

A Method of Forest Management for the Planned Introduction of Intensive Husbandry in Virgin Forest Stands

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Abstract: The method proposed is derived from long experience of intensive management in forest stands of Central Europe and from our proposal for management in virgin Iranian forests of the Caspian Region. The method establishes the need for systematic planning of stand conversion to insure both sustained yield and the harvesting of sufficient timber to sustain economic development. The method also recognises the need to integrate the planning of silvicultural activities with capital investments in roads and machinery.

INTRODUCTION

The method described in this paper is based on the realization that forest planning must be consistent with the political and economic situation of a developing country, as well as with the given natural and economic conditions, financial position, market conditions, and the technological procedures involved in the process of production, which are all traditionally taken into consideration in forest husbandry. A method of this kind is expected also to reflect the latest scientific achievements in understanding of the forest as an entity. Market conditions must be considered to insure a reasonable financial return from management. It must also be recognized that the forest is a national resource of special value in a country's watershed management and in the development of an environment beneficial to its population.

The principles discussed below and incorporated in the method for introducing an intensive system of management into virgin forest stands were obtained partly from what has been gathered during the past 250 years of intensive management in the forest stands of Central Europe, and partly from the experience gained while compiling our proposal for forest management in virgin Iranian forests of the Caspian Region. The method is based on the principles that (1) the introduction of an intensive system of management into the virgin-like forest must be planned, and (2) once converted, the commercial forest must be able to produce sustained yields adequate in quality, volume, and monetary value, and must supply the market with sufficient amounts of timber in the species and assortments needed for economic development.

The method for introducing an intensive system of management as suggested here is based on the idea of short-term credits, which are required to make the virgin stands accessible for management, for purchasing needed machinery, and if necessary, even for constructing wood-processing plants. The short-term credit needed to secure accessibility of virgin-like forests can be estimated by assuming that the stand regeneration will progress through areas that are spatially linked, so that the transport of wood from the part of the forest which has just been made accessible passes through those which have already been made accessible. The availability of short-term credit indeed appears to be an important requirement for the introduction of intensive management in the forests of developing countries.

The suggested method is based on scientific knowledge of the forest. It utilizes data on the geographical and ecological classification of forests, which serves to stratify forest land. This stratification is needed to delimit forest land planning and control units for management, to define the quantities to be estimated, and to elaborate the instructions needed to manage the forest.

METHOD

Economic Evaluation of Wood Production

Delimitation of the Forest Land Resource

It would not be reasonable to introduce intensive management into forests which, within a known period of time, are intended to serve some other type of land utilization (such as fields, meadows, grassland, dwelling estates). It is therefore urgent to determine, on the basis of consultation with competent institutions in the country, which of the forest areas will be left as permanent stands, regardless of population increases. This task appears to be urgent, especially in the territories which are characterized either by a high or by a very low forest cover percentage, compared to the targets planned for the years to come.

Survey and Analysis of Natural and Working Conditions in the Forests

The primary concerns should be the survey and analysis of soil, climate, and terrain all of which are decisive for the future productivity of the forest stands. Survey and analysis should also be concerned with the present condition of the forest stands (existing species, diameter, health condition, forest inventory data, potential production of assortments suitable for commercial and industrial uses, and the like). The remaining items to be evaluated are: conditions for management, especially the character of the topography; potential accessibility of the stands and timber transport; delimitation of gravitational areas etc.; conditions for location of timber yards and sawmills; the level of protection needed against forest fire and destructive wind.

Maps produced using photogrammetry are part of the surveys mentioned above.

Marketing

An investigation is carried out to determine the opportunities for trading timber; to assess the demand for timber assortments by local population and industries, and to estimate the export requirements as well; finally, the potential for the processing of the timber harvest by woodworking plants is assessed.

Organization of the Forest Stands

Working Circle

These are the "frames" for harvest regulation. The areas range from 15 to 50,000 ha. They are designed to insure sustained, even, and sufficient supplies of timber, in order to simplify management, and to obtain the short-term financial credits needed to make the forest accessible to transport. Working circles cover contiguous areas encompassing entire watershed or timber sheds which are homogeneous with respect to both natural and economic conditions. These working circles permit the application of a uniform method of management and a uniform type of harvesting regulation. Relatively large areas are covered by working circles. This is made possible by the introduction of the concept of "working complexes" of stands, which refer to land units homogeneous with respect to production and management. The only role left for the working circle is to insure sustained and even yields from the forest. If required, working circles can be drawn for forests managed for purposes other than timber production, e.g., protection forests, recreation forests, nature reserves, and the like.

Working Complexes of Stands

These are defined as the groupings of forest stands with ecological, productional, and management characteristics so similar that they permit the introduction of a uniform system for (1) compilation of instructions for management, (2) calculation of the index of harvest regulation, and (3) calculation of the timing of management activities for the forest, etc. The reasons for introducing the working complexes of stands into forest management are to make the goals and the decisions of management concrete, to facilitate real planning and control of managerial actions, and to simplify the managerial process. Clearly the use of working complexes is indicated when a system of intensive management is introduced into virgin-like forests.

Forest Compartments

These are defined as the permanent land management units based on the forest's biological and management typification. They range in area from 30 to 100 ha. Where possible, the forest compartments are marked off by distinct characteristics of the terrain. Their uniform morphological character should mesh with the network used for timber skidding, and with the road system. Moreover, the forest compartments are supposed to be independent units also

from the point of view of forest protection. For this reason, preventive measures of protection are worked out for each compartment. Compartments are surveyed and, as a rule, their boundaries are located using photogrammetry. The forest compartments are the basic units of the forest's spatial organization, both with respect to planning and with respect to the realization of the plan.

Subcompartments

Under diversified natural and working conditions there are occasional cases when the compartment cannot cover all ecological and stand differences; it then follows that the compartment is not a convenient unit for the planning, control, and realization of pertinent measures of management in the sectors of silviculture and forest protection. Instead, subcompartments are delimited as a lower category of the forest's spatial organization. The subcompartments are assumed to possess the same properties indicated above for the compartments--those necessary for the uniform planning of management activities related to silviculture and forest protection. In this particular case, the planning of timber transport and skidding occurs within the frame of the compartment.

HARVEST REGULATION

The principle observed is that optimum productivity be reached in the forest stands within the compartment or subcompartment; at the same time, the yields produced within the frame of the working circle must be sustained and even. In compliance with the requirement for simplicity and the conditions in developing countries, harvest regulation should be based on area. It is true that allowable cuts are derived on the basis of area and volume, as well as on assortments and value, but always so that considerations for the elements of volume are subordinated to those of area.

Calculation of the Allowable Cut

The final allowable cut is determined primarily by the "normal" felling area, according to the formula:

$$e = i_n h_u$$

where e denotes the volume of the allowable cut, i_n stands for the normal felling area, in hectares, and h_u designates the average volume per hectare of the growing stock within the working circle at the time of stand maturity.

This average stock per hectare of the working circle is obtained with the formula:

$$\bar{h}_u = \sum i h_i F_i / \sum F_i$$

where h_i denotes the per-hectare stock in stands of individual working complexes, F_i indicates the area in hectares of the i th working complex belonging to the working circle, and

$$i = F/\bar{u}$$

where F is the area of the working circle and u is the rotation of the working circle, calculated according to the formula:

$$\bar{u} = \frac{\sum u_i F_i}{\sum F_i}$$

For the volume index of harvest regulation it is possible to use the final mean annual increment in stands of the working circle. This is calculated by summing up the final mean annual increments achieved in all the individual working complexes which constitute the working circle.

The stand volumes per hectare of individual working complexes are obtained by determining the growing stock volume per hectare in sample plots distributed in individual working complexes. Principles of systematic random selection must be observed to obtain representative estimates of the characteristics of the stands of the working circle.

Concerning the realization of the allowable cut: the main object of the method proposed here is to promote the harvesting of the allowable cut in a contiguous area (French terms: quartier de regeneration, affectation unique). The method thus permits respecting the silvicultural requirements of stands in individual subcompartments or compartments within the frame of the ecological and production conditions characterizing individual working complexes. In doing so, harmony is achieved between the interests of silviculture and those of cutting regulation.

For long rotations and the use of small-area harvesting systems, the allowable cut in the quartier de regeneration is calculated from the formula:

$$e = \frac{H_0 + C_i \cdot P/2}{P}$$

where H_0 denotes the total volume of stands in the quartier de regeneration, P stands for the regeneration period (cutting cycle) expressed in years, and C_i designates the current increment. The number of regeneration treatments is determined with respect to the ecological requirements of the species represented in or introduced into the stands. Regeneration in the subsequent quartier de regeneration does not commence until completion of the stand regeneration in the quartier de regeneration immediately preceding.

The harvesting in stands, except for the quartiers de regeneration just under regeneration, is dependent on the possibility of transporting the material exploited. As a rule, the plan is to utilize the wood for charcoal burning, and only then carry it out of inaccessible stands on the backs of mules or donkeys. Sanitary fellings are largely concerned with the removal of sick, ill-shaped, overaged, and similar trees which if kept would not contribute to the value of the stand. The cycle for these treatments is usually fixed at 10 or 20 years; the volume of timber harvested per hectare in individual working complexes is estimated on the basis of a current survey of the condition of the stands.

SYSTEMS OF MANAGEMENT AND EXPLOITATION

The method for introducing intensive management into virgin-like forests assumes the use of a system of management and exploitation that is consistent with the natural and economic conditions of the country concerned. The main --and highly desirable--objective is to avoid the destruction of the forest's sources of production--the soil above all--due to erosion, waterlogging, or excessive growth of woody plants. The selection of the system of management is dependent also on the ecological requirements of the species in the specific stand environment, and on the technique of skidding to be employed. In general, it seems advantageous to prefer the small-area systems of management, the better to maintain the forest's production capability. This, however, should not exclude the use of regeneration cuttings when conditions are suitable.

CONCLUSIONS

In addition to what has been indicated above, the method of introducing intensive management into virgin forests assumes thorough planning to carry out the management practices effectively and to use expensive harvesting and transporting machinery efficiently. Another requirement is that all the complex aspects of forest management be taken into consideration. The same amount of attention given to the harvesting of timber must be paid to afforestation of harvested areas and to the tending and protection of new stands. The construction of a network of timber transport roads, adequately dense and duly distributed in space (about 15 km/ha), is also a prerequisite.

The method discussed in this paper is not only consistent with all the latest achievements in Central European forestry, it is also consistent with the natural, working, and politico-economic conditions found in developing countries.