

## Forest and environmental degradation

M. J. Eden

Royal Holloway, University of London, Egham, Surrey TW20 0EX, UK

Recurrent concern has been expressed over recent decades regarding tropical deforestation. Concern has focused on the unsustainable nature of many of the agronomic systems that have been established on cleared forest land and on the broader biophysical feedbacks that are associated with the loss of forest cover; the latter include climatic and hydrological feedbacks and loss of biodiversity. The concern with tropical deforestation, dating particularly from the early 1970s (Gómez-Pompa *et al.*, 1972; Denevan, 1973; Richards, 1973) has been an important element of the global environmental movement and it has provoked considerable scientific investigation of tropical forests.

Much of this investigation has focused on the causes, extent and impact of deforestation, and has usefully alerted many individuals, agencies and governments to the need for forest management strategies that accommodate both development and conservation. However, this attention to deforestation has lately been perceived as too crude and partial for current purposes, and some beneficial broadening of the perspective on tropical forests has emerged which, on paper at least, enhances the possibility of more effective forest management.

A first advance has been the recognition that the present status of previously deforested land is a relevant variable. An earlier tendency to assume that cleared forest land stayed cleared, and was permanently deflected to some herb-dominated cover, has been succeeded by increasing recognition of the renewability of the forest and of the significance of the post-clearance land cover, not least in respect of the climatic and hydrological feedbacks of deforestation (Eden, 1996a). As a consequence, secondary forests and their ecological dynamics have lately received increasing attention (Chazdon, 1994; Corlett, 1995). Secondly, it has been recognized that

attention to forest damage, as distinct from deforestation (clear cutting), is also desirable. Forest damage, typically associated with selective logging, usually leaves a substantial canopy in place but causes a significant reduction in biomass and changes in species composition. Forest damage is less easily monitored than deforestation, but increasingly deserves the attention of forest researchers and managers.

Emerging from the above is the useful concept of forest degradation, which encompasses both deforestation and forest damage (Eden, 1996b; Grainger, 1996). Forest degradation is in turn a component of the broader concept of land degradation which, as perceived by Blaikie and Brookfield (1987), usefully emphasizes the social as well as the environmental aspects of degradation, and also stresses the idea of 'net degradation' as a product of counteractive 'degrading' and 'restorative' processes. In the present context, forest degradation is seen as a valuable generalizing concept that incorporates deforestation, extends therefrom to consider the nature of the post-clearance land cover, and also includes forest damage. In all cases, the environmental processes involved and their management implications are of concern.

The present chapter firstly examines the broad status of forest degradation in the tropics, with particular attention to remote sensing which is increasingly used to measure and monitor it; secondly, it reviews the physical and biological impacts of forest degradation; and thirdly, it discusses associated aspects of forest management, especially forest conservation that aims to minimize the biophysical impacts of forest degradation.

## 5.1 FOREST DEGRADATION

Forest degradation is an element of the broader phenomenon of land degradation. The latter has lately emerged as an integrative concept applicable to a range of physical and biological processes that cause land to suffer 'a loss of intrinsic qualities or a decline in capability' (Blaikie and Brookfield, 1987). Forest degradation, particularly when involving deforestation, has latterly received much attention and been seen as one of the more serious global environmental issues. As a result, considerable efforts have been made in recent decades to monitor deforestation, particularly using remote sensing techniques. Although useful data have accrued at national level, reliable pan-tropical information has not readily been obtained since the early 1970s, despite the availability of Landsat imagery. Only during the present decade has the long-standing objective of assembling a reliable, pan-tropical data set on deforestation approached reality. Monitoring forest damage, as opposed to deforestation, is a more challenging task and one which is only now beginning to be investigated. Ultimately, however, integrated data for forest degradation are required as an aid to formulating sound technical and management strategies of issues