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11 Forestry's long-term environmental role

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INTRODUCTION

The main topics of relevance to forestry's long-term environmental role appear to be:

(i) Discount rates
(ii) Timber as a renewable resource
(iii) Amenity and recreation
(iv) Wildlife conservation
(v) Genetic reserves of tree species
(vi) Soil fertility
(vii) Effects on climate

DISCOUNT RATES

Discount rates are central to all calculations of long-term costs or benefits. Current economic orthodoxy, as embodied in the HM Treasury (1972) cost/benefit study of forestry, adopts a uniformly high rate of discounting for all investments, which implies that anything which will be of value, in say, 100 years' time is more or less completely discounted by the economist, and tends, therefore, to be disregarded.

Other economists have proposed the use of lower rates of discounting for calculating the costs and benefits of future actions in as much as they affect the public at large, rather than any one particular individual (eg Baumol, 1968), but in the author's opinion the use of any standard discount rate is inappropriate (Helliwell, 1977). Actions with a low degree of risk in their outcome should be discounted at a lower rate than more risky actions, and some operations, such as growing timber on reasonably fertile soils, should be discounted at rates of about 1% or less, and some, such as conserving wildlife or stocks of fossil fuels, should be discounted at rates approaching zero. In fact, Price (1973) has suggested that

it may be realistic to use zero or even negative discount rates in some instances, but this implies that the capitalised value of a stream of benefits in such a case will be infinite, which does not seem realistic.

Using fairly low discount rates, as proposed, the situation shown in Table 1 emerges:

Table 1
SOME HYPOTHETICAL CAPITALISED VALUES OF VARIOUS RESOURCES USING DIFFERING DISCOUNT RATES

	Estimated annual returns (Market values or 'shadow prices', as appropriate)	Capitalised value using standard 10% discount rate	Appropriate discount rate	Capitalised value using appropriate discount rate
Timber	£3000	£30000	1.0%	£300000
Ice-cream kiosk	£1000	£10000	5.0%	£20000
Wildlife conservation	£500	£5000	0.2%	£250000
Genetic reserve	£50	£500	0.2%	£25000

Using current methods of calculation, the importance of timber production appears to be twice as great as everything else combined, both in the short term and the long term, but, using the suggested alternative approach, it is placed on a more or less equal footing with the other benefits, in the long term.

TIMBER AS A RENEWABLE RESOURCE

Timber is one of our most important renewable resources, and its production is, on the whole, non-polluting and not very energy-intensive. Trends towards whole-tree logging, and the use of shorter rotations and more fertilizers may change this, but it is expected that these trends will be halted or reversed at some fairly early stage, due to the increasing shortage of cheap sources of energy.

The growing of timber as carried out in Scandinavia some 20 years ago typified many aspects of timber production using a low input of energy, and being capable of continual production indefinitely. Trees were felled by hand-saw, trimmed by axe, and de-barked on the spot with a barking spade. The logs were then left for several months, by which time they had lost some of their moisture and were easier to transport, by horse, winch, or light tractor. Most of the branches and bark, which contain about 75% of the nutrients in the tree (Rennie,

1956) were left on site, and the stands were open enough and contained a sufficient mixture of broadleaved trees to prevent undue detriment to the soil, the flora, or the fauna (Helliwell, in preparation). The forest was also fairly natural in appearance and was easy and pleasant to walk in.

The coming of the chain-saw did little to alter this situation, but the recent advent of the 'feller-buncher', clearing a hundred hectares or so at a time, and the large increase in aerial applications of fertilizer are changing the situation in as yet unpredictable ways.

However, some form of forestry is likely to be regarded as profitable (if appropriate discount rates are used) under any foreseeable energy/resource situation, giving Man a steady supply of raw materials and easing the pressure on other, more damaging, methods of obtaining the necessities of life.

AMENITY AND RECREATION

Forestry has a considerable potential for recreational use, being capable of absorbing large numbers of people without the area appearing to be crowded. Caravans, tents, chalets, etc. can be hidden from view, and any which are visible will be less obtrusive if they are in a forest setting than on a bare hillside.

Amenity is a slightly different question. Many people prefer open hillsides to dense forest, and it is likely that, in the long term, a mixture of open land and afforested land will be preferred (Dürk, 1965); although sudden change may be resented, if afforestation proceeds too rapidly, for example. Much has been written, and more will be written, about the size and shape of plantations, size and shape of felling coupes, location of rides, mixtures of species, silvicultural systems, etc. However, it should be sufficient to say that, for greatest amenity value, the forest should not disrupt the overall unity of the landscape, yet it should contain sufficient variation within it to avoid monotony, and should appear to be more 'natural' than artificial (Helliwell, in preparation-b). If these criteria are met, forestry should be able to contribute both to the quality and quantity of recreation that the uplands can provide.

WILDLIFE CONSERVATION

A mixture of forested and non-forested land in our uplands can support a wider range of wildlife than a completely non-forested landscape (Helliwell, 1971), as a large proportion of our wild plants and animals are inhabitants of forests. Appropriately managed forest can, therefore, contribute to the conservation of our wild fauna and flora.

This contribution will be enhanced if the forest is diversified within itself, and if conditions within it are relatively stable. The adoption of even-aged monocultures throughout the forest area (which is the present trend) will be less useful in this respect than would a more varied range of forest management. The

use of selection systems or group selection systems in some places could provide more stable conditions for the development of a more diverse woodland flora than is presently found in most commercially-managed timber-producing forests, and an admixture of broadleaved trees such as birch would be beneficial in this respect also (Helliwell, in preparation – a).

GENETIC RESERVES

I have no pretence of possessing any expert knowledge on the maintenance of gene pools in forest trees but it is evident that some areas of forest should be maintained for this purpose, in relative isolation from other forest areas of the same species, in order to maintain a resource of material for breeding trees which are resistant to particular pests or diseases, or for producing better yields of turpentine, timber, or other products. This is, in some respects, merely an extension of wildlife conservation in one particular direction.

The area of forest required for this particular purpose is probably less than 1% of the total forest area, and is not a major consideration in the overall picture.

SOIL FERTILITY

The question of soil fertility is a difficult one. It is known that our main coniferous species (spruces and pines) have certain effects on many soils, resulting in a tendency towards acidification of the surface horizons of the soil and a leaching of soluble material from these horizons, giving a tendency towards podzolisation. However, this effect may be less strong than under such non-forest cover as *Calluna*, and it has not been demonstrated that this podzolisation causes any reduction in the rate of growth of the pines and spruces grown on these soils (Laatsch, 1963). It does reduce the diversity of plant species in the forest (Helliwell, in preparation – a) and may make it more difficult to plant other tree species, but it is possible that the changes in the soil could be reversed by ploughing, fertilizing, or growing a species such as birch for one rotation (Dimbleby, 1962).

In general, therefore, it would be dangerous to place too much emphasis on the question of maintenance of soil fertility. On the other hand, claims by some foresters (eg Chard, 1972) that conifers 'build up' the fertility of the soil should be treated with equal or greater scepticism.

EFFECTS ON CLIMATE

In rough, hilly areas forests will add little to the general reduction in windspeed caused by the terrain, although they can supply local shelter for buildings and livestock; but in areas of less rugged terrain, forests can decrease the general windspeed as well as providing local shelter (Caborn, 1976).

The effects of forests on humidity, rainfall and temperature at a regional or global scale could also be important (Protopopov, 1975). Gay and Stewart (1974) report that a "Douglas-fir forest transformed 60% of its net radiation into latent energy as opposed to 36% for Scots pine". Such differences, or the differences between these figures and those for *Nardus* grassland or *Sphagnum* bog, could possibly affect climatic patterns if extensive areas are de-forested, forested, or planted with different species.

Nor is forestry completely neutral in the question of the concentration of CO_2 in the atmosphere, for, although during the life of a tree as much CO_2 will be produced in respiration and decay as has been used in photosynthesis, the destruction and burning of large areas of forest will release large amounts of CO_2 that would otherwise be held in the forest ecosystem. The concentration of CO_2 in the atmosphere is reported to have risen by about 15% in the last 100 years (Lewin, 1976), due mainly to the increased use of coal, oil, and natural gas. This increase represents only about half of the total estimated amount of CO_2 that has been emitted during this period (Gates, 1972). Much of the rest has been dissolved in the oceans, which currently contain about 60 times as much CO_2 as there is in the atmosphere. It is possible, however, that the oceans may become less effective as a 'sink' for CO_2 as they become more saturated.

Destruction of forests, for agricultural use, will add to any increase in CO_2 in the atmosphere, as the biomass of the agricultural system will be less than that in the forest; and, conversely, afforestation of bare land will decrease the CO_2 in most cases. Wood which is used for structural purposes, and which is not burned or allowed to rot, will also help to decrease the CO_2 level.

Increases in CO_2 are likely to increase the overall temperature of the earth's surface (although it is possible that the increase in CO_2 is the result of atmospheric warming rather than the cause). However, increased amounts of vapour trails from aeroplanes may be reflecting sunlight and causing a reduction of temperature in recent years, and as Gates (1972) says, we really do not know what is going on. It is possible, however, that the amount of forest and unburned wood in the world could be a significant factor in affecting global climate.

SUMMARY

I would stress the long-term value of forestry for timber production, wildlife conservation, and recreation; and, possibly, for influencing the climate. In the case of wildlife conservation and recreation, the distribution and type of forestry will be as important as its total extent. In all cases, calculations of costs and benefits should be carried out on a realistic basis and not on the basis of outmoded and irrelevant economic dogma.

REFERENCES

Baumol, W J (1968) On the social rate of discount. *American Economic Review,* 58, 788-802.

Caborn, J M (1976) Shelter, In: *The future of the small woodland.* Castleton: Peak District National Park Study Centre.

Chard, J S R (1972) Forestry and wildlife. *Quarterly Journal of Forestry,* 66, 113-122.

Dimbleby, G W (1962) *The development of British heathlands and their soils.* Oxford: Clarendon Press.

Dürk, P (1965) [The importance of the forest for the health of the population.] *Forst- und Holzwirt,* 20, 209-211.

Gates, D M (1972) *Man and his environment: Climate.* New York: Harper & Row.

Gay, L W & Stewart, J B (1974) *Energy balance studies in coniferous forests.* Institute of Hydrology, Report No 23. Wallingford: Institute of Hydrology.

Helliwell, D R (1971) *Changes in flora and fauna associated with the afforestation of a Scottish moor: an evaluation.* Merlewood R & D Paper No 29. Grange-over-Sands: ITE.

Helliwell, D R (1977) The end of the bank rate? *Environmental Conservation,* 4 (in press).

Helliwell, D R (in preparation – a). *Floristic diversity in some central Swedish forests.*

Helliwell, D R (in preparation – b). *Perception of landscapes: a preliminary investigation.*

H M Treasury (1972) *Forestry in Great Britain: an inter-departmental cost/benefit study.* London: HMSO.

Laatsch, W (1963) [Soil fertility and the planting of conifers.] Verlagsqesellschaft: Munich.

Lewin, R (1976) Why the Yule logs must not burn. *New Scientist,* 72, 750-751.

Price, C (1973) To the future: with indifference or concern? The social discount rate and its implications in land use. *Journal of Agricultural Economics,* 24, 393-397.

Protopopov, V V (1975) [The role of dark-coniferous forest in the formation of the environment.] Institut Lesa i Drevesing, Novosibirsk.

Rennie, P J (1956) The uptake of nutrients by mature forest growth. *Plant and Soil,* 7, 49-95.