

Suggestions derived from the joint activities of the Borneo Sustainability Forum

Importance of Borneo

Maintaining natural forest ecosystems in Borneo is important to meet the goals of UNFCCC because they are one of the carbon-densest forests and store a considerable fraction of terrestrial carbon of the world. They also harbour a rich assemblage of biological diversity and provide a range of services for human well-being both in a local and global context.

Present land-cover status

1. There are diverse types of natural forest ecosystems, each of which has adapted to a specific habitat and contains a highest amount of carbon in the habitat and a rich assemblage of biological diversity. If these ecosystems are converted, the consequence will be an inevitable net loss of carbon and biological diversity. As of 2005, the areas of major ecosystem types, which are relatively intact, are summarized as follows:

Table 1. The areas of major ecosystem types in Borneo, which are relatively intact as of 2005.

	Area (ha)
Mangrove forest	613,269
Swamp forest (including peat swamp)	9,319,451
Lowland forest (below 800 m)	23,533,588
Upper dipterocarp forest (800-1200 m)	4,435,425
Mountain forest (above 1,200 m)	1,825,344

#These figures were derived from a land cover classification based on MODIS satellite data (Langner et al. 2007). The accuracy of the classification was almost 85%.

Literature

Langner A, Miettinen J, Siegert F (2007) Land cover change 2002–2005 in Borneo and the role of fire derived from MODIS imagery. *Global Change Biology*, **13**, 2329–2340.

2. Deforestation and severe forest degradation are occurring in each ecosystem type. The overall rate of deforestation and severe degradation (those forests which considerably decreased in cover) in Borneo with all major ecosystem types combined was 2.15 million ha during the 3 years between 2002 and 2005. The annual deforestation and degradation rate relative to the forested area of 2002 was 1.7% during 2002-2005..

3. Generally, there are three types of land categories in Borneo, each of which needs to be managed in a specific way to maximize the long-term stability of carbon stock and other benefits for human well-being. Totally protected areas occupy 16.1% of Borneo (without Brunei) and need to be managed with the least human interference. Permanent forest estates are set aside for multiple human uses to receive a range of ecosystem services and exceed 45.5% of the total land area (without Brunei). Permanent forest estates need to be sustainably managed to harmonize human uses with carbon stock and conservation. State lands (government lands outside protected areas and permanent forest estates), which are still supporting remnants of natural forest ecosystems, may function to store carbon and to conserve biological diversity. State lands need to be managed with a legitimate ecosystem approach.

Table 2. The areas of land categories in Kalimantan, Sarawak and Sabah as of 2005

	Kalimantan (4 provinces)	Sarawak	Sabah	Total (without Brunei)	% of total area
Totally protected area	10,778,640	743,407	245,172	11,767,219	16.1
Permanent forest estate	24,820,750	4,755,570	3,594,519	33,170,839	45.5
State land	17,440,750	2,255,388	590,485	27,985,260	38.4
Others		4,615,314	3,083,323		
Total area	53,040,140	12,369,679	7,513,499	72,923,318	100

Future projections and consequences

1. Agricultural expansion will drastically reduce the area of the forests in state lands or other lands outside the permanent forest estates if the current rate of developments continues.
2. Degradation of the forests inside the permanent forest estates in Borneo (33,170,839 ha or 45.5% of Borneo except for Brunei) likely proceeds unless sustainable management policies are adopted and implemented as well as law strictly enforced.
3. Repeated occurrence of severe droughts (equivalent to the 1998 El Nino drought) may drastically reduce the above-ground biomass of the permanent forest estate and the net carbon loss can be as high as 50 ton carbon per ha. Combined effects of droughts and logging will further exacerbate the degradation of the forests.
4. Effects of fire will remain for a prolonged time in the future even if burning stops. Mortality of the remaining trees in burnt forests will remain high and droughts will prevent the burnt forests from recovering.

5. Reduced forest cover or stature may increase stream discharge and will change the hydrological cycles.
6. Upstream land uses may increase the total annual water yield, which in turn increases the total sediment yield in the downstream mangrove ecosystems. Such effects cause a change in the structure and function of the mangrove ecosystems, which are viable as nursery ground for many marine animals and thus will strongly affect fishery.
7. Poor logging practices reduce the biological diversity and above-ground biomass in the residual forest stands, while reduced-impact logging can maintain the diversity and biomass at the level comparable to a pre-harvest status.
8. Low level of environmental awareness may constraint achievements under the goals of sustainable forest management.
9. All these facts and projections taken into account, only 16.1% area of the terrestrial ecosystems (or 11.77 million ha; extant and proposed totally protected areas) of Borneo will remain relatively intact and provide healthy ecosystem services while virtually all other areas become non-forest categories or heavily degraded forests in the near future (Brunei not counted) (worst scenario).
10. If sustainable forestry is implemented, the rate of forest degradation will be ameliorated in 33.17 million ha or 45.5% of Borneo (Brunei not counted) (optimistic scenario). Upstream land uses will inevitably cause the degradation of downstream estuary mangrove ecosystems. However, virtually all ecosystems will be influenced by the global warming accompanying droughts irrespective of management.

Adaptations/Mitigations

1. Protected areas need to be increased, in particular, those found in isolation need to be connected to larger fragments to gain synergy of governance and sustainability.
2. Threats to protected areas need to be addressed i.e. development, population pressure, urban growth, uncontrolled tourism, natural disasters, agricultural developments, etc.
3. As a matter of land-use policy, permanent forest estates (PFE) should be established or maintained and protected by law. Thus, PFE should be designated for the permanent maintenance of forest cover.
4. Sustainable forestry needs to be adopted and implemented within each forest reserve. At the core is the balanced allocation of lands between intensively cultivated forest plantations and extensively managed natural forests.
5. Adaptation actions need to be considered at the forest level, including gene management, forest regeneration, forest silviculture and management, as well as pest and disease control.
6. Forest management in Borneo needs to adopt and develop mechanisms based on the international

framework to reduce carbon emissions from deforestation and forest degradation (REDD).

7. Reduce the discrepancies between central-local governments' interests that put pressure on the forests such as transmigration, expropriation and resulting frictions, thus leading to elevated deforestation rates, e.g. by the use of fire for land clearing.
8. There is a need to create greater access to eco-friendly markets for forest products.
9. Local communities are an important part of the forest landscape and their farming practices must be based on mechanisms that reduce emissions from agriculture, forestry and other land use activities.
10. Forest managers and policy makers must adopt an integrated ecosystem management based on an "eco-regional concept" to maximize the chances of capturing all conservation targets in sufficient number and distribution for their long-term survival.
11. The role of third party certification in forest management will help advance best practices, and need to be promoted among forest owners.
12. The Roundtable Sustainable Palm Oil (RSPO) initiative will guide existing oil palm plantations to best management practices, however, should not be construed as an encouragement to convert natural forests to new oil palm plantation.
13. There is a need to improve societal education level and raise environmental awareness to support the goals of sustainable forest management.
14. Knowledge production and policy decision on land-use change must be based on research results, and there is a need for greater investment in research.

Scientists concerned with the biological conservation and sustainable forest management of Borneo formed the Borneo Sustainability Forum in 2007 and received a grant from JSPS Asia-Africa Science Platform Program "Building a center for ecosystem ecology to develop societal adaptability for the land-use change in tropical rain forests (2007-2009). It is a voluntary group of scientists in the fields of forestry, natural history, ecology and conservation from Brunei, Indonesia, Malaysia and Japan. The goals of the forum are to study present and future land-use patterns and their consequences, and to suggest societal adaptations for policy makers with shared scenarios across political borders of Borneo. The forum organized a series of three annual seminars entitled "Land-use Change and Societal Adaptation under Global Climate Change in Asian Tropical Rain Forests." Land-use data and suggestions were compiled from these seminars by the following writing team.

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