

## **Tropical Forest Biodiversity and the World Heritage Convention**

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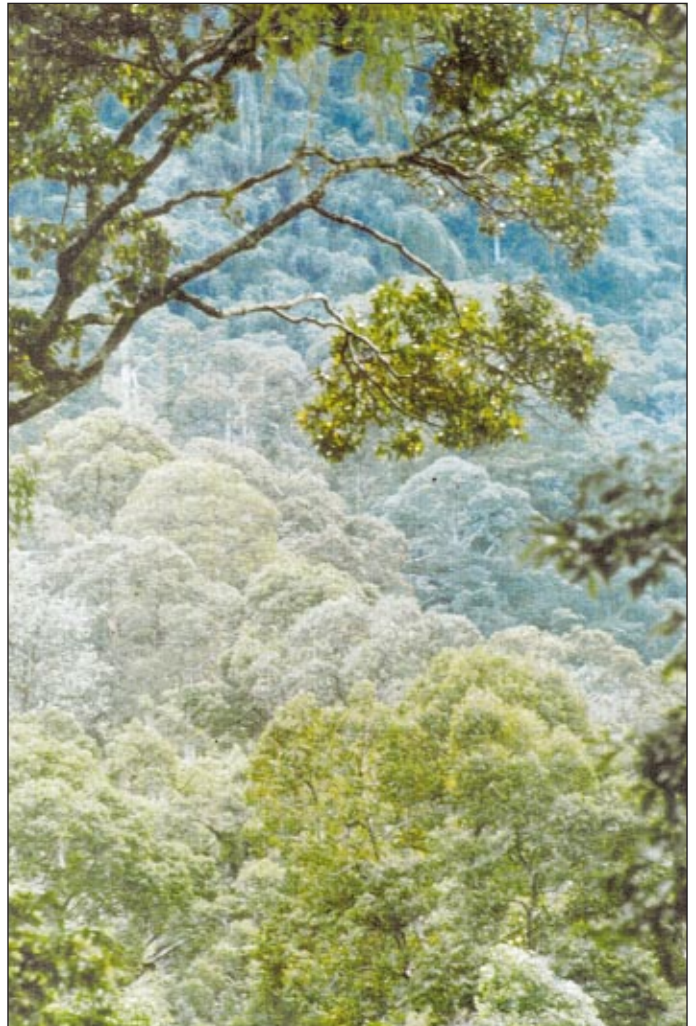
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# Tropical Forest Biodiversity and the World Heritage Convention

The World Heritage Convention has been ratified by 158 countries and provides an international legal regime for the conservation of sites of global cultural or natural value. There are 33 tropical forest sites listed under the convention, mainly for their global biodiversity value. They constitute an elite set of biodiversity sites covering approximately 2.5% of the world's closed tropical forests and making a significant contribution to the conservation of the world's terrestrial biodiversity. A range of international initiatives will eventually provide a framework for better conservation and sustainable management of forests worldwide, but the World Heritage Convention provides an existing mechanism which could quickly be mobilized to safeguard the most important forests. In the past sites were selected for listing under the convention if they were perceived to have minimal human impact. However, all forests are modified by humans and we contend that modification need not be inconsistent with the maintenance of global biodiversity values. The convention could have greater impact if it addressed more directly the reality of the ubiquitous human modification of forests. This could be achieved through use of more adaptive forms of management based on objective criteria and indicators to define tolerance of change and trigger management responses to achieve desired biodiversity outcomes. We conclude that an optimal list of world heritage tropical forest sites might include up to 100 sites or clusters of sites and that such a network of sites could effectively protect a high proportion of the world's forest biodiversity. The present rate of attrition of the world's tropical forests suggests the need for urgent international action to focus on a set of priority sites and the World Heritage Conservation could provide the best international framework for such action.

## INTERNATIONAL TROPICAL RAINFOREST CONSERVATION

The depletion of tropical rainforests became an international concern during the 1970s. The first attempt at quantifying the loss of tropical forests was in a paper by Sommer (1). In the late 1970s, international campaigns initiated by the World Wide Fund for Nature (WWF) and the International Union for the Conservation of Nature (IUCN) to conserve tropical forest primates highlighted the biological consequences of rainforest destruction. Then in 1980, FAO made available the preliminary results of their initial forest resources assessment. That same year, President Carter's Global 2000 initiative articulated for the first time the scale and potential consequences of tropical deforestation on a global scale. The following year, the World Conservation Strategy raised the issue of tropical forests to a prominent level and since then international activity has continued. The Tropical Forestry Action Plan (TFAP) was launched in 1985 and the International Tropical Timber Agreement (ITTA) was negotiated the following year. The Brundtland Commission highlighted the importance of tropical forests in its 1987 report. At the end of the 1980s, dissatisfaction with the approach of the TFAP led to suggestions for a tropical forest convention. The importance of tropical forests was raised again during the preparatory processes



An example of a forest in the foothills of the Maninjau Area in West Sumatra, Indonesia, which is almost entirely composed of planted fruit and latex bearing trees. These highly biodiverse forests could qualify for World Heritage listing as globally significant examples of exemplary human stewardship of forests. Photo: G. Michon.

for the 1992 United Nations Conference on Environment and Development (UNCED) at Rio de Janeiro. UNCED failed to reach a consensus on the question of an international forest convention and instead adopted a set of Forest Principles. Following the Rio conference, the Intergovernmental Panel on Forests (IPF) continued the debate and there is now an ongoing international policy dialogue under the aegis of the Intergovernmental Forum on Forests (IFF).

Throughout this period enormous amounts of money have been spent on tropical forest conservation. For example, although the ambitious targets of the Tropical Forest Action Plan were never reached, it is claimed to have generated over a billion dollars a year in forestry projects, many of which were for forest conservation. Chapter 11 of Agenda 21 adopted by the Rio Summit recommended that significant international financial resources should be made available for forest conservation. A more modest, but not inconsiderable, amount has now been disbursed

in support of the forest conservation objectives of Agenda 21 through the Global Environment Facility (GEF). Further, the International Convention on the Conservation of Biological Diversity (CBD), which was adopted at the Rio Summit, has acknowledged the important link between forests and biodiversity conservation. The CBD has brought about changes at the policy level but has yet to sponsor concrete conservation measures on the ground. An excellent and comprehensive review of all the post-UNCED forest initiatives is provided by Grayson and Maynard (2).

The level of international interest in the conservation of tropical forests has certainly made development assistance agencies, international development banks and conservation organizations more disposed to support actions in favor of tropical forest conservation. However in spite of the amount of discussion, the volume of funding and the number of policy statements in favor of various approaches to forest conservation, the practical results on the ground have been disappointing. Examples of successful programs for the establishment of sustainable forest management programs or even for the conservation of important national parks and other protected areas are rare. Despite the increase in international awareness and commitment, deforestation has continued and any variation in its rate or pattern can probably be attributed to the economic circumstances and actions by civil society in the countries concerned rather than to international conservation actions (3). In short, very large numbers of conservation projects have been executed but with only limited and local success (4–6).

## THE WORLD HERITAGE CONVENTION

Since its inception, the World Heritage Convention (WHC) has been little mentioned in the context of tropical forest conservation. Yet since its ratification in 1972 a truly outstanding set of forest sites throughout the tropics have been inscribed under the Convention. The WHC has not generated resources to support the conservation of these sites at an operational scale but it has intervened in a number of situations to help national conservation agencies maintain the integrity of listed sites. The WHC is already mandated to address many of the issues that are subject to negotiation under the present international forestry processes. The convention has now been ratified by 158 countries and it could provide a framework for addressing many of the goals that the other international processes are failing to achieve.

In order to assess the potential for increasing the impact of the WHC in pursuit of tropical forest conservation a group of conservation experts met at Berastagi in N. Sumatera in December 1998 with the following objectives:

- to analyze the present list of tropical forest sites on the World Heritage List and assess their value;
- to review the conservation problems of these sites and assess the ways in which the Convention could help to solve them;
- to identify gap areas and develop a list of potential sites which may merit consideration for future nomination to the world heritage list;
- to examine the need for more science-based criteria and indicators to evaluate and protect World Heritage tropical forest sites; and
- to increase awareness of the role of the World Heritage Convention in the conservation of tropical forest biodiversity; and explore ways in which it could be the basis for expanded activity to achieve real operational conservation of a network of the world's most important tropical forest sites.

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) adopted the World Heritage Convention (WHC) in 1972, and it came into force in 1975. In 1978, the World Heritage Committee began inscribing natural sites of "outstanding universal value" on the World Heritage List. Currently,



**Tropical forest biodiversity has evolved in the presence of continued human modification of forests over several millennia. These Dayaks in the forests of Borneo manage the forests and their biodiversity in a variety of subtle ways with the result that they obtain numerous benefits from the forest but high levels of biodiversity remain.**  
Photo: A. Compost.

158 countries have ratified the WHC and the list of natural sites has increased to 142. The international regime under which the WHC operates consists of the World Heritage Committee and the World Heritage Fund, both of which are administered by the World Heritage Centre at UNESCO in Paris. The World Heritage Committee, established under Article 8 of the WHC, is made up, at any one time, of representatives of 21 state parties to the Convention and meets each year to review the status of existing listed sites, consider nominations for the inscription of new sites and to authorize grants from the World Heritage Fund for conservation or rehabilitation measures at sites under threat. The World Conservation Union (IUCN) acts in an advisory capacity to UNESCO and the World Heritage Committee regarding natural sites.

## EXISTING WORLD HERITAGE SITES

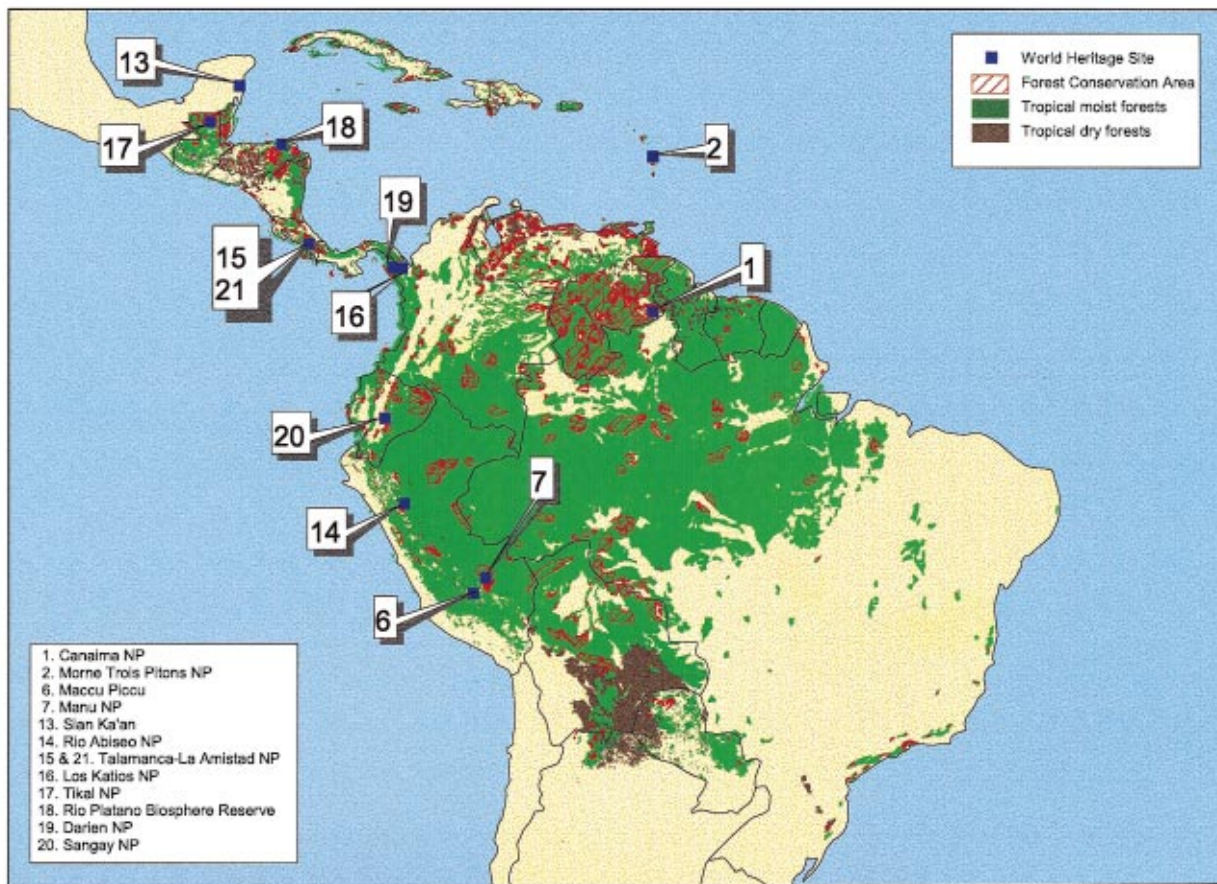
We have conducted an analysis of World Heritage sites which contain significant areas of tropical closed forests. The decision on whether or not to include sites in this analysis was based primarily on two criteria. First, information provided by the State Party in the nomination for World Heritage designation, and second, by overlaying World Heritage maps on world vegetation classifications from the databases held by the World Conservation Monitoring Centre (WCMC). For the purpose of this paper, we included sites if one or both of the above sources re-

vealed a 20% tropical forest cover and/or it was a primary reason why the site was nominated and inscribed on the World Heritage list. We have therefore excluded from the analysis some sites which contain fragments of closed forest even though they may have some significance for forest biodiversity. The sites we

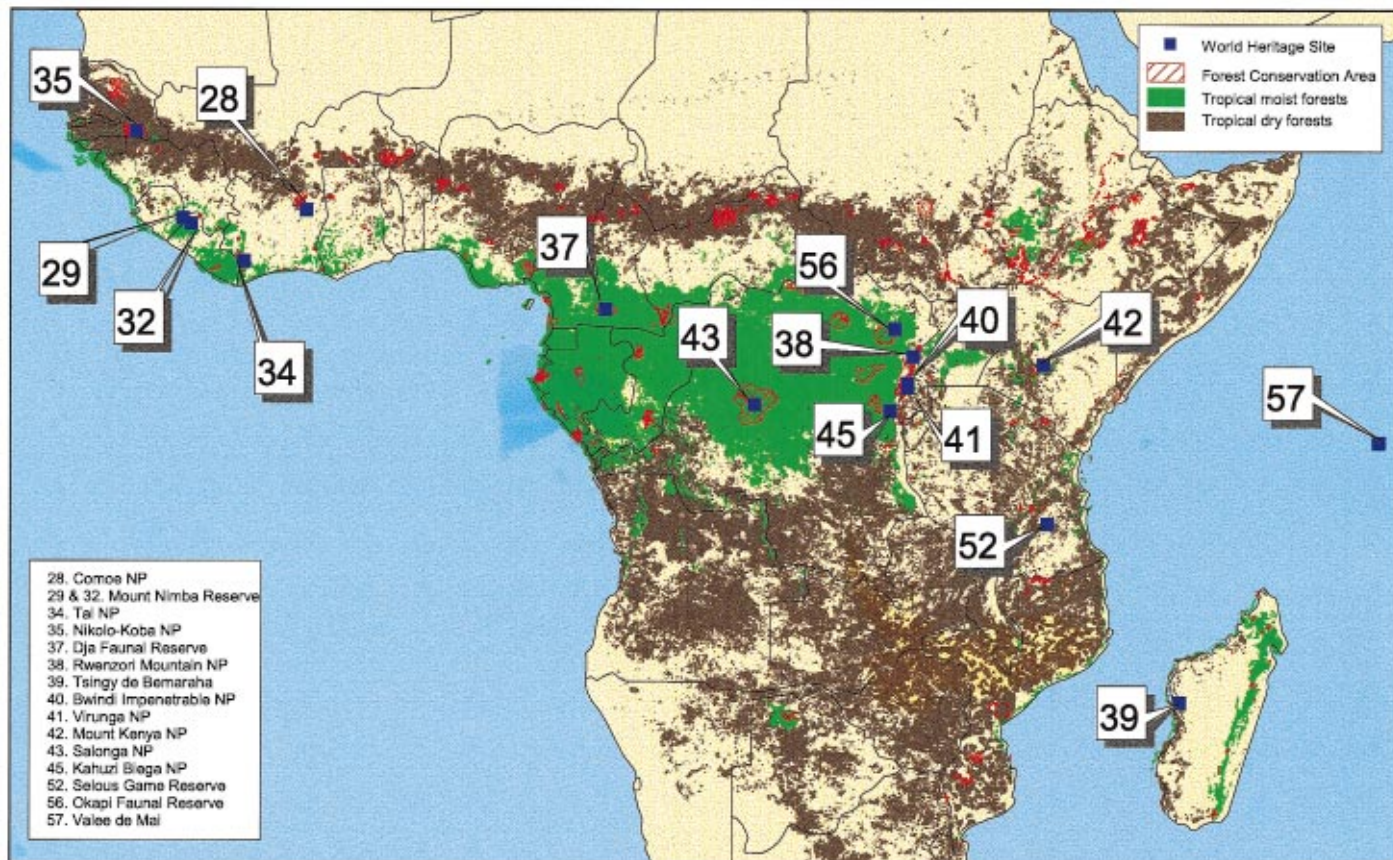
admitted for our analysis are shown superimposed on the three regional maps of tropical moist and monsoon (seasonal and dry) forests in Figures 1, 2 and 3. A list of the sites with their basic characteristics is given in Table 1.

It is difficult to determine accurately the proportion of differ-

**Figure 1. World Heritage natural sites and forest protected areas in Central and Latin America.**



**Figure 2. World Heritage natural sites and forest protected areas in Africa.**



ent forest types protected in existing World Heritage sites. Data sets on the world's forests are all of very coarse resolution and cannot be readily matched to the fine resolution maps of the individual sites. However, the 33 sites cover an aggregate of 24 760 493 ha or 2.35% of FAO's estimate of the area of the world's closed tropical forests. Table 2 gives an approximate estimate of how the sites are distributed between some major forest categories and these figures are aggregated in Table 3.

### BIODIVERSITY OF TROPICAL RAINFORESTS AND WORLD HERITAGE STATUS

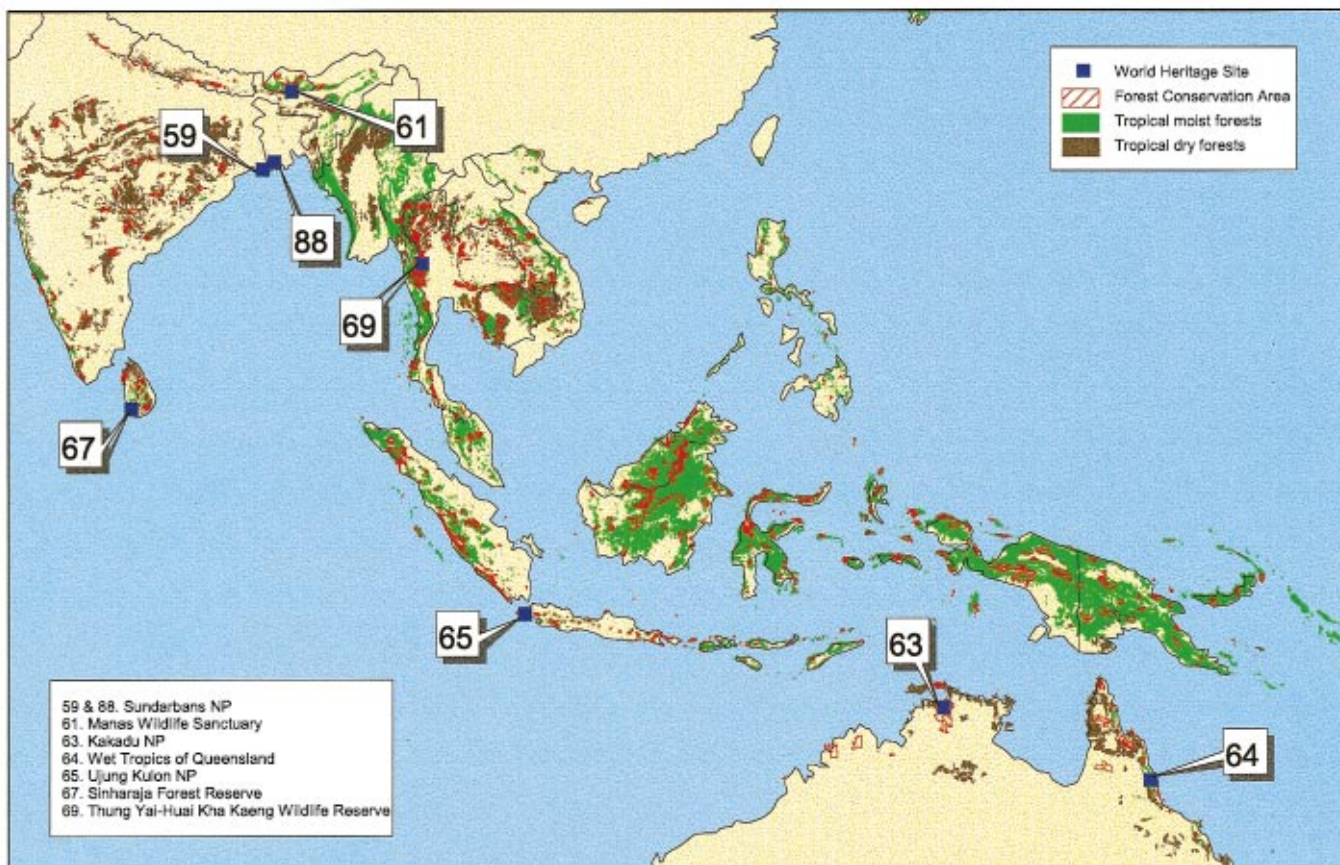
A major reason for the international concern about the loss of tropical forests is their high biodiversity value. Biodiversity has been the single most important criteria in selecting forest sites for inclusion in the World Heritage list. Tropical forest sites have been nominated and inscribed on the World Heritage list under criteria *ii* and *iv* in paragraphs 43–45 of the Operational Guidelines (7), which stipulate that sites must be of “outstanding universal value for the conservation of biological diversity”. It would, therefore, be instructive to do an analysis of the extent to which the total species and ecosystem diversity of tropical forests is covered in the existing network of sites. Unfortunately, the biodiversity of tropical forests is so poorly documented that such an analysis is only possible in very general terms. IUCN's Natural Heritage Program is currently attempting a Global Overview of the Biodiversity of World Heritage Natural Sites. However, anecdotal evidence and published studies for Africa (8, 9), suggest that a remarkably high proportion of the world's forest vertebrates may be protected in the existing tropical forest World Heritage sites. Therefore, it seems reasonable to conclude that this would also apply to other groups of animals and plants.

Much of the concern about the conservation of forest biodiversity in protected areas has centered on the potential impacts of the fragmentation of the forests. Some authors such as Myers (10) have implied that any fragmentation of forests will

**Table 1. World Heritage tropical forest sites classified by region.**

World Heritage tropical forest sites	Country	Year inscribed	Size (ha)
<b>ASIA/OCEANIA</b>			
Wet Tropics of Queensland	Australia	1988	894 420
Ujung Kulon	Indonesia	1991	78 359
Manas	India	1985	39 100
The Sundarbans	India/Bangladesh	1987/1997	728 000
Sinharaja	Sri Lanka	1988	8864
Thungyai – Huai Kha Khaeng	Thailand	1991	622 200
	<b>Total</b>		<b>2 370 943</b>
<b>CENTRAL and SOUTH AMERICA</b>			
Morne Trois Pitons	Dominica	1997	6857
Sangay	Ecuador	1983	271 925
Los Katios	Colombia	1981	72 000
Darien	Panama	1994	597 000
Talamanca -La Amistad	Costa Rica/Panama	1983	791 592
Tikal	Guatemala	1979	57 600
Río Platano	Honduras	1992	500 000
Sian Ka'an	Mexico	1987	528 000
Machu Picchu	Peru	1983	32 592
Manu	Peru	1987	1 532 806
Río Abiseo	Peru	1990	274 520
Canaima	Venezuela	1994	3 000 000
	<b>Total</b>		<b>7 664 892</b>
<b>AFRICA</b>			
Dja	Cameroon	1987	526 000
Mount Nimba	Côte D'ivoire/Guinea	1981	18 000
Comoé	Côte D'ivoire	1983	1 149 250
Tai	Côte D'ivoire	1982	330 000
Virunga	Dem. Rep. Congo	1979	790 000
Kahuzi-Biega	Dem. Rep. Congo	1981	600 000
Salonga	Dem. Rep. Congo	1984	3 600 000
Okapi	Dem. Rep. Congo	1996	1 372 625
Mount Kenya	Kenya	1997	142 071
Tsingy Bemaraha	Madagascar	1990	152 000
Niokolo-Koba	Senegal	1981	913 000
Vallée de Mai	Seychelles	1983	20
Selous	Tanzania	1982	5 000 000
Bwindi Impenetrable Forest	Uganda	1994	32 092
Rwenzori Mountains	Uganda	1994	99 600
	<b>Total</b>		<b>14 724 658</b>
<b>33 World Heritage tropical forest sites</b>			<b>24 760 493</b>

**Figure 3. World Heritage natural sites and forest protected areas in Asia and Australia.**



lead to large-scale loss of species. However, more recent studies (11, 12) suggest that this may not be the case and that protected areas of the size of most World Heritage sites are large enough to conserve populations of most forest species at least for the time scales with which conservationists are immediately concerned (decades or centuries). The sizes of tropical forest areas on the World Heritage list vary greatly, ranging from the 20

ha forest in Vallee de Mai Nature Reserve in the Seychelles to the 5 million ha Selous Game Reserve in Tanzania. But the majority of the 33 sites are over 0.5 million ha and the average size is 807 348 ha, well above the size range postulated by Zuidema et al. (12) as being ecologically viable in the medium term.

Recent papers by Sayer (3) and Palo (13), discuss the widely observed phenomenon of the increase in forest area that occurs in countries or regions when they exceed minimum thresholds of economic and social development. For example, at early stages of economic and social development, countries invariably suffer a decline in forest cover as there is often high demand for land for extensive agriculture. However, as the economy grows, governmental institutions and civil society strengthen, and a higher proportion of the population moves into manufacturing or services, this often leads to an increase in the area of forest (Fig. 4).

The challenge of forest conservation in developing countries is not necessarily to maximize forest extent, rather it is to ensure that the "building-blocks" for reconstituting optimal forest cover remain available. The building-blocks which are most at risk in tropical developing regions are the genes and species that compose their indigenous biodiversity. Thus, the main short- to medium-term challenge facing the conservation community is to conserve a network of tropical forest sites which contain as much of the world's forest biodiversity as possible. These areas will provide the basis for reconstituting forest when, hopefully, countries attain a level of economic and social development more favorable to the maintenance of extensive natural forest cover and the tendency towards deforestation in the tropics will be reversed. Our contention is that the World Heritage Convention has greater potential to achieve this goal than any of the other international forest conservation initiatives either in existence or under discussion.

#### AN OPTIMAL WORLD HERITAGE LIST

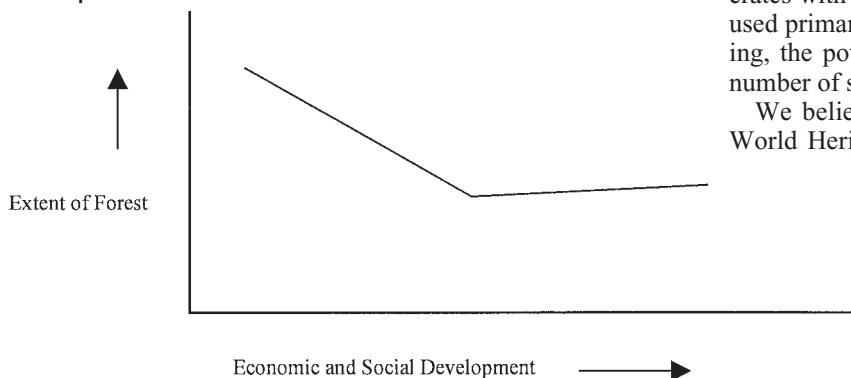
This leads us to the question of how many natural sites should optimally be listed on the World Heritage Convention. Over the initial 25 years of the Convention this was not a major issue. Only about 10 sites were nominated per year and only 50% of them were admitted to the list. However, there are over 140 natural sites currently on the list and indications of a recent increase in the rate of nominations by State Parties. In exploring this issue, we are assuming that there will be an inverse relation between the number of sites and the political will and financial resources that can be mobilized in support of their conservation. There will be a general tendency for the establishment of any new protected area to incur opportunity costs for existing areas by competing with them for conservation management resources. More sites may mean less intensity of management effort for all other sites. We postulate that this principle will apply at all levels from local to global and that it will mean that there will be a general inverse relation between number of sites and quality of sites (12). For instance, the World Heritage Fund currently operates with a budget of less than USD 3 million per year and is used primarily to respond to emergencies. At this level of funding, the potential for providing meaningful support to a large number of sites is clearly limited.

We believe that for tropical forests the optimal number of World Heritage sites should be defined in terms of the incre-

**Table 2. World Heritage tropical forest sites classified by major forest type.**

Area name	Country	Size (ha) IUCN List*
<b>Mangrove</b>		
Sundarbans National Park	India/Bangladesh	728 000
<b>Total /28 000</b>		
<b>Montane rain forest</b>		
Morne Trois Pitons	Dominica	6857
Machu Picchu	Peru	32 592
Sangay National Park	Ecuador	271 925
Talamanca Range-La Amistad Reserves	Costa Rica/Panama	791 592
Mount Nimba Reserves	Côte D'ivoire/Guinea	18 000
Bwindi Impenetrable National Park	Uganda	32 092
Mt. Kenya National Park	Kenya	142 071
Canaima National Park	Venezuela	3 000 000
Rwenzoti Mountains National Park	Uganda	99 600
<b>Total 4 394 729</b>		
<b>Lowland rain forest</b>		
Sinharaja Forest Reserve	Sri Lanka	8864
Wet Tropics of Queensland	Australia	894 420
Ujung Kulon National Park	Indonesia	78 359
Thung Yai-Huay Kha Kaen Wildlife Sanctuary	Thailand	622 200
Los Katios National Park	Colombia	72 000
Río Platano Biosphere Reserve	Honduras	500 000
Tikal National Park	Guatemala	57 600
Virunga National Park	Dem. Rep. Congo	790 000
Kahuzi-Biega National Park	Dem. Rep. Congo	600 000
Tai National Park	Côte D'ivoire	330 000
Salonga National Park	Dem. Rep. Congo	3 600 000
Okapi Faunal Reserve	Dem. Rep. Congo	1 372 625
Sian Ka'an	Mexico	528 000
Dja Faunal Reserve	Cameroon	526 000
<b>Total 9 980 068</b>		
<b>Sub-montane rain forest</b>		
Manu National Park	Peru	1 532 806
Darien National Park	Panama	597 000
Río Abiseo National Park	Peru	274 520
<b>Total 2 404 326</b>		
<b>Lowland monsoon and dry forest</b>		
Selous Game Reserve	Tanzania	5 000 000
Comoé National Park	Côte D'ivoire	1 149 250
Niokolo-Koba National Park	Senegal	913 000
Vallee de Mai Nature Reserve	Seychelles	20
Tsingy Bemaraha Nature Reserve	Madagascar	152 000
Manas Wildlife Sanctuary	India	39 100
<b>Total 7 253 370</b>		
<b>Total area, all forest types 24 760 493</b>		

**Figure 4. Schematic representation of the inflexion in the forest area curve which occurs when thresholds of economic and social development are exceeded.**



**Table 3. Closed forest World Heritage sites as a percentage of existing world forest cover (Extent of forest area based on CIFOR data derived from figures from FAO and WCMC).**

Forest category	Total area (ha)	Area covered in the WHS (ha)	% of area covered
Mangrove	15 754 282.10	728 000	4.62%
Montane rain forest	82 823 814.35	4 394 729	5.31%
Lowland rain forest	878 380 606.01	9 980 068	1.14%
Sub-montane rain forest	37 311 847.43	2 404 326	6.44%
Lowland monsoon and dry forest	37 377 966.27	7 253 370 *	19.41%
<b>Total</b>	<b>1 051 648 516.16</b>	<b>24 760 493</b>	<b>2.35%</b>

\*These high figures result from the inclusion of the very extensive Selous Game Reserve, Comoé National Park and Niokolo-Koba in the lowland monsoon forest category. In reality, these sites are all at the dry limit of vegetation which can be realistically described as forest. However, on FAO generalized world forest maps, they do fall into the Monsson category.

**Table 4. Key indicators of forest biodiversity.**

**Genetic level**

- Spatial/temporal changes in levels of genetic variation
- Directional change in allele/genotype frequencies
- Capacity for migration among populations
- Changes in reproductive system

**Population/species level**

- Temporal changes in community guild structures
- Temporal changes in selected (indicator) taxa
- Changes in population structure of key taxa

**Habitat level**

- Changes in nutrient cycling/decomposition
- Changes in water quality and quantity
- Temporal changes in habitat diversity

**Landscape level**

- Changes in area of each vegetation type
- Changes in landscape patterns (connectivity, dominance, edges)

mental increase in coverage of biodiversity obtained with each additional listing. This could be determined by reviewing the biodiversity of existing World Heritage tropical forest sites and determining the minimum number of additional sites needed to attain coverage of all the major forest biomes or eco-floristic zones. We postulate that an appropriate and achievable threshold for the three forest types which are the most biodiverse (lowland, sub-montane and montane rainforest) might be 3–5% of the 1999 total global extent of the forest type. A relatively modest number of additional World Heritage sites would be needed to reach this target (Table 3). We believe that such coverage would ensure the protection of a major proportion of the world's forest biodiversity under the World Heritage Convention. The most significant omissions from the present set of World Heritage forest sites are the forests of the Amazon Basin, the Western Ghats of India, Peninsular and Insular Southeast Asia, particularly the islands of Borneo, Sumatra and Sulawesi, the island of New Guinea, the larger forested areas in the islands of Oceania and the moist forests of Madagascar.

On the basis of a discussion of these issues during the policy dialogue on World Heritage tropical forest sites and biodiversity conservation which took place in Berastagi, North Sumatra, in December 1998, 72 forest experts from 20 countries compiled a draft list of potential tropical forest sites for consideration for World Heritage nomination (14, 15). In preparing their list, they drew heavily on a number of maps of priority sites for forest biodiversity conservation which have been drawn up independently by conservation organizations focussing on general habitat conservation and on groups such as birds, primates and higher plants. There is a marked convergence of priority sites derived from different types of analysis and the surprising conclusion of the meeting was that less than 100 tropical forest sites or clusters of sites worldwide were finally selected as being of truly global importance for biodiversity (14).

**CRITERIA AND INDICATORS FOR WORLD HERITAGE LISTING**

Perhaps more important than a discussion of the number of sites that should be included on the list is the need to have a much more rigorous definition of the criteria for inclusion and the indicators which might be used to both assess nominations and determine the desirability of possible de-listing. There has been considerable international attention devoted recently to the question of Criteria and Indicators for assessing various aspects of environmental management and conservation. The work that has been conducted over the past few years by CIFOR on Criteria and Indicators for forest biodiversity has considerable potential application to the World Heritage Convention (16). This research

has sought to establish Criteria and Indicators for assessing the relative value of different sites for biodiversity and more importantly the impact of changed land-use practices on the status of that biodiversity. Table 4 shows Criteria and Indicators for biodiversity which could be applied to World Heritage forest sites. Criteria and indicators should capture the biodiversity of the site at the ecosystem and species level and give some measure of the relative importance of the site viz a viz other potential sites. The second major attribute that must be assessed is the extent to which the biodiversity values are being sustained over time.

The great interest of C and I for the World Heritage Convention is that it would provide a rigorous basis for discussion of the extent to which human activities could be tolerated within sites. For decades, one of the primary criteria for selecting protected areas has been their perceived pristine status. World Heritage listing has been contingent on sites being largely covered with species-rich old-growth forest and this was usually equated with minimum human modification of the forest. However, as more information becomes available on both World Heritage sites and other tropical forest areas of high biodiversity value it is becoming apparent that many of them have been subject to much more human modification than had previously been thought (17). A recent review of the current sites reveals that many of them have significant human populations (15). Of the World Heritage natural sites located in non-OECD countries 70 of the 75 have extractive activities occurring within the borders of the protected area with poaching, agriculture, grazing, logging and mining being widespread. Furthermore, all of the 33 World Heritage tropical forest sites are subject to one or more of the above human activities.

It is also clear that human activities have been occurring for very long periods and that the present biodiversity of the sites has been maintained in spite of the human presence or may have developed in response to it. This recognition of the co-evolution of biodiversity and human societies is one of the major emerging paradigm shifts of conservation biology. For instance Soulé and Kohm (18) recognized that “[The] ubiquity of human disturbance and destruction... is dramatized by the modern convention of putting quotation marks around such words as “pristine,” and “natural.” Biologists are painfully aware that there are virtually no unpolluted, unperturbed *sanctum sanctori* left on the planet. Nature, as we observe it today, merely manifests degrees of disturbance...Indeed, there are few sites left...where one can observe something very close to pre-human nature. Nevertheless, it is important to understand that protecting biological diversity, as a practical matter, is independent of the pursuit of the Holy Grail of “pristine.” Just because a system is not pristine does not mean it is of no value for conservation. The task of

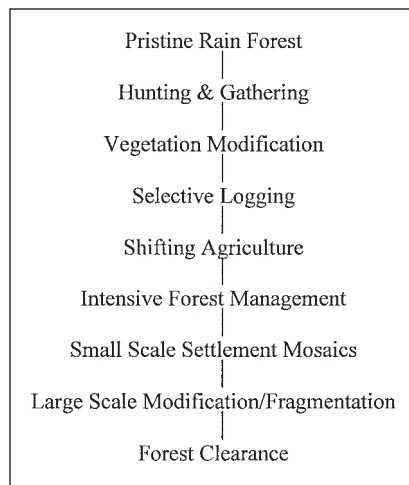
conservation is not to preserve some ideal, pristine nature. Rather, its task is to protect diversity.”

In Figure 5, we have attempted to show schematically the nature of the changes to tropical forest systems in so far as they impact on biodiversity. The existing World Heritage list includes sites at all of these stages of modification except for the last when forest cover is totally cleared. This suggests that forests can continue to have global values for biodiversity at high levels of modification and disturbance.

The tolerance limits for human activities in sites will be a fundamental issue for the World Heritage Convention in the future. In virtually every tropical forest studied to date there is evidence that the present state of the forest has resulted from varying degrees of human use over periods of up to several thousand years. Studies in Sumatra and Kalimantan, for instance, have shown that forests which had been considered pristine are in fact subject to sophisticated ongoing but subtle management by local communities (17). Conservation practitioners tend to focus on contemporary impacts such as conversion for agriculture, road building, commercial logging, mining, etc. However, it would be more objective, culturally neutral and useful for management if we focussed on the impact of intervention on biodiversity rather than on the nature of the intervention. Thus, for some types of biodiversity even very minor interventions may be inconsistent with conservation. In other situations, major human activities may be consistent with the maintenance of the biodiversity values of a site. We believe that if criteria are adequately defined and indicators are developed, there is no inherent reason why sites which are subject to major human interventions should not be retained on the World Heritage list (14). The essential criteria should be to demonstrate that the biodiversity values of the site are being maintained or have not degraded below their condition at the time of inscription on the World Heritage list (7; Operational Guidelines paragraphs 76–79). A number of recent reviews have emphasized both the value of modified landscapes for biodiversity conservation and the potential of practical management intervention, to enhance and sustain this biodiversity (19–21).

A recent WWF-IUCN policy paper presented to Earth Summit II in June 1997 (22) provides interesting perspectives on the question of conservation in modified or managed habitats. It points out that the different categories of protected areas recognized by IUCN contribute to biodiversity conservation in different ways. Allocation of forests to IUCN’s strictly protected categories I and II will provide greater protection for biodiversity than allocation of the same area to the managed or modified categories V and VI. But the opportunity costs, in terms of local and national income foregone, are much lower in the categories where some human activities are permitted. It is easier to achieve 10% coverage of protected areas in the less stringently protected areas than it is in the strict nature reserve and national parks categories. This reality is recognized in countries such as the United Kingdom, France and Indonesia where the term national park is defined to include areas in IUCN’s category VI “Managed Resource Protected Area” or category V “Protected Landscape.” Our contention is that many existing World Heritage forest sites are *de facto* Protected Landscapes or Managed Resource Protected Areas, and that this reality should be given legitimacy under the convention. We would further argue that whereas viable models exist for protected areas in the strictly protected categories I and II, the problems associated with biodiversity conservation in the multiple-use categories V and VI are much more complex and few good management models exist, especially for the tropics (14).

Our basic thesis is that the World Heritage Convention will not make its maximum potential contribution to conservation if it simply awards accolades to pseudo-pristine sites that have achieved exemplary protection status. Its real potential impact



**Figure 5. Degrees of modification of tropical forests. Biodiversity can continue to be of global value under all levels of modification, except total clearance.**

will be through being an effective mechanism to help globally significant sites achieve appropriate exemplary management. If the greatest challenge is to achieve exemplary management in sites in categories V and VI then such sites should be a target for future listing on the World Heritage Convention. Criteria and Indicators will be essential components of the identification and management of such sites. They will also be essential tools to provide the management feedback needed to permit the adaptive management that is essential to fine tune conservation programs and reconcile productive and protective functions.

We believe that further negotiation and research is required in order to establish a broadly accepted set of Criteria and Indicators for existing and potential World Heritage forest sites. A number of techniques for assessing the status and monitoring the changes in biodiversity exist or are under development and these have potential for application to global monitoring programs for World Heritage sites (23, 24).

## THE MANAGEMENT OF WORLD HERITAGE SITES

The underlying premise that World Heritage forest sites should be as “pristine” and undisturbed as possible, may have led to the perception that the only management for World Heritage sites should be to protect them against all human interventions except for limited ecotourism. We believe that this view of management of World Heritage sites should be re-examined as forests become more fragmented and the pressures upon them increase. Simple protection will not often result in the maintenance of the status quo and the retention of the values for which sites have been established. Picket and White (25) have pointed out the “essential paradox of wilderness conservation is that we must seek to preserve what must change”. Some change in World Heritage sites is inevitable and this is not necessarily undesirable, however, it is important that we have the capacity to manage so as to maintain the values of the site within limits which are predetermined. Holling and Meffe (26) have pointed out that “ecosystems are moving targets with multiple potential futures that are uncertain and unpredictable. Therefore, management has to be flexible, adaptive and experimental”. Nowhere is this more true than in a global network of World Heritage tropical forest sites. It will not be possible for the tolerances of management to be determined at a global level, rather what should be determined globally is the tolerance of change. It will be necessary that scientists continually monitor the condition of biodiversity within the sites and that there is a capacity to intervene in order to direct the evolution of the systems and minimize any degradation of their values. It is inevitable that interventionist management will be required as listed sites become more isolated from other bodies of forest. Changes in the frequency of genes within populations of animals and plants will occur, major cata-



strophic events will threaten some components of biodiversity, invasive species will begin to pose a danger and global climatic change will pose threats about which we can only at present speculate.

## DISCUSSION

The objective of this paper is to support the greater use of the World Heritage Convention in conserving the world's tropical forest biodiversity. Whilst we fully endorse the international processes that are at present underway and the eventual aim to bring all forests under sustainable management, we believe that the international conservation community may be fiddling while Rome burns. It is urgent that there should be significant action within the next decade to ensure that the building blocks for sustainable forest management are still available to our descendants. The World Heritage Convention provides a mechanism which already exists, which has international legitimacy, has a proven record in protection of tropical forest sites, and which could rapidly be mobilized to cover more sites and to intervene

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- Since this manuscript was submitted, 6 additional tropical forest sites have been added to the World Heritage list. They are East Renell, Solomen Islands 37 000 ha, Lorenz, Indonesia 3.2 million ha, St. Pauls, Philippines 20 000 ha, Guanacaste, Costa Rica 88 000 ha and the Discovery Coast 112 000 ha and S.E. Atlantic Forests 468 000 ha in Brazil.
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operationally on the ground. The WHC is unique amongst the existing forest conservation initiatives in that the results of investments in the system could be measured. The cost of a monitoring system to track the management effectiveness for World Heritage forest sites would be modest compared to the potential costs of other forest conservation initiatives that are at present under discussion. A small operations center would be required with a capacity to maintain updated scientific information on each site and coordinate with an established and growing network of experts committed to World Heritage forest protection. A fund would be necessary to intervene in support of urgent action in sites which came under threat and it is likely that technical and operational support would be required to confront the problems of some sites. We propose that this support come from the personnel of other sites in the network. (State Parties are required under the Convention and Operational Guidelines to assist in the protection of other sites on the WH list even outside of their national borders). Thus, it would be consistent with the articles of the Convention for those sites where management capacity is strongest to support those where it is weaker and threats may be higher. A global support program with a relatively modest budget could maintain the integrity of a strategically located network of, say, double the existing set of tropical forest sites (27). In the context of other global forest conservation initiatives we believe that this improved World Heritage network would provide a cost effective option to conserve a large proportion of the world's tropical forest biodiversity.

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