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INVITED VIEWS IN BASIC AND APPLIED ECOLOGY

## **Tropical biodiversity loss and people – A brief review**

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### **Abstract**

Massive anthropogenic land use changes are taking place in the tropics. These changes have not only jeopardized native biodiversity but also people. Environmental apathy, corruption, poor natural resource governance, poverty and lack of conservation funding remain formidable challenges for conservation biologists. Any meaningful success in tropical conservation will, hence, need active collaboration by the civil society, biologists, social scientists, lawyers, funding agencies, national and multinational corporations, governments and non-governmental organizations. Concerted research efforts are urgently needed to understand the imperiled tropical biodiversity.

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### **Zusammenfassung**

Massive anthropogene Änderungen der Landnutzung finden gegenwärtig in den Tropen statt. Diese Veränderungen haben nicht nur die einheimische Biodiversität gefährdet, sondern auch die Bevölkerung. Gleichgültigkeit gegenüber Umweltfragen, Korruption, unzulängliche Steuerung der Nutzung natürlicher Ressourcen, Armut und die fehlende Finanzierung für den Naturschutz bleiben gewaltige Herausforderungen für Naturschutzbiologen. Jeder bedeutsame Erfolg im tropischen Naturschutz bedarf deshalb der aktiven Zusammenarbeit von Zivilgesellschaft, Biologen, Sozialwissenschaftlern, Juristen, Geldgebern, nationalen und multinationalen Körperschaften, Regierungen und Nichtregierungsorganisationen. Gemeinschaftliche Forschungsanstrengungen sind dringend erforderlich, um die gefährdete tropische Biodiversität zu verstehen.

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**Keywords:** Biotas; Extinctions; Deforestation; Conservation; Hotspots

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## Introduction

Lying between the Tropics of Cancer and Capricorn, i.e. 23.5° north and south of the equator, the tropics harbor two-thirds of earth's biodiversity and is experiencing massive losses of native habitats (Dirzo & Raven, 2003). Despite this, conservation successes in the tropics have been few and far between. Here I first briefly review the loss of tropical native habitats and its causes. I also highlight negative effects of habitat loss on both biodiversity and people. After underscoring some hurdles in tropical conservation, I briefly present ways to overcome these. Finally, I make a plea for more research on tropical biodiversity. Due to space restrictions, I do not claim to be comprehensive.

## Unprecedented loss of tropical habitats

Massive land conversion by humans has exerted a profound and irreversible effect on tropical biodiversity (Sala et al., 2000). Anthropogenic activities such as logging are degrading and destroying tropical rainforests at a rate unprecedented in history (Acharid et al., 2002; Laurance, 1999). Tropical forests support over 50% of earth's species (Dirzo & Raven, 2003) and these forests are also critical for carbon sequestration and energy cycles (Millennium Ecosystem Assessment, 2005). Therefore, tropical forests are not only crucial for biodiversity conservation, but also play critical roles in mitigating global climate change. Despite this, more than 40% of tropical forests have been eliminated from Asia alone (Wright, 2005). The United Nations Food and Agricultural Organization (FAO) has reported that countries with the largest annual net forest losses between 2000 and 2005 are all situated in the tropics (FAO, 2005). These countries include Brazil, Indonesia, Sudan, and Myanmar, and they have collectively lost 8.2 million hectares (ha) of forest every year between 2000 and 2005 (FAO, 2005). A particularly disconcerting fact is that although native forest loss seems to be slowing in tropical Latin America, it continues to accelerate in most of tropical Africa and Asia (Hansen & DeFries, 2004; Koh, 2007a; Matthews, 2001). Additionally, about a quarter of regenerating forests has been lost between 1982 and 1999 in tropical Asia and Africa (Hansen & DeFries, 2004). These secondary forests could be crucial for global carbon cycles and conservation of some forest biotas (Wright, 2005).

Wright and Muller-Landau (2006) argue that future deforestation will slow down due to a decrease in human population growth and increasing migration to urban centers. They argue that such changes in human demographics will be conducive for forest regeneration. However, Brook, Bradshaw, Koh, and Sodhi (2006) argue that this predicament is unlikely and even if this

happens, it may dampen deforestation too late to stop the mass extinction of tropical biodiversity. Laurance (2007a) also argues that Wright and Muller-Landau's (2006) prediction of dampening of catastrophic deforestation-driven extinctions in the tropics due to forest regeneration are overly optimistic.

Devastating losses are not restricted to tropical rainforests. Mangrove forests, juxtaposed between land and sea, cover approximately 8% of the world's tropical coastline across 112 countries (Adeel & Pomeroy, 2002). In addition to direct overharvesting of trees, mangrove forests are threatened by pollution, siltation, coastal development, aquaculture development, and boating and shipping (Adeel & Pomeroy, 2002). Mangroves support extensive marine, estuarine, and terrestrial biodiversity and contribute to varied ecosystem functions. For example, the presence of mangroves may enhance fish, shrimp, and prawn catches, producing an estimated US \$66 to almost US \$3000 of fisheries-related annual income per hectare of mangroves (Baran & Hambrey, 1998). Despite their obvious environmental and economic benefits if left intact, mangroves are still currently being removed at a rate of 2–8% per year. Between 4% and over 60% loss of the original mangrove cover has occurred in various tropical countries (Adeel & Pomeroy, 2002; Valiela, Bowen, & York, 2001).

Tropical savannas or grasslands are also imperiled. The world's greatest diversity (>40 species) of ungulates is, for example, found in the savannas of Africa and includes wildebeest (*Connochaetes taurinus*), oryx (*Oryx gazella*) and zebra (*Equus* spp.). These species-rich communities of large-bodied mammals attract a diverse set of carnivores such as lions (*Panthera leo*), cheetahs (*Acinonyx jubatus*), jackals (*Canis adustus*), and hyenas (*Crocuta crocuta*). The mega-herbivores and their predators require large areas to sustain themselves and are thus highly vulnerable to habitat loss. Worldwide, 50% of the tropical and sub-tropical savannas have already been sequestered for use by humans, with further projected losses of about 20% by the year 2050 (Millennium Ecosystem Assessment, 2005).

## Drivers of habitat loss

Direct causes of destruction of tropical habitats are many, including slash-and-burn clearing, selective logging, cattle ranching, plantations, agriculture, fuel-wood collection, and urbanization. These drivers can act singly or in concert. In the tropics, the main proximate drivers of deforestation are clearing forest for agriculture, followed by wood extraction and infrastructure expansion (Geist & Lambin, 2002). The precise underpinnings of these causes of deforestation are complex and geographically variable, however

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