FOREST PLANTATIONS

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Keywords: Forest plantations, plantation forestry, planted forests, silviculture, sustainability, monoculture

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Summary

Forest plantations are an increasingly important forest resource worldwide. In some countries (Australia, New Zealand, Chile) they already provide the bulk of wood products. By 2050 the total area of plantations is expected to exceed 200 million hectares, and owing to their generally higher productivity than natural forest, for plantations to become the main source of wood products globally. Future demand for

wood will increasingly be met from forest plantations, so helping to alleviate pressure on remaining natural forests. Successful forest plantations require species well matched with sites, improvement of genetic stock, control of competing vegetation, and attention to thinning and related operations that enhance tree quality and stand growth. Plantations are more at risk from pests and diseases than natural forest formations, but experience so far shows that with adequate monitoring and with underpinning of biological research such risks do not make plantation forestry unsustainable. Long-term monitoring of productivity over successive rotations suggests that plantation practices are sustainable provided that due attention is given to conserving organic matter and avoiding damage to sites.

1. Definition

Forest plantations embrace a range of forest types with the one common feature that the great majority of the trees present were established on the site by planting and/or seeding (sowing). This almost banal statement belies the fact that when mature, many planted forests do not look very different from natural forest formations. While a geometrically shaped forest monoculture of a non-native species is plainly an artificial plantation, many old and famous forests in Europe appear natural and reveal few signs of their planted origin. Examples include the New Forest (UK), parts of the Black Forest (Germany), parts of the Forèt de Compiégne (France) and almost all the forests of Denmark.

There is no internationally agreed definition of forest plantations, although the expression “planted forest” is now widely used to embrace the continuum of forest types where forest origin is known to be by planting. The *International Experts Meeting on The Role of Planted Forests in Sustainable Forest Management* in Chile in 1999 (CONAF 1999) recommended that the question of definition be considered by the UN Food and Agriculture Organization (FAO), the principal body responsible for forestry, since the boundary between planted and natural forests is often indistinct, and among countries there are different degrees of management and different objectives for planted forests.

For the purposes of this article forest plantations are taken to be those planted forests by origin which still possess features of uniformity, shape, and often intensity of management, which readily distinguish them as artificial. Often, although not always, they will have been established on land devoid of tree cover, at least in the previous 50 years.

2. History

Planting trees has a long history, certainly as far back as ancient civilizations, as references in the Old Testament portion of the Bible indicate. But planting trees as a way of regenerating forests used, for example, for wood production, and as a way of afforesting bare land is relatively recent. Early references to planting in Britain date from the sixteenth century, and the practice, albeit still on a limited scale, only became commonplace across Europe by the eighteenth century. The nineteenth century saw plantation establishment as one means of “modern” organized forestry, and it became

fashionable in Germany as an efficient way of growing a uniform crop of trees; also in this century, the first concerns were voiced about plantation monoculture causing damage to the soil, or being susceptible to pests and diseases. The twentieth century saw major plantation establishment, initially in temperate and Mediterranean climatic regions, and since the 1950s to an ever-increasing extent, in the tropics and subtropics.

Tree introductions have facilitated plantation development, and many of the successful plantations of the last 150 years were built on experience gained from arboreta and trials of exotic (introduced) species. Such plant collections were made by botanists and plant taxonomists gathering reproductive material, such as seeds, fruits and cuttings, for testing back in their home countries. Both in temperate and tropical environments, this approach yielded many exotic species that have proved amongst the most successful of all plantation species, outstanding examples of which are conifers from the Pacific Northwest of America into Western Europe, *Pinus radiata* from California into Southern Hemisphere countries such as Australia, Chile, New Zealand and South Africa, teak (*Tectona grandis*) from India, Myanmar and Thailand into many tropical countries, and several Australian eucalypts and acacias in the tropics and subtropics. Together, these trees form many millions of hectares of productive forest plantations far from their natural habitats.

At the beginning of the twenty-first century, forest plantations of all types probably amount to some 187 million hectares or about 5% of all forest cover in the world. However, they account for an estimated at 22% of raw material supply. Exact figures are uncertain owing to variable standards between countries in recording forest plantation statistics, and dispute over what is defined as a plantation. Some countries, notably in Europe, have extensive areas of "planted forests," but which look, and are treated as, natural, and for political reasons—or to be charitable because of disagreement about definitions—are not reported as areas of forest plantations.

3. Future Developments

There is already a substantial resource of plantation forest, and current establishment of new plantations at the annual rate of 4.5 million hectares will soon bring a time when such forest will become the main source of wood products. This is predicted to occur in 30 to 50 years time if current rates of planting continue, and possibly a little sooner if massive afforestation arises from carbon sequestration initiatives (see Section 4.6). A total forest plantation resource of 250–300 million hectares would satisfy most of world wood requirements for the foreseeable future.

An increasing area of planted forest is only one anticipated development. The nature of forest plantations is also likely to shift in balance (a) from domination by exotic species to greater emphasis on native ones, although exotics will always play an important role, (b) from a largely industrial focus to a wider perspective including industrial, rural development, and environmental roles, and (c) from a single-use to a multiple-use forest. Other trends are increasing involvement of smallholder investors, and increasing privatization of forest plantation ownership.

4. Types of Plantations

4.1 Industrial Plantations

Industrial plantations are the "arable" crops of forestry; their principal objective is to grow a product, usually wood fiber, efficiently. The main purposes include fuel production—firewood and charcoal, pulpwood for paper and cardboard, panel products, sawn timber (lumber or sawnwood), and sometimes veneers. Commonly one plantation supplies several of these products in the course of a rotation. Of course there will always be other products, whether as other roundwood products such as posts and poles, or non-wood forest products, and benefits such as amenity or even biodiversity enhancement, where a plantation has been established on an impoverished site. But the dominant objective is to grow a commercial product.

Figure 1. Large pine plantation in Swaziland in southern Africa for growing pulpwood for making brown paper. So far three successive crops have been harvested without any loss in productivity (reproduced with permission © J. Evans)

As a generalization, industrial plantations have only been moderately successful in growing high-grade cabinet timbers owing to the long rotations required in temperate countries, and the difficulties in the tropics of growing mahoganies and related species of Meliaceae in plantations because of shoot borers, or the silvicultural complexity of domesticating dipterocarps, merantis and rosewoods. One important exception is teak, which can be grown easily in plantations throughout the tropics.

Some industrial plantations of trees are grown for non-wood forest products (NWFPs, also termed non-timber forest products, NTFPs) used in naval stores, gums and resins. Although exceeding 9 million hectares in extent, rubber plantations (*Hevea brasiliensis*) have not generally been considered as plantation forestry since their main product is rubber latex. Such plantations are increasingly being exploited for their wood, particularly in Malaysia, Indonesia, Thailand, and Vietnam) where markets have been developed for light furniture and panel products.

Industrial purpose dominates management in terms of species choice (usually only one), stocking density, thinning prescriptions, rotation length to maximize financial returns or

grow crops to a particular market specification, and clear-cutting silvicultural systems for efficiency of harvest.

4.2 Social and Community Plantations and Woodlots

Planting trees is one way of compensating for loss of natural forests as a means of providing domestic products such as building poles, fencing materials, firewood and even leaves for livestock fodder. It was widely promoted in the 1970s and 1980s in countries of the African Sahel, in India, and elsewhere in usually the drier tropics, but was not always successful. Sometimes choice of species was poor, sometimes tenure and ownership of land, or even the planted trees, were unclear, but commonly the problems lay in a failure to involve the local community or village adequately in the decision-making process. Woodlots were foisted on communities rather than being their initiatives to help in local wood supply.

Tree planting for social and community needs are now embraced as part of rural development forestry, and are subject to participatory processes to place them firmly in local people's control. In India, these are sometimes termed as "Communities of Protection," in the Philippines they are termed community based forest management (CBFM), while in Ethiopia many planting projects begun as food-for-work initiatives during the 1980s famine have become a village resource. Collectively these kinds of plantation projects often form part of joint forest management (JFM) initiatives.

Figure 2. Community forestry project where 800 ha of trees were planted along the west bank of Bilate River in southern Ethiopia to prevent soil erosion and provide building poles, animal fodder and firewood for local people (reproduced with permission © J. Evans)

Social, smallholder and community plantations possess many of the same features as industrial crops, they are often but not exclusively, single species, and they tend to be block plantings, although size may be as little as 0.01 ha. As well as supplying one or more products, they may confer benefits of shade and shelter, amenity and even soil erosion control.

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Biographical Sketch

Julian Evans in Professor of Tropical Forestry at Imperial College of London University and was formerly Chief Research Officer (S) of the British Forestry Commission's Research Station at Alice Holt Lodge. He holds B.Sc., Ph.D. and D.Sc. degrees from the University of Wales, Bangor, is a Fellow of the Institute of Chartered Foresters (FICFor), Chairman of the Commonwealth Forestry Association (CFA), and Country Vice-President for the UK for the International Society of Tropical Foresters (ISTF). He has authored more than 120 scientific and technical papers and seven books on tropical and temperate forestry. He was appointed OBE in 1997, for services to forestry and the third world, by Her Majesty the Queen.