

Commentary

# Lessons from Research for Sustainable Development and Conservation in Borneo

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Academic Editors: Barry Brook and Jessie C. Buettel

Received: 23 October 2016; Accepted: 7 December 2016; Published: 11 December 2016

**Abstract:** I present a brief synopsis of six key lessons provided by research on forest ecology and conservation, focusing particularly on the Malaysian state of Sabah in northeastern Borneo. These lessons are generalizable to other contexts, especially for tropical developing nations, where surviving forests are under growing pressures from a range of human activities.

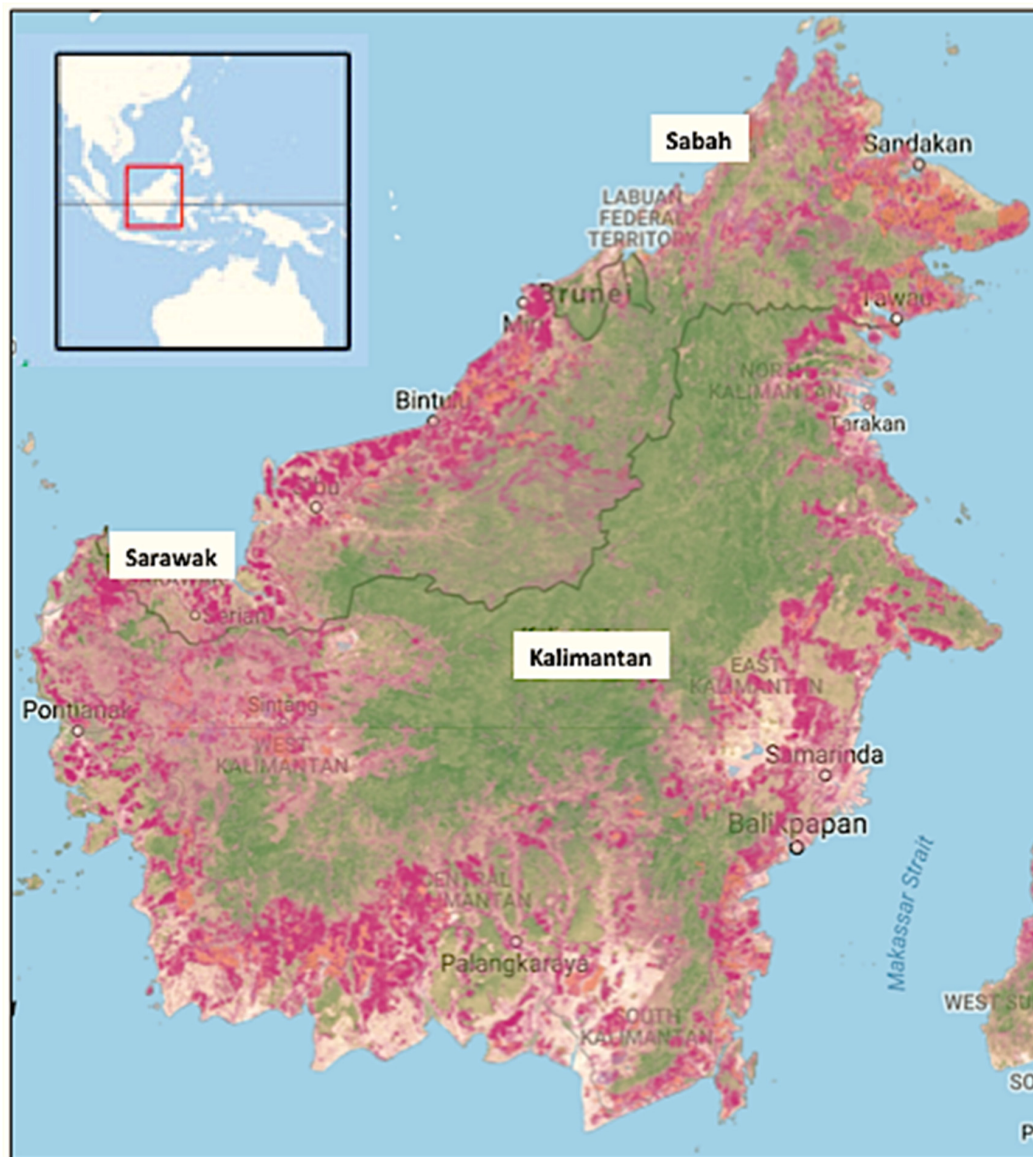
**Keywords:** Borneo; climate change; land-use planning; Malaysia; oil palm; protected areas; pulpwood plantations; Sabah; selective logging

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## 1. Introduction

The forests of Borneo harbor exceptional biological diversity and endemism, and also provide key ecosystem services such as large-scale carbon storage that would otherwise contribute to harmful climatic change [1,2]. Unfortunately, Borneo's forests have been rapidly cleared, fragmented, and degraded by a range of human activities, with industrial oil palm and wood-pulp plantations being among the greatest current threats, often following intensive industrial logging [3–5].

Research in tropical ecology and conservation biology has provided important lessons for guiding forest conservation and development activities in Borneo (e.g., [6–9]). In this brief essay, I provide a snapshot of key points from the perspective of maintaining the region's remarkably rich terrestrial biodiversity, especially that in Sabah, Malaysia (Figure 1).



**Figure 1.** The island of Borneo, showing the Malaysian states of Sabah and Sarawak, and the Indonesian state of Kalimantan. Areas in pink have had high rates of native-forest loss (2000–2015), areas in red are oil palm or wood-pulp plantations (2015), and areas in green have high aboveground biomass of native trees (image and data from Global Forest Watch).

## 2. Lessons for Conservation

### 2.1. Save Logged Forests

With the exception of protected areas, most physically accessible forests in Borneo have been selectively logged, often repeatedly, and often with heavy harvest intensities. Selectively logged native forests can sustain considerable biodiversity and environmental values [8,10–12] but are highly vulnerable to subsequent forest conversion for other uses, such as industrial plantations and swidden farming. For these reasons, protecting logged native forests is a crucial priority. This is probably the greatest challenge and priority for Sabah, given the extent of its logged forests [2]. Conserving selectively logged forests also has great generality given that some 400 million hectares of tropical forests worldwide are currently held in logging estates [12].

## 2.2. Combat Poaching in Protected Areas

Hunting is devastating for some fauna, particularly larger-bodied species whose declines can have serious impacts on forest ecology and functioning [13,14]. It is vital to limit hunting in protected areas and other habitats for sensitive wildlife. Some national parks in Borneo, such as Lambir Hills National Park in Sarawak, Malaysia, are being severely degraded by poaching, with major declines of wildlife and a collapse of basic ecological services such as seed dispersal [14,15].

There is a dire need to enforce anti-hunting regulations in protected areas. Logistical support and guidance from conservationist interests such as the Borneo Futures Initiative [16] and groups combating the illegal wildlife trade [17] are important for augmenting limited government resources for reserve protection. Public-education campaigns (e.g., [18]) and the first-ever fatwa (Islamic religious ban) on illegal trafficking in endangered species [19] are also helpful.

## 2.3. Maintain Forest Connectivity

Many protected areas across the tropics are suffering biologically as they become increasingly isolated from surrounding forests (Figure 2) [7]. For this reason it is essential to reduce forest loss and maintain biological connectivity wherever possible in the vulnerable lands surrounding protected areas. Particularly notable are efforts by the Sabah Forestry Department and Sabah Foundation to establish forest corridors and buffer zones in the greater Danum Valley area [2]. This area is notable for containing some of the last remaining tracts of unhunted forests in all of Borneo, parts of which have never been logged. The corridors are linking together several protected areas in eastern Sabah while attempting to provide linkages between surviving lowland and upland forests. Because they harbor considerable biodiversity [10–12], selectively logged forests can provide effective buffer zones and connecting elements for such forest-conservation networks.



**Figure 2.** The forests surrounding many protected areas are being rapidly cleared or degraded. Shown is recent deforestation for oil palm plantations along the edge of Bukit Palong National Park in Peninsular Malaysia (photograph by William Laurance).



#### 2.4. Limit Infrastructure Expansion in Environmentally Sensitive Habitats

Combinations of environmental threats, such as hunting and habitat destruction or logging and fires, are major drivers of species declines and extinctions [20,21]. It is difficult to limit such threats where human influences are strong, and thus conserving nature requires retaining extensive remote areas free from roads and other infrastructure that can greatly increase encroachment, hunting, fires, and other human impacts on forests [22–24]. For such reasons road expansion should be greatly limited in forested areas wherever possible.

In Borneo, of particular concern are efforts to dramatically expand roads across much of Malaysian Borneo (Sarawak and Sabah) under the auspices of the ambitious “Pan-Borneo Highway Program” and across Indonesian Borneo (Kalimantan) via the massive “Trans-Kalimantan Highway and Economic Corridor”. In this context, proactive land-use planning that seeks to optimize the economic benefits of new infrastructure while reducing its impacts on wilderness and protected areas is vital [25].

#### 2.5. Include Climate Change in Conservation Planning

A key priority is to consider both natural climatic variability and the prospects of future climatic change in conservation planning [26]. Current climate models suggest that El Niño droughts will increase in intensity in the western Pacific region [27], which includes Borneo. Such droughts, in concert with logging, forest fragmentation, and fire-based swidden farming, can lead to intense forest fires (Figure 3) that have severe impacts both on forests and on agricultural lands and human livelihoods [28]. Special measures, such as effectively enforced government bans on burning, may become essential during future droughts.



**Figure 3.** A destructive forest fire near Riau in central Sumatra, Indonesia (photograph by William Laurance).

Climate change should also be incorporated into the design of nature reserves and reserve networks. By conserving major elevational gradients for Borneo’s migratory birds, mammals, and insects [29,30] and providing refugia for species that are vulnerable to extreme weather events, the growing conservation network around Danum Valley in eastern Sabah could help to buffer wildlife populations and biodiversity from future climatic change [26]. This vital initiative should be strongly applauded internationally and used to showcase the importance of effective reserve-design efforts [1,2].

## 2.6. Promote Research as a Tool for Conservation

The presence of researchers is often a valuable means to defend parks from illegal encroachment and hunting [31] and to advocate persuasively for the importance of forest conservation [32]. Hence, promoting long-term research may be one of the most effective ways to ensure that parks remain biologically viable.

For example, under the auspices of the Southeast Asian Rainforest Research Partnership (SEARRP), the British Royal Society and other scientists have played a very active role in promoting forest conservation in Sabah [2]. Among their most effective initiatives has been the close liaison between SEARRP researchers and the Sabah Forestry Department to design and promote the linked network of protected areas in the greater Danum Valley area. The success of this effort underscores the vital potential for long-term research programs to build successful relationships with local land-use managers and government authorities. A related SEARRP research effort in Sabah, known as the SAFE (the Stability of Altered Forest Ecosystems) Project, is providing key insights into the effects of forest fragmentation by oil palm plantations on a variety of plant and animal species and ecological processes [33].

## 3. Conclusions

The forests of insular Southeast Asia are among the biologically richest and most imperiled ecosystems on Earth. Ideally, one would hope to conserve large, pristine blocks of forest that represent the region's great diversity of biogeographic regions. In reality, conservationists are scrambling to protect dwindling areas of logged forests before they are bulldozed or razed for industrial plantations or swidden farming. In a perfect world the region's protected areas would be well managed, yet many reserves suffer from illegal encroachment, hunting, and mining—chronic threats that must be battled. One would also hope to have strong legacies of research across the archipelago to inform land-use and conservation decisions—yet scientific efforts are spotty, underfunded, and frequently inadequate.

These are the environmental realities one faces in Southeast Asia, and indeed across much of the tropics. Yet we are not powerless. We know enough right now to set clear conservation priorities. The question is whether we will have the perseverance and determination needed to achieve them.

**Acknowledgments:** This research was supported by the Australian Research Council, the Arcus Foundation, and other philanthropic donors. My thanks to Glen Reynolds and two anonymous referees for useful comments on the manuscript.

**Conflicts of Interest:** The author declares no conflict of interest.

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