



WORLD HERITAGE TENTATIVE LISTED SITES IN PAPUA NEW GUINEA

**REPORT ON A REVIEW OF THE SITES
By Peter Hitchcock and Jennifer Gabriel**

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Photo Credit: Rodrick Vana, Oro Province

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Dedication

This report is dedicated to the memory of the late Mr. Vagi Renagi Genorupa, Manager, National World Heritage Secretariat, PNG Department of Environment and Conservation (d . 2nd December, 2014).



Background

The Government of Papua New Guinea advised its acceptance of the World Heritage Convention on Monday, July 28, 1997.

In advising its acceptance of the Convention, the Government of PNG joined other signatories in committing to, amongst other things, as far as possible to:

1. *“adopt a general policy that aims to give the cultural and natural heritage a function in the life of the community and to integrate the protection of that heritage into comprehensive planning programs”;*
2. *undertake ‘appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage’;*
3. *refrain from ‘any deliberate measures which might damage, directly or indirectly, the cultural and natural heritage’ of other Parties to the Convention, and to help other Parties in the identification and protection of their properties.” UNESCO*

In accordance with Article 11 (1) of the Convention, in 2006 PNG formally nominated seven identified areas for Tentative Listing. To date none of these areas has been nominated to the World Heritage List. This desktop review examines each area and reports on the current knowledge, condition and threats to each area; as well recommendations are made to address identified issues and to provide guidance for advancing the processes of *“identification, protection, conservation, presentation and rehabilitation of this heritage”*.

Executive Summary

“Identification” - Of the 7 nominations, only four (Sepik, Trans-Fly, Kikori, Milne Bay) had clearly identified and mapped boundaries and the remainder were limited to mostly broad geographic descriptions. This review provides recommendations for delineation of all seven areas, including some proposed adjustments to existing boundaries;

“Protection” - The Review found that only three sites had any significant amounts of formal protected areas and that since listing in 2006, little or no progress has been made in formal protection of the sites. Recommendations are made on priorities for progressing protection.

“Conservation” - The Review found that there was minimal conservation management activity evident and that likely the only on-ground management activity was by customary landowners. Apart from the activities of the Kokoda Initiative, there was no evidence of direct government contribution to site management.

“Presentation” - No evidence was found of any presentation activity for any of the sites. Indeed there is such a paucity of information available on the Internet that even local or national awareness of the existence of the Tentative Listed sites could be expected to be minimal.

“Rehabilitation” - Apart from on-going local efforts in management of aquatic weeds in the Sepik, no evidence was found of any rehabilitation activities in any other sites.

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“Values Knowledge”- Improvement in knowledge of the heritage attributes and values within the Tentative List sites since the 2006 listing varies greatly from area to area, from virtually nil improvement in some to major improvements in others, including the recognition of new attributes and values since listing. All of the karst areas in the original Sublime Karst listing show a substantial increase in biodiversity data. In the Sepik site, a major new cultural heritage precinct has been identified and research of it continues. Independent non-government researchers generated almost all of the new knowledge.

The review identified a number of important areas of Intact Forested Landscape (IFLs) - unlogged intact forest in a number of the Tentative Listed sites. IFL is increasingly regarded globally as being a premium conservation resource so recognition of IFL's in the Tentative Listed sites further enhances their outstanding natural heritage significance. The main threat to IFL values is logging and associated roads.

“Threats” - The Review identified minor to serious threats to the heritage values of 6 of the 7 sites. Recommendations are presented for responding to those threats. The main threats already in operation or threatening include road construction and logging (Nakanai, Kikori, Kokoda-Owen Stanley) Serious threats to some areas include logging, mining and associated activities, petroleum exploration and development, SABL's tenures and oil palm development. Longer-term threats from climate change apply particularly to the Sepik and Milne Bay sites.

Less obvious than most identified threats, unsustainable hunting is a definite threat to species conservation in some areas, especially in the more accessible lowlands and some montane areas.

Failure to actively confront existing threats since nomination has resulted in some loss of values and integrity. However, with increasing development pressures apparent, it is clear that unless there is a concerted proactive effort to respond to some of the more serious threats, globally significant heritage values will be lost, possibly leading to the delisting of parts or whole of some listed sites.

Nomination:

The Review found that none of the Tentative Listed areas have been nominated for World Heritage nor are any in the process of having nominations prepared. The two most prospective Tentative Listed Areas for early nomination as World Heritage are the Trans-Fly and Huon Terraces sites. Whilst Trans-Fly is 100% protected, Huon Terraces has no formal protection but would appear straight-forward for preparation of the necessary protection and management planning preparatory to drafting of a nomination. The Trans-Fly site should ideally be a trans-boundary nomination with Indonesia. The other five Tentative Listed areas will require a substantial amount of effort to collaborate with customary owners and government agencies regarding threats, protection and management issues before any decision to proceed to preparation of nominations.

Potential additional Sites:

Some attention was given to scoping the prospects for additional sites for Tentative Listing. The 7 existing Tentative Listed sites, assuming the recommended boundaries, do appear to represent the most important major landscapes with potential for recognition of Outstanding Universal Values (OUV) and hence World Heritage, at least based on natural heritage values. Some smaller more specific sites might in future be identified as being of OUV.

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There is some scope and case for extension of some of the existing Tentative Listed sites, in some cases to embrace additional values not represented in the existing site. (Trans-Fly, Kikori, Sublime Karst, Huon Terraces. Subject to further study, there is also scope within the Kokoda-Owen Stanley Ranges site to support more than one World Heritage nomination or a serial nomination.

Some significant cultural features and themes were recognized independent of the existing Listed Areas that deserve further consideration for their potential OUV's.

The Vitu Islands (Bali-Vitu) off West New Britain form part of a broader monumental cultural landscape. Uneapa Island is home to four distinct types of rock art, involving thousands of modified and constructed stone features scattered across the island's landscape. Sites range from single modified stones to large-scale complexes of and "seats" and "tables", mortars, cooking places, grinding stones and carved boulders. Research indicates that the rock art is not a static component of past landscapes but, rather, a dynamic one influencing and impacting on communities, with each generation adding their marks and stories, establishing an intergenerational narrative expressed through stone.

An archaeological survey of Muiuw (Woodlark Island) in the 1970s located caves, as well as a number of stone arrangements. The stone monuments represent some of the earliest known evidence of occupation in the northern Massim. The stone arrangements form a complex Early Period (~1500BP-600BP) landscape built for the dead to negotiate relationships between the living throughout the northern Massim. These sites are important in relation to the prehistory of the island and the region as a whole.

There are some equally impressive carved rocks in New Hanover and also two series in Bougainville, one each in the south (Buin and Siwai) and central (Togarau/Wakunai) area.

Overall

Overall, this review finds that the greater part of the heritage values recognized at the time of nomination in 2006 still exist and that in a number of cases, new heritage values have been identified and/or knowledge of known values has been significantly enhanced. Notwithstanding, the range and magnitude of threats to these values has increased and some important heritage values are seriously threatened with destruction.

It is apparent that the only way that known heritage values will be maintained for the foreseeable future will be through a well-resourced pro-active program of protection. Much of that can be achieved with the assistance of non-government organizations and local government but of critical importance is leadership at the national Government level. The role of the World Heritage Secretariat is fundamental to progressing implementation of PNG's responsibilities under the World Heritage Convention.

The temptation to concentrate solely on the most prospective sites for early World Heritage nomination must be balanced against the priority need to address the most immediate threats to the most important heritage values.

The reader is encouraged to study each of the separate reports on the Tentative Listed sites, most especially the recommendations in each section. For the interim, a summary statement is provided for each of the listed sites.

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Huon Terraces:

Evidence of the scientific importance of the Huon coral terraces has continued to be researched and their global significance is beyond doubt.

This review recommends that this site, previously not delineated, be re-focused onto the geological features of scientific importance to facilitate a more rapid address of protection, management and possible nomination.

Notwithstanding that none of this site is subject to formal protection, the nature of the coral terraces and the low level of threat is such that it should be possible to negotiate with the customary owners for an appropriate level of protection and a prospective early nomination. Traditional protection as provided for in Para 97 of the Operational Guidelines might be explored.

Trans-Fly:

Incorporating as it does a major representation of the largest tract of savanna on the island of New Guinea, this site has outstanding conservation significance. Subject to address of management issues, there appear to be good prospects for successful nomination for World Heritage.

Unlike all other PNG Tentative Listed sites, the Trans-Fly is already 100% protected area*.

Collaboration with Indonesia on a trans-border nomination is highly recommended. Both sides of the border are already recognized Ramsar wetlands - effectively a trans-national Ramsar site.

* Gazettal of Wareave and Aramba WMA's needs to be finalized/clarified.

Sepik:

Incorporating Papua New Guinea's largest freshwater wetland, outstanding intact forest and an outstanding suite of cultural features, the Sepik Tentative Listed area is potentially one of the premier conservation areas of the world.

Outstanding new cultural attributes have been researched and documented since nomination in 2006, substantially enhancing the cultural heritage values of the site. Delineation of these features necessitates a minor adjustment of the boundary of the Tentative Listed area.

The conservation values of the Sepik will only survive if there is an urgent and concerted effort to address threats and seek appropriate levels of protection. If conservation intervention proves successful then there are good prospects of a successful World Heritage nomination.

Kikori:

The Kikori Tentative Listed site as nominated in 2006 is a very diverse area of outstanding conservation value. It contains a substantial tract of Intact Forest Landscape (IFL), including lowland rainforest and so is of very high conservation value.

Much of the Kikori is threatened by a range of potential resource exploitation and development activities including logging, mining and hydrocarbon extraction.

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The high conservation values of the Kikori will only be maintained if a very concerted effort is made to address the identified threats. Failure to proactively achieve conservation of this outstanding area will greatly diminish the prospects of this globally outstanding area being successfully nominated for World Heritage.

Sublime Karst (Mainland section):

Further survey and research conducted since nomination of the 'Sublime Karst' in 2006 has greatly enhanced the biodiversity importance of both the Hindenburg Wall and Muller Plateau sections. Regrettably, the whole of these areas remain unprotected and potentially threatened.

There is a geographic and thematic case for considering the linking of the Hindenburg and Muller sections with the Kikori, potentially creating an outstanding serial site.

Notwithstanding the mineral and hydrocarbon prospects of adjacent lands, protection of the very vulnerable biodiversity of the area should be a high priority.

Sublime Karst (Nakanai Section):

As with the mainland sections of the Sublime Karst site, biodiversity knowledge has increased substantially since nomination in 2006, further enhancing the natural heritage significance of Nakanai. Since nomination it has become apparent that Nakanai has very high biodiversity conservation values additional to the already documented geo-diversity values. A cultural heritage research project commenced in 2014 has the potential to identify and document cultural attributes and substantially enhance the cultural heritage values of the site. The project will develop methodologies for describing an 'Associate Cultural Landscape' in order to integrate the cultural and natural values for a potential cultural landscape nomination.

Nakanai is immediately threatened and deserving of urgent proactive action to protect the high conservation values of the site.

Kokoda Track - Owen Stanley Ranges:

The relatively poor documentation of natural history of much of the Tentative Listed site has seen only limited improvement since nomination in 2006; a major obstacle to prioritizing those areas of greatest known conservation significance.

The site is subject to a diverse array of threats, some immediate and some potential. Formal protection of the site remains minimal.

No part of the site is yet clearly recognizable as being of high potential for World Heritage nomination but a number of areas of apparent highest conservation potential are recommended for active conservation action.

Milne Bay:

Documentation of this site is mostly very poor, notwithstanding that much of the area has been subjected to various surveys, particularly marine biodiversity. Some of the islands were found to be of high conservation value, including local endemic species, some threatened.

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Whilst the site is in a strategic location for marine conservation and the natural heritage values are fairly self evident, a great deal more work is needed to prove this site up to a protected area and any possible World Heritage nomination.

There are identified threats to parts of the site, mainly from mining on some of the islands. Sustainable fishing is still not guaranteed.

Nomination for World Heritage should only proceed with the full cooperation of the traditional owners and users of the islands and the surrounding sea.

Conclusion:

The 7 World Heritage Tentative Listed areas of Papua New Guinea are confirmed as being areas of great importance for conservation and collectively represent some of the best prospects for conservation of the nation's outstanding natural and cultural heritage of which PNG can be very proud. However, in the lapse of 8 years since the nomination of these areas to the Tentative List, it is apparent that little progress, if any, has been made towards protection of their natural and cultural heritage values and the overall level of threat has greatly increased.

For PNG to uphold the spirit of its commitment to the World Heritage Convention, there must be a much greater commitment of resources and effort to protection of the outstanding heritage of the country represented by the Tentative Listed sites. Only one or two Tentative Listed sites (Huon Terraces and Trans Fly) have good prospects for early nomination to the World Heritage list and other sites will require a recommitment and concerted proactive action to undertake the necessary protection and management prerequisite to nomination for World Heritage. Due to some immediate threats, there is some urgency for intervention to prevent destruction of important heritage values in several sites.

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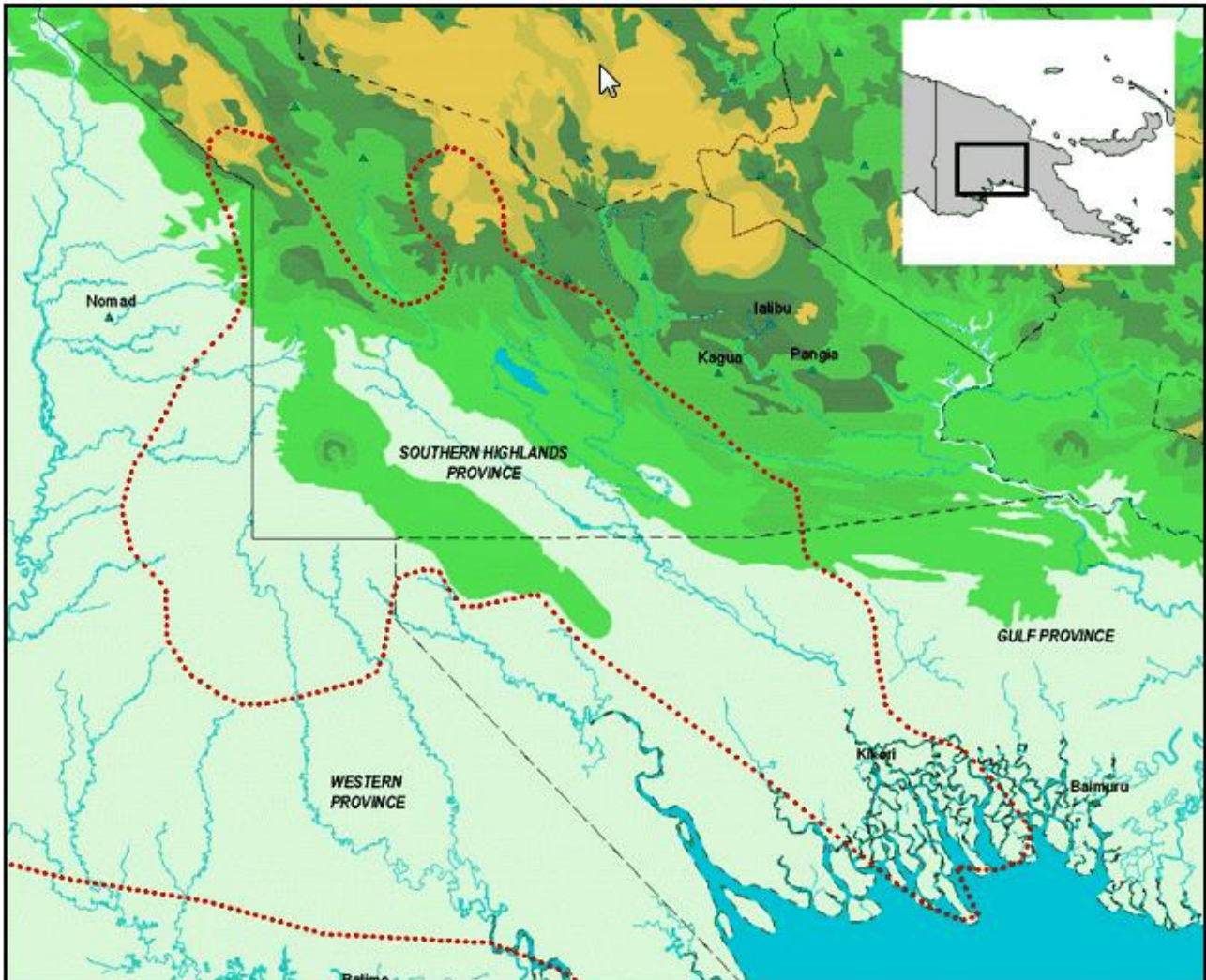
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KIKORI RIVER BASIN REPORT

1) Current Situation (listing, boundaries, action towards protection etc)



The WWF diagram on which the 2006 Tentative List nomination was based. For scale, the delineated area is 300 kms long and up to 150 kms at its widest.

2) Description of Site

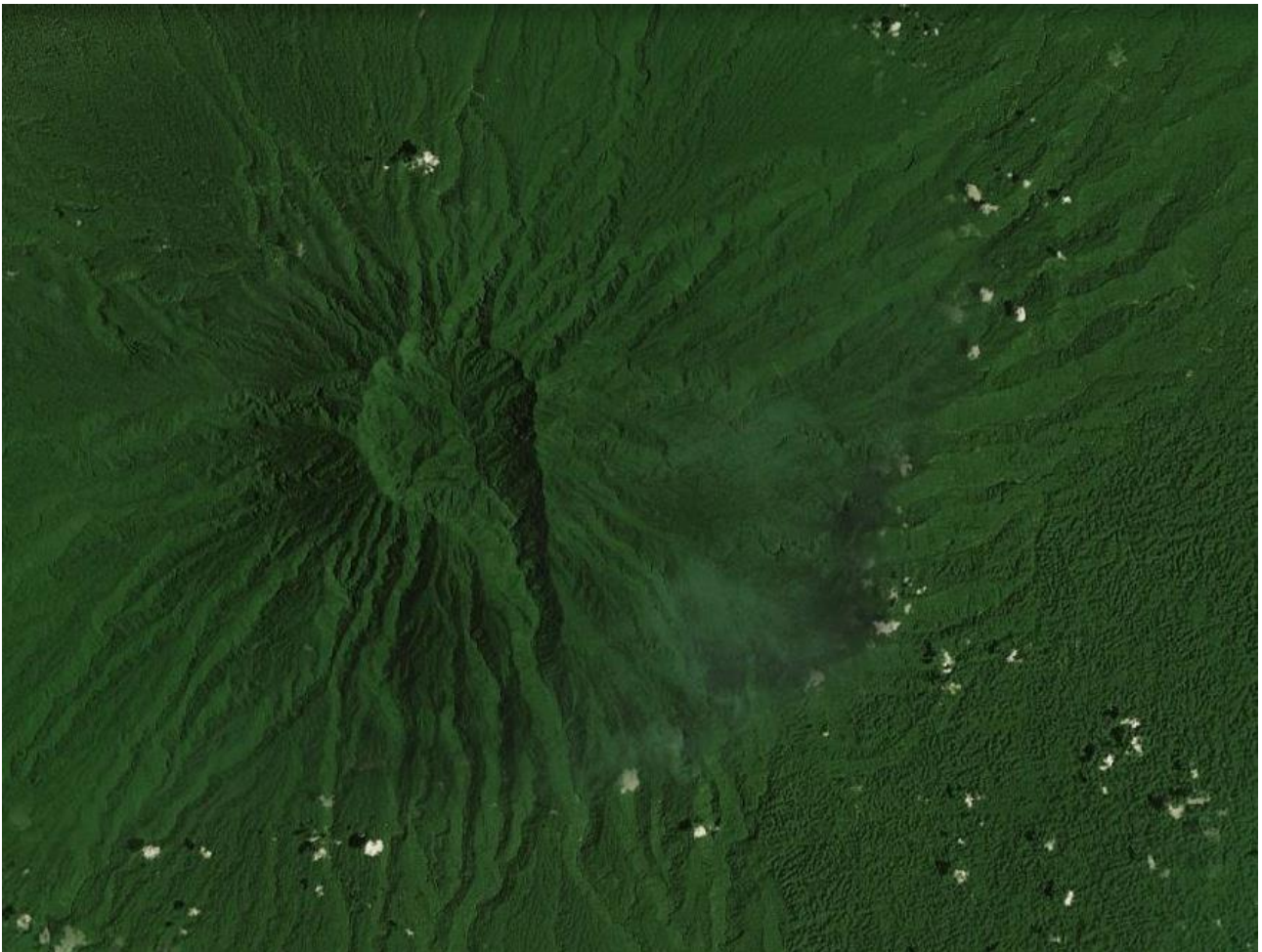
The Kikori Basin Tentative List area is a very large and diverse area extending from highland areas down to a very complex deltaic estuary. A simplified approach to the geography of the area recognises five major landscapes viz.

- **Mount Bosavi** - a rugged and dissected landscape centred around the massive cone and crater of this extinct strato-volcano;
- **Lake Campbell foothills and lowlands (south west of Bosavi)** - comprising the headwaters of the numerous rivers which flow west and south west of the Mount Bosavi volcanic shield to the Fly River and to the Turama River in the south. A

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predominantly volcanic landscape derived from Mount Bosavi volcano and a number of smaller satellite craters in the Lake Campbell area;

- ***Darai Limestone*** - a major karstic limestone plateau extending south east from Mount Bosavi, grading gently to the south until disappearing below sea level in the south. Bounded in the east by the Kikori River;
- ***East Kikori -Lake Kutubu*** within the Kikori River catchment foothills within the Kikori catchment east of Kikori River, including a tract of parallel limestone ridge centred on Lake Kutubu. Oil and gas production is underway;
- ***Kikori Delta***: A complex system of estuarine channels and islands.



Mount Bosavi - the remains of an extinct major volcano rising to more than 2,500 metres asl on the south western lowlands of PNG. The crater is 4km across and 1km deep. Bosavi volcano was active in the Pleistocene but is now regarded as extinct. (PNG Mining Cadastre Portal)

Mount Bosavi Volcano:

Mount Bosavi is the remains of a massive Pleistocene Volcano that may have reached more than 4,000 metres in height but even after a long period of erosion, is still rates an impressive 2,500 metres above the floodplain of the Fly-Strickland Rivers - higher than Mount Kosciuzko, Australia's highest mountain. Its caldera is approximately 4 km wide and 1 km deep.

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At the landscape level, Mount Bosavi is of special importance from a natural heritage perspective. It is the highest volcano in the West Pacific and South East Asia that still retains continuous intact tracts of vegetation cover from its summit to the lowlands, an altitudinal range of approx. 2, 400 metres. Further, almost the whole of that altitudinal sequence to the south west of the crater is on volcanic flow material from the main crater (may be locally mixed with debris from small satellite volcanic cones south west of Lake Campbell). This is a unique opportunity on mainland New Guinea, indeed in the West Pacific region, to protect the full altitude sequence of biota from volcano summit to coastal lowlands. (Although the Mount Victory extinct volcano in Oro Province of PNG retains a more or less uninterrupted vegetation sequence from summit to sea level, the altitudinal range is much less than Bosavi and agricultural development is occurring on the slopes, albeit on a small scale.)

The altitudinal sequence to the south east of the Bosavi crater is also important and complementary to the south west (Lake Campbell) sequence as it includes the transition from the volcanics of the cone to the limestones of the Darai Plateau. This sequence is well represented in the (proposed) Sulamesi WMA.

Whilst Mount Bosavi may not rate as OUV from a geological viewpoint (Criterion (viii)) it rates highly from a biodiversity (ecological diversity) viewpoint and represents a globally rare opportunity to preserve such a large intact altitudinal biological sequence, at least in the tropics. (Criterion (ix), possibly (x))

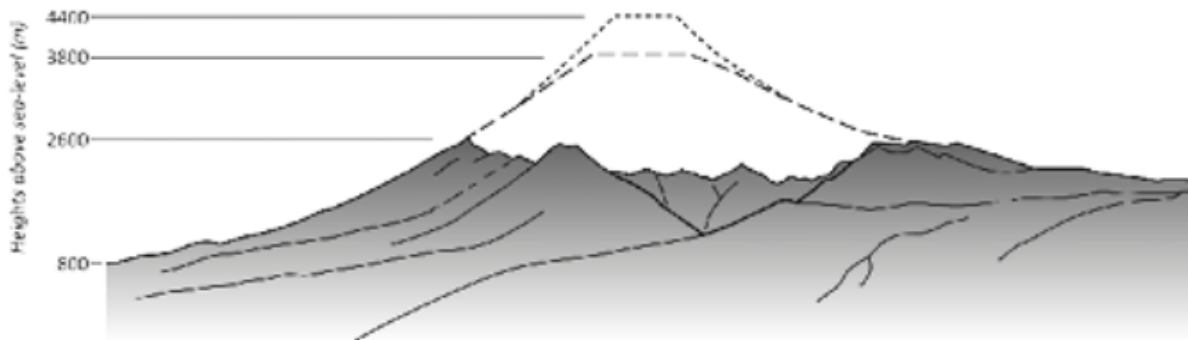


Figure 34. The deeply eroded volcano of Mount Bosavi may originally have been as high as 3,800 or 4,400 metres above sea level, as suggested by the two dashed lines. The lower reconstructed profile may be the more likely. Bosavi today is still an impressive volcano, even in its eroded state, rising from the Fly River plateau in forested and still sparsely populated country, and occupied by a breached crater that has been enlarged by erosion. The mapped extent of Bosavi is greater than that of any other volcano in Near Oceania.

Source: Adapted from Mackenzie & Johnson (1984, Figure 25B).

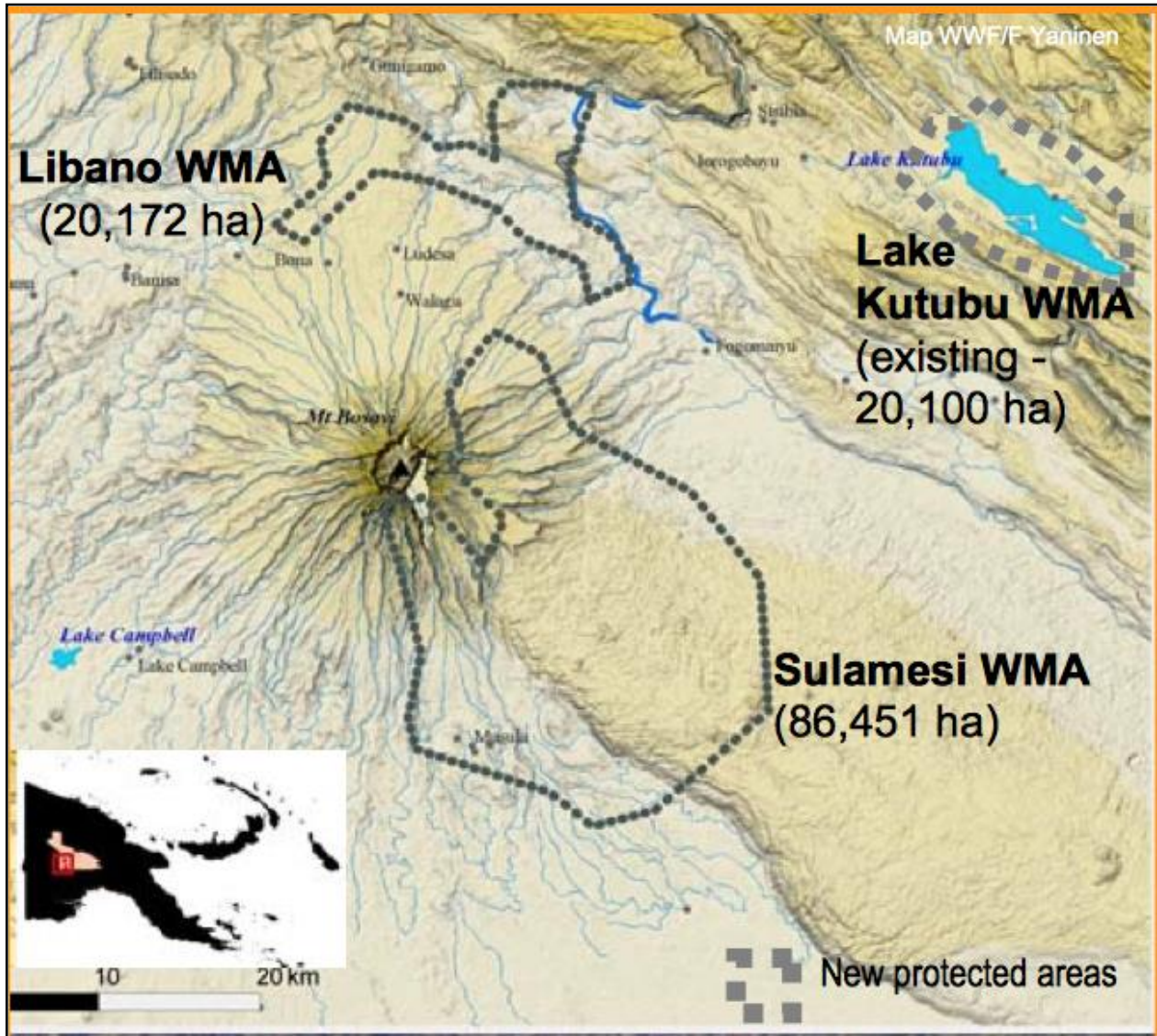
Figure extracted from *Fire Mountains of the Islands* by R.Wally Johnson, ANU Press.

Sulamesi WMA:

WWF reports that *“The Sulamesi Wildlife Management Area (WMA) was declared on 20th October 2006. It encompasses 86,451 hectares to the south east of Mount Bosavi and includes a large part of PPL 287. The purpose of the Sulamesi WMA is ostensibly to protect fish from becoming scarce, preserve crocodiles, protect wildlife and other resources, protect sacred sites, control over-fishing and over-hunting, identify landmarks and boundaries, protect medicinal plants, protect breeding homes for animals, protect the homes of special flying foxes, prevent illegal trespass by strangers/outsideers, prevent industrial logging coming inside this area and protect the area from spills of chemicals or waste”* (WWF 2006).

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Unfortunately, this statement appears to be in error because the Department of Environment and Conservation subsequently imposed a moratorium on the gazettal of any new protected areas in PNG with the result that the Sulamesi WMA was never finalised. Internal update advice suggests that the gazettal process has now been completed but this has not been confirmed by other sources. This is a very important proposed protected area that should be implemented at the first opportunity.



There is a cluster of Wildlife Management Areas (WMA's) on the slopes of Mount Bosavi, comprising Libano-Hose, Libano-Arisai and Sulamesi WMA's (the final gazettal of Sulamesi could not be confirmed).

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Earth.esa lidar image of Mount Bosavi (top left) and the Darai Plateau karstic limestone extending south easterly from Bosavi. Some remote sensing interpreters have interpreted from the pseudo flow patterns in the image to suggest that this is a large volcanic flow when in reality it is a massive bed of limestone. The European Space Agency (ESA) has interpreted the circular holes in the Darai limestone as caused by volcanic gas explosions but most of the 'holes' are more likely to be karstic collapse dolines. A French speleological team reached the Darai Doline - the world's largest - in 1993 and confirmed some volcanic role in its formation. The 'hills' may be the result of volcanic gases punching through the limestone.

The Bosavi Volcano has left a major contribution to the present day landscape in the form of extensive landscapes of volcanic rocks, up to 90 kms across from north east to south west (see map below). The volcanic soils make an important contribution to the biota of the region and hence the conservation significance of the area.

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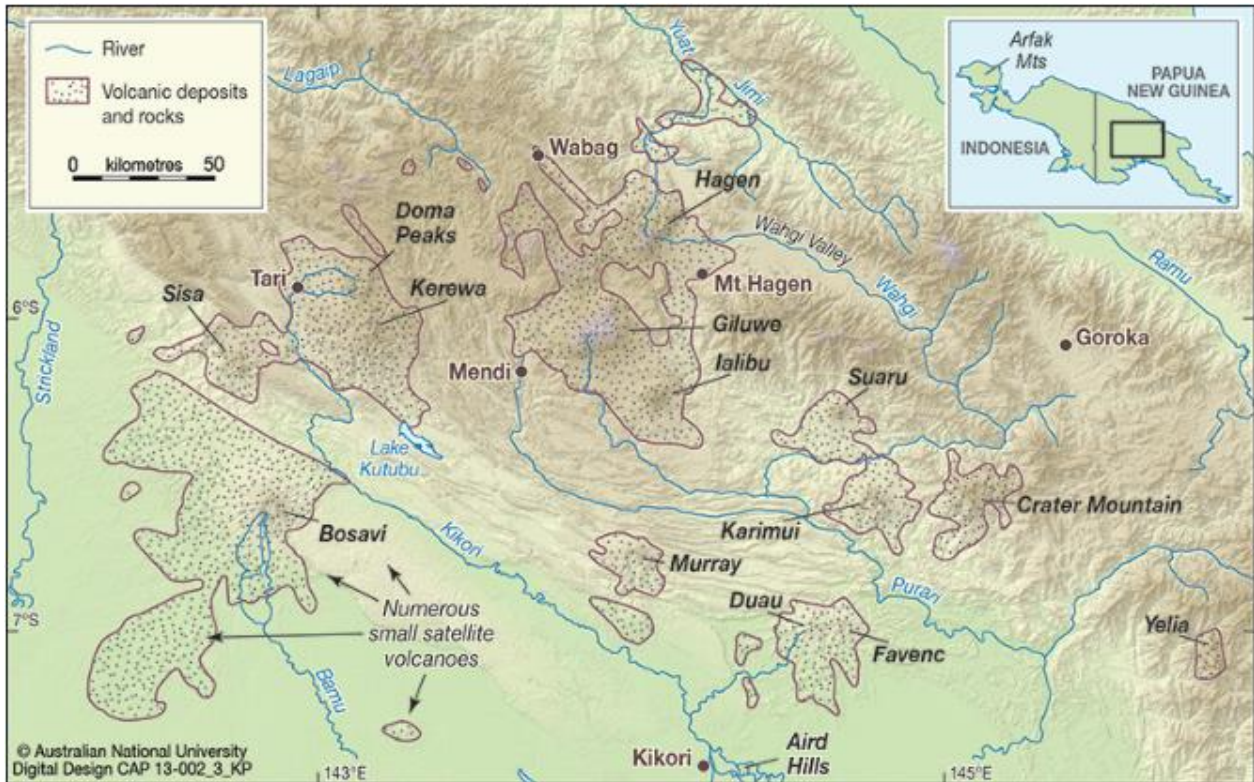


Figure 35. The considerable extents of the volcanoes of the Fly-Highlands province are shown clearly by the areas of volcanic deposits and rocks mapped by geologists during the 1960s and 1970s.

Source: Adapted from D'Addario et al. (1975). See also Mackenzie & Johnson (1984, Figure 1).

Diagram extracted from R.Wally Johnson's *Fire Mountains of the Islands*.

3) Key attributes and values

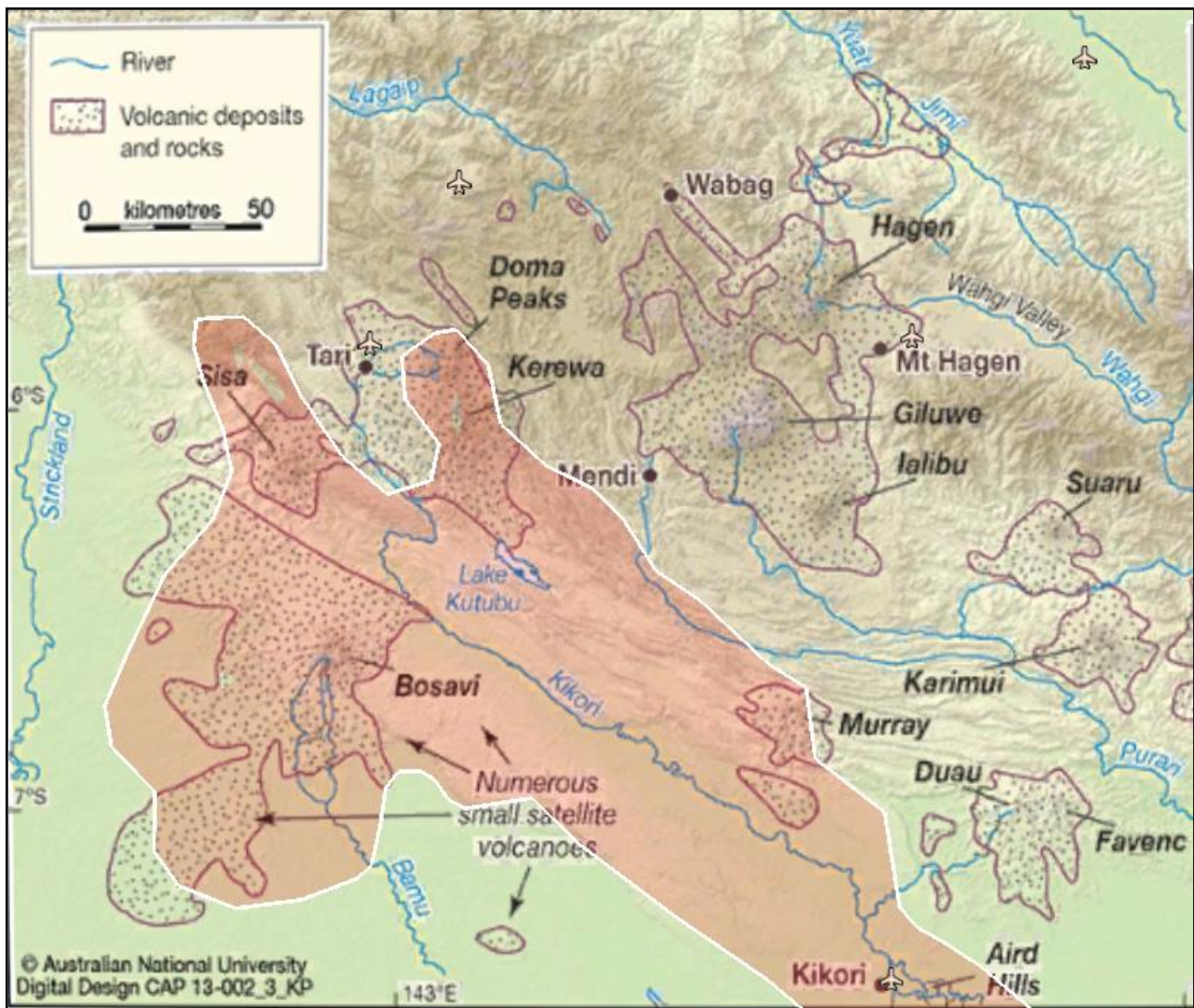
3a. *Natural Heritage*

Just a few examples of feature components of the Tentative Listed area are described below.

"Hides did not refer to volcanoes there, but he did write that the Leonard Murray Mountains — his name for Bosavi— 'appeared like a giant Fujiyama [the famous Japanese volcano], drawing themselves together from the plateau' (in R. Wally Johnson 2013).

Champion and Adamson, who approached Bosavi from the south-west, noted the existence, well away from the main mountain, of a crater lake and '*much loose volcanic rock*'. These are part of a volcanic field formed by eruptions from many small volcanic centres south-west of Bosavi. The party spent many days on the northern flank of Bosavi prospecting for gold, but none was found. Champion wrote that '*This mountain massif may be likened to a giant octopus, the peaks being at the head, and the spurs the long arms which run out for miles with deep gullies between*' (in R. Wally Johnson 2013).

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A key attribute of the Kikori Tentative Listed area is the incorporation of the greater part of Mount Bosavi, a Pleistocene strato volcano, together with associated volcanic landscapes extending to the lowlands. This provides an intact ecological sequence from 2,500 metres above sea level (asl) at the summit to around 50 m asl on the Fly and Turama River plains.

Lake Kutubu:

Lake Kutubu has been well documented and is known to be a site of outstanding conservation value, especially given the richness of its freshwater fish diversity.

Darai Karst Plateau:

The Darai Plateau has been described: “With over 5,000 square kilometres of tangled rainforest, the plateau is completely unexplored and represents one of the last wild places on earth” (Beck in 2003). Its surface has also been described as resembling a lunar landscape.

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The 'lunar landscape' of the Darai Plateau, a 5,000 sq. kilometre tract of karst limestone with no surface drainage. (PNG Mining Cadastre Portal)

Speleological exploration has been very limited, mostly occurring in 1993. This international expedition targeted several resurgences on the western wall of the Darai Plateau, in particular where the Hawoi River emerges from deep underground. Another resurgence to the south was also explored.

But highest on the agenda of the French cavers was accessing and exploring a huge doline that had been identified from aerial photography and satellite imagery and already dubbed in French the 'Darai Gouffre', otherwise known in English as the Darai Doline. An attempt to reach the giant hole overland from their base camp below the western wall of the plateau was thwarted by the extreme difficulty of the topography and the dense scrubby vegetation. Eventually the giant doline was accessed by helicopter and a small team descended to the floor of this enormous hole in the ground. Close study of the floor over 3 days revealed some extraordinary results, that volcanic magma had played a part in chemical breakdown of the limestone. Here we had an outstanding example of interaction between volcanism and karst - as well as being a globally outstanding mega doline.

"With a calculated volume of around 150 million cubic metres, the Darai Doline is without a doubt the largest known karst cavity on Earth" Beck

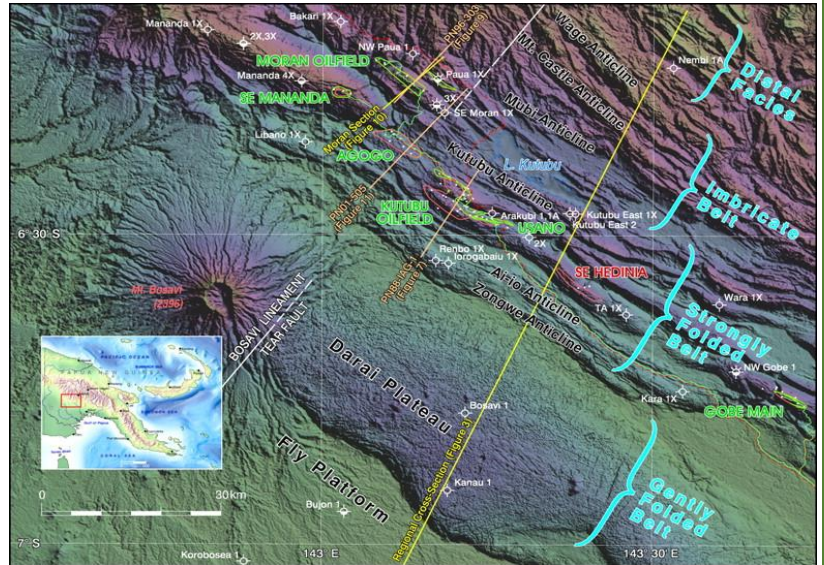
The speleological explorations of the Darai Plateau to date point to it being highly likely that there are many more discoveries of karst features to be made, especially underground rivers. But the extreme topography and entangling vegetation will ensure that such exploration will be a very long term project. It is extraordinary that this wild and rugged landscape is held as a logging concession (Appears to have been renamed from 'Hekiko' to Turama, no doubt after the Malaysian logging company that holds it); one can only wonder at the impracticability of

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building roads into this karst, let alone the extraordinary environmental damage that will be occasioned by such activity.

80. *Oxyeleotris caeca* Allen, 1996. **Common name:** ihaaribi (blind, in Yagi language). **Etymology:** *caeca* (L) blind. **Major synonyms:** None. **History:** Rumors of the existence of this fish date back to 1978 but it was not captured until June 1995 by inhabitants of Kafa Village. **Distribution:** Papua New Guinea, creek near Kafa, tributary of the Mubi River, upper Kikori River system (ca. 6°34'30" S, 143°29'30" E). **Habitat and ecology:** In a creek connected to a small cave 100–200 m upstream, at an elevation of 650 m a.s.l. **Remarks:** Eyes not externally visible. Mostly depigmented except for the dorsal region. Most of the scales embedded. Description based on a single specimen. Seems to be closely related to *O. fimbriata*, one of the most widely distributed gudgeons in New Guinea and the only freshwater-restricted member of the genus occurring on both sides of the Central Dividing Range.

Much of the Kikori River basin is so little explored that the following is an example of the chance collection of a blind fish species that is found in caves on the Waga River and only known from one specimen. Likely, many more species await discovery, both plants and animals.



Geological diagram illustrating the relationship between the massive Darai Plateau limestone karst and the Bosavi volcanics to the north-west, the Fly lowlands to the south west and the fold belt to the east. sp.lyellcollection.org.

3b. Cultural Heritage:

Just a few examples of cultural heritage attributes of the Tentative Listed area are described below (refer to Appendix 4 & 5 for more details).

The artistic and traditional customs of the Foi and Kaluli communities (see Appendix 5), embody a spiritual relationship of the people with nature and express a long and intimate relationship with their natural environment. The persistence of cultural practices is exemplified in the continuing inscription of the landscape through song and dance. These cultural practices bear witness to the persistence of unique ways of inscribing the landscape, still relevant to the people of the region. Archeological sites also provide important information about human occupation and trade in the region.

The transmission of cultural knowledge historically was conducted within community cultural spaces, known as longhouses. Residential aggregation provided a way of increasing productivity, while creative forms of expression (poems, songs and dance) provided a medium for socialising the landscape. The remnant longhouses thus bear a unique testimony to the cultural traditions and practices which are still living (Criterion III) and may be considered to be an outstanding example of a type of building which illustrates a significant stage in human history (Criterion IV), prior to the introduction of Christianity in Papua New Guinea. The longhouses represent an outstanding example of a traditional human settlement which is representative of human interaction with the environment especially when it has become vulnerable under the impact of irreversible change (Criterion V).

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The Tentative Listed Area may also be considered as an outstanding example of an 'Associate Cultural Landscape' (ICOMOS), defined by material sites as well as the continuing attachment to the landscape through the interplay between cultural values, customs and land-use practices (which includes practices of 'remembering'). The landscape is the repository of intangible values and human meanings that nurture people's very existence (see Taylor 2008).

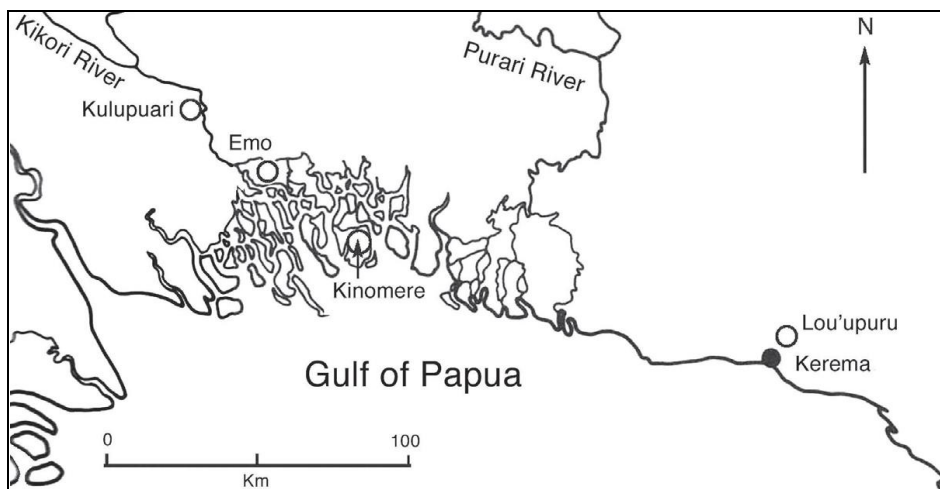
Archaeological Research of Kikori River Basin/Great Papuan Plateau

Archaeological excavations at the limestone cave site OJP, in the Kikori River lowlands reveal the first evidence for human activity in this part of PNG during the terminal Pleistocene (David et al 2007). A cave excavation in early 2006 identified cultural levels of terminal Pleistocene age and an assemblage comprising human skeletal materials, charcoal, burnt seeds, vertebrate faunal remains and marine shells.

This is a vast region with only smattering of archaeology mainly focused on the study of the history of the *hiri*, that is, the delta region. The environmental history of Lake Kutubu has been reported Haberle et al. (2001) but there has been no archaeology undertaken yet.

The archaeology of the hiri in the Gulf region

There are a series of sites within the Gulf delta region that have contributed some useful datasets that underpin our current understanding of the local archaeology. These sites were originally excavated and reported by Rhoads (1980, 1982, 1983) and more recently re-excavated by a team lead by Bruno David (David et al. 2010).



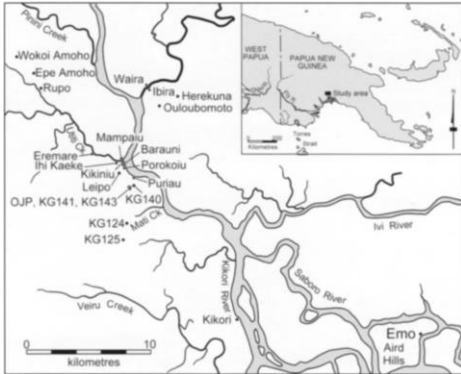
Some of the important Gulf sites (from Allen 2010)

The archaeology of the Emo/Aird Hills area (as seen in figure 3) has been investigated both by Rhoads and more recently by the team lead by Bruno David. The latter team excavated a number of sites across the landscape and are still in the process of publishing their results. David et al. (2010:51) identified 5 phases of occupation at Emo starting with the first arrival of people at 1840 years ago and followed by occupation at 1620, 1530 and 720 years ago and again during the early and again in the mid-20th century (David et al. 2010).

Pigs and dogs are present from 1620 years ago and perhaps earlier for pigs. Coconuts were being consumed by 1530 years ago. Pottery was present in the earliest phase but began to

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dramatically increase in quantity after 1530 years. This pottery is thought to represent low level trade that existed prior to the *hiri* (David et al. 2010). Marine shell contributes to the diet throughout the sequence (Thangavelu et al 2011).



Emo and the Aird Hills excavated sites (map from David et al. 2010:41)

The Keveoki 1 site is a surface pottery scatter representing a former coastal village that is now located inland within the vicinity of the Vailala River at the eastern end of the Gulf delta region. This short lived site reflects something of human behavior at the beginning of the *hiri* at 450-500 years ago (David et al. 2009).

Longhouses:

The unique longhouses of Lake Kutubu and Mt Bosavi (no longer built) are extensively recorded in anthropological literature, with the region's longhouse style being one of PNG's most distinctive architectural forms. Detailed ethnographic studies have provided important insights about the ways in which people of this region interact with the environment through cultural practices that provide a sense of identity and continuity, and convey knowledge about the landscape. Although the influence of Christianity has led to the end of longhouse construction, the people of Lake Kutubu and Mt Bosavi continue to practice their cultural traditions and rituals.



Longhouse of Lake Kutubu (image from google earth)



Longhouse of Mt Bosavi. (Image from Loupis 1983:370)

4) Threats (land use and land tenure changes, development)

A range of threats and potential threats have been identified, major threats having emerged since nomination in 2006. The type and level of threat varies with the particular landscape or land system within the Tentative Listed site. Threats are outlined below for each of 5 landscape units.

Mount Bosavi:

“Champion and Adamson, who approached Bosavi from the south-west, noted the existence, well away from the main mountain, of a crater lake and ‘much loose volcanic rock’. These are part of a volcanic field formed by eruptions from many small volcanic centres south-west of Bosavi. The party spent many days on the northern flank of Bosavi prospecting for gold, but none was found.” Johnson.

Alluvial gold has been reported from the southwestern slopes of Mt Bosavi. The volcanics in this region may have potential for near-surface epithermal gold mineralisation.

The steep and difficult terrain together with the geology of the mountain proper means that there is presently only a very low level of threat to this landscape. Currently (October 2014) there are no mineral exploration tenements on the mountain proper.

However, there appears to be one large Petroleum Prospecting License (PPL 287) though the currency of this cannot be confirmed as the Department of Petroleum and Energy website and data base was offline throughout the research for this section. PPL 287 was originally very extensive and covered much of the Tentative Listed area but has been progressively reduced and now comprises only two much smaller area, the greater part of Mount Bosavi, as might be expected, having been excised from the original license.

PPL 287 was held by South African owned Sasol but is reported to have recently been sold to another company following disappointing exploration in lowland areas prospected.

Given the difficult terrain, logging is unlikely to be a threat to the steeper slopes of the volcanic cone. Logging in the Wawoi Guavi concession to the south of Mount Bosavi, well inside the Tentative Listed area, appears to have extended to the limit of the gently sloping lowlands and not extended up the steep dissected slopes of the mountain.

Conclusion on Mount Bosavi:

It is apparent that the greater part of the ‘Mount Bosavi’ landscape - the steeper more rugged upper slopes of the volcanic cone - will not be subject to serious on-going threat from mining, petroleum development, logging or oil palm plantation development. Mineral, petroleum and logging interests should therefore not be an obstacle to its formal protection to exclude development. There are already 3 protected areas in this landscape (Libano-Hose, Libano-Arisai and *Sulamesi WMA’s) and so it is unlikely that there will be any resource exploitation constraints to extension of formal protection in this landscape.

*Subject to confirmation of gazettal

Lake Campbell foothills and lowlands:

In 1936, *“Champion and Adamson, who approached Bosavi from the south-west, noted the existence, well away from the main mountain, of a crater lake [Campbell Lake] and ‘much loose*

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volcanic rock'. These are part of a volcanic field formed by eruptions from many small volcanic centres south-west of Bosavi." Johnson 2013

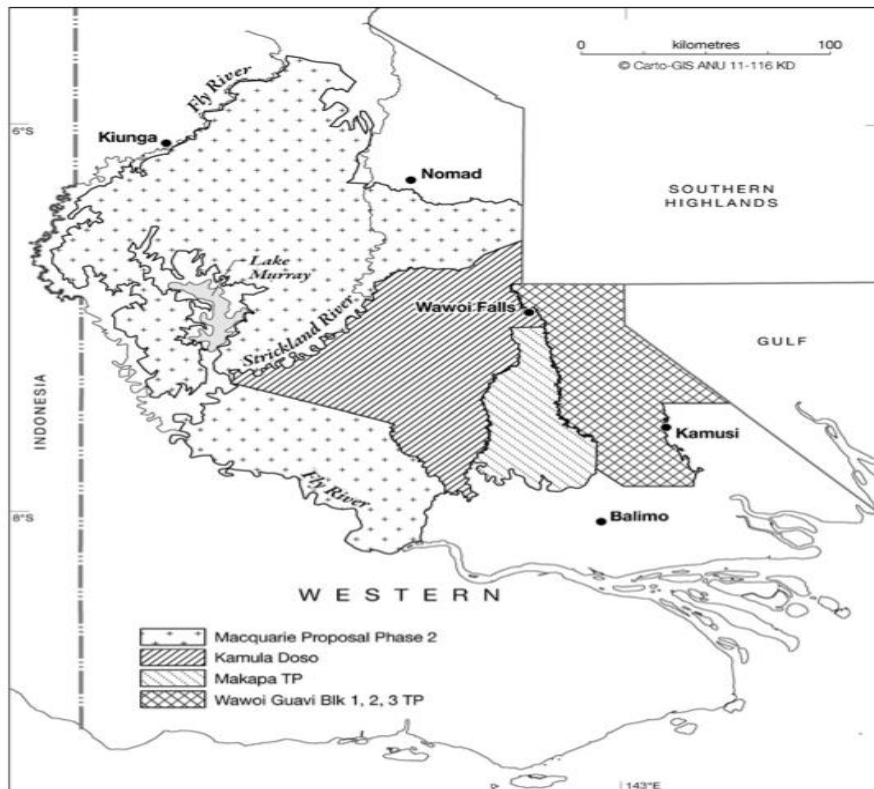
Champion had earlier made aerial observations of Lake Campbell, a feature of the western foothill lowlands.

Given the easier terrain and well developed forests on these lower slopes, bordering the lowlands of the Turama, Wawoi and other tributaries of the Fly River, there is potential for threats from logging, mining, petroleum exploration and oil palm development. The main threats are addressed below:



Extensive logging road network in Wawoi Guavi logging concession south of Mount Bosavi.
(Image from Google Earth)

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Kamula Doso Forest Management Area and adjoining forest interests.
(Map from Filer and Wood 2012)

Mineral exploration:

The whole of this landscape is now subject to new mineral exploration permits for coal. All tenements are held by Australian company Waterford Limited. Exploration for coal is a relatively new thing in Papua New Guinea and those applications for coal exploration are all concentrated in the south west, extending from just west of Port Moresby to the Strickland River.

The EL's held by Waterford extend right across the Kikori Tentative Listed area, indeed cover about 1 million ha. of the listed area or in the order of 50% of the total area.

Results of the limited drilling of coal deposits indicate a relatively low grade steaming coal, comparable with the coal mined in Indonesian Borneo. Notwithstanding, the scale of the deposits and the accessibility, particularly in terms of minimal overburden suggests that there may be a market for this coal. However, the on-going decline in the market price for this type of coal may preclude this locality being opened for mining.

The PNG mining legislation is currently considered not suitable for coal mining tenements and until such time as there are appropriate amendments to the legislation, many of the Waterford Limited tenements may lapse. (The legislation was drafted with metalliferous mining in mind and so the convention of progressive surrender of a proportion of an EL would force the surrender of large areas of known resource. Apparently there is a proposal for the relevant amendment to be expedited.)

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Any coal deposits may also be targeted as a source of coal seam gas (CSG) and be exploited accordingly.

In conclusion, if coal deposits are confirmed throughout the existing coal tenements within the Kikori Tentative Listed area, this would indeed represent a major threat, whether exploited for either CSG or for coal by open-cut mining, to a lot of the listed area, especially in the Lake Campbell area (also to the Darai, Kikori and Delta landscapes).

Petroleum exploration:

There are several extensive Petroleum License applications, including parts of PPL 261 and probably part of PPL 426. This landscape is likely to have some prospectivity for oil and gas and be subject to on-going exploration interest. In the event of oil and gas development occurring in this landscape, properly managed, it is likely to have only a limited impact on the conservation values of the area.

Logging:

There are several logging 'concessions' across the southern half of this landscape viz.

Kamula Doso (Part Block 3)

Wawoi Guavi

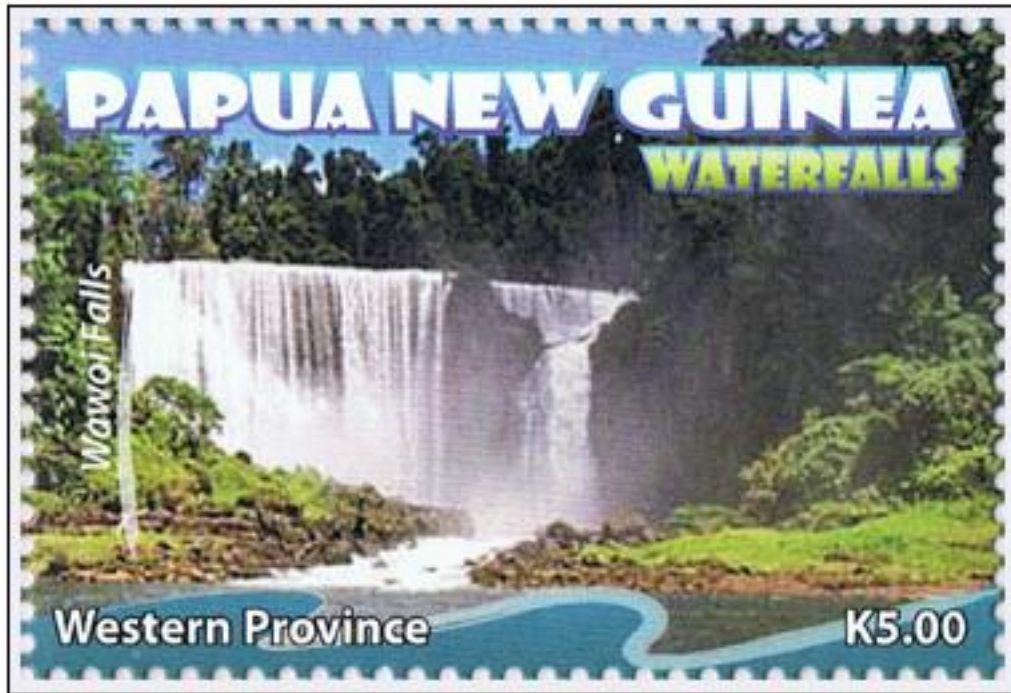
Makapa TP

The Kamula Doso block is particularly important for conservation as it embraces the greater part of the **unlogged** forest on the lowland volcanics. Logging has now advanced into this section of the Tentative Listed area with many logging roads now visible on satellite imagery, especially in the Wawoi Guavi concession. The eventual extent of this logging has not been ascertained. Logging has reached the spectacular Wawoi Falls.

Importantly, that part of the former Kamula Doso logging concession within the Tentative Listed area remains intact with no evidence of logging or road construction. This includes the extensive lowland and foothill volcanic landscape and so is of considerable conservation importance.

Oil Palm Development:

The lowland volcanic landscape of high conservation importance has also been mapped as having *moderate* potential for oil palm plantation (Butler 2013) so oil palm development must be regarded as a potential threat to the natural heritage values of this landscape.



The spectacular Wawoi Falls is within the Tentative List area. Unfortunately logging has now extended right to the falls.

Conclusion on Lake Campbell Foothills and Lowlands landscape:

In conclusion, there are major potential threats to the 'Lake Campbell landscape' (coal mining, logging, oil palm, petroleum development) and requires active review and intervention as needed.

Darai Limestone:

A major limestone karst plateau extending south east from Mount Bosavi, grading gently to the south until disappearing below sea level in the south. The area is sometimes referred to as the Darai Plateau and is shown on some older maps as the Leonard Murray Mountains, a relic of the name applied to Mount Bosavi by Hides during his epic exploration of the region.

"The Darai Plateau is interpreted as a large scale inverted half graben with strike extension of approximately 150km from Mt Bosavi in the northwest to the Barikewa gas field in the south east."

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Much of this particularly rugged and complex terrain remains unexplored and likely to be important for biodiversity conservation. Threats to this landscape appear minimal except at the lower, more accessible elevations in the south.



Mubi River Falls. Much of the landscape of the Kikori River valley and the Darai Plateau is dominated by karst limestone, much of it with underground drainage, underground rivers emerging in places as waterfalls. (Image from 'PhJ' Panoramio)

Mining and Petroleum:

There are presently no mining or mineral exploration tenements on the Darai Limestone landscape but there are extensive petroleum tenements PPL, not necessarily translating into on-ground activities. There is evidence of some exploration tracks and roads extending on to the less rugged eastern edge of the plateau. The Bosavi 1 petroleum exploration drill hole in the middle of the plateau proved to be a 'dry hole' so we may not see too much more petroleum exploration on the more rugged parts of the Darai Plateau.

Logging and palm oil plantation: The difficult terrain would appear to be not at all conducive to logging or palm oil development, except possibly in the far southern section. Notwithstanding, it seems incredible that a logging concession area has been declared over much of this rugged karst landscape. The Helkiko logging concession has been issued over the

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most rugged limestone karst on the Darai Plateau, indeed right to the summit of Mount Bosavi.

In conclusion, there are current threats to the Darai Limestone landscape from logging and potential threats are largely limited to petroleum exploration.

East Kikori -Lake Kutubu:

Comprises foothills within the Kikori catchment east of Kikori River, including a tract of parallel limestone ridges centred on Lake Kutubu.

This landscape is already accessible by roads and there is significant development being undertaken by gas and oil operations. A gas pipeline has now been constructed right down the Kikori River valley to a marine terminal (see diagram below).

The biodiversity values of this landscape are better known than most other parts of the Kikori Tentative Listed area and have been subject to a 'Blueprint' regional planning process for the Kikori River Basin using Marxan methodology. The results of the Marxan exercise need to be interpreted with great care given the narrow focus on species level conservation. The mapping can also be interpreted to illustrate the poor data from the Darai Limestone (WWF 2013).

Lake Kutubu:

A major deep water inland lake with an outstanding aquatic biodiversity, needs to be seen in a regional and global context. The island of New Guinea is renowned for its outstanding freshwater fish biodiversity. Tragically, it is also widely seen as the scene of an environmental tragedy in terms of loss and threats to the endemic fish fauna. Most lakes and rivers in Indonesian New Guinea have been ecologically compromised by ill-considered Government sponsored introduction of invasive fish species, in some cases resulting in extinction of native fish species. Although many of Papua New Guineas rivers have been subject to deliberate and accidental introduction of introduced species, some of the lakes have so far escaped introduction of exotic fish species.

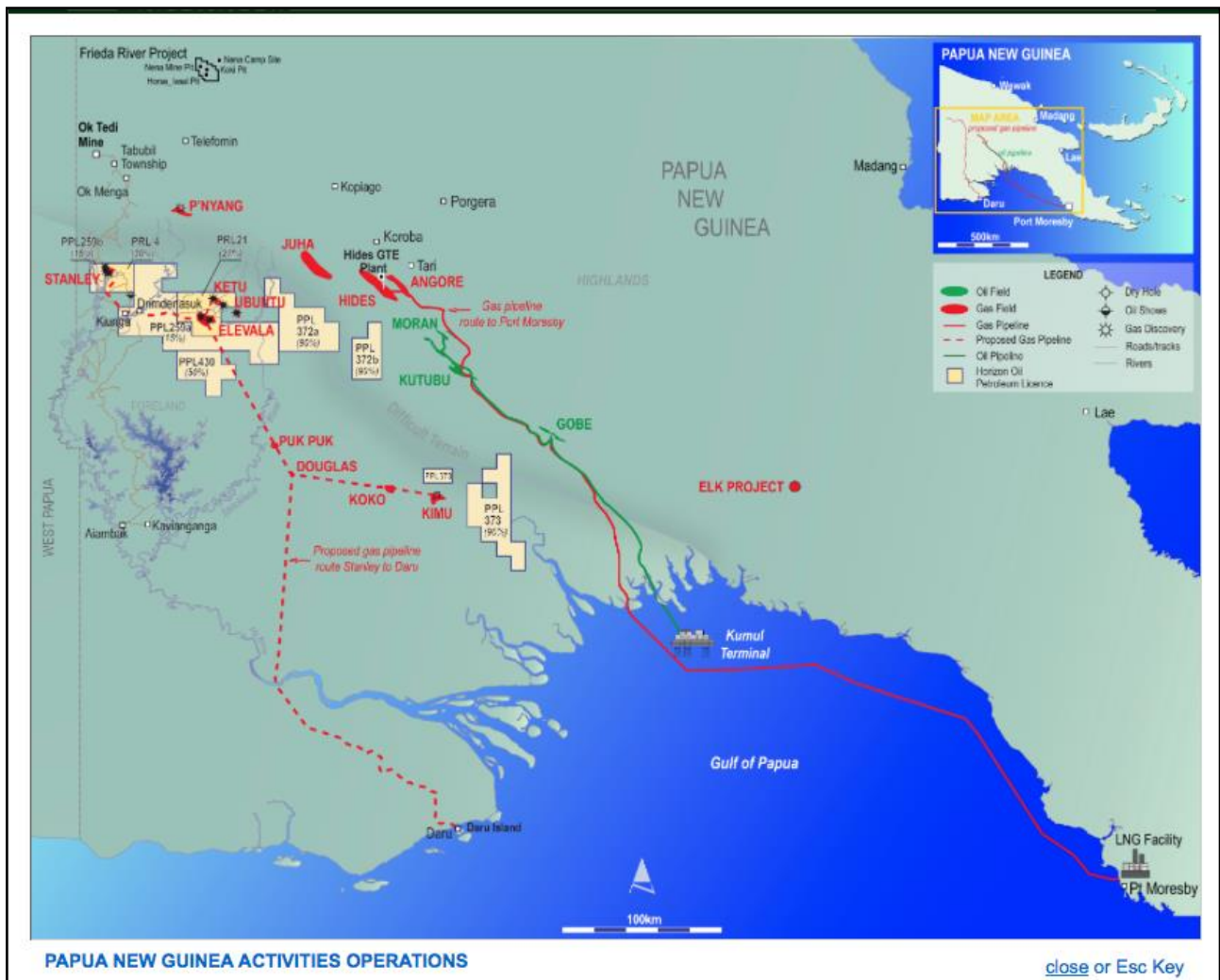
Lake Kutubu is an outstanding example of a lake with high fish endemism which has to date escaped the worst of fish introductions. History throughout the world illustrates how easy it is to destroy the biodiversity and ecology of freshwater lakes. The Outstanding Universal Value of the lake will only survive with active management intervention. Lake Kutubu is therefore deserving of a high level of management input and surveillance.

Given the extensive oil and gas exploration that is already occurring and the construction of the main gas pipeline down the Kikori River, this landscape is already under some threat. Depending upon the ultimate extent of the oil and gas development and moreso on the associated migration of development, much of the Kikori River landscape may eventually be precluded from consideration as being of World Heritage significance. Meanwhile, there needs to be active engagement with the oil and gas developers and customary landowners to minimize environmental impact and so retain as much of the conservation value of the area as practicable.

The Lake Kutubu area is an especially important area of likely Outstanding Universal Value (OUV) which deserves close attention from conservation authorities. It has already been the subject of international attention over allegations of pollution of lake waters by a petroleum

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company operating in the area. (2009) At that time the PNG Government was perceived to be inactive in addressing what globally was seen as a serious issue. In all probability, much of the evidence purported to be the result of pollution was the result of a recurrent natural phenomenon associated with this lake.



Current extent of oil and gas exploration and development. Image: Horizon Oil website

In conclusion, the East Kikori - Lake Kutubu landscape component of the Kikori Tentative Listed Area is subject to ongoing development associated with the petroleum industry and requires active engagement to minimize impact on conservation values.

Kikori Delta:

The Kikori Delta is a huge complex of estuarine environments with many estuarine channels and islands. Being one of the largest remaining intact estuarine wetlands systems in the Asia Pacific, the Kikori is of outstanding conservation importance for marine wildlife.

Exploration is progressively revealing that there are mineral and petroleum resources in the delta and immediate upstream areas. Indeed, the threats to the delta are manifold.

Notwithstanding the construction of the major gas pipeline through the western side of the delta, this landscape remains largely intact. The main threats and potential threats are:

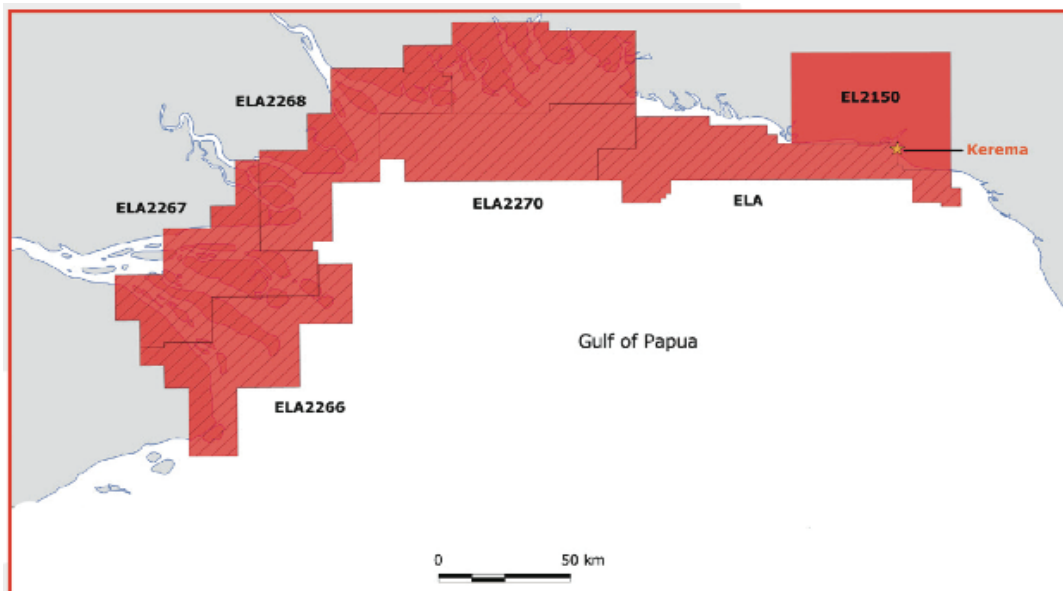
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Mining and Petroleum: There are multiple resources that are being explored for exploitation in the Gulf of Papua region.



Part of the Kikori River delta estuarine wetlands. There is a proposal for mining of this area for ironsands and heavy mineral sand by dredging.

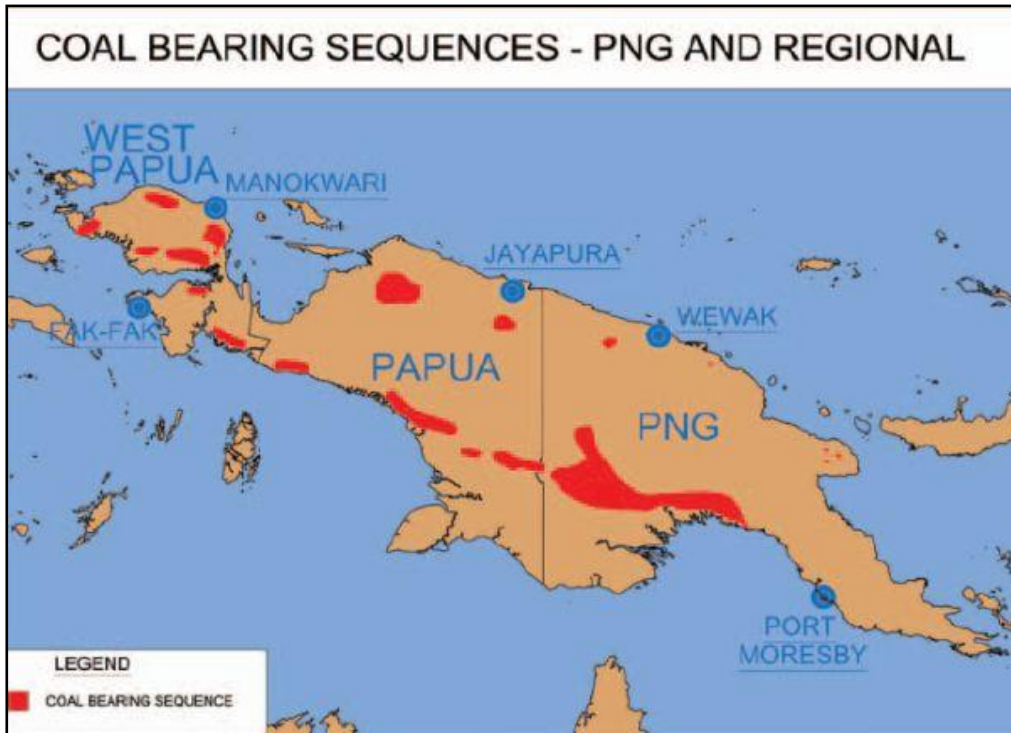
Iron Sands: A somewhat surprising mineral resource that is being targeted in mineral exploration is iron and heavy mineral sands along the coast of the Gulf of Papua. Mining of this resource has the potential to be very destructive of estuarine wetlands and coastal lowlands.



This continuous belt of Exploration Applications by the one company, Mayur Resources, is for iron sands and heavy mineral sands. It covers the entire coast of the Gulf of Papua, including much of the delta section of the Kikori World Heritage Tentative List area (diagram from Mayur Resources website).

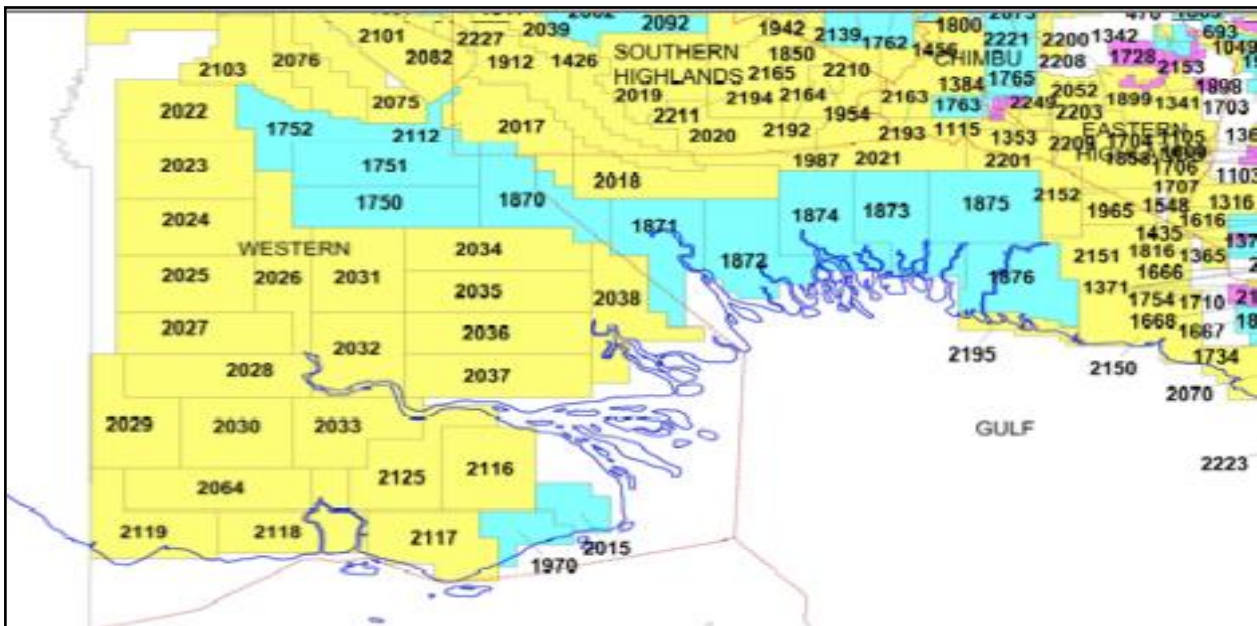
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Coal: Coal is a relatively new mineral exploration target in PNG and the main focus for coal exploration has become the Gulf of Papua lowlands and the Western Province.



Predicted main coal resources on the island of New Guinea (Waterford website).

Coal deposits are predicted to extend right across the Gulf of Papua to the western border of PNG (and beyond), including right across the southern section of the Kikori World Heritage Tentative Listed area. A single company, Waterford Limited holds all existing exploration licenses over almost the entire predicted resource (see diagram below).



The continuous belt of Exploration Applications for coal held by Waterford Limited as at November 2013. These EL's cut right across the Kikori delta section of the Kikori Tentative Listed Area.

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Apparently when the PNG mining legislation was drafted, no consideration was given to the possibility of coal tenements being applied for, with the result that the current legislation is an obstacle to development of coal. Unless these legislative issues are addressed the Waterford applications may lapse. There is therefore some uncertainty about whether coal mining may materialize in the near future and become a serious threat to the Tentative Listed area.

Oil and gas exploration and development:

Given the on-going interest by petroleum explorers, both upstream of the delta and offshore, it is reasonable to conclude that the delta will in future attract interest for petroleum exploration. Details of current petroleum exploration tenements could not be obtained during the review because the Dept of Petroleum and Energy website was 'down for maintenance' throughout. Petroleum exploration must be considered a potential future threat to the delta section of the Tentative List area and beyond.

Aquaculture:

Given the expanding interest in Asia of aquaculture for both fish and prawns, all estuarine areas such as the Kikori must be seen as having the potential for industrial scale aquaculture and therefore regarded as a potential future threat.

Conclusions on Kikori Delta landscape:

In conclusion, the Kikori Delta is currently subject to multiple serious potential threats, including some that could be highly destructive and should be kept under constant review to avoid or minimize impacts.

Summary of Threats to Kikori Tentative Listed area:

The Kikori Tentative Listed site is a very large tract of largely intact land with a great diversity of environments with a generally high conservation value of national and likely global significance. The threats to this important area vary greatly from locality to locality, more particularly from landscape unit to landscape unit.

Petroleum:

The whole of the area is of interest for petroleum exploration though in reality this is unlikely to include the main volcanic cone of Mount Bosavi. Similarly, much of the Darai Plateau is likely to remain without threat from petroleum development in the foreseeable future.

Mining:

On the other hand, the area appears to have a mostly low potential for major mineral discoveries and hence mining is a low level potential threat.

Logging and Oil Palm Plantation:

Since nomination in 2006, there has been extensive logging in the Tentative Listed area, namely the lowlands section south of Mount Bosavi. The high conservation value (HCV) lowland volcanic landscape south west of Mount Bosavi is potentially threatened by logging and oil palm plantation development and warrants active intervention.

Overall the Kikori Tentative Listed area is in a region where the lowland forests are being actively logged and most of the area is being explored and/or developed for oil and gas. In order to protect the high conservation values of likely Outstanding Universal Value it will be necessary to take a proactive approach. Failure to take a proactive approach may in future necessitate major excisions from the Tentative Listed area.

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Threats from Mining and Petroleum exploration and production

Landscape Unit	Mineral exploration tenements	Petroleum exploration tenements
Mount Bosavi volcanics	No	Yes
Bosavi western volcanic foothills and lowlands	No	Yes
Darai limestone	No	Yes
East Kikori - Lake Kutubu	Some potential	Yes
Kikori delta	Yes	Yes

All of the current and potential threats from exploitation activities are not only a threat to the natural heritage values but likely also a threat to the local culture and cultural heritage attributes.

5) Protection Needs and Priorities

It is apparent that a large proportion of the Kikori Tentative Listed area is under threat from mineral and petroleum exploration and also from logging. Only a small proportion of the area has any formal protection, mostly in areas where little threat exists (Mount Bosavi).

If the spirit of the World Heritage Convention is to be followed, there is a need for a much more concerted effort to formally protect the critical components of the Kikori Tentative Listed Area.

The critical components of the listed area that deserve priority protection, in broad order of priority are:

- I. Lake Kutubu: Deserves a higher order of protection than WMA and requires a smart management strategy to protect the OUV of the lake;
- II. That part within the Kamulo Duso (ex?) logging concession (unlogged forest in a lowland volcanic landscape);
- III. That part of the Wawoi Guavi logging concession. (although already logged, it is important to prevent conversion of this section into oil palm development);
- IV. Upslope (south west) of the Libano WMA's and east of Ludesa Mission (consolidates link from limestone lowlands to volcanic upland landscape of Mount Bosavi. This would effectively consolidate protection by linking the Libano WMA's and Sulamesi WMA).

6) Revised description

Given that there is a large amount of outstanding research and review to be conducted, there is no pressing need to review the Description in the official citation.

7) Revised Statements of authenticity and/or integrity

Since nomination to the World Heritage Tentative List in 2006 there has been extensive logging in parts of the area (e.g. Wawoi Guavi logging concession) and extensive track and

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seismic line construction in the Kikori River region. The Statement of Integrity should be revised to reflect this reduction in natural integrity.

Under the circumstances, the revision should be undertaken as an internal adjustment without the need to seek a revision of the official citation at this stage.

8) Revised Comparative Analysis

The current Comparative Analysis is altogether unsatisfactory and should have been rejected in 2006. A completely new Comparative Analysis should therefore be formulated for notification to the World Heritage Committee.

9) Recommendations arising

Summary Statement:

It is clear that the Kikori Tentative Listed area has outstanding natural and cultural heritage values and represents a definite contender for a future World Heritage nomination. Notwithstanding, given the large size and poor accessibility, it is not surprising that there are still major gaps in our knowledge of the area.

A measure of the relative significance of the Kikori site as a potential World Heritage Site is that the greater part of the area remains a largely intact landscape, joining the globally diminishing league of Intact Forest Landscapes (IFL)

Outstanding as the Kikori Tentative Listed area is, of all the tentative listed sites in PNG this is easily the most threatened. Some threats are already impacting, others are immediate and still others are potential threats, some of which may never be realized. What is clear however is that without a concerted conservation effort, there is a very real possibility that the current and potential threats may be so great as to contribute to the gross degradation of this impressive landscape that it may in future need to be abandoned as a prospective World Heritage Site.

The threat of logging is greatly amplified as much of the proposed logging is on fragile karst landscape, apparently in contravention of Government policy about limiting logging on karst.

The Tentative Listed site contains a series of distinctive cultures, some with relatively minimal modification by outside agents though this is expected to change if resource exploitation development moves into these lands.

Given the 'high heritage value - high threat' scenario, it is incumbent upon the World Heritage lead agency of Papua New Guinea to urgently and actively engage in seeking to protect the outstanding heritage values. Accordingly, the following recommendations are presented as a potential path to effective protection of this magnificent part of PNG:

a) Name:

The current name of the Tentative Listed site, "*The Kikori River Basin / Great Papuan Plateau*" is rather clumsy and fails to mention several of the most important and/or outstanding features of the area, viz Lake Kutubu, Mount Bosavi volcano and the Kikori delta.

The name Mount Bosavi, for better or for worse, is the only globally publicized and known feature but is missing from the name.

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Given the major threats to the area, World Heritage nomination of the site is some years away so it is not critically important to change the name at this stage.

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Retain the official name of the 'Kikori River Basin/Great Papuan Plateau Tentative Listed area in the interim but review the appropriateness of the name prior to any nomination for World Heritage status.*
- *Consider using an abbreviated interim name internally, such as 'Bosavi-Kikori'.*

b) Boundary:

Given that:

- The Kikori Tentative Listed site is a very large tract of land (circa 2 million ha.);
- Substantial parts of the boundary are imprecise;
- Some parts of the site are remote and poorly known;
- There are identifiable lands of potential conservation significance immediately outside the existing boundary;
- There appears to be a case for incorporating the Muller Plateau section of the Sublime Karsts Tentative List into the Kikori Listed Area (Indeed, the Hindenburg Wall, Muller Plateau and the Darai Plateau and Kikori River parts of the Kikori Tentative List are all formed on the Darai (Karst) Limestone and might be considered for a serial nomination with an underlying karst theme).

There is a need to more precisely delineate the Tentative Listed area as knowledge of the area is improved and on-ground circumstances are better known. Also, the review identified several potential additions to the area (see Research needs).

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Recognise the imprecise and interim nature of the current boundary;*
- *Consider reduction of the eastern boundary in the area south of Nipa to remove cleared, developed land;*
- *Regularly review the boundary in response to new information;*
- *Be mindful of the case for extension of the boundary within the unlogged forest of Kamula Doso logging concession in the south west and a link with the Muller Plateau in the north;*
- *In the interim, retain the existing boundary.*

c) Responding to Threats, Protection Needs

Given the:

- Multiple and major threats to most of the Kikori Tentative List;
- Emerging new (for PNG) threats (e.g. coal mining and coal seam gas (CSG))

Logging:

Given the:

- Extent to which the lowlands have already been logged (e.g. Wawoi Guavi);
- High conservation value of the intact (unlogged) lowland forests, in particular on the volcanic geology (Lake Campbell) [Kamula Doso logging concession];
- Potential major environmental impact of logging on the Darai Plateau karst;
- Valuable biodiversity of the Kikori River valley.

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It is **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Ensure that Libano-Hose, Libano-Arasai and Sulamesi WMA's are protected from logging;*
- *Give priority to preventing logging of that part of Kamula Doso concession within the existing Tentative Listed area; (see diagrams);*
- *Give priority to seeking a review of the 'Hekiko'* logging concession on the Darai Plateau karst and explore prohibition of logging ;*part may also be known as 'Turama');*
- *Review logging concessions in the Kikori valley and especially in the Waga and Mubi River karst.*

Mining:

Given that there are two emerging types of mining that are emerging that have the potential to seriously impact on the heritage values of the Kikori Tentative Listed area, namely:

- Coal mining;
- Iron sands and heavy mineral sand mining of coasts and coastal lowlands.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Recognize the potential major impact of open cut coal mining and iron sands mining on the existing Kikori Tentative Listed area;*
- *Lodge objections with MRA to coal mining and iron sands mining within the existing Kikori Tentative Listed area.*

Petroleum Exploration and Exploitation:

Given that a large proportion of the Tentative Listed area is already under petroleum exploration tenements;

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Seek a comprehensive update of the extent of petroleum exploration tenements;*
- *Actively engage in responding to all exploration applications and petroleum development projects.*

Oil Palm Development:

A number of parts of the Kikori Tentative Listed area have potential for oil palm development, in particular in the 'Lake Campbell' sector (e.g. part of Kamula Doso) and to some extent in the Kikori valley. Oil palm development is not appropriate in a formal protected area, including a natural heritage World Heritage area.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Seek to protect the Tentative Listed area from oil palm development, in particular within the Kamula Doso logging concession section of the Tentative Listed area.*

d) Protection:

Given the:

- High conservation value of the Listed Area, including demonstrable Outstanding Universal Value (OUV);
- Recognized threats to those values, there is a case for an active program of protection.

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It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee:

- *Lake Kutubu WMA: Urgently review the management effectiveness for Lake Kutubu WMA;*
- *Lake Kutubu WMA: Seek to upgrade the protection status of Lake Kutubu from WMA to at least Conservation Area or better, consistent with the very important conservation value;*
- *Sulamesi WMA: Urgently seek completion of gazettal of this important reserve. (It is apparent that establishment of this large and important protected area was completed up to but not including the gazettal stage);*
- *Kumula Doso: Seek to protect* that part of the Kumula Doso (ex) logging concession from logging and oil palm development; *(At least WMA status though Conservation Area status would be preferable.) Note: The boundary of the Tentative Listed area should be regarded as indicative only and greater attention given to the geological and soil patterns in delineating the area of greatest conservation importance. Extension of protection to the Strickland River would be a desirable objective;*
- *Wawoi Guavi: Seek to protect the relevant part of the Wawoi Guavi logging concession from further logging and from oil palm plantation.*
- *Libano-Sulamesi Link: Seek to negotiate a WMA for lands upslope of the two Libano WMA's* and the (proposed) Sulamesi WMA to consolidate protection on the east side of Mount Bosavi. *(east of Ludesa mission, including Wasu and possibly Sesani lands);*
- *Kikori River Delta: Consider nomination of the Kikori River delta and associated wetlands as a Wetland of International Importance;*
- *Actively explore further formal protection of those parts of the Kikori Tentative Listed area as landowners indicate a preparedness to support protection.*

e) Further Research:

Given that:

- The Kikori Tentative Listed area is a large area, in excess of 2 million ha ;
- Substantial parts of the listed area are largely unexplored (e.g. Darai Plateau);
- There is an overlap with the Muller Plateau section of the Sublime Karst Tentative Listed area, there is a clear need for further research to clarify and confirm the areas of highest conservation value and particularly areas of OUV.
- The unique longhouses of Mt Bosavi and Lake Kutubu are extensively recorded, but there is a gap in contemporary research about their continued significance in oral and cultural traditions;
- Lake Kutubu has been reported as important to the Hiri trade but there has been no archaeological or anthropological surveys undertaken yet.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee encourage further field survey with priority for:

- *Lake Campbell region (particularly the forests on volcanics) [Kumula Doso]Corridor connection to Muller Plateau - biodiversity surveys;*
- *Kikori River corridor - biodiversity survey;*
- *Speleological exploration, especially on northern half and western margin of Darai Plateau (dolines and caves);*
- *Waga River - Mubi River (potential underground rivers);*
- *Kikori Delta - biodiversity surveys;*
- *Mt. Bosavi – archaeological and anthropological research into culturally significant sites including important burial caves and cave paintings;*

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- *Contemporary anthropological research into living traditions and practices;*
- *Anthropological and archaeological research in the Lake Kutubu area.*

f) SABL's

In April 2009, TTD (Tumu Timbers Development) was granted a 99-year SABL over the Kamula Doso forest area. The legality of this was subsequently explored in a Commission of Inquiry into SABLs. The report of the Inquiry has been presented to Government but no decision has been made.

The status and ownership of the SABL has important implications for the possible logging and development of the Kamula Doso area and hence the World Heritage Tentative Listed area.

Accordingly, it is therefore **recommended** that:

- The PNG World Heritage Secretariat/Committee:
- Explore the current status of the TTD SABL's and its implications for the Kamula Doso section of the Tentative Listed area.

g) Towards Awareness, Recognition and Protection:

Given the:

- Apparent poor awareness within Government and the wider community of the Kikori Tentative List area;
- Outstanding natural heritage conservation value of the Listed area;
- Multiple major threats to the area;

Accordingly it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee:

- *Promote awareness of the Kikori River Basin/Great Papuan Plateau Tentative List area and its heritage attributes to the wider community;*
- *Promote awareness of and accurate information on this and other Tentative Listed areas by placement of details on an appropriate website;*
- *The need for the PNG Government to establish a process to address and reconcile known and potential conflicts between protection of globally significant heritage values, both natural and cultural;*
- *Promote the case for major international funding and/or other assistance for this purpose.*

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http://article.wn.com/view/2012/04/13/Mt_Bosavi_people_still_left_in_the_dark/

Appendix 1: WHC Citation

Papua New Guinea

Date of Submission: 06/06/2006

Criteria: [\(iii\)](#)[\(iv\)](#)[\(v\)](#)[\(vii\)](#)[\(viii\)](#)[\(ix\)](#)[\(x\)](#)

Category: Mixed

Submitted by:

Department of Environment and Conservation

State, Province or Region:

Gulf, Western and Southern Highlands Provinces

Ref.: 5060

Description

The property is a mixed cultural and natural site covering over 6% of the landmass of PNG. The Kikori River Basin / Great Papuan Plateau encompasses over two million hectares. There are few landscapes in Melanesia as dramatic with features including the extinct volcano of Mt Bosavi, cockpit and needle karst of the extensive Darai limestone, remarkable Hegigio Gorge and the spectacular Wassi and Wawoi waterfalls. The Kikori basin / Great Papuan Plateau contains one of the largest remaining tracts of undisturbed forest in the Southern Hemisphere. The catchment spans across nearly all forest types found in PNG, from alpine and montane forests in the north, to increasingly rare intact lowland forests in the south, to the largest block of mangrove forest in the Pacific. The region has about half the bird species richness of the entire North American continent. Included is a rich assemblage of birds-of-paradise species as well as the world's only underground roosting bird. Many species occur nowhere else in the world. The region represents three Centres of Plant Diversity, two endemic bird areas, and important segments of the G200 New Guinea Central Range Montane Rainforest and the Southern Lowland Rainforest Ecoregions. Ramsar listed Lake Kutubu - part of the Lakes Kutubu and Sentani ecoregion - is the most unique lacustrine habitat in the New Guinea-Australia region and provides the entire habitat of 12 endemic fish species. Equally Mt Bosavi and the Darai Limestone Karst are of particular importance with high levels of endemism, unique geological formations and extensive cave development. Over 60,000 people of the Kikori catchment belong to at least 16 different ethnic groups who depend largely on the natural world for subsistence and livelihoods. The forest has significant economic value for timber, ecotourism and non-timber forest products such as the recent discovered valuable fragrant resin eaglewood (also known as agarwood or aloeswood). Lake Kutubu and Mt. Bosavi are host to a number of cultural significant archaeological sites including important burial caves and cave paintings. The unique longhouse cultures of Mt Bosavi and Lake Kutubu are extensively recorded in anthropological literature. Collectively, these natural and cultural resources put the Kikori Basin on the map as an exceptional global treasure. The Basin is also the site of PNG's first major oil development. A partnership between the oil consortium and WWF has led to the declaration of over 86,000 ha of protected areas. These include the Lake Kutubu Wildlife Management Area (24,057 ha), Neiru WMA (3,984 ha), Libano WMA (8,250 ha) and Sulamesi WMA (49,800 ha). Further interest has been lodged by communities to establish protected areas within the Kikori River Basin. Development will commence this year on PNG's largest industrial development, a USD 3.5 billion-gas pipeline from the Southern Highlands to Queensland. Proposed road development will place extreme pressure on the environments of the Basin. Many of these threats can only be addressed through coordination under the context of a catchment management programme now being initiated by WWF with key partners. A partnership of NGOs,

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government, corporate interests offers a possibility for sustainable finance for effective management of the region.

Statements of authenticity and/or integrity

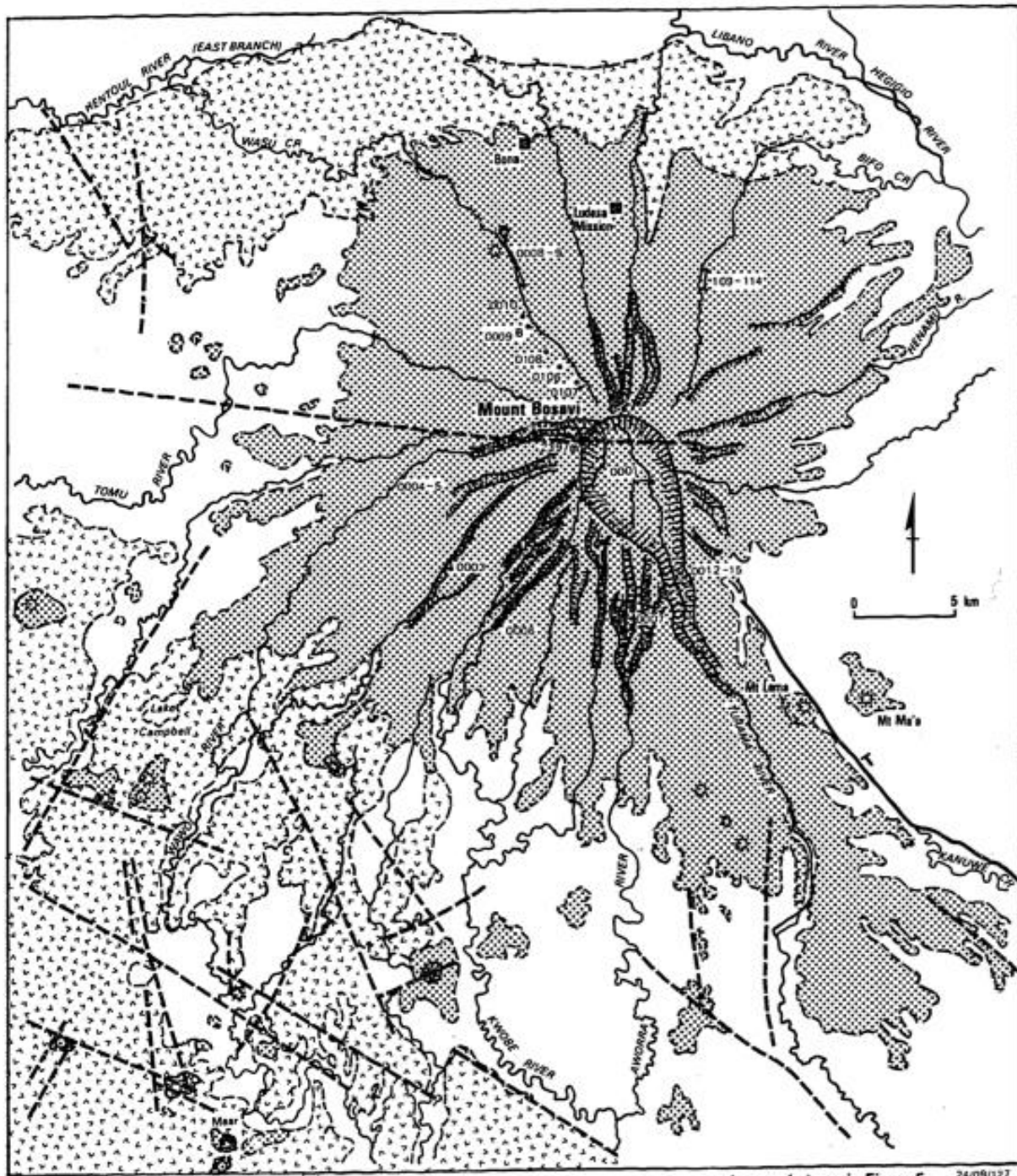
Natural systems remain in remarkable good condition with only a few limited areas of human habitation. A World Heritage listing would reinforce efforts for catchment management and conservation of the natural, biological and cultural integrity and human survival through sustainable management of resources. Presence of culturally significant sites in the Kikori River Basin also gives an added reason for the protection of the area. A World Heritage listing will provide a focus for efforts to conserve biologically important areas and promote sustainable economic opportunities such as tourism and forest product harvest.

Comparison with other similar properties





World Heritage Area protects some species that are shared with this region but there are significant differences in species composition, ecosystems, climate and geology.

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Appendix 2: Geological Sketch Map of Mount Bosavi



other symbols as in Figure 5. 24/09/127

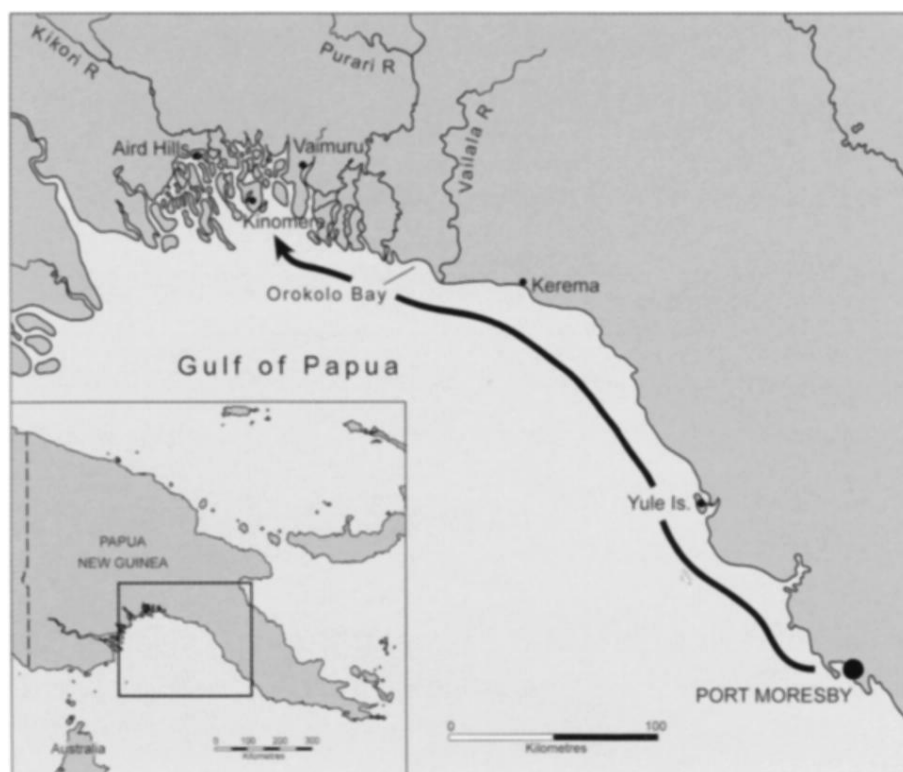
- | | | | |
|---|--|---|-------------------------------|
|  | Bosavi Volcanics — mainly lava, some pyroclastic deposits, minor derived sediments; |  | Minor eruptive centre (cone); |
|  | Bosavi Volcanics — mainly pyroclastic and water — reworked deposits, including lahars. |  | Minor eruptive centre; |

Based on Brown et al (1978) in Mackenzie and Johnson (1984)

Appendix 3: A potted history of the Hiri

Pottery was first introduced to the Papuan coast by Lapita people at 2900 BP (McNiven et al. 2011) and it is dispersed as far west as the Vailala River. While Lapita people are thought to have migrated to Caution Bay the jury is still out as to whether the Hopo site Lapita pottery was the product of human migration or low-level exchange (Moffat et al. 2011; Skelly et al. 2010; Skelly et al. 2014). Either way, pottery seems to have been traded around the immediate region until 1600 years ago when we see the first substantial increase in pottery deposition in the Gulf sites (David et al. 2010). This is followed by continuing exchange networks until 500 years ago when we see a massive increase in pottery along the entire Papuan coast marking the beginning of the *hiri* comparable with ethnographic sources (Irwin 1991).

The *hiri* is a motu word for a massive historic trade and exchange network that connected Motuans with the Gulf of Papua. Motuan pottery-makers filled large coastal trading vessels called *lagotai* with literally hundreds of clay pots each and sailed west along the Papuan Coast into the Gulf region and exchanged the pots primarily for sago and canoe logs before returning to the Moresby region. Some estimates put the number of pots transported in a single season at 20,000 which were thought to have been exchanged for something in the order of 500 tonnes of sago (Allen 1977; David et al. 2009). The ethnographic stories place the origin of the *hiri* firmly in the hands of a gentleman from Boera village by the name of Edai Siabo (see Barton (1910) for an account of this story). On one occasion Chalmers went along for the ride and reported his journey and also presents an account (Chalmers 1887).



The annual hiri left the Port Moresby region with clay pots and traded them for sago before returning home (map from David et al. 2010:40).

The archaeology of the *hiri* suggests that the system was an expansion of a pre-existing low level system that began after the arrival of Lapita in Caution Bay (~20 km north of Port

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Moresby). From the perspective of the history of Papuan coast archaeology the *hiri* has been investigated in two phases of research namely the 1970s by a group of loosely affiliated archaeologists associated with the then fledgling UPNG (with assistance from ANU) and then again in the mid-2000s lead by Bruno David and Ian McNiven (Monash). The latter series of projects was born out of a consulting project designed to report on the archaeology in the vicinity of a proposed pipeline that was subsequently abandoned. Nevertheless this and subsequent projects by the same team (some of which are ongoing), created some interesting archaeological datasets that further informed notions of the *hiri*.

Within the context of the *hiri* the pottery production villages have been conceptualized as the 'centre' while the Gulf region has been conceptualized as the recipient end of the network. This is not necessarily unreasonable given that the Motuan pot producers appear in a majority cases seem to have been the catalyst but not forgetting that the Gulf people did from time to time initiate their own trading voyages (David et al. 2008).

Gulf region history and archaeology:

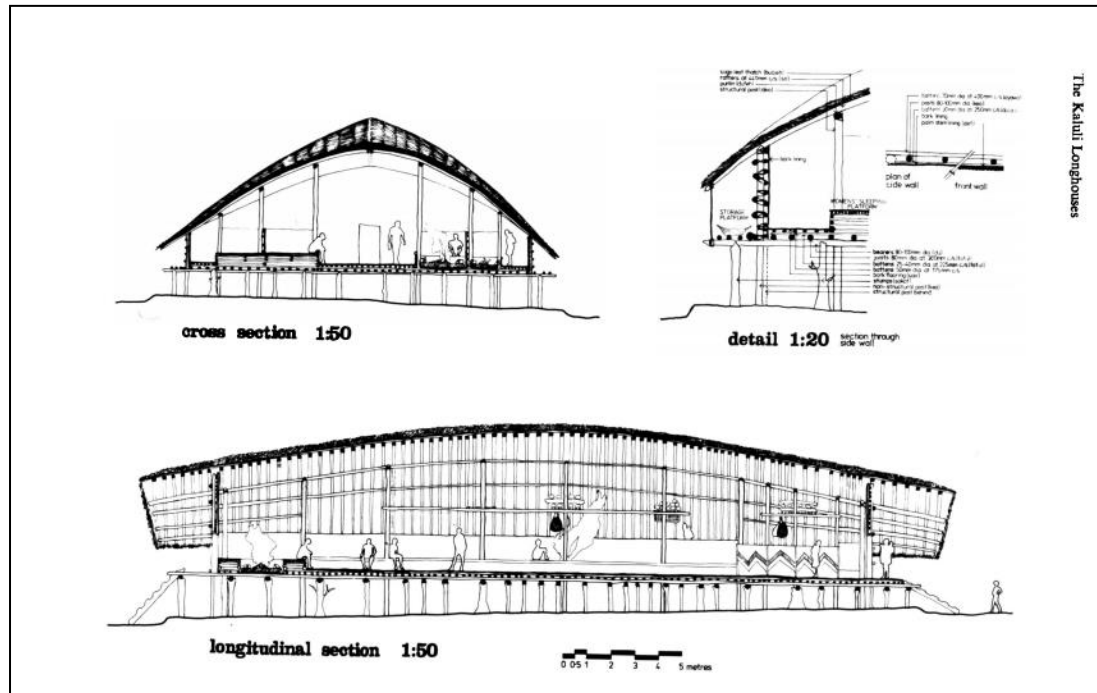
The colonial history of the Gulf region includes the famous story about when Chalmers was murdered at Goaribari and the subsequent raid which resulted in the burning of a Long House. The historical description of events are interesting in terms of considering notions of colonialism and cultural contact while the long houses themselves although long since broken down have an archaeological signature (Barker et al. 2011; Barker et al. ms).

Elsewhere in the Kikori region, the Aird Hills site known as Kumukumu 1 has been interpreted as representing something of the movement and relocation of village sites at 600 BP immediately prior to the onset of the *hiri*. The basic argument here is that settlement sites were reconfigured to take advantage of the *hiri* and mediated by social tension associated with land access issues (David et al. in press). The region also has some interesting evidence reflecting recent non-*hiri* related hunting behavior (David et al. 2012; McNiven et al. 2010).

As described above the *hiri* appears to have been instigated by Motuans however, there is some suggestion that the Elema speakers in the Gulf region sometimes instigated their own trade voyages (Williams 1940:15-16). Indeed, some quite remarkable archaeological evidence has been brought to this issue in the form of two (2) canoe logs at the Upihoi site near the mouth of the Vailala River. David et al. (2008) interpret this site as the remains of an ill-fated *lagatoi* crewed by Gulf people that was wrecked soon after launching (David et al. 2008). While future research may challenge the interpretation the preservation and recovery of the canoe log is remarkable in and of itself.

Appendix 4: Mount Bosavi Longhouses

The longhouses of Mt Bosavi are renowned for their turtle-shaped roofs. The curved roof is what distinguishes the Kaluli longhouses from other longhouses in Papua New Guinea. The elevation of the roof over the central hall highlights the importance which the Kaluli placed upon it for ceremonies (see following pages on the *Gisaro* ceremony. The roof shape also reflects the curves of Mount Bosavi, which the Kaluli pride as their 'real' home (Loupis 1983:363).



Mt Bosavi Longhouse. (sketch by Loupis 1983:368)

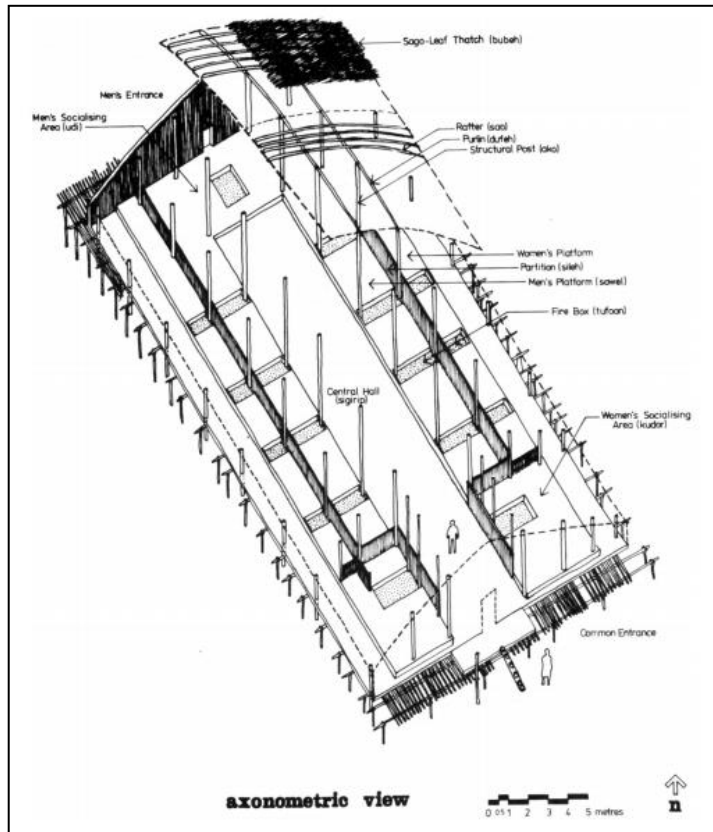
The people living just north of the mountain refer to themselves as *Bosavi kalu* (people of Bosavi) and divide into four linguistic groups, the Kaluli, Ologo, Walulu, and Wisesi, but are collectively referred to as Bosavi kalu ("men of Bosavi"). The first contact with the Bosavi people was made by Jack Hides and Jim O'Malley in 1935. The Kaluli are the most numerous and the most thoroughly studied (see Bibliography). Kaluli language is part of the Bosavi language family, which includes about 20 loosely related languages.

Prior to the influence of Christianity, the Kaluli people lived in longhouse communities of around 100 people. The massive 120 metre Isago longhouse, which housed 500 people was pulled down in 1978 and not rebuilt. The longhouses of Mount Bosavi have been extensively documented by George Loupis in 1983.

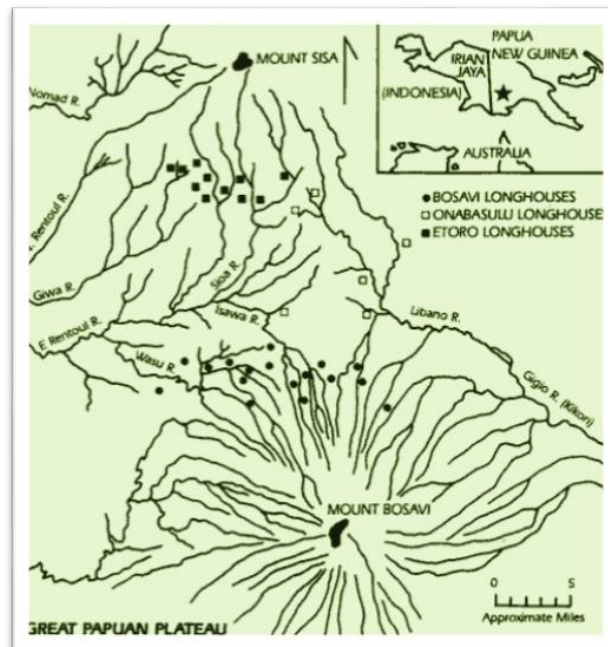
Families now live in smaller houses around the longhouse. The longhouses are built on the slopes of Mount Bosavi between the altitudes of 750 and 1,000 meters. They are linked by tracks at intervals of around 30 to 90 minutes walking distance between each other (Loupis 1983:358). The average territory of each longhouse is around 500 and 1,000 hectares and is built always near water and sago stands. Once the gardens were depleted of nutrients the

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longhouse was pulled down and ceremonial burnt, and the salvageable parts of the longhouse would be utilised in the new one.¹



Design of Mt Bosavi Longhouse (sketch from Loupis 1983:367)



Location of longhouses on Mt Bosavi in 1983 (Loupis 1983:367)

¹ Because the Kaluli shifted their longhouses and gardens, they were classified as semi-nomadic by the administrative patrols (Loupis 1983:360).

Appendix 5: Attributes of a Cultural Landscape

Foi Inscription of the Landscape:

For the Foi people who live in the vicinity of Lake Kutubu, human history and intention is recreated through the narration of movement between places (Weiner 2002:270-271). The Foi poetry consists of “sago chants’ (*obedobora*) and mourning songs (*sorohabora*). The sago song is considered by the Foi to be their original poetic medium. The poems are designed to associate the memory of deceased relatives with the territories they once frequented.” Indeed the most salient feature of the Foi landscape, according to anthropologist James Weiner, is that it marked not only though physical alteration, but also memorised through poetry (Weiner 2002:282). The memory of a person’s life can only be made permanent through the repetitive singing of poetic songs, which involves the serial listing of place names, and/or description of hunting territories, for example. In stylized and poetic forms, body parts are referred to in memorial songs and myths.

For the Foi: “A man's life is represented by the sequence of places where his actions and work made visible impressions; the songs express the total man as a series of interconnected places” (Weiner 1988:284). The description of places in memorial songs highlighted the productive activities a man carried out during his lifetime. A woman's memorial song generally focused on the creeks in which she fished.

Kaluli Inscription of the Landscape:

The Kaluli origin story emphasises the creation of the landscape by the people:

They allege that when the land was formed it was inhabited only by people, without any trees, animals, streams, food, etc. Seeing that the people were cold, hungry and without shelter, one man (not named) got up and said to a gathering 'You be trees' and one group of people became trees, 'You be fish' and fish were created, and so on until all the animals, plants and natural features (mountains, rivers) were formed....(Schieffelin 1977:94 cited in Loupis 1983:359).

Despite the introduction of education and Christian beliefs, the Kaluli of Mount Bosavi continue to practice many of their cultural traditions. The most important ceremony is the *Gisaro*, which is performed by guests at special occasions for the benefit of the celebrating hosts. The preparation may take up to two weeks for making the dance costumes, and composing the songs. The dancers are decorated in feathered headdresses, body paint, shell necklaces and massive capes made of sago leaves (Loupis 1983:382). The ritual expression of emotion and place, as articulated in the Kaluli *Gisaro* ceremony involves topographical references that evoke a sense of belonging in the landscape. A *Gisaro* song represents the progression over an area of land, and it is possible to map any area of the region concerned and trace its history over a 10 to 15 year period (Schiefflin 2005:183).

Not only does the *Gisaro* ceremony bring forth biographical memories, it also gives rise to what may be thought of as a shared, social remembering (Houseman 1998:456). The *Gisaro* ceremony, which deals with both places and place-names, recontextualises pre-existing links with the land. The ritual proceeds from, and reaffirms people’s connection to the land (Houseman 1998:461).

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Important Note:

The Kokoda Track and Owen Stanley Ranges Tentative Listed Site had not been delineated at the time of nomination in 2006 and the official citation was fairly vague about the geographic extent of the site. A desktop scoping review of the Tentative Listed site by one of the authors of this review was conducted in 2009-10. No new field research was conducted for that scoping exercise, rather existing data and new interpretations were assembled to explore the prospective heritage attributes of the wider Owen Stanley Ranges region. The results of that exercise are held by the World Heritage Secretariat of the Department of Environment and Heritage and so the details of that will not be repeated here but some elements of the results will be given some focus in this review.



Proposed delineation of Kokoda Track and Owen Stanley World Heritage Tentative List area.

1) Current Situation (listing, boundaries, action towards protection etc.)

At the time of nomination and listing of the Tentative List area in 2006, no boundaries had been established and the citation was somewhat vague about the extent of the area being nominated.

In 2009 one of the authors of this review (Peter Hitchcock) was appointed as World Heritage Advisor to the Kokoda Initiative, an Australian funded project for progression of protection

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and management of the Tentative Listed area but with a particular emphasis on the Kokoda Track component. The World Heritage Advisor conducted a largely desk top evaluation of the potential World Heritage values of the Owen Stanley Ranges region, including the vicinity of the Kokoda Track. That scoping study resulted in preliminary delineation of a series of geographic 'precincts' across the region which combined into an aggregate single entity. The conservation attributes, particularly natural heritage aspects, were documented for each precinct and the results are held by the Department of Environment and Conservation.

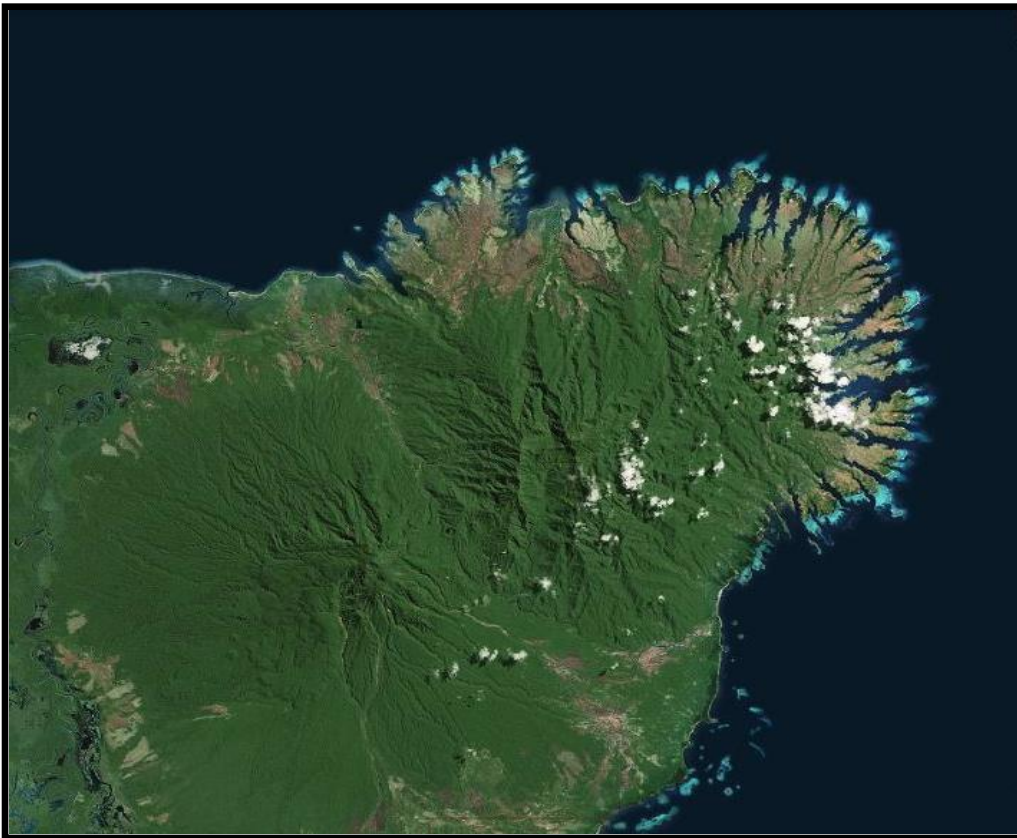
The 2009 -2010 project resulted in delineation of an 'Area of Interest' which in reality is a defacto delineation of the Tentative Listed area. This review recommends adoption of the 'Area of Interest' as the delineation for the purpose of delineating the Tentative Listed area.

2) Description of Site

The Kokoda-Owen Stanley Ranges Tentative List site comprises mostly intact forest, several parts of which qualify as Intact Forest Landscape (IFL) as defined by Intactforest.org. There are many cultural sites and artefacts within the Kokoda-Owen Stanley Ranges that demonstrate people's long and continuous relationship with the area, such as old village sites, spirit places, pilgrimage places and archaeological sites together with modern military history sites and artifacts.

3) Key attributes and values

3a. Natural Heritage:



The spectacular Tufi coast, a distinctive classic 'ria' (drowned valley) coastline, is the result of subsidence of Mount Trafalgar, a large extinct volcano, and as a consequence, invasion by the sea of the radial pattern deeply eroded valleys on the slopes of the volcano. The much younger active volcano, Mount Victory, adjoins to the west (left) (Source: PNG Mining Cadastre Portal)

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Outstanding scenic landscape created by glaciation on Mount Albert Edward in the Kokoda Track - Owen Stanley Ranges World Heritage Tentative Listed area (Image M. Prebble)

3b. Cultural Heritage:

Sites of potential cultural heritage significance in the Tentative Area include:

- Kokoda Track (military cultural heritage) no need to cover because of current studies
- Kosipe - Ivane River (archaeological)
- Madilogo site (archaeological) – DEC research project
- Kosipe - Mount Albert Edward - Christian missionary pilgrimage

The cultural heritage sites mentioned herein can collectively be considered as outstanding examples of human interaction with the environment especially when it has become vulnerable under the impact of irreversible change (Criteria V).

In addition, the continuation of cultural practices involving specific techniques, such as tapa-cloth production, are an important part of the heritage of this region, constituting a living symbol of PNG identity; and a tangible expression of regional cultural and social identity.

Cultural Heritage as a 'Landscape of Powers'

Eric Hirsch (2003) coined the term “a landscape of powers”, which is a useful concept to understand the Owen Stanley Ranges as a unique conceptual and emotional landscape that is simultaneously a distinctive material landscape. A “landscape of powers” emphasises processes of alteration; in particular, the changes effected upon the local people as

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missionaries and military came to inhabit and transform cultural practices and places in the Owen Stanley Ranges, and how the people subsequently re-indigenised these places on their own terms.



Madilogo Falls on the Naoro River – a site of cultural significance
(Image provided by Peter Hitchcock)

Prior to WWII – the Kokoda Track as it is known today, became a walking track used by the Australian colonial Administration to cross the Owen Stanley Range into what was then called Northern Province – now called Oro Province. During WW11 the Kokoda Track was planned to be used by the Japanese to cross the Owen Stanley Ranges to take Port Moresby and were confronted by the Australian Army entering the track from the Port Moresby end. These sites constitute “a landscape of powers”, with custodians and other actors actively engaging to reclaim the meaning of the track.

A second parallel track, the Kapa Kapa track, was used by the US Army for troops to cross the Owen Stanley Ranges in a flanking movement to cut off the Japanese Army supply line to the Kokoda Track. The Kapa Kapa Track, perhaps a more spectacular and difficult track than the Kokoda, has all but faded from history because of the lack of Australian involvement and awareness of its military significance. Further research is also needed to identify sites that are culturally significant to the Koiari and Orokaiva peoples, as traditional owners of the Kokoda Track. For instance, Madilogo Falls on the Naoro River is a feature important to the culture of the Mountain Koiari (photo above).

In addition to the significant military sites associated with the Kokoda Track and World War II military action ie; ‘Lost Battlefield of Eora Creek and Blamey’s Garden (not included in this report because they have already been extensively researched and documented), archaeological sites in the Ivane valley are important to acknowledge in terms of the cultural heritage values of the region. Further west along the Owen Stanley Range, the Ivane Valley contains some of the oldest remains left by people some 46,000 years.

Kosipe - Ivane River Archaeological Site:

Archaeological research in the Ivane valley (Summerhayes et al. 2010,2009), located within the Owen Stanley Ranges dates initial colonisation of this site to between 43,000–49,000 years cal. BP, placing it within the earliest stages of occupation of Papua New Guinea and Sahul (Ford 2011).

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The archaeological site is located in the grounds of the Kosipe Sacre Coeur Mission, on a ridge overlying the Ivane Valley. In the 1960s Catholic fathers of the mission found wasted stone axes while digging church foundations (Summerhayes 2011). A team led by Glenn Summerhayes has been exploring the archaeology of Kosipe Valley and unlocking answers to the colonisation of the land mass known as Sahul.

The significance of this early occupation is that the colonisation of the valley marks the first time in the Sahul region that modern humans moved into this type of 'cold climate' created with the higher altitude of the area. The Ivane Valley site provides important evidence to show that early modern humans not only adapted their behavior to new environments, but also used and deliberately managed the landscape through fire. This is some of the earliest evidence in the world of modern peoples changing their landscapes (Summerhayes 2011).



(Above) Archaeologists Geoffrey Hope (ANU) and Matthew Leavesley (UPNG) examining a stone axe taken from Piari's Ditch (image: Summerhayes 2007)



(Above) Coring and sieving soil for lab analysis during the Madilogo archaeology survey in November 2012 (Image by Elton Kaitokai in Kokoda Initiative Annual Report 2012)

Madilogo Site:

Archaeological research, sponsored by DEC, has been conducted on the Madilogo site. Further information can be obtained from Mr James Sabi, Project Manager.

Mount Albert Edward Site - Christian missionary pilgrimage:

Pilgrimage places (such as Mount Albert Edward) are important heritage sites. *Kosipe* may represent a nationally significant pilgrimage site, as evidenced by the pilgrims being led by the Bishop from Mosbi and pilgrims include people from other parts of PNG).

Mount Albert Edward, in the Owen Stanley Ranges, is a 3,990-metre high consisting of two peaks about 400 metres apart. A cross marks the top of the slightly higher western peak and a trig station marks the eastern peak. The Metal Cross at the peak of Mount Albert Edward was erected by Father Jules Dubuy (pronounce: Dubui) MSC, in 1938 in commemoration of the first 25 years of the evangelisation of St. Joan of Arc. Every year there is a pilgrimage, involving a three hour walk to the mountain by the Goilala people to commemorate the Evangelisation of the region.²

²<http://www.youtube.com/watch?v=oIWcyqfhlc>; <http://www.youtube.com/watch?v=U0VJsYdV7JQ>
<http://www.youtube.com/watch?v=HtQU26u4wZs>; http://www.youtube.com/watch?v=th5h8n_i3AY
<http://www.youtube.com/watch?v=dDjG0osR7JA>; <http://www.youtube.com/watch?v=QShau21EiZo>

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The local Evangelisation campaign began after a meeting of catechists in 1996 when they decided to make a crucifix and carry it from village to village with a three-fold message: to forgive, to be reconciled and to prepare for the jubilee year. The evangelisation continued for three years among the Goilala villages, then travelled over the mountains to Popondetta where it was received by the Anglican bishop. One hundred and fifty people then took turns to carry it over the Kokoda track to Port Moresby. On February 24, 1999 the cross was received by the Catholic archbishop of Port Moresby and then for a month the campaign moved around the parishes and communities of the city. With the arrival of the cross there were frequent dramatic scenes as young men who had been leading lives of crime, came to surrender their weapons, according to the STA (Gibbs 1999).



Cross marking the highest peak



Commemoration of Evangelisation of the area

The original idea for the Evangelisation campaign is said to have come from within the community, prompted by the deaths of so many young men. Women played a prominent role in receiving the cross into the villages. (Gibbs 1999). Traditional symbols added to the effectiveness of the campaign. Arrangements were made through the system of chiefs. A letter would not be taken seriously unless it was accompanied by betelnut and tobacco. Pigs were killed as a sign of a real commitment to reconciliation. Surrenders took place only after the proper rituals had been followed for receiving the body of Jesus into the village. The cross itself was decorated with feathers from the bird of paradise. These feathers were so important that when someone removed them in Port Moresby, they had to be restored in a ceremony involving the killing of a pig and smearing the blood on the cross (Gibbs 1999).

Tapa Production as Cultural Heritage

A shared distinctive feature of Pacific cultures is the making of tapa (bark cloth), but in Papua New Guinea, tapa cloth production involves unique designs that can convey signals about clan allegiance. For the Maisin people of Collingwood Bay, historical tapa designs are living cultural heritage, and today the people are combining content, form and tradition in new ways that are intimately connected with the social and cultural identity of individuals, groups, and even the nation. As Anna-Karina Hermkins has shown, among Maisin, *barkcloth is crucial in mediating relationships between groups of people, and between the living and the dead. In fact, the production and use of tapa engenders Maisin people and their identities. At the same time, Maisin tapa is used by other Papua New Guineans as a traditional garment and is reworked into*

fashionable dresses and high-heeled women's shoes, becoming a statement of modern PNG identity ('Made in Oceania' Conference 2014). (see Appendix 1).

In addition, new innovations in tapa design and utility signify the continuing significance of Maisin cultural practices in contemporary contexts. As such, the continuing production and increasing relevance of tapa in social identity can be considered an outstanding example of a technological ensemble (designs and method) which illustrates a significant stage in human history (Criterion IV); Thus Maisin tapa cloth production involving the transmission of skill and knowledge, can be considered to be directly associated with events and living traditions, and with ideas, beliefs, and artistic works of outstanding universal significance (VI).

4) Threats (land use and land tenure changes, development)

Logging:

The greater part of the Kokoda Track and Owen Stanley Ranges Tentative Listed area is forested but a large proportion of that forest is on steep to very steep terrain and/or low value timber species. Although not yet specifically mapped, several precincts contain intact forests that can be expected to qualify as IFL's (Intact Forest Landscape) as defined by the IFL Mapping Team of Intactforest.org

A number of logging concessions exist within or partly within the Tentative Listed area but it has not been possible to update the details as part of this review. At least one concession is known to have already been logged (Brown River by Rimbunan Hijau).

The main logging concessions of particular concern are in the area behind Collingwood Bay and includes the Collingwood Bay Forest Management Area (FMA) and the adjoining Musa Pongani area. No update of logging operations could be accessed during this review but there is clearly a series of on-going disputes.

The forests affected by the Collingwood Bay FMA, Musa Pongani and East Collingwood logging interests are undoubtedly of biodiversity conservation importance, especially given that lowland tropical rainforest has been extensively logged and developed, increasing the value of any remaining intact forests such as in the Collingwood Bay area.

In *conclusion*, future logging represents a significant threat to a limited number of areas in the Tentative List area but most such areas are of high conservation value and hence the threat is significant and on-going. The threat is even greater when combined with proposed conversion to oil palm plantation.

Mining:

The geology of much of the Owen Stanley Range is claimed to be most conducive to discovery of metalliferous ore bodies but in reality, few such substantial ore bodies have been discovered, let alone developed. The largest of operating mines within the Tentative Listed area is Tolukuma, a State-owned gold mine south west of Mount Albert Edward.

Some of the lowland areas (e.g. Brown-Vanapa wetlands, Tufi-Mount Trafalgar) and possibly some of the higher altitude areas such as Mount Albert Edward may be less attractive for mineral exploration and may be available for permanent conservation reservation.

Some lowland areas may have potential for hydrocarbon resource extraction (oil and gas)

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In *conclusion*, given the geology of the Owen Stanley Range, the region will continue to attract mineral exploration interests, particularly for metalliferous minerals, and so mineral exploration and mining will remain an on-going and significant threat to the heritage values of much of the Tentative Listed areas.

Agriculture/Plantation:

The greater part of the 'Area of Interest' (read Tentative Listed area), particularly the high mountains and steeper hillslopes have a very low potential for industrial scale agriculture and plantation development. However, some of the lowland areas, all identified as being of conservation importance, do have potential for agriculture and plantation development. The key lowland areas where agriculture is possible, in particular oil palm plantation and therefore represents a threat include:

- Collingwood Bay - Upper Musa River - Mount Victory precinct
- Hydrographers Range - Embi Lakes
- Brown River (Edevu) - Brown-Vanapa wetlands

In *conclusion*, whilst most of the Kokoda Track - Owen Stanley Tentative List area has little or no potential for industrial scale agriculture, including oil palm plantation, agriculture (and logging) is a threat to several localities, including some that are considered of high biodiversity conservation significance. Some of these threats are immediate (e.g. Collingwood Bay)

SABL's:

The controversial SABL (Special Agricultural Business Lease) issue continues in PNG. Public agitation resulted in a Commission of Inquiry and the Commission subsequently handed its report and recommendations to Government. The Inquiry found substantial evidence that the ultimate purchasers of some SABL's had no demonstrable interest in agricultural development but rather saw the leases as opportunities to conduct logging without the usual constraints and regulations that apply to logging concessions. Recommendations of the Inquiry included the cancellation of numerous SABL's.

The report has been with Government for more than a year at the time of conducting this review and no decision has been announced.

A substantial area within the Kokoda-Owen Stanley 'Area of Interest' was subject to SABL's, particularly in the Collingwood Bay - Mount Victory area in the east. Landowner initiated court action has been successful in invalidating a major proportion of the SABL land but there remains the issue of enforcing the court orders issued to the foreign companies that had purchased the leases. Landholder court action and other protests continue for some of the smaller remaining SABL's in the Collingwood Bay area.

The SABL's in the Collingwood Bay - Mount Victory area, being mostly well-developed lowland rainforest, are considered to be of importance for conservation because a major part of comparable lowland coastal rainforests of PNG have already been logged and/or cleared. Should any of these SABL's in the lowlands be converted to oil palm plantation there will be a substantial loss of forest biodiversity.

There are a number of SABL's in Central Province that may be of conservation importance but the biodiversity has not been well examined and the future of agricultural/plantation

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development in some of these leases may depend on whether the recommendations of the Inquiry are adopted and implemented.

In conclusion: the extent to which the SABL's falling within the 'Area of Interest' represent a threat to the heritage values of the area remains unknown and is largely dependent on Government decisions in respect of the Inquiry recommendations and current landowner actions.

Fire:

Fire is a major vector in deforestation in Papua New Guinea, especially on the steep mountain slopes such as on both flanks of the Owen Stanley Range.

Fire has been identified as an important contributor to deforestation in PNG.

A study of the 'State of the Forests of PNG' (Shearman et al 2008) identified the main human activities driving forest change as "*commercial forestry, subsistence agriculture, fires and the development of mines and plantations.*"

The vulnerability of forests to wildfire is increased by logging which leads to a drying of the forest condition, especially so on steep slopes. Shearman et al (2008) identify several mountain ranges that have undergone substantial deforestation as a result of fire and singles out for mention the Owen Stanley Ranges, in particular Central Province section.

Given the steep slopes, increased disturbance from subsistence agriculture and logging, much of the Kokoda-Owen Stanley Tentative List area is vulnerable to fire, especially wildfire during El Nino events.

In conclusion, fire represents a serious and on-going threat to the natural heritage values of the Kokoda-Owen Stanley Tentative List area.

Hunting:

A less apparent but serious threat to the natural heritage values of many parts of Papua New Guinea is hunting, or more precisely, unsustainable hunting. There is ample evidence that unsustainable hunting has led to local extinctions and is seriously threatening some species. Two examples where hunting took species to the threshold of extinction are Bulmer's Fruit Bat (*Aproteles bulmerae*), only known from Sublime Karst Tentative Listed area, and the Tenkile (*Dendrolagus scottae*) in the Torricelli Mountains. The Tenkile has been rescued from extinction but Bulmer's Fruit Bat reportedly remains critically endangered with no recovery plan. Similarly, the Giant Bandicoot (*Peroryctes broadbenti*) has been unsustainably hunted and is now considered endangered.

Numerous species of mammals occurring within the Kokoda Track-Owen Stanley Tentative List area are threatened by unsustainable hunting, especially in the lowland and foothill habitats. Unless there is a serious address of unsustainable hunting, the Tentative Listed area will face animal extinctions and hence loss of heritage values.

The overall *conclusion* is that the Kokoda-Owen Stanley Tentative List area is subject to a number of serious and on-going threats; some can be predicted in terms of geographic likelihood (logging, plantation) but others are less predictable in terms of time or place (mining, fire).

5) Revised Description

The most fundamental deficiency of the 'Description' in the official citation for the listing in 2006 is the imprecise extent and delineation of the listing, there being no map delineation and mostly vague geographic references in the text.

Work undertaken in 2009-10 as a part of the Kokoda Initiative included scoping the geographic and thematic extent of the Tentative Listed area for possible future World Heritage nomination. The Department of Environment and Conservation holds the reports from that work so details will not be repeated here.

One of the fundamental problems encountered in the World Heritage scoping work was the huge geographic extent and the exceptional diversity of the Owen Stanley Ranges. Prospective components of the Tentative List area potentially extending from the Bulldog track on the Lakekamu River in the west to the vicinity of Mount Simpson in the east, a distance of over 400 kms. Whereas a lot of the focus in the nomination and subsequently has been on the 'mountain range' of the Owen Stanley, it is often the altitudinal sequences from the mountain range down to the lowlands that is of great interest biologically.

The higher altitude parts of the Owen Stanley attract a lot of interest from a botanical perspective but the high mountains have many other features of interest such as evidence of glaciation and volcanism.

The cultural elements of the Owen Stanley Ranges tend to be more focused on the lower elevations rather than the high mountain and alpine environments which are either sparsely or not at all permanently occupied. For many indigenous groups, the Owen Stanley Range is a barrier between the north and the south, and that continues to be the case in modern day PNG.

Much of the military history associated with the Owen Stanley Ranges tends to be focussed on the handful of walking tracks that existed and were used to cross the formidable mountain barrier during World War II. The three main tracks with a military history focus are:

- Bulldog (and connecting Black Cat)
- Kokoda
- Kapa Kapa

The Bulldog was used mainly for non-combat access and the Kapa Kapa was used by the US Army for movement of troops across the mountains in parallel with Australian troop movement up the Kokoda Track, with military action only at the northern end of the Kapa Kapa track. The Kokoda Track featured prominently with the Australian and Japanese military as the track became a scene of land battle between Australian and Japanese troops. Not surprisingly, a lot of interest in the Kokoda Track is maintained by Australians and more recently by the trekking industry that seeks to benefit from that interest.

Few major field research activities have been conducted in the area since 2006 but there has continued to be smaller scale field survey and research that has added to overall knowledge base of both the natural and cultural heritage attributes of the Tentative List area. Notwithstanding, large tracts of the region continue to be poorly surveyed for biodiversity. Some higher mountain areas have been the subject of botanical survey by Australian scientists in the past but regrettably much of this remains unpublished.

6) Revised Statements of authenticity and/or integrity

Whilst the current Statement of Integrity is of limited value, there is no compelling reason to change it at this time.

7) Revised Comparative Analysis (where needed)

Whilst the current analysis is of very limited value, the current limited progress in boundary refinement and assessment of heritage attributes, there is nothing to be gained at this point in time attempting to refine the Comparative Analysis.

8) Recommendations Arising

CONCLUSIONS:

It is reasonable to conclude that there are a number of heritage attributes, natural and cultural, or combination thereof, which potentially constitute Outstanding Universal Values (OUV).

The area has a very high biological diversity, both in terms of species diversity and ecological diversity. In selecting potential areas that may qualify for World Heritage nomination, it is important to consider the ecological diversity as much as the species diversity of 'biodiversity'. Forming a high dividing range, the Owen Stanley Range provides some very graphic altitudinal sequences which represent contemporary climatic conditions, many of those sequences remaining intact. The obvious places where altitudinal sequences are optimized are on the slopes of Mounts Albert Edward, Victoria and Kenevi.

There are a number of precincts where there are identified cultural sites and attributes but based on this review, none presently appear to represent stand-alone cultural sites of OUV. It may well be that some deserve to be considered as parts of a serial thematic nomination. Irrespective of the question of a World Heritage nomination, the Kosipe-Ivane River precinct is considered to be of such national significance and potential international significance that it should be given priority for formal protection.

Importantly, for the Kokoda Track and Owen Stanley Ranges Tentative Listed area to have any meaning in terms of the World Heritage Convention, there must be a concerted effort to progress knowledge, understanding and protection. The 'do nothing' option will negate compliance with the World Heritage Convention and is therefore not a responsible option.

Irrespective of any World Heritage nomination, the Kokoda Track - Owen Stanley Tentative Listed area, if protected, would make a major contribution to biodiversity conservation in Papua New Guinea and so deserve priority for at least selective protection.

Given the:

- Large scale and great diversity of landscape in the Kokoda Track and Owen Stanley Ranges Tentative Listed area;
- Major gaps in knowledge of the natural and cultural heritage attributes;
- The various on-going threats to heritage values;
- The necessity of involving customary landowners in the protection and management of conservation areas;

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The recommendations presented here are necessarily general but also target a selection of geographic and thematically specific areas.

a) Name of Listed Area:

The name is sufficiently general as to leave flexibility in future refinement of any World Heritage nomination associated with the Owen Stanley Range.

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee:

- *Retain the name 'Kokoda Track and Owen Stanley Ranges', at least in the interim.*

b) Boundary:

Given that since 2006, research within the PNG Department of Environment and Conservation delineated at least an 'Area of Interest' for the Owen Stanley Ranges region.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee:

- *The 'Area of Interest' delineated in the 2009-10 study be adopted as a boundary for the Kokoda Track - Owen Stanley Ranges World Heritage Tentative Listed site.*
- *Disseminate delineation details of the Tentative Listed site to relevant Government agencies.*

c) Further Research:

Given that large parts of the Kokoda - Owen Stanley Ranges Tentative Listed area are poorly studied or unknown in terms of natural and cultural heritage attributes, further survey and research is essential. Notwithstanding the relative close proximity of the Owen Stanley Ranges to the PNG capital Port Moresby, extensive areas have not been subject to biological survey, no doubt in part a reflection of the difficulty of access to the mountains and the relatively few mining projects that might have stimulated biological survey. Of the 7 World Heritage Tentative Listed sites in PNG, the Kokoda-Owen Stanley Ranges site is probably the least well studied and documented from a natural heritage perspective.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Prioritize precincts within the World Heritage Tentative Listed Area for survey and research;*
- *Promote survey and research by others according to the identified precinct priorities;*
- *In the interim, adopt the following set of priority precincts for survey and research:*
- *Musa River - Collingwood Bay (biodiversity and cultural)*
- *Vanapa - Brown River wetlands (biodiversity)*
- *Goldie River (biodiversity)*
- *Tufi - Mount Trafalgar - Mount Victory (biodiversity and cultural)*
- *more clearly identify the cultural and archaeological values of the region*

d) Responding to Threats:

Logging:

Logging is not presently a significant threat to the higher mountains of the Owen Stanley Ranges but certainly represents a threat to some of the lower and mid altitude forests along

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the slopes of the range. Some lowland forests of conservation importance are at greatest risk e.g. Collingwood Bay area on the north coast.

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Actively review all existing and proposed logging concessions within the Tentative Listed area, giving priority to the Musa River-Collingwood Bay precinct.*

Mining:

As indicated above, mining exploration and mining represent a significant and on-going threat to the heritage values of the Tentative Listed area. Where these threats might be manifest will be difficult if not impossible to accurately predict so it will be a case of being prepared for any eventuality. Adoption of a strategy for proactive expansion of knowledge of natural and cultural heritage values will ensure that the relevant World Heritage lead agency will be fully prepared to respond to any specific threat from mineral exploration or mining.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Ensure that the Mineral Resources Authority is aware of the geographic extent of the Tentative Area and request MRA for routine advice on new applications received that impinge on the Tentative List area;*
- *Regularly review all new exploration and mining applications that fall within the Tentative Listed area.*

SABL's and Agriculture/ Plantation:

The issues of SABL's and Plantation development within the Tentative List area are closely related.

Special Agricultural Business Leases (SABL's) are a threat to a potentially high conservation value area in the north east of the Tentative Listed area, namely the Upper Musa River-Collingwood Bay area. The customary owners of the land have been actively seeking return of their land through court and other actions and have so far been relatively successful but there is a problem in enforcement of court decisions.

Coastal lowland rainforests in PNG have, not surprisingly, been the most heavily impacted by logging and agriculture. As a consequence intact coastal lowland rainforests are now a relatively rare plant community and are thus of definite conservation value. The coastal lowland rainforests in the Upper Musa River - Collingwood Bay district are good examples of this forest community. These forests adjoin other forests of conservation value including the forests associated with the adjacent Mount Victory volcano.

Given:

- the high biodiversity value (coastal lowland rainforest) and the current largely intact condition of the subject forests;

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Actively encourage investigation of the lowland forests to more fully assess natural heritage values and if appropriate, promote an intervention in the logging, clearing and plantation development of the lowland forests;*
- *Ascertain landowner interest in protection of the forests affected by the SABL's.*

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Hunting:

Numerous species of mammals occurring within the Kokoda Track-Owen Stanley Tentative List area are threatened by unsustainable hunting, especially in the lowland and foothill habitats.

Unless there is a serious address of unsustainable hunting, the Tentative Listed area will face animal extinctions and hence loss of heritage values. The precinct which appears to be under greatest threat from unsustainable hunting is the lowland savanna and rainforest in the Port Moresby hinterland, an area of high conservation value. Species known to be locally threatened include the Giant Bandicoot, Doria's Tree Kangaroo and the Dusky Pademelon.

*Accordingly, it is therefore **recommended** that:*

The PNG World Heritage Secretariat/Committee

- *In consultation with wildlife specialists, explore options for addressing unsustainable harvesting of wildlife, particularly in the lowland savanna and rainforest in the Port Moresby hinterland.*
- *In consultation with wildlife specialists, develop recovery plans for all mammal species currently threatened by unsustainable hunting.*

e) Protection Needs:

Because of the absence of an adopted boundary at the time the Tentative Listing was made in 2006 it is not possible to be precise about what level of protection was in place at that time. However, within the now recommended delineated Tentative Listed site, there remains a minimal level of formal protection.

The only recorded formal protected areas in existence as at 2006 were:

- Namanatabu Historic Site
- Iomare WMA
- Varirata National Park

Collectively these three small areas represent a tiny proportion of the total Tentative Listed area. No new protected areas have been established in the proposed Tentative Listed area since 2006.

Since 2006, the Kokoda Initiative, a joint arrangement between the PNG and Australian Governments, has resulted in substantial studies, planning and community development, almost wholly confined to the Kokoda Track and its immediate vicinity. An 'Interim Protection Area' has been identified but not formally promulgated.

There appears to have been no tangible progress in formal protection of the Tentative Listed area since 2006. If PNG is to take the Kokoda Track-Owen Stanley Ranges Tentative listing seriously, there is a need to commit to further progressing research, field survey and protection. World Heritage nomination for any part of the proposed Tentative List area should not be considered until biodiversity research, landowner agreements and protection are much further advanced.

The current Kokoda Track Initiative has identified an Interim Protection Zone (IPZ), the whole of which falls within the Tentative Listed Area. If that interim protected area is converted into a permanent protection zone, it would make a very significant contribution to

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protection of the Tentative Listed area. However, the IPZ has little prospect of being able to stand alone as a World Heritage nomination, at least on natural heritage values.

Given the on-going threat to heritage values by mining and other development activities, no part of the Kokoda Track and Owen Stanley Ranges Tentative Listed area should be considered for formal nomination as a World Heritage area until such time as an adequate extent of high value areas is formally protected. Given this prerequisite, it may be years before a suitable tract of land is protected and worth considering for World Heritage nomination.

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Identify priority areas/precincts for formal conservation protection;*
- *Promote departmental action to protect the priority areas;*
- *In the interim, adopt the following list of priority areas for seeking formal protection:*
 - *Musa River - Collingwood Bay coastal lowland rainforest*
 - *Goldie River lowlands (savanna - rainforest mosaic)*
 - *Vanapa-Brown River wetlands*
 - *Mount Albert Edward - Kosipe (sub-alpine habitat, endangered species, archaeological sites)*
 - *Mount Victoria to Mount Kenevi (sub-alpine and montane habitat)*
 - *Kokoda-Brown River Interim Protection Zone*
 - *Mount Victory - Mount Trafalgar - Tufi Precinct*
 - *Managalas Plateau*
- *Recognize the glacial landscapes of Mount Albert Edward and the ria (fiords) coastline of Tufi as being outstanding scenic landscapes worthy of national recognition and appropriate protection.*

f) Awareness, Promotion of Protection:

The absence of a clear boundary has in the past been both a blessing and problem in terms of communicating the concept of the Kokoda Track and Owen Stanley Ranges to the PNG public. Absence of a boundary has proven frustrating for some. Still others have been rather inventive about what area was considered 'World Heritage'. The use of an "Interim Protection Zone" by the Kokoda Initiative has been a further complication in communication to the public.

Notwithstanding that the recommended boundary for the "Tentative Listed" area might be seen as being drawn wide, a relatively precise boundary should make it easier to communicate the concept of the Tentative List area. However, it is critically important that in communicating this information, clear statements are made about what the Tentative List area is and also what it is not. Considerable effort will be necessary to ensure that it is not interpreted as a 'land grab' or land acquisition as such. Ideally, any formal protection will be the end product of open and honest negotiations with the customary landowners and other stakeholders in the land.

Wildlife Management Area (WMA) or equivalent reservation would be adequate for consideration of a World Heritage nomination but Conservation Area (CA) or National Park or equivalent would be preferable. A lesser form of protection, including some form of 'customary agreement', could also be considered providing that MRA, the DPE and the National Forest Authority were prepared to recognize such and commit to abstaining from issuing titles or permits over such area.

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Author observations suggest that the Department of Environment and Conservation devotes too little resources, if any, to maintaining a working relationship with the traditional owners of the relatively few existing protected areas. As on-site conservation management of most protected areas in PNG is very much dependent upon the customary owners of the protected area, and will likely remain so for the foreseeable future, much greater resources/effort needs to be committed to building positive working relations between government and customary landowners.

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee;

- *Develop and implement an awareness strategy for communicating an understanding of World Heritage in general, the existence of the Kokoda Track - Owen Stanley Range Tentative List area to the wider community.*

g) Future World Heritage Nomination:

It is strongly recommended that the primary objective be seen as protection of the most important areas for conservation and that nomination for World Heritage be seen as only a secondary and complementary objective.

The Kokoda - Owen Stanley Tentative List (assuming adoption of the recommended delineation) site is large, topographically and biologically complex; much of the natural history is poorly known; has complex ownership; is variously threatened, including by mining, logging and oil palm plantation. It follows that nomination for World Heritage listing of the whole of the Tentative Listed area is highly unlikely. If World Heritage listing is the objective, the only realistic options for possible future nomination is to select that area or areas with the greatest conservation value and explore opportunities for protection under national protected area legislation and later consider for World Heritage nomination.

Any consideration of nomination of any part of the Kokoda Track - Owen Stanley Ranges to the World Heritage List should only be taken in the context of other options and opportunities to nominate lands elsewhere in PNG for World Heritage listing. Several of the other existing Tentative Listed areas have much better defined heritage values and arguably greater prospects for successful nomination than has much of the Kokoda-Owen Stanley Tentative List area.

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Appendix 1: Citation for Tentative Listing

Papua New Guinea

Date of Submission: 06/06/2006

Criteria: (iii)(v)(vi)(vii)(x)

Category: Mixed

Submitted by:

Department of Environment and Conservation

State, Province or Region:

Central and Oro Provinces

Description

The property is a mixed cultural and natural site covering a significant proportion of the Owen Stanley Ranges near Port Moresby and potentially including the Kokoda Track, Managalas Plateau and Mount Victoria and Mount Albert Edward region. The Owen Stanley Ranges, through which the Kokoda Track passes, is one of the most biologically important areas in the Asia Pacific. The 3,800 m high Ranges are a significant element of the globally outstanding (G200) South East Papua Rainforest Ecoregion. Extreme altitudinal and climatic variation have produced a rich variety of vegetation types from savanna to monsoon forest, lowland rainforest and cloud forest. Some of the most extensive and least disturbed subalpine herb and grasslands in New Guinea are found on Mount Albert Edward. The Owen Stanley Mountains Centre of Plant Diversity has one of the richest floras of any mountain range in New Guinea with more than 4000 plant species including many local endemics. This exceeds the floral diversity of the entire World Heritage listed wet tropic rainforests of North Queensland. The Owen Stanley forests provide habitat for endemic birds of paradise, bowerbirds, finches, wallabies, rats and numerous species of butterflies and aquatic insects including a number of endangered or critically endangered species. The Central Papuan Mountains Endemic Bird Area is one of the richest areas for endemic birds on earth with 510 species (almost two thirds of all New Guinea birds) and 40 endemic or near endemic species. The Laloki/Brown River wetlands is a particularly important dry season refuge for migrant waterfowl from Australia and a staging area for migratory Palearctic shorebirds. The southern flanks of the Range provide part of the water catchment for Port Moresby. The Koiari and Orokaiva peoples, the traditional owners of the region, retain a subsistence economy augmented by income from a growing tourism industry. Communities strongly support the protection of the historical and natural values of the Track and proudly demonstrate their culture. The Kokoda Track is iconic in the history of PNG, Australia and New Zealand as the site of a major World War II battle that turned the fortunes of the Japanese in the Pacific. This is PNG's most significant land-based tourism drawcard offering a combination of historical, cultural and natural features. 2000 trekkers walked the grueling ten day journey in 2005 and further growth is anticipated. The current Kokoda Track Reserve protects an area only 10 meters wide on either side of the track. A Kokoda Memorial Park is now proposed that will protect the historic, cultural and natural values of the region in much larger reserve. A 300,000 ha protected area is also being established on the Managalas Plateau. The Kokoda Track Authority was established in 2005 to develop a coherent management regime for the Track region and a Sustainable Tourism Strategy will be launched in April 2006.

KOKODA TRACK AND OWEN STANLEY RANGES

Statements of authenticity and/or integrity

Natural systems remain in remarkable good condition with only a few limited areas of human habitation. A World Heritage listing would assist in addressing threats to the region from logging and mining proposals. Orokaiva and Koiari cultures have withstood massive changes in the last century and are facing further pressures with the growth of tourism. A World Heritage listing will support efforts to effectively manage the region in ways that reflect local culture and ambitions, that support national and international interest in tourism and historic site protection and that promotes pride in cultural traditions.

Comparison with other similar properties

There are no existing properties that represent elements of the biodiversity or culture of the south eastern New Guinea. Lorentz World Heritage Area protects some species that are shared with this region but there are significant differences in species composition, ecosystems, climate and geology.

Appendix 2: Tapa Bark Cloth Production - Oro Province:

Oro Province is the main province in PNG where tapa cloth originated. In the Oro culture, women are the custodians of the intellectual property that encompasses tapa and tattoo designs. Women beat the inner bark of paper mulberry with a baton-like stick until it is stretched. Patterns are intricately painted using line and dot method onto the tapa cloth with natural dyes. Traditionally, each design identified a particular clan or family. Tapa is not just a traditional garment; it provides a link with the past and provides dreams for the future.



(Image: <http://www.blakdot.com.au/to-dance-in-beauty-omie-tapa-from-new-guinea/>)

Maisin-speaking people occupy three areas in Tufi subdistrict of Oro Province. All but the remote Kosirau people refer to themselves as Maisin. Westerners called these groups Kosirava and Maisina in early reports. There are two dialects: Maisin and Kosirava. Maisin attracted scholarly attention from an early date as a rare example of a language that combines grammatical features from both Austronesian and Non-Austronesian sources; thus Maisin has been variously classed as "mixed" or as "Non-Austronesian."

The Kosirau live in small isolated settlements within the vast swamps of the Musa River basin. A second group of Maisin speakers shares the village of Uwe with Korafe speakers on the northeast coast of Cape Nelson. The largest portion of the population lives in eight villages along the southern shores of Collingwood Bay. Behind the coastal villages stretches a vast area of unpopulated forest, swamp, and mountains.

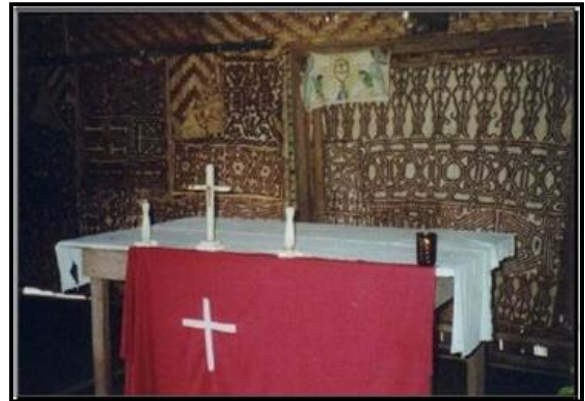
For the Maisin people living along the coast of Collingwood Bay, the importance of tapa is exemplified by the phrase "Maisin is tapa" (Hermkems n.d.). Different types of tapas designs signify their own story. The first type of design is called 'a moi kayan', which means 'just a design'. These 'general' designs visualise the skill and imagination of individual women, embedded within Maisin tradition and style of designing. Some designs narrate stories about Maisin clan ancestors and their travels from Musa River down to Collingwood Bay. These designs are clan designs, called evovi, and belong to particular clans. Another type of design encompasses visual displays of Christian worship, which can be regarded as tokens of Maisin people's religious history.

Since the advent of Anglican missionaries in Collingwood Bay in 1890, Anglican worship and emblems have been appropriated and incorporated into Maisin tapa. Almost all missionaries stationed in Collingwood Bay collected artefacts like tapa, and some of them even decorated their houses with pieces of tapa.

KOKODA TRACK AND OWEN STANLEY RANGES



Maisin women wearing Tapa Kapa Bark Cloth³



Many Anglican Churches in Collingwood Bay are decorated with tapa. Religious scenes are displayed on tapa and bibles are wrapped in pieces of tapa (Hermkems n.d.)

Since the 1980s, Maisin people have been actively promoting their culture via the display and exhibition of tapa (barkcloth). In 1986, at the Commonwealth Arts Festival in Edinburgh, a man from Ganjiga village, called Franklin, represented the Maisin people and the art of tapa making. He even had the opportunity to hand over two pieces of barkcloth to Prince Charles and Princess Diana, thereby incorporating Maisin barkcloth in the Royal collection of Westminster Abbey (Hermkems n.d.).

The barkcloth (tapa) of Oro Province has also been used in political campaigns against the logging industry. In the mid-1990s, the Maisin came to the attention of environmental activists when villagers launched a public campaign to prevent the national government from permitting commercial logging on their ancestral lands. In their struggle, the Maisin received support from Greenpeace, who actively used Maisin barkcloth in promoting of support and the fight against logging. "Painting a sustainable future; Maisin art and rainforest

³ <http://www.addoway.com/viewad/Maisin-Tapa-Kapa-Bark-Cloth-Abstract-Tribal-Traditional-Tattoo-Motif-New-Guinea-2033992>

KOKODA TRACK AND OWEN STANLEY RANGES

conservation”, was the heading of an international campaign which represented the Maisin as a tribal people whose ancestral barkcloth-art could save the rainforest and bring development at the same time (Hermkems n.d.).



In addition to two-dimensional pieces of cloth, Maisin have also started to make three-dimensional objects from bark cloth, such as bags and hats.

TRANS-FLY COMPLEX REPORT

1) Current Situation



Locality map illustrating relationship between Tonda Wildlife Management Area (WMA) in PNG and Wasur National Park in Indonesia. Also shown is Aramba WMA, Wereave WMA and additions to Tonda WMA, all in late stages of establishment. Note that the Australian territorial boundary is adjacent to south east corner of Tonda, including Boigu Island.



Tonda WMA near Bensbach airfield (Image WWF).

2) Description of Site



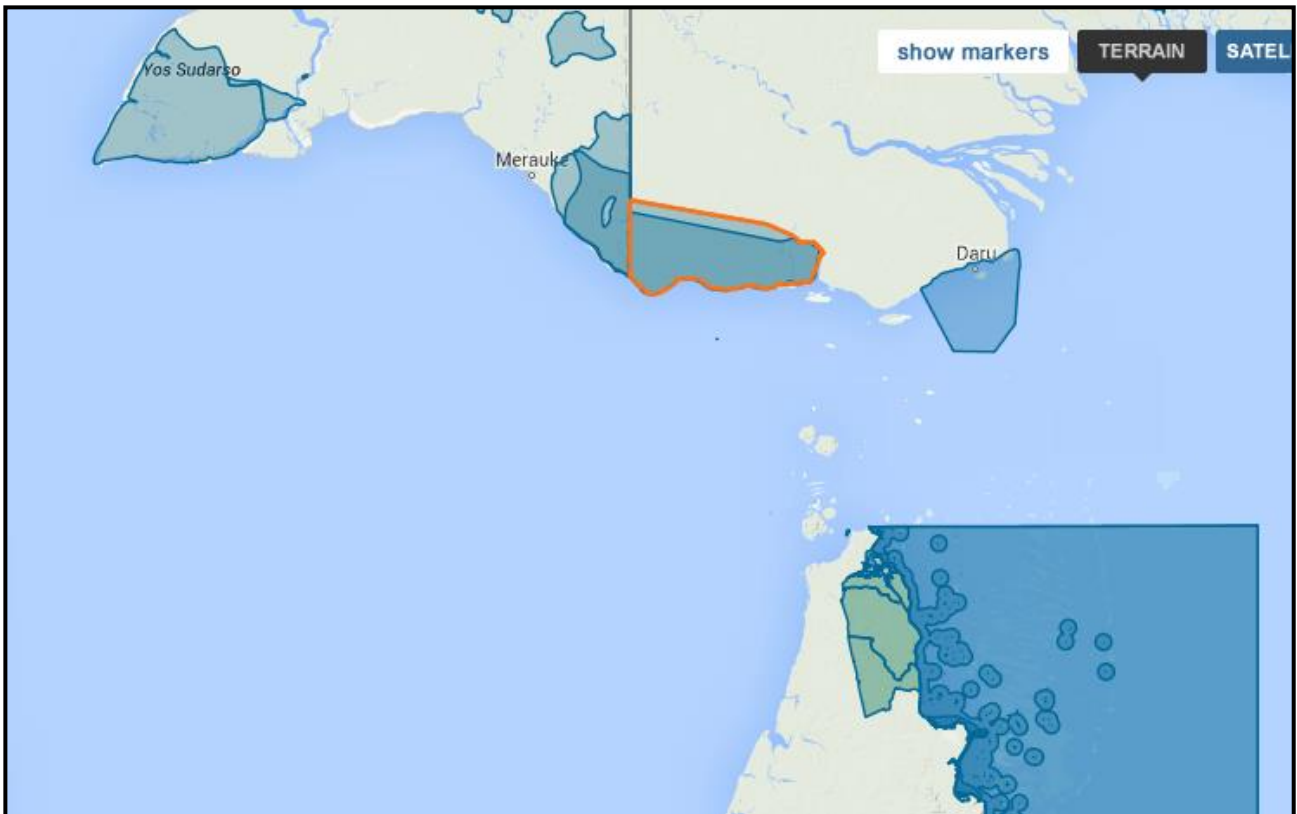
Much of the island of New Guinea is characterized by high rainfall, typically supporting tropical rainforest. The central southern plains of the island, extending across the international border between Indonesia and PNG is distinctly different to most of the island in being a region of strongly seasonal rainfall, resulting in a vast savanna landscape including extensive areas of grassland, wetlands, swamp forest (yellow colour). The 'Savannas of southern New Guinea' form what WWF describes as the "Trans-Fly Complex".

The savanna environment in the southern lowlands of the island of New Guinea is distinctly different to the mainly rainforested landscapes of the rest of the island and its satellite islands to the east. Ecologically, the monsoon savannas of southern New Guinea are much more closely related to the savannas of the adjacent sections of the Australian continent (Cape York and Arnhem Land) than to other parts of New Guinea. Indeed, until sea level rises about 6-8,000 years BP the savannas of southern New Guinea were connected to those of the Australian mainland.

A smaller tract of savanna in a low foothill landscape is found in PNG extending along the coast either side of the capital Port Moresby. Dolok Island west of Merauke in Papua Province also includes areas of savanna, especially swamp savanna.

The Trans-Fly Tentative Listed site, together with the immediately adjoining Wasur National Park in the Indonesian province of Papua, represent a large proportion of the tract of savanna in this region of the island. This is an especially important conservation consideration because such a large proportion of this important ecoregion is already protected. The combination of the PNG Trans-Fly Tentative Listed Area and Wasur National Park in Papua Province represents the second largest protected area on the island, second only to the World Heritage listed Lorentz National Park in Papua Province of around 2,200,000 hectares. The two great protected area complexes comprise very different natural environments and so are totally complementary.

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Existing Protected Areas: Tonda WMA (edged) relative to Wasur National Park (Indonesian Papua) and northern part of Cape York Peninsula in Australia. All three areas are in monsoon climate zone. The proposed Aramba and Wareave WMA's, in final stages of establishment, are not shown (map from ProtectedPlanet.com).

3) Key attributes and values

3a. Natural Heritage:

An assumption is made that the heritage attributes and values specified at the time of nomination in 2006 remain intact. Little or no new documentation on natural history of this region is evident. The major book '*The Fly River, Papua New Guinea Environmental Studies in an Impacted Tropical River System*' (Bolton 2008) makes a major contribution to knowledge and understanding of the Fly River and its floodplain but largely excludes the so-called Trans-Fly. However, some information in that publication can be extrapolated into the Trans-Fly.

3b. Cultural Heritage:

Although the nomination was for a Mixed Site, and included listing against two cultural heritage criterion (v) and (vi), there was no specific evidence presented for what the cultural heritage attributes comprised.

This review explored documentation of cultural attributes of the region that might be relevant to listing. Some elements of cultural heritage attributes are presented in Appendix 2 of this report.

One particular cultural feature that we focused on is described in the literature as "mound-and-ditch" structures. These agricultural structures, now largely disused, are evident in the landscape and in some cases can be identified on aerial photography and satellite imagery within Tonda WMA and areas to the east. The origin and use of these agricultural systems have been researched by Dr. Gareth Hitchcock, focusing on well-developed examples on the

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Torassi River inside Tonda WMA. Comparable structures have been reported in Wasur National Park (Indonesia) by WWF but no published record of these could be located.

During the review a large system of 'mound-and-ditch' structures was located on satellite imagery in the vicinity of Kuperi, some 65 kilometres east of Tonda WMA, and had been previously reported by Hitchcock as being near Waidoro.

This review does not make a claim of Outstanding Universal Value (OUV) for the 'mound-and-ditch' structures but merely draws attention to their existence and recommends further consideration of the contribution that these distinctive structures and their associated culture values might make to any nomination of the area for World Heritage. Further research is strongly recommended.

Notwithstanding our documentation of the 'mound-and-ditch' structures and other aspects of indigenous culture in the region, without further research it may be difficult to sustain a World Heritage nomination on cultural criteria. We remain confident that a robust case based on natural heritage values could be mounted.

4) Threats (land use and land tenure changes, development)

The Tonda WMA - and the proposed Aramba and Weraeve WMA's - is remote from the capital of Port Moresby and difficult of access except by air. A number of small airports provide the main transport links to the rest of PNG but boat access along the coast and the lower Fly River provide local transport links. International access can be gained via a PNG international airport on Daru Island.

The Tonda WMA and proposed Weraeve and Aramba WMA's and adjoining lands are essentially part of a large tract of intact savanna and seasonal wetland. Although there is presently little agricultural development in the region, large scale agriculture may represent a threat to the environmental characteristics of the Tentative Listed site.

Agriculture:

Large scale agriculture of the type occurring in the adjacent section of Papua Province of Indonesia may well be proposed. However, the remoteness, highly seasonal rainfall and long seasonal drought together with current lack of infrastructure are a major challenge for any industrial scale development. Most of the Trans-Fly has been mapped as marginal to unsuitable for oil palm plantation (Trangmar et al 1995 cited in Nelson 2013) so threats from industrial scale agriculture are probably limited.

Invasive Species:

The Trans-Fly savanna and wetlands are already suffering from a range of invasive species, most of which have migrated or been deliberately introduced across the Indonesian border.

Mammals:

The most conspicuous mammal invasive species are the pig and rusa deer but the date of arrival in this region is subject to some debate but the most likely is introduction of Rusa deer by the Dutch in 1920's in the Merauke area. According to research conducted with local people on the Torassi River, Garrick Hitchcock reports (2005) that the local perception is that the deer have had a major detrimental impact on the environment. Notwithstanding the detrimental impact, the deer are now making a significant contribution to the economy of the local people as a source of salable venison. Because of the proximity to a sensitive border

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area, local people are restricted in owning firearms that could be used to hunt the deer, thereby exercising a degree of control over this pest species.

Fish:

According to Garrick Hitchcock (2005) "*Four Asian species are recent introductions into the Torassi River: Climbing Perch (Anabas testudineus), Tilapia (Oreochromis mossamba), Walking Catfish (Clarius batrachus), and Striped Snakehead (Channa striata). It seems likely that some of these fish were introduced by transmigrants from other parts of Indonesia who have brought their food fishes with them to the Merauke border area;*"

Plants:

As with all lowland wetlands, invasive aquatic and semi-aquatic plants represent a potentially serious threat to the ecology of the New Guinea savannas. An absence of any bio-security on the Indonesian side of the border and a major migratory vector like the feral deer, the Trans-Fly landscape must be considered at high risk of existing invasive species spreading and new species arriving.

The potentially most serious invasive that has the potential to invade the Trans-Fly is the aggressive shrub, Giant Sensitive Plant or 'Mimosa'.

Mimosa, Mimosa pigra L. "The nomenclature of *M. pigra* is rather confusing as this name has been widely applied to collections of *Mimosa pellita*. In 1991, Barneby corrected this mistake by clearly differentiating the two species. Accordingly, the name *M. pigra* corresponds with an endemic species restricted to the lower Paraná basin of Paraguay and Argentina. *M. pellita* on the other hand corresponded with the widespread weedy species which has been misidentified as *M. pigra* in numerous botanical and technical publications. Given the pervasive misapplication of *M. pigra*, this name was conserved with the type of *M. pellita* and therefore, the name to be used for the widespread species is *M. pigra*. In addition to the typical variety, *M. pigra* contains the narrow endemic *M. pigra* var. *dehiscens* restricted to parts of Venezuela."

<http://www.cabi.org/isc/datasheet/34199>

The great threat from *Mimosa* arises from the fact that there are no known means of biological control and the large number of long lived seeds makes it a highly successful coloniser.

Mining:

There are currently a total of only two* exploration license applications (ELA2119 and 2118) which extend over about 75% of Tonda WMA. Both applications are by Bulawe Minerals (PNG) Ltd. and according to the Mining Cadastre Portal, the applications are with the Minister for Mines for consideration. An internet search failed to find any company called Bulawe and so the purpose of the applications is unknown but given the scale and location suggest they could be for iron sands or heavy mineral sands exploration. Large reserves of these minerals have been discovered right along the coast from the Fly River all the way to Port Moresby. Major open cut and dredge mining are already being promoted by Australian company, Mayur Iron (PNG) Ltd which holds extensive Exploration titles right along the coast in the Gulf of Papua. If the exploration is for iron and mineral sands, this could eventually constitute a major threat to the environment of the Tonda WMA section of the Trans-Fly if these minerals are discovered.⁴

⁴ At the commencement of the review there were 3 applications but one appears to have been cancelled and/or withdrawn during preparation of this report.

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Almost the entire extent of Tonda Wildlife Management Area (WMA) is currently the subject of Exploration Licenses. (Mining Cadastre Portal)

Petroleum Exploration:

As the website and data base of the Department of Petroleum and Energy was 'down for maintenance' for the duration of the review, it was not possible to obtain up-to-date information on petroleum exploration tenements in the Trans-Fly.

There appears to be one petroleum tenement overlapping the proposed 'Tentative List' area; Petroleum License PPL 285 overlaps about 30% of the Aramba WMA (in process). There appear to be no other Petroleum tenements affecting the combined Tonda, Weraeve and Aramba WMA's but this needs checking. (See recommendations)

5) Protection Needs

As there is no formal record of the geographic limits of the Tentative Listed site, the de-facto boundary for the purpose of this review is the combination of Tonda WMA and the currently proposed Weraeve and Aramba WMA's (in process). A case may exist for other adjoining or adjacent lands to be later incorporated into the Tentative List site.

The 'core' of the 'Trans-Fly' Tentative List area is already protected as Tonda Wildlife Management Area (WMA) of 590,000 ha, a protected area of medium security. The precise status of the proposed Weraeve and Aramba WMA, together with proposed additions to Tonda WMA is not clear but apparently awaits finalization at Ministerial level.

Ramsar Listing: Tonda WMA is listed as a Ramsar Wetland of International Importance. In considering the protection status of the Tentative Listed Area of 590,000 ha., it is instructive to look at the protection on the Indonesian side of the international border. Wasur

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National Park (Taman Nasional Wasur) provides protection for about 413,800 hectares. Wasur is also a Ramsar Wetland of International Importance.



Wasur Ramsar Wetland of International Importance adjoins the Tonda Ramsar Area, creating a defacto Transboundary Ramsar site of more than 1 million ha.

In effect, Ramsar listing extends across the international border but has not been recognized by the Ramsar Secretariat as a trans-border listing per se, possibly because each was nominated separately and no attention draw to their being geographically adjoined. This deserves a submission to the Ramsar Secretariat to seek recognition of the trans-boundary relationship between the Wasur and Tonda Ramsar sites.

The combination of the Wasur National Park and Tonda WMA represents a tract of protected area of some 1,003,800 ha., making the combination the second largest protected area on the island of New Guinea after the World Heritage listed Lorentz National Park in Papua Province.

In a significant move, in principle approval was given by the Governments of PNG and Indonesia at the 1996 Ramsar Conference in Brisbane Australia for the establishment of a cross border conservation area coordinating management between Tonda and Wasur. There is no evidence that this has occurred.

In summary, the combination of Wasur and Tonda represents an existing trans-border Ramsar site of more than 1 million hectares and potentially, combined, a World Heritage nomination.

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Protection Status:

There are three protected areas in the Trans-Fly Listed Area which total 1,320,000 ha. namely:

Tonda Wildlife Management Area (some further additions in progress)
Aramba WMA (in progress) and
Weriaver WMA (in progress)

The adjoining Wasur National Park in Indonesian Papua comprises a further 413,800 ha of protected area, resulting in a total tract of 1,733,800 ha. of protected area.

Both Wasur and Tonda are part of a Tri-national Wetlands Conservation Project agreement between Kakadu (Australia) Wasur (Indonesia) and Tonda (PNG). Wetlands in all three protected areas each form a significant stop- over point in the migration of birds on the East Asian/Australasian Flyway. (Chatterton).

“Tri National Wetlands Conservation Project - Kakadu is part of a project developed by the World Wide Fund for Nature Australia which encourages sharing of knowledge in managing wetlands between the local Indigenous people of Kakadu National Park, Wasur National Park (Irian Jaya) and Tonda Wildlife Management Area (Papua New Guinea)” (Dept. of Environment, Australia).

An important part of this tri-nation agreement is recognition that all three areas are managed by or in consultation with the indigenous traditional owners of the land.

Given the apparently limited threat of development in both Wasur and Tonda [Plus Aramba and Weriave WMA's], it may be timely to consider an early trans-border World Heritage nomination for a Wasur-Tonda (Savanna of New Guinea) World Heritage Area. World Heritage listing would help to cement the protection of the site into place.

6) Revised Description

This review concluded that there was a need to revise the current description in the official citation for the Trans-Fly. This arises from several important issues, including:

- There is a potentially embarrassing introduction to the Description that refers to the Tentative List site being a “site straddling the international border of Papua New Guinea and Indonesia”. Wasur National Park has not been nominated by Indonesia for tentative listing so the claim that this Tentative Site is ‘straddling the international border’ may be of some surprise to Indonesia.
- Additional information regarding cultural heritage features in the form of evidence of past agricultural practices in both Tonda WMA and in Wasur N.P.
- An over-emphasis on the ecological link with Kakadu World Heritage Area and a complete omission of the stronger ecological links with the adjacent Cape York Peninsula (proposed World Heritage nomination) savanna *Note:* The two areas were directly linked in prehistoric times until the formation of Torres Strait by rising sea level. If there is any case for a serial nomination it would make a lot more sense to be linked to Cape York Peninsula.
- Whereas the ‘Description’ makes no mention of what comprises the “Tentative Site”, the inference in the ‘Protection and Management’ section of the citation seems to suggest that a nomination would comprise both PNG and Indonesian components and in addition

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suggests a serial nomination including Kakadu World Heritage in Australia. Whilst a nomination of the existing PNG protected areas has the potential to be a successful nomination, the review suggests that a trans-border nomination, including as well Wasur National Park, would have a much greater prospect of successful nomination. There is no compelling reason why a serial nomination including Kakadu World Heritage Site should be considered.

- There is no compelling reason for revising the Description at this stage but it should be completed at least one year in advance of any proposal for a nomination.



Geographic juxtaposition of New Guinea ('Trans-Fly') savanna and savanna of Cape York Peninsula, Australia. Until the end of the Pleistocene ice age, when a rising sea level created Torres Strait, the two areas were contiguous and hence still share many species.

7) Revised Statements of authenticity and/or integrity

No change to the Statement of Integrity is proposed.

8) Revised Comparative Analysis

The Comparative Analysis is proposed to be amended. As mentioned above, there is what is considered an over-emphasis on a comparison with Kakadu World Heritage Area and no mention made of Cape York Peninsula which geographically and ecologically has greater similarity and therefore deserves to be mentioned in the Comparative Analysis. Whilst Cape York Peninsula (CYP) has long been proposed for World Heritage nomination, action towards this end is presently suspended, the area is not yet World Heritage. CYP has been extensively documented so there is a sound basis for comparison. A serial nomination of the New Guinea savannas with Cape York might well be an option to consider in the future. Whilst both CYP and the New Guinea savannas have many overlapping features, they also have substantial

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differences, so likely each could stand alone as separate World Heritage nominations and do not depend on a serial approach.

CONCLUSIONS:

Attributes/Values: This review confirms the outstanding natural heritage conservation values of the Trans-Fly World Heritage Tentative Listed area as documented for the nomination in 2006.

Natural Heritage: A literature search has failed to find any new (Post 2006) published documentation relating to the natural history of the greater Trans-Fly region. Given the rather limited documentation currently available, this lack of on-going research is a matter of some concern.

The natural heritage significance revolves in large part on a suite of ecological diversity attributes viz;

- The New Guinea savanna's being both a distinctive ecoregion and an ecoregion that is anomalous in the context of the island of New Guinea;
- The high natural integrity of almost the entire ecoregion (e.g. few roads and tracks, no industrial or urban development, no current mining) and natural hydrology intact;
- The substantial wetlands systems already recognised as Ramsar Wetlands of International Significance;
- The large scale intact habitat that supports many taxa of animals and plants, many of which are either local endemics or New Guinea endemics. A number of species are shared with Cape York Peninsula to which the Trans Fly was previously joined but which demonstrate evidence of evolutionary divergence since formation of Torres Strait. e.g. Agile Wallaby *Macropus agilis papuanus* in Trans-Fly and *M.agilis jardinei* on Cape York Peninsula;
- The very complex and diverse array of habitats is a positive contribution to the high conservation value of the area.

Cultural Heritage:

The citation for the Trans Fly Tentative List area is almost devoid of references to cultural attributes but this review has identified some important cultural attributes which deserve to be included in formal documentation.

Particularly noteworthy and well documented are the 'mound-and-ditch' agricultural structures evident throughout the region and well represented along the Torassi River in the Tonda WMA. These and other cultural attributes referred to in Appendix 2 need to be further considered in management of the site and in exploring the case for cultural heritage values in any future World Heritage nomination.

a) Threats:

Some threats to the natural and cultural heritage attributes and values of the New Guinea savanna (Trans-Fly) were identified. However, compared with other ecoregions on the island of New Guinea, the threats are comparatively limited and most are manageable.

Mining: Within the PNG protected areas in the Trans Fly there are only two current mining Exploration Licence Applications but their purpose is unknown though likely for mineral sands and/or iron sands.

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Invasive Species: There is no doubt that the greatest threat to the ecology of the Tentative List site is invasive species of both plants and animals. A number of invasive species are already impacting on the environment and require management intervention.

Agriculture: Most of the Trans-Fly has been mapped as marginal to unsuitable for oil palm plantation (Nelson 2013) so threats from agriculture is probably quite limited.

b) Protection:

At the time of nomination in 2006, more than 1 million ha of the New Guinea Savanna had been formally protected and since then substantial additional areas have been protected in PNG in the form of two additional WMA's (near finalization). An impressive 100% of the Trans-Fly Tentative Listed area has protection, far greater than for any other PNG Tentative Listed sites, most of which are devoid of any significant protection. This level of protection augers well for an early World Heritage nomination.

c) Management:

Management of the protected areas which comprise the whole of the Trans-Fly Tentative Listed Area is in the hands of the customary landowners who receive little or no assistance from Government. The main management issues are dealing with invasive species and cross-border poachers.

Whereas Indonesia has a substantial Government supported management presence in Wasur National Park, PNG has no on-ground Government presence in Tonda. The review suggests that the general lack of support by Government for the landowners of the WMA's represents a threat to the sustainability of the protected areas.

Overall, the Trans-Fly is clearly an area of very high conservation value, has a high degree of protection and only limited threats to the natural and cultural value, and is the most advanced of the PNG World Heritage Tentative List areas in terms of the preparatory process required for nomination as World Heritage. Notwithstanding, there is a critical need for further evaluation and assistance to ensure sustainable management of the landowner managed protected areas preliminary to any nomination.

9) Recommendations Arising

a) Context:

The "Trans-Fly" World Heritage Tentative Listed area, interpreted to be coincident with the Tonda, Aramba and Wereave WMA's, is an area of outstanding conservation value. It includes a major example of the New Guinea 'Trans-Fly' tropical savanna which extends from the western side of the Fly River in PNG into Papua Province of Indonesia. Notwithstanding that the natural heritage attributes have been subject to only limited additional research, the area is distinctly different to almost every other part of the environment on the large island of New Guinea. Research has established that the wetlands of the region are of global importance for migratory water birds and also for numerous endemic species of birds.

The long term future of the ecological environments of the Tentative Listed area is inevitably linked to the adjoining Wasur National Park protected area on the Indonesian side of the international border. At the border, the natural savanna landscape extends across the border almost without evidence of a political boundary, the classic opportunity for collaborative management across an international frontier.

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Whilst the opportunity for cross-border cooperation has already been recognized, including through the Tri-national Wetland Conservation Project agreement, there is scope for considerably more international cooperation across the border. The fact that both Indonesia and PNG have separately established major protected areas on the New Guinea (Trans-Fly) savanna (Wasur National Park, Tonda, Aramba, WereaveWMA's each separately nominated their respective areas as Ramsar Wetlands of International Importance and together joined in the Tri-national Wetland Conservation Project is evidence of a shared vision for the savanna and its major wetlands. This outstanding opportunity for further trans-border collaboration is an important context for the following recommendations.

b) Name:

The official name of the site is the "Trans-Fly Complex". "Trans-Fly" has some meaning from a PNG perspective in the sense that it means 'beyond' the Fly River, but the term "Complex" provides no illumination as to why the area is valued. Whilst there may be some case for changing the name of the Tentative Listed site there are no particular advantages at this point in time. From an Indonesian viewpoint, "Trans-Fly" may be somewhat irrelevant and seen to be biased towards PNG. If a trans-border World Heritage nomination eventuates, a more neutral generic name would be preferable, such as 'Savannas of New Guinea'.

In the interim, it is **recommended** that:

The PNG World Heritage Secretariat/Committee consider

- *Retaining the name of the Tentative Listed site as "Trans-Fly Complex" for the Tentative Listed area, at least in the interim;*
- *For internal purposes, use as an interim name the more descriptive "Trans-Fly Savanna" to draw attention to the 'savanna' and to provide a better indication of what the landscape is like;*
- *For any communications with Indonesia, consider trialing the name of "Savannas of New Guinea" as a potential consensus name for a trans-border nomination.*

c) Boundary:

Given that no formal boundary has been declared for the "Trans-Fly" Tentative Listed Site and the review is unaware of any active plan for formally delineating the area, it is recommended that the de-facto boundary be that of the Tonda, Aramba and Wereave WMA's.

Until such time as there are further field studies and cases made for any additional protected areas associated with Tonda WMA, there is no pressing necessity to extend the boundary.

The external boundaries of the Tonda, Aramba and Wereave WMA's are appropriate and appear to present no particular management problems apart from field definition of the northern and eastern boundaries. The western boundary is the international border with Indonesia and the southern boundary is the coastline.

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Adopt the external boundary of the Tonda, Aramba and Werivave WMA's as an appropriate boundary for the "Trans-Fly World Heritage Tentative Listed Area";*
- *Notify relevant departmental branches and Government authorities, in particular the Mineral Resources Authority (MRA), of the boundary details of the WMA's and Tentative Listed Area;*

TRANS-FLY COMPLEX

- Promote public awareness of the existence of the Trans-Fly World Heritage Tentative Listed site and its values.

d) Responding to Threats:

At the landscape level, there appear to be no immediate new threats to the heritage attributes and values. However, at the ecological level there are existing and on-going threats to the ecology of the area, mostly posed by introduced species, including Rusa deer.

There is currently a total of only two* exploration license applications (ELA2119 and 2118) which extend over about 75% of Tonda WMA. Both applications are by Bulawe Minerals (PNG) Ltd. and according to the Mining Cadastre Portal, the applications are with the Minister for Mines for consideration. An internet search failed to find any company called Bulawe and so the purpose of the applications is unknown but given the scale and location is likely to be for mineral sands or iron sands exploration.⁵

The status of any petroleum tenements over the area could not be checked due to the relevant data base being offline.

Mining and Mining Exploration:

Given that:

- There are two current mining exploration license applications over Tonda WMA;

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Actively engage with the Mineral Resources Authority to establish the status and nature of the proposed exploration on Tonda WMA and if appropriate, lodge objections to granting of those sections of the applications over the WMA.*

Invasive Species:

Given that:

- A number of serious invasive species are already recorded in the Trans-Fly Tentative Area and surrounds (e.g. Rusa deer);
- The invasive species issue is shared with Wasur National Park on the Indonesian side of the border.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *In consultation with the relevant landowners, initiate a rapid survey to identify existing invasive species, both plants and animals (including any evidence of giant Mimosa);*
- *In consultation with the relevant landowners, prepare an Invasive Species Management Strategy for the Tentative Listed Area;*
- *Review the status of the Tri-national Wetlands Conservation Project agreement between Kakadu (Australia) Wasur (Indonesia) and Tonda (PNG);*

⁵ At the commencement of the review there were 3 applications but one appears to have been cancelled/withdrawn during preparation of this report.

TRANS-FLY COMPLEX

- Re-establish communications with the Indonesian Departemen Kerhutanan, the management agency responsible for Wasur National Park, to explore further collaboration on management of invasive species across the savanna region.



The Trans-Fly wetlands are famous for their wildlife such as magpie geese but also, including in this case introduced deer (*Rusa timorensis*). (Photo: Panoramio)

Ramsar Listing:

Given that:

- Both Tonda WMA and Wasur National Park are Ramsar listed wetlands of International Importance, totaling more than 1 million ha;
- The two Ramsar sites immediately adjoin;
- The two Ramsar sites share many management issues including transborder movement of invasive species;
- The Wasur-Tonda Ramsar wetlands are not officially recognised as Transboundary Ramsar Sites.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Consider liaising with Indonesian Ramsar authorities to explore the prospect of a simple MOU regarding collaboration on management of the Ramsar wetlands of the New Guinea Savanna (Trans-Fly) ecoregion with view to a joint approach seeking formal recognition by the Ramsar secretariat to the Wasur-Tonda Ramsar wetlands as Transboundary Ramsar Wetlands. (The first in the Asia-Pacific region) (See copy of Ramsar document on the subject of Transboundary wetlands (Ramsar 2008 in bibliography).*
- *Ensure that the PNG annual report to Ramsar is submitted on time for the next COP meeting in Uruguay in June 2015.*

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e) Further Research:

Given that:

- Some aspects of both the natural and cultural environment of the Tentative Listed area are poorly known;
- There is a need to undertake further research and data gathering to inform management and to justify a World Heritage nomination;
- There is a need to survey and monitor invasive species (see above).

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Encourage further archaeological research of the mound-ditch agricultural structures in the Tentative Listed Area;*
- *Collaborate with managers of Wasur National Park (Taman Nasional Wasur) for any information or documentation on mound-ditch agricultural structures reported in Wasur NP;*
- *Take every opportunity to encourage or direct biodiversity survey projects into the Tentative Listed area. (e.g. Bishop Museum research, UPNG, James Cook University, Cairns)*

f) Towards Awareness, Recognition and Protection:

Given that:

- Some 590,000 ha of the Trans-Fly has been formally protected as Wildlife Management Area (Will be 1,320,000 ha. when Aramba and Weriaver WMA's are confirmed);
- The Trans-Fly Tentative Listed area is immediately adjoined by another protected area, Wasur National Park of 413,800 ha. in Papua Province of Indonesia.
- Collectively, more than 1 million ha of the New Guinea savanna has been listed as Ramsar wetland of International Importance;

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Urgently seek completion of gazettal of additions to Tonda WMA and establishment of Aramba and Weriave WMA's;*
- *Consider bringing forward commencement of a World Heritage nomination process for the Trans-Fly. (but only if Aramba and Weriave WMA's finalised);*
- *Consider consultation with Indonesian authorities about the possibility of a joint trans-border World Heritage nomination to include Wasur National Park. (possibly also other adjoining reserves);*
- *As a prerequisite to any World Heritage nomination, review the management rules of the existing Wildlife Management Areas and consider the option of a single overall strategic management document (to complement existing rules for WMA's) to help meet the management plan conditions for any future World Heritage nomination.*

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Appendix 1: Citation for Tentative Listing

[Papua New Guinea](#)

Trans-Fly Complex

Date of Submission: 06/06/2006

Criteria: [\(v\)](#)[\(vi\)](#)[\(x\)](#)

Category: Mixed

Submitted by:

Department of Environment and Conservation

State, Province or Region:

Western Province, PNG

Ref.: 5062

Export

[Word File](#)

Description

Mixed Cultural/Natural Property

The property is a mixed cultural and natural site straddling the international border of Papua New Guinea and Indonesia. This low-lying region of savannas, wetlands and monsoon forest habitats covers more than 10 million ha. The area is home to some of the largest and healthiest wetlands in the Asia-Pacific region. Combined with the Kakadu World heritage Site, it represents the only environment of its kind in Australasia. Millions of birds inhabit the floodplains of slow moving rivers, and the surrounding savannas and monsoon forests are unique to the Trans-Fly. The area is home to an endemic marsupial cat, flying possums and birds of paradise. Over 50% of New Guinea's total bird population is found in the ecoregion, including 80 species endemic to New Guinea. A complete range of largely intact vegetation types from coastal mangroves through savannas and tropical dry forests includes all representative types of monsoonal climate vegetation. It is suggested that this site could potentially be a serial trans-boundary nomination with 1) the existing Kakadu World Heritage Site in Australia's Northern Territory with which shares many similar environmental conditions and 2) the adjacent savannas, wetlands and monsoon forests of the Indonesian side of the border in Papua Province. The cultural links across the border with Papua, Indonesia are significant - many groups share languages and cultural traditions and many sacred sites and ancestor routes are important to groups on both sides of the border. The biological links to Kakadu are also significant, as a large percentage of the biodiversity is shared between these two sites. However, the Trans-Fly includes many New Guinea endemic species not found in Kakadu.

Protection and Management

The area comprises parts of three Global 200 ecoregions, an endemic bird area and a centre of plant diversity. Part of the area (590,000 ha) has already been designated as a Ramsar site and a site on the Shorebirds Reserve Network. The area also contains approximately 1,310,000ha of existing or currently being gazetted community managed protected areas. [Update needed] The site contains PNG's largest protected area - the 590,000ha Tonda Wildlife Management Area, which is a community managed protected area. The area is lightly populated, most people still living a traditional lifestyle of hunting, gathering and small scale shifting yam cultivation. In PNG most protected areas are managed by a committee of local landowners who decide upon the rules for management. WWF has worked with the Tonda

TRANS-FLY COMPLEX

WMA Committee to develop a set of rules that are based on threats to the reserve and have been conducting research into key ecological processes, key species and management concepts to assist the local people to manage the reserve. On the northern edge of Tonda, contiguous with it, three new WMAs are being established with local landowning communities. The total area of these is approximately 720,000ha. The Trans-Fly protected areas are greater than all the rest of the protected areas in PNG put together. These new protected areas cover significant expanses of monsoon forests and some key wetlands in the south and middle Fly floodplains. There is increasing demand for cash income amongst the communities of the Trans-Fly and there is evidence of some unsustainable wildlife harvest of certain species such as Saratoga - a species of fish that is traded over the border with Indonesia. WWF is working with Traffic and local landowners to develop management plans for key species of commercial value.

Statements of authenticity and/or integrity

Trans-Fly cultures retain land use practices and traditions with an ancient lineage. These are experiencing dramatic change particularly in areas close the border. A World Heritage listing will assist to document, revitalise and promote a pride in these traditions. Natural systems remain in remarkably good condition with only a few limited areas of human habitation and impacts. The area is remote and rarely visited by outsiders. There are no commercial flights into the area and very few bush tracks. Motorised vehicles are rare. Various studies have recommended that this area receive protection and assistance with management as a result of their findings, but more information is needed to inform management interventions. No major roads cross the region and the human population is sparse.

Comparison with other similar properties

The Trans-Fly can only be compared to similar large tropical wetlands in Africa and South America: the Okavango delta, the Pantanal and the Venezuelan-Colombian Llanos. But the comparison must be weighed carefully, because the Trans-Fly is located in an island, is of very recent origin (Pleistocene), and thus for these reasons alone ecological theory predicts lower diversity. Perhaps the most important aspect of the Trans-Fly is that it represents the only ecosystem of this kind in Australasia. The Pantanal, a part of which was only recently nominated as World Heritage Site, is also of recent origin (also Pleistocene - previously a desert), but is affected by highly diverse ecosystems, such as the Amazon and Brazilian Atlantic Forests, the Chaco and the foothills of the Andes. Not surprisingly, the diversity of mammals and birds in the Pantanal is higher than in the Trans-Fly (124 and 463 species in Pantanal, respectively, vs. about 70 and 360 in Trans-Fly). However, the comparison is inappropriate. First, while the Trans-Fly encompasses 1.3 million hectares, the Pantanal encompasses 16 million hectares; that is, an area about 12 times bigger than the Trans-Fly. It is important to note that the connectivity of Pantanal to other ecosystems means that it contains fewer endemic species in absolute numbers and in percentages compared to the Trans-Fly. The Okavango delta in Botswana is also an important wetland, housing millions of migratory species that arrive seasonally in their migrations across the African continent and into Europe and Asia. This ecosystem is much older than the Trans-Fly, and is surrounded by large landmass areas of high diversity. Much like Pantanal, the Okavango delta has fewer endemic species in absolute numbers and percentages than the Trans-Fly. The Llanos of Venezuela and Colombia are similarly seasonally flooded wetlands and a matrix of habitat types. Their origin is recent, as the Orinoco and Magdalena rivers drifted eastwards with the raise of the Andean cordillera 5 million years ago. These are also an important ecosystem for several migratory species, especially wildfowl, and are adjacent to the region with the highest avian diversity in the world: the Andean foothills. The Llanos are usually not a major stopover

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site for migratory species from North America. Most species follow the Andes mountain ranges to South America, including the Pantanal and the Argentinean Pampas. Similar to Pantanal, the Llanos house species of wildlife typical of Amazonian forests, such as tapirs and anteaters, spider monkeys and many species of parrots. Endemism is also very low. The low endemism of the Pantanal, Okavango delta and the Llanos is an important metric of the uniqueness of the Trans-Fly. The endemism stems from two peculiarities of the Trans-Fly: it is found in an island and its geomorphology and origins are unique in Australasia. Regionally, the Trans-Fly is very rich in bird fauna and no other site in the region compares to it, including Kakadu World Heritage Site.

Appendix 2: The Cultural Significance of the Trans-Fly

Throughout time, Melanesian horticulturalists have not only adapted crop production to a wide range of environments, they have also made adjustments to cultivation techniques as a result of environmental changes (Barrau 1980, p.255; Hitchcock 2004, p.158-159).

The relict “ditch and mound gardens” makes a major contribution to knowledge about the long term agricultural and cultural practices of the peoples of the Trans-Fly, and provides:

- Evidence of Continued adaptation with cultivation techniques as a result of environmental change and broader contexts of socio-cultural complexity.
- Possible evidence of complex social relations required for the amassing of huge surpluses of root crops for use in ceremonial purposes (Williams 1936).

The Trans-Fly region of Western Province is unusual in having no significant population growth or migration. Along the 300 km coastline of the Trans-Fly are no less than 14 distinct languages and more than 25 dialects; each of which represents a distinct cultural group. Due to the remoteness of the area and poor rainfall and soils, it remains largely untouched by western industrial development (Chatterton n.d). The Trans-Fly communities are known for their field systems for producing swamp taro, comprising long rectangular mounds separated by ditches. These mound-and-ditch fields were constructed up until the 1930s, but vegetational and hydrological changes contributed towards the Waratha ceasing to make them (Hitchcock 1996, pp.37-38).

The introduction of ditch and mound agricultural systems represents an important human adaptation to the marginal environment of the Trans-Fly. The region was described by F. E. Williams, an Australian Government anthropologist in 1935 as “one of the most unpleasant areas of the habitable globe” - a vast swamp in the wet season and for the most part parched waterless land in the dry (Seligman 1938, p.736). Seligman (1938) describes an important origin story told to Williams in 1935:

... over the whole area westwards from the Oriomo River there is the legend that the original inhabitants lived in a tree without the knowledge of fire, from which condition they were delivered by a hero who came from the north, who gave the people new food plants.... There is also a legend of two brothers, one who might perhaps be regarded as Papuan and the other as Melanesian, i.e., from the description of their appearance.

Until about 300 years ago, taro, a water demanding crop was the most important food crop in PNG. It is now generally accepted that many of the PNG food crops that were important before 1870 were domesticated in New Guinea or nearby areas, including the Bismarck Archipelago, as well as in Asia. Swamp taro was likely domesticated in PNG or has very ancient traditions (Bourke 2011).

In 2005 Garrick Hitchcock published a critical ethnographic account of the Wartha people, a small group of hunter-horticulturalists living on the Torassi or Bensbach River. Taro was grown in extensive areas of relict mound-and-ditch agricultural systems in the middle Torassi area, called montj by the Wartha people, whose elders recount that these systems were last constructed around the 1930s. These agricultural systems comprise long parallel mounds, measuring 3-5 m in width, separated by ditches less than one metre deep. Digging sticks were used to dig long trenches in marshy grassland (the cut crass was used as mulch), and the excavated earth was thrown up between them to create a planting surface for taro to survive

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wet season flooding.⁶ Hitchcock mapped the occurrence of montj gardens at 39 named locations in the middle Torassi area. In some places the systems merge to form networks covering hundreds of hectares.

The Wartha abandoned constructing this type of garden in response to dynamic vegetational and hydrological changes, which included a process of forest colonisation of grasslands on uplands and floodplains that continues today. Wet season flood levels have dropped substantially, and the areas traditionally used for mound-and-ditch agriculture is now 'harder' and more 'dry' than in the past. People have also moved to higher ground as a result of forest colonisation. The Wartha ceased making mound-and-ditch gardens and shifted to an agricultural regime based predominantly on swidden cultivation in forested areas above the highest level of wet season inundation (Hitchcock 2005, p.158).

In the past, stone tools, including axes, were very rare in this part of New Guinea (e.g. Hitchcock 2004b; Williams 1936:428-429). The import of axes, knives and shovels from Merauke—at the very time that the environmental changes were creating more forest, and a drop in the water table—probably accelerated the shift to swidden agriculture, given that montj gardening was now comparatively less productive and more labour intensive (and people were now far fewer). The introduction of other cultivars such as easy-to-grow cassava, most likely around the late nineteenth century, displaced labour-intensive taro throughout the district.

The relict systems are still useful today. Due to their vast extent, they are often encountered when people clear forest. People plant water-tolerant taro in the ditches, and yams on the top of the mounds, so that in the rainy season the former will be irrigated, and the latter will not rot as a result of inundation. The continued use of the relict mound and ditch gardens thus involves a shift from planting taro on the mounds for drainage, to incidental planting in the drains to take advantage of wet season runoff. In very flat areas with poor drainage characteristics, people use shovels to allow water to exit the garden. The relict mound and ditch agricultural systems must be understood as embedded within the total socio-cultural system of which they are a part.

Archaeology of the Trans-Fly

The archaeological evidence of the Trans-Fly is scant (McNiven et al 2004, p.271) but adds an important contribution to the origin of stone axes along the Trans-Fly and contributes knowledge about symbiotic trade between the Torres Strait people and the Trans-Fly people.

The origin and date of large stone axes found at the mouth of the Trans-Fly on Kiwai Island and plentiful along the Trans-Fly coast are estimated to be prior to sustained European contact in the late 19th century. In 1901 Haddon postulated that the large axes may have been a symbol of prestige or authority:

In this island a number of very large, well-shaped, polished stone implements are found in the bush. The largest I have seen was in Mr Chalmer's house – it measured 18 $\frac{3}{4}$ inches (47.5cm) in length. These stones are now placed at the head and foot, or all round the graves and the natives do not appear to know anything about their former use..... The large implements are so cumbersome and heavy that it is difficult to understand how some of them could ever have been used, and I suspect the largest

⁶ Similar systems have been recorded from swampy environments elsewhere in southern New Guinea and the Pacific (e.g. Barham et al. 2004; Hitchcock 1996; Swadling 1983:Figure 12; Thaman 1984:109).

TRANS-FLY COMPLEX

ones were in reality, symbols of wealth or possibly of authority (Haddon 1901:108 cited in (McNiven et al 2004, pp.272-273).

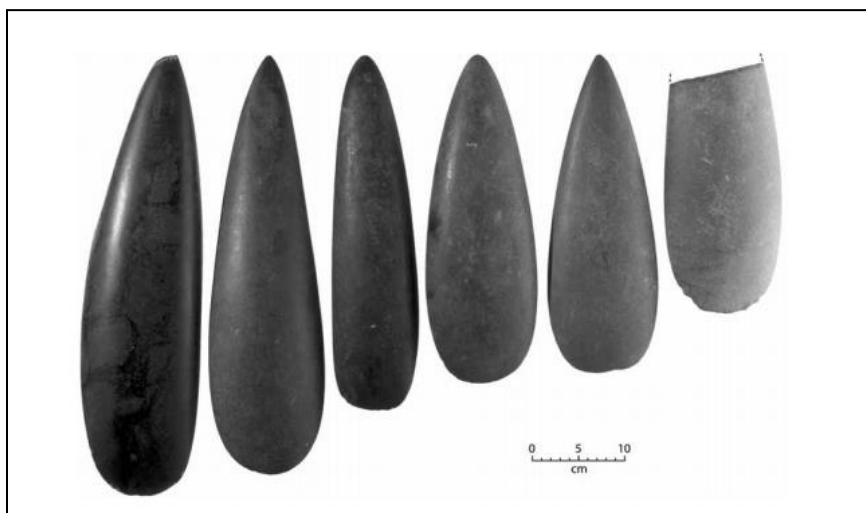
Gunner Landtman, who conducted anthropological research on Kiwai Island in 1910-1912 noted that the smaller hafted axes could be acquired in abundance and their value was minimal, following technological transition to metal tools. The large unhafted axes in contrast still held 'very great value' and could be used in bride-price or to purchase a canoe. Landtman also felt that the 'unwieldiness' of the large axes was consistent with ceremonial use. The ceremonial value of the axes seems to have increased after the introduction of metal tools and were often used at graves or water holes, stuck in the ground in an upright position. long term Resident Magistrate who had observed numerous Kiwai axes said the large axes were supposed to be 'agricultural charms', and added that this use had been forgotten by the early 20th century.

Origins of the Stone Axes

Landtman's ethnographic research provided evidence of procurement and manufacture of the stone axes from the Torres Strait. In regard to the larger stones, Torres Strait Islanders obtained the stones from diving to the bottom of the sea. The large stone axes were kept in the sea during intervals in the work to soften them, and were then hardened in the sun or before a fire. Archaeological research on axes from Kiwai Island in the Queensland Museum collection indicates that most of the axes were made from stone quarried in the Torres Strait.

Significance of the Stone Axes

Despite the Torres Strait being the source of the stone axes, very few were located there. Most of the 'Kiwai' type of stone axes were found in the Trans-Fly region, and were used to make canoes. The Torres Strait, unlike Papua, lacked large trees, and it is likely that a trade in canoes commenced between the Trans-Fly and the Torres Strait in the late Holocene. A symbiotic relationship can be thus described where the Papuan Trans-Fly people needed stones for canoe construction and the Torres Strait Islander people required canoes for their maritime existence. Landtman's research on Islanders diving for suitable rocks indicates that canoes were important for the manufacture of the large axes.



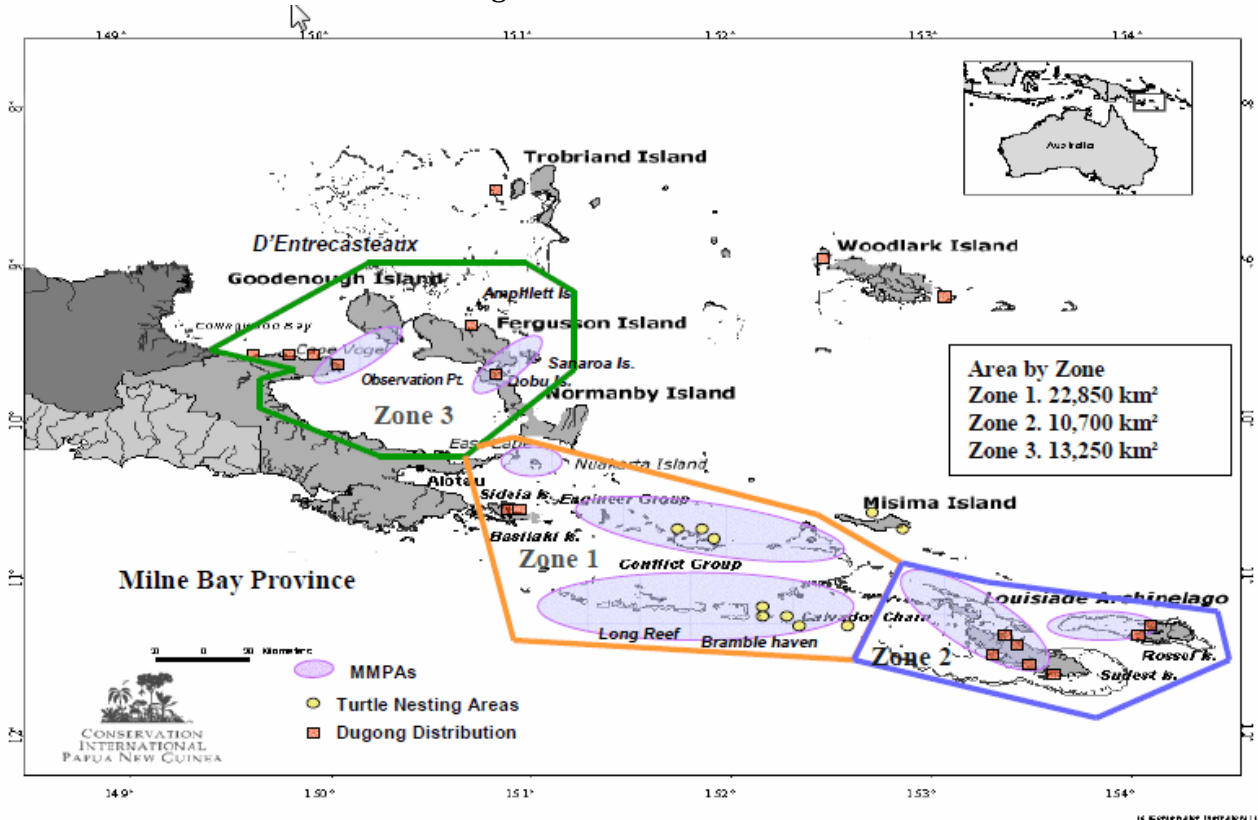
Extra-large Kiwai 'type' Axes (McNiven et al 2004)

MILNE BAY SEASCAPES REPORT

1) Current Situation

Boundary:

At the time of nomination, no boundaries appear to have been submitted. However, it is clear from the description and documentation by Conservation International that the intent was to adopt the boundaries* of three designated 'zones' for the purpose of the Tentative Listing. The three zones are illustrated in the diagram below.



*Future reviews of the boundary of the Tentative Area should consider the need for additional areas based on cultural considerations

Protection:

There are only three national protected areas within the Tentative Listed area, all terrestrial, all in Zone 3. They are:

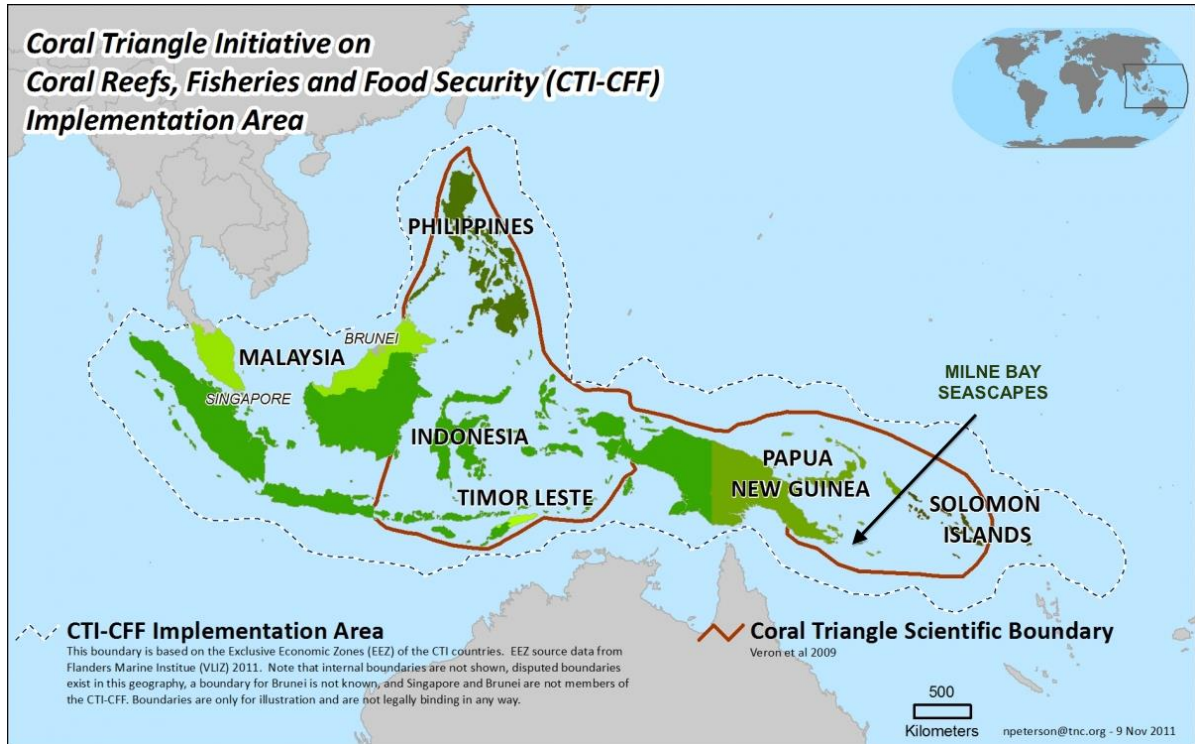
- I. Oi Mada Wara WMA on Goodenough Island.
- II. Lake Lavu WMA on Fergusson Island.
- III. Sawataetae WMA on Normanby Island.

No new protected areas were established since the nomination in 2006.

It is understood that there have been local initiatives to establish marine protection.

2) Description of Site

The entire area is characterized by an extensive and complex system of submerged and emergent coral reefs and numerous islands ranging from large 'high' islands to very small islands and atolls.



Location of Milne Bay Seascapes Tentative List area relative to the "Coral Triangle".



The 3 Zones of the Tentative Listed area as at 2006. Note that the area includes a number of large islands.

3) Key attributes and values

3a. Natural Heritage

Whilst the focus of the citation for the Milne Bay Tentative Listed area focusses very much on the marine environment, it needs to be recognized that the area includes numerous islands, including the large islands of Goodenough and Ferguson. The islands in the listed areas are known for their endemic species and so make an important contribution to the heritage values of the area. Endemic birds include two species of Bird of Paradise including Goldie's Bird-of-paradise (*Paradisaea decora*) on Ferguson Island and Curl-crested Manucode (*Manucodia comrii*) on Ferguson, Goodenough and several adjacent islands. The Louisiade EBA contains 7 endemic species of birds, a measure of its relative remoteness from the mainland.

Goodenough Island has a critically endangered (CR in IUCN Red List) species of wallaby, *Dorcopsis atrata*, which is in danger of being hunted to extinction. Oi Mada Wara WMA is a very important protected area for a number of globally important species.

The listed area encompasses parts of two Endemic Bird Areas (EBA), '196 D'Entrecasteaux and Trobriand Islands' (2 endemic species in listed areas) and Louisiade Archipelago (7 endemic species)

It will be apparent that the Milne Bay Tentative Listed area is an area of great importance for conservation of both marine and terrestrial biodiversity.



Oi Mada Wara Wildlife Management Area (green) on Goodenough Island is the largest and most important protected area in the Milne Bay Tentative Listed Area. The reserve is critically important for survival of the critically endangered (CR in IUCN Red List) wallaby, *Dorcopsis atrata*.

MILNES BAY SEASCAPES

The Milne Bay Tentative Listed area is undoubtedly an outstanding marine environment of potentially World Heritage significance. It is a premier marine environment both in a PNG context and within the wider Coral Triangle region. Milne Bay coral reef environment is not only globally significant in terms of biodiversity but is in much better condition than many of the reefs elsewhere in the Coral Triangle. The marine environment is complemented by a highly significant terrestrial biota on the many islands within the area.

Protection of Milne Bay Tentative Listed area deserves a high priority both national and internationally. It requires informed active intervention to prevent its deterioration, a case of a 'do nothing' option is not an option if the area is to remain globally significant.

3b. Cultural

The rich cultural heritage of the Milne Bay region includes:

- Kula Ring (a regional socio-cultural network)
- Ceremonial Canoes
- Samurai Island
- Stone Church on Kwato Island
- 'Mutuaga Carvings'
- Stone Megaliths (regional)

It should be noted that the delineation of the Milne Bay World Heritage Tentative Listed area appears to have been largely based on marine environment rather than culture. The Tentative Listed area forms only part of the distinctive Massim cultural province, so much so that cultural links exist between the Listed Area and islands some distance away such as Woodlark and the Trobriand Islands. For these reasons, we draw attention to some specific cultural components outside the Tentative Listed area as well as to the overarching Massim cultural links.

Culturally the Milne Bay region is often referred to as "the *Massim*", a term which possibly derives from the Misima Island. The Massim cultural area begins with Milne Bay at the east end of New Guinea and includes the island peaks of submerged mountains and coral ringed archipelagos beyond to the southeast and southwest for as far as 300 miles (480 km).

Massim societies are usually characterized elaborate mortuary sequences and complex systems of ritual exchange including the Kula ring. Significant cultural variations occur from Island group to Island group and even between close lying islands. Bronislaw Malinowski, who is considered the 'father' of modern anthropology documented the reciprocal trading and exchange cycles known as the "Kula Ring". Other long-term trading relationships existed throughout the Pacific at the time of European contact, but the Kula is the best known as an example of complex social and cultural systems linked by exchange and reciprocity.

The Kula season begins with the harvesting of surplus yams for the trading and feasts. Although taro is a staple food, yams accord much higher status and are pivotal for the Kula trade. The yams are displayed competitively. The Kula trading period involves the trade of various commodities, as well as cultural events such as "Trobriand cricket", and ceremonial feasting. The various elements serve to link islanders with their Kula partners. There is an opening gift and finally a closing gift, all presented within the familiar context of tradition and ceremony, linking people to the past.

MILNES BAY SEASCAPES

The Kula Ring regional trading system was particularly elaborate. People traded pottery from the Amphlett Islands and canoe timber and greenstone blades from Muyua (Woodlark Island). Carved platters, canoe prow boards, and other valuables were complemented by a flow of yams and pigs from areas with rich resources to smaller, ecologically less-favoured islands. Through chains of intermediary trading partnerships between neighbouring peoples, exchange systems in the interior of New Guinea connected communities that were otherwise separated by hundreds of miles of rugged mountains. Such networks carried salt, shell, and other objects from coasts to interiors, and forest products, such as black palm, from interiors to coasts.

The Kula ring spans at least 18 island communities of the Massim archipelago, including the Trobriand Islands. The word Kula is derived from *bita kuli*, a verb, meaning both “to form in the likeness or image of another” and “to be formed as a likeness or image of the other.” This is the “reciprocity” that Malinowski wrote about. “It is a motion, an action of giving and taking between people—two people (partners) to begin with. This expands to include and link whole communities and islands that are otherwise very far away (Malnic and Kasaipwalova, 1998).



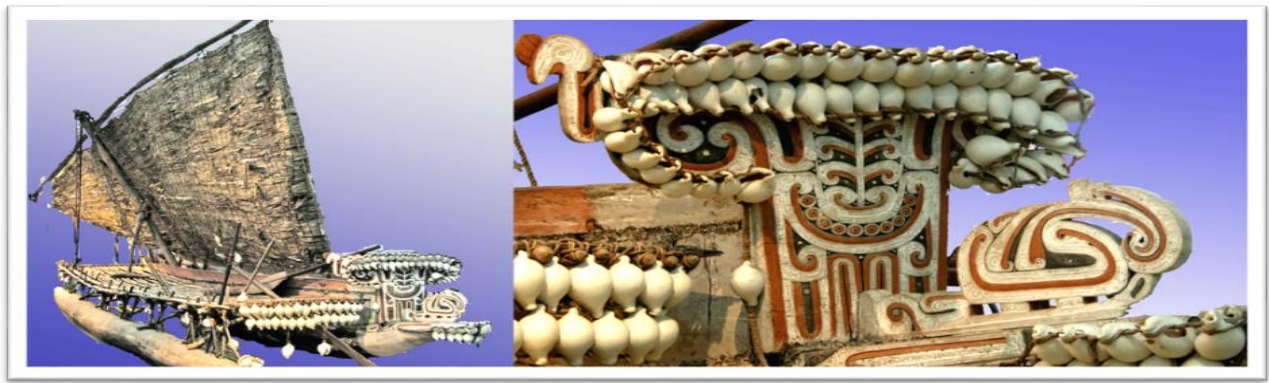
Massim Area and trade routes showing the direction of kula ring cycles. Necklaces travel clockwise, arm-shells counter-clockwise

In the 1980s, under the “Louisiade Archipelago Project” Geoff Irwin carried out an archaeological survey of the east coast and islands, focussing on the evolution of the systems of trade and exchange which integrated them at European contact. Irwin was interested in the particular relationship which developed between the southeastern corner of the Massim and the wider circle of the well-known Kula cycle. His research explored the interaction between the land-oriented populations of the large vegetable-rich islands of the archipelago and the mobile sea-farers of the small-island chains, as well as the nexus between trade and warfare which was so prolific in the region prior to European contact. More than 100 sites were recorded and collected between Samarai and Sudest Island and four were excavated (Australian Heritage Commission Department Records).⁷

⁷ http://www.jps.auckland.ac.nz/docs/Memoirs/mem_048/manandahalf067.pdf

Massim Sailing Canoes

Traditional sailing canoes, called “Sailaus” still play a significant role in Milne Bay culture. This is one of the last places in the world where traditional voyaging canoes still travel across hundreds of kilometres of open-ocean with no compasses or charts. Traditional knowledge of the sea, weather and stars is used to reach their destinations. Great trading voyages are still undertaken for betel nut, sago and clay pots - the currency is bagi shell jewellery and greenstone axes traded from faraway Suau. The highly decorated *waga*, or ceremonial canoe used for the Kula trade is made to hold approximately 15 men traveling comfortably over hundreds of miles at open sea. The symbols carved and painted on the *lagim* (splashboard) on the bow of each canoe show the social ranking of that *waga* and the party on board. A *bwalai* (small man figure) at the bow represents the spirit of the man in charge of the canoe and allows his spirit to search the ocean. They utilize designs of *minudoga* sandpipers, a bird that floats on the ocean, which symbolize the care that must be taken by the leader for his crew and his community. The journey reinforces the ideas that status has obligation, and that each social position has its unique value (New World Encyclopedia.org).



Kula Trading Canoe and Prow Board

The Kula trade partnerships produced long term ties between partners over great expanses of time and distance. *Kula*, which revolves around the exchange of shell necklaces and armbands, mediates relationships between people in the many islands in the Massim and is intertwined with principles of fame, hierarchy, value and kinship (Bickler & Turner 2002). Bickler (2006) suggests that archaeological evidence linked to the Kula rests mostly on the production and exchange of pottery. There are two major contexts in which this pottery has been found on archaeological sites in the northern Massim. The first, and most common, context is in surface scatters found throughout the islands.

The second context is provided by burials in pots, most commonly in caves, found throughout the Massim and dating to the later period (Bidder 1998; Egloff 1972). This was the preferred method of burial in the villages prior to the Christian missions. Secondary burials, including some with pots, have been described in the ethnographic literature and found in the stone monuments (see e.g. Seligmann 1910; Bidder 1998; Egloff 1972).

Stone Megaliths and Adze Manufacturing sites

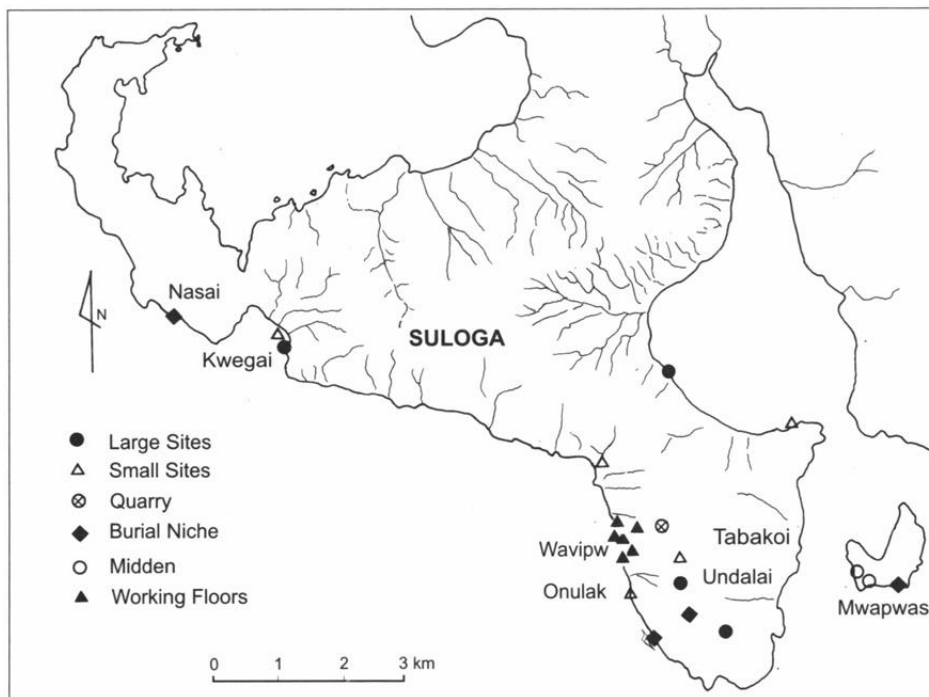
Archaeological survey of Muyuw (Woodlark Island) in the 1970s located caves, as well as a number of stone arrangements. The stone monuments represent some of the earliest known evidence of occupation in the northern Massim. The stone arrangements form a complex Early Period (~1500BP–600BP) landscape built for the dead to negotiate relationships between the living throughout the northern Massim. These sites are important in relation to the prehistory of the island and the region as a whole.

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The stone arrangements were used to provide a regional framework for the settlement of new communities perhaps led by some form of organised elite (Bickler 2006). Test excavations revealed their use as burial structures. Geologists Ollier and Pain suggested a link between the caves and stones based on relationships of stories about emergence of people from the caves, the building of stone houses (megaliths) and the presence of inverted stalactites in some megaliths. They concluded that the megaliths were most likely originally funerary monuments (Ollier and Pain 1978). Damon (1979, 1983) identified a new type of archaeological structure – trenches – they linked the trenches with the megaliths due to the proximity of both. Trenches may be also present on other Massim islands.

Bickler & Turner (2002) point out that the shell valuables of the Kula Trade are only one component of a complex exchange of valuables and food. During the period of European contact and colonisation, highly prized stone adzes represented much of the social currency in circulation. Archaeological investigation of the Suloga stone quarry, the source of most of the best stone tools in the Massim, and tool manufacturing sites on Woodlark Island, located in the north-east of the Massim. Bickler and Turner (2002) note that the fame of the Suloga stone was well understood by European explorers during the 19th century. Colonial authorities considered it sufficiently important to warrant a visit by the first Lieutenant-Governor of British New Guinea, Sir William MacGregor, during his trip to Woodlark in 1893 (MacGregor 1894), although the area had been abandoned by then. Anthropologist Charles Seligmann (Seligmann and Short 1906) provided the richest description of the Suloga working floors:

Flakes lay everywhere, literally acres of flakes; not scattered specimens, but in compact sheets having a thickness measurable at least in inches — plain evidence of a vast amount of work extending over a considerable period of time (Seligmann and Strong 1906:250).



Archaeological sites. Suloga Peninsula – Woodlark Island (Source Bickler & Turner 2002)

Samarai Island- national cultural heritage

In 2006 the National Executive Council (NEC) declared Samarai Island a national historical heritage island. The island was first settled as a London Missionary Society (LMS) Church station in 1878. Captain John Moresby from the Royal British Navy first named the island “Dinner Island” when he sailed through in 1873 and enjoyed a meal in Samarai.

Samarai became the District headquarters for the Milne Bay District before the advent of provinces. It was a hub for many islanders and a government centre for Milne Bay District until 1968. The island is historically significant as the site of a trading port and stop-over between Australia and East Asia. At one stage the port was larger than Port Moresby with ships coming direct from Cooktown, Australia to ship out gold from nearby mines at Sudest, Misima, Woodlark Islands and Gibara.

Life on the island of Samarai was very grand. There were three large hotels, several large shops, and a regular ship service carrying cargo and passengers directly from Sydney. One of modern PNG’s trading companies, Steamships, had its origins on Samarai in 1919. Copra (trade coconut) production was a major economic activity throughout the islands. After the outbreak of World War II and with the Japanese advance into the Pacific the Australian Government ordered the evacuation of Samarai in January 1942 and later in the year it was destroyed to stop the wharves and buildings falling under Japanese control. During the war Milne Bay became a huge naval base through which hundreds of thousands of servicemen passed.

Ruins and relics still remain; grand architectural buildings (now very run-down) are symbols of a time when Samarai was the ‘Pearl of the Pacific’.



The once iconic Anglican Church on Samarai Island, now in disrepair
(Image: <http://islandmeri.wordpress.com/>)

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The main wharf and old Steamships wharf - alongside each other. The seafront was a hive of activity in the '60s and '70s (Image: <http://islandmeri.wordpress.com/>)



Ship loading copra at the Samuarai Wharf c.1903 (Image: Queensland State Library)

Stone Church on Kwato Island

Kwato Island, which is about 2 to 3km west of Samarai Island is a very important island to the history of the Milne Bay province due to a revolutionary missionary Charles Able and his wife Beatrice. The Reverend Charles Abel and his wife founded a non-hierarchical church in 1891 on Kwato. The Mission on Kwato functioned as a successful educational and boat building centre. The mission's boats were used to transport and supply the Australian Coastwatchers during the Second World War. The skills and attitudes taught became famously known as the 'Kwato way'. Skills taught to men included sawmilling, carpentry, house and boat building, operation of boats and engines, seamanship, blacksmithing and plumbing. Women were taught domestic skills. The trained women became 'tanuagas' and trained the younger girls.

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The old stone church is one of the oldest surviving buildings and is surrounded by outstanding views of the China Straits⁸.



Kwato Stone Church



It is believed that Charles Abel, who established the mission station on Kwato Island, advised Mutuaga, a master wood carver, who lived from about 1860 to the early 1920s, to carve human figures for sale to Europeans. Mutuaga was born in Dagodagoisu village on the mainland, opposite Suau Island. Suau is an island off the south coast in the Milne Bay Province was the site of the first London Missionary Society mission in the Milne Bay region, established by James Chalmers and Rarotongan missionaries in 1878. Because of this the Suau language became a lingua franca in much of the Milne Bay region.

Mutuaga was widely known in his region for his fine carvings of lime spatulas, human figures and walking sticks. He had the nickname Oitau (carved man). At that time Samarai was a main port and ships going north from Australia called there. Abel acquired several of Mutuaga's carvings and leading missionaries and government officers who visited the region also collected his work. Mutuaga's style has been described as naturalistic because his figures more closely resemble the natural shape and features of human beings than the work of other Massim woodcarvers. He was not the first to make spatulas with handles carved as pigs or human beings, but he perfected their designs.



Artworks in the naturalist style by Mutuaga associated with the Abel Family⁹

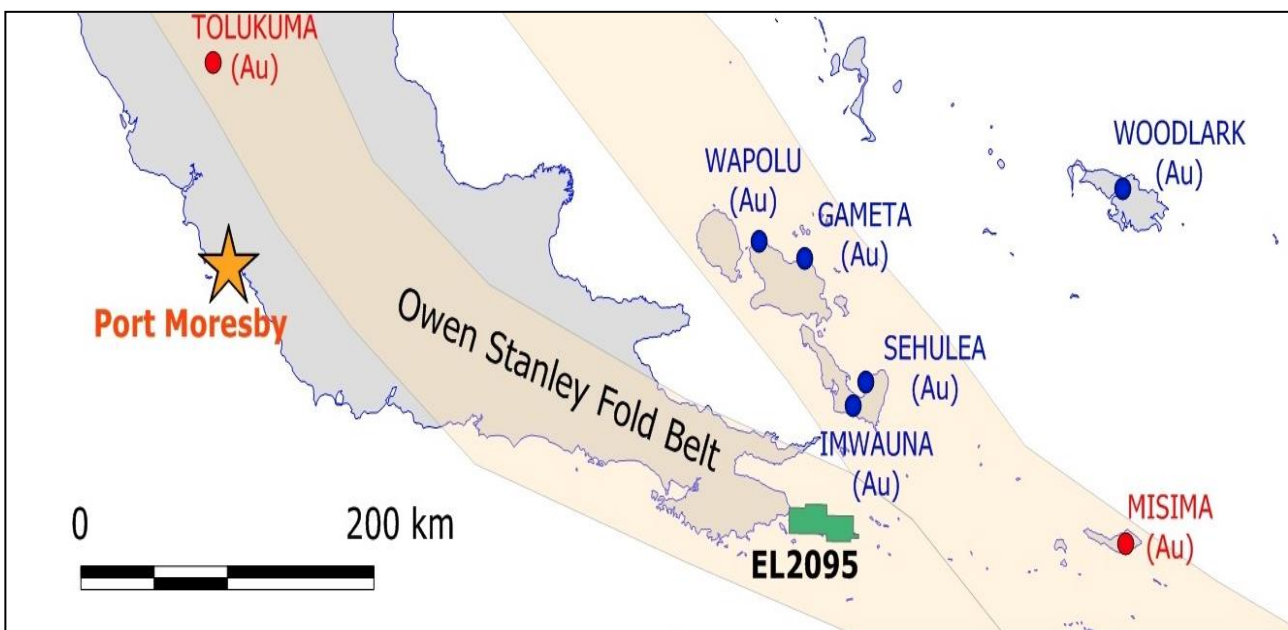
⁸ <http://www.michie.net/pnginfo/mbp/kwato4.html>

4) Threats (land use and land tenure changes, development)

The predominantly marine environment of the Milne Bay Tentative Listed area is already experiencing a number of threats to its heritage values and other potential threats have been identified.

The main current threats to the marine environment are maritime based, mainly in the form of unsustainable fishery and shell fish harvesting. However, mining represents a potentially serious source of pollution of the marine environment and in some cases, a serious threat to terrestrial environments on islands.

There are already significant mining operations occurring on islands and coasts in the region (e.g. Lihir) and more seem likely. Large scale mining for gold on Missima Island, just outside the Tentative Listed area, has been completed and rehabilitation is on-going.



Simplified structural geology diagram drawing attention to the relationship between some of the islands off Milne Bay and the Owen Stanley (Range) Fold Belt which is regarded as moderately prospective for metalliferous mineral deposits. EL2095 illustrated covers almost the whole of Basilaki, Sariba and Sideia Islands.

The Conservation International report RAP 2000 draws attention to the threat posed from activities on land, particularly in the form of agricultural and mining development. Indeed, world-wide, on-land activities represent a threat to near shore coral reefs and other marine environments. Run off from mainland areas is particularly a concern for Zone 3 which is immediately adjoining a coastal lowland region where agricultural development is occurring. Both Zones 1 and 3 include larger island where agricultural and mining development is a potential threat. (See EL2095)

⁹ <http://arthur-palmer.blogspot.com.au/2011/08/mutuaga-massim-lime-spatula-handles.html>



Exploration License 2095 by Mayur Resources covers almost the whole of Basilaki, Sariba and Sideia Islands. A later application over the balance of the islands and adjacent seas appears to have been refused or withdrawn.

5) Revised description

There is no necessity to revise the official description of the site at this time.

6) Revised Statements of authenticity and/or integrity

There is no necessity to revise the official statement of integrity of the site at this time.

7) Revised Comparative Analysis

There is no necessity to revise the official comparative analysis of the site at this time.

8) Recommendations Arising

The Papua New Guinea (PNG) National Plan of Action (NPOA) for marine resources identifies five goals:

Goal 1: *Designation and effective management of priority seascapes*

Goal 2: *Application of an ecosystem approach to management of fisheries and other marine resources*

Goal 3: *Establishment and effective management of marine protected areas*

Goal 4: *Application of climate change adaptation measures*

Goal 5: *Improvement of the status of threatened species*

All aspects of the NPOA are consistent with the Coral Triangle Initiative (CTI) principles and guidelines. Each of these five goals includes appropriate strategies and quantitative targets.

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It is apparent therefore there is a sound national and international framework for advancing the cause of marine resource conservation in PNG. The 2014 report of the ADB on State of the Coral Triangle - Papua New Guinea outlines strategies and programs already underway and identifies some of the issues being encountered.

The Milne Bay Tentative Listed area is a very important component of PNG's marine environment, including for example more than 30% of the PNG's coral reef environment. (Allan et al 2003)

It is understood that some on-going local-based marine conservation activities are being undertaken in within the Tentative List area but details of these activities were not accessed.

It is apparent that for all intents and purposes, the Milne Bay Tentative Listed site has from a World Heritage perspective been 'on hold' since the time of listing with no apparent progress in specific research or protection related to its Tentative List status. Given the increasing threats to the recognized natural history values, it is critically important that a decision is made about whether the Tentative Listing is to be taken seriously. There is no doubt that the Tentative Listed area has outstanding conservation potential but unless there is a program of further research and protection, there may be a case for delisting of this site.

The Tentative List area could become an important framework within which all marine conservation activities could be developed. A World Heritage nomination of the area could be presented as a longer term vision but the primary objective should remain marine conservation.

At least for the marine environment of the Milne Bay area, the results and recommendations contained in the RAP 2000 Report are a valuable guide to the steps necessary to deal with identified threats. Accordingly, a copy of the summary and recommendations of that important document have been attached to this review report as Appendix 2.

The following recommendations are presented as a guide to taking meaningful steps towards effective protection of the site.

a) Name:

The current name of this site is appropriate and adequately defines the geographic location.

Accordingly, it is therefore **recommended** that:

That the PNG World Heritage Secretariat/Committee

- *Retain the name of the Tentative Listed area as Milne Bay Seascape (Pacific Jewels of Marine Biodiversity)*

b) Boundary:

As there has been no further research since nomination to suggest the need for any variation in the boundary;

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *"Adopt the '3 zones' as an appropriate interim boundary.*
- *"Subject to further archaeological and anthropological research, review the boundary for possible inclusion of some additional areas, including Woodlark*

c) Responding to Threats:

As a mainly marine Tentative Listed area the some threats are somewhat different to the other 6 terrestrial List areas. However, the area shares with others the threat from mining. As a geological extension of the Owen Stanley Range, some of the high islands in the region have mineral prospects and some mining has already taken place.

Mining:

Mining looms as a potentially serious threat to the Milne Bay Tentative Listed area, initially by mining of island-based ore bodies and given a recent precedent near New Britain, could possibly be move into seabed mining.

There are some mining tailings disposal methods in use in other parts of PNG that would be quite inappropriate and threatening to the important marine environments of the Milne Bay Tentative Listed areas. It is therefore important that the special heritage conservation significance of the Milne Bay Tentative Listed area be recognized at the national level and a higher standard of terrestrial and marine environmental management be applied than is the case for other parts of the country. It is therefore an imperative that;

- The high conservation value of the area is promoted and;
- There is proactive address of mineral exploration and mining.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Immediately investigate and respond to EL2095 over Basilaki, Sariba and Sideia Islands to ensure that its location within the Milne Bay World Heritage Tentative Listed area is taken in to account;*
- *Promote proactive address of any mineral exploration or mining proposal within the Tentative Listed area to avoid or minimise any adverse environmental impact on natural and cultural heritage values.*

Unsustainable Fishing:

Unsustainable commercial fishing is a major threat to both fish stocks and biodiversity in many parts of the world, including in extensive parts of the Coral Triangle. Illegal foreign flagged fishing vessels are a major contributor to over-fishing, including in many parts of the Pacific.

Given the low level of fisheries surveillance in much of PNG waters, it is reasonable to assume that illegal fishing occurs within the Milne Bay Tentative Listed Area and represents a threat to the biodiversity of the area.

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Collaborate with relevant divisions and agencies, in particular the National Fisheries Authority to promote:*
 - *sustainable fishing*
 - *marine habitat protection and*
 - *biodiversity conservation in the Milne Bay Tentative Listed area.*

Land-based Activities:

One of the recommendations arising from the RAP marine survey was to address the issue of land based activities that might threaten the marine environment. Agricultural type

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developments may be particularly a problem for Zone 3 which immediately adjoins extensive coastlines of both the mainland and large islands.

Accordingly it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Conduct a preliminary review of existing and proposed commercial scale agriculture and other potential sources of run-off and pollution of adjacent marine environments, in particular for those sections of coast adjoining Zone 3;*
- *Alert the Milne Bay Provincial Government to the concerns about increased run-off and contamination from agricultural and other developments adjoining the Milne Bay Tentative List area and encourage appropriate impact mitigation.*

d) Knowledge Acquisition:

The RAP 2003 recommendations referred to the need for filling of information gaps for some specific marine areas which had not been surveyed during the RAP process including the Trobriand Islands, Woodlark Island, Egum Atoll, Misima Island, Sudest Island south Barrier reef, Bramble Haven, Long/Kossman reef, and the southern mainland coast.

In conducting this review it also became apparent that biodiversity data for the terrestrial components of the Tentative List area is in need of update. A desktop review may lead to identification of the need for field survey on particular islands or targeting particular species.

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *In consultation with other relevant divisions or agencies, commission a desktop review of the terrestrial biodiversity and conservation status of all islands in the Milne Bay Tentative List area;*
- *Periodically review the need for biodiversity field survey of islands in the Listed area;*
- *Promote further cultural research both within the Tentative Listed area and outside to other parts of the Massim cultural province, including Woodlark Island and the Trobriand Islands.*

e) Towards Awareness, Recognition and Protection:

Internet searching indicates that apart from the UNESCO World Heritage Site, there is negligible global and local awareness of the existence of the Milne Bay Tentative Listed site. We can only speculate about the level of awareness in local communities living in the site. Such a low level of awareness is not at all helpful for promoting protection and conservation of the area, let alone seeking its nomination to the World Heritage List.

Accordingly, it is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Develop and implement an awareness program for promoting awareness of the Milne Bay Tentative Listed area. Initially, priority should be given to creating awareness within national government agencies, later moving to provincial and local government;*
- *Develop and implement an awareness program for customary land and sea owners within the Listed area;*
- *Collaborate with the Marine Ecosystems branch of DEC and with National Fisheries Authority to help promote sustainable harvesting of both fish and shellfish, giant clam and sea cucumbers;*

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- *Identify businesses currently actively engaged in nature-based tourism within the Listed Area and develop an awareness program in consultation with the industry;*
- *Maintain close working relationship with the Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security.*

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Appendix 1: WHC Citation

Milne Bay Seascape (Pacific Jewels of Marine Biodiversity)

Date of Submission: 06/06/2006

Criteria: (iii)(v)(vii)(viii)(ix)(x)

Category: Mixed

Submitted by:

Department of Environment and Conservation

State, Province or Region:

Bramble Heaven, Conflict Group, Lunn Island, Jormard Island and Samarai Island

Ref.: 5063

Description

Mixed Cultural/Natural Properties.

This property is a mixed cultural and natural serial site comprising five (5) sites, largely uninhabited coral atolls and islands with numerous coral reefs system, which are currently earmarked as proposed marine protected areas targeted under the current Community Based Coastal and Marine Conservation Programme undertaken by Conservation International and the PNG Government and Samarai Island a PNG Government declared National Heritage Island. The property cover range of latitudes depicting low-lying coral atolls and islands with variations in reef system and habitats as well as encompassing as International Shipping Route featuring many ship wreckages in Bramble Haven and Jormard Islands and Navigational Lighthouses to Samarai Island a colonial establish town in Papua. The Conflict group of islands consists of a total number of 20 coral atolls islands. The 3 large islands include Irai, Panasesa Auriora and Panarakum Island. The Conflict group is an atoll of small coral cays with diversified ecosystems that is interconnected by the continental shelf that runs from Irai to Auriora Island. A 2000 rapid assessment program by Conservation International and Commonwealth of Scientific and Industrial Research Organisation revealed that the island of Irai was significantly diverse in the number of fish and coral species. The richness in biological diversity and the colonial history that the island has makes it both biologically and historically significant site that deserves recognition under the world heritage list. The Bramble Haven group of islands consists of a total of 5 coral cay islands namely, Punawan, Dupere Islets, Siva, Panapwa Awanagamwana Islands. These islands are important habitat to marine fauna and flora. These island lies on a reef platform of approximate depth range of 2-25 meters. The southern part of these groups of islands is moderately exposed fringing/lagoon type reefs with gentle slope to deep water with sand and coral bommies in the shallow and coral ridges running horizontally across the slope. These islands house species that have been listed in the IUCN Redlist. Green, hawksbill and loggerhead turtles often utilize these areas for nesting, mating and foraging. This area is commercially exploited at a very low level. Factors that contributes toward this include the location of these islands in relation to the exploited human settlement. Mode of transport by the local communities using motorized boats is also very limited. The (X) islands are significantly important as other sites in Milne Bay in biodiversity distribution. With vast reef area and the extensive Long/Krossman reefs provides for a countless number of other important species such like the Humphead maori Wrasse (*Cheilinus undulatus*) and the whale shark (*Rhincodon typus*). This area provides to be one of the last frontiers that is extensive and is cross-cultural. Lunn island is further located east of the main Conflict group of islands. Lunn Island is also records high number of turtle nesting every year. The most eastern side of Lunn is a complex of limestone and calcareous rubble which consists of narrow fringing,

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irregular reef sloping down to a depth of 15 meters (approx), then abrupt, nearly vertical drop-off to narrow bench at approximately 50-55 metres before dropping steeply into the abyss. The coral cover and species diversity is high due to a wide range of habitats. The shore area is not a nesting area as compared to the other sides of the island. The northwestern end to the Southern part of the island accommodates high nesting of green and hawksbill turtles. A survey by Conservation International revealed that Lunn Island recorded the highest turtle nesting per night compared to the other islands in the Conflict. The biodiversity extends to endangered species such as the Maori Wrasse (*Cheilinus undulatus*). Jomard Island is a small coral cay island constructed on reef platforms, which have reached sea level during the Holocene. The island is fringed by a coral reef of significant size. The morphology of the fringing reef varies from site to site due to the different physical processes that take place on different parts of the island (e.g. wind and wave action). Without the current protection provided by the fringing reef, the physical processes evident will ultimately erode the island away. The fringing reef of Jomard Island also provides a significant habitat for marine species such as fish, crustaceans, corals, bivalves and other marine organisms. The marine life surrounding Jomard Island is extremely diverse in nature and has been identified as a sensitive habitat of environmental significance. The beaches at Jomard Island are made up of fine sands and coral rubble. Ground vegetation lines the upper limits of the beach providing beach stability and protection from eroding process, while the littoral zone (intertidal zone) is home to corals that have adapted to withstand intense ultraviolet radiation, desiccation and high salinities. The reefs surrounding Jomard provides very good shelter for foraging and mating activities for turtles. Furthermore, these diverse reef systems provides a lot to other animal species like fish, clam and sea cucumber who seek food, refuge and thrive in this healthy ecosystem. The beaches of Jomard Island and its fringing reefs accommodate a number of globally endangered species like turtles and others. The terrestrial environment provides very good shelter for birds like pigeons, crows and sea eagles. Jomard Island has been identified to have the largest turtle-nesting rookery in the southern part of Milne Bay Province. Samarai Island once known as the 'Pearl of the Pacific' is a historic island in Milne Bay Province. The island, with land area 0.1208 square mile was the first administrative and commercial center for Papua Administration during the height of European expansion and colonialism in the Pacific. The island is relatively smaller but still contains some of the buildings established during the colonial era including the Memorial Hall, District Commissioners resident, Old Steamship and Burns Philips buildings and the Government Wharf. Samarai Island has highly disturbed reef in front of the town jetty, wharf pilings and wreckage providing abundant shelter for variety of fishes, an unusual array of encrusting corals including the second only colony of *Acanthastrea minuta* ever recorded; mostly rubble bottom contains sparse coral growth; azooxanthellate (non-reef) corals, primary Tubastrea, a visual spectacular. The cold up welling areas within Samarai are known habitat in New Guinea for a rare Black velvet angelfish *Chaetodontoplus melanosoma* quite different from those found in Indonesia, Philippines and Japan. The Milne Bay population differs in having a pale head instead of a pale back as in fishes from other areas, which represent an enigma and may be a separate endemic species to Samarai. Conflict Group, Bramble Haven, Jormad, and Lunn Islands during the traditional period and up to current period, are used extensively as important traditional pantry areas for nearby islands from Brooker, Panaeaty, Engineer Group, Ware and Misima who have traditional ties with each other due to presence of marine turtles and their eggs, giant clam species, fishes and marine products such as bechedemer and trochus shells. Conflict group of islands including Lunn Island and possibly Bramble Heaven and Jormard Islands holds the key as some of the marine biodiversity hotspot in the province or within the Coral Triangle together with other sites surveyed in the province, as per the Conservation International Rapid Biodiversity Assessment conducted during 1997. In Conflict

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and Lunn Islands, where the Rapid Biodiversity Assessment was conducted during 1997, biological the reefs have extensive areas of coral coverage, very high species diversity with an average of 220 species of fish per site compared to the Great Barrier Reef and other species new to science. All of these reefs are in pristine environmental condition with no effect of destructive fishing practices such as dynamite fishing, cyanide as well as coral bleaching within the coral triangle. The Conflict Group together with Bramble Haven, Lunn Island and Jormard Island are favourable Green, loggerhead and Hawksbill Turtles nesting and breeding sites, habitats for migratory marine and shore birds nesting sites, as well as for all giant clam species.

Protection and management

The Conflict Group of Islands is currently targeted under the Community Based Coastal and Marine Conservation Programme for the province as a Marine Protected Area (MPAs). The recent National Executive Council (NEC) meeting in Alotau declares Samarai Island as a National Heritage Island and the Central Agency Coordination Committee (CACC) visit to the island pledging funding support to renovate the monumental colonial establishment on the island clearly support the cause of Samarai Island to be placed under the Tentative List of the World Heritage Site.

Statements of authenticity and/or integrity

In general, the integrity of these sites are that they are entirely and holistic atolls ecosystem containing all composite features of all low-lying atolls (perimeter reefs, passes, lagoons, patch reefs, beaches and islets) for most parts uninhabited, isolated from each other to some degrees and from large islands surrounded by open ocean. This provides sufficient size for ongoing functioning of the natural system. The marine environment reef system has very high biodiversity especially along the Conflict Group and Lunn Island, showing wide range of species with average 220 species per site demonstrated the system is intact including migratory species such as turtles and pelagic species. In the case of Conflict Group, this site is recommended for protection under the Conservation International Rapid Biodiversity Assessment conducted during 1997 due to high rate of marine biodiversity. The Lunn and Jormard Islands for example which also contain the large nesting sites for green turtles are currently being considered by authorities to be protected to preserve the marine turtle nesting sites.

Comparison with other similar properties

Milne Bay Province harbors one of the most environmentally pristine areas of coral reefs remaining in the Coral Triangle, biologically diverse, and Conflict Group, Lunn Island and other sites covered are no exception; contain many of the keystone species. During the 1997 Conservation International Rapid Biodiversity Assessment in Milne Bay rated many of the sites in the province including those in Conflict Group have very high biodiversity in comparison with similar size areas within the Indo-Pacific region. In Milne Bay province most of the extensive coral reefs system and its biodiversity components are still undocumented which could also increase the number of coral reef species, reef and shore fish faunas and molluscs in the province exceeding other regions within the coral triangle. In Milne Bay Province along, there are possibility that in total, 420 coral species may occur in the region, which is higher than the Australian Great Barrier Reef World Heritage Property, Vanuatu with 296 species and possibly 410 species in Philippines covering Tubataha Reef Marine Park, World Heritage Property. The islets within Conflict Group, Bramble Haven and Jormard also serve as a nesting sites for green and hawksbill turtles as well as other avifauna as such the Nicobar Pigeon restricted only to certain location within Jormard Islands.

Appendix 2 - RAP Survey II by Conservation International

Milne Bay Province, Papua New Guinea—Survey II (2000)

Executive Summary

Milne Bay Province

Milne Bay encompasses the most extensive coral reef area of any province in Papua New Guinea. These reefs are scattered over approximately 265,000 km of ocean. In spite of its considerable area, Milne Bay Province is one of the least populated provinces, with only 205,000 inhabitants.

Although there are several large-scale development projects in the province, including mining and oil palm, most people earn their living primarily by subsistence farming, fishing, harvesting of sedentary marine resources, and the sale of products from these activities. The main challenge in Milne Bay is to improve the services and economic options for its people without sacrificing their cultural identity and unique biodiversity.

The Milne Bay 2000 Survey

The 2000 Marine RAP survey of Milne Bay Province assessed 57 sites over a 26-day period (30 May–24 June, 2001). General site areas were selected prior to the actual survey in order to maximize the diversity of habitats visited, thus facilitating a species list that incorporates maximum biodiversity. Due to logistic problems it was necessary to use a different live-aboard boat for each half of the survey.

Because of the smaller size of the second vessel, it was necessary to reduce the size of the RAP team. Consequently, no data were taken for molluscs on this part of the survey. At each site, an underwater inventory was made of two or three faunal groups selected to serve as indicators of overall coral reef biodiversity: scleractinian corals, molluscs (except sites 29–57), and reef fishes. Additional observations were made on the environmental condition of each site, including evaluation of various threat parameters. Observations and data on reef fisheries were also gathered.

The general survey area (see Map 1 on page 169) covered approximately 18,000 square kilometers, encompassing reefs of Goodenough and Collingwood bays on the PNG main-land, as well as Amphlett Islands, D'Entrecasteaux Islands, the Louisiade Archipelago, and isolated sites at Sideia, Basilaki, and Bently islands. Charter dive boats based at Alotau reached the 57 survey sites.

SUMMARY OF RESULTS

Most coral reefs in Milne Bay Province remain in good condition with relatively rich biodiversity. Notable results from the survey include:

- Corals

A total of 418 species of scleractinian corals were recorded, which is more than half of the world's species, indicating that Milne Bay Province is truly one of the globe's richest areas for corals. Several potential new species were collected.

MILNES BAY SEASCAPES

- Molluscs

Although molluscs were not surveyed during the Louisiades portion of the RAP, a total of 643 species was recorded with a range of 34–119 per site. Combined with the results of the 1996 survey, the current molluscs total for Milne Bay Province is 954 species.

- Reef Fishes

A total of 798 species were recorded. The overall reef fish fauna of Milne Bay resulting from the 997 and 2000 RAP surveys consists of 1109 species, the highest for any area in the Melanesian region. At least one new species (Pomacentridae) was collected.

- Reef Fisheries:

Significant stocks of edible reef fishes were observed on most reefs, but holothurians and giant clams were often scarce, the result of intensive harvesting. Detailed information for Brooker Island in the Louisiade Archipelago indicates that many local communities are dependent on marine resources for food and income.

- Reef Condition:

Reefs were generally in good shape with significant amounts of live coral cover. Using CI's Reef Condition Index, it was noted that nearly 50 percent of surveyed reefs were in good, excellent, or extraordinary condition. These are sites with the best combination of coral and fish diversity. They are also relatively free of damage and disease. In contrast, only eight percent of reefs were considered to be in poor condition, but these were mainly confined to sheltered bays with high levels of silting.

CONSERVATION RECOMMENDATIONS

The coral reefs of Milne Bay Province play an integral role in sustaining coastal communities and represent an important component of PNG's rich natural heritage. Until recently, this environment was under minimum stress, mainly due to the small human population of Milne Bay Province and its remoteness. However, there are increasing signs of habitat degradation, mainly due to land-based activities and overharvesting of sedentary marine resources. For these reasons, and because the province contains some of the best examples of relatively undisturbed reefs in the entire Coral Triangle region, it is vitally important that both government agencies and communities commit necessary resources to ensure that Milne Bay's reefs are conserved for future generations. In order to achieve this aim we propose the following recommendations:

1. Evaluate and address threats to the marine environment from land-based activities.

The effects of sedimentation on reefs from deforestation, agriculture, and mining are of some concern. Any emerging threats from land-based activities should be closely monitored and appropriate actions taken to mitigate any detrimental effects they may have on the marine environment. Watershed protection also needs to be a primary objective.

2. Establish community-based marine conservation and resource management areas that result in sustainable fisheries management.

There are numerous tools available to fisheries managers and conservation practitioners to achieve this. One of the tools that could be considered by communities and agencies for Milne Bay Province is the establishment of Marine Protected Areas (MPAs). Currently there are no

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MPAs in Milne Bay Province. The ultimate success of any MPA is dependent upon the recognition of the biological, social, and economic issues relevant to the local communities and their subsequent incorporation into the selection and design process of MPA establishment.

3. Conduct more scientific surveys to fill gaps in biological and habitat data.

Further biological surveys and baseline data collection are required to prioritize more specific areas for MPA establishment. Milne Bay Province occupies a vast area, and several RAP surveys would be required to adequately cover all the important reef areas. Locations that remain unsurveyed include the Trobriand Islands, Woodlark Island, Egum Atoll, Misima Island, Sudest Island south Barrier reef, Bramble Haven, Long/Kossman reef, and the southern mainland coast.

4. Continue collaboration with the National Fisheries Authority on rigorous stock assessments of commercially harvested species, and influence the formulation of species management plans.

The over-harvesting of sea cucumbers, giant clam, and shellfish is a serious concern in Milne Bay Province. Rigorous stock assessments are necessary on a continual basis to gauge the current status of these resources and influence the development of appropriate management plans.

5. Continue to link tourism benefits to the conservation of marine resources.

To achieve the sustainable conservation of marine resources, the benefits from the dive industry should be shared with communities to provide incentives for conservation.

6. Continue to develop and implement an environmental education and awareness program to impart conservation values to students and communities at all levels.

An environmental education and awareness campaign is required to instill conservation values among students and communities in order to generate support for marine conservation efforts in Milne Bay Province.

7. Continue participation in the annual PNG Coastal Cleanup campaign.

This campaign was introduced in 1999 as a collaborative effort between CI and the National Capital District Commission (NCDC). This activity increases public awareness of marine issues in PNG, in particular those pertaining to litter and waste (such as plastic bags), and the detrimental effects they are having on the marine environment and marine species.

8. Assist in the community mapping of resource ownership.

Customary marine tenure gives control and ownership of most near-shore areas, including reefs, to communities. At present customary marine tenure is loosely defined in Milne Bay Province, and this issue needs to be resolved in order to achieve long-term conservation outcomes and avoid conflicts between communities as resources become scarce or as regulations of MPAs are enforced.

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9. Strengthen capacity within the province for effective implementation of the marine conservation program.

Milne Bay Province has very few staff and resources for conservation or the provision of other services. Strengthening the capacity of the Milne Bay Provincial Government is therefore necessary for it to confront the growing environmental pressures and implement an effective marine conservation program.

10. Enforce existing laws and propose options for surveillance of illegal foreign fishing vessels.

Greater enforcement of regulations outlined by species management plans is required to address the ongoing problem of over-harvesting and to ensure the long-term viability of these fisheries. The national government also needs to investigate various options and make clear proposals for the surveillance of illegal foreign fishing vessels so that PNG does not continue to lose the economic and biological values of marine species.

11. Monitor the status of the current moratorium on the live reef fish trade.

There is a current national moratorium on live reef fishing. However, trial licenses may be issued after a management plan for the trade is developed and the fishery is deemed viable.

12. Establish a long-term environmental monitoring program.

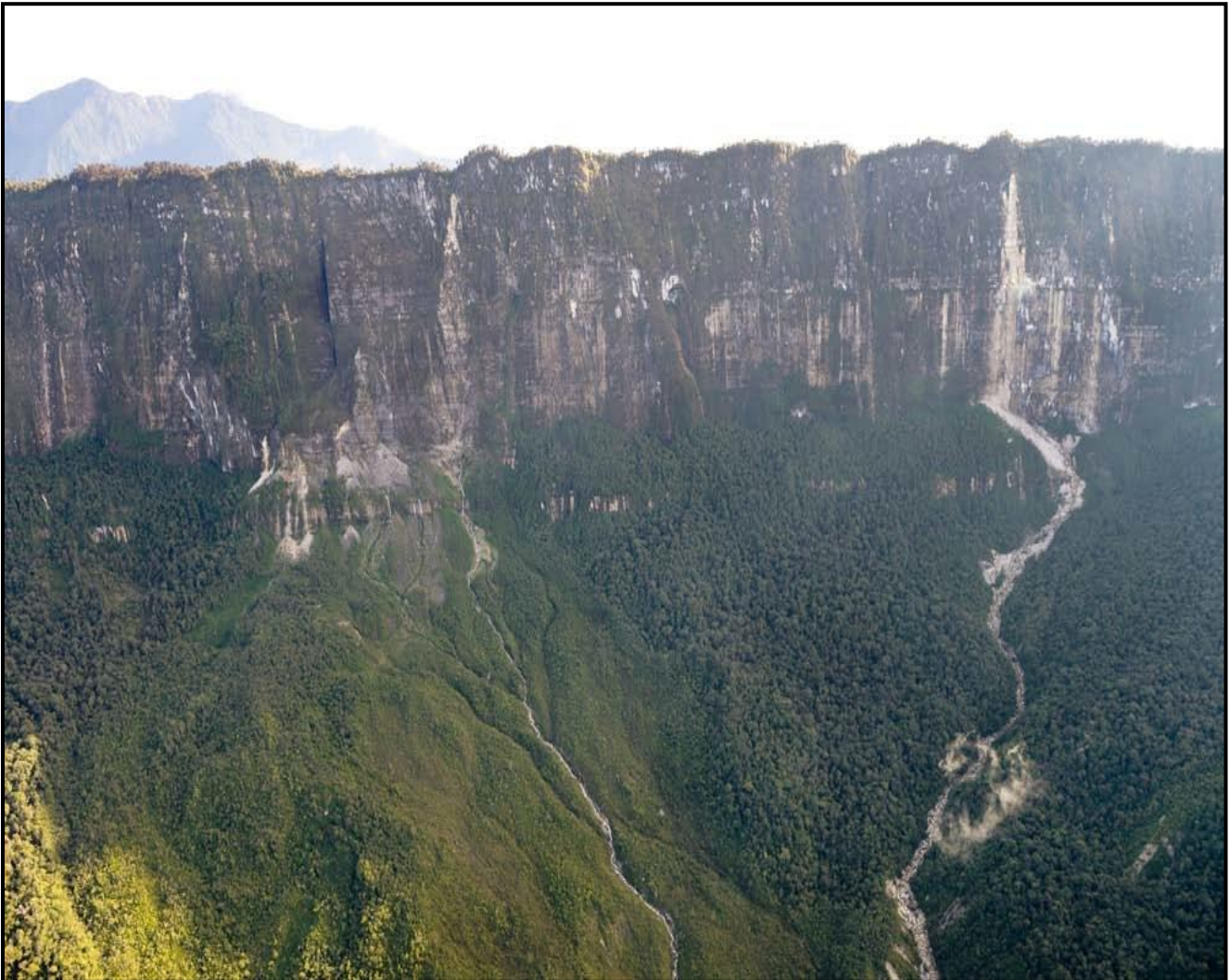
Bi-annual surveys by marine biologists, students, and communities are recommended to monitor the status of reef environments and particular species and promote awareness and interest in their conservation.

13. Continue to promote inter-agency coordination and collaboration between relevant non-government and government institutions.

Many institutions work in isolation from each other and do not benefit from shared experiences, lessons, expertise, and resources. Another recommendation is that the government commit to developing an integrated coastal management strategy that improves inter-agency coordination.

SUBLIME KARSTS REPORT (not including Nakanai)

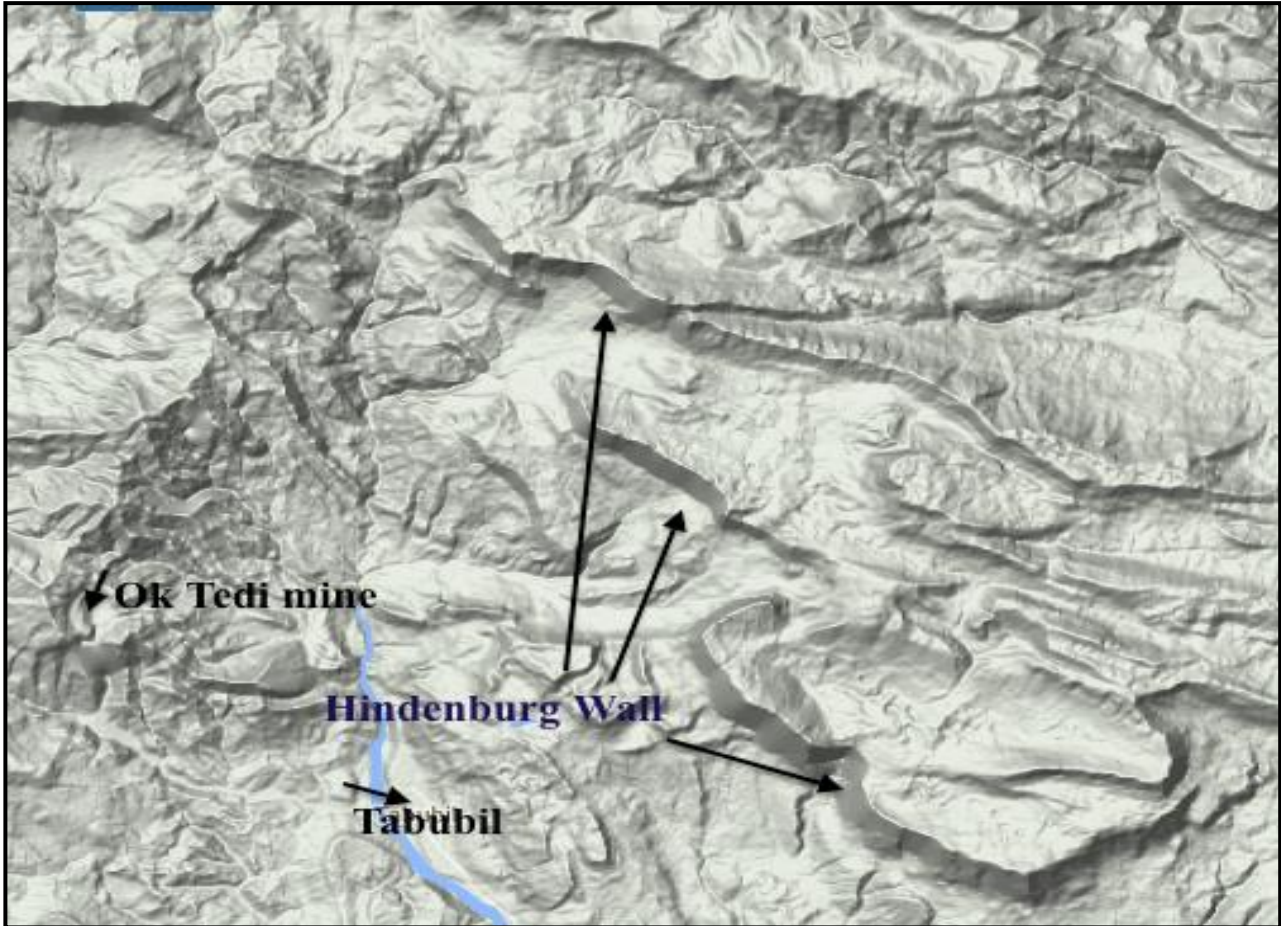
NOTE: For the purpose of this Review of the World Heritage Tentative Listed sites of PNG, the Nakanai component of the original “Sublime Karsts of PNG’ has been separately addressed. This arises from the peculiarities of the Nakanai Karst, the geographic remoteness of Nakanai and the perceived greater prospects of advancing the Nakanai to protection and eventually, World Heritage nomination, in the foreseeable future. The Hindenburg Wall and the Muller Plateau, unlike the Nakanai, are areas that are highly prospective for discovery of minerals, oil and gas and may prove rather more problematic in achieving the necessary level of protection prerequisite for a nomination.



Part of the major landscape feature known as the Hindenburg Wall. The ‘wall’ comprises three separate sections that extend for approximately 50 kms and ranges between 1 and 2 kilometres in height. Image from the 2012 Hindenburg Wall review (Zeriga-Alone et al 2012)

1) Current Situation (listing, boundaries, action towards protection etc)

Hindenburg Wall



The 3 components of what is commonly referred to as the Hindenburg Wall. Diagram from 2012 'Hindenburg Wall Review' (Zeriga-Alone et al (2012))

Boundary:

The 2006 nomination did not specify a boundary for the Hindenburg Wall component and the description provides only limited indications of any intended extent of the Tentative Listed area. However, it is very clear from the 2006 nomination that the focus is very much on the spectacular landform(s) known as the Hindenburg Wall but it is apparent that the adjacent forested karst was also of particular interest from a conservation perspective.

The 2012 'Hindenburg Wall Review' (Zeriga-Alone et al 2012) presents a map with what might be described as an expanded interpretation of what constitutes the "Hindenburg Wall", being a series of three adjacent limestone wall escarpments. Indeed, this appears to be the common definition of 'the wall' such as articulated by the Wildlife Conservation Society, partners in the 2012 Review:

"The Hindenburg Wall is a spectacular landform that has been described as a natural wonder of the world. Rather than a single structure, the Hindenburg Wall is a series of limestone escarpments and plateaus running some 50 km within the Star Mountains of Papua New Guinea's Western province."

The definition of what constitutes the "Hindenburg Wall" is important for development of a boundary for the Tentative Area. (See below) This Review supports a broader interpretation

SUBLIME KARSTS (NOT INCLUDING NAKANAI)

which is not limited to the “Hindenburg Wall” landscape feature but embraces adjoining forested areas of high biodiversity conservation value as well as unexplored karst (See below).



Protection:

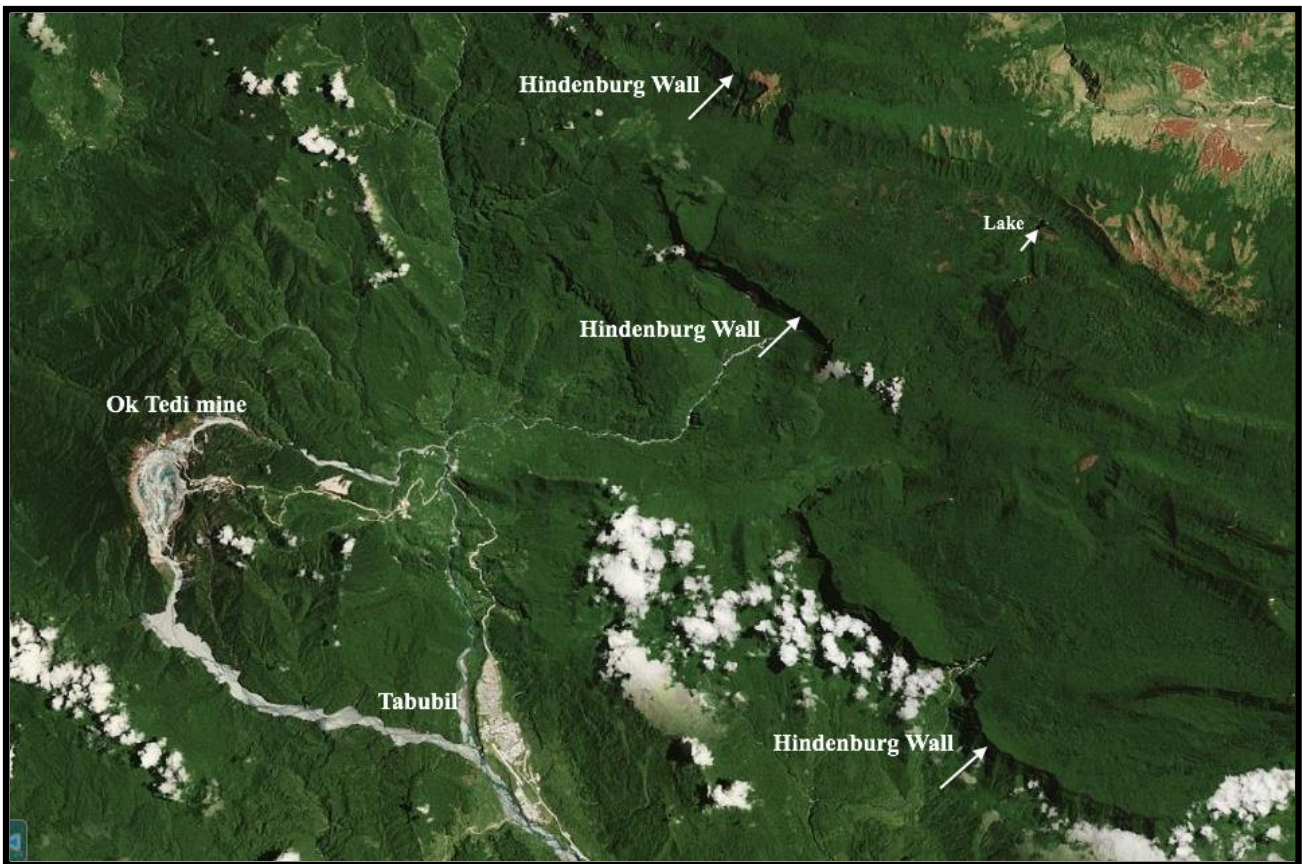
No part of the Hindenburg Wall was formally protected at the time of nomination in 2006 and that remains the situation.

A Wildlife Conservation Society website reports that they are ‘currently’ (2014) engaged in developing a Conservation Area with local landowners.

Data and Knowledge:

In 2012 a report titled “*Hindenburg Wall: A review of existing knowledge*” was completed by the Wildlife Conservation Society in consultation with the PNG Department of Environment and Conservation and the PNG Sustainable Development Program. This report is a major advance in documentation of knowledge since nomination in 2006 and so represents an excellent contribution towards building knowledge of this Tentative Listed site. This important advance greatly contributes to building the case for recognition of global significance, not just on geodiversity values but also biodiversity.

SUBLIME KARSTS (NOT INCLUDING NAKANAI)



Muller Plateau:

Boundary:

As with the Hindenburg Wall, the Muller Plateau had not been delineated on a map at the time of its nomination as part of the 'Sublime Karsts of PNG' Tentative List area in 2006 but instead relied on a common interpretation of the plateau as a recognizable geographic entity.

Protection:

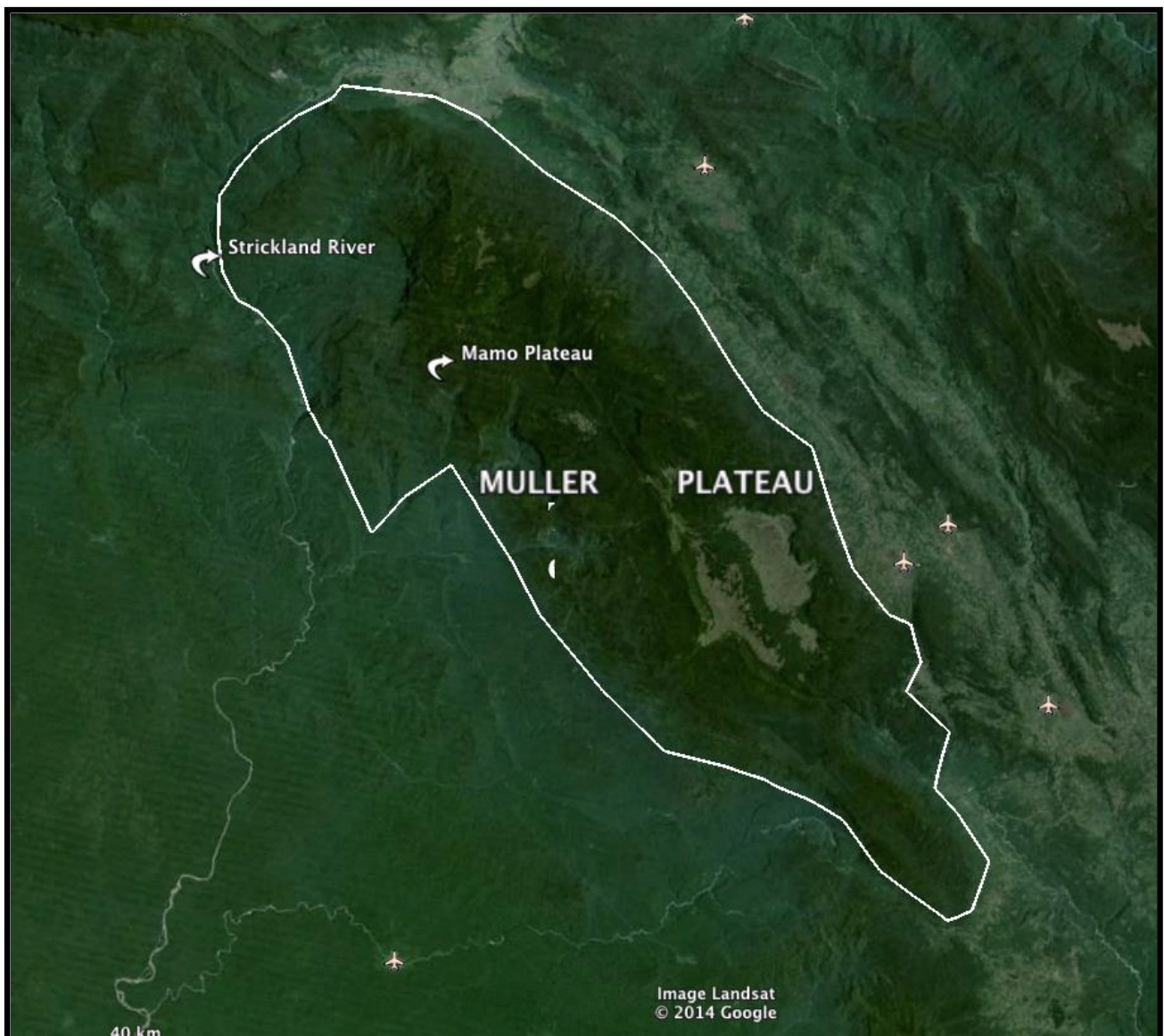
At the time of Tentative Listing in 2006 no part of the Muller Plateau was subject to formal protection and that remains the case today.

Less well defined geographically than the Hindenburg Wall, the Muller Plateau can nevertheless be reasonably well defined in geographic terms. Various scientific studies help to define what is meant by Muller Plateau. This review has provided an indicative boundary for the area to facilitate progressing study and protection of the areas of high conservation value.

Data and Knowledge:

Since nomination as part of a Tentative List area in 2006 there has been comprehensive scientific study of the Muller Plateau, particularly by Conservation International (CI). A series of scientific reports have been published, clearly documenting the outstanding biodiversity conservation values of the plateau. The published data substantially widens the conservation importance of the Muller Plateau from the origin emphasis on the karst landscape. This is similar to the Nakanai Karst in New Britain where the heritage significance at the time of nomination was very much the geophysical aspects of the karst landscape but these values have now been complemented by subsequent biodiversity studies that have established a high biodiversity value.

SUBLIME KARSTS (NOT INCLUDING NAKANAI)



2) Description of Site

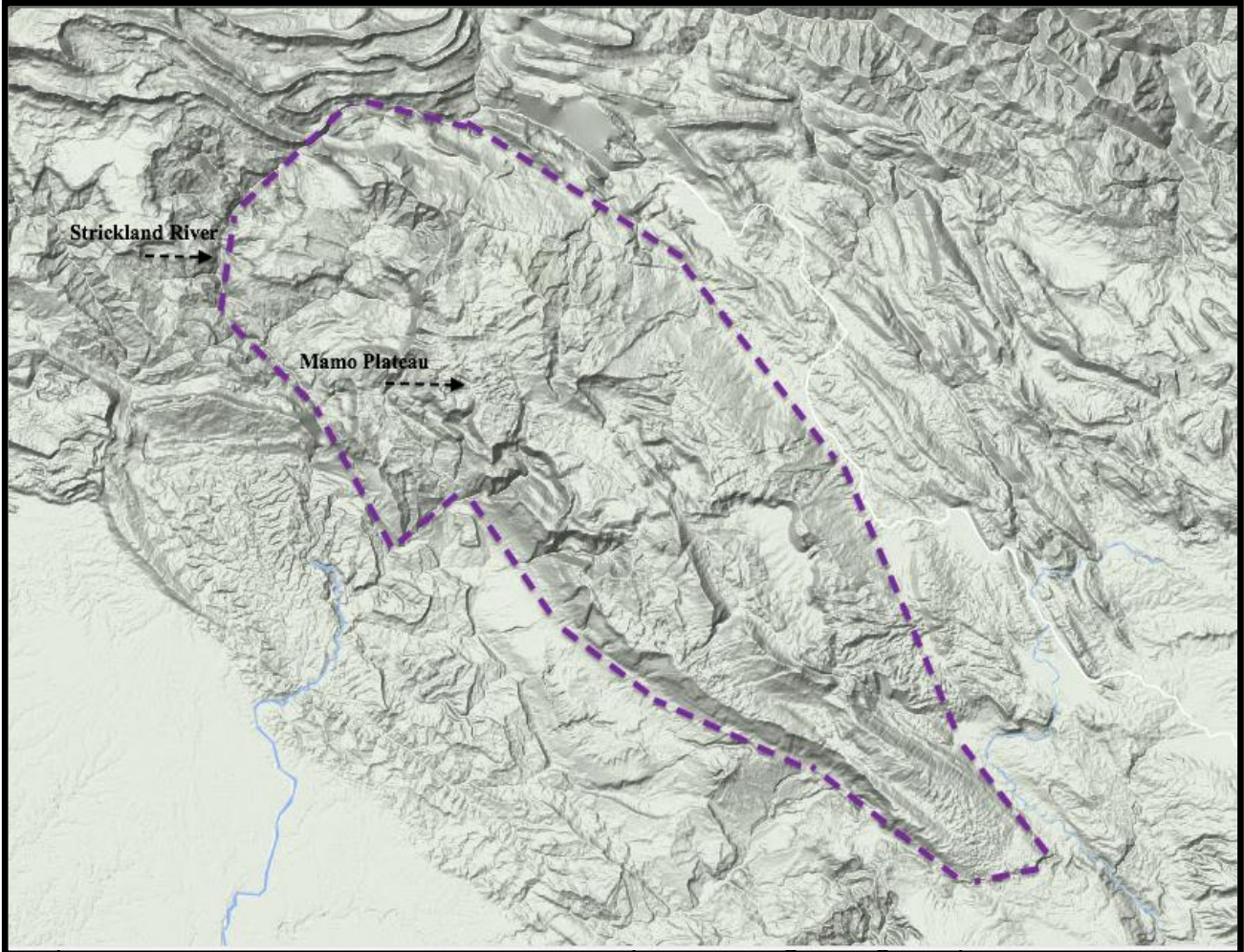
Hindenburg Wall

The Hindenburg Wall is a world-renowned landform comprising a suite of major limestone cliffs in the western extremity of Papua New Guinea, forming part of the central spine of the New Guinea cordillera. Despite its remote location, parts of the wall are relatively accessible from the town of Tabubil, a town supporting the nearby Ok Tedi gold mine. Tabubil is only accessible by air and is located immediately below the southern section of the Hindenburg Wall.

The Hindenburg Wall has been called a 'Wonder of the World' or the 'Eighth wonder of the world' and attracts attention because of its spectacle as a huge cliff face(s).

The common interpretation of what constitutes the Hindenburg Wall is that it comprises three adjacent massive cliffed escarpments extending over about 50 kilometres.

Muller Plateau



The Muller Plateau or Muller Range, is a relatively discrete upland limestone karst region in the southern highlands of Papua New Guinea. Because of the rugged terrain and soils developed on porous limestone (Darai formation), most of the area is unoccupied. The main human occupation is confined to the deep walled or 'hidden valleys' in the centre of the plateau and a scatter of other smaller settlements. It is part of a much larger tract of karstic limestone that extends across the region and so forms one of a number of southerly spurs from the main island cordillera.

The Mamo Plateau is a distinctive part of the main plateau renowned for its concentration of giant dolines, more than 100 giant dolines in an area of about 100 sq. km.. Most famous of the explored caves on the Muller Plateau is probably Mamo Kananda which has yielded more than 54 kms of underground passage to international speleo teams commencing in the 1970s.

A distinctive geomorphological feature of Muller Plateau is a 'window' through the massive limestone beds in the form of a large 'hidden' valley walled in by high limestone cliffs. The sloping floor of this 'window' has created a series of small lakes ponded against the cliffs, possibly the result of now impeded drainage through underground river caves flowing eastward.

SUBLIME KARSTS (NOT INCLUDING NAKANAI)



The Lavani 'hidden valley' window through the massive Darai limestone beds of the Muller Plateau. Note the agricultural settlements (Gwali?) along the western edge of the valley and the numerous lakes in the lower eastern section, including lakes that are banked up against the massive limestone cliff line. The largest lakes show signs of a fluctuating water level and are likely drained by river caves running east. Several large dolines east of the lakes hint at the presence of an underground river from the lakes.

3) Key attributes and values

Hindenburg Wall:

3a. Natural Heritage

In 2012 a report titled "*Hindenburg Wall: A review of existing knowledge*", was completed by the Wildlife Conservation Society in consultation with the PNG Department of Environment and Conservation and the PNG Sustainable Development Program. This report provides valuable new record of the biodiversity of the Hindenburg Wall precinct and adds a whole new biodiversity aspect to the record of natural heritage attributes in the area.

The Hindenburg Wall includes the only confirmed roost of the critically endangered Bulmers Fruit Bat *Aproteles bulmerae* (Critically endangered species IUCN Red List). First known from 12,000 year old fossils, a live population of the species was discovered (Flannery) living in a single cave above the Hindenburg Wall. The population was subsequently hunted to near

SUBLIME KARSTS (NOT INCLUDING NAKANAI)

extinction by local tribesmen using shotguns but later reports suggest that a small population has survived but the species remains critically endangered and very vulnerable to extinction. The species is named after archaeologist Susan Bulmer who first found the fossil bones of the species.

3b. Cultural Heritage

The people of central New Guinea have been termed the 'Mountain-Ok', also referred to more recently, the Mountain-Ok¹⁰ as the Min. Extensive anthropological research of the Mountain-Ok has been carried out since the 1960's (eg; Craig 1969; Jorgenson 1969, Brumbaugh 1980, (Cranstone 1971; Wheatcroft 1976; Barth 1971; Poole 1976; Perey 1973; Gardner 1981; Eggertsson 1997, 2003; Lohmann 2000). For a comprehensive review of anthropological research see chapter three – of "The Hindenburg Wall A review of existing knowledge" by the Wildlife Conservation Society in 2012).

Research into the Mountain Ok region includes Pamela Swadling's evidence (1983) for the origin and dispersal of the peoples of central New Guinea, sites of archaeological and traditional significance, sources of materials for stone tool manufacture, and data about trade routes and trade goods. Through radio-carbon dating, Swadling et al. (1990) provided evidence that people have been in the Ifi valley, where Telefomin is located, for about 17,000 years. An excavation in the village of Telefolip, the most sacred site of the Mountain Ok, indicates it was established 300 to 400 years ago.

Only one report on cultural features of the listed area has been located. David Gillieson reports on several unusual man-made features found in a large limestone cave (Selminum Tem Cave) adjacent to the Hindenburg Wall. Gillieson (1980) speculated that these could have been pit traps, animal storage pits or may have had a role in ritual, and the Tifalmin hunters who accompanied him were unable to explain the structures (Zeriga-Alone, Whitmore & Sinclair 2012).

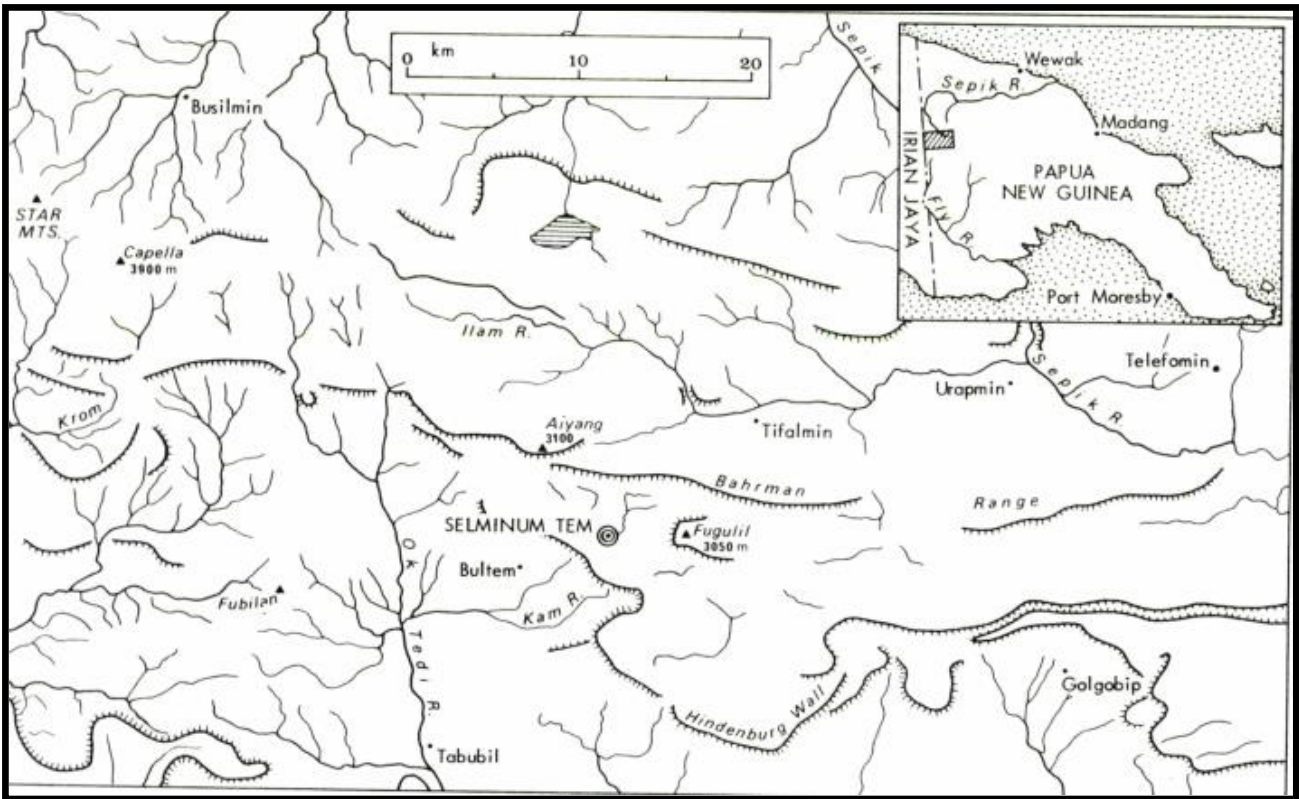
The British caving expedition that first discovered the pits reports that one of their carriers was a Wopkaimin who told of a large cave, within the Selminum doline (sinkhole) in which his people used to hunt flying foxes (BCRA 1975). The two man-made pits discovered within Selminum Tem Cave by the British caving expedition in 1975 are located in the Hindenburg Ranges at latitude 5' 10's and longitude 141' 20'E. The entrance is in a large doline on the surface of the plateau, which lies at an elevation between the Bahrman Range and the Hindenburg Wall, overlooking the headwaters of the Ok Tedi River (see map over page). The upper cave entrance is on a broad ledge near the base of an overhanging limestone cliff in the doline (sinkhole). The smoke blackened wall and extensive hearths suggest long-term use as a hunting shelter, and the site is within the hunting territory of both Wopkaimin and Tifalmin groups. Gillieson (1980) posits three possible functions of the pits: 1) Pit traps for small mammals, which are known to enter limestone caves; 2) Storage pits for flying fox or small mammals which have been trapped by other means (this explanation would account for the scratch marks inside pit 2, and the small hearths nearby - it is custom amongst Tifalmin hunters to consume at least half of any game whilst hunting; and 3) A ritual function associated with the cult of an ancestral deity, recorded from the area.

The British caving expedition also located an engraving of a bird 700ft (200m) from the entrance of the Selminum cave. Other engravings were also found, but like the hearths and the

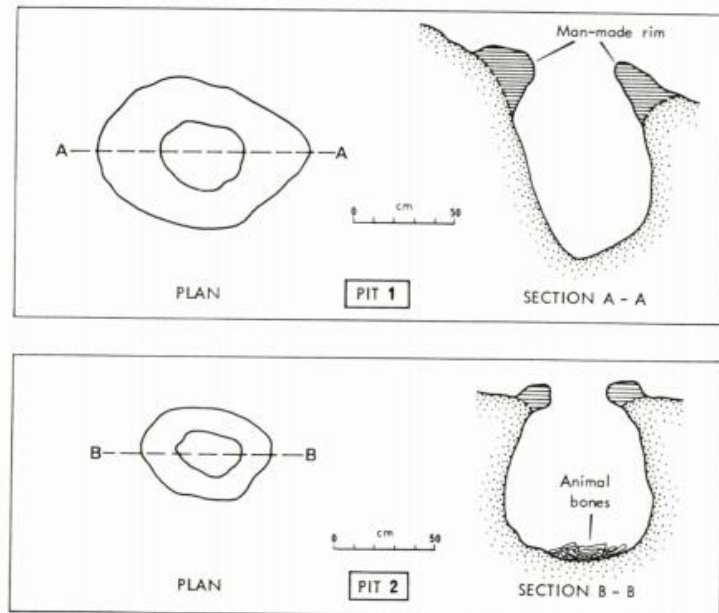
¹⁰ 'Ok' means 'water' or 'river' in this sub-family of languages. More recently, the Mountain-Ok are being called the Min.

SUBLIME KARSTS (NOT INCLUDING NAKANAI)

pits, the local did not know the origins, which may indicate significant time-depth to their existence. Further research is needed to determine the antiquity and cultural significance of the engravings, hearth-pits, and other potential archaeological sites.



Location of the man-made pits in Selminum Tem Cave (Map: Gillieson 1980:27)

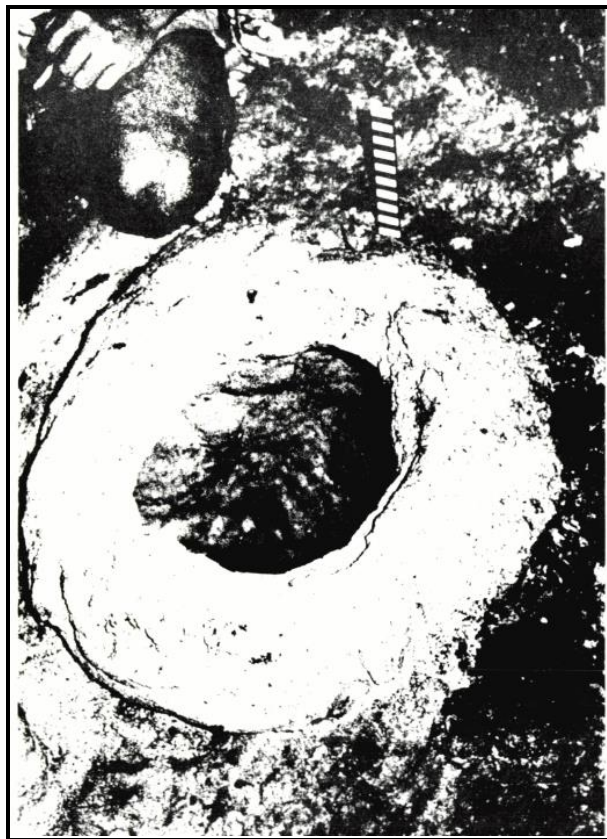


Structural details of the pits (diagram: Gillieson 1980:29)

SUBLIME KARSTS (NOT INCLUDING NAKANAI)



Upper entrance to Selminum Tern (Image: Brook in BRCA 1975)



The second pit structure in Selminum Tern. Note the overhanging moulded rim. This rim is formed from compacted sediment and overhangs the interior wall by 20cm. A small hearth is located nearby. A shallow layer of well-preserved limb bones, probably flying fox (*Aproteles bulmerae* and *Dobsonia moluccensis*) and Kapul (*Pseudocheirus* spp. and *Phalanger* spp.), covers the base of the pit (Image (Gillieson 1980:30).

SUBLIME KARSTS (NOT INCLUDING NAKANAI)

Muller Plateau:

The Muller Plateau or Muller Range comprises a major upland area of predominantly limestone. A massive limestone formation known as the Darai formation, extends from north of the Hindenburg Wall, indeed the walls are formed in this formation, extending south easterly to include the Muller Plateau and its descent to the coast can be traced to near the Kikori delta where it presumably plunges below sea level.

The Mamo Kananda Cave in Mamo Plateau has explored passages 55 km long, and is one of the longest known cave systems in Papua New Guinea. Three largest cave chambers have a volume of 1 million m³. Enormous cavity called Space Oddity is located 525 m below the entrance" (Wondermondo.com).

The Giant Dolines of Mamo Plateau:

The giant dolines on the Mamo Plateau, a discrete component of the larger Muller Plateau, are globally renowned as attested by the following quotes:

"The giant dolines are the largest karst features on the Muller Plateau, as are the megadolines in the Nakanai Mountains and the tiankengs in South China. In common with the other two areas, they have formed after rapid uplift in places where there is continuing tectonic activity."....."Classification of dolines on the Muller Plateau is complicated because the solution and collapse dolines have very similar appearance.".....

"The Muller Plateau dolines are distinguished by lying high above the active cave rivers, and the Mamo sector is remarkable for its high density of giant dolines.".....

"The tiankengs of South China, with their vertical cliffs of bare rock are without doubt among the largest, most impressive and aesthetically pleasing karst landforms in the world. The giant dolines of the Nakanai and the Muller stand close behind them, and are equally remarkable as features of geomorphological significance." (James 2006).

"Here close together are located more than 100 giant sinkholes, up to 600 m wide and up to 420m deep (Uli Malemuli sinkhole)" (Wondermondo.com).

Obviously the Mamo Plateau unit makes an important contribution to the geodiversity of the Muller Plateau and in turn to the 'Sublime Karst' Tentative Listed sites.

Similarly, the results of the 2009 RAP survey of the Muller Plateau has delivered an important tranche of data on the biodiversity of the plateau, including many species new to science, propelling the Muller Range to being recognized as an area of outstanding biodiversity importance. The RAP results are not comprehensive but are of sufficient quality to draw some important conclusions on the biodiversity and conservation potential.

Not only is it an area of exceptional biodiversity but is now regarded as being of great importance for conservation. One of the most important contributions to it being assessed as being of high conservation value is that it has much less evidence of human impacts than most other areas of PNG. Tribal people with access to modern firearms are a major threatening factor in many parts of PNG but so far the Muller Plateau has escaped these depredations. The rugged terrain and good natural boundaries stand the area in good stead for long term

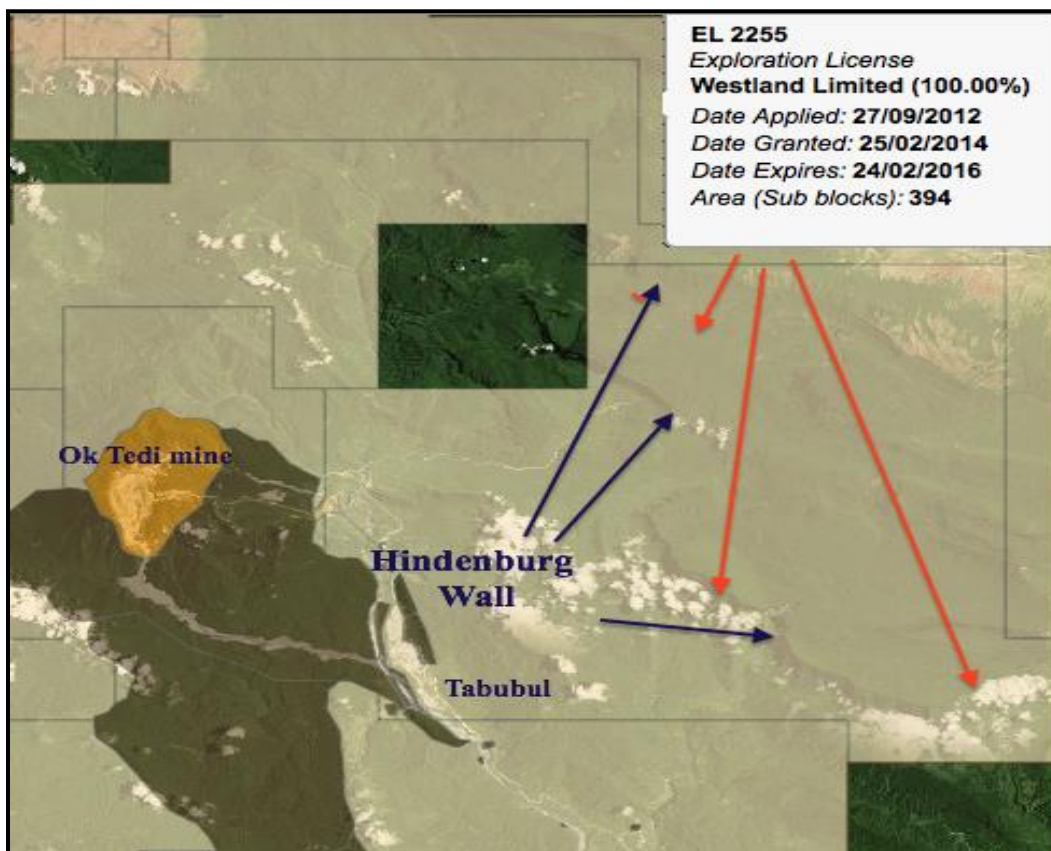
SUBLIME KARSTS (NOT INCLUDING NAKANAI)

conservation of its high biodiversity, in particular the mammals and birds which are otherwise targeted by hunters.

“The 2009 Muller Range RAP survey provided a brief and very partial glimpse of a diverse mammal community living in an almost pristine swathe of forest that spans a remarkably broad elevational range on the western side of the range, beginning with hill forests at around 500 m and passing up through lower and upper montane forests to culminate in a diversity of spectacular and unique subalpine habitats above 2,500 m. Although most of the mammals that inhabit these forests are probably quite widely distributed in the extensive catchments of the Strickland and Kikori Rivers, the intact nature of the forest ecosystems across such a broad elevational gradient is almost without parallel in the wider region....

.....The Muller Range is one of the very few places on Earth where the pressures of the modern age have yet to arrive. From the standpoint of conservation, it would be best if they never did. However, a more likely future will involve some degree of incursion of the modern world into this pristine paradise, and it can only be hoped that this occurs with a genuine commitment to conservation from all partners. Knowledge of the ecosystems will be fundamental to achieving the best possible outcome - knowledge of the biodiversity and how it is distributed within the landscape; knowledge of how the organisms work together to form balanced ecosystems; and knowledge of how human-induced changes might impact on the environment at all levels, from individual species through to entire ecosystems. The scientific results of the Muller Range RAP are a small first step toward acquisition of the necessary knowledge” (Aplin and Kale 2009).

4) Threats (land use and land tenure changes, development)



Almost the whole of the Hindenburg Wall is currently held under Exploration License by Australian company Westland Limited. There are no current mines within the Hindenburg precinct, Ok Tedi to the west (left) being the closest (Information and Image from PNG Mining Cadastre Portal 2014).

SUBLIME KARSTS (NOT INCLUDING NAKANAI)

Hindenburg Wall:

Like so much of Papua New Guinea, the Hindenburg Wall precinct is of interest for mineral exploration. The Ok Tedi gold mine, a major mine that has been very controversial, is located just across the valley from the southern section of the Hindenburg Wall. The company also holds exploration rights to the north of the existing mine so there is a possibility of mining expanding in this locality in the future.

Almost the entire Hindenburg Wall and immediately adjoining forested lands are currently held under an Exploration License by an Australian company, Westland Limited. (See diagram above) This is a very large Exploration License so may be subject to longer term extension as exploration progresses. (The convention is that exploration provides the opportunity to narrow the area of interest and so progressively reduce the size of the tenement)

The very same physical attributes that contribute to the conservation potential of the Hindenburg Wall precinct, the massive high clifflines and high plateau's, may well offer some natural protection from mining development.

It is likely that the higher plateau sections of the Hindenburg Wall precinct will not be of great interest for mining because of the massive depth of limestone but fringing areas may have mineral potential where access to geological structures lower in the landscape can be accessed in a way similar to Ok Tedi.

In conclusion, mining is a potential threat to the heritage values of the Hindenburg Wall precinct but it is too early to draw any firm conclusions.

Muller Plateau:

Geologically the Muller Plateau is similar to that of the Hindenburg Wall (Darai limestone) precinct and no less attractive for mineral exploration.



There are currently three mining exploration tenements over the Muller Plateau. The details the two Exploration Licenses are provided below. EL2131 is the larger tenement and EL1595 is in two parts. PNG Mining Cadastre Portal.

SUBLIME KARSTS (NOT INCLUDING NAKANAI)

EL 2131 <i>Exploration License</i> Highlands Pacific Resources Limited (100.00%) <i>Date Applied: 05/12/2011</i> <i>Date Granted: 20/12/2012</i> <i>Date Expires: 19/12/2014</i> <i>Area (Sub blocks): 132</i>	Active	EL 1595 <i>Exploration License</i> Frontier Gold (PNG) Limited (100.00%) <i>Date Applied: 09/08/2007</i> <i>Date Granted: 07/07/2008</i> <i>Date Expires: 06/07/2014</i> <i>Area (Sub blocks): 30</i>	Pending Renewal - Registration Complete
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Each of these licenses is over remote pristine forest area so any on-ground exploration could be a threat to the natural integrity of the site.

Unsustainable hunting probably remains the most important immediate threat to the biodiversity of the Muller Plateau but there is a need to take an active interest in the conduct of mineral exploration where ground activities are involved.

5) Protection Needs

Hindenburg Wall:

The conservation importance of the Hindenburg Wall precinct has been established beyond doubt. Similarly, there is compelling evidence about how uncontrolled and unsustainable hunting can seriously threaten mammal and bird species in remote natural sanctuaries such as the high plateau above the Hindenburg Wall (e.g. Bulmer's fruit bat).

Given that both mining and unsustainable hunting are the main threats to the natural heritage values of the Hindenburg Wall precinct, action to achieve some formal protection of the site is highly recommended. Priority attention to negotiation of a Wildlife Management Area might be a useful interim step but negotiation of the more secure Conservation Area option is the preferred longer-term option. In either case, the support and cooperation of the customary landowners is absolutely essential for effective conservation so the protection process should use a 'bottom-up' approach that fully engages the landowners.

The cooperation and support of the landowners will always be more effective in on-ground protection of wildlife than any citation in a Government Gazette and a lack of law enforcement.

Muller Plateau:

As with the Hindenburg Wall precinct, the conservation importance of the Muller Plateau has now been proved beyond any doubt, though there remain some important gaps in information. The Muller Plateau is an important refugium for wildlife but it takes on even greater conservation significance because of its outstanding natural integrity and topography and natural barriers that provide a high level of natural protection.

Notwithstanding, the Muller Plateau is vulnerable to both unsustainable hunting and to mining and mining related developments. On this point it needs to be pointed out that the impacts of a mine in a remote wilderness like the Muller Plateau is not restricted to the direct impacts of the mining per se but includes the sometimes dramatic impacts of a new wave of hunting and other impacts occasioned by migration of outside people to the vicinity of the mine.

Given that the Muller Plateau is already receiving attention for mineral exploration, it is important to begin the process of exploring options for protection with some sense of

SUBLIME KARSTS (NOT INCLUDING NAKANAI)

urgency. Early alert to the high biodiversity values and exceptional conservation importance may well avert the realization of the identified potential threats.

6) Revised Description

- Hindenburg Wall
- Muller Plateau

Notwithstanding the greater level of knowledge acquired since the nomination of the Hindenburg Wall and Muller Plateau since their nomination as a part of the Sublime Karsts in 2006, there appears to be no pressing need to revise the formal description citation at this stage. Far more important is proceeding with the process of protection.

7) Revised Statements of authenticity and/or integrity

- Hindenburg Wall
- Muller Plateau

There is no necessity to change this part of the citation.

8) Revised Comparative Analysis (where needed)

- Hindenburg Wall
- Muller Plateau

Again, there is no pressing necessity to amend the formal citation.

Given the shared geological substrate (Darai limestone) of the Hindenburg Wall, Muller Plateau and a large part of the adjacent Kikori Basin Tentative List area, there needs to be ongoing review of these three areas as any or all progress towards protection and possible World Heritage nomination. Rather than seeing any need to compare these separate areas there appears to be some case for a serial nomination of all three. Together they provide the full altitudinal sequence of the Darai limestone, from the high plateau sections of the Hindenburg (circa 2,200 m asl) down to a few tens of metres in the southern part of the Kikori site where the Darai limestone grades slowly down to sea level. Similarly, the rainfall gradient is from very high rainfall with high incidence of cloud and mist in the Hindenburg Wall precinct down to a lower rainfall, more seasonal rainfall in the southern Kikori.

Overall, whilst there has been a significant increase in knowledge since nomination in 2006, amendment of the official citation is not seen as a necessity at this stage. This applies equally to the Nakanai component of the original "Sublime Karsts" nomination. Knowledge of Nakanai has undoubtedly improved since 2006 but current research and consultation with landowners should be left to run for the time being without any need to change the formal status of the Tentative List citation(s).

9) Recommendations Arising

The two mainland components of the original "Sublime Karst of PNG" Tentative Listing, Hindenburg Wall and Muller Plateau, have been subject to a substantial upgrade of data since nomination, in particular of natural history. Similarly, the Nakanai component has been subject to important further biodiversity studies since listing and exploration of caves has continued, adding substantially to our knowledge of the underground parts of Nakanai.

SUBLIME KARSTS (NOT INCLUDING NAKANAI)

The result in all three localities is that each component is now known to have a much greater biodiversity significance than assumed at the time of listing and in each case is less dependent upon karst landform attributes for their international significance. Whilst all three are outstanding karst landscapes, each is now by a certain coincidence proving to be of outstanding biodiversity significance. Overall, the conservation value and international significance of the natural heritage attributes has been substantially reinforced and enhanced. As such, each is less dependent on the other for achieving global significance. Nakanai in particular has the prospects of a stand-alone nomination for world heritage whereas the Hindenburg Wall precinct and the Muller Plateau are more closely related both geographically and biologically. Indeed, it is apparent that the Muller Plateau also adjoins, if not overlaps, the Kikori Basin Tentative Listed area. That raises the possibility in the longer term of all three areas, Hindenburg, Muller and Kikori being incorporated into a single serial nomination.

The Hindenburg Wall precinct, combining geo-diversity and biodiversity (Criteria (vii) and (x)), has the potential as a stand-alone World Heritage nomination but would be far more convincing if combined with a substantial proportion of the Muller Plateau.

a) Name:

Whereas the natural heritage emphasis has moved somewhat from focus on the geo-diversity (Criterion (viii)) towards biodiversity (Criterion (x)), there is presently no necessity for this to be reflected in the name. Further, there may be a case in future for once again incorporating Nakanai into a Sublime Karsts nomination. Alternatively, it seems preferable that the Hindenburg Wall and the Muller Plateau might be linked up with the Kikori Tentative List site, possibly as a serial nomination. It is therefore recommended:

That the PNG World Heritage Secretariat/Committee retain the name of the Tentative Listed area as "The Sublime Karsts of PNG" for the present but keep this under review over time, particularly having regard for the relationship between this Listed area and the adjoining Kikori Tentative Listed area.

b) Boundary:

Given:

- The absence of any delineation of any of the Sublime Karst components at the time of nomination for Tentative Listing in 2006
- The need to eventually delineate each component
- The development of an indicative boundary for the Hindenburg Wall and Muller Plateau as part of this review

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Adopt the indicative boundaries for the Hindenburg Wall and the Muller Plateau as proposed in diagrammatic form in this report; (kmz files can be provided);*
- *Notify relevant internal branches of DEC and relevant government agencies of the new boundaries, in particular the MRA and DPE should be advised.*

Responding to Threats:

Given that the main threats to the heritage values are mining (including on-ground exploration) and unsustainable hunting,

It is therefore **recommended** that:

SUBLIME KARSTS (NOT INCLUDING NAKANAI)

The PNG World Heritage Secretariat/Committee

- *Communicate update details of the Sublime Karsts Tentative List to the Mineral Resources Authority (MRA) and Department of Petroleum and Energy;*
- *Actively review and respond to all exploration and mining proposals that affect the Tentative Listed areas;*
- *Open communications with the traditional owners of the Hindenburg Wall and Muller Plateau about the heritage attributes of these Tentative Listed areas and the need to ensure that all hunting is sustainable. (Could be the opening stage of negotiations for formal protection).*

Further Research:

Given that:

- Since nomination in 2006, there has been substantial improvement in knowledge of natural heritage attributes of both the Hindenburg Wall precinct and the Muller Plateau;
- Notwithstanding the improvements in knowledge, there remain substantial gaps in knowledge, both geographic and thematic;
- Knowledge of cultural attributes in the Hindenburg Wall precinct and the Muller Plateau appears very limited;

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Encourage further field survey and research of both natural and cultural attributes in both the Hindenburg Wall and Muller Plateau precincts.*

Towards Awareness, Recognition and Protection:

Given that:

- There is substantial evidence of the very high natural heritage conservation values of both the Hindenburg Wall and Muller Plateau precincts;
- No part of the Hindenburg Wall and Muller Plateau has any form of formal protection;

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Promote collaboration with the customary landowners to explore habitat protection and elimination of unsustainable hunting;*
- *Promote awareness within Government and within the wider community of the heritage attributes of the Sublime Karst Tentative List area;*
- *Promote negotiation of formal protection of the most important parts of the Tentative List areas;*
- *Develop a strategy and program to move towards full protection and World Heritage nomination.*
- *Explore opportunities for community development for customary owner communities as offsets for habitat protection and on-going management.*
- *Consider the option of World Heritage nomination only when formal protection measures have been established for the key components of the Tentative List areas. Coordinate any plans for nomination with the adjoining Kikori Basin Tentative List area.*

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Appendix 1: WHC Citation

The Sublime Karsts of Papua New Guinea

Papua New Guinea

Date of Submission: 06/06/2006

Criteria: (v)(vii)(viii)(ix)(x)

Category: Mixed

Submitted by:

Department of Environment and Conservation

State, Province or Region:

East New Britain Province: Nakanai Range

Southern Highlands Province: Muller Range

Western Province: Hinderburg Range

Description

Nakanai. The Nakanai Mountains is an area of outstanding natural beauty on the Island of New Britain, Papua New Guinea. To the north the mountain range is dominated by a group of spectacular volcanoes. It is bounded on the east by the Kol Mountains and to the west the Kapiura - Ania Divide which divides the Nakanai Mountains from the Whiteman Range.

Muller Plateau. The surface terrain of the Muller Plateau is extremely inhospitable and difficult to traverse. The area being proposed for inclusion here is in fact virtually uninhabited.

The Hinderburg Wall. The geological and geomorphic history is probably even more complex than that of the Muller Range. The Darai limestones are extremely variable and interbedded with shales and siltstones. Chert nodules and distinctive "fossil" forms of uncertain origin are common. Then there are a number of faults and anticlines from tectonic change. The giant scarps of the Hinderburg wall and the Bahrman Range give rise to unique patterns of air movement that in turn have sculpted the rock surface. Various phases of tectonic change and of valley glaciation caused major changes in hydrological patterns and cave morphology. Meanwhile the surface was shaped by erosion into towerkarst, then collapse of successive phases of towerkarst. In broad terms, the region is characterised by the mountain scarps on north and south.

Statements of authenticity and/or integrity

Nakanai. The ranges and plateau have only a very sparse human population, with only small villages generally on the lower lands. Various areas of flat or near-flat land are used for cultivation, but then once harvested are left to lie fallow until secondary forest is re-established. Some natural disturbance results from such causes as earthquakes or landslides. Thus, one can say that the natural forest has remained very much in its original but nevertheless, is in a dynamic and constantly changing state.

Muller Plateau. The Plateau remains uninhabited and is undergoing little change other than that which is natural and endemic to the geological instability of the country.

The Hinderburg Wall. Much of the area is uninhabited; most of the caves have only been entered by a single expedition. It is in a less disturbed state than virtually any other part of the country.

**The Hindenburg Wall?
Comparison with other similar properties**

Nakanai. As already emphasized, the Papua New Guinea environments must be recognised as distinctive. None of the other major underground rivers share the continuous volume and turbulence of the Nakanai Rivers. The giant Baliem River system in the Lorentz WHA of West Papua (and several other underground rivers) is of similar volume only during short periods of massive flooding which may not even occur every year. Aerial reconnaissance only suggests that a more comparable example may lie in a totally unexplored region of Halmahera in Indonesia.

Muller Plateau. It is difficult to identify a World Heritage property that is genuinely comparable with this. Probably that which most closely approximates is Gunung Mulu (Malaysia), but the geological structure and hence morphology of the karst is totally different, and hence, so is the biodiversity.

The Hindenburg Wall. It is difficult to identify a World Heritage property that is genuinely comparable with this. Probably that which most closely approximates is the Lorentz WHA, situated in West Papua at the other extremity of the Star Mountains. However, there are many differences in the nature of the terrain and certainly in the biodiversity.

NAKANAI KARST REPORT

NOTE: For the purpose of this Review of the World Heritage Tentative Listed sites of PNG, the Nakanai component of the original "Sublime Karsts of PNG" has been separately addressed. This arises from the peculiarities of the Nakanai Karst, the geographic remoteness of Nakanai and the perceived greater prospects of advancing the Nakanai to protection and eventually, World Heritage nomination, in the foreseeable future.



Kavakuna Cave WMA - part of the major landscape feature known as the Nakanai Ranges
(Image: Steven Alvaraz)

1) Current situation (listing, boundaries, action towards protection etc)

Location:

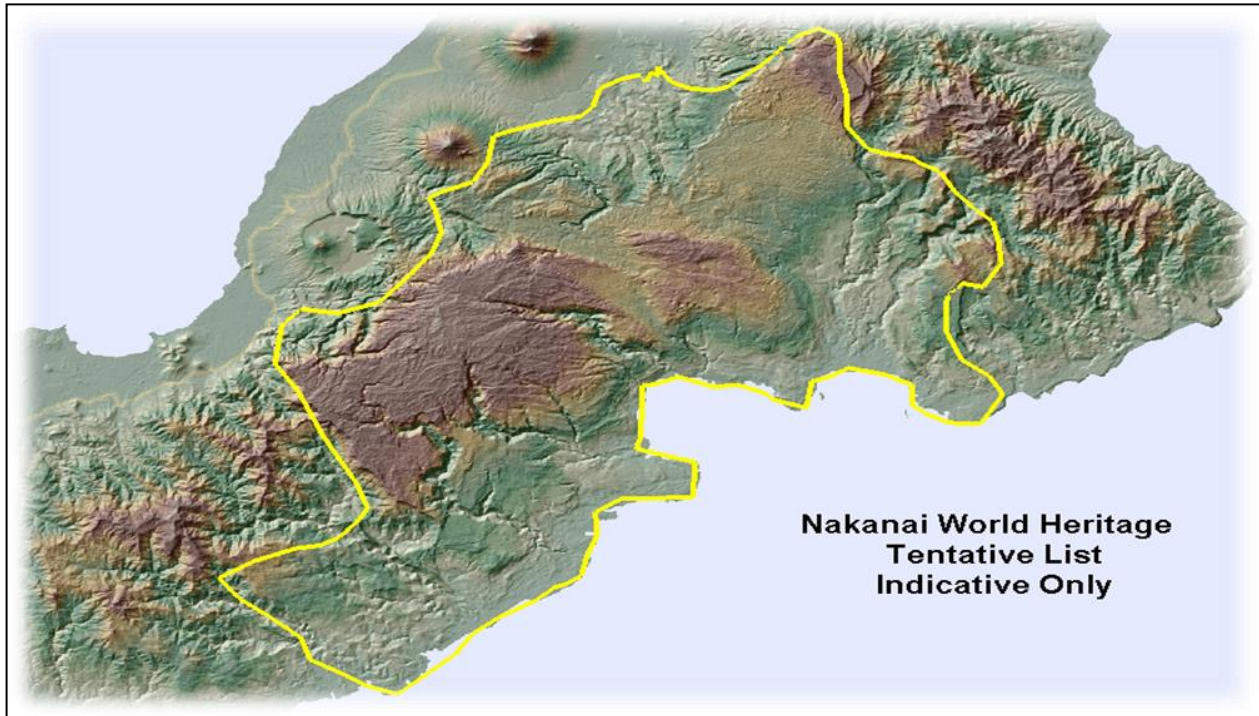
The Nakanai mountain range in East New Britain is located in primary rainforest with an area of over 3000 square kilometres (Gill 2012:1). The limestone karst area extends from the mountain summits to the southern coastline. Within the Nakanai Mountains are some of the largest caves in the Southern Hemisphere, known collectively as the Nakanai Caves.

Boundary:

The Nakanai Mountains are up to 2,185 metres high in the central-eastern part of the island. The total area of these mountains is about 5,500 km². They are bounded on the east by the Kol Mountains and to the west the Kapiura-Aina Divide which separates the Nakanai Mountains from the Whiteman Range. At the time of nomination to the World Heritage Tentative List in 2006, an indicative boundary for the Nakanai karst had not been prepared. The Nakanai Karst section of the Sublime Karst site does not specify a boundary, only the karst - the cavernous limestone of the Nakanai. The proposed boundary (see diagram p.2) therefore follows the

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natural limit of the limestone karst area, spanning from the coastal area to the mountain interior. The western boundary is defined by the Kapiura-Ania Divide which separates the Nakanai Mountains from the Whiteman Range. The northern boundary is dominated by a group of spectacular volcanoes. The eastern boundary is defined by the Kol Mountains.



Nakanai Ranges Proposed World Heritage Boundary

Protection:

The Nakanai Mountains has been nominated within the 'Sublime Karsts of Papua New Guinea' Tentative Listed area. The Sublime Karsts is a serial site comprising three separate karst areas on mainland New Guinea - Muller Plateau and Hindenburg Wall in the highlands, and Nakanai Mountains in New Britain.

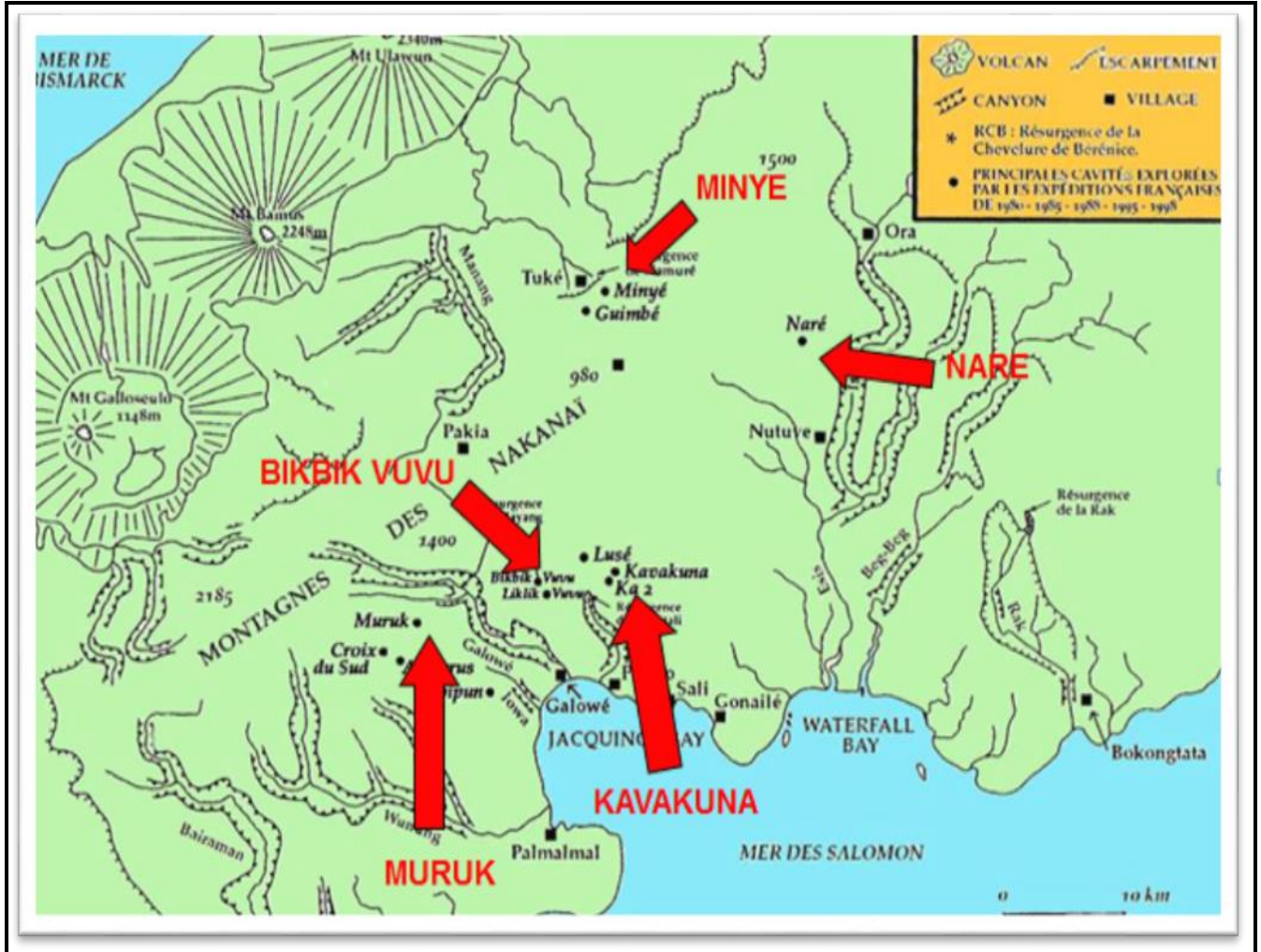
Data and Knowledge:

The Nakanai Mountains are made up of very thick (up to 1.5 km) layers of Miocene limestone about 22.5 to 10.5 million years old, covered with fragmentary layers of fine volcanic sediments from around 5.3 to 2.6 million years ago (Pliocene era). The high rainfall created rivers in the mountains, which over time has created deeply incised valleys. Over the last 200,000 years in the Nakanai Mountains eight giant canyons have formed with depths reaching 600 - 1,000 metres. The upper reaches of these canyons and their side ravines contain some of the most powerful springs in the world. Their sources are located deep inside the limestone layer, in giant caves. It is possible that these are the most powerful underground rivers in the world.

The cave systems also contain many endemic cave organisms. Whilst major underground rivers and caves have been explored by international expeditions, much of the Nakanai karst still remains unexplored. Although the Nakanai Mountains were bundled within the "Sublime Karsts of Papua New Guinea" Tentative Listing, the many discoveries since listing in 2006, both in the caves and in the surrounding rainforest raises the likelihood that the Nakanai Caves could well qualify as a 'stand-alone' World Heritage nomination.

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Major advances in understanding the Nakanai Caves have been achieved through four decades of expeditions undertaken by Australian, French, Swiss, and British cave explorers (speleologists). 1972 Australian expedition; 1978 French expedition; 1980 French expedition; 1984 British expedition; 2002 French expedition; 2003 French expedition; 2005 French expedition; 2006 British expedition; 2010 French expedition; 2012 French expedition; 2014 French expedition.



The arrows above indicate some of the caves explored and documented by the speleologists over the last 40 years

Since its tentative listing in 2006, the PNG Department of Conservation (DEC) in partnership with the Global Environmental Fund (GEF/UNDP) have identified the Nakanai Range as a Conservation Priority and allocated funding toward the establishment of a conservation corridor. Current work is focused on collating biological data and filling information gaps as well as encouraging existing/recognized WMAs and neighboring areas (new areas) to be part of a network of the Protected Area system within a Nakanai Range Conservation Corridor.

The only protected area currently in the proposed tentative boundary is the Kavakuna WMA, covering 3,219.67 hectares (see image p.1).

2) Description of Site

The Nakanai Karst extends from the seacoast up to more than 2,000 metres elevation on the Nakanai Mountains. The spectacular caves, underground rivers, and surrounding biodiversity of the Nakanai Range have been documented and analysed over the last 30 years by speleologists, biologists, and other scientists (Audra et al 2000, Beck 2003; Richards 2011; Gill 2012). Cave etchings have been documented in an entrance to one of the caves. Between 2008 and 2009 a team of scientists with Conservation International documented more than 100 new species of animals in the region (Richards 2011). Major advances in understanding the Nakanai Caves have been achieved through four decades of expeditions undertaken by Australian, French, Swiss, and British cave explorers (speleologists). These explorations have gathered scientific knowledge on a number of significant caves including those known as Nare Kavakuna, Minyé, Wowo, Vuvu and Muruk caves. The research indicates that the massive caves contain some of the fastest flowing underground streams in the world. Geologic features in the karst area known as "dolines" (or sinkholes), are also amongst the largest in the world, as reported in the National Geographic Magazine in 2006:

Deep beneath the rain forests of New Britain, an island off the coast of Papua New Guinea, churning rapids jet through enormous passages, some of the largest, most remote river caves on the planet. To reach them, explorers must first descend into massive dolines—sinkholes where soluble rock, weakened by runoff from an estimated 18 feet of rainfall a year, has collapsed. From the air they appear like impact craters, as if a volley of meteorites had long ago pummelled the forest (National Geographic, September 2006.

3) Key attributes and values

3a. Natural Heritage

From a conservation perspective, the mountain range is very important for planning protection and management of the Nakanai karst. The Nakanai Range provides not only species habitat, but is also important to many environmental processes such as watershed protection. The Nakanai Mountains are covered by primary tropical forest (Audra et al, 2001). In these tropical areas, full forest vegetation can grow even on the steepest slopes and rock is only visible in occasional cliffs and where landslips have removed the plant and soil cover.

Cave Systems

The World Heritage Tentative Listed area encompasses the Caves of the Nakanai Mountains. The 2010 caving expedition by the French-Swiss team to the Nakanai Ranges found the junction of two big caves. A huge underground system, deeper than 1000 meters, was located beneath the surface of the plateau.

The expedition in 2012 by the French-Swiss team explored the Wowo cave system, which now contains more than 20km of charted terrain and thus becomes the most extensive cave system to date in New Britain. At 660 meters deep, it is also the second deepest cave in PNG. Wowo cave contains beautiful, pristine dripstone formations.

Muruk Cave, discovered by Jean Paul Sounier, is 17km in length and nearly 1200 metres in depth and thought to be the largest in the Southern Hemisphere (Audra 2011).

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Muruk Cave, discovered by Jean Paul Sounier, is 17km in length and nearly 1200 metres in depth and thought to be the largest in the Southern Hemisphere (Audra 2011).



LikLik Cave contains stunning galleries of stalactites hanging like icicles from the ceiling

Significant Geological Features in the Nakanai Mountains

MegaDolines

The Nakanai Mountains (and the South China karst) contain the greatest number of giant dolines (tiankengs or 'sinkholes') in the world. They have formed after rapid uplift in places where there is continuing tectonic activity. The Nakanai Mountains uplift is believed to be at the exceptionally rapid rate of 3 mm per year (Löffler, 1977). The Nakanai Mountains have a hyper-humid, equatorial, mountain climate with an extremely high rainfall estimated to be between 10 and 12.5 m (Audra, 2001b). The rims of the megadolines that contain rivers are at altitudes of 200-600m, where the rainfall is much lower (Audra et al, 2001). The rivers flowing through the megadolines have enormous flows, estimated at up to 20 m³/s (Audra et al, 2001). These rivers transform the megadolines from depressions filled with tropical forest into magnificent and awesome sites. Ora dolines and caves, which have been explored to more than 5 km length, contain impressive, up to 40m tall waterfalls.

The megadolines, which are largely collapsed dolines, are the largest karst features on the Nakanai Plateau (James 2006). The impressive Ora dolines, known as Minyé and Naré (discussed next page) look like giant holes in the dense green jungle, visible even in comparatively blurry satellite images. Both dolines are nearly perfectly round. These dolines are amongst the largest in the world.

- **Ka 2** - East New Britain Province - up to 125 metres deep and up to 130 metres wide sinkhole, volume - 1.2 million m³. Walls are vertical.
- Lusé - East New Britain Province - up to 250 metres deep and up to 800 metres wide sinkhole, volume - 61 million m³. Largest sinkhole in New Britain and perhaps the world.
- Kavakuna sinkhole- East New Britain Province. Up to 480 metres deep, 380 - 300 metres across. Volume - 12 million m³. Vertical wall in one side, debris goes up to the other side.
- Kukumbu doline - West New Britain - up to 300 metres deep and up to 1000 metres long sinkhole, with water volume around 75 million m³.
- LikLik Vuvu doline - East New Britain Province - more than 140 metres deep and up to 190 metres wide sinkhole, volume - 1.5 million m³. Walls are nearly vertical, below is a river in a deep canyon. Underground river can become furious, with volume more than 1000 m³ per second, while normally it is 20 m³ per second.
- Poipun doline - East New Britain - up to 160 metres deep and 150 metres wide with water volume of 1.7 million m³.
- Wunung doline - East New Britain - up to 160 metres deep and up to 500 metres wide with water volume of 24 million m³.
- Minyé doline - East New Britain Province (coordinates 5.2432 S 151.5049 E) - first researched by Australian speleologists, descending to a depth of 60 metres. French speleologists researched it in 1978 (first descent to bottom) and in 1984 it was further researched by the French/ Swiss expedition; numerous expeditions came later. It lies on a plateau at an elevation of 1000 metres, close to the Kol village of Ora, which is located in the Iso Gorge some 500 metres lower. The area of the sinkhole is approximately 75,000 m², water volume - 26 million m³. The doline is around 350m diameter and a depth of 400 - 510m. Because Minyé is located on a slope the upper rim is approximately 100 metres higher than the lower rim. The floor of the sinkhole is crossed by a powerful river - from the upper rim it may look like a narrow stream, but the volume of the stream is 15-25 cubic metres per second, increasing significantly after torrential rain. The cave passages at the bottom of Minyé have been mapped as containing 5,421 metre long passages, but this may be just a small part of the system. Powerful subterranean rivers require large passages - and caves under Minyé are giants in this respect. The largest room in this cave

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is Tuké chamber - one of the largest cave chambers in the world. It is 240 metres long, 200 metres wide and 180 metres high. The floor area of this chamber is 48,000 square metres with water volume of 6,240,000 cubic metres.

- Naré doline (coordinates - 5.2940 S 151.6399 E) - East New Britain Province - one of the most spectacular sinkholes in the world. Naré is around 150 metres long and 120 metres wide. The depth is 240 to 310 metres, with the volume of water estimated to be 4.7 million m³. The walls of the sinkhole are vertical and are not covered with jungle. All of the limestone, which earlier filled the present hole, has been washed down the mountains by a subterranean river, named Vaisseau Fantôme river (Flying Dutchman river), flowing across the bottom of the sinkhole. The volume of this river is some 15-20 cubic metres per second while after heavy rains the discharge can be even 50 times higher. French explorers descended into this doline in 1978 and 1980, exploring cave passages up to 2km length. British speleologists continued their work in 1986. Naré caves belong to technically most difficult caves to explore. The mighty subterranean river in Naré caves is extremely loud - special earplugs are needed to endure exploration.



Cross-section of Nare and Minyé doline compared with Boeing 747-400
(Image and diagrams: wondermondo.com)

Biodiversity

The Nakanai region is considered to be one of the most bio-diverse ecosystems in the world, harbouring large numbers of endemic species of plants and animals.

In April 2009, a team of scientists from Conservation International and the Papua New Guinea Institute of Biological Research joined with local landowners to survey the biodiversity of East New Britain's rugged, rainforest-covered Nakanai Mountains. Spectacular results were obtained in the Nakanai Mountains. A report entitled 'Rapid Biological Assessments' of the Nakanai Mountains and the upper Strickland Basin: surveying the biodiversity of Papua New Guinea's sublime karst environments' outlines the findings (Richards and Gamui 2011). The survey documented more than sixty-four species of birds in the Nakanai Mountains, seven of which are endemic to the Island. The most significant of these was a very rare sighting of the slatey-backed goshawk (*Accipiter luteoschistaceus*), an uncommon species endemic to New Britain and nearby Umboi Island. More than 100 species of spiders were documented, of which at least 50 appear to be undescribed.

New Britain, together with the New Ireland group of islands have an impressive array of local endemic species; New Britain has 14 endemic species and shares an additional 12 with New Ireland. Birdlife International recognises this high endemic diversity in EBA195 - New Britain and New Ireland. (Birdlife International)

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The survey of mammals around three sites in the Nakanai Mountains – Lamas, Vouvou, and Tompoi -identified 26 species, including 10 species of terrestrial mammals. It appears that three species of mammals from the high elevation site are undescribed, including two rats and a white-tailed mouse that represents a previously unknown genus. A total of 23 frog and 16 reptile species were documented in the Nakanai Mountains.

Four species of frogs are new to science, with the highest proportion of previously undescribed frog species located at the site with the highest elevation – Tompoi (1,500-1,700 metres). This new species belongs to a group of frogs that lay their eggs on land or in the trees where they hatch directly into little froglets, and they have no tadpole stage. The breeding strategy is of immense benefit to frogs in places like the Nakanai Mountains where, despite the high rainfall, surface-water is very scarce because it drains quickly underground to join streams and rivers that flow through underground caves (Conservation International 2009).



Previously undescribed species of montane mouse (Conservation International 2007)



Newly discovered frog - *Platymantis* sp. nov. (Conservation International 2007)

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Slatey-backed goshawk (Conservation International 2007)

The RAP Study documented more than sixty-four species of birds, seven of which are endemic to the Island. The most significant of these was a very rare sighting of the slatey-backed goshawk an uncommon species endemic to New Britain (photo above).

Cultural Heritage:

While many of the natural values of the Nakanai Caves have been documented, there has been limited focus on the possible cultural values. The tentative listing suggests that the place would meet criterion (v) “to be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change”. The region has a rich archaeological heritage and the reports from various caving expeditions suggest that there is potential for significant archaeological cultural values at Nakanai. More research is required to demonstrate that the Nakanai Caves region meets the threshold for listing under this criterion. In addition to the physical sites, places and objects that may exist in association with the Nakanai Caves are also likely to be a range of what are referred to as ‘intangible’ cultural values associated with the Nakanai caves and these might include beliefs and traditions about the caves and their formations or about the art work or objects in the caves or local community practices that contribute to the maintenance and sustainability of the natural and cultural values.

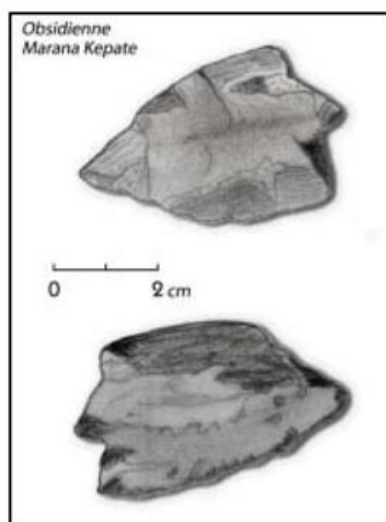
Since 1992 the World Heritage Convention has recognised significant interactions between people and the natural environment as cultural landscapes. A cultural landscape approach to the consideration of the caves will mean that the values of the caves will be considered along with their cultural and natural setting and in conjunction with the communities that own, sustain and relate to them. For this reason the input of local communities is very important, as are the belief systems including stories, understandings and practices associated with the Caves and the natural and cultural features that are identified as important to the values of the place.

There are a small number of archaeological sites within the Nakanai caves region area, although to date no archaeological excavations have been attempted. However, preliminary reports indicate two broad site types are present and a third is most likely to be formally

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identified in due course. These are coastal village sites, rock engraving art sites and cave mouth occupation sites. A single coastal village site was recently reported by Leavesley and Sarrar (2013). It consists of a midden material including pottery fragments consistent with Late-Lapita motifs, known from other sites within New Britain, the Bismarck Archipelago and the south western Pacific. The site is significant because it provides an opportunity to investigate notions of Austronesian dispersals and landscape use.

Elsewhere in the Jacquinot Bay region Specht (1984) reported surface scatters that include obsidian artefacts. These are significant because obsidian can be relatively easily sourced thereby providing insight into notions of prehistoric trade/exchange and by implication socio-cultural connectivity potentially over broad distances. In this case, the nearest obsidian source to Jacquinot Bay is Mopir, several 100 kms to the west of Pomio (Summerhayes and Allen 1993). Although the obsidian artefacts reported by Specht cannot be directly dated we can confidently interpret them as representing prehistoric trade/exchange that occurred between neighboring groups of people between Mopir and Pomio sometime in the past. Only by the recovery of these artefacts from archaeological deposits will it be possible to determine the precise timing of this trade/exchange network. This can be achieved through further archaeological investigations in the region. In 2005, the French Federation of Speleologists reported the presence of obsidian artefacts found in the Marana Kapate Cave (below).



Obsidian – Marana Kapate Site (Image: Fédération Française de Spéléologie 2005:11)



Lapita sherd found at the Liton River mouth, Jacquinot Bay. This site was first reported by Mr Patrick Sarar with assistance from his son Andrew (see Leavesley and Sarar 2013).

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Potential significance of the current archaeology of the Nakanai

The Kiton River site has the potential to inform some issues of local, regional and Pacific wide importance. This is because Late-Lapita pottery is conventionally found on the smaller off-shore islands while the Kiton River site is located on the New Britain mainland itself and therefore it does not fit with convention, with the consequence that it provides a unique opportunity to test the conventional interpretation of the Late-Lapita archaeological record. The importance of the Kiton River mouth site lies in the fact that few Lapita sites have been observed on the larger islands of the region, providing an important opportunity to explore current interpretative paradigms.

The Nakanai cave rock art sites are potentially of global importance if they can be demonstrated to be of some/any antiquity. Rock art has immense interpretative value to pre-historians primarily because it provides an opportunity to investigate ancient notions of symbolism. Investigations into symbolic behaviour are central to archaeologists because the use of complex symbols is the exclusive domain of anatomically modern humans. Evidence from the FABM site indicates that hunter-gatherers first colonized New Britain by 40,000 years ago allowing for the possibility that the Nakanai karst country rock art is of a comparable age. Only further archaeological investigation will determine the age of the rock art. The rock engraving art sites at Marana Kepate on the south western corner of Jaquinet Bay have been informally reported by various caving expeditions (*Fédération Française de Spéléologie* 2005). To date, there have been no reports of cave mouth sites reported from the study area. However, preliminary investigations based on photographs from members of various caving expeditions suggest the likelihood that cave sites are present within the study area. Based on previous archaeological research in the region this site type has a very high probability of providing important data supporting interpretation into a range of issues including colonization, dispersal patterns, mobility, land use and resource across the region. The 'cave mouth occupation sites' will most likely provide information of regional heritage value. The term 'cave mouth occupation sites' refer to archaeological sites that reflect hunter-gatherer camping behavior as an accumulation of cultural debris in the mouth of a cave. While no cave mouth sites have yet been formally recorded, anecdotal evidence suggests that they exist within the Nakanai karst country. Based on evidence from elsewhere in the Bismarck Archipelago it is entirely likely that these sites will provide evidence of the first hunter-gatherers to occupy the Nakanai karst country reflecting aspects of their life ways including resource-use, land-use and mobility.



Marana Kepate Rock Etchings (Image: Phil Bence 2005)

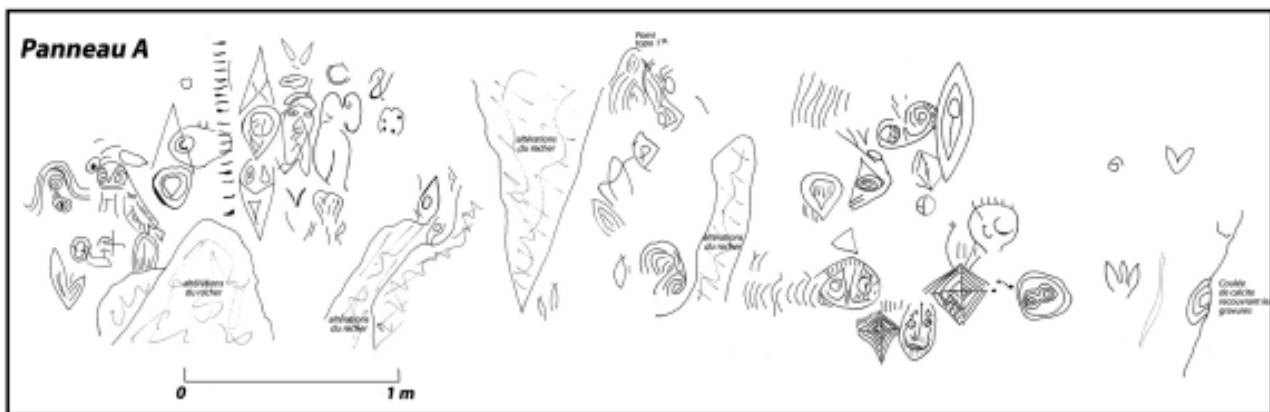
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Marana Kepaté Rock Art – showing erosion marks which may indicate time-depth of engravings (Image: Phil Bence 2005)

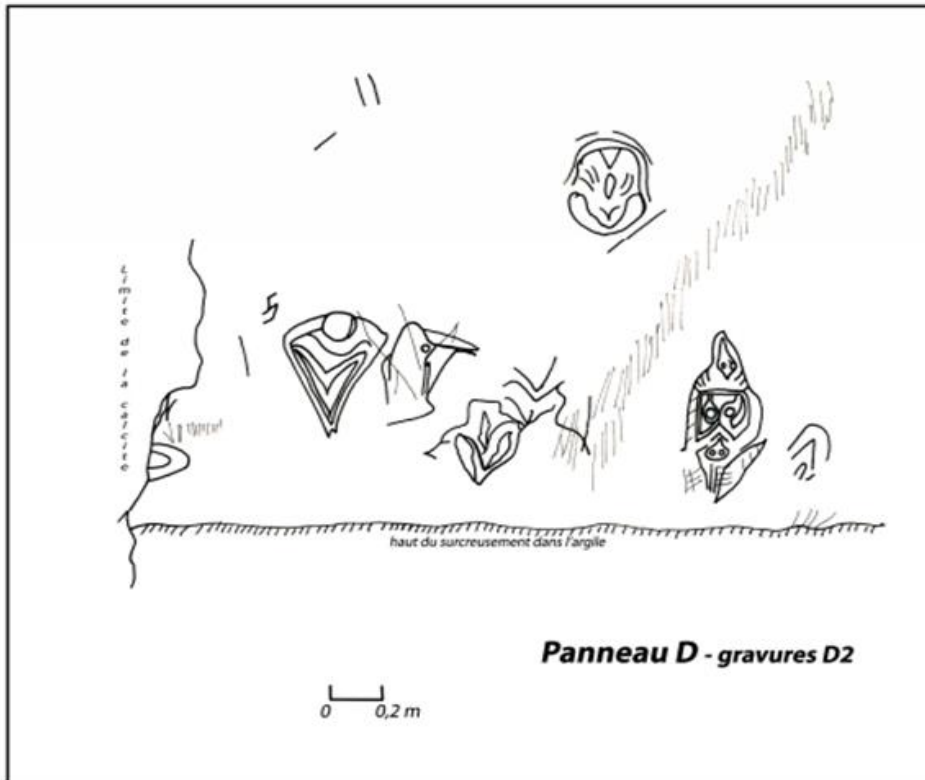


Marana Kepate Site (Fédération Française de Spéléologie 2005)

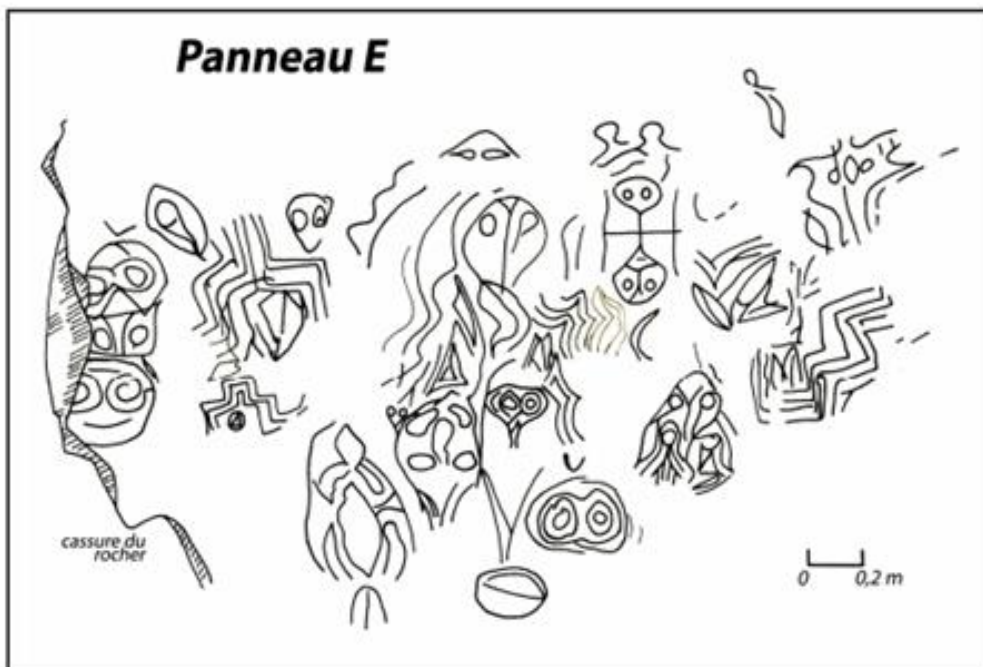


Panel A: Panel of Rock Art discovered in cave entrance (Image: Spelunca Mémoires 2009)

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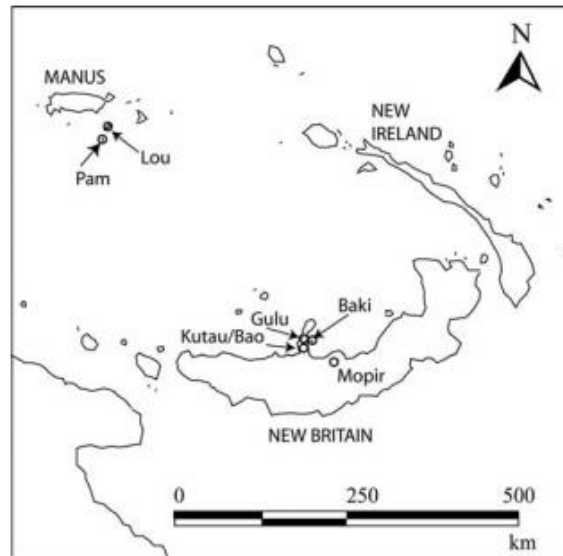
Panel D: Panel of Rock Art discovered in cave entrance (Image: Spelunca Mémoires 2009)



Panel E: Panel of Rock Art discovered in cave entrance (Image: Spelunca Mémoires 2009)

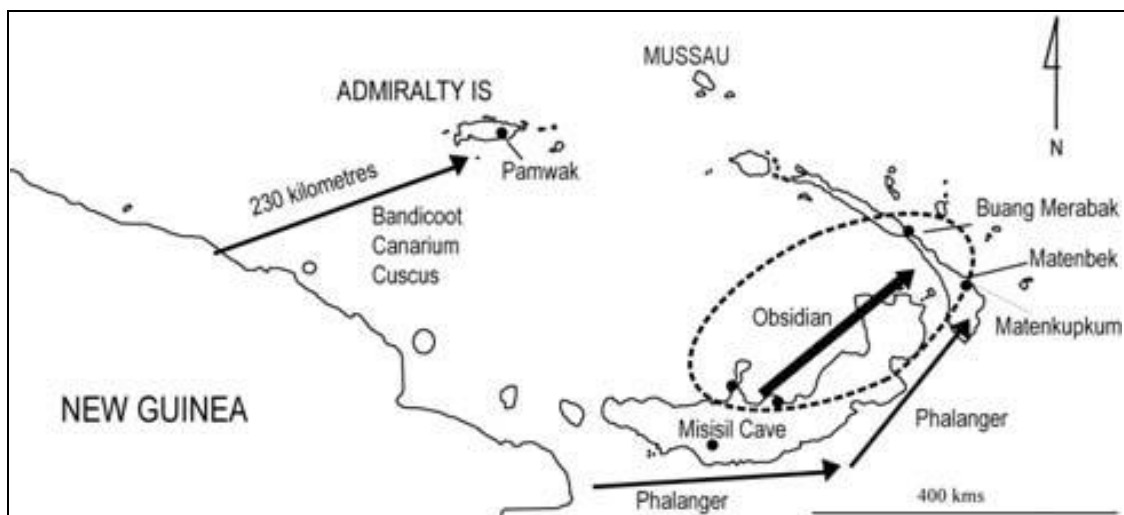
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Outside the immediate study but in the broader region



Mopir obsidian quarry site (Map: Torrence et al. 2009:124)

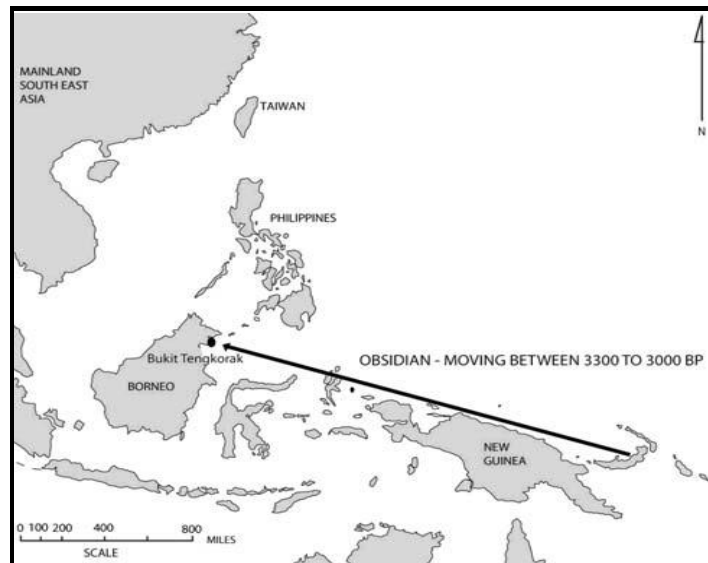
Further afield in West New Britain is the Mopir obsidian quarry site. Obsidian is a naturally forming volcanic glass that is very high in silica. Each obsidian outcrop was geologically formed under unique conditions and therefore each has its own unique geochemical signature that can be determined by experts. The specific geo-chemical characteristics of obsidian allow that in the hands of an expert knapper it can be manipulated to form highly intricate and extremely sharp ('stone') tools. The Mopir site is extremely important. It is the source site for a number of artefacts that have been excavated from stratified sites as far away as central New Ireland in deposits dated as early as 20,000 years ago (Leavesley and Allen 1998; Leavesley and Read 2011; Summerhayes and Allen 1993). This is the earliest evidence for trade/exchange for the entire region.



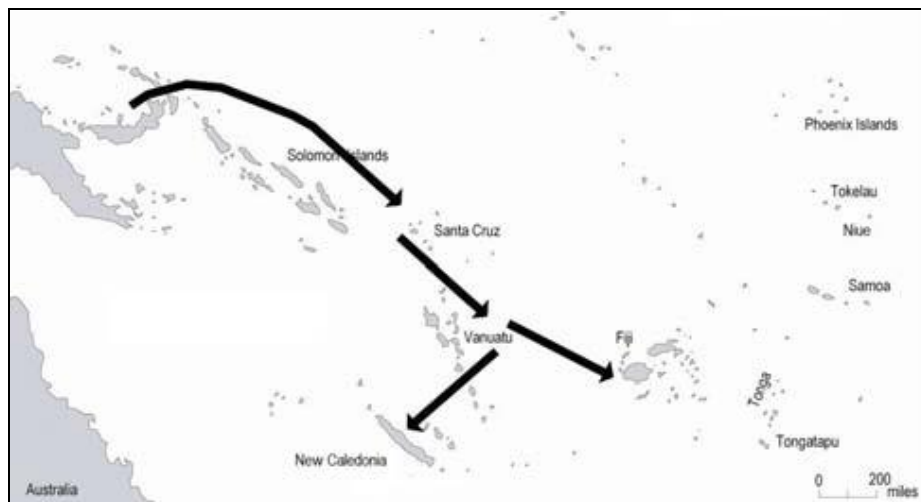
Pleistocene movement of obsidian at 20,000 BP. Note the movement of obsidian from Mopir to southern and central New Ireland (Map: Summerhayes 2009)

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To the northwest, in the Willaumez Peninsula there are a suite of obsidian sources that demonstrate the extent of obsidian trade/exchange during the Lapita and post-Lapita period. Obsidian from these (and the Admiralty Islands) sources are distributed across 3000 kms from Fiji to Sulawesi during the Late Holocene (Summerhayes 2009).



New Britain obsidian has been identified in archaeological deposits in Sabah dated to between 3300 to 2800 Cal. BP (Map: Summerhayes 2009)

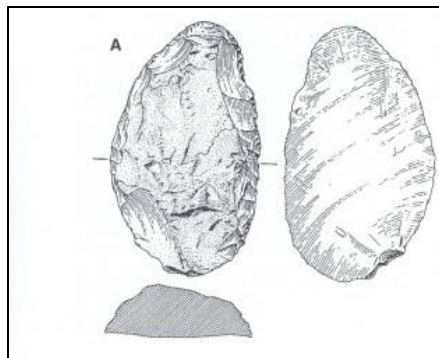


New Britain obsidian has been identified in archaeological deposits as far east as Fiji dated to after 3000 Cal. BP (Map: Summerhayes 2009)

A rather interesting open site known by its PNG National Museum & Art Gallery site code as FABM has been reported from the Willaumez Peninsula region. This site was investigated by a team lead by Robin Torrence (Australian Museum) and human occupation has been dated using the TL method to ~40,000 years ago (Torrence et al. 2004). The importance of this site lies in the fact that it is the oldest evidence of human occupation in New Britain and is consistent with previously reported data from Yombon (Pavlidis 2004) and early sites (Buang Merabak and Matenkupkum) in neighboring New Ireland (Leavesley and Allen 1998; Leavesley et al. 2002; Leavesley & Chappell 2004).

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Further to the west is an important Pleistocene archaeological site at Yombon. Evidence from Yombon demonstrates that early hunter-gatherers rapidly moved into the interior of west New Britain utilizing locally available cherts for stone tool (see figure 5) manufacture (Pavlidis 1993; 2004, Pavlidis and Gosden 1994).



An ovoid scraper from Yombon (Pavlidis 2004)

Well outside the study area, to the north of Rabaul, there are a number of Lapita sites on both Watom (Green and Anson 2000) and the Duke of York Islands (White 2007). These sites reflect evidence of the appearance of a new group of migrants into the Bismarck Archipelago that ultimately dispersed across the entire Pacific region giving rise to modern-day Polynesian societies. Lapita people are thought to have originated from Taiwan about 9000 years ago. Upon their arrival into the Bismarck Archipelago they encountered extant hunter-gatherer populations and settled on the smaller off-shore islands before integrating over the ensuing 300-400 years. They introduced pigs, dogs, chickens, gardening and the Austronesian language (Kirch 2000).

4) Threats (incl. land use and land tenure changes, development)

The Nakanai Range is threatened by the expanding timber industry and agricultural developments including oil palm plantations. The largest scale logging operation on the island is concentrated on the lowland areas and plains, but this is steadily expanding to the mountains. This expansion is thinning the rainforests on the inaccessibly mountainous areas on the Nakanai Ranges.

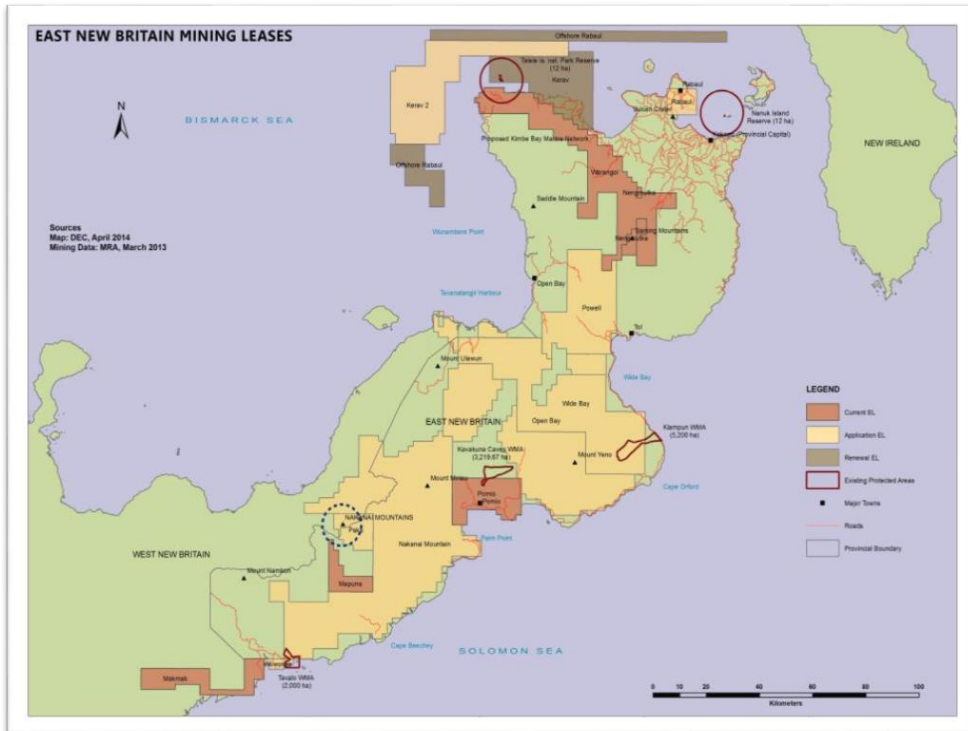
There are a number of the areas designated for agroforestry projects under Special Agricultural Business Leases (SABLs)¹¹ that will impact on the Nakanai Caves area. Karst is fragile and can be highly problematic for any surface development, especially where highly cavernous as in Nakanai. A total of five SABLs are located on the Nakanai Karst and includes more than 80 kms of ocean frontage. Runoff from roads, logging operations, oil palm refuse all threaten the pristine caves below.

Mining:

Current and future mining operations are proposed in the tentative world heritage area. Most notable among the prospective mining developments in the Nakanai Mountains is an Exploration Lease (EL2122) issued over a large area of the Nakanai Mountains, including part of the Kavakuna Caves which has been designated as a Wildlife Management Area (WMA). The map below indicates that mining exploration permits have either been granted or are pending for a large tract of mountainous terrain within the Nakanai Mountain Range.

¹¹ Presented on website <http://www.pngsdf.com/sabl/>

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Map showing East New Britain Mining Tenements (PNG DEC 2014)

Logging:

Logging of primary forests has already been an issue. Already the first signs of discarded oil drums are starting to show up in the caves: eg; oil drum in *Liklik Vuvu* (Jean-Paul Sounier, pers com. May 24, 2012).



Logging roads on the Nakanai Karsts (Image: Jean-Paul Sounier).

“it seems certain that logging is taking place on the karst of the Yalam limestone’. Previous expeditions have reported dolines blocked with road debris..” (Gill 2012:26).

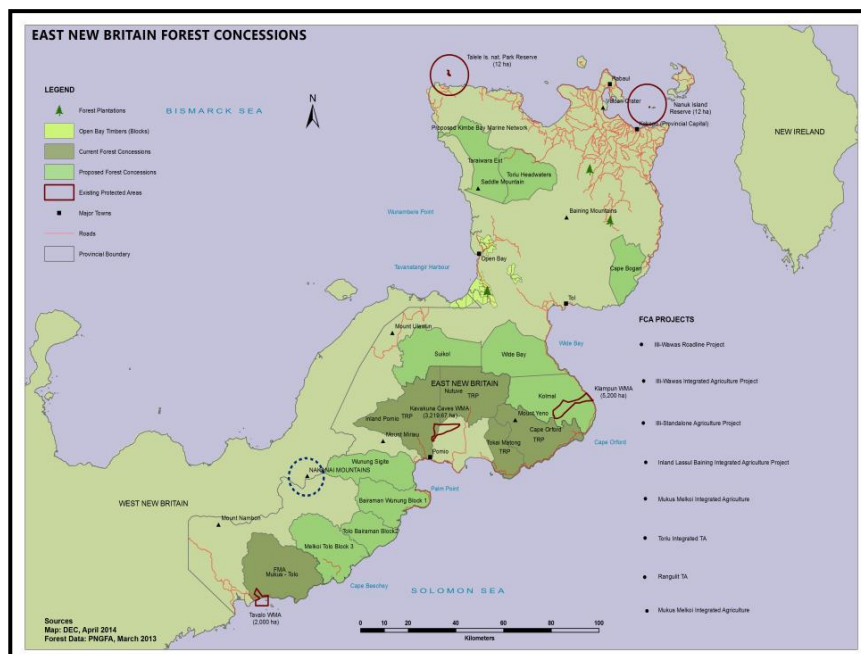
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Logging Roads in Nakanai Mountains (Image: Greenpeace 2011)

Photos of dirt logging roads (as above) on the Nakanai limestone karsts have been taken by French cave expedition leader Jean-Paul Sounier:

- 2006 Expedition - 10 pictures taken in Berg Berg. 'They started logging from the coast up the limestone plateaux. On the 2010 trip, I saw from the airplane huge scars due to the logging road going further inside the mountains' (Jean-Paul Sounier pers com. 30 May 2012);
- 1998 Expedition – 4 pictures taken in the Galowe area. Galowe 1 shows part of the logging camp built on the shore. Galowe 2 is on the plateau at about 1250 m high; it is on the way to Muruk. The photos show that dolines have suffered from the tracks as wastes go right into them. Galowe 3 and 4 show the damages done on the karst; altitude is around 1200 m (Jean-Paul Sounier pers com.31 May 2012).



Forest Concessions in East New Britain (Map: PNG DEC 2014)

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Special Agricultural Business Leases (SABL's):



The map above identifies the location of the five SABL's issued in East New Britain. Of these SABLs, the Sigite–Mukus Integrated Development Project (top right of photo) will have the greatest impact on the Nakanai karst area.

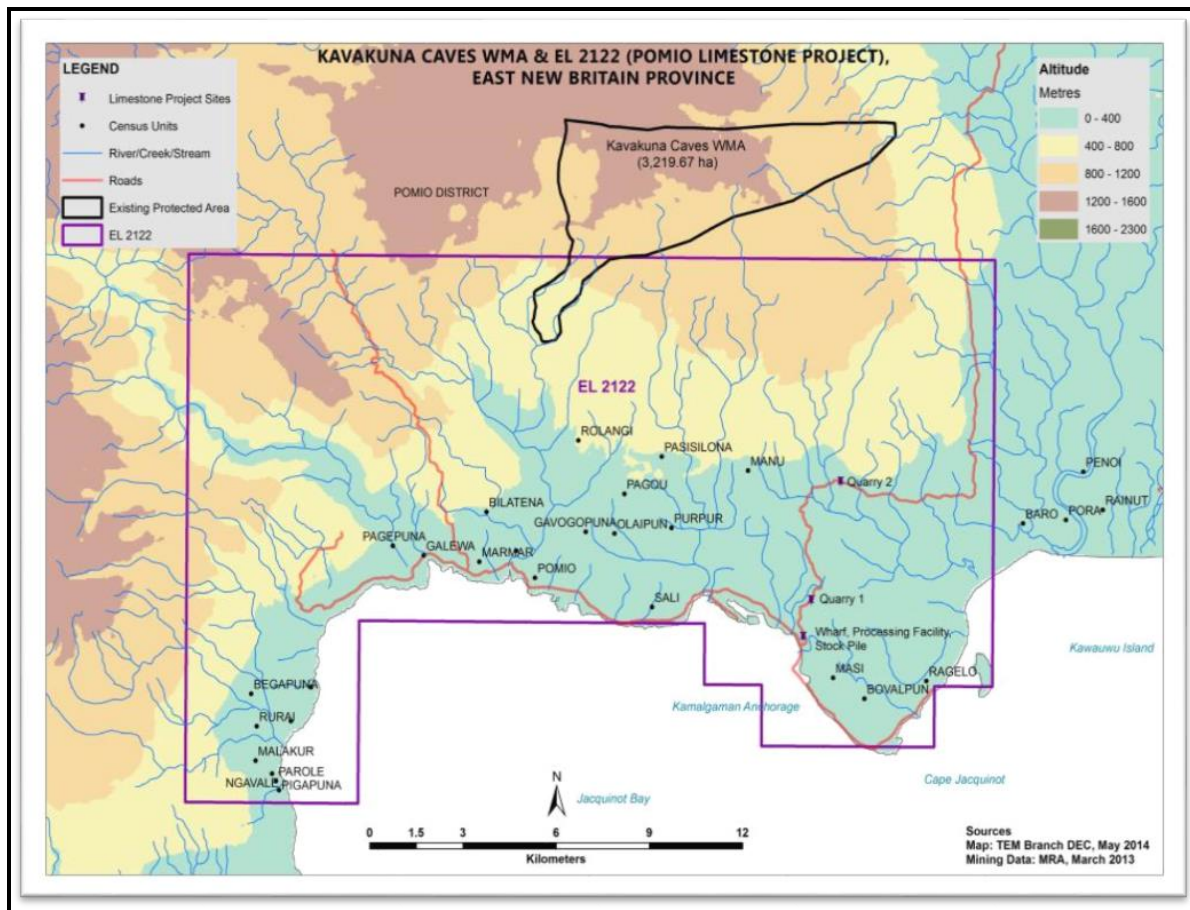
Sigite-Mukus Integrated Agriculture Development Project (55,400 hectares)

The Sigite-Mukus consolidated land area comprises six customary land blocks of which the first three blocks have been identified for initial development. The total land is located within the census division boundary of East Pomio, Inland Pomio, Central Pomio, Mamusi and Melkoi. At its closest point along the southwest coast from the main administrative center of Kokopo is Irena village which is 169 kilometres. The Sigite-Mukus project is one of four main impact projects supported by the provincial government in its attempt to develop the outlying areas of East New Britain, especially the Pomio and Baining areas. It has been opposed by some landowners on the basis that they have existing eco-tourism and eco-forestry projects, and harvest their own timber for their own use. A Forest Clearance Authority (FCA) has been granted over 43,430 hectares (issued 2007 and extended for an additional six years in 2014).

Protection Needs

Some progress has already been made by PNG in protection of the Tentative List area (Kavakuna Caves Wildlife Area of 3,219.67 ha). The UNDP is currently working with DEC to establish Community Conservation Areas (CCAs) However the Pomio Limestone Project (EL2122) poses an immediate threat to the designated WMA, cultural heritage values, and the unique world-class caves of the Nakanai Mountains.

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Nakanai Mountains as a Cultural Landscape?

One of the questions that arise as a result of the new information relating to the cultural heritage attributes in the Nakanai Mountains currently being worked on by an interdisciplinary team of archaeologists and anthropologists is whether the Nakanai Caves might be considered as an Associate Cultural Landscape.

The preliminary research undertaken by French Archaeologist Florence Guillot suggests that there may be cultural attributes of 'Outstanding Universal Value' in the Nakanai Caves. Crucial to this question is the documentation of etched rock art (which is unusual in limestone), according to Jim Specht, who has extensive experience working in Papua New Guinea, and almost fifty years working in East New Britain.

In 2014, one of the authors of this report (Gabriel) sought funding, which was received from the Australian Research Council (ARC), in 2014, to support a three year research project conducted by a team of anthropologists and archaeologists from James Cook University, Australian National University, Sydney University, Archaeological & Heritage Management Solutions and PNG Partners with Melanesians. The aim of the research is to study the rock art and other cultural sites in the vicinity of the Nakanai Caves, and to understand the importance of the caves and other places to people in the Pomio region. The research will document and integrate the natural and cultural values of the Nakanai Caves in preparation for a possible cultural landscape World Heritage nomination. The methodology incorporates community knowledge with archaeological and anthropological evidence to link natural and cultural values and define the landscape from local perspectives. In pursuing the possibility of a

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Cultural Landscape Listing, the research will explore associated ideas of landscape and memory.

5) Revised Description

There is a case for revising the official description of the Sublime Karsts of PNG, especially to disclose the identified new values and new threats.

A revised Description should be developed as current studies progress.

6) Revised Statements of authenticity and/or integrity

A slightly revised statement should be developed when appropriate.

7) Revised Comparative Analysis

No changes proposed.

CONCLUSIONS:

Attributes/Values: This review reaffirms and reinforces the outstanding heritage potential of the Nakanai Karst Tentative Listed Area. Additional important attributes recognized since nomination in 2006, both natural and cultural heritage, were identified and documented as a part of this review. There is a pressing need to complete anthropological and archaeological surveys and documentation of the Nakanai Caves and cultural attributes of the surrounding landscape, publication of the results and development of a strategy to provide effective protection.

It is a reasonable conclusion that the Nakanai Karst Tentative List area is of global significance, especially for geo-heritage and biodiversity.

The existing Tentative Listed site warrants formulation of a new formal description, namely the Nakanai Karst, and that the official description in the WHC citation be updated to accommodate the new knowledge of attributes and values.

Threats: Some definite threats to the values, current and potential, were identified. Logging is already impacting on the Karst environment and potential additional threats were identified. The most serious imminent threat identified in this review is the mining exploration leases in the Tentative Listed site, which encroaches on the Kavakuna Caves WMA, as well as impacts from the Special Agricultural Business Leases. Current and future proposals for logging, mining and agricultural development represent threats to the area.

Protection: Since nomination in 2006 there has been some progress by DEC in protection of the identified heritage values in the Tentative Listed area. The existing Kavakuna Caves WMA represents a significant first step in protection of important values but there is an urgent need to initiate additional protection as opportunities permit.

Management: There is currently no heritage-specific management of the site, although the customary landowners and provincial government are aware of the heritage significance and are actively exploring future options for further protection.

8) Recommendations Arising

The Nakanai Ranges contains some of the world largest caves and sinkholes and impressive biodiversity. Complementing the limestone karst features are tracts of primary forest of outstanding conservation value. Notwithstanding that much remains to be explored in terms of natural and cultural heritage within and adjacent to the Tentative Listed site, this review has confirmed the high probability of Outstanding Universal Values, both natural and cultural, existing in the site. Therefore, in accord with the undertakings given by the Government of Papua New Guinea under the 'World Heritage' Convention, there is a need to actively monitor and as far as practicable maintain those values. A concerted effort will be required to maintain the existing values and to achieve an appropriate level of protection. The following recommendations provide a pathway forward for monitoring and protection of the global significance of this outstanding area.

a) Name:

It is **recommended**:

That the PNG World Heritage Secretariat/Committee

- *Create a separate Tentative Listed area for the Nakanai Mountains and any nomination process be known as The Nakanai Karst.*

b) Boundary:

Given:

- The existence of at least a tentative boundary;
- The tentative boundary appears mostly logical and defensible

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Adopt a boundary for the Tentative Listed area to incorporate the whole of the predominantly karst Nakanai Mountain Range as illustrated in this report;*
- *Register the boundary of the Tentative Listed site with DEC GIS branch and with other relevant branches, together with relevant PNG government agencies, in particular the Mineral Resources Authority and Provincial Government. (It would be valuable if MRA were to include boundaries (where they exist) of Tentative List sites in their on-line Mining Cadastre Portal.)*

See "NAKANAI KARST TENTATIVE LIST BOUNDARY.kmz"

c) Responding to Threats:

Pomio Limestone Project (EL2122)

Given that:

- EL2122 extends over some of the better known and more spectacular karst in the area that limestone mining/quarrying can be totally destructive of karst,

It is therefore **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Urgently investigate the status of EL2122;*
- *Urgently inform the Mineral Resources Authority that EL2122 is within a World Heritage Tentative List area.*

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- *Urgently assess environmental impact of proposed quarrying/mining on heritage values, especially prospective Outstanding Universal Value.*
- *Lodge objections to EL2122 and any quarrying operation that is considered a threat to karst and associated heritage values.*

SABL's

Given that:

- the existence of Special Agricultural Business Leases (SABL's) within the Tentative Listed area

It is **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Actively investigate the potential for cancellation or prohibition of development of at least those parts of the SABL's within the existing boundary of the Nakanai Tentative Listed area.*

d) Towards Awareness, Recognition and Protection:

Given the:

Large scale of the Tentative List site;

Gaps in information on attributes and values and the pressing need to complete anthropological and archaeological surveys and documentation of the Nakanai Caves and cultural attributes of the surrounding landscape, publication of the results and development of a strategy to provide effective protection;

The limited area of protected areas within the site;

Existing and likely future threats, including mining, and industrial agriculture;

It is **recommended** that the:

PNG World Heritage Secretariat/Committee:

- *Promote awareness of the Nakanai Tentative List area and its heritage attributes;*
- *The need for the PNG Government to establish a process to address and reconcile known and potential conflicts between protection of globally significant heritage values, natural and cultural;*
- *Promote the case for major international funding and/or other assistance for this purpose.*
- *Actively promotes further formal protection of those parts of the Nakanai as landowners indicate a preparedness to support protection.*
- *Initiate annual dialogue sessions with the owners/managers of Kavakuna Wildlife Management Area (WMA).to ensure on-going commitment to protection of this important forest.*
- *Actively maintain liaison with the team of researchers from James Cook University, coordinated by Gabriel (co-author of this report).*

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Appendix 1: WHC Citation

The Sublime Karsts of Papua New Guinea

Nakanai Section:

Papua New Guinea

Date of Submission: 06/06/2006

Criteria: (v)(vii)(viii)(ix)(x)

Category: Mixed

Submitted by:

Department of Environment and Conservation

State, Province or Region:

East New Britain Province: Nakanai Range

Ref.: 5064

Description

The Nakanai Mountains is an area of outstanding natural beauty on the Island of New Britain, Papua New Guinea. To the north the mountain range is dominated by a group of spectacular volcanoes. It is bounded on the east by the Kol Mountains and to the west the Kapiura - Ania Divide which divides the Nakanai Mountains from the Whiteman Range.

Statements of authenticity and/or integrity

The ranges and plateau have only a very sparse human population, with only small villages generally on the lower lands. Various areas of flat or near-flat land are used for cultivation, but then once harvested are left to lie fallow until secondary forest is re-established. Some natural disturbance results from such causes as earthquakes or landslides. Thus, one can say that the natural forest has remained very much in its original but nevertheless, is in a dynamic and constantly changing state.

Comparison with other similar properties

As already emphasized, the Papua New Guinea environments must be recognised as distinctive. None of the other major underground rivers share the continuous volume and turbulence of the Nakanai Rivers. The giant Baliem River system in the Lorentz WHA of West Papua (and several other underground rivers) is of similar volume only during short periods of massive flooding which may not even occur every year. Aerial reconnaissance only suggests that a more comparable example may lie in a totally unexplored region of Halmahera in Indonesia.

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Location:

The Upper Sepik River Basin is located in the north west of Papua New Guinea. The Sepik River catchment of more than 70,000 square kilometres, is located on the north side of the main island cordillera and drains north east into the Bismarck Sea. The greater part of the catchment is undeveloped, without roads, and the main transport thoroughfare is the Sepik River which, with a length of around 1126 km, forms a virtual waterway 'highway' the length of the massive Sepik wetlands.

The site takes its name from the Sepik River basin and at 1126km in length is the largest river on the island of New Guinea.



Sepik River and village (Image: www.magellantraders.net)

1) Current Situation (listing, boundaries, action towards protection etc.)

Boundary:

At the time of nomination to the World Heritage Tentative List in 2006, an indicative boundary for the Upper Sepik site had been prepared. See diagram below. No details of how the boundary was developed could be located but certain deductions can be made. viz

Southern: Much of the southern boundary follows a prominent watershed which is also the boundary, in part, between East Sepik and Enga provinces and East Sepik and Southern Highlands.

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South West: The southern and south-western boundary also approximates the main divide between the Sepik River catchment to the north and the Fly River catchment to the south.

Western: The western boundary cuts across the Sepik catchment and it is apparent that this boundary was located so as to embrace the upstream limit of the Sepik River wetlands.

Northern: The northern boundary of the Tentative Listed site largely coincides with the boundary between the Sandaun (West Sepik) and East Sepik provinces but more likely the intent was to encompass the main wetlands.

Eastern: The rationale for location of the eastern boundary is not so clear; it is likely that the intent was again to embrace the main wetlands. Unfortunately, plots of the eastern boundary suggest that the boundary actually transects some of the larger wetland units and has no apparent regard for natural landscape features. It is possible that the intent was to use the well-defined Yuat River to delineate the nominated area.

South Eastern: Similarly, the south-eastern section of the boundary fails to reveal a clear rationale for its location. This is a problem because this section of boundary transects the 'Karawari Caves Precinct', the concentrated cluster of many caves with recorded cave art. As a result this review recommends an adjustment to the boundary to ensure that the recorded cave art sites are fully included within the Tentative Listed area.

It is understood that no action has been taken by PNG Government agencies to protect additional parts of the area since listing in 2006 or to consult with landowners.

Protection:

The official citation for the Upper Sepik River Basin Tentative Listed site includes the following statement.

"One protected area is established in the area - the Hunstein Range Wildlife Management Area (220,000 ha). Proposals for two adjacent WMAs totaling approx 48,000 ha have been submitted to the GoPNG in October 2005 and a number of further WMAs are being prepared. Plans exist to include these PAs on the Ramsar list."

UPPER SEPIK RIVER BASIN



The Upper Sepik River Basin Tentative Listed Site, as nominated in 2006, focusses primarily on the great tract of wetlands associated with the Sepik River but also includes some of the densely forested steeper escarpment and mountainous terrain of the southern tributaries of the Sepik.

It is apparent that the two proposed additions to the Hunstein Range WMA referred to have not occurred and so need to be investigated. Similarly, none of the Sepik has been nominated as a Ramsar Wetland of International Importance but reconsideration of nomination is one of the recommendations of this review.

It is understood that there are no currently active proposals for additional formal protection of lands within the Upper Sepik River Basin Tentative Listed Site. One limited exception is the proposal by Nancy Sullivan to seek protection of an area centered on the Karawari Caves Precinct, probably as a Conservation Area. Given her long association with the customary owners of the Karawari Caves Precinct, Nancy Sullivan is in a good position to facilitate landholder engagement in the process laid down for Conservation Area establishment. The process followed in the establishment of the YUS Conservation Area is an appropriate model for landholder participation.

2) Description of Site

The Sepik River heads in mountainous terrain of the main cordillera (vicinity of Telefomin) at an elevation above 2,000 metres asl. From this point the main thread of the Sepik flows steeply to the west, then north-west, before plunging through a narrow gorge at Yapsiei beyond which it spreads widely onto a vast floodplain. From Yapsiei the broad braided stream of the Sepik takes a huge curve, eventually swinging eastward. Indeed the Sepik below Yapsiei flows north-west to cross the international border into Indonesian New Guinea (Papua Province) before turning east and recrossing into PNG.

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From the international border, the Sepik takes on the character of a mainly single thread meandering stream featuring massive seasonal over-bank floodplain inundation. The floodplain features many areas of open water, some in the form of discrete floodplain lakes and others merging into treed wetlands and open water. The largest named lake, Chambri Lake, is about 16 kms long and 9 km wide, located east of Ambunti. Cut-off ox-bow lakes are numerous and continue to form on both the Sepik and some of its tributaries.

Lake Chambri approximately represents the most inland incursion of the sea at about 6,000 years BP (Before Present) according to Swadling. Others suggest that the maximum upstream extent of the sea during the Holocene was further east. It will be apparent from this that the vast tract of wetlands downstream (east) of Lake Chambri would likely have been open shallow sea as at 6,000 years ago, suggesting the Sepik wetlands in their present freshwater form are young and developed only in the past 6,000 years.

The World Heritage Tentative Listed area of the Upper Sepik embraces the greater part of the vast tract of wetlands associated with the Sepik floodplain but, interestingly, extends to include a number of the numerous southern tributary catchments. Heading in a high altitude/high rainfall mountainous region, the southern catchments play a significant role in the maintenance of wetlands on the southern side of the Sepik River and beyond.

From a conservation perspective, the series of tributary southern catchments are very important modules for planning protection and management of lands within the Tentative Site. The Hunstein Range WMA already sets a good precedent as a landscape unit that is largely independent of any future activities and development on adjacent lands.

Central to the Listed Area is a mountainous tract known as the Hunstein Range, almost surrounded by swampy reaches of the April and Karawari Rivers on two sides and the Sepik on the third. The Hunstein Range area - part of the April Salome Forest Management Area - has been the subject of a major dispute over logging rights and as a result of Government intervention is now largely reserved as Hunstein Range Wildlife Management Area. The traditional landowners were paid a substantial compensation for foregoing logging of these magnificent forests. The protected area is renowned for its unlogged tracts of the endemic Western New Guinea Kauri Pine *Agathis billardieri* and also includes the type locality of the Klinki Pine *Araucaria hunsteinii*, largest of the world's Araucarias.

The southern boundary of the Tentative Listing generally follows the high mountains demarcating the Highlands. Many parts of this section form a precipitous or even cliffed escarpment. In the south-eastern section, the 'Karawari' precinct, extensive cliffed escarpments include many rock shelters which contain important cultural features (see cultural values of Karawari section below)

A 'Karawari Caves Precinct' has been designed to delineate a major collection of cave art sites. Cave art sites are known in the rugged landscape further west and an indicative area has been designed to indicate the approximate extend of the as yet undocumented art sites.

3) Key attributes and values

3a. Natural Heritage

There has been only very limited further field survey of natural heritage attributes since listing in 2006. The only significant biodiversity studies have been undertaken as an extension of the on-going Karawari cultural studies in the south east of the site. These biodiversity studies provide useful additional information but are limited in evaluation of context.

The originally nominated natural heritage values were based on Shearman 1999 and remain relevant and if anything have been enhanced by on-going contributions and increasing awareness and understanding of the ecology and geography of the Sepik basin.

The main biodiversity surveys identified in the review included entomological research on Mount Hunstein (Cox et al) and as yet unpublished biodiversity studies associated with the Karawari Cave Art project (copies of drafts to be supplied).

The natural heritage significance of the Hunstein Range WMA has been enhanced by entomological studies.

3b. Cultural Heritage

The Sepik River is famous for its iconic Spirit Houses, or '*Haus Tambaran*', which function as a meeting-house and site for rituals and initiations. An array of carvings including masks, statues and figures are kept inside the Haus Tambaran. It is within the spirit house that groups of men perform the rituals and rite of passage ceremonies that are believed to be of vital importance for the economic, political, and ancestral well-being of the community in which it is located. There is a dearth of literature about the significance of the *haus tambaran* to Sepik River communities (see Coffey 1990; Jell and Jell-Bahlsen 2005).



Image from Lars Krutak.com (Anthropologist)

UPPER SEPIK RIVER BASIN



Anthropologist Lars Krutak has documented the scarification practices of communities along the Blackwater River, Middle Sepik. The skin-cutting ritual is a vehicle for the creation and re-creation of Sepik men.

The skin-cuts resemble the bumpy scaled skin of a crocodile, which artfully follow the natural contours of their body. Symbolically, the practice of scarification ‘fills’ men with the power of the crocodile spirit, which is the symbol of the Sepik River region.

“The Kaningara say that the crocodile spirit “swallows the initiates” just as their war canoes “devoured” their enemies. Some Sepik scholars suggest that the war canoe is the moveable (and aggressive) aspect of the spirit house. At Kaningara, an abstract and oversized canoe prow-like ornament with crocodile teeth hangs at the entrance of the spirit house. This is one of the many ways the Kaningara artistically render the crocodile spirit Nashut” (Lars Krutak).

A Cultural Heritage Precinct:

Major new cultural heritage attributes have been discovered and/or documented since the 2006 listing and with them a much greater knowledge and understanding of the cultural heritage potential within the Tentative Listed area.

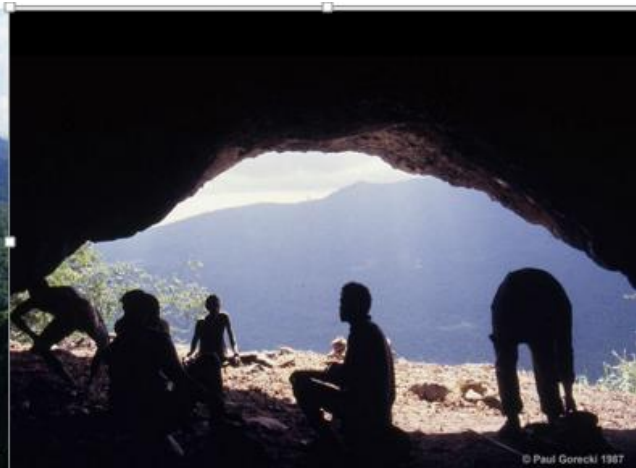


Photo: Paul Gorecki (1987)

The ‘Karawari Cave Art’ project has been on-going since the 2006 listing and generated a large amount of new information. The results of this work, which has only recently been widened to include biodiversity studies, are mostly as yet unpublished but the Review team has had extensive communications with anthropologist Nancy Sullivan, the leader of this research. Suffice to say, the Karawari project has contributed major new cultural attributes to the Tentative Listed site, values which were little known or ignored at the time of nomination.

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A report (in-press) by Jennifer Gabriel and Paul Gorecki provides considerable insight into the culture and symbolic conventions of the semi-nomadic peoples who inhabited the caves. Archaeologists Paul Gorecki and Rhys Jones were the first to systematically document the caves of the Upper Karawari and Arafundi region in 1987. The report highlights how the caves and the associated cultural assemblage of practices, beliefs and knowledge are the expression of how the people of this area understand their relationships to places, landscapes and geography.



Photo: Edwards & Sullivan (2008:26)

Gabriel and Gorecki (in press) note that the cultural connectivity of the Sepik River people with their environment has established common, yet distinct ways of ritualising the landscape to assert dominance over nature and the spiritual world, and to ensure success in warfare (in the past) and hunting. An array of ritual material, including sacred flutes, sculptures combining human and animal forms, carved masks and shields (to bring success in warfare and hunting), bark paintings, and spirit houses define the cultural connectivity of the Sepik River people, however subtle differences in style and cultural practices correspond to the areas along the river from which people come. In the inland regions of the upper Karawari and Arafundi ranges, known geographically as the 'Middle Sepik', 'hook figures' and 'hunting charms' were stored inside hidden caves. Initiations took place within special men's caves, which were the functional equivalent of 'spirit houses' for these groups of semi-nomadic people (Roscoe & Telban 2004:94). These material and metaphysical expressions are the property of small groups of people living along the Arafundi River hills, whom are unique among tropical forest people firstly, because they lived almost entirely as hunter gatherers at contact, and secondly because they were the creators of a rock art tradition that made caves functionally equivalent to men's spirit houses (Roscoe & Telban 2004:94). The cluster of caves in at least three river tributaries, which include villages and hamlets in the upper Karawari-Arafundi region can be defined inclusively as the 'Karawari Caves Precinct' (Gabriel & Gorecki in press – PDF attached).

A considerable effort has been given to understanding the national and global significance of the contributions of the Karawari project and how they relate to the previously quoted other cultural heritage values, particularly along the Sepik River. Active protection of the caves commenced with the Karawari Cave Arts Project, which began the conservation effort in 2008, as before that a lot of looting and destruction had occurred in these caves. The concerted and deliberate efforts of local people and Nancy's Sullivan's team working together

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since 2007 to find and document all the caves, educate the region about their importance, and learn more about the costs of development and conservation more generally, were all supported by Christensen Fund, Give2Asia, The National Geographic Society, Rainforest Norway Foundation, the Guggenheim Foundation and so many more supporters. In 2008, the conservation efforts generated an archaeological expedition by Antonio Cruz Mayor with personnel from Nancy Sullivan and Associates (NSA) and a team of participants from Easter Island, Chile, who visited caves in the Upper Karawari and Upper Arafundi area (including Pundimbung cave in Auwim) to conduct ethnographic and archaeological research.

3) Threats (incl. land use and land tenure changes, development)

Threats to the Outstanding Universal Values and other heritage values in the Sepik are many and varied. The main threats identified are outlined below.

Invasive Animal Species:

As with any wetland or waterway, there is an ongoing risk of invasive aquatic species being introduced deliberately or inadvertently into the Sepik and a number of serious introductions are already threatening the ecology of the wetlands, indeed the economies of local communities. The vulnerability of the Sepik to invasive species is greatly heightened because part of the upper catchment of the Sepik extends into Papua Province of Indonesia, a country that has a very poor record with biosecurity and a reputation of deliberate introduction of exotic fish to waterways of Papua, many of which have now been recognized as a threat to the indigenous aquatic ecosystems throughout the island of New Guinea.

The island of New Guinea has a rich indigenous biodiversity of aquatic species, in particular freshwater fish species. However, introduction of non-native fish species to the island in the past 50-60 years has been disastrous for the native aquatic ecosystems. Early introductions may have been well meaning for the purpose of improving fisheries to benefit the nutrition of local people but it is now clear that little attention was paid to the negative implications of such introductions. Some introduced species proved unsuccessful but others had major impacts on native fish species. Even as late as the 1990's, further introductions were made without real regard for the environmental impacts of their release into the wild.

Despite the vastness of the Sepik wetlands and waterways, they have not escaped introduction of non-native fish species. Benefits to local people have been noted in some cases but the mix of introduced species has been reported as counterproductive in some areas.

Most of the introductions to the Sepik were deliberate decisions of the colonial or national governments, often with the urging of the FAO. Several species became established as a result of escape from village aquaculture ventures. The Sepik has a mix of the more common introductions including at least one species of tilapia, carp and a giant gourami.

The risks of fish introductions without first fully researching the implications is illustrated by a somewhat notorious species, the Brazilian Giant Pacu, a piranha species previously considered to be strictly vegetarian. It has been found in the Sepik to behave differently to in its native habitat in the Amazon and evolved into a rapacious omnivore, decimating local fish stocks, destroying vegetation and natural habitats, and even diminishing crocodile numbers due to its taste for young hatchlings. Further, in its new habitat it is growing to 2 metres in length and around 50 kg. Its notoriety has given rise to a new local name, the 'Ball Cutter'. (dispela pis i kaikai bol bilong yu)

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The reality is that this once great intact aquatic ecosystem has been significantly compromised by often well-meaning but ignorant introductions of non-native fish species. The lesson to be learned is to take a great deal more care with research before any further fish species are released into Sepik - Ramu waters, indeed any PNG waters.

The notoriety of the 'Sepik River Piranha' is illustrated by someone's resort to verse on the subject.

Sepik River Piranha¹²

The people of the Sepik
Are hungry and need fish
Let's introduce the Pacu
That's a tasty dish
It may be a piranha
But it doesn't feed on meat
It mostly crushes nuts
With its large and fearsome teeth
Now the ball-cutter piranha
Feeds on other nuts
As it lurks in shallow water
Close to peoples huts

Invasive Plants Species:

As with most of the world's great wetlands, the Sepik has its fair share of introduced plants of which a significant number are invasive and ecologically detrimental and detrimental to the livelihood of the people.

A particularly troublesome weed, a floating fern called *Salvinia molesta*, is believed to have been inadvertently introduced at Pagwi by missionaries that had disposed of some *Salvinia* that had been used in a fish aquarium. By 1977 the smothering fern had occupied more than 37 sq. km. of the Sepik River. By 1979 it had appeared in the large Chamri Lake and was occupying a total of 79 sq. km, of which some 47 sq. km. was located in Chamri Lake - a truly devastating rate of spread and with major ecological and economic impacts (Richards 1979).

The *Salvinia* infestation of the Sepik was clearly out of control until the fortuitous application of biological control by the introduction of a beetle, *Cyrtobagous salviniae*, in the early 1980's and by 1985 was being actively and widely spread with the result that within a few years "most of the large infestations had broken up and been washed out to sea" (Shearman 1999).

Shared with many other lowland rivers on the island of New Guinea and Australia is the floating South American Water Hyacinth, *Eichornia crassipes*, the scourge of lowland wetlands. Only a recent arrival in the Sepik, by the 1980's it had spread as predicted and rated as a serious weed, smothering many of the ox-bow lakes in the mid and lower Sepik with serious consequences for fish and fishing. Water hyacinth is probably the most dramatic of invasive water plants and which has had major ecological and economic impact on many tropical and sub-tropical waterways and wetlands. It has been known to completely stop navigation on some waterways.

¹² By Anonymous? <http://envirowizard.blogspot.com.au/2011/11/sepik-river-piranha.html>

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A control program was commenced with help from CSIRO Australia, commencing with introduction of a weevil that had been proving effective in control of hyacinth in Australia. The weevil bores into the hollow stem, allowing water to enter, with the result that the plant sinks and dies.

The CSIRO achieved spectacular results in the Sepik within 5 years of introduction of the weevil. However, the weed is understood to still be present and capable of reestablishing unless the weevil population is maintained. A second beetle species has been introduced but the control of the water hyacinth requires vigilance and on-going commitment of resources to monitoring and supporting the biological control with captive breeding of the weevil and beetle for regular distribution.

There are a number of other species of aquatic weeds that have been introduced into the Sepik but perhaps the Sepik has already seen the world's worst of known aquatic weeds in *Eichornia* and *Salvinia*.

A major potential threat to the Sepik is from a species already introduced to PNG, probably on logging equipment from Malaysia, the Giant Sensitive Plant, *Mimosa pigra*. Although not a floating aquatic, it has the potential to be absolutely devastating on seasonally flooded lands in the Sepik. Sometimes described as the perfect weed, it is highly invasive, shades out other species of plants, is thorny, produces huge number of long lived seeds and to date, there appears no prospect of any biological control. **The potential threat of Mimosa to the Sepik ecosystem and its people cannot be overstated.**

Bio-security and quarantining must become a high priority as developments, such as the proposed Frieda mine, occur in the headwaters of the Sepik. These sorts of development in the headwaters can be a high risk source of new invasive weed species. Given that a part of the headwaters of the Sepik cross an international border, trans-national cooperation is essential.

Given that a number of serious aquatic weed species are now extensively established in the Sepik, it is critically important, both from an ecological and economic perspective that an aquatic weed strategy is in place and resources are allocated for **on-going weed management**.

The reality is that if the ecological and economic attributes of the Sepik are to be maintained, it is absolutely essential that a permanent whole-of-river-basin invasive species management program is established and resources are dedicated to on-going monitoring and strategic intervention.

The opportunity exists for funding of an Invasive Species Management Program (ISMP) by imposition of a 'river levy' on barging transport along the Sepik waterway by Frieda mine. Control of water hyacinth alone would be essential to maintain the navigability of the Sepik for barge and other traffic by Frieda mine.

Mining:

Current and future mining operations are almost ubiquitous in Papua New Guinea. Very soon, all major river catchments on the mainland will contain mining development, usually including open cut mining. That point has yet to be reached with the Sepik as no mining has yet commenced operations in the Sepik catchment. Most notable and most advanced of the

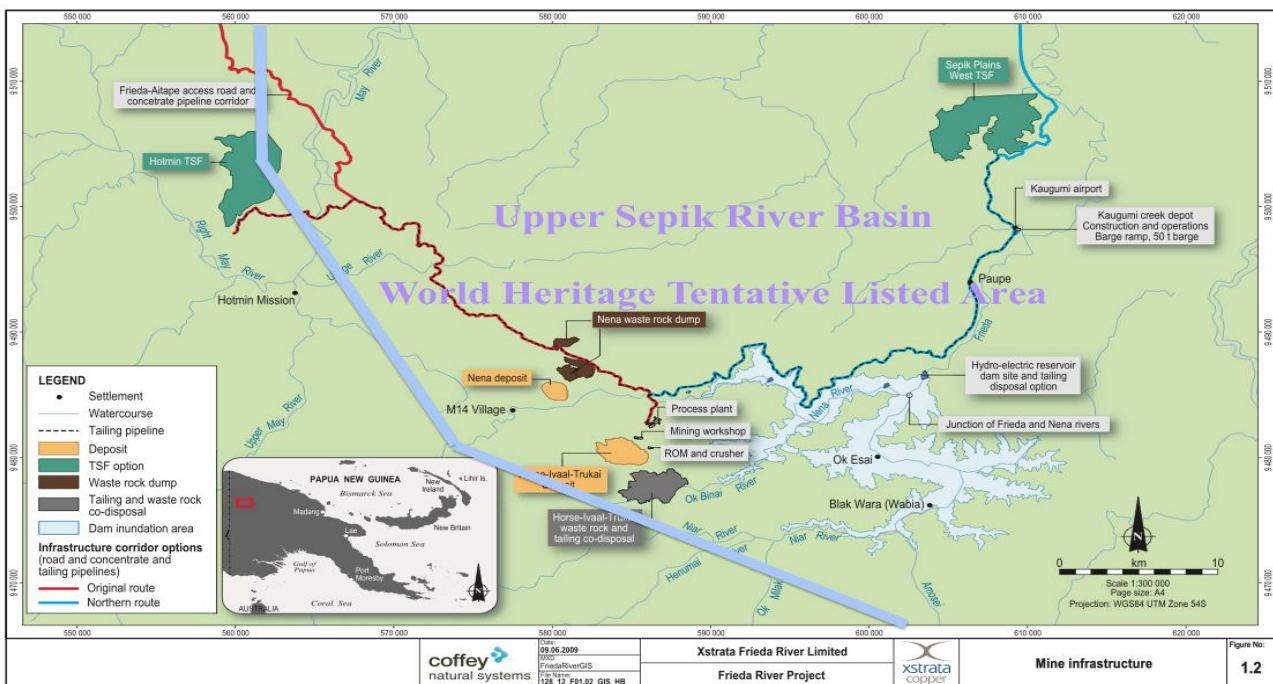
UPPER SEPIK RIVER BASIN

proposed and prospective mining developments in the Sepik is the Frieda mine in headwater tributaries of the Sepik, the Frieda and May Rivers. Approval processes for Frieda mine are now underway and at this time no approvals have been granted to proceed to production stage.

Exploration permits have either been granted or are pending for a large tract of mountainous terrain along the southern slopes and escarpment of the basin, including over the Karawari Caves Precinct.

It should be noted that the major development which forms the Frieda mine complex is almost wholly within the Tentative List site and so obviously represents a serious conflict between the aspirations of the mine owners and the aspirations of establishing the Sepik as a World Heritage Site using the same boundaries as the Tentative List site.

“The Frieda River Copper-Gold Project is located on the border of the Sandaun and East Sepik provinces in Papua New Guinea (Figure 1), in the foothills of the Schattenberg Range at elevations ranging from 300mRL to 800mRL. The Project comprises four copper-gold deposits and several prospects along a 10 kilometre trend and is one of the largest known undeveloped copper deposits in the world. The joint venture feasibility study will focus on the HIT porphyry deposit” (PanAust ASX Announcement 2 September 2014).



Most of the proposed mine development and associated infrastructure is within the Tentative Listed Area. (Base map from Xstrata Environmental Inception Report 2009, World Heritage Tentative List boundary (blue) and annotation added)

Potential first production is currently claimed to be not before 2016.

The owners of Frieda mine as at 2010 (Xstrata) had previously published their Environmental Inception Report (2010) and Xstrata Copper delivered a Feasibility Study and 2012 Study Program Report in December 2012, identifying a potential operation with an estimated capital cost of \$5.6 billion, and an estimated average annual production profile of 204,000 tonnes of copper and 305,000 ounces of gold, over a 20-year mine life.

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Xstrata subsequently sold its interests in the Frieda mine and the mine is now owned by joint partners comprising PanAust (80%) and Highlands Pacific (20%), both Australian based companies. The PNG Government owns 30% of Highlands Pacific and has the right by law to purchase an overall interest up to 30% in the Frieda mine. The Chinese provincial Government company, Guangdong Rising Assets Management (GRAM), which holds 22.8% of PanAust shares, has been attempting to buy out the whole company but has to date been rebuffed by PanAust. It appears that this move has given rise to local reference to the Frieda mine as the “Chinese mine” but given that the takeover has so far not succeeded, the mine is certainly not owned by a Chinese government company.

NOTE: It is apparent that recent change of ownership of Frieda is precipitating review of the approach to development of the Frieda resource so there is a need to closely follow any changes to this proposed major mining operation in the Tentative Area. See Appendix 6

In all probability the Frieda mine will be not be the only mine to be developed in the Sepik basin region. A tract of prospective geological formation running east from Frieda is the subject of extensive exploration interest, extending east to beyond the Tentative Listed area. (See <http://portal.mra.gov.pg/Map/>) It will therefore be necessary to more closely study the heritage values of the southern margins of the Tentative List area and to closely monitor any mining proposals for implications on the natural and cultural values of the area. This is particularly important given the already identified extensive and important cultural heritage, in particular the cave art of the ‘Karawari Caves Precinct’. Mining in this precinct could be devastating to the cultural heritage values that only survive because of their relative remoteness.

Impacts of Frieda Mine

The Frieda mine will undoubtedly have significant impacts on the heritage values of the Upper Sepik River Basin Tentative List area. Although no environmental impact assessment has yet been publicly released it is apparent that the mine will have a number of identifiable impacts on the heritage values, natural and cultural including but not limited to:

Direct impact on mine site precinct (located towards the head of a tributary catchment, there are implications for all downstream river environments.) On-site developments include open cut mines, tailings disposal areas, airport, water storage dam, power generation facility, pipelines, powerlines, roads, residential camps etc.

Barge transport (The current plan is for all ore concentrate to be shipped the length of the Sepik River and so serious environmental implications arise for the entire length of the river - and the communities - along the river. Similarly, barges will be backloading fuel oil and mining equipment and chemicals. The risk of mishap with barges carrying both copper ore concentrate and such consumables as fuel oil and chemicals should not be overlooked.)

Frieda River Mine Implications for Tentative Listed Area?

There is no doubt that the proposed Frieda mine has serious implications for the existing Upper Sepik Basin Tentative Listed site, both directly and indirectly.

Direct: The proposed mine and associated roads, pipelines, airstrip, dam infrastructure is almost all located within the Tentative List site (see map above). Depending on whether the mine proceeds and what form it takes, there may be a need to make a substantial excision of the development from the Tentative Site.

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Indirect: The major barge traffic on the Sepik River will no doubt have an impact on the ecology and aesthetics of the waterway and on the economies of communities along the river. The barge traffic is likely to seriously detract from the aesthetics and hence the current tourism appeal of the river.

The whole operation has a high potential to introduce invasive species, both via the mine site and operations and via the barging process. A high level of on-going biosecurity engagement will need to be applied to the whole Frieda operation to minimise the threats to the ecology of the Sepik.

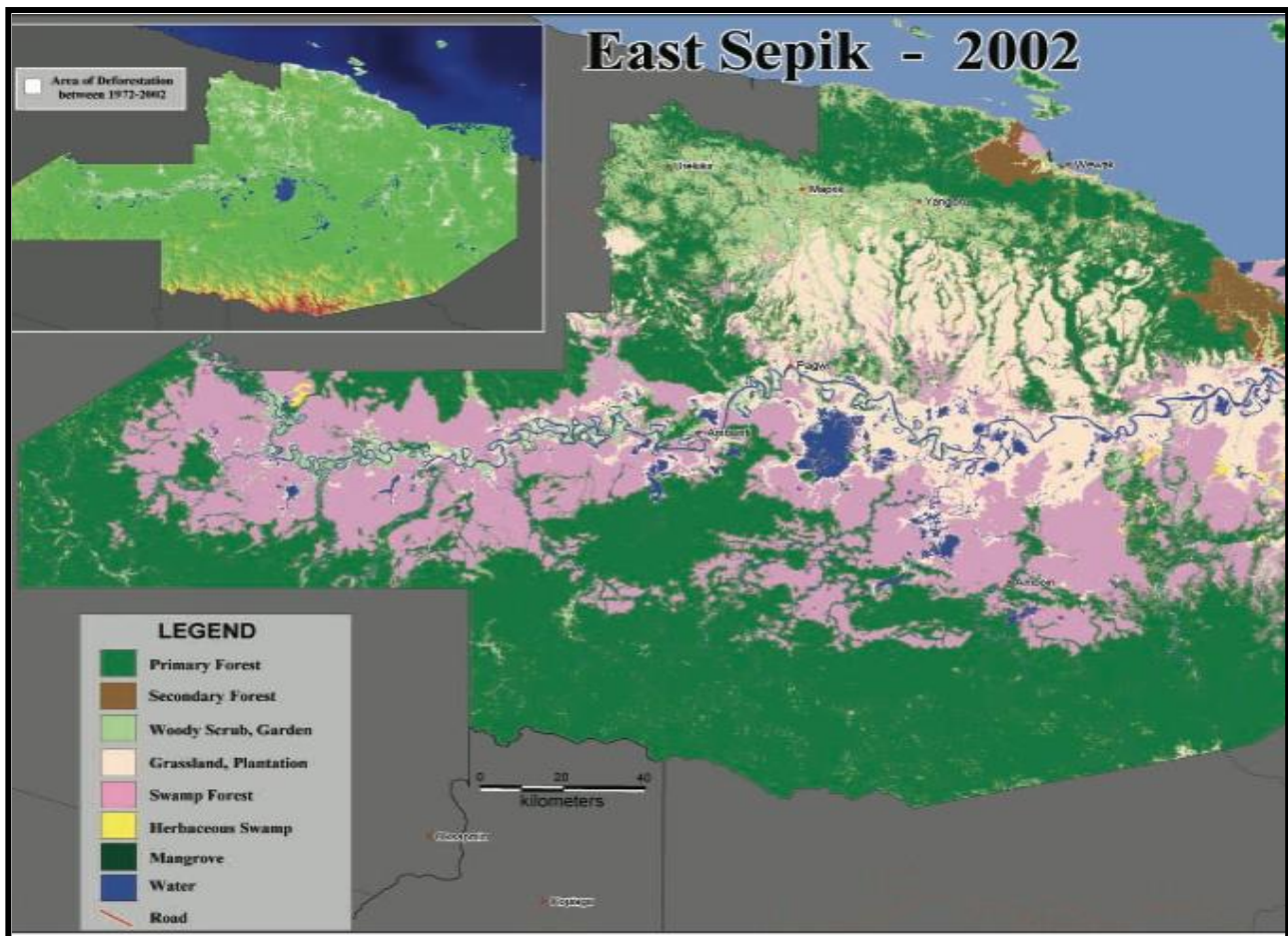
The PNG Government, already holds a financial interest in one of the Frieda joint partners, and is potentially a purchaser of up to 30% of the total holding in Frieda. Further, it is also the mining regulator and environmental assessor of the mine. Under the World Heritage Convention, the PNG Government it is also responsible for the protection of areas of Outstanding Universal Value. Under the circumstances, the PNG Government is placed in a position of potential conflict of interest, especially given the prospect of financial gain from being a partner in the proposed Frieda mine. Such a conflict of interest does not auger well for fulfillment of World Heritage commitments in respect of the Sepik Tentative Site.

Logging:

Logging of primary forests has already been an issue, in particular the landowner reaction to proposed logging in the April Salome Forest Management Area. The details of this major dispute will not be presented here other than to record that one of the outcomes was the protection of a substantial part of the Management Area, gazetted as Hunstein Range Wildlife Management Area of some 220,000 ha.

It is apparent that there are a number of logging concessions over parts of the Sepik Tentative Listed area but further research would be necessary to establish whether logging is already occurring or is planned. At least one of the SABL's on the north side of the Sepik River has been recorded by the Chinese owners as being held primarily for the purpose of logging. (PNG Resource Holdings Pty Ltd.) though this claim has recently been removed from their website. Logging of this large tract has already commenced but the legality has been questioned along with the legality of the agricultural lease.

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This forest type map illustrates the dominance of wetlands and swamp forest in the Sepik basin. A continuous tract of mainly rainforest extends along the upper catchments of the numerous rivers flowing north into the Sepik River. The primary forest (green) area south west of Chamri Lake and almost surrounded by swamp forest, is the Hunstein Range, much of which is already a protected area (Hunstein Range WMA). (Image: Shearman et al 2008)

Any logging in the southern catchments of the Sepik must be regarded as environmentally problematic given the need for road access to be developed. Logging and associated roading particularly represents a threat to the many cultural sites that presently enjoy a high degree of protection by virtue of their remoteness. Logging roads could radically change the access, hence remoteness and lead to a serious threat to these important sites. **At the very least, a moratorium on any logging in the southern catchments of the Sepik is highly recommended.** Any and all logging and associated road construction would detract from the natural and cultural heritage values of the Sepik Tentative Listed area and so should if possible be avoided.

Special Agricultural Business Leases (SABL's):

There is map evidence of at least three issued SABL's extending into the Sepik Tentative Listed site. These comprise three large adjoining blocks on the north side of the Sepik, extending from the vicinity of Yellow River in the west to adjacent to Ambunti in the east. The western most block has direct frontage onto the Sepik River and the eastern most block has a short frontage on to the Sepik.

All of the SABL's in PNG have been the subject of an inquiry regarding the legitimacy of the leases. In the Sepik region, the Commission of Inquiry recommended the cancellation of at least the largest of the SABL's that intrude into the Tentative Listed area, the SABL held by

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PNG Resources Holdings (originally a Cayman Island registered Chinese real estate and pork business, previously known as Le Roi Holdings. The company registration has recently been moved from the Cayman Islands to Bermuda).

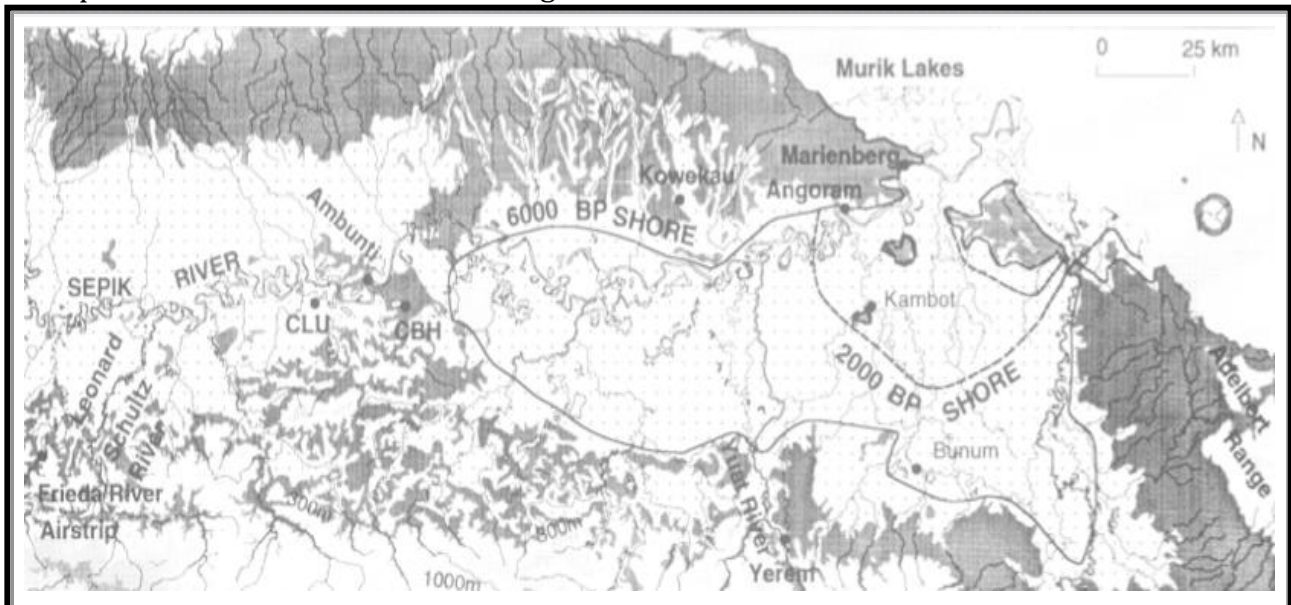
The recommendations of the Commission of Inquiry have now (October 2014) been with the Government for more than a year and it is understood that no decision has yet been made.

Logging and agricultural activities arising from the three SABL's extending into the Tentative Listed area would certainly detract from the heritage significance of the area and has the potential to seriously impact on heritage values. Development of that part of any of the SABL's within the Listed Area should be avoided if at all possible.

It is not known if the Commission of Inquiry was aware of the World Heritage Tentative List status of parts of the three SABL's. There is a clear need to follow up on the status of all three SABL's and any development activities arising from this tenure.

Climate Change/Sea Level Rise:

At about 6,000 years BP, a large proportion of the present-day middle and lower Sepik floodplains were a shallow sea. See diagram below



Indicative Sepik shorelines in the Holocene. Note that the 6,000 BP shoreline extended far up the Sepik to about the western shore of Lake Chambri just east of Ambunti (Image: Swadling 1997)

This earlier higher sea level and associated major extension of the sea up the Sepik valley has attracted the interest of archaeologists because of the evidence of apparent shoreline settlements far inland from the existing coastal shoreline. See section on cultural heritage.

This earlier marine shoreline extends well into the Tentative List area and also provides a guide to the likely implications of a now rising sea level. Implications of the now rising sea level are not just about increased inundation but also salt water invasion of freshwater wetlands like the Sepik, indeed, in the case of the Sepik, the sea are likely to eventually invade the freshwater wetlands of the Sepik for a considerable distance inland from the present coast. Changes in salinity would impact on the aquatic life, in particular for fish and so could impact on the local economies dependent on fish.

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The existing freshwater wetlands of the Sepik were in large part created by a falling sea level but conversely, a now rising sea level driven by climate change has the potential to threaten the Sepik wetlands both in terms of extent and by increased water salinity.

The one obvious potential for climate change to seriously impact the Sepik is rising sea level but there may be other threats not yet predicted and published such as reduced rainfall.

The now validated predictions of future global sea level rise as a consequence of global warming allow firm prediction that rising sea levels will definitely impact on the Sepik wetlands. However, the precise nature and timetable of impacts are less clear.

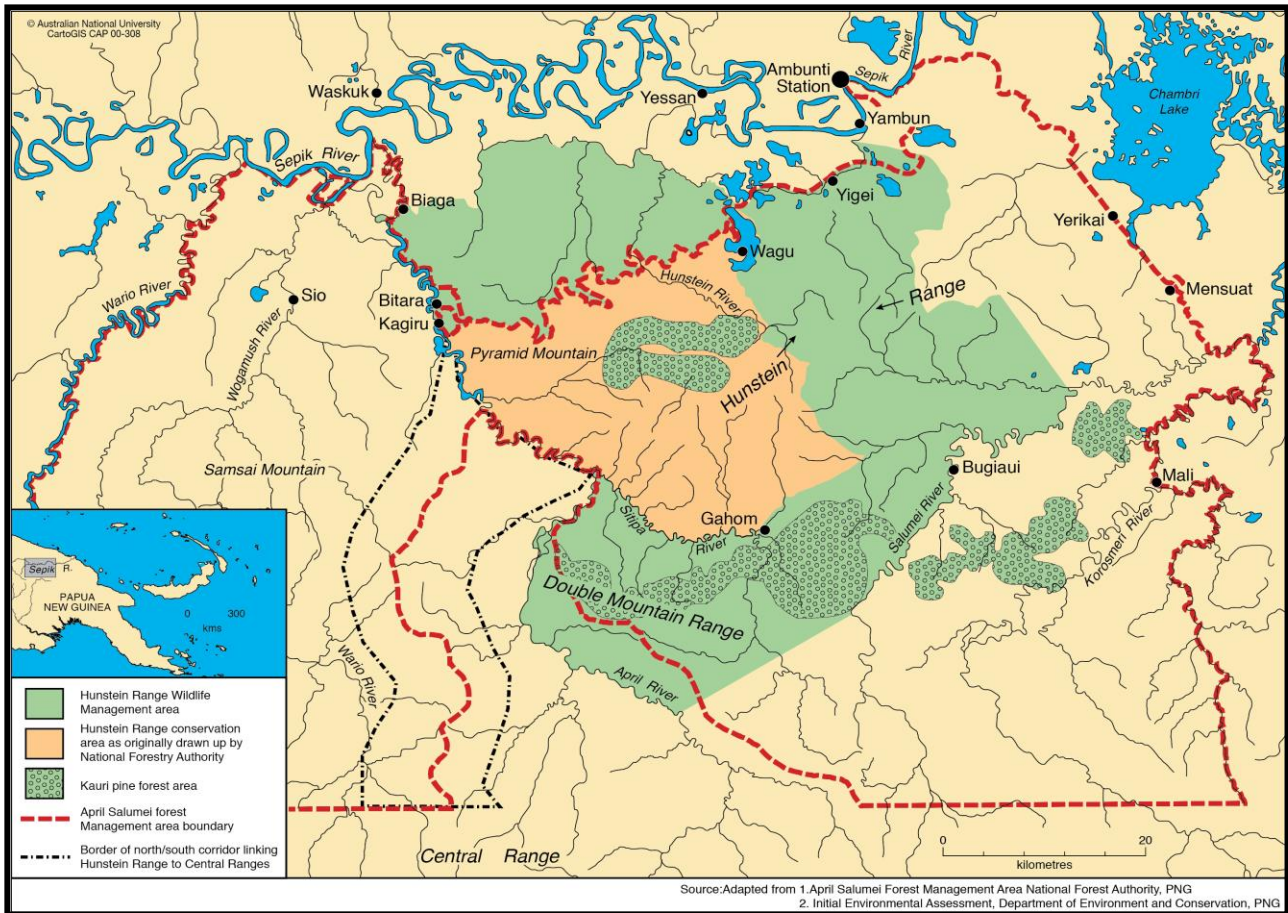
Conclusion on Climate Change: Of the forecast impacts of global climate change, the one aspect that is a definite threat to the existing ecological and economic systems of the Sepik, is through rising sea level. Climate change may have other impacts such as reduced rainfall but modeling suggests that the changes in the Sepik region will be less problematic than sea level rise. Impacts of climate change can be expected to first appear in the lower elevation downstream sections of the wetlands system.

4) Protection Needs

Some progress has already been made by PNG in protection of the Sepik Tentative List area. The Hunstein Range WMA is a very important first step in the protection of the heritage values contained in the Sepik Tentative Listed area but needs to be complemented by further protection of key areas of globally significant environments. In particular, from a natural heritage perspective there is a need to secure a major tract of the main wetlands, especially incorporating as complete a range of the natural diversity of the Sepik River wetlands (e.g. lakes, oxbows, sedge swamp, swamp forest etc).

Extension of the Hunstein Range WMA northwards to include an outstandingly diverse river and wetlands environment (between April River and Ambunti) and north easterly to include Chamri Lake may provide a viable first step for world heritage nomination based on natural heritage values.

UPPER SEPIK RIVER BASIN

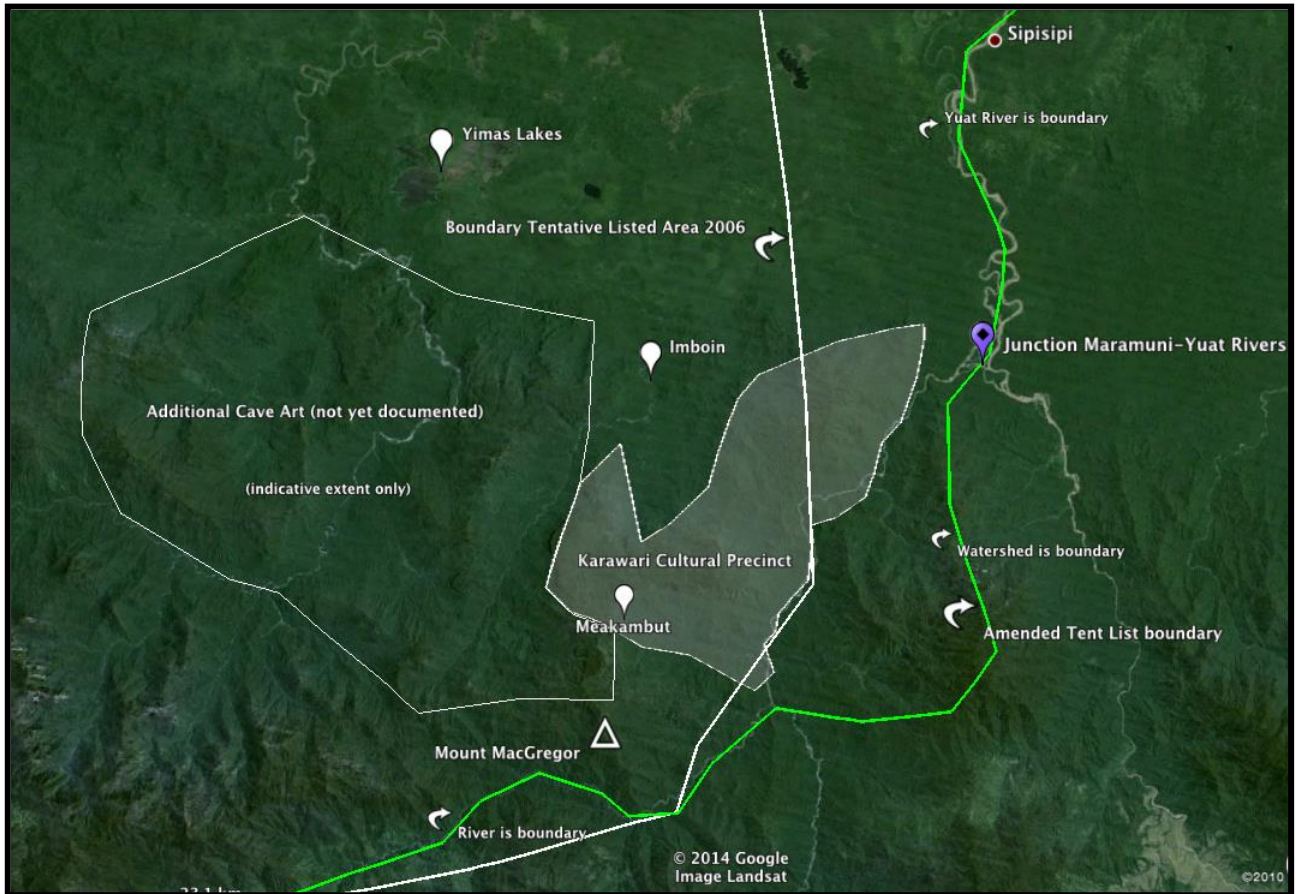


Hunstein Range Wildlife Management Area (WMA) within the April Salome Forest Management Area. This vitally important protected area is at the very centre of the Tentative Listed site and represents a good starting point for protection of additional areas.



Hunstein Range WMA is central to the Sepik Tentative Listed area and includes important stands of forest including an outstanding example of unlogged Western New Guinea Kauri *Agathis billardieri* and also contains the type locality for Klinki Pine *Araucaria hunsteinii*. The WMA also includes an outstanding wetland unit in the form of the Wagu Lake wetlands. The lake is especially valued for its birdlife.

UPPER SEPIK RIVER BASIN



Karawari:

Information assembled during the review clearly indicates that there is a major new cultural precinct of definite national significance **and likely global significance** that urgently requires protection. The most effective interim protection is to maintain the existing remoteness and lack of vehicular access and to maintain a positive working relationship with the customary landowners.

Karawari as a separate entity?

One of the questions that arise as a result of the new information relating to the cultural heritage attributes in the Karawari project area currently being worked on by anthropologist Nancy Sullivan and the local community is whether the Karawari 'Caves precinct' might be considered as a separate Tentative List site.

One line of argument is that the documentation of the Karawari Caves precinct suggests that the cultural attributes are of 'Outstanding Universal Value' and that there may be a case for its separate recognition. It is fortuitous however that a large proportion of the cave art sites, of which there are hundreds, fall within the existing Upper Sepik River Basin Tentative List site. A minor adjustment to the boundary would ensure that the whole of the Karawari Caves Precinct is included in the Tentative Listed area. Details of that boundary adjustment are illustrated in the diagram above.

A second line of argument is that Karawari does not need to be a separately listed area but rather the description and values of the existing site be updated in recognition of the new information.

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The original nomination of the Sepik, including listing against cultural heritage criteria, but made no mention of the Karawari cave art sites. Instead, mention was made of the famed 'Haus Tambaran' culture along the river. The site therefore already is seen as including likely OUV cultural heritage independent of the Karawari precinct.

The 'Karawari Caves Precinct' is mostly within the existing Tentative Listed area but partly extends beyond. It is proposed to adjust the TL boundary, as indicated by green line, to fully accommodate the known extent of the cave art precinct.

Following some deliberation on these two options over the past 4 years, including dialogue with UNESCO World Heritage Centre, this review recommends that special recognition be given to the Karawari precinct as being of National Heritage significance but given that the international significance requires further deliberation, Karawari should remain as an integral part of the existing Tentative Listed site. This therefore requires the Description of the Tentative Listed area to be updated to recognize the new cultural heritage information in the Karawari area.

6) Revised Description

There is a case for revising the official description of the Sepik Tentative Listed area, especially to disclose the identified new values and new threats.

A revised Description is at Appendix 5.

7) Revised Statements of authenticity and/or integrity

A slightly revised statement is at Appendix 5.

8) Revised Comparative Analysis

No changes proposed.

CONCLUSIONS

Attributes/Values:

This review reaffirms and reinforces the outstanding heritage potential of the Upper Sepik River Basin Tentative Listed Area. Additional important attributes, both natural and cultural heritage, were identified and documented. There is a pressing need to complete field surveys and documentation of the Karawari Cave Art precinct, publication of the results and development of a strategy to provide effective protection.

Notwithstanding the type and scale of newly documented cultural heritage attributes in the Karawari precinct, it is recommended that this precinct, presently partly within and partly outside, be fully incorporated into the Tentative Listed area. The existing Tentative Listed site, with minor boundary adjustment, should be retained but that the official description in the WHC citation be updated to accommodate the new knowledge of attributes and values.

Threats:

Some definite threats to the values, current and potential, were identified. Invasive plant and animal species are already impacting on the Sepik environment and potential additional

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threats were identified. The most serious imminent threat identified in this review is the development of the Frieda copper mine in the headwaters of the Sepik. Giant mimosa is the most serious biological potential threat.

Current and future proposals for logging, mining and agricultural development represent threats to the area for both natural and cultural heritage.

Protection:

Since nomination in 2006 there has been no progress in protection of the identified heritage values in the Tentative Listed area. The existing Hunstein Range WMA represents an excellent first step in protection of important values but there is an urgent need to initiate additional protection as opportunities permit.

Management:

Given the existing serious invasive species issue and the high risk of additional invasive species, there is an urgent need to ensure that an on-going and adequately resourced Invasive Species Management Program is established.

The Sepik River wetlands are one of the world's great wetlands but their maintenance and protection will only be achieved via on-going intervention and management. The 'do nothing' option is not an option for maintenance of the outstanding natural and cultural heritage values.

9) Recommendations Arising

The Sepik River basin contains of the world's great wetland ecosystems. Complementing the wetlands are tracts of primary forest of outstanding conservation value. Notwithstanding that much remains to be explored in terms of natural and cultural heritage within and adjacent to the Tentative Listed site, this review has confirmed the high probability of Outstanding Universal Values, both natural and cultural, existing in the site. Therefore, in accord with the undertakings given by the Government of Papua New Guinea under the 'World Heritage' Convention, there is a need to actively monitor and as far as practicable maintain those values. A concerted effort will be required to maintain the existing values and to achieve an appropriate level of protection. The following recommendations provide a pathway forward for monitoring and protection of the global significance of this outstanding area.

a) Name:

Whilst there may be a case for eventually shortening the name of the Tentative Listed site, no purpose would be served at this very preliminary stage.

Accordingly, it is **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Retain the name of the Tentative Listed area and any nomination process continues to be known as Upper Sepik River Basin.*

b) Boundary:

Given the:

- existence of at least a tentative boundary,
- tentative boundary appears mostly logical and defensible,

UPPER SEPIK RIVER BASIN

It is **recommended** that:

The PNG World Heritage Secretariat/Committee:

- *Adjust the boundary to incorporate the whole of the Karawari Caves Precinct*
- *Register the (amended) boundary of the Tentative Listed site with DEC GIS branch and with other relevant branches, together with relevant PNG government agencies, in particular the Mineral Resources *Authority, the Department of Petroleum and Energy and Provincial Government.*

**(It would be valuable if MRA were to include boundaries (where they exist) of Tentative List sites in their on-line Mining Cadastre Portal.)*

“UPPER SEPIK TENTATIVE LIST BOUNDARY.kmz”

c) Responding to Threats:

Proposed Frieda Mine:

Given the:

- major investment already made towards development of the Frieda mine in the head of the Sepik basin and
- recent change of ownership of the tenement and mine proposal and hence
- the probability that the mine will proceed in the foreseeable future

It is **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Actively engage in contributing a heritage perspective to the process leading towards any whole-of-Government approval of the mine.*
- *A suggested set of conditions that might be requested for attachment to any approval for the Frieda mine is at Appendix 2.*

Invasive Species:

Given the:

- Proven vulnerability of the Sepik river and associated wetlands to the impacts of invasive aquatic species, both plants and animals;
- Potential for **major environmental and economic impacts** from invasive species, plants and animals

It is **recommended** that:

The PNG World Heritage Secretariat/Committee

Actively engage in promoting the need for a PNG Government commitment to a national program for on-going active surveillance and management¹³ of invasive species in the whole Sepik catchment, in particular of aquatic plants and animals.

SABL's

Given the:

- Existence of at least three granted SABL's within the Tentative Listed area, totaling possibly more than 150,000 ha;
- Recommendation of the Commission of Inquiry that at least one of the subject SABL's be cancelled

¹³ Includes prevention of introduction, early warning detection of invasive, eradication where practicable and on-going management of invasive species established in the catchment.

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It is **recommended** that:

The PNG World Heritage Secretariat/Committee

- *Actively investigate the potential for cancellation or prohibition of development of at least those parts of the SABL's within the existing boundary of the Sepik Tentative Listed area.*

Towards Awareness, Recognition and Protection:

Given the:

- large scale of the Tentative List site,
- gaps in information on attributes and values,
- the limited area of protected areas within the site,
- existing and likely future threats, including mining, invasive species and industrial agriculture

It is **recommended** that:

The PNG World Heritage Secretariat/Committee actively promote:

- *Awareness of the Upper Sepik River Basin Tentative List area and its heritage attributes;*
- *The need for the PNG Government to establish a process to address and reconcile known and potential conflicts between protection of globally significant heritage values, natural and cultural;*
- *The case for major international funding and/or other assistance for this purpose.*
- *Further formal protection of those parts of the Sepik as landowners indicate a preparedness to support protection.*
- *Initiate annual dialogue sessions with the owners/managers of Hunstein Range Wildlife Management Area (WMA) to ensure on-going commitment to protection of this important forest.*
- *Seek to nominate the Sepik Wetlands as a Ramsar Wetland of International Significance as an important interim recognition of the global significance of the wetlands. (The wetlands contained in the Tentative List site would likely readily qualify. Such a nomination would represent a significant further step towards the protection of the wetlands and would represent the third Ramsar listing for PNG. The criteria for nomination of a Ramsar wetland are at Appendix 3.)*

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Appendix 1: Citation for Tentative Listing**Upper Sepik River Basin**Papua New Guinea**Date of Submission:** 06/06/2006**Criteria:** (i)(iii)(iv)(v)(vii)(viii)(ix)(x)**Category:** Mixed**Submitted by:**

Department of Environment and Conservation

State, Province or Region:

East and West Sepik Provinces

Ref.: 5065**Description**

The property is a mixed cultural and natural site covering the middle and upper reaches of the Sepik River basin including slopes of the Central Range and potentially the Torricelli and Prince Alexander mountains. The Sepik River at 1126 km in length and covering an area of 7.7 million hectares is one of the world's greatest river systems. It is the largest unpolluted freshwater system in New Guinea and among the largest and most intact freshwater basins in the Asia Pacific. The diverse habitats of the basin rate as globally significant on a number of biodiversity indices. The area contains two Global 200 eco-regions, three endemic bird areas and three centres of plant diversity. Vegetation types, at altitudes from 0 to 3800 metres asl, include mangrove forest, herb swamps, tall lowland rainforest, cloud forest, and alpine heaths. The Telefomin region is said to contain the greatest marsupial diversity on the planet. Threatened species such as the New Guinea Harpy Eagle, Victoria Crowned Pigeon and the Northern Cassowary remain common and a number of restricted range birds are represented. The Sepik river fish fauna reflects the Great Northern Fish province, sharing many species with the Ramu and Mamberano Rivers. Important waterbird and crocodile populations are supported by the 1500 lakes and other wetlands associated with the basin. The Sepik River is one of the least developed areas in PNG and home to approximately 430,000 people who depend almost entirely on products from the rivers and forests for their livelihoods. This is perhaps the most linguistically and culturally diverse area in the planet with over 300 languages in an area the size of France. The area is famed for the gabled spirit houses or "haus tambarans", one of the most dramatic examples of indigenous Melanesian architecture, and a very rich ceremonial carving and music tradition. Sepik peoples maintain their cultural integrity proudly and have influenced styles across the nation. One protected area is established in the area - the Hunstein Range Wildlife Management Area (220,000 ha). Proposals for two adjacent WMAs totalling approx 48,000 ha have been submitted to the GoPNG in October 2005 and a number of further WMAs are being prepared. Plans exist to include these PAs on the Ramsar list. The Sepik Wetlands Management Initiative is addressing crocodile habitat retention and invasive species removal across the Middle and Upper Sepik River and adjacent lakes. A catchment management programme, led by WWF with a range of stakeholders, aims to establish coherent management of this region.

Statements of authenticity and/or integrity

The Upper Sepik is the heart of one of the least modified landscapes in the Asia Pacific. A major river runs free without dams, weirs or industrial developments. A band of unbroken rainforest extends for hundreds of kilometres. There are few places left in earth in this condition. A World Heritage listing would reinforce efforts to ensure that these values survive while also encouraging sustainable development for some poor and remote communities whose average income rarely exceed US\$10.00 per person per annum. There a few places in

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Melanesia where cultural heritage is as diverse, dramatically displayed or proudly protected. And yet change is coming rapidly to this region. World Heritage listing linked with an effective catchment management regime can offer a chance to draw tourism, support sustainable development and foster the celebration of the Sepik's rich cultural heritage.

Comparison with other similar properties

No properties represent elements of the biodiversity or culture of the northern catchments of New Guinea. Lorentz World Heritage Area protects some species that are shared with this region but there are significant differences in species composition, ecosystems, climate and geology.

Appendix 2: Suggested Conditions that might attach to any approval for the proposed Frieda Mine

Pipeline Vs Barging of Copper Concentrate:

Given that:

- the proponents of the Frieda mine have previously identified a pipeline to the north coast for transport of ore concentrate as an alternative to barging the length of the Sepik River ;
- the very much lower risk to the Sepik river and wetlands of spillage from a pipeline compared with any spillage from barges

Accordingly, it is **recommended** that

- Further consideration be given to the pipeline option.

River and Wetlands Levy:

Given that:

- Many activities associated with the proposed mine in the upstream of the Sepik catchment have the potential to have downstream impact, especially the river and associated wetlands;
- The major barge traffic along the length of the Sepik River has high potential to impact on the river and wetland environment;
- The need for on-going active surveillance and management of invasive species of plants and animals (see recommendations in report)

It is suggested that:

- *The proponents of the Frieda mine be subject to a Sepik River and Wetland Levy* for the purpose of funding on-going surveillance and monitoring of invasive species and any remedial work required as a consequence of detrimental environmental impact occasioned by the barging activity.*

*The levy could be based on tonnage of material transported in both directions.

Biosecurity:

Given that:

- Activities associated with the proposed mine have the potential to be the vectors for the introduction and spread of invasive species in the Sepik River catchment.
- Barges have been implicated in introduction of invasive species e.g. introduction of rats into Renell Island in the Solomons (site of East Rennell World Heritage Site) by logging barges.

*There is a need for **strict biosecurity conditions** to be imposed on all activities associated with the mine within the Sepik catchment. For example, there should be strict prohibitions on exotic species of fish being transported to the mine site where there is a risk of escape/release into the river (The seriously invasive plant *Salvinia* is alleged to have been introduced into the Sepik as a result of discard into the river from an aquarium in a mission at Pagwi).*

Appendix 3: The Criteria for Identifying Wetlands of International Importance

01/08/1999

[Note: This is a simple list of the Criteria themselves out of their explanatory settings. They should properly be used as part of the [Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance](#) as amended by COP9, 2005.]

Adopted by the 7th (1999) and 9th (2005) Meetings of the Conference of the Contracting Parties, superseding earlier Criteria adopted by the 4th and 6th Meetings of the COP (1990 and 1996), to guide implementation of Article 2.1 on designation of Ramsar sites.

Group A of the Criteria. Sites containing representative, rare or unique wetland types

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Group B of the Criteria. Sites of international importance for conserving biological diversity

Criteria based on species and ecological communities

- Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
- Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
- Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Specific criteria based on waterbirds

- Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.
- Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Specific criteria based on fish

- Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.
- Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

Specific criteria based on other taxa

- Criterion 9: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

Appendix 4: Chronology of Research into the Karawari Caves Precinct

- 1959 - Ethnologist Alfred Buhler conducted a fieldtrip to the upper Korewori in 1959. Bühler, who was director of the Museum für Volkerkunde in Basel (now the Museum der Kulturen) was the first anthropologist to visit the region. ("Kultkrokodile vom Korewori," *Zeitschrift für Ethnologie* 86, pp.183-207, 1961).
- 1964 - Prof. Eike Haberland wrote about the hooked figures in a 1964 article ("Zum Problem der 'Hakenfiguren' der südlichen Sepik-Region in Neuguinea," *Paideuma* 10, pp.52-71). Haberland and Siegfried Seyfarth wrote a more extensive ethnology of this region (1974: *Die Yimar am oberen Korewori (Neuguinea)*. Studien zur Kulturkunde, vol.36). Eike Haberland's (*The Caves of Karawari* (New York, D'Arcy Galleries, 1968) shows dozens of carved hooked figures of approximately a meter or more in height. These figures, carved from timber were found in caves and rock shelters of the upper Korewori River, a tributary of the middle Sepik.
- 1973 - Kaufmann (2003) details a study expedition to the area in 1973. After the Museum der Kulturen had acquired most of the known hooked figures, the Basel anthropologist Christian Kaufmann and his wife Annemarie Kaufmann-Heinimann visited the region to help document the collection (see *Ethnographische Notizen zur Basler Korewori-Sammlung: Aus den Ergebnissen der Sepik-Expedition 1972/73, Verhandlungen der Naturforschenden Gesellschaft in Basel* 84, pp.711-725, 1974).
- 1987 – Archaeologists and anthropologists Paul Gorecki and Rhys Jones conducted the first systematic exploration of numerous caves and rock shelters, documenting ten major rock art friezes associated with religious and other cultural customs. Their confidential report recommended National protection of the general area of the sites. ('A New Rock Art Province in new Guinea', 1987).
- 2004 - Anthropologists Borut Telban and Paul Roscoe conducted a survey of some of the foraging societies in the lower Arafundi basin related to the Korewari people (*The People of the Lower Arafundi: Tropical Foragers of the New Guinea Rainforest, Ethnology* 42(2), pp.93-115, 2004).
- 2005 – Anthropologist Nancy Sullivan began visiting the hill caves and shelters and started working with the Penale people to document and record the sites. (Sullivan, N. 1998. "The Awim Caves," *Paradise, Air Niugini in-flight Magazine* 129:23-25; *Sago Bark Painting and the Transformation of Community Identity on the Arafundi River (Pacific Arts Journal | New Series, Volume 12, Number 2, 2012)*).
- 2008 - Edmundo Edwards and Nancy Sullivan and their team conducted short-term ethnographic and archaeological work in some of the caves. (Preliminary Report of the Cruz Mayor Rock Art Expedition to Papua New Guinea. May -July, 2008).

Appendix 5: Redraft of 'Description', 'Statement of authenticity and/or integrity', 'Comparison with other similar properties'.

Criteria: [\(i\)](#)[\(iii\)](#)[\(iv\)](#)[\(v\)](#)[\(vii\)](#)[\(viii\)](#)[\(ix\)](#)[\(x\)](#)

Description:

The property is a mixed cultural and natural site covering the middle and upper reaches of the Sepik River basin including the steep mountainous slopes of the Central Range along the southern flank of the basin. The Sepik River at 1126 km in length and a catchment of around 7.7 million hectares is one of the world's greatest river systems. It is the largest unpolluted freshwater system in New Guinea and among the largest and certainly most intact freshwater basin in the Asia Pacific. The diverse habitats of the basin rate as globally significant on a number of biodiversity indices. The area contains two Global 200 eco-regions, three endemic bird areas and three centres of plant diversity. Vegetation communities, at altitudes from 0 to 3800 metres asl, include mangrove forest, herb swamps, swamp forest, tall lowland rainforest, cloud forest, and alpine heaths. The Telefomin region in the headwaters is said to contain the greatest marsupial diversity on the planet. Threatened species such as the New Guinea Harpy Eagle, Victoria Crowned Pigeon and the Northern Cassowary remain common and a number of restricted range birds are represented. The Sepik river fish fauna reflects the Great Northern Fish province, sharing many species with the Ramu and Mamberano Rivers. Important waterbird and crocodile populations are supported by the 1500 lakes and other wetlands associated with the basin.

The Sepik River is one of the least developed areas in PNG and home to approximately 430,000 people who depend almost entirely on products from the rivers and forests for their livelihoods. This is perhaps the most linguistically and culturally diverse area in the planet with over 300 languages in an area the size of France. The Sepik is famed for the gabled spirit houses or "haus tambarans", one of the most dramatic examples of indigenous Melanesian architecture, and a very rich ceremonial carving and music tradition. Sepik peoples maintain their cultural integrity proudly and have influenced styles across the nation.

Recent studies have revealed a major system of cave art sites that were largely unpublished at the time of nomination in 2006 and therefore not mentioned in the nomination. This new information further enhances cultural attributes even greater than thought at the time of nomination. The Karawari cave art project is on-going and continues to reveal important art sites and other cultural features in remote escarpment lands forming a southern rim to the lower Sepik basin. Many of the caves were once multipurpose ceremonial, burial and hiding grounds. The caves were also used to increase success in warfare and hunting. These are places said to be first occupied by the ancestors. The caves are part of a spiritual landscape defined by rituals, stories, objects, and practices that are intimately linked to knowledge about life and ancestors. The inscriptions of people's presence remains as personal expressions of place marking, but these places and landscapes are socially and sensually anchored through the production of a sense of belonging. Paul Gorecki, who has had extensive experience of archaeological work in Papua New Guinea, believes the caves of the Karawari and Upper Arafundi could constitute "the greatest example of rock art in the whole of Melanesia" (Gorecki & Jones 1987a; 1987b:3). In 1987 Gorecki and Jones recommended that the caves received national protection before their location was publically revealed, in order to preserve the significance of the site for the people.

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One protected area is established in the area - the Hunstein Range Wildlife Management Area (220,000 ha). Consideration will be given to nomination of the Sepik wetlands as a Ramsar wetland of international importance. The Sepik Wetlands Management Initiative is addressing crocodile habitat retention and invasive species removal across the Middle and Upper Sepik River and adjacent lakes.”

Statements of authenticity and/or integrity

The Upper Sepik is the heart of one of the least modified landscapes in the Asia Pacific. A major river runs free without dams, weirs or industrial developments. A band of unbroken rainforest extends for hundreds of kilometres. There are few places left in earth in this condition. A World Heritage listing would reinforce efforts to ensure that these values survive while also encouraging sustainable development for some poor and remote communities. There are few places in Melanesia where cultural heritage is as diverse, dramatically displayed or so proudly protected. And yet change is coming rapidly to this region. World Heritage listing linked with an effective catchment management regime can offer a chance to draw tourism, support sustainable development and foster the celebration of the Sepik's rich cultural heritage.

Comparison with other similar properties

No properties represent elements of the biodiversity or culture of the northern catchments of New Guinea. Lorentz World Heritage Area protects some species that are shared with this region but there are significant differences in species composition, ecosystems, climate and geology.

Appendix 6: Statement on Frieda Mine from Highland Pacific

PNG Participation: The terms of the agreement between PanAust and Highlands provide that should the Government of PNG elect to take up its right under PNG Law to 30% of the project, PanAust will sell down the first 20% of its joint venture interest and thereafter the parties will sell down in equal amounts. Under a scenario where the Government of PNG elects to take up its maximum 30% of the project, the respective joint venture interests would be PanAust 55%, the Government of PNG 30% and Highlands 15%.

Licence Status: The Frieda River Joint Venture various exploration licenses with the main resource area being covered by EL 58. Environmental studies have been undertaken but are yet to be finalized as an Environment Impact Statement. This will occur when a formal development application is lodged to seek government approvals and conversion of the exploration licenses to a Special Mining Lease (SML) which is a pre-cursor for funding, finance and development. It is at the time of a SML that the joint venture partners would arrange project finance and the PNG Government can elect to take a 30% direct equity interest in the project.

Study Spend: PanAust will be responsible for 100% of the costs incurred by the Frieda River Joint Venture to finalise the definitive feasibility study for PanAust's development concept and will appoint and fund the cost of an independent expert to provide a peer review. PanAust will also be responsible for 100% of the costs to maintain the Frieda River project site, assets and community relations programmes up to the point in time of lodgement of the Mining Lease or Special Mining Lease application.

Revised Feasibility Study: As part of PanAust's due diligence work, it completed a scoping study based on a smaller circa 24 million tonne per annum conventional open pit and flotation operation producing a copper-gold concentrate for export to custom smelters.

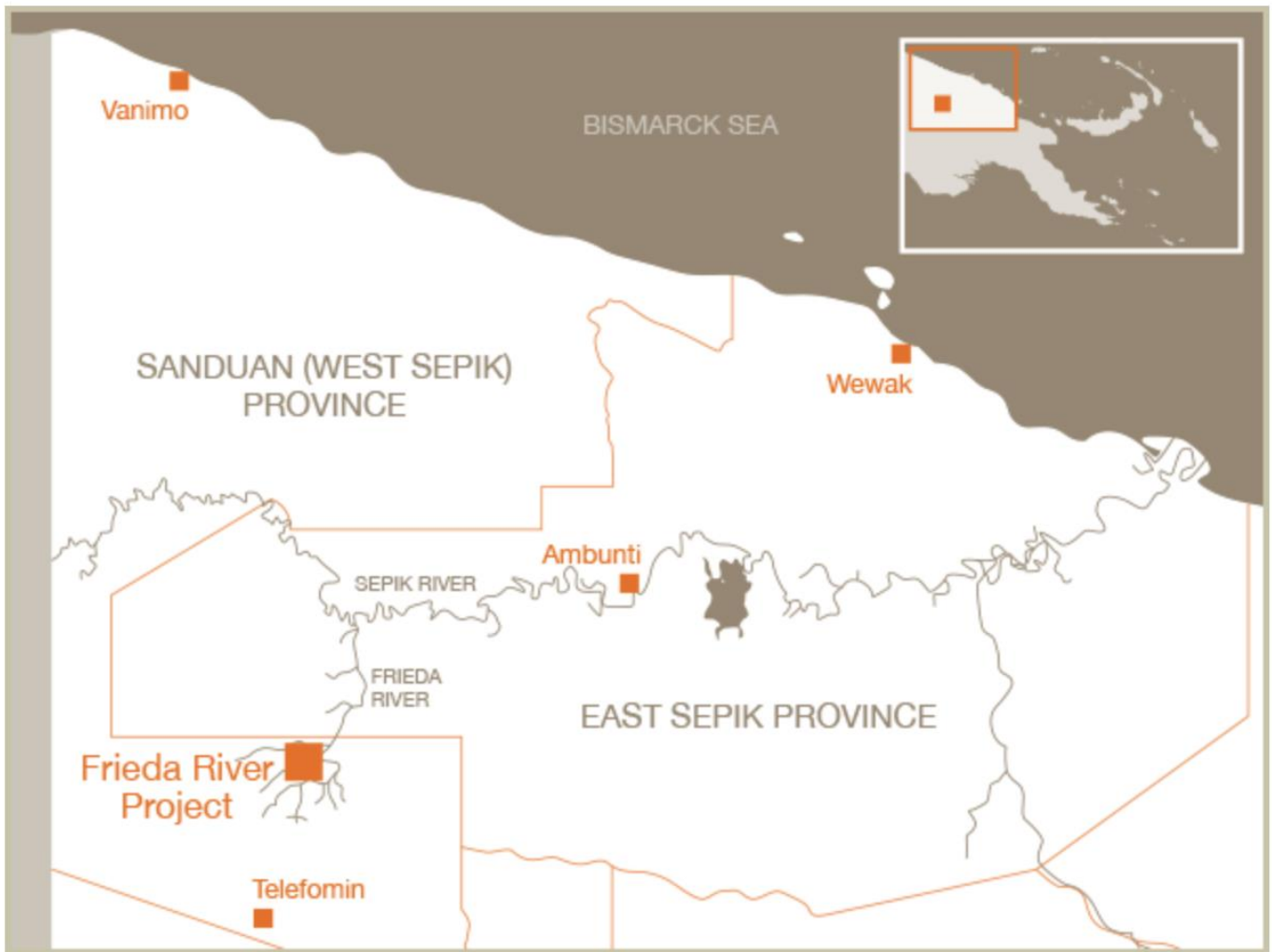
The scale of development is significantly more manageable in the current market environment than the previous design given PanAust's estimate of development capital in the range of US\$1.5 billion to US\$1.8 billion (100% basis, 2013 dollars). This would equate to a competitive capital intensity of less than US\$13,000/t of annual copper equivalent production.

The scoping study assumed mill feed from the HIT deposit of 430 million tonnes grading 0.54% copper and 0.3g/t gold and provided average annual production (100% basis) of over 100,000 tonnes of copper and 160,000 ounces of gold in concentrate at a competitive cash cost of approximately US\$1.25/lb (after gold credits) over a plus 18-year mine life. The economics are in large part driven by the low waste to ore strip ratio (less than 0.6:1 including pre-strip). Upon completion of the PanAust Glencore Agreement, this scoping study will form the basis of a revised feasibility study that is anticipated to be completed during 2015.

UPPER SEPIK RIVER BASIN

Frieda River Copper-Gold

The project is owned by PanAust Limited (manager) 80% and Highlands Pacific (20%)



HUON TERRACES REPORT

Location

The 'Huon Terraces - Stairway to the Past' World Heritage Tentative Listed site is located on the north eastern coast of the Huon Peninsula of mainland Papua New Guinea, 360 km north of the PNG capital, Port Moresby. Access is limited to a rough coastal track connecting to Finschafen and air access via several small airstrips (Siwea, Masa and Sialum). Boat access is problematic with no sheltered harbors on this exposed section of coast.

1) Current Situation (listing, boundaries, action towards protection etc)

Boundary:

As at the commencement of this review, the Huon Terraces Tentative List site shared with several other PNG sites a lack of defined boundary. The geographic extent of at least the identified geological and archaeological attributes in the citation can be identified with a degree of precision but not so the biodiversity attributes.

The site takes its name from the geological features known as the 'Huon Terraces'. These are clearly seen as the key natural heritage values and their geographic extent is reasonably well identified in a number of scientific papers.

Other natural heritage attributes such as the "*probably the largest unlogged Dacrydium and other podocarp forests in the Southern hemisphere. This is a superb example of the early Gondwanan conifer forests*" are much less clearly defined geographically and indeed their significance appears as yet unconfirmed/undocumented and the geographic extent of any such values is unclear and cannot therefore be confidently factored into the boundary delineation at this time.

The original Tentative List nomination in 2006 included listing against two cultural heritage criteria (iii) and (v). At the time of listing, the archaeological attributes were still considered of potentially global significance but with the discovery of other sites on the island, the global significance of the Huon Peninsula site is now under revision. (see Appendix 2) The sites of the archaeological investigations which prompted inclusion of cultural heritage values in the 2006 listing are associated with the coral terraces, towards the southern end of the site.

Protection:

The site is unprotected. It is understood that no action has been taken by PNG Government agencies to protect the area since listing in 2006 or to consult with landowners.

The 2006 Tentative List nomination of the Huon Terraces did not include delineation on a map. Whilst the scientifically important coral terraces and the archaeological sites are readily identifiable, the inland extent of the forests described in the listing citation are too imprecise to speculate on an inland delimitation of the site.

2) Description of Site



Image of Huon Terraces coast. The general parallel pattern of terraces is evident in the non-forested slopes to the sea. Note the stranded and open lagoons formed by modern fringing reefs. (image from PNG Mining Cadastre Portal)

Based on identification of the terraces and archaeological sites, the proposed delineated Tentative List site would comprise a 60 km strip of coastal foothills between the Kapugara River in the north and the Musaweng River in the south. Much of the recommended 'Core Area' comprises non-forested landscape of grassland. The grassland appears likely to be maintained by regular firing and grazing. As a result of the non-forested condition of the site, the scientifically important raised coral terraces are highly visible from the coast and from the air, especially inland from the village of Sialum. (see images in this report) The coral terraces extend more or less continuously for the length of the Core Area, being broken only by sections that have been truncated by stream erosion and burial by mass movement of soil. A number of studies have correlated the different sections along the coast according to age class, age being determined by radio carbon dating of main clam shells found on the terraces.

A major contribution to the scientific values of the site is the fact that this section of the Huon Peninsula has, for hundreds of thousands of years, been progressively tectonically uplifted. Recent earthquakes and uplift have been witnessed, recorded and studied. Geophysically, the site is in active uplift* and subject to frequent earthquakes. Whilst the uplifting process provides its own complications in researching the coral terraces, the important contribution

HUON TERRACES

made by the uplift is that sequential fringing reefs representing different relative sea levels have been uplifted above the sea and so preserved on land. Dating of each coral terrace has allowed extrapolation of past global sea levels and so has made highly significant contributions to understanding past sea level fluctuation and hence climatic change with obvious potential to extrapolate these findings globally. ¹⁴

Each coral terrace includes the remains of an associated narrow coastal lagoon and which has retained evidence of the marine life that previously occupied the lagoon. For example, each terrace has retained, in excellent condition, specimens of giant clams which have been key to much of the dating work for the terraces. There are today a series of coastal lagoons in the Sialum area which are examples of pre-existing lagoons that have been progressively lifted upslope and their form and contents preserved.

Based on the results of the archaeological research conducted in the site, there has likely been continuous human occupation for tens of thousands of years. Human occupation and associated periodic firing combined with the skeletal soils of the coral terraces and steep slopes has resulted in a landscape unusually devoid of forest. The grasslands of the site reportedly support around 4,000 head of cattle suggesting that the local people have an interest in preventing reforestation of the area.



Fortification Point with coral terraces evident. Note cattle grazing in foreground (Image: Drugrunnerpng.blogspot.com)

¹⁴ * Some localised sections were downthrust in 1992.

HUON TERRACES

The deforested condition of the site no doubt enhances the opportunity to see the overall extent and formation of the coral terraces and which has contributed to understanding the extent and nature of the coral terraces the length of the coast.

3) Key attributes and values

3a. Natural Heritage

This review confirmed that the key attributes of the Huon Terraces Tentative Listed Site, those which are considered to be highly likely to qualify as 'Outstanding Universal Value', are the numerous raised coral reef formations which extend from the existing coast to around 420 metres (Pandolfi 1998) elevation above sea level. These terraces are evident even on satellite imagery for the seaward slopes extending along the coast for around 60 kms, from Kapugara River in the north to Musaweng River in the south. They appear to reach their most extensive development in the vicinity of Sialum, a small coastal settlement about midway along this section of coast. The indicative boundaries designed as part of this review fully encompass all of the reefs mapped by Bloom et al (1974) and as well includes some of the upslope landscape context. Given the uplift history of this landscape, it is possible that some remnants of additional coral reefs may be located at higher elevations in this contextual zone above 420 metres ASL.

The coral terraces are valued not just for their fossil coral formations but even more so for the preserved contents of the lagoon features behind each reef. Calcareous invertebrate shell material has been well preserved and provides an outstanding opportunity for both dating purposes and for researching biological changes in the coastal seas of the region. The known archaeological sites are associated with the raised coral terraces.

The Huon Terraces were intensively researched from the 1970's and especially in the 1990's and 2,000's with the result that their global significance has become very well established. The research results from the Huon Terraces are regularly cited in the global literature and their global significance continues to increase as each study is completed. Numerous research projects have been undertaken and the site continues to reveal globally important data about sea level change and climate change. Indeed, the site has become an undoubted globally important research site which appears to readily meet criterion (viii) viz

"..... be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;" (World Heritage Criterion (viii) Operational Guidelines 2013)

Extensive and ongoing scientific research has established and continues to confirm the global scientific significance of the site, especially for study of climate change and sea level change over more than 300,000 years. As geological uplift is on-going, the site is dynamic and can be expected to generate further fossil reefs over time. The selectively listed scientific publications in the Bibliography at the end of this report are testimony to the great diversity and intensity of the research so far conducted.

There undoubtedly remain many opportunities for further scientific research of the fossil raised terraces as well as the adjacent existing coastal landforms and marine life. Scientific interest can be expected to be on-going.

3b. Cultural Heritage:

The Huon Peninsula archaeological record has contributed significantly to notions of global human dispersals by informing notions of the first colonists of Sahul (Australia and New Guinea), particularly when it was a 'hot site' in the 1980's and 90's. More recently however, as other sites start to produce comparative datasets the role of the Huon Peninsula site data is likely to become (perhaps is already becoming), increasingly marginalized in the academic debate about global dispersals. Accordingly, the prospect of the cultural values of the Huon Peninsula achieving Outstanding Universal Value of the Huon Peninsula site in relation to cultural criteria has receded since nomination to the Tentative List in 2006. Arguably this might be reversed with further academic/research interest in the site. In the meantime, the national significance of the site is not in question for the foreseeable future and so the site deserves protection for further research purposes.

A result of this review is therefore to question the adequacy of the known cultural attributes to qualify as Outstanding Universal Value. Our informed advice therefore is that the archaeological attributes are currently considered to be of national significance but not of global significance. If PNG decides to proceed with a full nomination of the site for World Heritage listing, the current knowledge of the cultural values suggests that the nomination could not qualify on cultural criteria.

Given our reservations about the case for heritage listing based on as yet poorly defined biodiversity values, the site delineation was necessarily based on the demonstrated scientifically important coral terraces. The documented archaeological sites fall within the delineated core area based on geological attributes.

CAVEAT: It should be noted that if the site proceeds to a full nomination, it may not be necessary for the whole of the now delineated Tentative Listed area to be nominated. However, in order to ensure that the most important values are included and the Conditions of Integrity are met, care will need to be taken in selecting which sections are nominated. Accordingly, prior to any nomination, the boundary will need to be reviewed in detail by specialists to ensure capture of the most important values but consistent with landowner approvals.

Biodiversity:

The original citation for the Tentative Listing refers to some biological natural heritage attributes such as the *"probably the largest unlogged Dacrydium and other podocarp forests in the Southern hemisphere. This is a superb example of the early Gondwanan conifer forests"*. These are much less clearly defined geographically and their significance appears as yet unconfirmed/undocumented and the geographic extent of any such values is unclear and cannot therefore be factored into delineation of the site.

If biological or cultural attributes of global significance are identified in the future, the boundaries of the site might be adjusted accordingly.

4) Threats (land use and land tenure changes, development)

Most of the delineated core area is devoid of forest and the vegetation appears to be extensive grasslands, likely maintained by fire and grazing. Grazing of cattle has been observed, at least on the lower slopes and it is reported that about 4,000 cattle graze this tract of coastal grasslands.

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There are no immediately evident threats to the key natural heritage attributes of the site, the geomorphic and geologic features. There are no mining or exploration titles issued over the site (PNG Mining Cadastre Portal) and there appears to be little if any forest logging potential.

The greater part of the site appears to have little agricultural potential given the rocky terrain, shallow soils and exposure to on-shore winds. Yams are reported to be the main food staple and grown in small gardens on the coast and in some upland areas. There appear to be no Special Agricultural Business Leases (SABL's) registered over the site. Oil palm plantation may have some potential and could pose some threat to the geomorphology and scientific values of the site but the area is likely to be marginal at best for oil palm development.

The only potential major threats might be quarrying or mining which could disturb the geomorphic features. Mass movement of soil from the steep slopes upslope of the site could also pose some risk to parts of the site by erosion or burial. (see Buffer Zone below) Earthworks such as road construction, industrial mining or logging have the potential to mobilize mass movement and mass movement landslides have been known to occur in recent years and have caused loss of life. The vulnerability of the site to geological uplift and earthquake only underscores the need for great care with any disturbance in the steep mountain slopes.

There are therefore no identified immediate threats to the OUV at the macro level but threat, particularly at the micro level, should be reviewed at the time of conducting management planning for the site.

Protection Needs:

Since listing in 2006, it is apparent that no known protection has been applied to the site nor boundary delineation undertaken. There is a small (22.23 ha) Wildlife Management Area in the mountains south of the Terrace Coast and appears to have no particular relevance to the Tentative Listed site.

Given the relatively robust nature of the geological features of probable Outstanding Universal Value, there appears no necessity for the area to come under direct government ownership or management to achieve an adequate and appropriate level of protection. A landowner managed tenure should be adequate. Perhaps even more important than formal protection, is the preparation and implementation of a management plan. Such plan will need to be in place or in preparation at the time of any nomination to the World Heritage List. The management plan will need to be prepared with the participation of the landowners.

Buffer Zone:

Given the very steep mountainous catchments upslope of the coral terraces, it was considered desirable to delineate a potential buffer zone to minimize any activity that might initiate mass earth movement downslope. Mass landslides in these catchments are also known to be a threat to habitations on the coast so that protection of the precipitous catchments and slopes will benefit the people as well as the geological feature. The effect of the Buffer Zone would be to alert authorities in the event of any proposal for major mining, roading or logging within the catchment of the site; not necessarily to prohibit activities but to ensure that any proposed activity takes into account the potential for downstream/downslope impact on the coral terrace environment.

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Future management of the site would need to ensure that even minor disturbance to the site did not compromise the scientific value of the area. For example, movement of shell material from one terrace to another could confound research dating. Landowner awareness and understanding of the global scientific importance of the site is essential.

Of the 7 World Heritage Tentative Listed sites in Papua New Guinea, the Huon Terraces site as now delineated appears to be by far the least complicated and least threatened and most easily to protect and nominate for World Heritage.

Given the relative robustness of the site, it would be desirable for the lead agency in World Heritage in PNG to prepare a simple brochure, in consultation with the landowners and lead scientists, to create an awareness of the nature and significance of this globally significant site.

5) Proposed Revised of data, citation and boundary

Revised Criteria: The existing citation for the Tentative Site includes listing against Criteria (iii)(v)(vii)(viii)(ix)(x). As indicated above, the site is now considered unlikely to qualify against cultural criteria (iii) and (v) and so it is recommended that these criteria could be removed from the citation. Similarly, given the lack of information about biodiversity attributes, it is proposed that Criteria (ix) and (x) might be removed from the citation. Criterion (viii) (Earths evolution/geological) is the key criteria for any nomination. A case might also be made against Criteria (vii). (Natural phenomena)

Revised Description:

The current official description attaching to the Tentative Listing (see Appendix 1) is adequate for the present but could be refined for greater focus consistent with the proposed boundaries for the site. It is suggested that the following be **added**:

“The most significant feature of the region is the remarkable sequence of coastal terraces, particularly well expressed and preserved at Sialum. These are not only spectacular, but have proven to be of immense value as testimony to the geo-climatic history of the Pacific region (and even the world) over the last 300,000 years. These are certainly the finest sequence of such terraces in the world, and have attracted a great deal of attention and continuing research.’

Their greatest significance has been as a source of information on the way that global sea level has changed over the past 300,000 years. The rapid uplift of this section of coastline has resulted in the preservation of a series of fossil coral-reef terraces, and there have been ongoing programs of research to date the corals within these terraces and reconstruct the elevation of the sea over at least two cycles of glaciation and ice-melt during the Quaternary.

The delineated ‘core area’ of the site encompasses the complete suite of mapped coral reef terraces in the region, extending along the coast for a distance of approximately 60 kilometres and extending inland up to 5 kilometres inland and to an elevation of about 420 metres. The widest and best developed sequence of terraces are inland of Sialum. Only limited exploration of submerged offshore reefs has been conducted As there is a likelihood that some fossil reef terraces are found below sea level, the boundary of the Tentative Listed area extends a nominal 1km seaward of the coast..”

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Recommended Boundary:



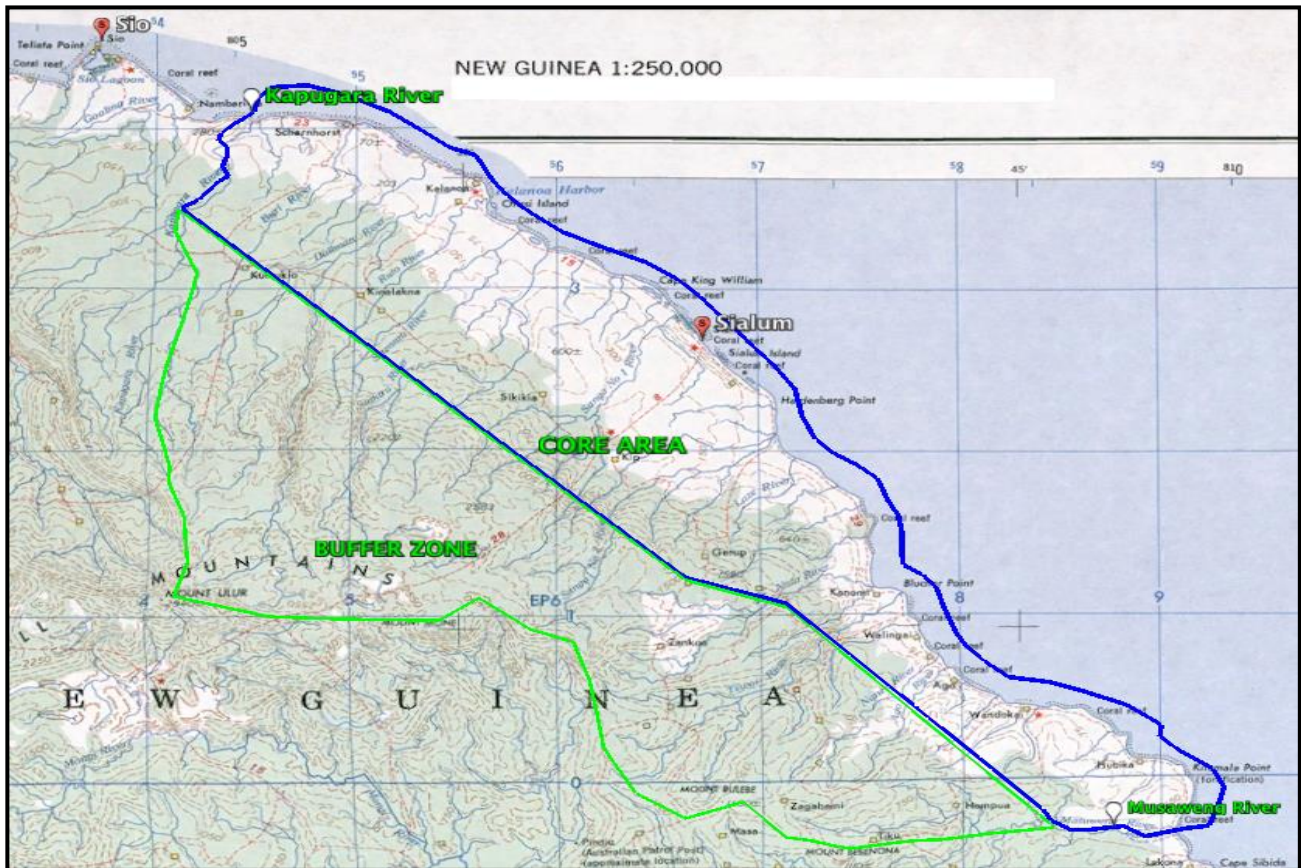
Recommended indicative boundaries for the 'Core Area' and 'Buffer Zone' (optional) for the Huon Terraces World Heritage Tentative Listed site. (Image from Google Earth)

This review conducted a delineation of the Tentative Site based on the revised identification of the attributes of likely Outstanding Universal Value.

The proposed 'Core Area' indicative boundary (see map and diagram below) is considered to be an optimum boundary for the site. However, for the purposes of a future nomination for World Heritage, a lesser area could be considered providing a more detailed technical assessment is conducted to ensure that the most important precincts from a scientific viewpoint are included in such nomination. The locality of the archaeological studies should be included regardless.

A recommended Buffer Zone has been identified and delineated as outlined elsewhere.

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Recommended boundary for the Huon Terraces Tentative List. Note that the Buffer Zone encompasses the heads of catchments flowing through the terraced landscape.

6) Revised Statement of Integrity

The site as delineated would readily meet general Conditions of Integrity and as well meet the special Condition of Integrity attaching to any nomination under criterion (viii) viz “*should contain all or most of the key interrelated and interdependent elements in their natural relationships*” (Para 93 Operational Guidelines 2013).

A completely new Statement of Integrity reflecting the revised values is proposed as below:

“The delineated Tentative Listed site encompasses the complete suite of the globally renowned Huon Terraces - fossil coral reefs. The site therefore is fully inclusive of this distinctive globally significant suite of coastal landforms. The occurrence of any submarine fossil reefs has not yet been explored but the boundary of the site extends a nominal 1km seaward as a reminder of such prospect.”

Development of the site is minimal, comprising several coastal villages and a small number of traditional small villages in upland areas. Catchments of the many short but steep rivers are essentially undeveloped and roads are limited to minor vehicular tracks along the immediate coastline.

None of the coral terraces have been significantly damaged and excavations and disturbance by researchers have been minimal.”

7) Revised Comparison with other similar properties

Recommended new wording:

“The only other sequence of such terraces to have had as focused a program of research occur is on the West Indian island of Barbados. Both sites provided convincing evidence of highstands of sea-level during the last interglacial and the two following interstadials. The advantage of the Huon Peninsula sequence of reef terraces, in comparison with those on Barbados, is that there has been a more rapid rate of uplift at Huon, which has resulted in the preservation above present sea level of more terraces. This has enabled reconstruction of sea level across much of the period known as oxygen isotope stages 4 and 3, as the ice sheets accumulated, and sea level progressively fell, during the last glaciation; this period is poorly preserved on Barbados because of the slower uplift.

There are other sites around the world where such terraces are preserved, for example, on several of the Indonesian islands, within the Ryukyu Islands, in Vanuatu, and on other West Indian islands, including Cuba. However, not only have none of these been shown to have as many terraces with as well preserved fossil corals within them, but furthermore, none of them have yet been shown to have records that preserve the shorter-term variations of sea level that can be determined from the Huon Peninsula. The Huon Peninsula contains the best sequence of well-preserved terraces, enabling a broad history of sea level that indicates sea-level history during the last interglacial and the two subsequent interstadials (substages 5e, 5c and 5a), as well as indicating sea-level elevations for terraces dated over the period 65,000 to 30,000 years B.P. (before present). However, the Huon terraces have also been shown to preserve a short-term record of oscillations of sea level that has provided independent evidence for ice breakout events (Heinrich events) during which sea level has risen rapidly for a couple of millennia. The site remains central to sea-level research.”

CONCLUSIONS:

The **global significance of the scientific values** of the Huon Terraces is reaffirmed.

The core geomorphic/geological features comprising the coral reef terraces have been identified on maps and imagery and an **indicative boundary designed** to encompass the main features.

A potential **buffer zone** has been designed for the Tentative Listed site. (see diagrams).

Given that:

- There are no mineral tenements or forest concessions over the Tentative Site;
- There are no SABL's registered over the site and agricultural potential appears low;
- The majority of the site is devoid of forest;
- Any nomination for World Heritage would probably be limited to geological/geomorphological features, (Nomination against criterion (viii), though, nomination against (vi) also could be considered), and would not require any significant change of landuse.

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The Huon Terraces represent an outstanding opportunity for PNG to nominate as World Heritage, an area of outstanding global scientific value and which is unlikely to negatively impact on landowners and therefore unlikely to be controversial and unlikely to impact on mineral and agricultural development.

8) Recommendations Arising

a) Boundary:

Register the recommended indicative boundary (Core +/- Buffer) of the Tentative Listed site with DEC GIS and with PNG government agencies, in particular the Mineral Resources Authority and Provincial Government. (It would be valuable if MRA were to include boundaries (where they exist) of Tentative List sites in their on-line Mining Cadastre Portal.)

Landowner Consultation:

As opportunity permits, conduct consultation with customary and other landowners within the indicative boundaries of the Tentative Listed site to:

- create awareness of the existence and implications of the existing Tentative Listing.
- ascertain preparedness to proceed with a full World Heritage nomination.

(Note: Because it would initially be a nomination based on natural criterion (viii), (geological) listing would not require any significant change of land use and would have little or no negative impact, possibly only positive impact in terms of global awareness and conduct of further on-site scientific research. Notwithstanding, some form of formal protection (could be traditional) and a management plan will be needed as a prerequisite to nomination).

b) Name:

That the Tentative Listed area and any nomination process continue to be known as “Huon Terraces - Stairway to the Past”.

c) Cultural Values:

Encourage further research of the cultural attributes of the site, in particular further archaeological research and periodically review the significance of those values.

d) Revision of Citation:

Consideration be given to submitting of a revised citation for the Huon Terraces to the World Heritage Committee. A map of the delineated site should also be submitted. Recommended changes are presented above.

e) Brochure:

Consider preparation and distribution of a simple brochure about the site for the purposes of creating greater awareness of the site.

f) Nomination:

Consider the case for priority nomination of the Huon Terraces for World Heritage listing.

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Appendix 1: WHC Citation

Huon Terraces - World Heritage Tentative List Citation

Papua New Guinea

Date of Submission: 06/06/2006

Criteria: (iii)(v)(vii)(viii)(ix)(x)

Category: Mixed

Submitted by:

Department of Environment and Conservation

State, Province or Region:

Morobe Province

Coordinates: E146 to E148 S5.50 to 6.50

Ref.: 5066

Description

This portion of New Guinea has a turbulent geologic history, being located on the junction between the Australian and Pacific crustal plates. The surface geology of this eco-region is a combination of Miocene siltstone, conglomerate, volcanics, and limestone. It has been subject to a long history of volcanism, earthquakes, tsunamis, faulting and other fragmentation. In turn, this has resulted in fragmentation of the biological habitat and hence a high level of localisation and endemism. The Pacific plate is subducted beneath the Australian, and the land is one of the most rapidly rising areas of the world. The Finisterre and Saruwaged Ranges each consist of a massive ridge of limestone dipping steeply to the ocean. The most significant feature of the region is the remarkable sequence of coastal terraces, particularly well expressed and preserved at Sialum. These are not only spectacular, but have proven to be of immense value as testimony to the geo-climatic history of the Pacific region (and even the world) over the last 300,000 years. These are certainly the finest sequence of such terraces in the world, and have attracted a great deal of attention and continuing research. Further, as the land has emerged, the surface is generally covered with tephra - a layer of volcanic dust and rock shards, often referred to as volcanic ash. This serves to protect the emerging landscapes and to preserve the landscape history to a remarkable degree. It thus provides an invaluable resource for understanding of landscape evolution, biological history and human occupation. The ranges themselves have extensive underground drainage, with springs occurring both on the terraces and at sea level. However, there are freshwater risings in the ocean some 15 km. from the coast, probably based upon groundwater flows through karst conduits. The various nutrients carried with the freshwater apparently provide for a rich marine fauna and hence the rising is a key resource for the fishing industry of the North Coast.

Statements of authenticity and/or integrity

Except for some forest loss along the southern part and the Buweng Timber Rights Purchase (using helicopters), most of the eco-region's natural habitat is intact. The Huon Highlands are a major wilderness area and include probably the largest unlogged Dacrydium and other podocarp forests in the Southern hemisphere. This is a superb example of the early Gondwanan conifer forests. A consortium of zoological institutions has given special attention to protection of and research upon the Matschie's Tree-Kangaroo, and a special Conservation Reserve is currently in the process of being established.

Comparison with other similar properties

The only comparable World Heritage property is the Cuban Desembarco del Granma National Park with the marine terraces of Cabo Cruz. The two sites are visually similar, but that in Cuba

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has not had the exhaustive geo-historic and related research and in fact lacks the protective tephra deposits that have provided the protection of historical evidence of the Huon. Conversely, it has more adequate data on surface biodiversity (but that comprises totally different and unrelated biotic communities). We have not been able to identify other comparable sites outside of the World Heritage Registry.

Appendix 2: Notes on Cultural Heritage Review

Stone axes found in streams on the Huon Peninsula are assumed to come from peoples practicing a hunter-gatherer lifestyle who migrated to PNG across the sea of islands geographically called Wallacea, and moved gradually throughout the country from west to east over thousands of years (Sillitoe 1998, p.13). In the 1980's archaeologist Jim Specht undertook a study of settlement history and exchange network development in the region of the Huon Peninsula (Specht et al., 1981: 13). Specht et al (2006) noted that the Huon Gulf-Finschhafen area is one of the few parts of the New Guinea region where compound fishhooks with a shell lure shank occur. The Huon Gulf-Finschhafen forms differ from those of the Solomon's and Micronesia.

Interactions between people living on the coast and in the interior of New Guinea in the mid-Holocene era are said to have been based on the exchange of bird plumes and other valuable items. Reflecting this, avian features dominate the decoration of mortars and pestles of areas previously, or currently suitable for taro cultivation. Exchange from the Huon Gulf extended in one direction via the Markham valley into the Kainantu area of the Eastern Highlands and in the other direction from the gulf into the upper Watut area. Pottery was traded widely throughout different parts of Huon Peninsula and Huon Gulf (Specht 2006).

Pottery described as "Type X" is one of five pottery styles on coastal Huon Peninsula and the Siassi Islands, Morobe Province. Type X pottery is one of four "Post-Lapita" pottery styles and was likely made on the Huon Peninsula. The distribution of pottery known as Type X suggests contact between the Huon peninsula and the Palau Islands of western Micronesia about 1000 years ago (Specht 2006:25).

A number of sites of archaeological interest have been recorded across the region. Two of these sites have been subject to archaeological excavations, a coastal midden site that was analysed as an unpublished Honours project at UPNG by digim'Rina and the second is published by Les Groube and colleagues as Groube et al. (1986) and Groube (1989). The latter is known as the Huon Peninsula site and is the topic of the following paragraphs.

The site and pivotal data

The archaeological evidence for human occupation of the Huon Peninsula comes from investigations led by Groube. Excavations were carried out at two locations in the Fortification Point region near Bobongara on terraces 9 and 10, ~120 m asl. and known as Joe's Creek (Groube et al. 1986 and Groube 1989). A stone axe was excavated from archaeological deposits dated by TL to somewhere between 40,000 to 60,000 years ago.

The Huon Peninsula site interpretation

At the time of this project these data were interpreted as the oldest evidence of human occupation known in New Guinea and where comparable to data emerging from Australia. Groube (1989) interpreted the data to argue for his theory that the rainforest was not a barrier to human dispersal. Groube hypothesized that as the axe came from arguably the oldest archaeological deposits in New Guinea and represented a level of technology that would have allowed hunter-gatherers to utilize tropical rainforest resources that the rainforest was not a barrier to human dispersal. Indeed, he encapsulated this idea in the phrase "taming the rainforests".

Academic issues

The primary academic concern with the data from this site turns on the specifics of the implementation of the TL dating technique. First, the TL technique dates individual sediment grains which in and of themselves, aren't immediately linked to human behavior. In order to make TL dates 'speak' to human behavior the sediments must be demonstrably argued to represent human behavior. Much of the debate about the validity of Groube's (1989) model turn on whether one accepts the argument that the axe is the same age as the sediments. Secondly, TL is much more accurate when dating samples that are much older than the period in question. These limitations are acknowledged by Groube et al. (1986) in the way that the results are presented as a period spanning 20,000 years and in the way that they err on the site of the younger end of the period rather than the older.

In recent years a team led by Prof Summerhayes (Otago) has recovered and presented archaeological evidence from the Ivane Valley indicating human occupation at least by 46-49,000 years ago (Summerhayes 2010). This evidence goes some way to corroborate the evidence from the Huon Peninsula but does not, in and of itself, confirm the Huon Peninsula results.

Heritage Value

At the time of publication the information presented from this site gained national prominence in PNG because it was the first archaeological evidence that indicated what people already knew which was that the human occupation of New Guinea is of great antiquity. Secondly, from an academic perspective, the Huon Peninsula dataset ensured that New Guinea wasn't left out of either the national debate around the timing of the first occupation of Australia and the international debate reflecting notions of global dispersals out of Africa by ancestral *Homo sapiens sapiens* (Davidson 2013).