THE STATE OF CONSERVATION OF WORLD HERITAGE FORESTS

Marc Patry[1], Clare Bassett[2] and Benedicte Leclerq[1]

(this article will appear in the proceedings of the 2nd World Heritage Forest Meeting, held at Nancy, France, March 11-13, 2005)

INTRODUCTION

No previous systematic and standardized assessment of the state of conservation (SOC) of WH forests has been made to date, beyond the assembly of basic quantitative attributes of these sites as a group and qualitative summaries of conservation issues on a site by site basis (Thorsell and Sigaty, 1997). Though the WH Centre began orchestrating a six yearly "periodic reporting" process on the SOC of WH sites in 1999, focusing on one of 6 geographic regions annually, this process is still being improved and information so gathered is highly variable in consistency and detail, and thus not readily interpreted for the purposes of comparative temporal or spacial analyses. At the request of the WH Committee, occasional site level "reactive monitoring" missions are carried out by WH Centre and IUCN staff, during which a variety of information, under no standard format, is gathered. Some global initiatives are under way in an attempt to standardize a set of criteria across all protected areas in such a way as to permit quantitative and comparative analyses, specifically through various Management Effectiveness Assessment methodologies. These include the Rapid Assessment and Prioritization of Protected Areas Management (RAPPAM) methodology developed by WWF, the World Bank / WWF tracking tool (both further discussed in a subsequent paper in this publication) and recently the WH Centre's own Enhancing our Heritage methodology . Though they are useful, these methodologies have been applied haphazardly to only a very few WH sites to date, resulting in very limited analytical uses across WH Forest sites.

Despite these limitations, there exists information readily available to the WH Centre which permits it to monitor objective and quantitative indicators on the following attributes of WH Forests:

1. Extent and nature of WH Forest coverage

   i) Total area of WH Forests (by region, by biome)
   ii) Total forest cover within WH Forest (by region, by biome)

2. Relative importance WH Forests to global forest conservation

   iii) Ratio of total WH forest cover to total global forest cover
   iv) Ratio of total WH forest cover to total IUCN category I-IV protected forests

3. State of conservation of WH Forests

   v) Number of WH Forests on the List WH in Danger
   vi) Proportion of WH Forests on the List of WH in Danger
   vii) Threat intensity to which WH Forests are subjected
   viii) Average threat intensity for entire WH Forest network

The value of these indicators can be tracked over time, providing important information on trends, and allowing for a variety of practical analyses. All raw data used to generate the graphs in this

[1] World Heritage Centre, UNESCO, Paris.
[2] Consultant for the World Heritag Centre, UNESCO, Paris.

paper can be found in Annex 1 of this publication, and on the World Heritage Forest Programme website at: http://whc.unesco.org/en/forests.

1. EXTENT AND NATURE OF WH FOREST COVERAGE

It is possible to draw a picture of the WH Forest programme as a whole using data on the size and forest cover of WH Forest sites. Manipulating data on a regional or temporal basis provides additional information allowing for comparative analyses between regions, biomes and time. Data for two indicators can be readily obtained for this analysis:

INDICATOR 1: Total area of WH Forests

This figure represents the total surface area of sites considered as WH Forests[3]. Figures for the surface area are obtained from the WH site nomination dossiers presented to the WH Centre by national authorities. Though less accurate than the following indicator in terms of providing a measure of actual forest area enjoying WH status, this figure is more precise in that there can be little argument over its numerical value, and may also encompass broader non-forest ecosystem on which forests, or forest component species may depend for long term survival.

INDICATOR 2: Total forest cover within WH Forests:

Given the definition of WH Forest (see footnote 1 below), it is not unusual for WH forest sites to contain significant expanses of non-forest ecosystems. Though this would likely be the case for any large scale (e.g. national government, FAO) effort at measuring very large expanses of forest cover (e.g. water bodies, glaciers, rocky areas, major wetlands, prairie/open savanna ecosystems), the authors wish to be as conservative as readily available information allows them to be when citing actual forest cover figures for WH forest sites.

To this end, a desktop analysis of information available on-line from both WCMC, and from the original WH site nomination dossier was carried out in an effort to identify and quantify the non-forest area of WH forest sites. In some cases, very obvious non-forest components were removed from the total surface area of the WH forest site, leaving a significantly reduced value for the WH forest site's actual forest cover. Some egregious examples incude Lake Baikal (where the lake component alone covers 3.15M hectares, or 36% of the site's total area), some mixed land/marine sites for which the marine component is much larger (e.g. Cocos island National Park – Costa Rica, 99% non-forest cover). Though a review of all WH Forest dossiers and WCMC data sheets was carried out, final forest cover figures may not be accurate for each WH Forest site, given the frequently incomplete or inaccurate source information, or low resolution mapping. The forest cover values for each site are subject to constant improvement, and the authors welcome any information that would help them ensure greater precision.

1.1 WH Forest Coverage – Number, Surface Area and Biomes of WH Forests

The year 1997 is an arbitrary benchmark against which the current number and surface areas of WH Forests is compared, though there is some degree of rationale for having selected this year. The first published values for WH Forest coverage included all WH Forest inscribed to 1997 (Thorsell and Sigaty, 1997). It also is the baseline against which can be assessed the 1998 push to increase the coverage of tropical biome WH Forests (subsequent to the 1st WH Forest meeting – known as the Berastagi meeting). Comparing the 1997 figures with those of 2006 provides

[3] WH Forest: A World Heritage site for which the nomination file provided by State Party, or WCMC forest data reveal a substantial amount of forest cover within the terrestrial component of the site and for which forest ecosystems contribute to the site's OUV

some information on the extent and nature of changes to WH Forest representation on the WH List, and the chance to see how well the Berastagi meeting did in promoting the identification and inscription of tropical forests to the WH list. These are summarized in the following charts.

There were 64 WH Forest sites as of January 1997 (these include 1 site not initially considered under Thorsell and Sigaty's more restricted definition of WH Forest). By 2006 (subsequent to the July WH Committee meeting) an additional 28 forest sites had been inscribed (44% increase). The vast majority of these (22) were tropical forests, reflecting in large part the successful post-Berastagi efforts to increase the representation of these biodiversity rich sites on the WH list (see chart 1).

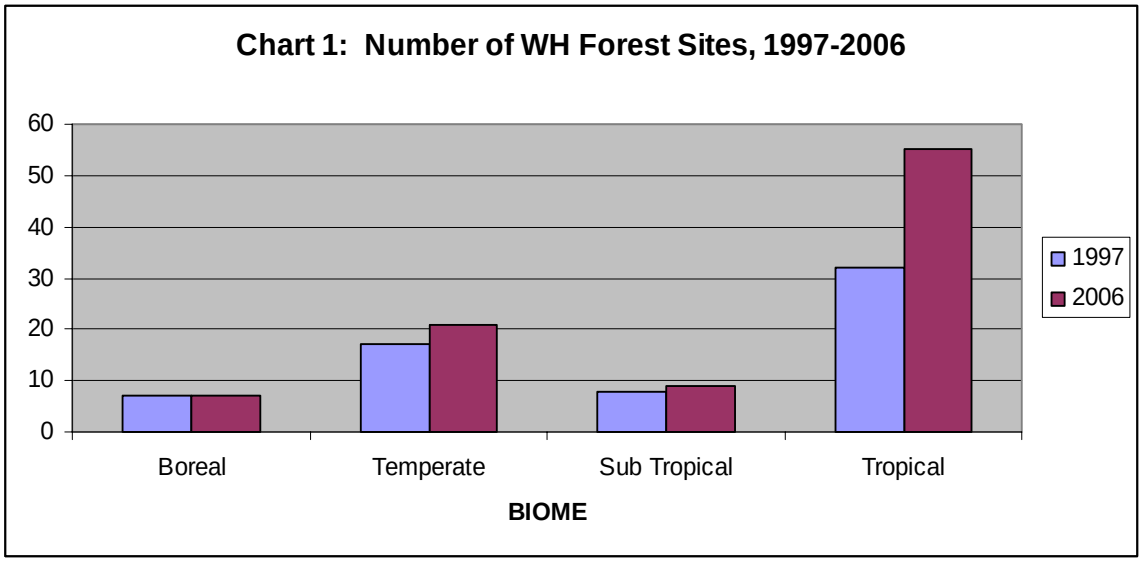
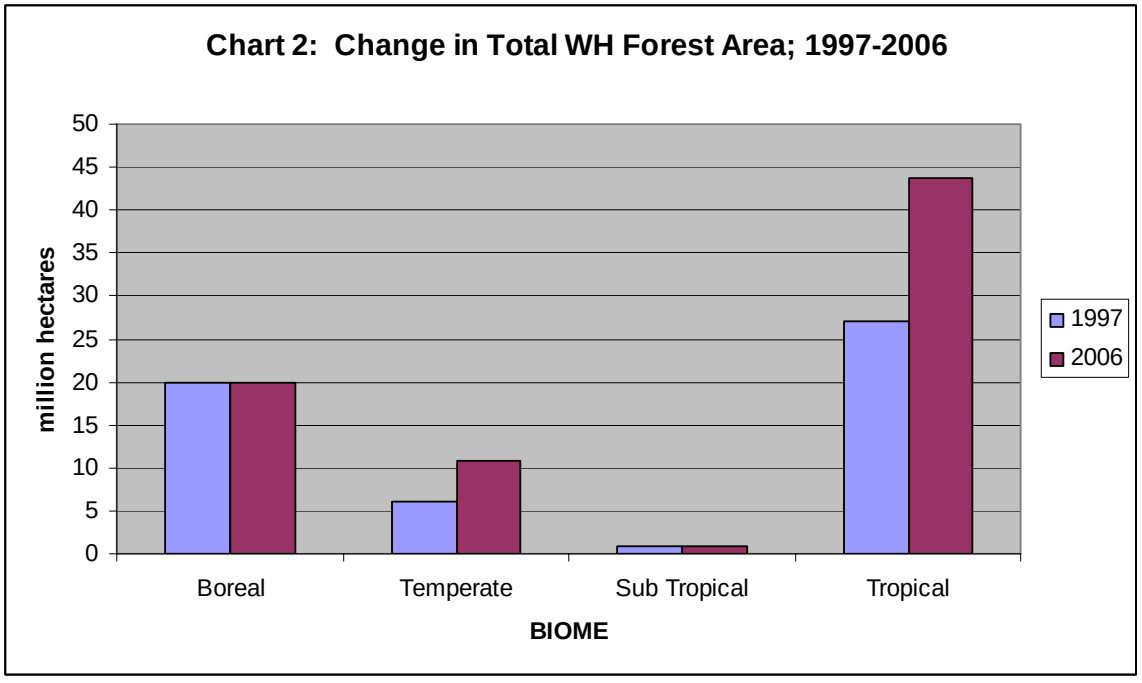


Chart 2 below illustrates that the total area of WH Forest sites increased from 53.6 million hectares to nearly 75.3 million hectares, an increase of over 22 million hectares (41%) indicating that the average size of WH Forest inscriptions since 1997 has not changed significantly (apx. 840,000 ha), though there are considerable differences in average size between forest types (see discussion in 1.3 below).



1.2 Area of Forest Cover within WH forest sites

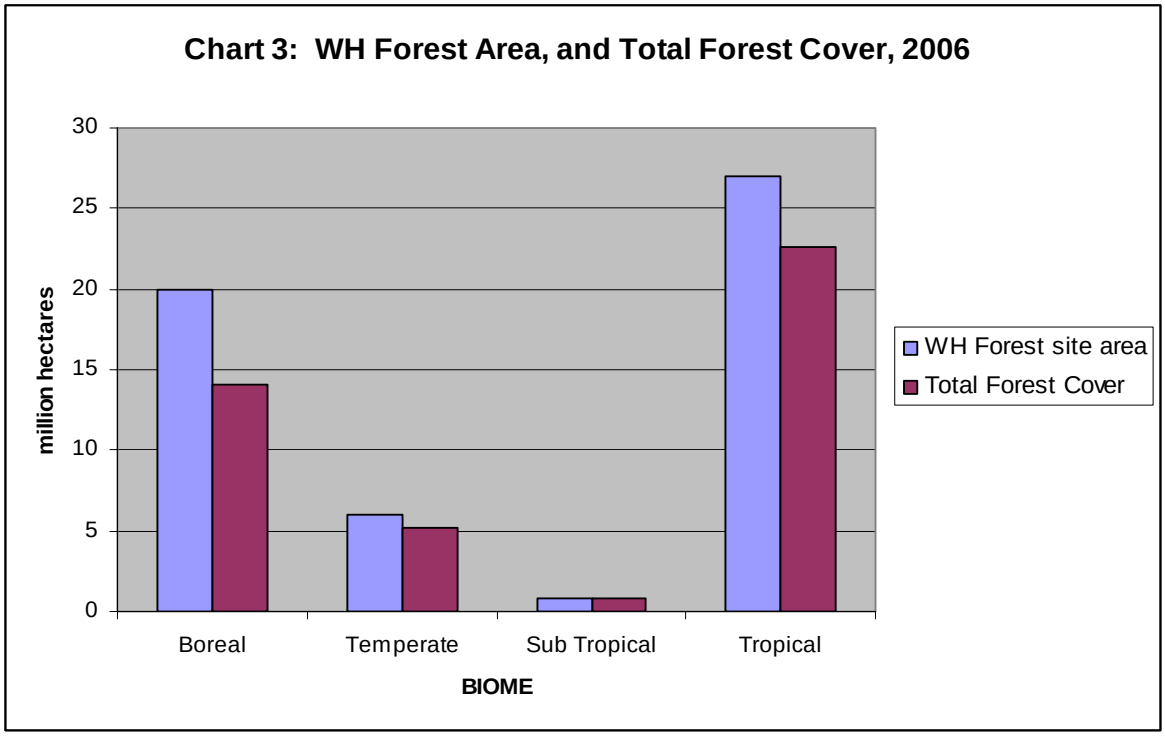


Chart 3 above compares the total surface area of WH Forest sites with the total forest cover within WH Forests, for each of the 4 main forest biomes. Whereas the total area for all WH Forest sites amounts to 75.3 million hectares, this figure drops to 63.7 million hectares when identifiable non-forest lands are removed from the total (based on available information, actual figure may be different). See annex 1 for forest cover values for individual WH Forest site.

1.3 Regional Representation

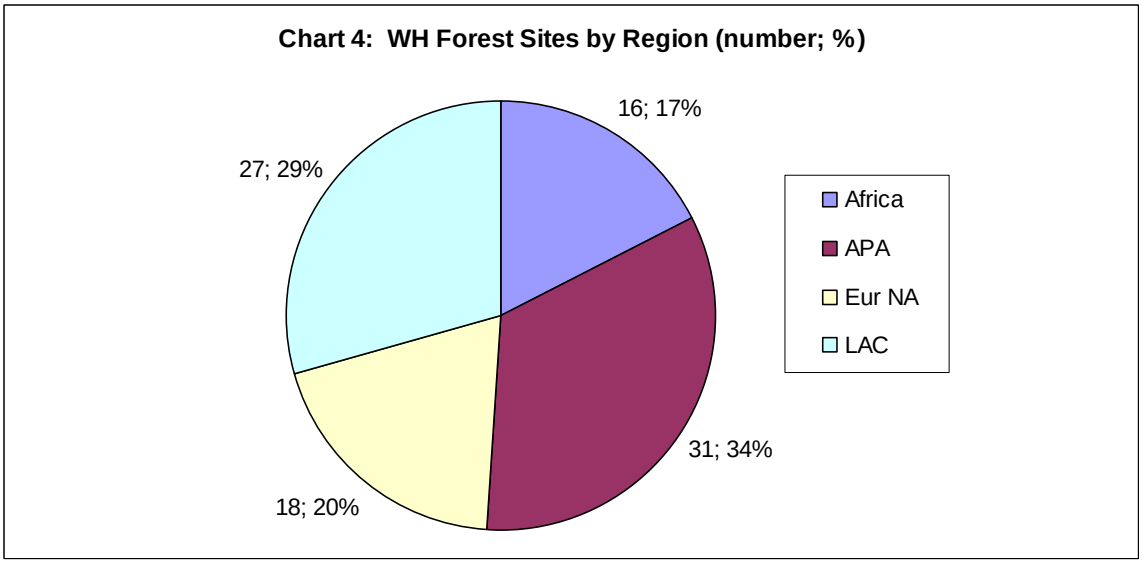
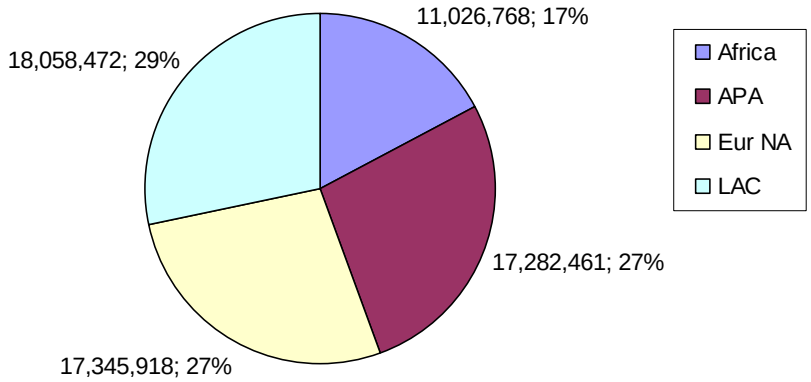


Chart 4 illustrates the regional distribution of WH Forests by number, while chart 5 illustrates it by total forest cover with WH Forests (APA = Asia Pacific, Eur NA = Europe and North America, LAC = Latin America and the Caribbean). Comparing these two charts quickly reveals how average WH Forest size is larger in the Eur NA region, and smaller in the Asia Pacific Region.

Chart 5: Total Forest Cover Within WH Forest Sites by Region (ha; %)



1.4 Average WH Forest Size

Tropical WH forests are numerous (55 out of 91), have a large average area of forest cover (707,000 hectares), and are dominated by 6 sites with more than 2.5M hectares of forest cover (Central Amazon Conservation Complex - Brazil, Selous Game Reserve - Tanzania, Canaima National Park - Venezuela, Lorentz National Park - Indonesia, Tropical Rainforest Heritage of Sumatra – Indonesia, Salonga National Park, Dem. Rep. Congo). But the smallest WH Forest sites are also represented in this group, 3 of which are under 3,000 hectares, and the smallest standing at 18 hectares (Vallee de Mai Nature Reserve - Seychelles, Cocos Island National Park – Costa Rica, Brazilian Atlantic Islands - Brazil). Being so small, they contain very little forest cover, less so than likely many natural WH sites not considered as Forest sites, and likely less than many cultural landscape sites and even some cultural sites – though in these sites, the forests are not formally recognized as contributing to their OUV, hence could not be readily expected to benefit from protection unde the WH Convention.

Table 1: WH forest cover areas in 4 biomes

Biome	Average forest cover area (ha)	Largest forest cover area (ha)	Smallest forest cover area (ha)
Tropical	707,000	6,076,000	18
Sub-Tropical	101,000	370,000	3,984
Temperate	446,000	2,000,000	15,400
Boreal	1,900,000	5,650,000	162,450

Subtropical WH forests are much fewer in number (9 out of 89) with a comparatively much smaller area (average forest cover of 101,000 hectares), I likely reflection of the relative scarcity of such forests on the planet.

The few boreal WH forests (7) are dominated by the vast Lake Baikal (Russia) and Wood Buffalo (Canada) sites, each with a forest cover of approximately 4.5 – 5.5 million hectares, while the 20 temperate WH forests, with an average forest cover of 446,000 hectares, are led by 4 sites of over 1 million hectares of forest cover each (Te Wahipounamu, New Zealand; Three Parallel Rivers of Yunnan, China; Central Sikhote-Alin, Japan; Tasmanian Wilderness, Australia).

2. RELATIVE IMPORTANCE OF WH FORESTS TO GLOBAL FOREST CONSERVATION

Assuming the availability of accurate global forest cover information, along with similarly available mapping of all existing forest protected areas of the world, it would be possible to obtain a measure of the relative contribution and importance of WH Forests to global forest conservation

initiatives. Data on these indicators is available, though its reliability is not complete, in combination with data on WH forest cover, it can begin to provide valuable information in measuring the following two indicators:

INDICATOR 3: Ratio of total WH forest cover to total global forest cover

INDICATOR 4: Ratio of total WH forest cover to total IUCN Category I-IV forest cover

In reality, it remains difficult to get a very accurate value describing the proportion of WH Forest to forest coverage worldwide, or more specifically to protected forests. Doing so would require the simultaneous application of a high resolution methodology to measure and accurately map the extent of real forest cover in every country (according to a commonly agreed definition of forest cover), and the ability to overlay that map with the accurate boundaries of all protected areas of the world, including those that enjoy WH status. Though the FAO assembles forest cover data on a regular basis, it recognizes important resolution limiations.

Despite these handicaps, a review of litterature does reveal a variety of efforts at determining reasonably accurate values for these indicators, though results are usually involving data obtained over different timeframes (e.g. thus factoring in an error related to changes in forest cover during that time), or with varying degrees of accuracy. As a result, the value obtained for the proportion of the world's forests that enjoy WH status vary measurably.

Iremonger et al (1997), using GIS technology and information obtained from a great variety of national and regional sources, produced a global forest cover map onto which was overlain protected area boundaries found within the UNEP-WCMC's global database on protected areas. According to their calculations (admitting a degree of uncertainty due to variable mapping resolutions, and protected area boundary mapping difficulties), they accounted for 3,988,792,400 hectares of global forest cover in 1996, of which 311,283,500 hectares were located in IUCN category I-VI protected areas. Using the forest cover value for WH Forest sites in 1997 (42,759,174ha), one would obtain a proportion of 13.7% of total IUCN Category I-VI protected forest area as enjoying WH status in 1997.

In chapter 7 of its Global Forest Resources Assessment (FAO, 2001), the FAO puts forward a total forest cover of 3,869,455,000 hectares with a total IUCN category I-VI protected forest cover of 479,000,000 hectares, based on the UNEP-WCMC database in part, but also using different methodologies (again admitting to a degree of uncertainty)[4]. With these numbers, and relying on 2006 WH forest data, one obtains a proportion of 13.3% of total IUCN Category I-VI protected forest area as enjoying WH status in 2005 (assuming that the 2001 figure used in the study has not changed dramatically).

Table 2: Ratio of WH forest cover to global and IUCN category I-IV forest cover

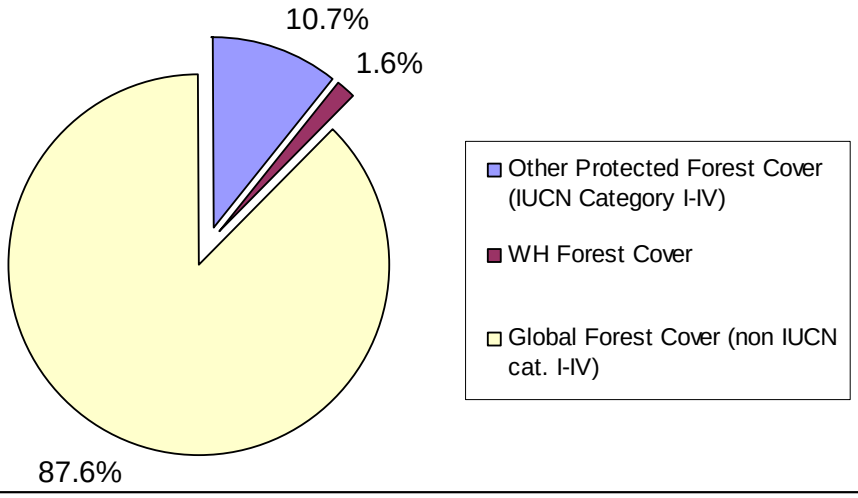
Year	Total Global Forest Cover	Total IUCN Category I-IV forests	Total WH Forest cover	WH Forest cover / IUCN Cat. I-IV	WH Cover / Global Forest cover
1997 (Iremonger et al, 1997)	3,988,792,400	311,283,500	42,759,174	13.7%	1.1%
2006 (FAO, WCMC)	3,869,455,000	479,000,000	63,713,619	13.3%	1.6%

Whether 13.3% or 13.7%, this relatively large proportion of protected forests inscribed on the WH list implies an important mandate for the WH Committee in regards to advancing the interests of global forest biodiversity conservation. Similarly, assuming that with the complete support of the WH Convention, the forest cover in WH forests will never decline, and likely increase on one

[4] One is left questioning the apparent dramatic increase in the area of IUCN category I-IV forest areas during this relatively short period (e.g. 54% increase in 5 years). Discussions with a co-author of one of these studies suggest that this increase is likely attributed to a real increase in the area of protected forests, and the application of a different methodology (Corinna Ravilious, WCMC, pers. com.).

hand, and that the global forest cover will undergo many more years of decline before stabilizing, the WH forest cover as a proportion of global forest cover is set to increase regularly. This trend is already manifest through a 45% increase in this ratio over the past 9 years (e.g. 1.1% to 1.6%).

CHART 3: WH Forest Cover in relation to Global and IUCN Category I-IV Forest Cover



3. STATE OF CONSERVATION OF WH FORESTS

Those WH Forests indicators for which data acquisition is most challenging are those that could provide tangible and comparable measures of the state of conservation for individual sites. Though fairly detailed information on conservation challenges at various WH Forest sites are regularly gathered by the WH Centre (through its reactive monitoring process and by way of third party information), the data so obtained is rarely of a nature that allows for objective quantifiable analysis. The realist is that there is no systematic network-wide process through which uniform, reliable and quantifiable data is regularly gathered. Under these severe limitations, a pragmatic approach to identifying and developing practical indicators for the state of conservation of individual WH Foersts is required. A look at the type of data available at the WH Centre leads us to propose 4 such indicators. The first two (indicators 5 and 6) are based on WH Forest sites' possible incription on the list of World Heritage in Danger, and the others (indicators 7 and 8) are based on whether monitored conditions at individual WH Forest sites reveal significant enough threats to trigger a call for particular attention from the WH Committee.

INDICATOR 5: Absolute number of WH forest sites on the List of WH in Danger

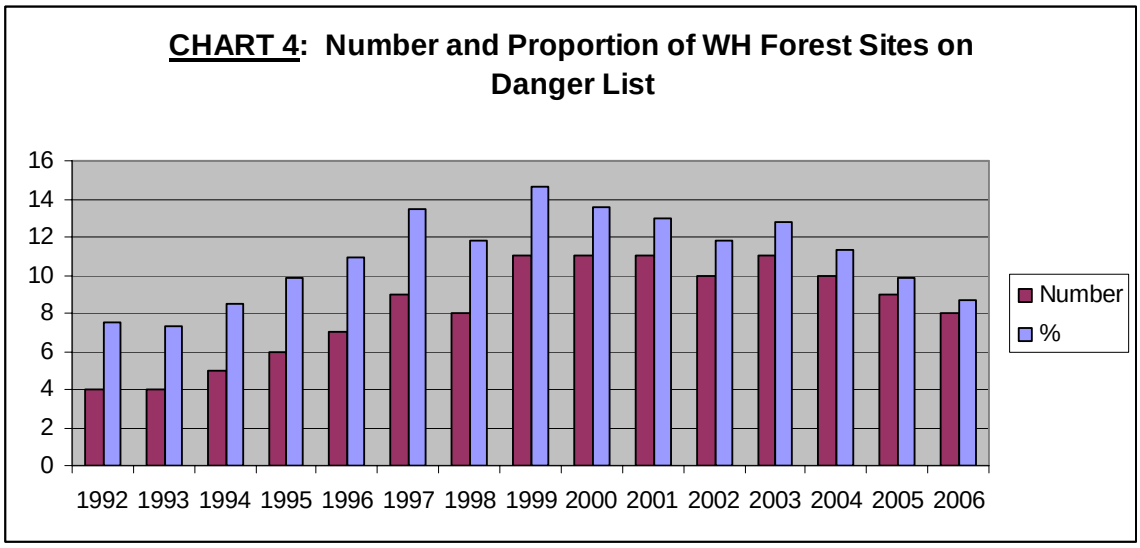
INDICATOR 6: Proportion of all WH Forest sites on the List of WH in Danger (number of WH Forest sites on Danger List / Total number of WH Forest sites).

The WH Committee has the option of inscribing a WH site on the list of WH in Danger when the site's OUVs appear to be threatened by ascertained or potential danger (see convention text, article 11, and operational guidelines, paragraphs 177-198). "Danger Listing" serves to highlight a heightened state of concern over the site's integrity, and to draw the support of national and international conservation stakeholders to the severity of the threats to which the site is subjected in an effort to mitigate or eliminate them.

In 2006, 8 WH Forest sites (or 8.7% of all WH Forest sites) were on the Danger list (see Chart 4). Since 1992, when the first WH Forest sites were inscribed on the List of WH in danger, the proportion of WH Forest sites on the Danger list has ranged from as low as 7.3% (1993) to as high as 14.7% (1999). This indicator would be a measure of the degree to which WH Forests were under threat worldwide. The values for indicators 3.1 and 3.2 are since 1992 are illustrated

in Chart 4, and a list of all WH Forest sites having been inscribed on the List of WH in Danger is provided in Table 3.

A future indicator of the state of WH Forests overall might focus on the forest surface area of WH forests in danger as a proporation of total WH Forest cover. This indicator would provide a more accurate picture than indicator 6. However, given the on-going unreliability of forest cover values within WH forest sites, it is premature to consider this indicator.



The average time spent on the Danger list for WH Forests is 9 years[5]. A review of the nature of threats that affect hose sites having been on the Danger list for less than the average duration (see table 4) usually show threats that tend to be fairly well circumscribed, and arising from one

Table 3: WH Forest sites previously and currently on the Danger list

Country	WH Forest	**Threats** (taken from World Heritage Centre State of Conservation Reports)	Year inscribed on:		Yr Removed from Danger List	# Yrs on Danger List
			WH List	Danger List		
Croatia	Plitvice Lakes National Park	High vehicle traffic through the park, excessive and poorly managed visitation.	1979	1992	1997	5
Ecuador	Sangay National Park	Poaching, illegal livestock grazing, encroachment along the park's perimeter, unplanned road construction.	1983	1992	2005	14
Guinea/ Ivory Coast	Mount Nimba Strict Nature Reserve	Agricultural pressure, deforestation, mining, poaching, weak management capacity, lack of transborder cooperation.	1981	1992	**Still on**	13
India	Manas Wildlife Sanctuary	Insurgency related threats resulting in destruction to park infrastructure and depletion of	1985	1992	**Still on**	14

[5] This includes 8 sites that remain on the Danger list – and likely contributing to a annual increase in the average time on the Danger list, as most show no indication of being removed from the list in the foreseeable future.

Table 3: WH Forest sites previously and currently on the Danger list

Country	WH Forest	**Threats** (taken from World Heritage Centre State of Conservation Reports)	Year inscribed on:		Yr Removed from Danger List	# Yrs on Danger List
			WH List	Danger List		
		forest habitat and wildlife populations				
Ivory Coast	Comoe National Park	Conflict and political instability, poaching and uncontrolled hunting, diminishing protection, human occupation, agriculture pressure.	1983	2003	**Still on**	3
Uganda	Rwenzori Mountains National Park	Security issues; park out of the control of the management authority	1994	1999	2004	5
Brazil	Iguacu National Park	Illegal construction of a road through park lands.	1986	1999	2001	2
Honduras	Rio Platano Biosphere Reserve	Expansion of the agricultural frontier, illegal logging, squatting.	1982	1996	**Still on**	10
USA	Yellowstone National Park	Tourism regulation; control of wildlife infection and transmission to domestic stock; invasive species eradication and control.	1978	1995	2003	8
DR Congo	Virunga National Park	Armed conflict and political instability, poaching, deforestation, encroachment by local populations and refugees, artisanal mining, uncontrolled immigration (Okapi Wildlife Reserve), expansion of illegal fisheries (Virunga National Park).	1979	1994	**Still on**	12
DR Congo	Kahuzi-Biega		1980	1997	**Still on**	9
DR Congo	Okapi		1996	1997	**Still on**	9
DR Congo	Salonga		1984	1999	**Still on**	7

or a few institutional decisions (e.g infrastructure development, visitation management, certain biologically related management issues), while those that remain on the Danger list for more than the average 9 years tend to be afflicted by systemic issues, such as generalized conflict and large poverty driven social movements.

INDICATOR 7: Threat Intensity to which WH Forests are Subjected

The previous indicators (5 and 6) focusing on the number and proportion of WH Forest sites on the Danger list are useful, but limited in that provide very narrow information on the state of conservation of a restricted number of WH Forest sites (e.g. 8 out of 91 as of the WH Committee meeting in 2006), or on how WH Forest sites are faring as a whole. Indicator 7 overcomes these limitations by providing information on the changing state of conservation for each WH Forest site.

STATE OF CONSERVATION (SoC) REPORTING

Throughout the year, the WH Centre and IUCN receive unsollicited and sollicited information related to emerging and on-going conservation issues in natural WH sites from a variety of sources. Once a year, in the run up to the World Heritage Committee meeting, the IUCN and the WH Centre meet to review and discuss information gathered during the previous months and jointly decide whether conditions warrant that a particular site and its conservation issues should be brought to the attention of the WH Committee for discussion and action. In the affirmative, the WH Centre and IUCN prepare a "*State of Conservation Report*" or SoC Report, which includes a

brief analysis of the conservation threats for the selected sites, along with a draft decision for the WH Committee's consideration. Typically, a SoC report will be requested when the values for which a site was inscribed on the WH List appear to be significantly threatened by either existing processes (e.g. illegal logging), or threatened by potential processes with a high likelihood of taking place (e.g. plans for road construction).

During its annual meeting in June/July, the intergovernmental WH Committee, which carries out the business of the WH Convention, reviews the SoC reports and takes decisions on specific courses of action. Generally, they request that a State Party implement particular measures to contain or eliminate threats. Usually, the WH Committee then requests that a SoC report be produced for the following year's WH Committee meeting to determine if the threats have been properly managed. If a subsequent SoC report indicates that threats have been satisfactorily contained, the WH Committee then usually ceases to request any further SoC reports for that particular site. Otherwise, a SoC report will be requested again for the following year's meeting.

This fairly rigorous process provides the necessary data to develop an indicator of the overall level of threat intensity to which particular WH sites are being subjected. The reliability of this indicator is based on the following assumptions:

ASSUMPTIONS

1. The WH Centre, the WH Committee and / or the IUCN are aware of all of the major conservation threats at all WH sites at all times.
2. A *standard minimum threshold of concern* is passed before the decision to produce a SOC report is made.

METHODOLOGY

A database indicating the absence (value = 0) / presence (value = 1) of a SoC report for a WH site for each of the previous 15 years was created (e.g starting in 1991). An overall Threat Intentisty Coefficient (TIC) was calculated by applying a simple algorithm incorporating both the frequency of SoC reports over the previous 15 years, and the relative distance in time the SoC was produced, giving an arbitrarily greater weight to more recent SoC reports as illustrated in table 4, in an effort to reflect the estimated relevance of past SoC reports to the present value of the TIC.

Sites having been inscribed only within the past 4 years were given a distinct treatment. The algorithm gave greater weight to SoC reports, under the assumption that a first SoC emanating from a very recently inscribed WH Site indicated a heightened level of concern, compared to a first SoC produced for a site having been inscribed for several years.

Table 4 : Relative weighting of SoCs

Period	Weighting
1-5 years	12 pts / year: Total 60 pts
6-10 years	5 pts / year: Total 25 pts
11-15 years	3 pts / year: Total 15 pts

Using this methodology, a TIC value can be calculated each year, whereby the 5 year weighting tranches slide forward each year. In the meantime, the value for year 15 drops off the calculation, and the values for years 5 and 10 sliding into lower weighted tranches (see samples in table 5).

Table 5. Threat Intensity Coefficient (TIC) values from year to year, for 2 sample WH Forest sites

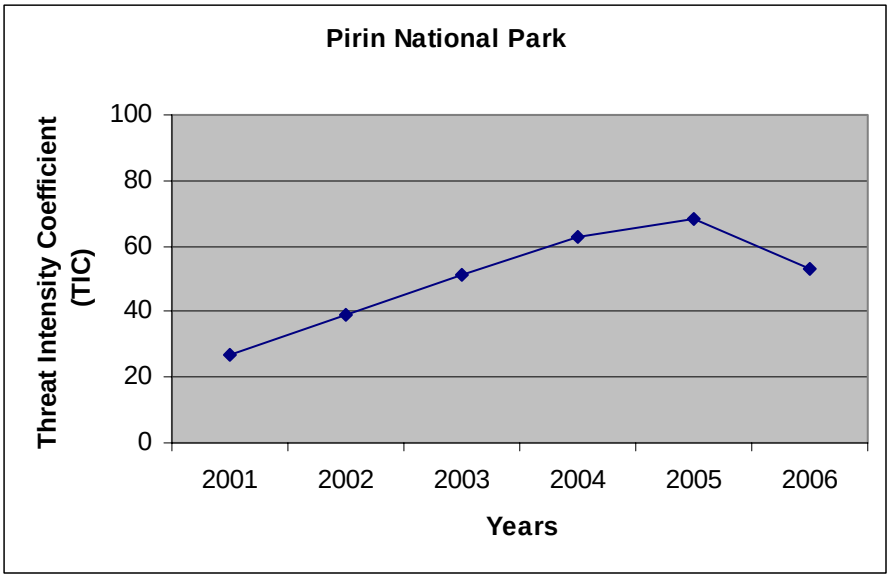
YR	Site	Number of SoC reports			TIC
5 yr period →		**1992-1996**	**1997-2001**	**2002-2006**	
'06	E. Rennell		0	2	24
	Pirin	0	1	4	53
5 yr period →		**1991-1995**	**1996-2000**	**2001-2005**	**2005**
'05	E. Rennell		0	2	24
	Pirin	1	1	5	68
5 yr period →		**1990-1994**	**1995-1999**	**2000-2004**	**2004**
'04	E. Rennell		0	1	12
	Pirin	1	0	5	63
5 yr period →		**1989-1993**	**1994-1998**	**1999-2003**	**2003**
'03	E. Rennell			1	12
	Pirin	1	0	4	51
5 yr period →		**1988-1992**	**1993-1997**	**1998-2002**	**2002**
'02	E. Rennell			0	0
	Pirin	1	0	3	39
5 yr period →		**1987-1991**	**1992-1996**	**1997-2001**	**2001**
'01	E. Rennell			0	0
	Pirin	1	0	2	27

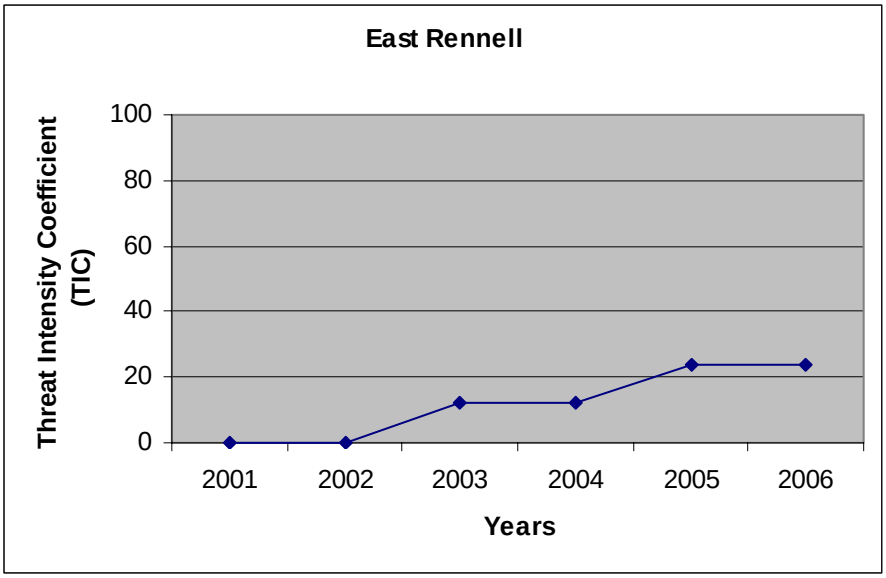
RESULTS

Of the 91 WH Forest sites, 30 have a Threat Intensity Coefficient = 0, indicating, under the assumptions noted above, that the overall threat intensity to those sites' OUVs have not surpassed the minimun standard threshold of concern in the past 15 years, or since the site was inscribed, if less than 15 years ago. For a list of these sites, see table 2 in Annex 2: "*Sites with a Threat Intensity Coefficient of 0*".

Given the shifting value of the TIC over time, it is possible to graph it for individual sites, illustrating how it fluctuates (see figure 1).

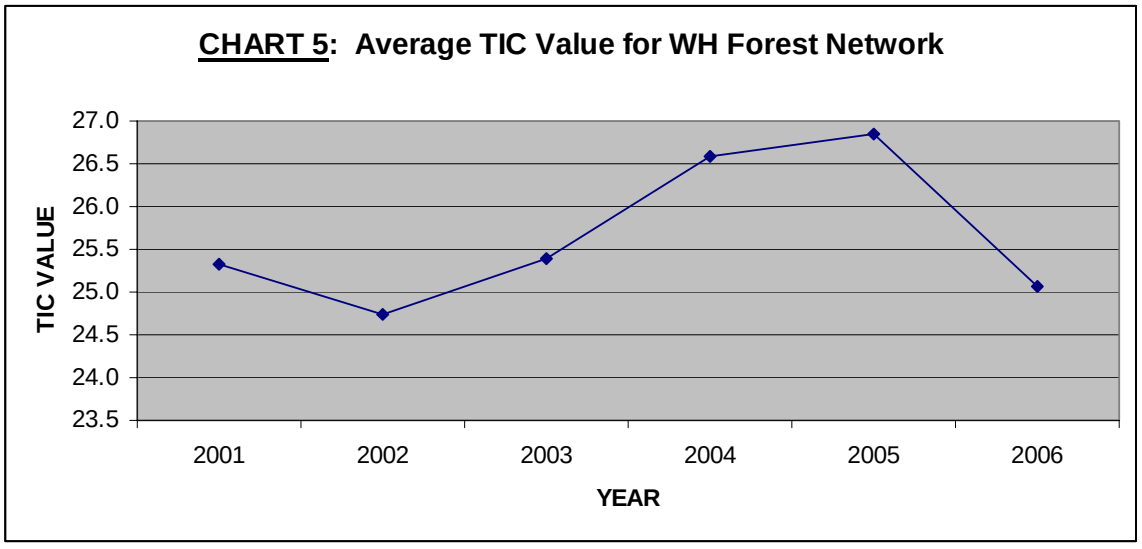
Figure 1: Sample Threat Intensity Coefficients for 2 WH Forest sites, over time.





INDICATOR 8: Average TIC Value for entire WH Forest Network

By calculating the average annual values of the TIC, one should, over time, have an indicator of the TIC of the WH forest network overall. Chart 5 below illustrates this value from 2001 to 2006. The average TIC value duing this 6 year interval 25.1 (2006) and 26.8 (2005). These values are affected by a combination of the actual TIC values of WH forest sites, and the total number of WH Sites. This number increased by 3 from 2004 to 2005, and as SoC reports for newly inscribed WH sites are rarely requested, this increase creates a downward pressure on the average TIC valule. The actual utility of this indicator remains to be seen over time.



DISCUSSION

The TIC provides **a measure of the current and historical intensity of threats to the conservation of WH Site OUVs.** Its ability to do so accurately is a function of how well the assumptions noted above hold true. Charting the changing TIC value year over year also reveals trends in threat intensity over time – a decreasing TIC value, even though with a high present value, indicates a trend towards reduced threat intensity and should convey a guardedly positive

message (see graph above, Pirin National Park), whereas a site with a lower TIC for the same year, but one that denotes an increase over time, demonstrates relatively new threats that show no indication of being properly addressed by the relevant WH Site management agency (see graph above, East Rennell). Because TIC trends are a much better overall indicator than a single yearly value, TIC values are best represented as a function of time, and charted accordingly (see Annex 2 for the charted TIC values of all WH Forest sites for which the TIC for any of the past six years is greater than zero).

Limitations of the TIC

- The TIC does not provide any information whatsoever on the nature of the threats.
- Its accuracy is dependent on the information gathering capacity of the IUCN and WH Centre, and on the ability to establish and maintain a rigorous test in establishing whether the level of threat surpasses a standard mimum threshold of concern.

Advantages of the TIC

- Provides a quantitative and standardized value on the threat intensity of a WH site, allowing for comparisons through time, and between sites.
- Can be applied equally to all WH sites, cultural and natural.
- Is based on information readily available at the WH Centre.
- Annual TIC values can be tabulated quickly ensuring the sustainability of the indicator.
- Draws attention to cases where TIC values do not reflect popular conception of the actual SoC of a site (e.g. Niokola-Koba), showing that the site may have been overlooked in the past, and triggering closer monitoring on behalf of the WH Committee.

Factoring Historical Threats in Calculating the TIC

The rationale behind having SoCs produced up to 15 years in the past influence the current TIC value rests on the fact that many threats to WH Forest sites are of an intractable nature (see table 4 above, containing a description of threats to WH forest sites in danger). Such permanent, long duration or recurring threats are usually rooted in much broader and only very slowly evolving macro-economic and socio-political realities over which WH site managers have little or no influence. In these circumstances, best case conservation responses are often those where sufficient investment in management responses is made to contain pressures arising from these deep rooted but immediate threats. When there is reduction in management response investment (e.g. sudden budgetary constraints, governance problems), it becomes more difficut to contain those threats. Alternatively, the sudden increase in the intensity of particular threats can also overcome an established, and previously adequate management response investment (e.g. armed conflict, refugee migration, invasion of alien species), again resulting in unacceptable impacts the WH site. In both cases, the *standard minimum threshold of concern* would be breached and the IUCN / WH Centre / WH Committee would decide to produce a SoC report.

When the management response is either restored to its original level, or increased to deal with the higher threat intensity, impacts on the WH sites would presumably once again be reduced below the *standard minimum threshold of concern*, and this change would be noted by the WH Committee in its decision not to request further SoC report for that site.

Under these circumstances, though the level of a threat affecting a WH site may drop below the *standard minimum threshold of concern*, the TIC value is designed to reflect the fact that the concern threshold had been breached in the past. This would indicate that for any site with a TIC value greater than zero, some serious threat had been detected by the WH Committee within the past 15 years, and that given the nature of such threats, they likely remain a potential concern, though are currently managed sufficiently well as to not pose a serious challenge to the SoC of the site. The methodology also assumes that no recurrence beyond 15 years can be interpreted as the threat having been effectively eliminated.

CONCLUSION

Given the absence of any framework under which a homogeneous set of indicators on the state of conservation (SoC) of WH forest sites worldwide can be constructed for the time being, it will remain extremely difficult to develop a highly reliable measure of how well WH forests are being conserved over time. Under these difficult conditions, the WH Centre must rely on indirect measures of the SoC, either on a global or regional basis, using numbers and surface areas of WH forests, or on a site by site basis, using the danger listing or the Threat Intensity Coefficient.

However, based on the information so gathered, one can be generally positive on the state of conservation of WH forests. The average TIC values for the entire WH Forest network over the past 5 years have been relatively constant (ranging between 25.1 and 26.8), and the proportion of WH forest sites on the danger list is at its lowest point since 1994, whereas the absolute number of such sites is at its lowest since 1998.

A good deal more work can be done using and interpreting the various indicators identified in this paper. The Threat Intensity Coefficient is a first attempt at providing a quantitative value on the state of conservation of World Heritage sites that can be replicated for all WH sites, be they natural or cultural. The algorithm used to obtain TIC values was arbitrarily developed, based on the authors' overall appreciation of the dynamics and nature of State of Conservation reporting. There is no doubt room for further discussion, and possible refinement. But in the end, it is important to interpret the information provided by these indicators in light of the limitations within which they are developed. This caveat will be applicable to any indicators based on data that is in part obtained in a subjective manner (e.g. defining a standard minimum threshold of concern).