is not significant enough to conclude that the insect

infestation is directly related to the soil compaction. Nutrient analysis shows a general reduction in nutrients from the undisturbed site to the plantation which is normally expected as a result of harvest. This may create some subtle nutrient deficiencies that cannot be deduced without more research in conifer nutrition.

Another site factor to consider is microclimate. The plantation lies in a broad, protected draw that may offer milder climatic conditions for insects to survive in. Microclimate may be more of a contributing factor or may be acting in combination with the compacted soils to offer the right conditions for an infestation.

V. DATA

ELEMENTS (ppm)	SITE 1 (Surface)*	SITE 1 (Subsoil)**	SITE 2 (Surface)*	SITE 2 (Subsoil)**	SITE 3 (Control)
Aluminum	17.4	10.8	21.1	20.6	46.6
Boron	0.5	0.0	0.4	0.4	0.4
Calcium	2550.0	654.0	1370.0	1235.0	1460.0
Copper	1.12	2.18	2.74	3.0	2.06
Iron	42.4	17.6	71.5	74.7	63.8
Magnesium	84.0	35.0	175.0	132.0	144.0
Manganese	20.8	3.6	13.0	11.0	31.8
Mercury	.7	0.0	0.5	0.4	0.5
Potassium	267.0	88.0	450.0	449.0	368.0
Molybdenum	-0-	-0-	-0-	-0-	-0-
Phosphorus	33.7	8.2	23.2	15.0	17.0
Sodium	14.3	4.0	17.4	29.5	19.3
Silicon	45.6	17.4	45.6	62.8	64.7
Zinc	2.04	.76	2.42	1.28	1.56
Titanium	.64	.34	.75	.81	.93
TOTAL Nitrogen	748.0	164.0	554.0	506.0	880.0
% Organic Matter	5.62	1.22	4.86	4.60	7.78
Bulk Density (gm/cm3)	1.09		1.26		.80

SITE 1 - Slash windrow with topsoil deposited from other portions of plantation.

SITE 2 - Soil compacted and topsoil has been removed and/or mixed.

SITE 3 - Control; natural, undisturbed soil under ABGR/LIBO H.T.

* Surface is defined as the E soil horizon, 0-10"
** Subsoil is defined as the B horizon, 10-20"

Joni Sasich

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Enclosure

cc:
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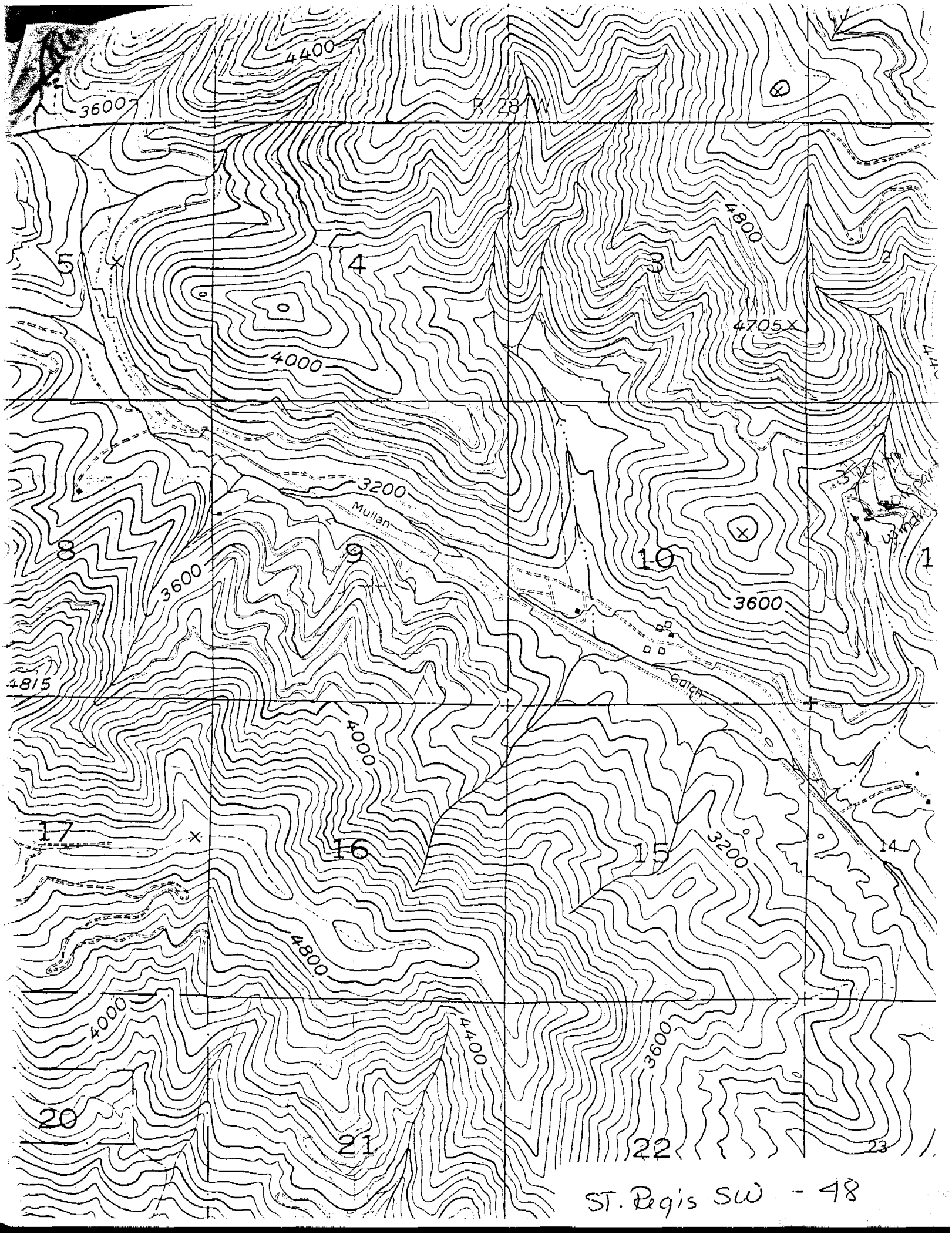

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