Quantification Problems in the Design of Forest Policy Programs

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Some of the quantification problems which face the designer of a forest policy program are discussed. Experiences drawn from the preparation of the Forest 2000 Program in Finland are used as examples. Both the defining of goals and the choice of means are surveyed and their interconnection in the planning process emphasized.

Keywords: forest policy design, quantification of means, planning process, Forest 2000

Introduction

A policy program should always include explicit answers to the questions:

1) what is wanted, i.e. what are the goals to be striven for?

and

2) how this want is to be satisfied, i.e. by which means the set goals are to be achieved?

For analytical and practical reasons the two questions are usually thought to be tackled separately, and in the said order: the goals are set first, then the feasible means for them are chosen (e.g. Vehkamäki 1986).

In reality the two phases are more or less interconnected. The decision makers are not very willing to decide on goals before they have at least some knowledge about the probable choice of means. As Duerr (1979, p.29) expresses it, the goals, means, and values are all determined together, simultaneously or by successive approximations. In practice this means that the designing of a realistic policy program always involves some interaction between the two phases.

It would be theoretically tempting to define the policy designing process as solving of an optimization problem where social utility, social net benefit, GNP, or some other criterion is maximized under the restrictions of biological production functions, forest industry demand function, forest owners' utility functions, and government budget constraints. That approach would, however, oversimplify the designing process and overlook the many difficulties which face the planner when he tries to quantify the essential relationships for the optimization model.

In 1983–1985, a long-term program for the Finnish forestry and forest industries was drawn, called Forest 2000 Program. It was preceeded by five earlier nationwide forest production programs, in 1959, 1962, 1965, 1968 and 1974. The Forest 2000 Program was however the first trying to cover the whole forest sector quantitatively.

In the following I will shortly discuss some of the problems which were met when quantifying the goals and means for forest policy. I start with a brief description of the planning process to give background for the problem analysis.

And I end with a more detailed discussion about the determination of the production goals and the choice of the policy means.

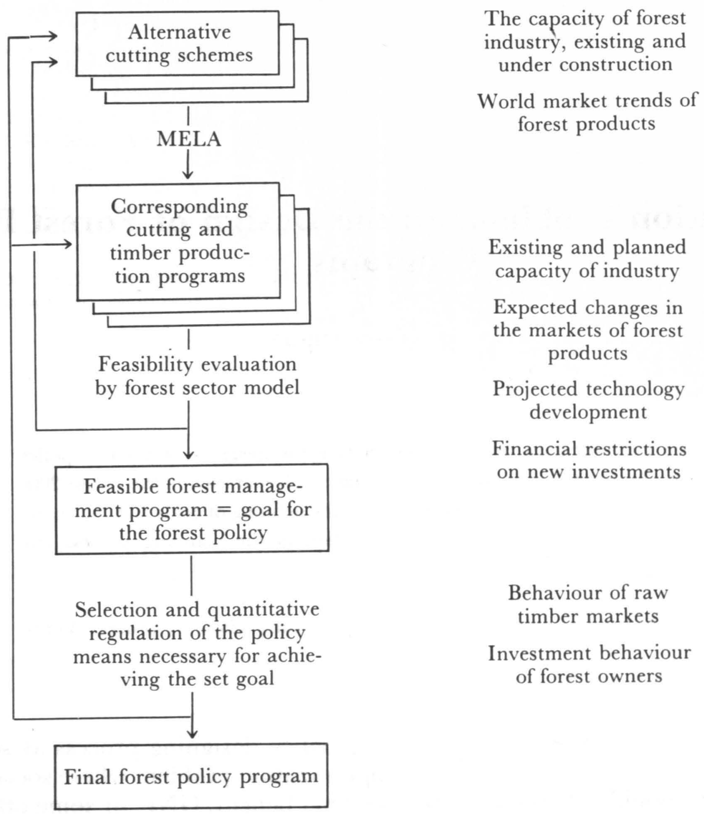

Figure 1. The policy designing process in the project Forest 2000.

Experiences from the designing process of Forest 2000 Program

The planning process

Figure 1 shows the main phases of the process together with some basic variables taken into account in each phase. The planning of policy goals was started by forming half a dozen different but reasonable cutting schemes. The total annual cuttings during the first years were assumed to be at the level which corresponds the present wood using capacity of the forest products industry, or alternatively the mean annual drain during the early eighties. Then the annual cuttings were thought to increase steadily until year 2000 by an annual rate which varies from 2 to 6 per cent according to the scheme alternative (Fig. 2).

Using MELA, a computing system for long-term forest management planning (Siitonen 1983), the management of forest resources was then simulated under the requirement that the total annual cuttings should equal the amounts set in the schemes. The allocation of cuttings and other measures between the various kinds of forests was optimal in the sense that the total net revenue from the forests was maximized.

As a result, MELA gives data about

- the structure (tree species, size of trees) of removals,
- the size and structure development of the growing stock,
- the amounts of silviculture and necessary improvements and
- the labor and capital inputs needed.

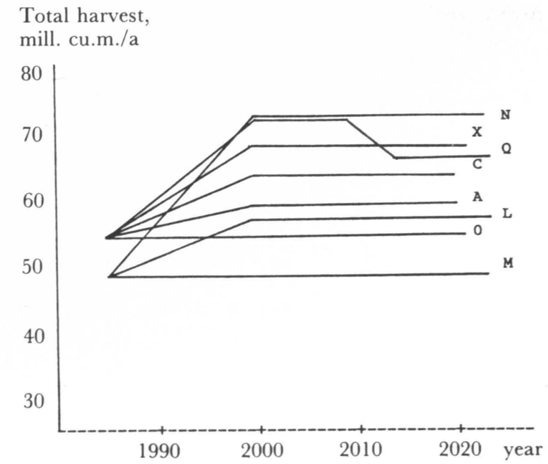

Figure 2. Cutting scheme alternatives studied in the Forest 2000 project.

The feasibility of each cutting scheme and corresponding management program was checked by comparing the cutting possibilities with the technological and economic limits of industry in using various kinds of wood. Cost-benefit calculations completed the comparisons.

The results were surveyed by the forest policy decision makers, and some new cutting schemes and slight alterations to the older ones were made with renewed calculations, before the tentative goal was chosen and fixed.

In the next phase, the policy instruments necessary for achieving the chosen goal were considered, and the extents of their use determined. Less sophisticated methods were used than in the earlier phases. Main interest was on the questions, how to affect the supply and demand on the raw timber markets and how to stimulate investments to forest improvements. Again the results gave decision makers reason to ask alterations to the forest management programs.

After 3 to 4 rounds, this interactive process ended with a final forest policy program proposition.

Problems in defining of goals

In a country like Finland, setting of a production goal for the forests is by far more adjusting the industry to the cutting possibilities than vice versa. The very long rotations make the potentials of e.g. pine sawlog cuttings quite inelastic in the middle long run. All the trees harvestable as sawlogs within the next 30 to 40 years are already existing, and relatively little only can be done to increase their growth. Even lesser are the chances to change the tree species distribution of the sawtimber stock available for harvest within the same time interval.

Therefore, the central problem in forest management planning seems to be the right timing and allocation of the cuttings. This problem clearly dominates the questions on silviculture and forest improvement investments.

On the other side, forest industry faces the question, how to adjust its capacity and activities between the rather inflexible rawtimber markets, the changing demand of different products, and the changing cost structure. New products and new technology will be introduced which will essentially alter the planning premises many times within the same period which from the forestry viewpoint seems quite fixed. (Of time horizon problems, see e.g. Keltikangas 1969, 1971).

For both purposes, planning the use of forest resources and planning the development of forest industries, separate models were used. The combining of the two into one bigger model was considered but there were unsolved problems. One of them comes from the fact that the resources needed in timber growing are relatively small as compared to the inputs of industry. Thus the marginal changes in forest activities easily fit into the error limits of industry production functions.

The MELA system optimizes, i.e. it produces a program for timber growing, which is assumed to be the best possible. This program is then used as such to form the basis of further calculations and planning. In practice, the forest owners, and the forest officials either, are not making exactly similar 'right' decisions. Certainly there will be deviations from the optimum on aggregate level, too. But how great deviations? The average statistics about the past silvicultural behaviour of forest owners does not tell how the things will be in the future. The past decisions have been made in very different socio-economic situations, with lesser knowledge we now have, and by different people.

To make the production goals more realistic, some changes were made into the MELA calculation program. The choices and the occurrence of alternatives were partly randomized thus allowing deviations from the strict optimum. No guarantee, however, can be given that this has been the right procedure.

Problems in the choice of means

There are, at least in theory, a whole arsenal of different policy instruments available for making the forest owners willing to contribute to the achievement of the goals set. A rational planning procedure would require that all instruments are considered, their effectiveness determined and then those means elected which together guarantee the goal attainment with minimum costs. Our knowledge, especially in the sense of exact quantitative functions, about the effectiveness of various instruments still is, however, far too scarce and fragmentary to allow such a procedure.

We may know that the use of some instrument A will affect positively to the forest owners' propensity to invest in regeneration. The extent of this effect may also be known. This knowledge makes it possible to quantify the volume of A needed to reach the desired effect. But if we do not have the same data of other instruments B, C, and D, it is not in any way possible to optimize the selection of policy means.

Fig. 3 tries to illustrate the difficulties we had in trying to determine how much more government support is needed to get the forest owners to invest so and so much more in certain forest improvements, such as fertilization and road construction. Government subsidizes the costs of both improvements by giving free planning, supervision, and technical aid, by giving direct grant, and through long-term low-interest loans. The terms of the support have been practically unaltered for past 20 to 30 years.

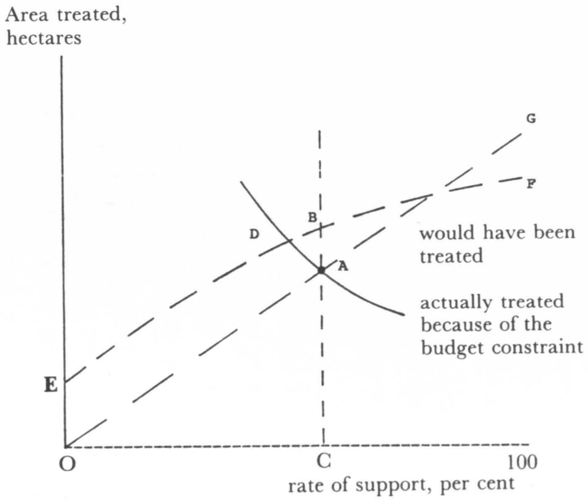

Figure 3. Area treated as a function of the government's share of costs.

From statistics we can calculate that the average support being C per cent of the total investment costs, A hectares are treated. This is the only certain data we have. Usually more improvements would have been done, if more government money in the absolute terms had been available. Were there no budget constraint on the distribution of support, B hectares perhaps would have been treated.

The curve through points A and D shows how many hectares could be supported with the fixed budget when the rate of support varies.

The other curve E–F through the points D and B is the support-investment function we are looking for, but with no variation in the terms of support we have no possibilities to determine its right position.

Were the situation as in fig. 3, how much should the budget be increased to get 15 per cent more hectares treated? Obviously no more because the desired increase in hectares could be gotten just by decreasing the rate of support a little. If we want bigger increase, then more budgetary money will be needed.

But if we already are in the point B position, i.e. the function goes through A, then increased areas are reached only by increasing both the budget money and the rate of support. Without knowing more than the location of point A in the picture, the exact estimation of the needed level of support is almost impossible. We must then resort to various simplified assumptions if not quesses. Line OAC is one example of such simplifications.

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