Geo Factsheet

Number 40

Multipurpose Forestry

Forests cover 30% of the planet, providing valuable habitats and play an essential role in maintaining atmospheric composition and climatic and nutrient cycles. Increasing human populations are threatening all of the remaining natural forests of the planet. In both the developed and developing world, relatively little natural woodland remains and what is left is under great pressure to accommodate many demands. This Factsheet will consider how forests can be managed to accommodate such demands.

Table 1. Roles of the world's forests

Role	Explanation
Atmospheric Regulation	Through photosynthesis, trees absorb CO_2 and act as a carbon sink. Thus, afforestation can potentially reduce the enhanced greenhouse effect.
Regulation of hydrological cycle	Large forested areas release thousands of gallons of water daily through transpiration. This may increase humidity sufficiently to generate rain, giving rise to so-called rainforests. By intercepting, storing and slowing down rainfall, forests reduce the incidence of flooding.
Habitat	Forests provide an irreplaceable habitat to an estimated 1m species of animal. Species diversity is greatest in the tropical rainforest which only covers 6% of the earth's surface but contains over 50% of all animal and plant species in the world.
Soil conservation	Trees reduce soil erosion through interception, reduction in impact velocity, root binding and through the addition of organic matter.
Microclimate	Trees reduce windspeed and decrease the soil moisture and temperature variability.
Forest products	In both developed and developing countries, forest products are essential for day to day life eg. construction timber, furniture, board and paper.
Recreation and amenity	Particularly in the developed world, forests provide an important escape from urban life. As retirement age falls and holidays increase, this role will become more important.

Forests and Development

In developing countries, forests are an essential source of many renewable products which, in turn, can provide the basis for the development of many other industries.

Traditionally, developing countries have exported raw materials such as unsawn logs to western Europe, only to end up buying back the expensive products. Since the mid-1970s, most exporting countries have developed their own processing industries and are increasingly exporting much more valuable products. Exploitation by developing countries such as **Brazil** and **Thailand** of their tropical forests has been criticised by western governments and pressure groups, particularly in view of the crucial role of these forests in influencing global climate and because of their importance as a source of potentially valuable genes. In response, such countries have argued that in making such criticisms, western countries are being hypocritical; we have little of our own native woodland left, and in the case of the UK, it was the exploitation of our natural woodlands that initially fuelled the industrial revolution. In other words, we developed by exploiting our forests and those countries which are developing now should be free to do the same. Furthermore, it is argued, the revenue from such exploitation will "**trickle down**" or create a multiplier effect within the economy of the developing country, helping to raise the standard of living of all.

Recently, ecologists and economists have begun to try to assess the monetary value of what are known as intangibles. How much, for example, is the hydrological role of a forest really worth? By using computer-generated models of the soil erosion, siltation and flooding which results from deforestation, and by assessing the costs of repairing subsequent damage, the revenue lost from crops etc. which can never be grown again on the eroded, infertile lands, the true value of forests has been calculated. Once this has been done, it is hoped that the global value of such forests will encourage the governments of developed countries to pay the developing countries not to destroy their resources. This has already begun in the form of Debt for Nature swaps.

Forestry in the UK

Forests once covered 80% of the UK but now cover only 10% - a consequence of clearance for agriculture, fuel, construction and urbanisation. The purpose of forest management in the UK has also dramatically changed over the last 80 years.

1900-1945 Strategic role - Forests acted as a strategic reserve, supplying wood essential for coal mining which, in turn, was essential for production of weapons and transport. The Forestry Commission was established in 1919, as a direct consequence of the lessons learned during World War I. The development of nuclear weapons led to a decline in the importance of this strategic function.

1945-1980 Timber production - As the economy grew, demand for paper and all forms of packaging grew, so too did demand for construction timber and for pallets, fencing material, furniture and tools. The employment potential of forestry was also regarded as important, particularly in upland, rural areas eg. the Scottish Highlands where few other employment opportunities existed. Home-grown material, it was also argued, led to significant import savings.

1980 - Recreation, conservation and timber production - The harmful environmental effects of monoculture plantations of coniferous species, planted close together in straight lines, with heavy fertiliser and pesticide application, became apparent. Increasing pressure on the countryside to provide recreational opportunities and the increasing importance of conservation objectives led to the development of the National Forest, covering almost 200 square miles of derelict mining areas of Leicestershire, Derbyshire and Staffordshire. New coniferous afforestation has been dramatically decreased and re-introduction of native deciduous species beneath conifers has increased. The objectives of timber production, conservation and recreation are now often given equal importance.

Multipurpose Forests in the UK

Private forest companies manage forests with one objective in mind - to maximise timber production, hence profit. The government agency with responsibility for UK forests - the Forest Authority - have to manage forests with a broader range of objectives in mind. Besides timber production, forests must provide opportunities for recreation, conservation and amenity. Essentially, these objectives can be achieved in two ways:

1. By managing individual forests for one objective. For example, one forest would be managed for timber production whilst another forest would be managed purely for conservation.
2. Several objectives can be achieved in any individual forest. That is, the individual forest can be the focus for **multipurpose management**.

The second strategy is much more difficult than the first! However, this has always been the traditional form of forest management in many other European countries, notably Germany and France, and this is the way in which UK forests are increasingly being managed. Attempting to manage an individual forest to achieve timber production, conservation and recreation objectives all at the same time leads to conflict which means that none of these individual objectives can be **maximised**. Instead, foresters aim to **optimise** several objectives. The conflicts which this causes are summarised in Table 2.

It is clear that, if a forest is managed for timber production, conservation and recreation, then open areas, the use of less productive species, less dense planting patterns etc. will mean that timber production is reduced, in comparison to a forest managed solely for this objective. Thus, trying to acheive all three objectives in one forest comes at a cost - this is known as the **opportunity cost.**

Table 2 - Conflicts in Forest Management

	Primary reason for forest management		
	Timber production	**Nature conservation**	**Recreation**
Tree species	Exotic conifer because they have faster growth rate than native broadleaves	Native broadleaves because they have the highest associated numbers of insect and bird species	Mixed to provide varied and interesting landscpe
Tree age	All trees are of the same age to make forest operations easier and allow all trees to be harvested at the same time	Mixed to allow for variety of habitats	Mixed to provide diversity
Planting density	Dense to allow for rapid canopy enclosure - reducing light to forest floor, thus reducing branch growth and incidence of knots which weaken/reduce the value of timber	Mixed - some dense areas, some completely open to allow development of ground flora	Mixed - some dense areas to give sense of privacy but some completely open to allow development of ground flora
Planting pattern	Straight lines for easier planting, thinning, weeding, fertilising and felling	Varied, to increase number of niches	Varied to create a more scenic and natural atmosphere
Open areas?	No, will reduce production and allow weed growth because of extra light	Yes, to increase number of niches and to provide, for example, feeding areas for deer	Yes - for facilities such as picnic areas. More paths, orienteering routes etc.
Fencing around or within woodland	Yes, to stop deer and visitors	No - although valuable areas may be fenced to protect disturbance	No
Weeding carried out? If so, how?	Yes, to reduce competition for light, nutrients, etc. herbicides	Yes, to encourage more valuable species; by hand or machine	Yes, to keep pathways etc. clear
Dead trees left?	No - dead trees act as a source of pathogens	Yes - provides habitat for birds and insects, a source of food for saprophytes	No - safety considerations
Fertilisers used?	Yes - if economically viable	No	No
Will the woodland be thinned?	If thinnings can be sold	Yes - to increase niches. Coppicing, where trees are cut just above ground level to produce sprouting stumps, provides a very rich habitat	Possibly - Visitors may be attracted to a working forest
Timing of operations, eg. thinning	Economic considerations - demand, availability of labour etc.	Ecological considerations - avoid nesting times	Safety considerations
Interpretation facilities?	No	Possibly	Yes - eg. orienteering guides, bird watching guides etc.

Multipurpose Forestry in the Tropics

The tropical rain forests have developed over millions of years and this is the reason that they are now so biologically diverse and valuable. Once rain forests have been felled, re-growth may quickly follow but species number, diversity and ecological complexity will never be regained in any timescale practical to humans. However, tropical forests are under ever-increasing pressure from growing native populations who need agricultural land as well as from timber companies, trans-nationals and the governments of these countries. One of the aims of multi-purpose tropical forest management is to satisfy the needs of these very different groups.

1. Plantations

Plantation forestry is attractive because:

(i) Plantations can be established on land which is unsuitable for agriculture;

(ii) By growing the high-value species such as teak, mahogany, rosewood etc., which western countries demand, in plantations, the effect on virgin rain forest is reduced;

(iii) Plantations of one species can be extremely productive. For example, Pinus Patula plantations in Swaziland yield 19m^3 ha^{-1} yr^{-1} (compared, eg. oak in the UK which on average yields 6m^3 ha^{-1} yr^{-1});

(iv) Initial tree spacing and thinning regimes can easily be manipulated to optimise the range of products - stems, poles, branchwood, fodder etc.

(v) Plantations rapidly create local employment;

(vi) By afforesting land, environmental problems such as soil erosion etc. are reduced.

However, the advantages of tropical plantations have been such that significant areas of natural forest have been cleared to make way for them. Destruction of such biologically, ecologically, hydrologically and economically valuable forests is hard to justify and, as many have argued, some of the other potential advantages, such as the creation of employment and the environmental benefits of reduced soil erosion are temporary - once the plantation is harvested, jobs, soil and fertility disappear. The long-term productivity of such plantations is usually dependent on continuing inputs of expensive and often imported fertilisers which, in any case, are based upon finite fossil fuels. Thus, plantation forests are regarded by many as a useful means of satisfying domestic and export demand for a narrow range of high-value products. They do not, however, represent a sustainable form of multi-purpose management.

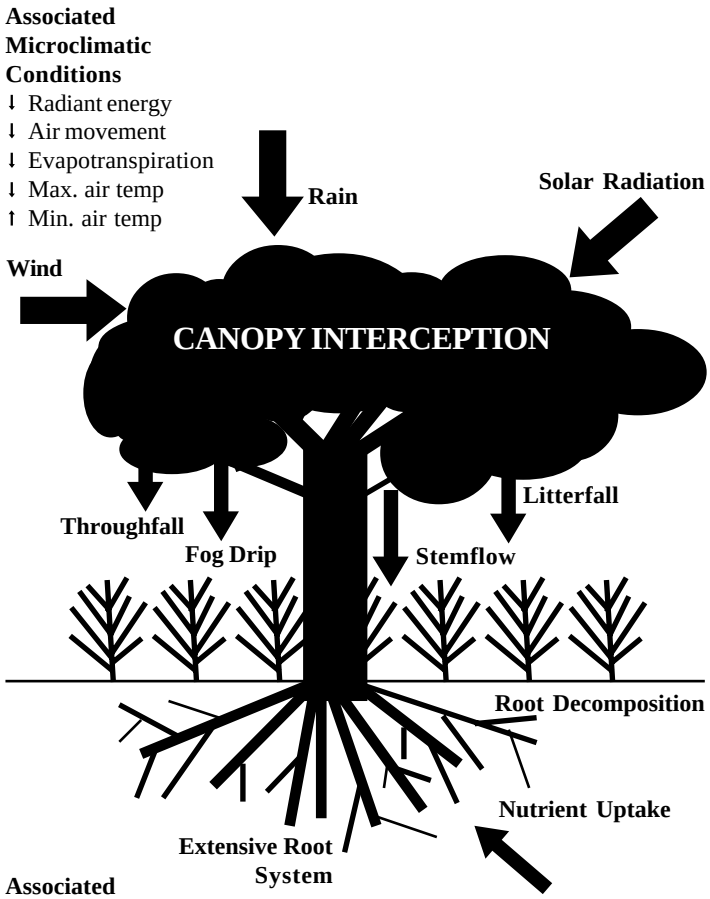
2. Agroforestry

The term agroforestry covers a huge range of land-use management systems in which trees are combined spatially and/or temporally with agricultural crops and/or animals. The underlying aim is to exploit the interactions between tree crops and animals in a sustainable and highly productive way.

It is perceived as a potentially practical solution to the problem of small peasant farmers who possess or have access to insufficient land to be able to devote whole areas to one particular objective. Agroforestry takes many different forms. In India, crops such as black pepper, cocao, and pineapple are grown under coconut. The trees and crops exploit different regions of the soil and the micro-climatic effects of the trees provide suitable conditions for the growth of the crops.

In Brazil, industrial tree crops such as rubber, oil palm and brazil nut have been successfully underplanted with grasses and leguminous forage crops which then allow rearing of chickens and pigs. The legumes and faeces of the animals increase the nitrogen content of the soil and the trees - valuable crops in their own right - provide shade, fodder, small branchwood and recycle more deeply held nutrients. The common characteristic of all agroforestery systems is the invaluable microclimatological influence of the trees (Fig 1).

Fig 1. The influence of trees in Tlaxcala, Mexico, on the growing environment of maize



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