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Adaptive risk management for certifiably sustainable forestry

B.A. Wintle [a,*], D.B. Lindenmayer [b]

[a] Commonwealth Environment Research Facility (AEDA), School of Botany, The University of Melbourne, Parkville, Victoria 3010, Australia
[b] Commonwealth Environment Research Facility (AEDA), Fenner School of Environment and Society, The Australian National University, Canberra, ACT 0200, Australia

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ABSTRACT

The past decade has seen a global surge in forest management certification, with over 200 million hectares of the world's forest now certified as sustainably harvested. Because forests are some of the most species-rich environments on earth and more than 90% of the world's forests occur outside formal protected area systems, forest management certification will be one of the pervasive influences on global biodiversity for the foreseeable future. We find that current forest certification schemes are largely deficient because they fail to demand: (i) measurable management objectives for biodiversity, (ii) formal risk assessment of competing management options that integrate impacts on biodiversity, (iii) monitoring that directly addresses management performance requirements and a clear plan for how monitoring information will be used to make better management decisions, and (iv) ongoing research targeted toward practices that enhance biodiversity in managed landscapes. We argue that the credibility of certification schemes hinges on their ability to dictate scientifically defensible management systems for biodiversity conservation. We present a framework for adaptive risk management (ARM) of biodiversity that is both responsibly proactive and diligently reactive and recommend its incorporation in all certification schemes. We highlight the need for substantial government and agency investment in fostering ARM.

1. Introduction

Forests are among the most species-rich environments on earth and the way they are managed has a substantial impact on global biodiversity loss (Millennium Ecosystem Assessment, 2005). Much of the focus on conserving forest biodiversity has centered on setting aside large reserves (Soulé and Sanjayan, 1998; Mittermeier et al., 2005) and wilderness areas (Donlan et al., 2005). Reserves undoubtedly play a key role (Mittermeier et al., 2005), but it is increasingly clear that off-reserve conservation is critical (Lindenmayer et al., 2006), especially as most of the world's biota is presently not in reserves or wilderness areas (Daily, 2001). Approximately 92% of the world's forests (and associated biota) occur in unreserved areas used for the production of wood, paper and other forest products (Lindenmayer and Franklin, 2002).

Biodiversity conservation is now widely acknowledged around the world as a fundamental part of ecologically sustainable forest management (Hunter, 1999; Lindenmayer et al., 2006). Policy documents note that the conservation of biodiversity requires "conserving species throughout their known ranges", maintaining the "evolutionary potential" of populations, and maintaining species interactions and "ecological processes" (e.g. Commonwealth of Australia, 1992, 1996; Haynes et al., 2006). Workable interpretations of these policy statements must be developed through cooperation between managers, the community, and ecologists to provide specific goals and performance measures as a basis for forest management.

Market-based instruments such as certification are rapidly gaining popularity as effective motivators for improved forest management. Certification schemes have developed in the fishing industry (Marine Stewardship and Council, 2002) and some areas of agriculture (USDA, 2000). As of mid-2005, more than 214 million ha of forest worldwide had been certified under various standards with more than 50% of European forests and 30% of North American forests managed under certification schemes (UNECE/FAO, 2005). The area of forest certified under the Forest Stewardship Council (FSC) has increased approximately linearly since 1998 (Fig. 1) and the total area of forest certified under the Pan European Forest Certification Scheme alone is now greater than 200 million hectares. Forest certification is considered a potentially important measure to counter the current ecological problems being created by globalization of the wood products industry (Viana et al., 1996;

* Corresponding author. Tel.: +61 3 83443306.
E-mail address: brendanw@unimelb.edu.au (B.A. Wintle).

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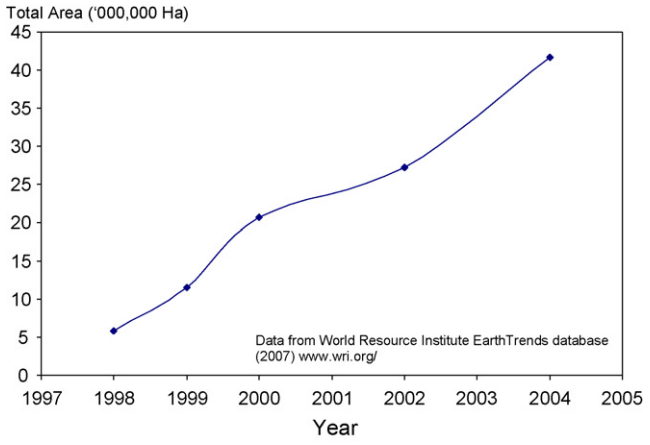

Fig. 1. Rate of growth in forest areas certified under the Forest Stewardship Council certification scheme since 1998.

Gullison, 2003). Thus, it is likely that forest management, practiced according to certification standards, will be one of, if not the major influence on forest biodiversity the foreseeable future. Other competing influences on forest biodiversity include forest conversion in the tropics, development in third world economies, and climate change.

Under forest certification schemes, standards of conduct are prescribed for forest operations. Some certification schemes defer to existing institutional arrangements in the jurisdiction under which the forest is managed, such as codes of practice and forest management plans. Successful certification rests largely on the existence and adherence to such processes (AFS, 2007). Other schemes are more prescriptive about what constitutes sustainable forest management (FSC, 1996). Common to all certification processes are periodic, third party assessments of adherence to the certification standard. The overall goal in certification is the adoption of standards that will ensure forest management is environmentally sensitive, socially aware, and economically viable (Upton and Base, 1996).

The focus of conservation biologists on reserve design as the pre-eminent tool for biodiversity conservation has meant that significantly less effort has been allocated to the development of ecologically sustainable management practices in forests outside reserves (Lindenmayer and Franklin, 2002). A convincing working definition is yet to be developed of what ecologically sustainable forest management actually means in terms of off-reserve forest management, making demonstration of sustainability difficult (Lindenmayer and Franklin, 2003). Noss (1993) concludes that sustainable forestry is a "multifaceted and relative concept". A more realistic approach to demonstrating sustainability may be to define it in terms of well measurable local and regional management goals, and attempt to demonstrate progress toward those goals (Lindenmayer and Franklin, 2003). Such an approach would be consistent with the principles of adaptive risk management outlined below.

We believe that six key factors underpin the failure to demonstrate ecologically sustainable forest management. These are:

1. A failure to clearly specify biodiversity management objectives and constraints in terms of measurable attributes at the management, landscape and regional level. This hinders transparent evaluation of management performance through monitoring and renders managers largely unaccountable for their management performance (Bunnell et al., 2003). Managers have largely failed to set measurable performance thresholds for biodiversity or to specify remedial actions that would be conducted if thresholds are breached.
2. Management options (e.g., silvicultural systems) are typically uniform throughout a forest type (e.g. wet schlerophyll eucalypt forest in Australia is almost always clear-felled Lutze et al., 1999), with no attempt to undertake management experiments to test competing theories about best practice and competing social preferences.
3. A failure to formalize competing views about the impacts of forest management (or relative impacts of competing management options) as transparent models. This makes it difficult for outside observers to identify the expected outcomes of management and how those expectations were determined.
4. A failure to embrace prospective biodiversity risk analysis (but see FEMAT, 1993). We could find no published peer-reviewed examples of biodiversity risk analyses being used to support the assertion that forest management practices are sustainable. However, there have been several cases where risk assessments demonstrate the opposite (Burnham et al., 1996; Noon and Blakesley, 2006).
5. A failure to design and implement monitoring (*sensu* Nichols and Williams, 2006) to assess the performance of management strategies for biodiversity conservation. There is commonly a mismatch between the amount of money required to implement successful monitoring and the amount of money managers and policy makers are prepared to invest in monitoring. A reluctance to set measurable biodiversity management objectives and thresholds (Point #1 above) also makes designing effective monitoring strategies very difficult.
6. A failure to take a systematic approach to setting research priorities based on the uncertainties that most impact on the quality of management decisions. Many of the uncertainties that substantially undermine the decision-making are not being resolved and many research projects are addressing questions that have only a minor influence on decision-making.

If forest management were not subject to uncertainty, then the major challenge facing managers would be to set goals that were agreeable to stakeholders. If agreeable goals could be set, implementation of management would proceed without controversy. However, because uncertainty is pervasive, we argue that a serious commitment to adaptive management (*sensu* Walters, 1986), linked to a systematic risk assessment protocol is necessary to provide a sound basis on which to assert 'ecologically sustainable forest management'. The expression "adaptive management" can be found in standards documents (e.g. FSCC, 2005; AFS, 2007) although the exact meaning seems to vary from standard to standard and definitions are largely absent. The context in which the expression "adaptive management" is commonly used in existing standards indicates a pervasive misconception that any decision to change a management action in light of an observed (usually unexpected) change in the state of a system is, by definition adaptive management. While a semantic argument in favor of this position may be defended, it ignores the large body of work that has developed the theory of adaptive management to a high degree of sophistication. Adaptive management provides a coherent approach to decision-making under uncertainty and a philosophy for learning (Nichols and Williams, 2006). However, this is only the case when it is properly implemented as a whole package from goal-setting and system modeling to monitoring and model-updating (e.g. Johnson et al., 1997). Despite frequent claims to the contrary, forest management relies more on trial-and-error management (sometimes augmented by the results of definitive experiments) than formal adaptive