Plantation forests protect our biodiversity? - too much of a generalisation to be true!

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There has long been controversy about the impacts of plantation forestry on the environment and on wildlife. This debate has been taking place in Europe for several decades. More recently, the 1992 Convention on Biological Diversity has promoted discussion about plantation forestry and biological diversity.

In the literature, there are indications of a growing misunderstanding of issues concerning biological diversity. One issue is about the nature of biological diversity. The other is about the impacts of forestry on wildlife and on wildlife habitats.

In this brief comment I explore what is meant by biologists when they use the term biological diversity and tackle some of the comments made by Wink Sutton (November issue). I then go on to assess the role of plantation forestry on biological diversity. Finally, I would like to give my own view on the implications of forestry in New Zealand and try to broaden some of the previous discussions which seem to overlook multi-use forestry (see for example Hugh Bigsby's article in the November issue).

Biodiversity: what is it?
Biological diversity (abbreviated as biodiversity) has become a widely-used term since it was first used in 1980. It is now in the scientific literature, in popular press and in policy documents. The popularisation of the term is creating differences in its use and its meaning. Biodiversity is commonly equated with meaning species, richness of species or the variety of species. The focus on species was not the intention of those who first promoted the term. Sometimes biodiversity is said to be the variety of life. That doesn't help us much either. The 1992 Convention (Article 2) provides the following:

"Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

Biologists have interpreted this to mean variety at all biological levels, variety of interactions between different biological levels of organisation and variety of ecological processes. There is, therefore, biological variety or diversity at the following levels: genetic, population, species, biological community, ecosystem. In nature, organisms, populations and species interact and therefore there is a variety of kinds of interactions (pollinator and plant, parasite and host). There is also a variety of processes including ecological succession, water cycles, energy cycles, and carbon cycles.

When we use the term biodiversity, we should qualify its use with a level of biological organisation: genetic, population, species level, and so on. Biodiversity includes diversity at the species level (whether they are 'wanted' or 'unwanted' species) but it is not just all about the species of plants and animals in our total living environment (there are other kinds of organisms than plants and animals).

Biodiversity: why use the term?
Previously, the terms nature and wildlife (wildlife meaning all kinds of plants, animals and other organisms in the wild) were widely used, and now use of the new term biodiversity seems to have caused some confusion. The reason why biodiversity was introduced in 1980 (in the sense it is used today) was to draw attention to the need to extend conservation beyond species. Conservation projects had previously focused on species (for example the Panda and the orchid), then later focused on habitats. This was because of the growing rates of species extinctions and growing rate of loss and fragmentation of habitats. However, for species to survive, there must be variety with species at the population level and genetic level.

In 1980 the World Conservation Strategy (IUCN, 1980) and later in 1987 the Brundtland report (Our Common Future) drew the world's attention to the importance of using nature and wildlife in a sustainable manner (WCED, 1987). No longer was it just about conserving species and habitats. There was a clear recognition of the role of nature's variety; genetic diversity for developing new breeds and cultivars; species diversity to act as an indicator of environmental 'health' or 'quality'; diversity among biological communities to buffer against natural disasters such as floods and erosion. It is the variety or the diversity at all levels and amongst all interactions and processes which sustains our standards of living.

Biodiversity: what's happening to it?
There are both gains and losses in biodiversity, but overall the gains are far less than the losses. This applies at all levels of biological diversity. Wink Sutton commented on the loss of smallpox, noting the apparent lack of concern. At the species level, the rate of extinction puts the elimination of smallpox into context; its loss pales far into insignificance when we consider that most species becoming extinct.

The Impact of forestry on the landscape. Should visual aspects be considered? Banks Peninsula, Canterbury. Photo: I. Spellerberg

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have not been studied.

Using and controlling nature's variety
As suggested by Wink Sutton, it is true that we depend on few species for food. Why is that? There are at least three reasons. One is because we depend on biodiversity for food at the genetic level, not at the species level. We have developed a huge variety of cultivars and breeds from a few species. The second reason is that we don't know what other species might prove useful because those species have not been studied. At the species level of biodiversity there are about 1.7 million named species (many more not named). The Brundtland report (WCED, 1987) tells us that scientists have investigated only one per cent of the earth's plant species and even fewer animal species.

Thirdly, we don't have the taxonomic expertise. There is a scarcity of taxonomic expertise and most taxonomists have an expertise appropriate only for the more common taxonomic groups. While we currently rely on a few species, a huge number of varieties and species are becoming extinct. We are selective in terms of species but not in terms of diversity at the genetic level.

Our success in increasing productivity from agricultural and forest plantations has been due to many things, including: 1, simplification of ecosystems; 2, reduction in some levels of biological diversity; 3, adding nutrients and water. We have developed a variety of methods for dealings with pests and pathogens. Chemicals have been widely used since World War II, and the success of these can be measured in terms of increased production in agricultural and forest plantation ecosystems. Without these added nutrients and chemicals it would not be possible to have such simple ecosystems.

There have been huge advances in food production but we are not adequately feeding the earth's massive world population, as suggested by Wink Sutton. There are widespread problems of equity throughout the world; famine and undernourishment is widespread. The energy costs of intensive agriculture should not be ignored, and so also should not the area of agricultural land now abandoned because of damage to the soil structure.

Intensive agriculture and intensive forestry have long-term environmental and biological costs. Long-term studies on the effect of pesticides on ecosystems, let alone long-term effects on non-target organisms, are few. In the World Conservation Strategy (IUCN 1980) there is a graph showing the rate of increase in the numbers of pest species now resistant to insecticides. The growing resistance of pests and pathogens to chemicals and drugs is becoming very worrying. It is perhaps not surprising that there has been growing interest in agriculture that is less based on chemicals, high energy inputs and simplified ecosystems. Will the same happen with intensive or high-yield forestry?

Forest plantations and biological diversity
There are many costs and benefits with plantation forests (Table 1). With specific reference to biodiversity, there are also costs and benefits. But that is a generalisation, and to be objective we should consider the following:

(i) location of the plantation
(ii) size and management of the plantation
(iii) the surrounding landuse and pressures on landuse.

The perceived impacts of plantation forestry have attracted criticism partly because of some planting on areas of biological importance and because of the visual effects on landscapes. In the UK, large areas of lowland heaths and upland moors have been destroyed along with the unique biological communities. Adjacent areas are affected by colonising trees from the plantations. The lesson to be learnt is not to locate the plantation in or near an area of biological interest and certainly not in an area of cultural, archaeological, geological or landscape interest.

Reducing the visual impacts of plantations on the landscape has become a well researched area in UK forestry. By way of contrast, there are many examples in New Zealand where the boundary is kept well away from the wetland – the plantation for timber, but the plantation and wetland have many uses. Photo: I. Spellerberg

Recognition of wetland values. Forest plantation in England where the boundary is kept well away from the wetland – the plantation for timber, but the plantation and wetland have many uses. Photo: I. Spellerberg

Forest plantation edges can be modified to improve wildlife habitats. An example from Dorset in England. Photo: I. Spellerberg

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Zealand where forest plantations have affected the visual qualities of the landscape. In New Zealand we have much to learn about forest landscaping.

Perhaps the most common criticism has been about forest plantations as being ‘biological deserts’. In a detailed review (Spellerberg and Sawyer, 1993) of this subject, it became evident that this is a generalisation. Plantation forests may reduce species numbers of some taxonomic groups and may equally increase species of other taxonomic groups.

The area of the plantation and the diversity of operations within forest complexes must also be considered when assessing the impacts of forest plantations on wildlife. Small, even-aged monocultures may well have low levels of woodland bird, plant and insect species. By way of comparison, large forest plantation operations can be structurally diverse because of different aged stands and other features. The different scales will alter the impacts of the plantation on wildlife and biological communities.

Forest plantation operations should be put into context with surrounding land use. In the UK the pressure on land is far greater than in New Zealand (contrasting human population densities). That is one of the reasons why the UK and other European countries are now supporting multi-use forestry. The European forestry industry must consider recreational values and levels of biological diversity in its production forests. There are many well-researched methods for increasing levels of wildlife in forest plantations (Spellerberg and Sawyer 1993).

Do plantation forests protect our biodiversity?
My response to this question is that it can’t be answered in a useful manner because the question is too much of a generalisation. Let’s start again: there are many issues surrounding high-yield forestry (Table 1) and certainly more than suggested by Hugh Bigsby’s article. Forest plantations may affect wildlife adversely, but that depends on the location, the surrounding land use, the scale and management of the operation. Plantation forestry in New Zealand could contribute to conservation of some of our biodiversity if we had a multi-use approach. I suspect that there could be very exciting opportunities for us if we look to the rest of the world.

Conclusions
Discussions about the impacts of forest plantations on biological diversity have become muddled and the meaning of biological diversity has become so popularised as to be removed from the biological meaning.

Biological diversity is variety at different levels of biological organisation and means more than just variety of species. We should always qualify the term with a level of biological diversity.

The impacts of forest plantations on biological communities, species and populations will vary, depending on the location, size and surrounding land use. New Zealand’s forestry could contribute to conservation of our wildlife if we were to look abroad at lessons learnt elsewhere.

Table 1
Plantation forests and the environment (landscape, ecosystems, biological communities and species); some costs and benefits

| 1.  | Plantation forestry may help reduce the demand on New Zealand native forests and could slow the rate of native forest use for commercial timber production. |
| 2.  | Plantations managed for high yield may be four to ten times more productive than native forests. |
| 3.  | There are greater contributions to domestic needs because not all products from native forests are marketable. |
| 4.  | The management deals with few tree species (plantations) and not a variety of species and interactions (native forests) about which little is known. |
| 5.  | More native forests could be retained for watersheds and conservation. |
| 6.  | Fast-growing forests have implications for the carbon cycle. |
| 7.  | Plantation forests may have greater economic returns than some present land uses. |
| 8.  | New Zealand plantation forestry could help to reduce loss of native forests in other countries. |
| 9.  | The short-term and long-term physical and chemical impacts of forest plantations and forestry practices on the environment (and environmental processes) are many and varied. |
| 10. | There are visual impacts on the landscape. |
| 11. | The effects on biological communities are many; some detrimental and some beneficial. |
| 12. | Plantations are difficult to confine because of the spread of seeds. |
| 13. | There are many different kinds of plantation forestry (not all using exotic species) and underlying forestry practices yet to be tried in New Zealand. |

References