ARTICLES

# Multiple-use, biological diversity and standards

**Ian F. Spellerberg[1] and John W.D. Sawyer[2]**

## ABSTRACT

*New Zealand's conifer plantations are multi-use. However, there appear to be few requirements or incentives in New Zealand (self-imposed or otherwise) for the forestry profession to provide for amenity, to consider landscaping issues or to restore or maintain biodiversity in their management of conifer plantations or to consider such objectives in their management decisions. Some methods for increasing levels of biodiversity in conifer plantations are given that have been derived from a report prepared for the Forestry Commission (UK) (see Spellerberg & Sawyer 1993). It is suggested that standards (levels of quality) be established for biodiversity in conifer plantation management at all spatial scales. Examples of possible biodiversity objectives for conifer plantation managers are presented along with appropriate standards and methods or indicators that may be used to monitor the effectiveness of management to achieve these objectives.*

## INTRODUCTION

The appearance of the New Zealand landscape has changed greatly over the last few centuries. One of the most recent transformations, that is continuing today, is reforestation and afforestation using even-aged, single-species stands of conifers. Although conifer plantations are established to produce timber, it is important also that biodiversity (the variety of life and the processes that sustain that variety) be a focus for attention when reforestation and afforestation is undertaken. Recent developments in the United Kingdom and North America have concentrated on the idea of multi-use forests whereby conifer plantations are managed for both timber **and** other benefits. The question is asked: "Will New Zealand Forestry follow examples in the northern hemisphere, in particular North America and the United Kingdom, where there is multi-use forestry and there are requirements for amenity, landscaping and biodiversity?"

## MULTIPLE-USE

Conifer plantations have been an important resource for New Zealand, primarily as a valuable source of timber. However, conifer plantations provide more than just timber; they provide several valuable ecosystem services such as soil conservation, a sink for atmospheric carbon dioxide and a habitat for native wildlife. In addition, recreational use is made of conifer plantations (e.g. for walking, mountain-biking, botany etc). Furthermore, New Zealand's threatened species are not confined to the

**Forest plantation rides (roads) are important amenity and wildlife habitats and potential wildlife corridors if managed appropriately. Above is a forest ride of low value and below a managed ride for wildlife. The ride edge has been widened and planted with broadleafed species. Photos: Ian Spellerberg**

1 *Director, Centre for Resource Management, Lincoln University, P.O. Box 56, Canterbury.*
2 *Department of Conservation, Wellington Conservancy, P.O. Box 5086, Wellington.*

parks and reserves of the Department of Conservation. Conifer plantations have been known to support populations of some of these species (see for example Daniel 1981).

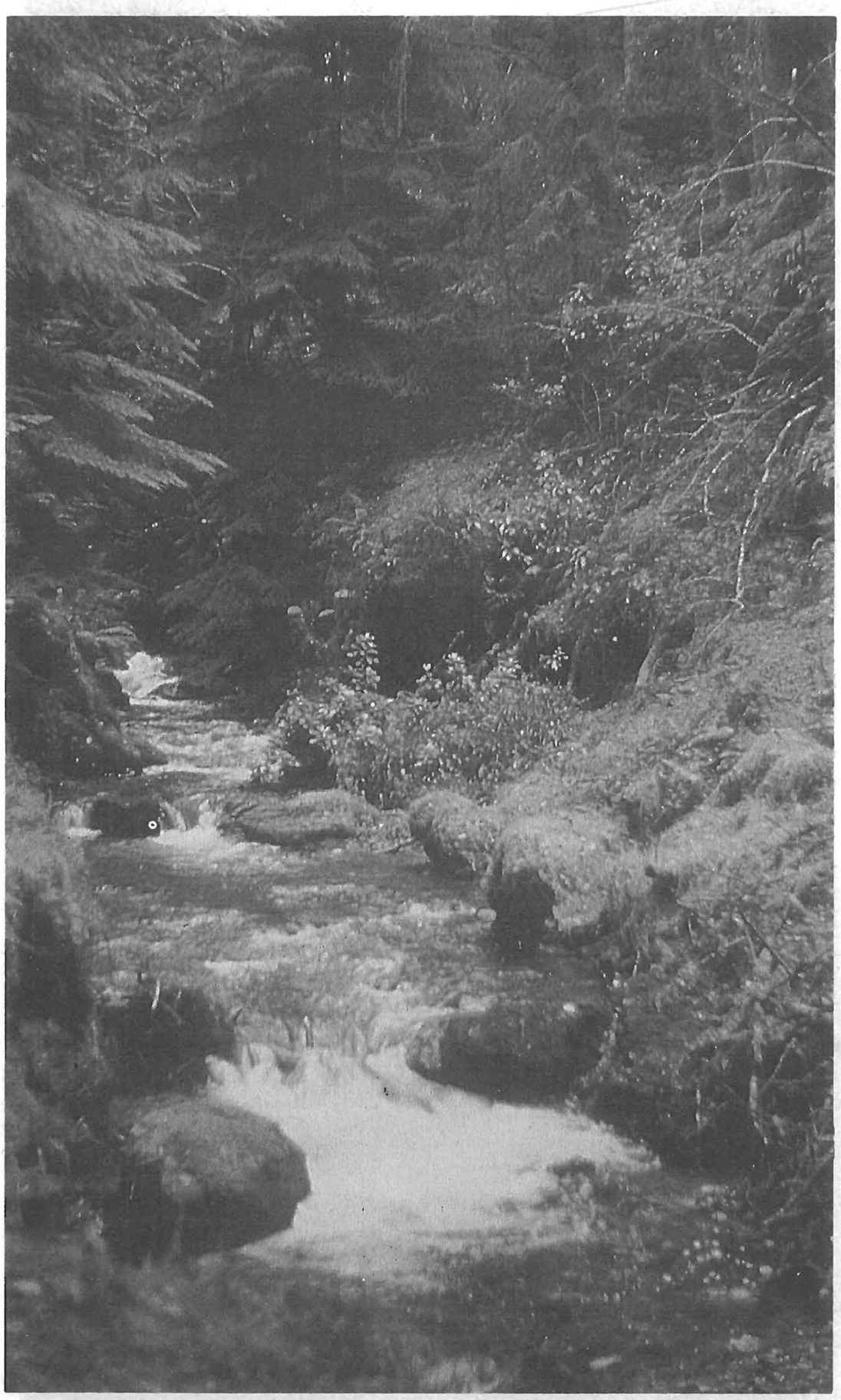
Conifer plantations are inherently multiple-use, whether they are designed to be or not. Multiple-use forestry in New Zealand is very much alive. The question is whether or not any recognition is made of other "uses" (over and above timber production) in design and/or ongoing management decision-making processes.

In New Zealand, for example, do members of the forestry profession actively seek.

* to restore or maintain biodiversity in the conifer plantations under their management;
* to provide amenity;
* to landscape so as to reduce the visual impact of their management operations and/or to landscape-design new plantations?

If they do, how are these objectives incorporated into management decisions? In some countries other forest outputs (such as amenity, landscape considerations and biodiversity) are now incorporated into forest management practices and decision-making. In fact, the conservation of biodiversity in conifer plantations has now become an integral part of forest policy in several countries, including the United Kingdom, USA and Canada.

Recently, Perley (1993) noted that in New Zealand, in addition to meeting the objective of timber production, "other forest outputs should affect our decisions". But how will this be done without realistic objectives to aim for and without establishing standards (a level of quality or excellence) for each objective? Standards already exist for the quantity and quality of timber from a given stand of trees. Not so for other uses.



**Forest stream in a plantation in Scotland. Riparian sites in forest plantations (of amenity and a biological diversity value) such as this can easily be lost by planting close to the stream. Photo: Ian Spellerberg**

## BIOLOGICAL DIVERSITY IN CONIFER PLANTATIONS

Conifer plantations may not be the "biological deserts" that many people perceive them to be. There has long been concern about the impact of these plantations on wildlife, particularly the impact of mature stands of trees with a closed canopy. However, in New Zealand, there are numerous examples of conifer plantations supporting native wildlife (Ryder 1948, Weeks 1949, Acres 1956, Caughley & Challies 1960, Black 1963, Daniel 1981, Reid 1983, Norton 1989, Burrows 1994, see also Allen *et al* this issue).

An investigation to look at ways of increasing levels of biodiversity in exotic conifer plantations without compromising an economic timber production enterprise was recently undertaken in the United Kingdom (UK) (Spellerberg & Sawyer 1993). That investigation was the result of a contract from the UK Forest Authority.

One of the products of this contract was a bibliographic database bringing together research papers and reports that examine ways of restoring and/or maintaining levels of biodiversity in exotic conifer plantations in temperate regions. The main aspects examined and assessed were:

* methods used to increase levels of biodiversity;
* the establishment of biodiversity standards;
* ecological monitoring procedures for long-term studies.

## RESTORING AND MAINTAINING LEVELS OF BIODIVERSITY

Spellerberg & Sawyer (1993) identified some of the ways that levels of biological diversity could be restored or maintained in conifer plantations in the temperate climatic zone:

* Provide open space habitat
* Provide dying and dead wood
* Increase tree species richness
* Maintain stands of mature trees and/or old growth
* Modify silvicultural practices
* Landscape design
* Sensitive management of understorey vegetation
* Manage riparian zones and set-asides of indigenous vegetation
* Increase wildlife's resources, e.g. nest boxes.

This review was biased towards some taxonomic groups and some habitat types and structures, reflecting the amount of literature available. A distinction was made throughout this review between intuitive approaches and scientifically researched methods for increasing levels of biodiversity in conifer plantations.

Modifying New Zealand's conifer plantations for wildlife is not a new idea (see Clout 1984). However, there appear to be few incentives for the forestry profession to consider anything but increasing efficiency by focusing on a single objective – that of

timber production. However, there is a very real environmental impact of conifer plantation that may reach far outside the forest fence. For example, downstream impacts of clearfelling operations on water quality in forestry streams, visual impacts etc. In these situations public scrutiny of the forestry profession's activities, with the help of non-governmental organisations (see for example Rosoman 1994), may lead to legislation regulating certain practices.

## THE NEED FOR STANDARDS AND MONITORING

If future plantation managers were to:

* maintain the existing levels of biodiversity that their conifer plantations currently support;
* restore levels of biodiversity to a level that is possible and appropriate given the existing site conditions and history of management;
* provide amenity where possible and appropriate;
* landscape so as to reduce the visual impact of plantation establishment or management operations;

what will they use as their objectives? Also, what standards will they set themselves to indicate the level of quality or excellence that is possible for each of these objectives? Furthermore, how will managers know when they are achieving these objectives?

It has been suggested recently that the voluntary imposition of standards using a code of practice or best management standards will be more desirable to forest managers than the imposition through legislation of inflexible, costly regulations (Perley 1993).

The self imposition of biodiversity standards for more than just timber production objectives may be a valuable step in terms of forest management. Standards may address the questions of quality and quantity for biodiversity, amenity and landscaping. Some form of monitoring may then be necessary to determine if managers are achieving these standards (see for example Marden 1994).

However, if standards are adopted who would audit the forest industry? Non-governmental organisations might be keen to scrutinise and familiarise themselves with standards if and when they are established. Visitors to plantations may also be interested.

However, a set of standards for multi-objective forestry is one that is designed so that foresters will be keen to strive to meet those standards as part of their work ethic. As noted by Perley (1994), "professionalism is often associated with the rigorous application to standards, both technical and ethical".

Examples of standards for biodiversity are provided in Table 1 for the structure, composition and function of the conifer plantation at the stand level. Some of these standards may be limited. For example, the presence of wildlife cannot be used alone as an indicator of habitat suitability. Presence of certain wildlife may reflect high immigration rates from sources outside the plantations and habitat conditions within conifer plantations may confer low fitness on those species present. However, limitations

**TABLE 1: Some possible biodiversity objectives with proposed standards for increasing biodiversity in conifer plantations and methods or indicators to be used to monitor the effectiveness of these standards at the level of a stand of conifers.**

| Stand level biodiversity | Objective | Standard | Method/Indicator |
|---|---|---|---|
| Structure | To provide site-specific 'key' structures e.g. dying and dead wood | Standards recommended by various authors e.g. 5 - 10 large snags to be left per hectare (Hunter 1990). | Presence of structure (i.e. number per hectare) or monitor for indicator species of particular structure(e.g. indicator species associated with successional stages of dead wood decomposition) |
| Composition | To accommodate site specific endemic species, threatened species and protected species | Presence (i.e. nesting or foraging), abundance or a minimum viable population of species with low spatial requirements (e.g. invertebrates, vascular plants etc) | Observation or field count of individuals of desired species |
| Function | To maintain organism health | Tree health (based on crown density and needle or leaf discoloration) | Monitor for visual symptoms of foliage damage. |

with existing standards should not divert attention away from the value of establishing standards.

## CONCLUSION

New Zealand forestry is very much multi-use and continues to expand. Small-scale farm forestry operations are underway and the development of more large-scale conifer plantations continues. In addition, the management of existing plantations and their successive rotations is also ongoing. However, whether New Zealand forestry will choose to impose on itself requirements for amenity, landscaping and biodiversity is not so clear.

Perley (1993) identified two possible courses of action:

* the self imposition of standards;
* continue to "get away" with current practices until society imposes inflexible, costly regulations on New Zealand forestry.

Whatever the case, there is a need, prior to reforestation and afforestation with exotic conifers, for an appropriate level of biodiversity to be identified at all spatial scales (e.g. at a stand, plantation and landscape level) to provide an objective for management. There is also a need for the existing biodiversity to be restored and/or maintained as part of the management of existing conifer plantations.

Standards could also be developed and applied not only for timber production but for amenity, landscaping and biodiversity objectives. The existing standard of excellence for each of these objectives may be determined by identifying who in New Zealand is setting the standard. The identification of suitable models or standards for conifer plantation management to meet

**Uneven aged stands and openings in forest plantations help to maintain biological diversity. UK forest plantation, Dorset, England. Photo: Ian Spellerberg**

multiple objectives (biodiversity, amenity and landscape) in New Zealand will be a useful exercise.

Standards that could be sought include any of the following:

* management standards for riparian zones and existing aquatic habitats and for restoration of wetlands within plantations;
* management standards for the provision and maintenance of certain habitats (e.g. open space, pockets of indigenous vegetation and buffer zones that surround them), structures (dying

and dead wood), food sources and shelter for native wildlife within the limits of their known distribution;
* management standards to accommodate landscaping principles into forest design, thinning and felling programmes.

## References


Acres, A., 1956: Native Bird life in a plantation. Notornis 7(2): 61-62.

Black, M.S., 1963: Red-Crowned Parakeet in Exotic Forest. Notornis 10(7): 354-355.

Burrows, C., 1994: Epiphytes on *Pinus radiata* trees at Weheka, Westland. Canterbury Botanical Society Journal 28: 62.

Caughley, G., C.N. Challies, 1960: Riflemen in exotic Pine Forests. Notornis 9(2): 63.

Clout, M.N, 1984: Improving exotic forests for native birds. New Zealand Journal of Forestry 29(2): 193-200.

Daniel, M.J., 1981: First record of a colony of long-tailed bats in a *Pinus radiata* forest. New Zealand Journal of Forestry 26(1): 108-111.

Gibbs, M.M., 1988: Iwitahi: A native orchid reserve in exotic pine forest, New Zealand. Orchadian 9(3): 49-51.

Hunter, M. 1990: Wildlife, forest and forestry: Principles of managing for biological diversity. Engelwood Cliffs, N.J. Prentice Hall.

Marden, M. 1994: Value of Environmental-impact monitoring to forest management under the Resource Management Act: Mangatu Forest. New Zealand Forestry, May: 39-41.

Perley, C., 1993: Multiple use – alive or dead? New Zealand Forestry, August: 2-3.

Perley, C., 1994: Biodiversity, sustainability and a land ethic. New Zealand Forestry, May: 2-3.

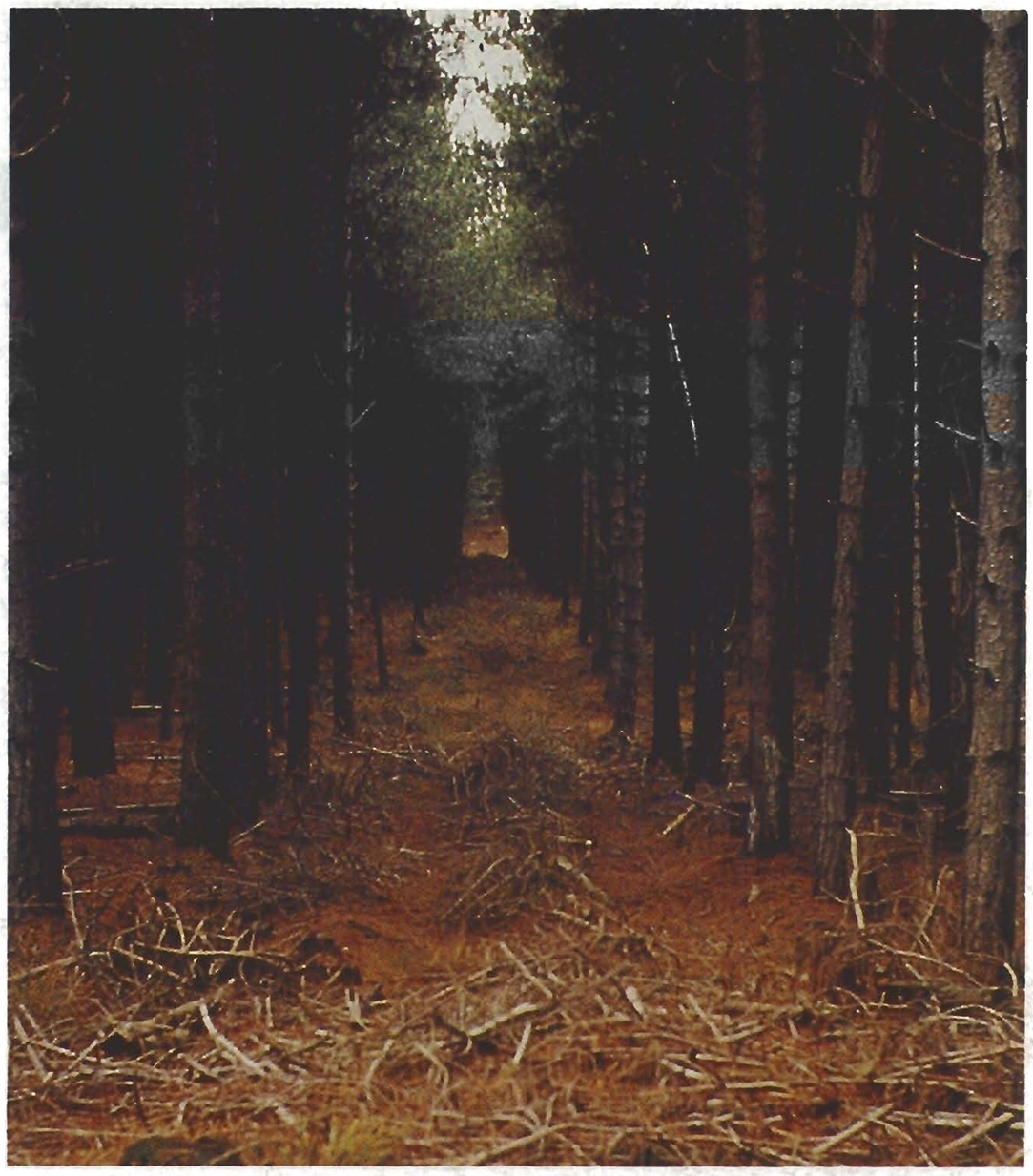
Reid, B., 1983: Kiwis and pine forests. Forest & Bird 14(5): 15-20.

Rosoman, G., 1994: The Plantation Effect. Ecoforestry Review of the Environmental Effects of Exotic Monoculture Tree Plantations in Aotearoa/New Zealand.

Ryder, H.R, 1948: Birds of Kaingaroa Forest. Notornis 3(1); 20-22.

Spellerberg, I.F., J.W.D. Sawyer, 1993: Biodiversity in Plantation Forests: Increasing levels and maintaining standards. Report to the Forestry Authority, UK.

Weeks, M.F., 1949: Bird population of exotic forests 1940-1948. Notornis 3(4): 83-84.

**Dead and dying wood is important for maintaining biological diversity in plantation forests. Photo: John Sawyer**