

THE REHABILITATION OF DISTURBED FOREST LAND

Paper Presented

By

S.G. Homoky
Research Branch
Ministry of Forests
Victoria, B.C.

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THE PROBLEM

Forest utilization leads to the inevitable disruption of stability and productive capability of forest soils. Disturbance can be permanent or temporary, mild or severe, but it cannot be fully eliminated. Some man-made disturbances can be tolerated and are even necessary for continuous resource management whereas others must be prevented or remedied for the sake of resource protection and the maintenance of productivity.

Two main classes of forest land disturbances are recognized as consequences of the removal of the protective vegetation cover and top soil horizon.

1. Exposed mineral soils, subjected to the forces of erosion, lead to the instability of slopes.
2. Depleted soil nutrient levels associated with unfavourable alteration of soil properties diminish or destroy the chances for forest establishment.

Damages to forest soils caused by management-related activities can originate both within and outside the road right-of-way.

Road-related damages are:

1. Impaired stability of the road structure on:
 - a. cut and fill slopes
 - b. roadbeds and associated drainage structures.
2. Damaged adjacent aquatic environment with respect to:
 - a. fish habitat
 - b. hydrology
 - c. community water supplies
3. Impaired aesthetic values. Soil disturbances originating outside the road right-of-way are:

- a. slides and gullies on logged mountain slopes
- b. skid trails on clearcuts
- c. landings

OPTIONS FOR PROBLEM SOLVING

In addressing the issue of forest land disturbances, several options are available to be chosen and applied in a logistical manner.

First, the two important concepts of prevention and actual rehabilitation must be observed before control methods are chosen.

Prevention calls for foresight, anticipation of damage, and planning. Activities in this area include the delineation of sensitive sites, geotechnic inventory, and engineering design of roads and drainage structures.

Rehabilitation is successfully applied when prerequisite criteria to prevent advanced site degradation, e.g. severe failures, are met. Reference is made to the MOP Land Management Report No. 4, under "Construction Criteria" on page 8. The recognition of surface versus mass erosion problems has priority in the decision-making process. Surface erosion can be dealt with under "rehabilitation" whereas major mass soil movement in the forest area can only be "prevented."

The most economical and most effective means of surface erosion control is provided by revegetation techniques. This can be accomplished by:

1. Grass-legume seeding through;
 - a. direct or dry seeding of slopes not exceeding 27% steepness,
or
 - b. hydroseeding or hydraulic seeding of steep slopes. This is more costly but also more effective than dry seeding.
2. The establishment of shrub and tree species on slopes where failures cannot be controlled by grass-legume mixes alone is most effective when woody plants are superimposed on an established grass-legume cover.

Both methods prove useful on cut and fill slopes, slides and gullies. Further, the timely application of surface erosion control methods can also prevent the eventual subsequent escalation of surface erosion problems to mass soil erosion; for instance, rills developing into gullies, undermining the slope.

The rehabilitation of landings involve the improvement of physical, chemical, and biological properties of compacted and nutrient-depleted forest soils. Unless rehabilitated, the total area of many landings add up to a significant area of forest land which is removed or "alienated" from forest production.

The problem of skid trails calls for principles and techniques listed under forest roads and landings, involving both erosion control and soil improvement measures. The most comprehensive practical handbook is currently under review, titled "Ground Skidding Handbook for the Nelson Forest Region" by H.L. Hammond.

The tools of rehabilitation by revegetation range from the simple cyclone seeder for dry seeding to the more sophisticated hydraulic slurry applicators. Aerial seeding techniques on mountain slopes not accessible with ground-based equipment are also in use. Dry seeding from helicopter is a simple and widely used technique. Currently the MOF is designing an improved version of an aerial hydroseeder to treat steep gully slopes and slides.

ACCOMPLISHMENTS AND RESULTS

The Ministry of Forests started a roadside revegetation research project in 1977 on a modest scale. Soon it became evident that the rehabilitation of all disturbed forest areas had to be included in a larger program. The propagation of shrub species was added to the revegetation program, followed by efforts directed toward landing rehabilitation. Earlier efforts to improve landing sites in the Cariboo Forest Region were experimentations with deep and shallow ripping of the compacted soil, followed by seeding with grasses and two tree species.

As most of the land rehabilitation research and semi-operational work concentrated on roadside hydroseeding, most slides shown here illustrate the erosion control aspect of land rehabilitation. The "shrubs" and

"landings" are still in the research phase whereas roadside erosion control is now being implemented.

Seeded test sites of "early" and "late" application were established in all six Forest Regions and in most biogeoclimatic zones. These test sites are monitored annually. Per cent slope cover and representation of the dominant grass and legume species are recorded. Foliar and soil analysis of the earliest test sites on Vancouver Island already indicated an increasing nutrient capital. Plant and soil N increased more than three-fold, and significant increases of Ca, Mg, P and K were also recorded.

Either simultaneously with or separately from test site establishments, training seminars and field demonstrations were given to MOF and industry personnel. Consultation and assistance was provided to Regions, Districts and licensees to help them initiate local operational roadside erosion control programs, and to convert existing implements into hydroseeder units. Technology transfer from research to MOF operations is formalized in a five year plan.

The collection and propagation of native shrub species commenced two years ago. Three propagation facilities exist in the province. At present, 4,000 coastal cuttings are ready for outplanting and another 3,000 are expected from the Chilliwack nursery. The initial plot-trial plantations on steep slides on the Queen Charlotte Islands, Lower Mainland and Kootenay locations have already been established during 1980 and 1981. Grass-legume data from aerial-seeded slides and gullies have not been analysed to date but cursory examination indicates slope cover in excess of 70%. The technique was tried on the Queen Charlotte Islands with great efficiency.

THE "BACKUP" SYSTEM

An administrative framework is necessary for the effective use of land rehabilitation methods in forest resource management. Besides guidelines and handbooks, the following important features support resource protection efforts.

1. Regional policies with regards to "putting roads to bed" and controlling surface erosion with dry seeding already exist in several forest regions.

2. The Valuation Branch formulates means of compensation to licensees and funding for MOF operations for costs expended on site protection projects.
3. A Policy Statement by the MOF addressing revegetation for various purposes has been drafted.
4. Revision of Chapter 6 of the Engineering Manual of the MOP is now completed. This chapter deals with revegetation of forest road slopes by grass-legume mixes, shrubs and tree species for stabilization purposes.

FUTURE PLANS

Activities planned for the future include the following features.

1. The "Five-Year Plan for Implementation of Research Results, Rehabilitation of Disturbed Forest Land."
 - a. Seeder units to be acquired and operated by Forest Regions.
 - b. Shift of research input from one area of land rehabilitation to another: grasses-legumes, shrubs, landings.
 - c. Continuing test site assessments.
 - d. Continuing training, consultation, assistance in starting Regional, District and industry plans for forest land rehabilitation.
2. Physical and chemical soil amendments in erosion control for critical failure-prone sites.
3. Improved engineering design and location of roads, with special emphasis on watershed values and maintenance of slope stability.

GENERAL PRINCIPLES OF OBJECTIVES

In general terms, endeavour should be directed to two important principles:

1. Improved, revegetated sites should provide favourable conditions for the establishment or re-establishment of indigenous vegetation to perpetuate the vegetation cover of slopes. Landings, skid trails should regain their former productive capability to support forest stand establishment and development.
2. Revegetation and engineering should blend into an inseparable unit. Revegetation should become an integral part of forest road design, construction and maintenance activities.