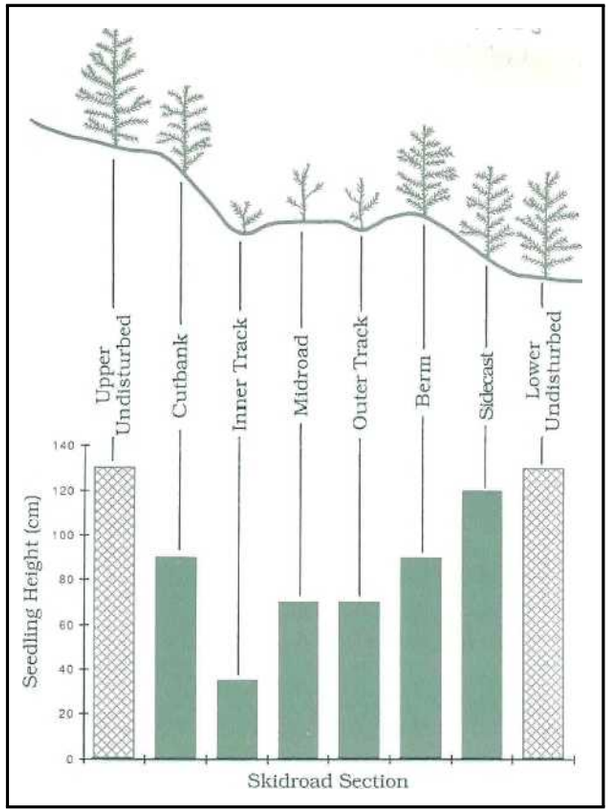


EtthCTS OF SOIL ? I h ON PRODUC'TIVIT i!'

What does soil disturbance mean to site productivity? Recent research shows:

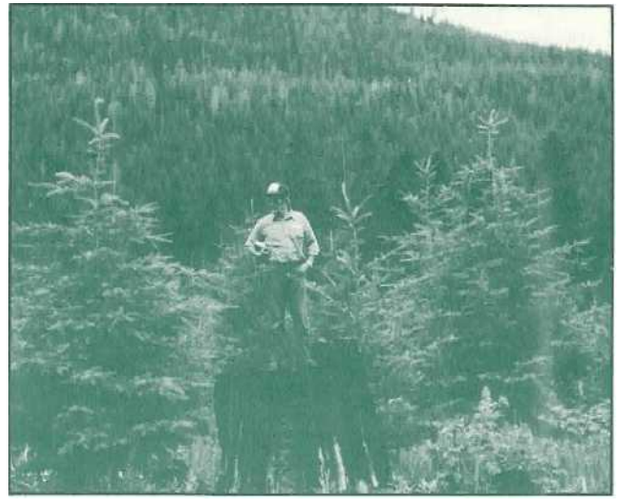
*In B.C., height growth of trees on landings and deeply-cut skidroads decreased 1 /3 to 1/2, reducing site productivity an estimated 15% (see above).

*In Oregon, soil density increases of 26% on the roads decreased height growth by 17% and stem volume by 48%. Total stand growth decreased an average of 14%.

-In the southeastern U.S., windrowing reduced the stand volume by 70m^3/ha after 20 years.

MAINTAINING PRODUCTIVE FOREST SOILS

Forest managers must understand that future forest growth depends on maintaining soil productivity. Disturbance which degrades our forest soils significantly affects long-term growth and the future viability of our forest industry.



... protect the soil while managing the forests

Maintaining forest productivity requires planning and the application of our best knowledge and equipment. Use of harvesting and site preparation practices which minimize soil disturbance In the first place Is a cost-effective strategy. Low-impact management systems should be prescribed for areas identified as sensitive. Rehabilitation of previously degraded soils can help recover lost productivity.

Ongoing research work is improving management guidelines, forestry equipment and soil rehabilitation methods. This work when applied to forestry planning and operations will ensure the maintenance of long-term soil productivity, so that our plantations and forests will continue to flourish.

CREDITS

Pre ared by:
G. *Still, B.C. Min. of Forests* & Lands, Nelson, B.C.
D. Macdonald, Kutenat Nature Investigations, Nelson, B.C.

Work of the following is gratefully acknowledged:
Dr. H. Froehlich, Dept. For. Eng., O.S.U., Corvallis, Oregon
D. McNabb, College Forestry, O.S.U., Corvallis, Oregon
Dr. R Smith, Can. Forestry Service, Victoria, B.C.

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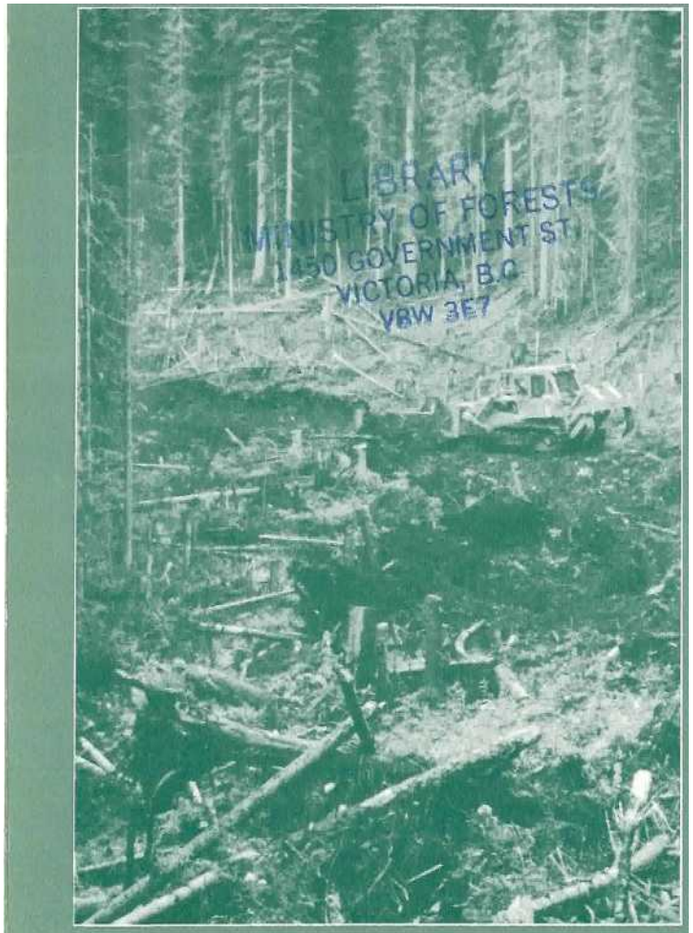
Forest Soils



BC Ministry of Forests and Lands

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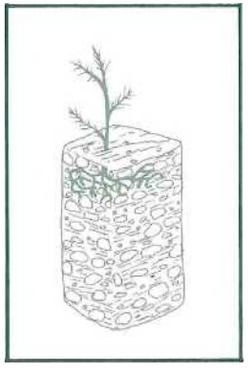
BASIC CONCEPTS

Future forest growth depends on maintaining soil productivity. Forestry operations do disturb soil. Minor disturbance may be beneficial in establishing a new forest, but excessive disturbance may degrade the soil and reduce future timber yields. Improved planning of forestry operations can minimize soil degradation and productivity losses.

Soil **density** is the dry weight of a given volume of soil. Density reflects soil porosity and strength, and affects root penetration and growth. Soil **compaction** Is an increase in soil density from its natural state. Machine travel during forestry operations can compact soils and reduce forest productivity for more than 30 years.

Abundance and availability of plant nutrients determines site fertility. In B.C. forest soils, the highest concentrations of available nutrients occur in the organic forest floor (litter), and the upper 25 cm of mineral soil. Burning, erosion or physical displacement (scalping) of these layers means a loss of nutrients and a reduction In fertility.

- low density results in good aeration and water infiltration capabilities
- Loose/friable structure encourages root penetration
- Organic matter on/near soil surface increases fertility
- Sufficient depth permits adequate rooting



- *compacted soil surface layers result In high soil density. poor root penetration and reduced aeration and infiltration
- scalped, buried, burned or eroded surface soil layers reduce nutrient levels
- exposed infertile calcareous subsoils reduce nutrient availability

During the construction and use of hauiroads, skidroads and landings:

- *fertile organic and upper mineral layers are scalped or buried
- surface soil is compacted by heavy equipment
- Calcareous or compact subsoils are exposed

This disturbance results in a significant portion of the harvested area developing higher soil density, lower penetrability, and lower nutrient and organic matter levels compared to undisturbed soils. This **means reduced** soil productivity.

Research shows that after ground-skidding operations on slopes over 30%, deeply disturbed and compacted haulroads, skidroads and landings can occupy 30-40% of the logged area.

Figure 1 shows that soil density increases dramatically after only a few passes of forestry equipment. Figure 2 shows the reduction in tree growth accompanying increased soil density.

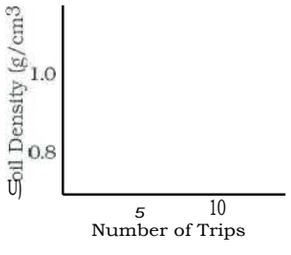


Figure 1

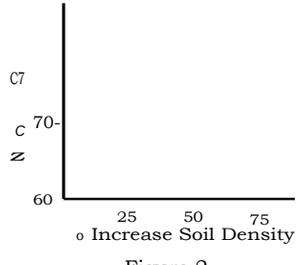


Figure 2

Harvesting may also cause soil erosion, mass wasting and diversion of subsurface water flow. These reduce productivity and may degrade off site resources, such as water quality and aesthetics.

Improving Harvest Practices

- plan and supervise harvesting carefully making special provisions for sensitive sites
- prelocate skidroads to take advantage of terrain features and to reduce skidroad density
- *use low-impact yarding systems such as low ground-pressure skidders or cable systems
- -use snow for skidroad construction
- *confine machine operations to skidroads
- yard on frozen ground or snow
- avoid diversion of natural drainage channels

Site preparation can improve seedling establishment, survival and growth. It is used to create a mineral seedbed for natural regeneration, provide planter access, and reduce weed competition.

Site preparation can also reduce productivity

- searification and windrowing can remove organic and upper soil layers, and cause widespread compaction
- Slashburning can reduce fertility by burning nutrient-rich litter and slash, and can increase erosion

Figure 3 shows the occurrence of nutrients in the upper sod layers. The concentration of nutrients in the organic layers can be 10 to 100 times greater than in the mineral soil.

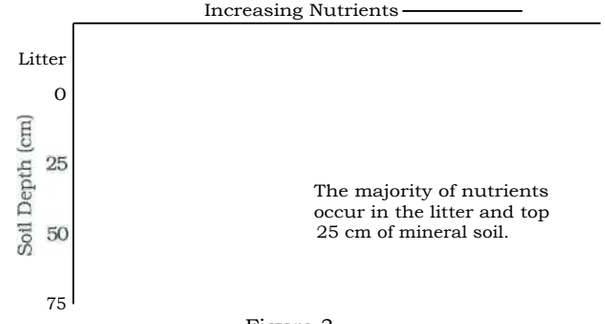


Figure 3

Improving Site Preparation Practices

- e avoid burning thin organic layers and on shallow or coarse soils, or minimize burn intensity
- *burn when duff moisture is high
- pile only concentrations of slash to minimize machine travel
- -avoid windrowing
- use appropriate machinery for the site
- *operate machinery when the soil is driest on sloping ground use discontinuous rather than blanket scarification
- practise better utilization

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Rehabilitate severely disturbed areas by:

- waterbarring steep sections of skidroads
- revegetating erosion-prone areas
- -tilling compacted soil