

Book reviews

Sustainable Management of Indigenous Forest

Southern Hemisphere Prospects based on
Ecological Research and Silvicultural Systems
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In a foreword to this publication Udo Benecke notes that the limited horizons of forestry have devalued the traditional art and science of silviculture. He sees this expressed in the widespread application of management systems that homogenise forest structure over large areas – a practice which may be detrimental to the rich diversity of natural forests. What then constitutes sustainable management of native forests?

Sustainability in Central European forests

E.F. Bruenig and C.F. Klemp see sustainability being achieved through a transition from 'conventional' to flexible and adaptive forms of 'near-natural' forestry.

In their erudite exploration of Central European forestry, Bruenig and Klemp take us through the emergence of near-natural or naturalistic silvicultural practice. Naturalistic forest management espouses the principle of continuous cover silviculture, canopy structures adapted to the carrying capacity of the site, the advantages of natural regeneration and mixed forests, and the integration of careful tree felling and low-impact harvesting. This philosophy, we are told, underpinned forest management as taught in forestry schools in Germany two centuries ago. However, in subsequent pursuit of the 'yield table and the linear normal forest' of industrial forestry, society came to neglect the holistic principles of classical forestry. This has resulted in highly stocked monocultures – often exceeding the carrying capacity of the site – vulnerable to natural correction through growth inhibition and mortality induced by pests, diseases and climatic impacts.

The Bruenig-Klemp philosophy is that the natural forest embodies the 'biological experience of surviving high risks and uncertainties'. On this basis, the forest ecosystem's original and present structure, processes and functions are 'presumed to indicate to us the way to reduce risks of damage and to improve chances of survival under the dynamic variation found in natural and cultural environments'. In practice a near-natural system is seen to be an evolving and constantly changing working tool of adaptive management for approaching sustainability by approximation.

As one example of near-natural management Bruenig and Klemp discuss the reshaping of forest management as it applied to a monoculture of Scots pine severely damaged by storm in 1972. Planning involved computer-designing more flexible,

site-adapted forest ecosystems of sturdy and vigorous stands with moderate aerodynamic roughness, high biodiversity, high quality wildlife habitat, and aesthetically pleasing physiognomy. The resulting forest structures and the ground vegetation looked dramatically unconventional and deviated drastically from the conventional yield table models of age class forestry. Official forestry, we are told, rejected a 'calamity grant' application for this program because the proposals did not conform to the conventional standards of orderly forestry of the time.

Could more naturalistic silviculture succeed in an economic sense? The authors believe they have substantially reduced establishment and early tending costs and still remained far below the cost levels of adjacent state forest for the same species on identical sites. Early risks of damage by snow and deer were also much reduced, while achieving superior diameter growth in more open, stable and diverse forest stands.

Sustainable practice in New Zealand indigenous forests

Four of the eleven papers examine aspects of sustainable management as it relates to New Zealand's natural forests. Two papers focus, as a starting point, on understanding natural structural diversity and reasons for it.

R.B. Allen and D.A. Norton see the structure of the podocarp forests as the product of several disturbance events with different frequencies and intensities – from frequent single-tree windthrows to infrequent earthquake-triggered stand collapse. These impacts are further modified by underlying substrate, for example, windthrow is more common on poorly-drained level sites than on well-drained sloping sites.

While there are some major similarities between background disturbances and those brought about by timber harvesting, there are also major differences, for example, historical, extensive clearcuts are seen to bear little relation to background disturbance patterns. Allen and Norton suggest that understanding the heterogeneous and fragmented landscape brought about by both 'natural' and human-related disturbances, while balancing the needs of society, will be a major challenge this century.

G.H. Stewart *et al.* develop much the same theme as it relates to mixtures of red and silver beech. The differences in the

regeneration dynamics of these species mean that silvicultural practice should mimic as closely as possible the natural variation in gap sizes, in order to maintain the compositional and structural variation typical of natural forest.

Sustainable practice may be particularly complex within the podocarp-beech-hardwood forests. Here, the nature, timing and severity of disturbances, and the complex species responses to these disturbances, may mean that any form of sustainable management will have to be precautionary and developed alongside, or after, further research.

The other two New Zealand papers explore biological questions relating to ecological sustainability - the potential use of invertebrates as indicators of sustainability in the beech forests (A. Evans), and the invasion of beech forests by exotic weeds (S. Wisser). Evans found that neither invertebrate diversity nor rate of litter decomposition was affected by the type or intensity of disturbance; and Wisser, that management to minimise invasion of exotic plants needs to recognise the high level of variation between forest sites, even when dominated by species of the same genus.

Towards sustainable practice in a South African forest

Sustainability in a South African multi-species uneven-aged natural forest is seen largely in terms of yield regulation systems that are sensitive to natural species and structural diversity (A. Seydack). It is recognised that the continuing development of such systems, adaptable to a variety of circumstances, will depend on an improved understanding of (i) regeneration dynamics, particularly of gap opportunist species, (ii) growth patterns as affected by site, competition, climate, and the way species respond to release, and (iii) the ecological basis of species diversity and dominance.

***Nothofagus* forests: Chile, Argentina and New Guinea**

The main recommendations for Chile's temperate forests (including *Nothofagus* forests) are the need (i) to acknowledge the heterogeneity of these forests regarding site, composition, structure and conservation status, (ii) to maintain or imitate the structural complexity of natural stands and (iii) to base adaptive management on the monitoring of systems (A. Lara and C. Donoso).

Sustainable management of Argentina's *Nothofagus* forest is presented in more conventional silvicultural terms (J. Bava). The author advocates replacing the current selective (high-grading) logging with a group selection system – felling no more than 30% of the stand area in groups of 3 to 6 sawlog-size trees and creating gaps of 150 to 400 m². At each cutting cycle, smaller trees within the gaps should be thinned and openings enlarged by removal of non-commercial trees.

Nothofagus and conifers are also a distinctive feature of Papua New Guinea's rainforests. Periodic regeneration mediated through a variety of disturbance types appears to be an important influence on the forests, resulting in all-sized and unimodal size class distributions (H. Rogers). Sustainability in these forests does not appear to be addressed; and current industrial-scale harvesting (based on selective harvesting to a diameter limit of 50 cm dbh) is widely seen to be socially,

economically and ecologically unsustainable. A forest policy document of 1991 required that forest operations must adhere to principles of sustainability, but this has not been done.

Sustainable practice in the eucalypt forests

Australian contributions are those of J. Bauhus (uneven-aged management) and J. Hickey and M. Neyland (silvicultural options for eucalypt-*Nothofagus* forest in Tasmania).

Bauhus presents a comprehensive account of uneven-aged management as it is applied to eucalypt forests – a practice he believes is better addressed from the perspective of management objectives than forest structure. The paper covers natural processes of regeneration, protection of advance growth and growing stock during harvesting, maintaining the growth of cohorts across the range of size classes, maintaining structural diversity, and adaptive forest management.

The maintenance of structural diversity is commonly projected as a key objective of uneven-aged management, and hence a key to the sustainable management of these forests. However, Bauhus notes the lack of simple measures to objectively quantify vertical and horizontal forest structure, and the need for clearer goals for residual stands.

Hickey and Neyland describe the trial in Tasmania's wet *Eucalyptus obliqua* forest being established to develop silvicultural alternatives to large-area clearfelling. The six silvicultural systems (conventional clearfell, burn and sow (CBS); CBS with understorey islands; stripfell/patchfell; 10% dispersed retention; 30% aggregated retention; and single tree/small group selection) represent a range of alternatives where account can be taken of local stand and site types, grower objectives and community attitudes. The authors suggest that at this very preliminary stage, retention systems based on islands or larger aggregates may offer an alternative to clearfelling for broader application in wet eucalypt forests.

Discussion

There is undoubtedly great diversity in the perception people have of sustainable management – and ecologically sustainable forest management (ESFM) in particular. At one end of the spectrum it may simply mean there has been a reasonably accurate determination of the level of harvest which can be maintained in perpetuity. We might now superimpose on this the requirement that, irrespective the silvicultural system imposed, there has been full site regeneration at a reproduction harvest and 'satisfactory' growth through the size classes. This might now be further extended where it is accepted there will be long-term ecological advantages in ensuring the species composition and structural attributes of the original forest are maintained as far as possible (as proposed by several papers to the symposium). ESFM can also mean that silvicultural practice is directed as much to conserving wildlife within the wood production forest as to wood production itself, a philosophy expressed, for example, in the current silvicultural policy for NSW public forests (Nicholson 1999). And finally, ESFM can mean a sensitive approach to maintaining the vitality and health of stands by appreciating the ecological and physiological attributes of species and species mixtures, and working to avoid stresses on sites and vulnerability of stands to pests and diseases.

This more comprehensive concept of ESFM undoubtedly underpins the Bruenig-Klemp approach to near-natural management. While the silvical attributes of eucalypts mean that forest management practices in Australia will normally differ appreciably from those in Europe, the philosophies espoused by Bruenig and Klemp are, nevertheless, of vital importance in achieving sustainable management of eucalypt forests.

Ultimately, ESFM within the eucalypt forests will depend on an appreciation of the way eucalypts may have evolved in response to a number of stresses (including declining soil nutrients and increasing drought and fire), the differing physiological attributes of species (particularly those influencing their competitive ability on soils varying in availability of soil nutrients, water and air), and the way present community patterns reflect the ecological sifting of a large number of species by site factors. If we accept this, we need to be cautious in applying practices which can substantially alter natural species mixtures, particularly where this involves increasing the frequency of a more site demanding and inherently vigorous species, and hence stress on site resources.

Stresses on site resources may also be created where highly stocked even-aged regrowth replaces old-growth forest which

may have been maintained in nature through a slow process of 'gap-phase' replacement. Highly stocked even-aged regrowth will make a far greater demand on site resources than old-growth forest with scattered patches of regrowth.

Incidence of stem borers, root disease, crown dieback, weak expression of dominance and 'locked stands' within even-aged regrowth may be an expression of forest practice that has failed to address ESFM at this more fundamental level. It follows we may need to be more conscious of the biological origins and attributes of eucalypt forests and their consequences for forest management.

If *Sustainable Management of Indigenous Forests*, particularly the thinking of Bruenig and Klemp, can stimulate interest in ecological sustainability, it will serve a very useful purpose indeed.

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