Papua New Guinea's Fourth National Report to the Convention on Biological Diversity

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FOREWORD

I am pleased to present Papua New Guinea's Fourth National Report to the United Nations Convention on Biological Diversity (CBD). Papua New Guinea (PNG) is immensely rich in biodiversity and culturally diverse would be to state the obvious. With more than 7% of the world's biodiversity in less than 1% of the land area and more than 800 languages, this puts PNG as the fourth mega-bio diverse country in the world with an unmatched cultural diversity.

PNG takes its commitment to preserving biodiversity very seriously. This is not only because of PNG's international obligations as a signatory to the CBD. It is also because PNG believes that protecting our biodiversity is a critical national priority as it is linked to local livelihoods of millions of people living in the rural areas of the country. Sustainable use of our biodiversity therefore has both ecological and economic value. It is with this objective that Papua New Guinea set up plans to develop an Environment Sustainable Economic Growth (ESEG) policy and the establishment of an Environment Protection Authority (EPA) with an explicit mandate of conservation of natural resources and associated knowledge as well as facilitating access to them in a sustainable manner.

This Fourth National Report focuses on the threats to biodiversity, the status of implementation of the National Biodiversity Strategic Action Plan (NBSAP) and the progress achieved towards meeting the 2010 biodiversity. It has been prepared in terms of the mandatory requirements under Article 26 of the CBD.

Considering the inherently multidisciplinary nature of biodiversity, it is imperative that any national document on the subject is prepared by involving the various stakeholders, experts and concerned organization and Ministries/Departments. I am happy to note that this Fourth National Report has been based on such a consultative process.

I congratulate all those who were involved in this assignment. I am confident that sharing of experiences with other Parties through the National Reports would immensely help in addressing the challenges we face today in perpetuating evolutionary process and maintaining our world's biodiversity.

Dated: June 25, 2010
Place: Port Moresby

Dr. Wari-lea Iamo
Secretary

EXECUTIVE SUMMARY

This fourth National Report to the CBD describes the measures taken by PNG to implement the various Articles of the CBD and especially through implementation of the NBSAP and the progress it has made towards the 2010 target and implementation of its Strategic Plan.

Chapter I gives an overview of biodiversity status, trends and threats, Chapter II assesses the status of implementation of the NBSAP, Chapter III addresses the level of integration of biodiversity considerations in national and sectoral plans and policies while Chapter IV concludes by giving the progress made towards the 2010 target and implementation of the CBD's Strategic Plan.

Papua New Guinea occupies the eastern half of the island of New Guinea, just north of Australia, and many outlying islands to the north and east, with a land area of about 462,243 sq. km, and an coastline of 20,197km and Sea Area/Exclusive Economic Zone (EEZ) of 3,120,000 sq.km

Lying at the collision line of the Australian and Pacific tectonic plates, Papua New Guinea is remarkably diverse in terms of species, landscapes and ecosystems. The forests of the island of New Guinea (consisting of Papua New Guinea and West Papua) constitute the third largest expanse of tropical rainforest on the planet after the Amazon and Congo forests (Brooks *et al.* 2006). Rainforests cover 28.2 million hectares of Papua New Guinea and comprise 80% of the forest estate (Shearman et al., 2008).

The total number of different plants and animals in Papua New Guinea is not accurately known but almost certainly exceeds 200,000 species and thus is far higher than the 26,318 total reported by IUCN, (figure 1-1.3-1). Scientists estimate that more than half the plants and animals found in Papua New Guinea have yet to be scientifically named..

People have depended heavily upon Papua New Guinea's plentiful and diverse biological resources for subsistence since arriving on the New Guinea landmass some 45-60,000 years ago. Even today, wildlife plays an important part in traditional diets, supplying the primary intake of proteins and fats in many highland areas and other isolated areas of the country. In coastal areas a wide variety of seafood, including fish, mollusks, and turtles, dominate local diets.

Papua New Guinea is the fourth smallest of the mega-diversity countries, but unquestionably one of the most unusual and interesting, especially in terms of diversity in human cultures.

Papua New Guinea has identified nine terrestrial and five marine eco-regions for the purpose of reporting units for assessing the status of species and ecosystems and their protection in PNG's Protected Area

System, and these units eco-region are to be used in the monitoring and evaluation framework for the Papua New Guinea Government's current natural resource management initiatives.

In recent years, the sustainable capacity of these ecosystems to continue to support PNG's rural population has come under threat. The major loss of biodiversity is contributed by;

✧ Rapidly expanding human population – Growth rate at 2.3% annually,

✧ Forest Conversion and Degradation - Rapid and substantial deforestation and logging related degradation has occurred in PNG's forests over the past 30 years. Between 1972 and 2002, a net 15% of PNG's tropical forests were cleared and 8.8% were degraded through logging. (Shearman *et al.* 2009)

✧ Industries include Mining, Oil and Natural Gas, Forestry, fiheries, palm oil, coffee, cocoa, coconuts, palm oil, timber, tea and vanilla. Almost all of these industries as well as small scale cash cropping by landowners are expanding. PNG has a nominal GDP of $8.2 billion USD. http://www.dfat.gov.au/geo/fs/png.pdf.

✧ Unregulated fisheries - The PNG National Fisheries Authority (PNG NFA) plays a key role in protecting PNG's vast fishing zone from illegal, unreported and unregulated foreign fishing.

✧ Pollution from both sea and land base.

✧ Climate Change - The impacts of climate change on biodiversity are many. The vulnerability of an ecosystem to climate change depends on its species' tolerance of change, the degree of change, and the other stresses that are already affecting it.

The PNG NBSAP was formulated and launched in 2007 but the implementation has been slow, uncoordinated and without proper funding and capacity allocated. The NBSAP requires urgent review and needs to take into consideration and incorporating the below appropriately;

1. Articulations and alignment of the national priorities with CBD requirements,

2. Formation of an institutional arrangement to coordinate implementation of the NBSAP,

3. Development of a national biodiversity conservation policy,

4. Improve implementation and resource mobilization strategy for the NBSAP,

5. Institute the Biosecurity Act and the Biosafety Policy Framework

6. Institute a legal regime to protect intellectual property rights of organizations and individuals involved in biodiversity research and development

7. Establishment of partnerships with NGOs, local communities and the donors

8. Application of best management practices in Protected area – including the development of management Plans for Protected Areas

9. Limited resources within DEC to support implementation of the NBSAP

10. Absence of a sustainable financing mechanism to support conservation work in PNG

11. Lack of a policy to guide national for strategies on invasive species

Since the formulation of the NBSAP, a number major government development have been developed and have implication of the progress and achievements of its goals and objectives. These include:

1. Vision 2050

2. Development Strategic Plan

3. Medium-Term Development Strategy

4. DEC Corporate Policy especially the Environmentally Sustainable Economic Growth Policy

5. Climate Compatible Development Plan

6. Millennium Development Goal 7 (MDG7)

Identifying priority areas for protection and integrated management in PNG needs to ensure the effective consideration of the PNG people, the traditional and customary landowners of PNG. Customary Landowners in PNG own the land and sea and are an integral part of the landscapes and seascapes of the Nation.

CHAPTER ONE: OVERVIEW OF BIODIVERSITY STATUS, TRENDS AND THREATS

1.1. Introduction

Papua New Guinea published its Conservation Needs Assessment (CNA) report in 1993 where teams of international and national experts compiled and analyzed the existing base of scientific information on the country's terrestrial and marine ecosystems and the biodiversity that they support. The reports and maps detailing areas of known biodiversity concentration, unusual ecosystems, and habitats and environmental threats were identified. Data poor areas were also identified. The process identified: 42 terrestrial high biodiversity areas and 13 important wetland habitats, 30 marine and coastal high biodiversity areas and 5 watersheds critical to the health of these and 16 biologically unknown areas that merit immediate survey and study (Alcorn 1993, Beehler 1993).

Papua New Guinea also published its first Country Study on Biological Diversity edited by N, Sekran and S. Miller in 1996. Chapter 6 provides details on the status of the biodiversity of the country and is used as the baseline for data analysis in addition to information provided by the World Conservation Union (IUCN) Red List program in Table1-1.2-1.

In order to easily comprehend the current condition, and to give a detailed and logical view of the status, trend and the threats of biodiversity in Papua New Guinea with the limited data, Chapter I is structured as follow:

- The first part of Chapter I (Section **1.2**) describes a general overview of the Papua New Guinea biodiversity, which comprises diversity at species and ecosystem levels with very little information on genetic diversity.
- The second part of Chapter I (Section **1.3**) describes the trends and status of important biodiversity components, mainly, terrestrial, marine and coastal, and inland water including the mangroves.
- The third part of Chapter I (Section **1.4**) describes the threats and implications of biodiversity loss at ecosystem, species and genetic levels in terms of socio-economic potential impacts as well as brief view on its changes.

1.2. Overview of Papua New Guinea Biodiversity

Papua New Guinea occupies the eastern half of the island of New Guinea, just north of Australia, and many outlying islands to the north and east, with an land area of 452,860 sq km and extends over an expanse of some 800,000 square kilometers of ocean, including 40,000 km^2 of coral reefs and EEZ.

Lying at the collision line of the Australian and Pacific tectonic plates, Papua New Guinea is remarkably diverse in terms of landscapes, ecosystems, and species. The forests of the island of New Guinea (Papua New Guinea

and West Papua together) constitute the third largest expanse of tropical rainforest on the planet after the Amazon and Congo forests (Brooks *et al.* 2006). Rainforests cover 28.2 million hectares of Papua New Guinea and comprise 80% of the forest estate (Shearman et al., 2008). The rest of the forest estate comprises dry evergreen forest, swamp forest, and mangroves. The total forest estate covers approximately 71% of the land area of Papua New Guinea. The remaining non-forest area includes extensive areas of lowland to mid-montane grassland (much of which may be anthropogenous), subalpine and alpine shrubland and grassland, human settlements, and water bodies (Shearman et al., 2008).

The flora of Papua New Guinea is poorly known. Estimates for the number of vascular plant species for the entire island of New Guinea range from 11,000 (Collins *et al.* 1991), to 13,858 (Roos *et al.* 2004), to 16,203 (Govaerts 2001), based on species-area relationships and publishing trends, to 20,000-25000 species (including undescribed taxa) calculated on the assumption that orchid and fern species, which are relatively well known, comprise about a quarter of the overall flora (Johns, 1995; Johns in Supriatna *et al.* 1999). About 6% of the world's flora (based on numbers in Höft 1992) is found in PNG. Endemism probably exceeds 30% for Papua New Guinea and is well over 70% for Papuasia (i.e, most species that are not endemic to the country of Papua New Guinea are endemic to Papuasia – the SW Pacific region from New Guinea to the Solomon Islands).

Papua New Guinea is extremely mountainous, with extensive areas above 3000 m. The highest mountain, Mt. Wilhelm (4509 m) frequently receives snow. Rainfall generally exceeds 2000 mm annually in most areas, with some areas receiving more than 10,000 mm. Rainfall is often seasonal and some areas , particularly in Western and Central provinces, have extensive dry seasons and which are covered with woodland-savanna. There are more than 5,000 lakes, and extensive river systems and wetlands. The species-rich mainland coastline includes more than 8,000 kilometers of mangrove swamps, lagoons, wetlands, coral reefs and atolls, plus island archipelagos and hundreds of offshore islands.

Papua New Guinea harbors a rich array of animals including an estimated 150,000 species of insects, 314 species of freshwater fishes (82 endemic), 641 species of amphibians and reptiles (328 endemic), 740 species of birds (600 resident; 77 endemic), and 276 species of mammals (69 endemic). Overall approximately a third of the species are endemic to Papua New Guinea and more than 70% are endemic to Papuasia.

PNG waters are considered part of the coral triangle, (Figure 1.1-2) the area of the world's highest known marine biological diversity. Its coral reefs and associated marine habitat are home to about 2800 species of fishes, about 10% of the world total. Almost all reef types found in PNG waters are within fringing and/or barrier reefs, with an estimated area of 40,000 km². In addition, PNG has some of the largest unpolluted tropical freshwater systems in the Asia Pacific region.

Given the high rainfall and generally rugged topography, rivers are usually fast-flowing with very high discharges. Consequently, except in the broader, lowland areas, most rivers in Papua New Guinea have a poorly developed aquatic fauna and flora. These coastal plains are swampy areas traversed by meandering rivers with associated oxbow lakes. The lower reaches of the rivers have extensive floodplains that may be seasonally inundated giving rise to vast swamps. Small wetlands are found in the highlands and on the islands.

It is important to note that there are large gaps in the scientific knowledge of Papua New Guinea's biodiversity. The number of frog species, currently 302, is likely to double when all species have been discovered and scientifically named. The number of species of reptiles and mammals is also expected to significantly increase as these taxa become better known. Enormous areas of the country have yet to be systematically surveyed and there is a growing need for a national biological survey to assist in assessing and managing Papua New Guinea's great biological wealth.

People have depended heavily upon Papua New Guinea's plentiful and diverse biological resources for subsistence. Melanesian societies have developed an extensive and detailed knowledge of Papua New Guinea's flora and fauna, and some 1,035 different plant species are known to be used for various purposes (Powell 1982). Wildlife plays an important part in traditional diets, supplying the primary intake of proteins and fats in many highland areas and other isolated areas of the country. In coastal areas a wide variety of seafood, including fish, mollusks, and turtles, dominate local diets.

Papua New Guinea is the fourth smallest of the megadiversity countries, but unquestionably one of the most unusual and interesting, especially in terms of diversity in human cultures. The human population of Papua New Guinea makes up a small fraction of the world's total but represents more than 12% of the world's languages.

1.2.1 The Papua New Guinea Environment.

Various approaches have been developed for assessing the distribution of biological and ecological phenomena in Papua New Guinea. For example, Sherman and Bryan, (2010) conducted a bioregional analysis of the distribution of rainforest cover, deforestation and degradation in Papua New Guinea using the biogeographical zones through the juxtaposition of two surfaces; one identifying 11 biogeographical zones and the other identifying 11 climatic domains. The combination of both datasets allowed assessment of long-term forest change in 81 separate regions or 'biomes' of the country.

Similarly, and more recently, Papua New Guinea has taken a regional approach to conservation by advancing the work on the eco-regions by (Olson et al. 2001). The ecoregions are defined as relatively large units of land containing a distinct assemblage of natural communities and species, with boundaries that approximate the original extent of natural communities prior to major land-use change.

To address the principle of representativeness, it is necessary to divide PNG into ecologically appropriate ecoregions within which biodiversity is to be represented (Figure 1.1-1). Further descriptions of these ecoregions are given in Table 1.3-2 adopted from the CNA Priority areas for terrestrial and wetlands.

Figure 1.2-1: Interim Stratification - Ecosystems are set in an eco-regional context. Adopted from the DEC/TNC POWPA project report 2010.

For the first time the ecoregions will become the reporting unit for assessing the status of species and ecosystems and their protection in PNG's Protected Area System, once endorsed by the National Executive Council. The ecoregion will also be used in the monitoring and evaluation framework for the Papua New Guinea Government's current natural resource management initiatives. The ecoregions is a cooperative approach and will continue to be refined as more detailed information on ecosystems or other base layers comes to hand. DEC with TNC delineated more accurate boundaries for the ecoregions by matching them with Land System boundaries in the PNGRIS II data and then created larger assessment units by: (a) aggregating adjacent archipelagos; (b) subsuming coastal units and small, upland ecoregions within their surrounding lowland ecoregions; (c) and aggregating the southern plains, wetlands and savannah ecoregions whose boundaries could not be consistently delineated. The number of ecoregions was reduced from 15 to 9 for the analysis (Table 1.1-1).

Table 1.2-1: Ecoregion Stratification Units adopted from DEC/TNC POWPA project report 2010

Ref	Ecoregions	Size (Hectares)	%	Source WWF Ecoregion
1	Manus Island	208,505	0.5	132. Admiralty Islands
2	North-eastern Islands	4,699,775	10.2	111. New Britain/New Ireland Lowlands 112. New Britain/New Ireland Uplands
3	Bougainville Island	939,137	2.0	119. Bougainville Island
4	Northern New Guinea	9,482,056	20.5	107. Huon Range 115. North New Guinea Lowlands 116. North New Guinea Uplands

5	Central Range	11,821,294	25.5	105. Central Range
6	Southeast Peninsula	7,457,004	16.1	120. Southeast Peninsula
7	Trobriand Island	432,689	0.9	125. Trobriand Islands
8	Louisiade (South-eastern Island)	181,395	0.4	110. Louisiade Archipelago
9	Southern New Guinea	11,053,974	23.9	121. Southern Wetlands 122. Southern Plains 708. Trans-fly
		46,275,829	**100%**	

Similarly to the terrestrial environment, an ecoregion approach was taken to map out the marine environment and is adopted from the TNC Expert Workshop Bali, 2003. The boundaries of an ecoregion are not fixed or sharp, but rather encompass an area within which important ecological and evolutionary processes most strongly interact (Figure 1.1-2).
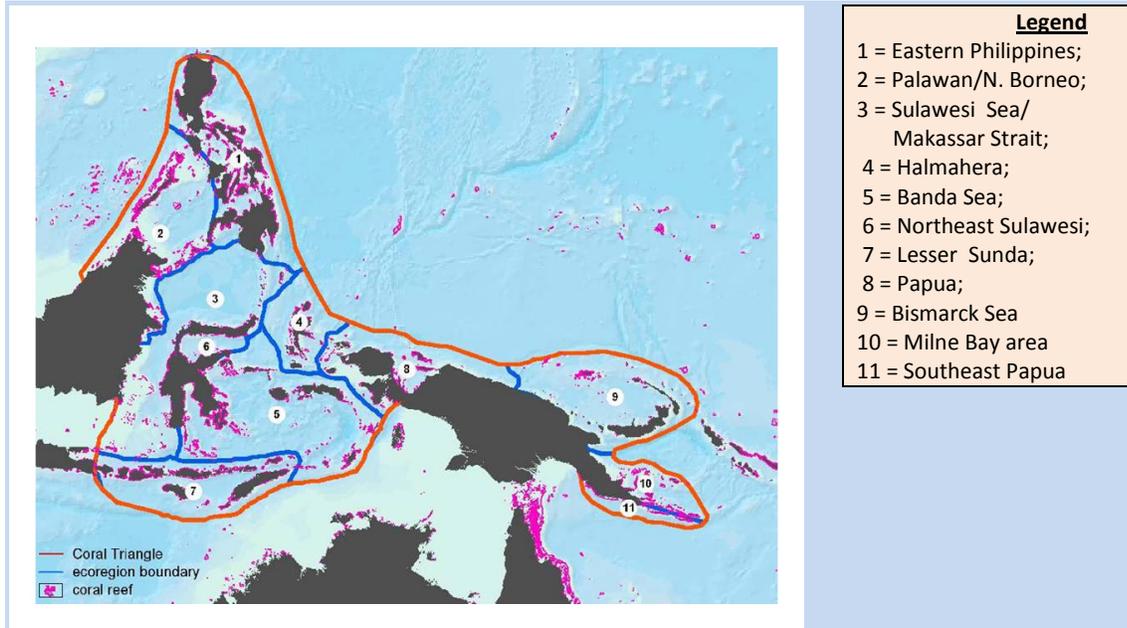
Figure 1.2-2: Boundaries of the ecoregions within the Coral Triangle (CTI) as delineated by the TNC Expert Workshop - Bali 2003

From the above assessment, PNG marine environment can be classified into three (3) ecoregions namely;

1. (9) Bismarck Sea –including the island of Manus, New Britain, New Ireland and north coast of the Momase region.
2. (10) Milne Bay Area – including the areas Lae to Milne Bay Province excluding the south east of the province,
3. (11) Southeast PNG – including the southeast coast line from Port Moresby to the further east to the Sudase Island in the Milne Bay Province.

The other two possible unclassified ecoregions missing from the above includes the followings which are;

4. Bougainville Island in the Solomon Seas, and
5. Southwest PNG – far west of Port Moresby including the Gulf of Papua and the Torres Strait area
    Further analysis is required to map out the marine ecoregions. For the purpose of the report these ecoregions in the analysis of the marine ecosystem.

Further data is required to properly delineate the boundaries of these marine ecoregions.

1.3. The Status and Trends of Papua New Guinea Biodiversity

1.3.1. Terrestrial Biodiversity

1.3.1.1. Species

Papua New Guinea is yet to develop a species or ecosystem database to determine conservation status and trends of species and ecosystems. For the purpose of this report, we have used the information provided by the World Conservation Society (IUCN) Red List program and is presented in table 1-1.2-1 below, supplemented by Bishop Museum's Pacific Biological Survey. For future work in conservation of species and ecosystems the list will help to identify species or ecosystems under greatest threat; assist in conservation planning and priority setting; and raise awareness of threatened species throughout Papua New Guinea. The list will also enable the monitoring of biodiversity, determination of the success of conservation initiatives, and reporting to various Conventions (e.g. the Convention on Biodiversity, RAMSAR, and CITIES) on trends in biodiversity.

Table 1-1.3-1: Estimated number of described and assessed species. *For sources, see page 2 of "The Pacific islands: An analysis of the status of species as listed on the 2008 IUCN Red List of Threatened Species™"

Taxonomic Group	Sub group	Estimated number of species described*	Number of Species Assessed	Revised Estimates from Bishop Museum's Pacific Bilogical Survey
Plants	Mosses	1286 1	**1**	
	Ferns	2414		
	Cycads	10	**6**	
	Conifer	110	**33**	
	Dicots	8278	222	
	Monocots	4367	2	
	Algae	189	**0**	
	Fungi	2240		
Total Plants		**18894**	**264**	
Birds		**719**	**719**	**740**
Mammals		**271**	**271**	**276**
Reptiles		**227**	**16**	**341**
Amphibians		**266**	**266**	**302**
Fish	Marine	2719	170	2800
	Fresh-water Fish	341	**0**	**314**
Total Fish		**3060**	**170**	
Invertebrates	Insecta	1644	22	150000 – 200000
	Arachnids	**8**	**0**	**~1500**
	Hard Corals	560	560	~600
	Molluscs (Bivalves and Gastropods)	669	7	~3000
	Crustaceans	**Unknown**	15	Unknown
	Hydrozoans	**Unknown**	6	Unknown
	Other	**Unknown**		Unknown
	Invertebrates			
Total Invertebrates		**2881**	**610**	
Totals		**26318**	**2316**	

The 2008 Red List provides the most up-to-date collated information for Papua New Guinea and can be found on *page 2 of* "The Pacific islands: after Country Study on Biological Diversity. This analysis indicates that our knowledge and information on the biodiversity of Papua New Guinea is generally either limited in accuracy and scope, out of date, or poorly documented.

At the same time most parts of Papua New Guinea lacks scientific knowledge and the two examples of expedition shows there are more species to be discovered and species data updated.

1.3.1.2. Descriptions and Status of the Terrestrial and Wetland Ecoregions

For the purpose of this report the ecoregions shown in Table 1.2-2 are aligned to the biodiversity priority areas listed in map presented in the Conservation Needs Assessment.

Table 1.3-2: Status of terrestrial and wetland priority areas within each ecoregions context

Ecoregions	Descriptions of Terrestrial and Wetland priority areas within ecoregion. (Adopted from the CNA terrestrial priority areas)	
1. Manus Island	**41. Manus Island.** The largest of the Admiralty group, isolated both from the great Bismarck islands to the southeast, and from mainland New Guinea far to the south. Not surprisingly, Manus's isolated fauna is rich in PNG endemics (eleven birds, two mammals). Of these, six are endemic to the Botanically, the area includes stands of an endemic *Calophyllum and Sararanga*, which are threatened by logging activity.	
2. North-eastern Islands	**32. Umboi Island.** Umboi is the largest and richest of PNG's north coastal islands. It is home to populations of large numbers of species endemic to PNG, as well as a supports one of the richest water bird populations in the Bismarck Archipelago. **33. West New Britain.** Mountain and lowland forests distinct from mainland. Threatened by large scale timber operations. The Whiteman Range and its foothills support an important tract of limestone flora, surrounded by forests developed on sedimentary materials. Little is known of the area, but large tracts of Nothofagus forest occur on the higher plateaus. **34. Willaumez Peninsula.** A remarkable physiographic feature with Lake Dakataua, it includes a very diverse area of lowland rain-forest on rich volcanic soils. Threatened by logging and proposed development for oil palm plantations. **35. Eastern New Britain.** Includes the uplifted and limestone-capped Nakanai Plateau. Little surveyed but apparently biotic ally rich. Lowland rainforest and montane forest, including areas of forest dominated by *Lithocarpus* and *Nothofagus* developed on the limestone substrate. The largest high altitude area in the Bismarck Archipelago. **36. The Baining Mountains.** The high ranges of easternmost New Britain, threatened by logging activities. Not adequately surveyed. These mountains, isolated by rivers and lowlands from the Nakanai Mountains to the southwest, are certainly as fascinating as the latter. They have not been adequately surveyed and are 500 meters higher. These mountains are surrounded by lowlands with a growing populace and probably will be degraded unless action is taken soon. **37. Southern New Ireland.** The Verron and Hans Meyer ranges are little known high ranges that merit study and conservation. Important montane and lowland vegetation. Brief initial surveys have shown this montane area to be very rich, with a num-ber of bird species endemic to New Ireland. **40. The Lelet Plateau.** Comprises important hill and lowland rainforests, with some lower montane elements as well. These probably contain many plant endemics with interesting biogeographical relationships with Manus, the Philippines, and the Solomon Islands. Threatened by selective logging in the lowlands.	**W16. Aria Wetlands.** Northern coast of western New Britain. **W17. Toriu.** Wetlands. On the eastern coast of the Gazelle Peninsula, comprise a large area of estuarine marshes and flood plains along the lower courses of the Toriu, Nesai, and Pali rivers. Mangrove forests occur in the north, and there are extensive areas of herbaceous swamps.

	41.Mussau Island. The interior of Mussau Island, the largest in the St. Matthias group, comprises a large block of rainforest. It sup-ports seven species of birds endemic to PNG, two of which are endemic to Mussau, the Mussau Rufous fantail (Rhipidura matthiae) and the Mussau pied monarch (Monarcha menckei).	
3. Bougainville Island	**38. Southern Bougainville Island.** Highland wet forests threatened by logging and development. This area includes the central and southern segments of the Crown Prince Range, from Panguna south to Lake Lorolu, and includes Mounts Takuan and Taraka. Where appropriate, this area extends downward toward the coast where good original forest prevails. Bougainville is home to many species whose affinities lie with the Solomon Islands to the south and southeast. Among the many interesting vertebrates is the little known Bougainville honeyeater (*Stresemannia bougainvillei*), repre-senting a genus endemic to this island. **39. Eastern Bougainville.** Supports the largest stands of bamboos in Papuasia. A variety of vegetation types occur, including remnant stands of Terminalia brassii in swamp forests. Threatened by logging and possibly sulfur mining.	**W18. Bougainville South Coastal Wetlands.** Important insular wetlands on the western coast of Bougainville island, dominated by Campnosperma brevipetiolata, Terminalia brassii, and Metroxylon solomonensis
4. Northern New Guinea	**1. The North Coastal Hills.** Lower montane and lowland alluvial forests that are relative-ly poorly surveyed but known to be rich in Irianese specialties. The area includes the endemic fern genus Rheopteris and also interesting coastal limestone communities. The highlands of the North Coastal Ranges support two endemic species of large mammals (the giant glider and Scott's tree kangaroo) and a number of isolated and taxonomically distinct bird populations. **2. The Star Highlands.** Pristine alpine and montane environments descending to mid-montane valleys, foothills, and fringing lowlands. They support a diverse montane and high altitude vegetation with many plant species in common with the mountains of Irian Jaya. The subalpine forests are home to a significant population of the globally threatened Macgregor's bird of paradise. The environmental transect from the summit heights northward to the Ai River lowlands has been documented as having the richest known mammal fauna in New Guinea. **3. Central Range/Sepik Foothills.** A large wilderness area with low human population and remarkable habitat diversity, from low- land to subalpine forest. The area includes extensive stands of *Agathis labillardier*i, which support a highly diverse epiphytic flora. The health of the Sepik hill forests are important to the river and its human cultures. **16. Finisterre Range.** PNG's youngest mountain range, with alpine highlands that remain little surveyed. This large montane forest tract, with a broad elevational range from coastal hill forest to the treeline, supports species endemics of three birds of paradise, two honeyeaters, and a tree kangaroo. **17.Saruwaged and Cromwell Ranges.** Alpine highlands and hill tracts threatened by development. This and the Finisterre area support numbers of locally endemic bird and mammal species and the only extensive Dacrydium forests in the Southern Hemisphere that remains unlogged.	**W6. Sissano Lagoon and Wetlands.** Comprise the largest coastal lagoon on the north coast of mainland PNG, associated with a large wetland. **W7. The Middle Sepik.** A huge complex of river meanders, oxbows, tributary lakes, marshes, and woodland swamps, both of ecological and economic importance. **W8. Sepik Delta/Middle Ramu.** A coastal wetland/deltaic complex (Sepik) in association with a low alluvial meander belt of the Ramu River, the latter rich in swamp forests. **W20. Ramu River at Brahman Mission.** Lowland swamp forest dominated by Campnosperma brevipetiolata.
5. Central Range	**4. Upper Fly Lowlands.** This area of lowland and hill forest is delimited by the Palmer River on the east and Irian border on the west and the southern scarp of the central cordillera on the north. Except for the extensive settlements related to the Ok Tedi mine (in the west) this area comprises a large expanse of old growth wet rainforest that supports a small human population and is characteristic of the extraordinarily rich biota of the upper Fly platform. **7. Mount Bosavi/Aramia Watershed.** An outlying Pleistocene volcano	**W11.Sirunki Wetlands.** The Sirunki Basin straddles the main montane watershed divide of PNG, with one segment of the wetlands draining northward into the Sepik, the other segment draining southward into the Fly system. An important highland headwaters. **W12.Lake Tebera.** One of PNG's few

	and vast alluvial plain. Virtually uninhabited. Proposed for national park status more than a decade ago, the forests of the great extinct Mount Bosavi volcano have long been recognized to be of importance to conservation in PNG. The tract comprises the volcanic cone plus lower slopes to the west and southwest. These forests are faunistically rich and virtually undisturbed. **8. Doma Peaks/Leiwaro Highlands.** Rich highlands environments with high scenic and biotic value. Doma Peaks (and Teri Gap) have been considered for national park status. These comprise a large mid-montane and upper montane tract of un-inhabited forest that is exceedingly rich in birds of paradise. Road access to 3000 meters on Tari Pass. Includes volcanic peaks. **9. Kikori Karst/Lake Kutubu.** Unknown and unsurveyed, with a remarkable karst topo-graphy and PNG's largest highland lake. Lake Kutubu supports a diverse aquatic plant flora, and 11 of the 14 known fish species in the lake are endemic to it. The area also includes an enormous tract of tower limestone, which is botanically unknown. Limestone floras in southeast Asia are often very rich, and, if the Great Papuan Plateau reflects this diversity, it is most important that detailed studies be made of its flora. The limestone flora is poorly known from New Guinea, but it will likely include many undescribed species and possibly new generic records. **10 Giluwe.** The massive Giluwe shield volcano is capped by the largest contiguous expanse of alpine vegetation in PNG. This is a globally significant montane and alpine wilderness threatened by logging of the beech-podocarp forests of its middle and upper slopes. Very rich biologically. Subalpine bogs extensive. **11. Adelbert Mountains.** Threatened lower montane forests that are home to the endemic fire-maned bowerbird. The rarest bird species in PNG and the bird species with the most circumscribed geographic range known for mainland PNG. The forests are little known but probably diverse. **12. Bismark Highlands/Ramu Basin.** From PNG's highest summit to one of its richest lowland alluvial forests. The Ramu supports extensive areas of lowland rainforest (including swamp forest), some of which is developed on ultrabasic parent rock. The only known locality of Lauterbachia (Monimiaceae). **13. Kubor Highlands.** High peaks and uninhabited montane forests, much on lime-stone capped with volcanic ash. A fragile ecosystem that probably contains local endemic plant species	lower montane lakes. Supports at least one endemic fish plus other rare fish species.
6. Southeast Peninsula	**18. Watut Hills and Watershed.** Little-studied hill country east of the central highlands area. The endemic plant genus Piora is recorded only from Mt. Piora and Mt. Amungwiwa. The lower reaches of the Watut River drainage support populations of the endemic root parasite Langsdorfia papuana, a genus otherwise known only from Madagas-car and Central and South America. **19. Lakekamu Basin/Chapman Range.** Includes an entirely uninhabited tract of forest that ranges from pristine lowland alluvial forest to upper montane forest near treeline, all within a transect of no more than 20 kilometers. The lowland forest supports large populations of the southern crowned pigeon, south-ern cassowary, and Pesquet's parrot. **20. Central Province Dry Zone.** Savanna and monsoon forest complex with wetlands, threatened by development. Also includes the second largest mangrove area in Central Province. **21. Bowutu Mountains/Kuper Range.** The Bowutu Mountains comprise an area of ultrabasic montane flora plus coastal, mangrove, and seagrass communities. The Kuper Range is a high coastal mountain complex that is virtually uninhabited and the site of a number of detailed ecological studies on birds and plants.	**W14. Mambare Wetlands.** Woodland swamps and mangroves. **W15. Central Province Wetlands.** A series of wetlands lie northwest of Port Moresby; because of proximity to the capital these wetlands are under varying levels of 2 0 exploitation and disturbance. They support large and diverse populations of waterfowl and other wetland birds. The area is particularly important as a dry season refuge for migrant waterfowl from Australia and as a staging area for Palearctic shorebirds on their way to and from wintering areas in Australia.

	22. Owen Stanley Highlands. Extensive alpine areas and vast tracts of pristine montane forests, ranging downward in the north to the forested Ioma lowlands. The Mount Albert Edward dome includes the largest alpine uplands in eastern PNG and thus is a critical montane resource. The lowland forests constitute a critically threatened resource in peninsular Papua, and those suggested for protection here may support populations of the globally threatened (and world's largest) butterfly, *Ornithoptera alexandrae.* **23. Musa River.** Little known lowland forests and wetlands. **24. Safia Dry Zone.** A low rainfall interior zone with unusual animal and plant communities. **25. Topographers Range.** An isolated volcanic cone in association with the coastal fjord-lands of Tufi. **26. Mt. Suckling.** A large montane wilderness isolated from the main Owen Stanley highlands. Virtually uninhabited and little disturbed at this point. The Suckling massif is the only significant alpine uplands in the eastern peninsula, and, in conjunction with the adjacent Bonua basin, stands as a remark-ably pristine aggregate of montane and low-land forest in easternmost mainland PNG. **27. Cloudy Mountains.** The most southerly mountain range 257.40in PNG. No collections are known from the area. Urgently needs study.	
7. Trobriand Islands	**28. Goodenough Highlands.** The massive central peaks of Goodenough Island are higher than any other mountains on New Guinea's fringing islands. The mountain forests that cloak these summits are home to an endemic species of forest wallaby and a bat endemic to these eastern islands. Many botanical novelties. **29. Fergusson/Normanby.** Unusual montane habitats and (on Normanby) ultrabasic dwarf forest. Fergusson Island is one of PNG's great biological unknowns, with three distinct mountain ranges, geothermal areas, and other natural wonders. The triok possum Dactylopsila tatei, is a species endemic to Fergusson. Goldie's bird of paradise is confined to the forests of these two islands. **30. Woodlark Island.** Floristically unusual; the forests of the interior of Woodlark are home to the endemic Woodlark cuscus.	
8. Louisiade Islands	**31. Louisiades.** The flora of this archipelago has been recognized as one of extreme botanical interest with high rates of local endemism, particularly at the species level. It includes important stands of Diospyros (including an undescribed ebony) and several locally endemic species of Hopea. The forests of Tagula Island are home to an endemic species of honeyeater and butcherbird.	
9. Southern New Guinea	**5. Tonda/Bulla Plain.** Savanna and riverine gallery forest unique in PNG. The large areas of savanna and seasonally flooded grasslands and marshes constitute a globally significant wintering ground for migratory waders and waterfowl both from Australia and the Palearctic. **6. The Northern Trans-Fly.** Unsurveyed seasonal forest and woodland that is probably a habitat formation unique in PNG. An undercollected flora closely related to that occurring in the Cape York Peninsula. **7. Mount Bosavi/Aramia Watershed.** An outlying Pleistocene volcano and vast alluvial plain. Virtually uninhabited. Proposed for national park status more than a decade ago, the forests of the great extinct Mount Bosavi volcano have long been recognized to be of importance to	**W9. Middle Fly.** The Fly River, although only 1200 km long, is, on volume of water discharged, so large that it ranks with the world's great rivers. The middle Fly floodplain, 15-20 km wide, is a mosaic of lakes, alluvial forest, swamp grassland, and swamp savanna. This includes PNG's largest lake (Lake Murray). **W10. Lower Fly.** A mosaic of swamps, open water, savanna, and gallery forest. The area has abundant wildlife and is an important tourist

conservation in PNG. The tract comprises the volcanic cone plus lower slopes to the west and southwest. These forests are faunistically rich and virtually undisturbed. **9. Kikori Karst/Lake Kutubu. (Shares with Central Range)** **15. Purari Basin.** Wet zone lowlands and hills. Virtually uninhabited and little studied. This includes a very diverse area of man-grove and swamp vegetation with lowland rainforest on small limestone hills out of the surrounding swamps. These evidently sup-port many local plant endemics but are virtually uncollected. The area includes numerous species of Pandanus and also a rich palm flora, particularly of Calamus.	destination. It constitutes a very important wetland both for migrating birds and resident waterfowl. In Australian drought years it becomes an important refuge for Australian wetland birds. **W13. East Gulf Coastal Wetlands.** The greater Purari delta comprises a large complex of mangroves, deltaic swamps, and tidal environments

1.3.1.3. Major Vegetation Change

Approximately 2.9 million hectares of rainforest (about 15% of the total) are currently degraded and a similar amount has been lost since 1972 when forests were first accurately mapped. This forest, which comprises 80% of the forest estate is currently being lost at the rate of 1.4% per year (Shearman, et al., 2008). The other major types of forest, dry evergreen forest, swamp forest and mangroves have remained relatively stable in extent since 1972.

Sherman and Bryan (2010), report that the majority of deforestation and degradation has occurred within the lowland forests, and that it is these forests that have the greatest potential for further losses in the near term. They also note the largest percentage of total change occurred in the east of PNG, in the islands and lowlands of the Bismarck, D'Entrecasteaux, East Papuan Islands and in the South-East Papua–Oro region. The only region with a significant highlands component to undergo deforestation at a comparable magnitude to the islands and lowland regions was the Huon Peninsula and Adelbert region. Significant changes have also occurred at higher elevations, especially at the interface of subalpine grasslands and upper montane forests. Lower montane forests have experienced proportionally less change, yet it is these forests that constitute the majority of forests enclosed within the protected area system.

1.3.2. Marine and Coastal Biodiversity

Papua New Guinea (PNG) is the largest equatorial island and lies adjacent to the northern tip of the Great Barrier Reef. The southern reefs of Papua New Guinea are a continuation of the GBR, whereas the reefs to the north and around the islands have strong affinities with reefs of the Solomon Islands to the east and Indonesia to the west.

In 2003, WWF brought together 60 scientists and experts from the government, institutions, researchers to map out the BSSE biodiversity as shown in Figure 1.3-1.
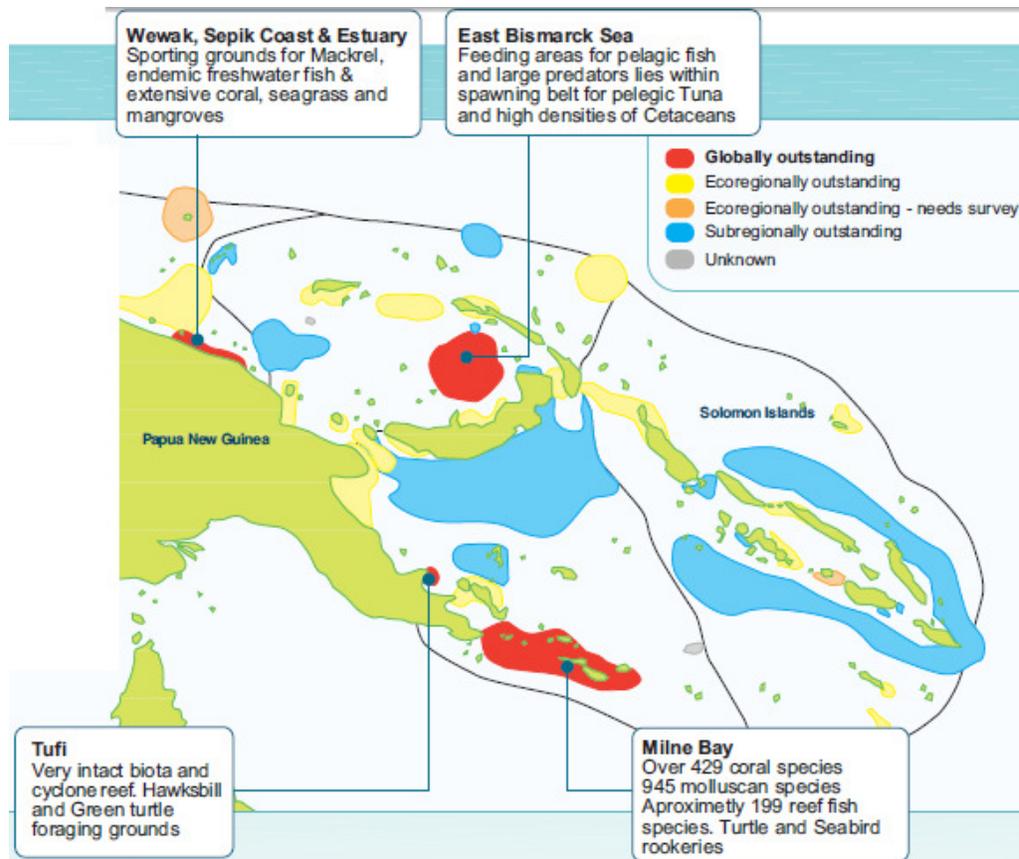
Figure 1.3-1: Modified from the WWF work on the Bismarck and Solomon Sea Ecoregion, 2003 with some modification.

1.3.2.1. Descriptions of Marine Ecoregions

PNG provides one of the last opportunities for the conservation of significant areas of coral reefs in the western Pacific region of maximum marine biodiversity. Few other locations offer the combination of large areas of high diversity reefs mostly undamaged by human activity; relatively low population size in most coastal areas; a scientific and management community that is committed to sustainable use of marine resources, and a customary land tenure system that can be used to enhance conservation efforts (Munday, 2000).

Table 1.3-3 Marine Priorities align to the Marine ecoregions defined in Figure 1.1-2 above

Analysis Ecoregions Source TNC Ecoregions (2003)	Descriptions of Marine priority areas within ecoregion. (Adopted from the CNA Report
(9) Bismarck Sea – including the island of Manus, New Britain, New Ireland and north coast of the Momase region.	**21. Hermit Islands.** Extensive, discrete patch reefs with sea turtles and a highly productive area of rich fisheries. Reef areas are far from population centres, but threats exist from poaching and overfishing. Uncontrolled tourism in the western islands may represent a potential threat as well. **22. Manus Complex.** Reefs and lagoon complexes, seagrass beds, and seabird rookery islands, with green tree snails, reef fishes, pelagics, and sea turtles. This is an area of high beta diversity with highly diverse reefs that are seriously threatened from dynamite fishing and by phosphate mining on seabird islands **11. Fullerborne.** Raised limestone islands, mangrove and associated nursery areas, and sea grass

	beds, with high habitat and structural **12. Talasea.** Reef and soft bottom marine habitats, nesting beaches for leatherback turtles. **13. Rabaul/Duke of York.** Mangrove, sea grass, reef, and offshore deepwater areas with thermal vents. Threats arise from proximity to Rabaul town and from timber operations in watersheds above the coast. **14. Tigak Islands.** Mangroves, sea grasses, reef, and deepwater mangrove lagoon, which are highly productive fishery areas. Beta diversity is very high, and threats arise from dynamite fishing. **15. Mussau Island.** This marine system includes reef systems and seagrasses, some parts of which are relatively pristine due to traditional practices of islanders, but now threatened by dynamite fishing. **16. Tanga/Tabar/Feni Islands.** Subsea volcanic formations, mineral-rich areas, and isolated island systems that may be very important for endangered vertebrates such as sea turtles. This is an area of diverse habitats and unusu-al geomorphology, possibly threatened by nearshore and offshore overfishing. **17. Southern New Ireland.** An area of fringing reefs. **23. Cape Cretin**. An area of ancient reef faces. **24. Vitiaz Straits.** Reefs, with steep land in proximity, threatened by land-use practices. **25. Volcanic Chain: Manam to Long.** Volcanic islands, reef walls, and sea mounts, sea turtle nesting beaches, and upwelling areas. Pelagic fishes congregate at the sea walls and sea mounts. Threats arise from overfishing and overharvesting of sea turtle eggs. **26. Madang Lagoon.** Coral reefs, lagoon islands, and mangrove patches, with coral and fish species. This is a well-studied area, species-rich, with high habitat diversity, which faces threats from commercial development in Madang town, as well as logging and dynamiting. **27. Laing Island.** This is a reef system and marine research station, threatened by dynamiting and by copra plantation wastes. **28. Sepik Delta.** Mangrove, brackish lake systems. This is a highly productive area with a unique hydrology and habitat for crocodiles. Threats arise from watershed mismanagement and introduction of exotic fishes. **29. Vokeo and Islands.** Small island systems in association with deep water. **30. Northwest Coast.** Sandy beaches with largely unsurveyed fauna. This area contains interesting current regimes and bottom topography and productive waters, and is threatened by overfishing and coastal
(10) Milne Bay Area – including the areas Lae to Milne Bay Province and south eastern part of the Central province, excluding the south west of Port Moresby	**6. Rossel Island. Reef systems, lagoons, isolated island areas, and an upwelling area, are largely unknown biologically and face possible threats from foreign poaching.** **7. Pocklington Reef. An extensive reef system, thought to be relatively pristine, and isolat-ed by deep water from all other reef systems in Milne Bay. This reef may show affinities to the New Georgia reef system**. **8. Morobe Coast.** An area of mangroves, sea walls, leatherback turtle nesting beaches, and fringing reefs, with the potential for community-initiated conservation action. An area of high beta diversity facing threats from nearby Lae town, especially logging of coastal hill forests. **9. Tufi Coastal Fjords.** Coral fjords, fringing reefs, mangrove, sea walls, thermal vents in a environment unique in Papua New Guinea, with high potential for nature tourism. **10. Trobriand Reef and Drop.** Extensive coral reefs, habitat for hawksbill. turtle, beche-demer, giant clams, dugongs, green sea turtles, coral reef fishes, and invertebrates. Largely unsurveyed, but thought to be highly productive reef systems.
(11) Southeast PNG – including the southeast coast line from Port Moresby to the further east to the Sudase island in the Milne Bay Province.	**4. Papuan Barrier and Lagoon.** Barrier reef, coastal lagoon, and mangrove Ð habitat for hawksbill turtles, reef fishes, corals, and marine invertebrates. This area of high diversity faces threats from dynamiting, overfishing, and eutrophication from sewage effluent emanating from development near Port Moresby. **5. Dumoulin.** A reef in proximity to the southern drop-off (potential upwelling), which is largely unknown; habitat for giant clams.

(12) Bougainville Island	**18. Buka.** A reef and lagoon complex with soft bottom communities and coral reef fishes, but otherwise largely unknown. Buka Channel comprises a unique habitat in Papua New Guinea but is threatened by overfishing and poor land-use practices. **19. South Coast Bougainville.** An area of reefs and associated habitats, with swamp forest, which differs from that on the mainland. Fauna are largely unknown, and this area contains reef systems in proximity to deep open ocean waters. **20. Borone Bay.** A largely unknown area with unusual hydrology coupled with steeply sloped shore fall-off, facing threats from logging and mining in upland areas **5. Dumoulin.** A reef in proximity to the southern drop-off (potential upwelling), which is largely unknown; habitat for giant clams. **6. Rossel Island.** Reef systems, lagoons, isolated island areas, and an upwelling area, are largely unknown biologically and face possible threats from foreign poaching. **8. Pocklington Reef.** An extensive reef system, thought to be relatively pristine, and isolat-ed by deep water from all other reef systems in Milne Bay. This reef may show affinities to the New Georgia reef system.
(13) Southwest PNG – far west of Port Moresby including the Gulf of Papua and the Torres Strait area.	**1. Maza/Fly Delta.** Mangrove and associated nursery habitats with seagrass beds, green sea turtle foraging habitats, and dugong habitat. Possibly threatened by overfishing and river-borne pollutants. **2. Gulf.** Shallow intertidal and soft bottom habitats, with mangrove communities that comprise important nursery areas for prawns, barramundi, and other commercially important species. Possible threats from overfishing, oil exploration, and pipeline. **3. Galley Reach.** A highly productive area of mangrove forests, wetlands, and reef, threatened by development and exploitation based in nearby Port Moresby.

1.4.   Agro- biodiversity

The PNG government has mandated the National Agricultural Research Institute (NARI) to be a custodian to all agro-biodiversity of the country. The sweet potato is a central component of the Papua New Guinean diet, and an estimated 5,000 cultivars of this staple are found within the country (Government of Papua New Guinea 1992). Numerous other plant species have traditionally been cultivated, including more than 30 root crops, 21 legume species, 40 leafy green vegetables, 60 other vegetables and roots, 43 varieties of nuts, 102 fruits, and 89 other plants used for food or for seasonings (Unisearch 1992). This traditional knowledge has already been tapped by the outside world: the winge-bean (*Psophocarpus tetragonolobus*), which is nutritionally similar to the soybean and is an important part of the diet in Papua New Guinean forest regions, is now cultivated in some 50 developing countries (Spears 1988).All main staple food crop species and fruits and nut species of the country have been collected over the years and are now conserved in 'living collections' or field gene-banks at various NARI Research Programme Centers throughout the country. The genetic diversity of major cash crop species such as sugarcane, coffee, cocoa, coconut, palm oil, rubber and tea are maintained by their own R&D institutes or companies at different locations in the country. Most of this diversity is introduced from over sea's gene-banks.

1.5. Inland Waters and Mangroves Ecosytems

1.5.1. Inland Water

The topography of Papua New Guinea is dominated by a broad central cordillera that runs through the middle of the country. On the border with Irian Jaya, the main mountain range is about 100 km wide, but it increases in width in the central highlands region to 300 km. From there, the cordillera narrows towards Milne Bay. These highlands are a complex system of ranges and valleys. The highest peaks are Mt Wilhelm (4,509 m), Mt Giluwe (4,368 m), Mt Albert Edward (3,990 m) and Mt Victoria (4,035 m).

There are number of important wetland ecosystems and these are

- North of the central cordillera is a depression which is occupied by the Sepik River in the west and by the Ramu River to the east. The Sepik and Ramu Rivers discharge to the Bismarck Sea in a wide gap between the Torricelli and Adelbert ranges
- The Markham River occupies the eastern part of this great northern depression, and is an unusual river for Papua New Guinea being a braided stream for most of its length.
- To the south, in the western part of Papua New Guinea, is a huge tract of low-lying land drained by the Fly and Strickland rivers. The Purari River has a large catchment area (33,670 km.sq.) draining the central highlands, and is the third largest river in Papua New Guinea, discharging 2,607 cubic metres per second into the sea. A detailed study of this river is reported in Petr (1983). The area east of the Purari River consists of the coastal plains of Gulf and Central Provinces. These coastal plains are swampy areas traversed by meandering rivers with associated oxbow lakes. The lower reaches of the rivers have extensive floodplains that may be seasonally inundated giving rise to vast swamps. Small wetlands are found in the highlands and on the islands.

Given the high rainfall and generally rugged topography, rivers are usually fast-flowing with very high discharges. Consequently, except in the broader, lowland areas, most rivers in Papua New Guinea have a poorly developed aquatic fauna and flora.

1.5.2. Mangroves

Mangrove swamps occupy 51.6 million hectares (~2% of the forest estate). They are normally found along protected bays and near the mouths of rivers and are especially abundant along the south coast in the Gulf of Papua into which several large rivers flow (e.g. the Fly, Kikori and Purari). A recent study (Shearman, 2010) demonstrated that the extent of mangroves in the Gulf of Papua has remained relatively stable for nearly 40 years, with expansion in some areas balanced by regression in other areas.

There are 33 species of mangrove trees known from Papua New Guinea. This flora, which includes 16 genera and 13 families of plants, constitutes the highest mangrove diversity in the world.   The south coast mangrove frogs, which in area comprise about 2/3 of the country's total, are composed of 31 species. Seven of these, *Aegialitis annulata*, *Bruguiera exaristata*, *Osbornia octodonta*, *Avicennia officalis*, *Sonneratia ovata*, *S. lanceolata* and *Camptostemon schultzii* occur only on the south coast. Two species, *Avicennia alba* and *Sonneratia caseolaris* occur only on the north coast. The remaining 23 species occur along both coasts (Ellison, 1997).

There seems to be many references on the mangroves of Papua New Guinea, yet lacks the followings;

- No systematic or comprehensive surveys have been made of the fauna of any wetland

- The vertebrate fauna is relatively well known, but there is very little information on the distribution and habitat requirements of invertebrates.
- It is, however, pertinent to note that the very lack of such information reflects the present state of knowledge of the majority of wildlife species
- At least 22 species of fish have been introduced into Papua New Guinea, representing 19 genera, 11 families and all six continents.

While there are many literature of the mangrove systems of PNG, recent studies in the extent of mangrove change in the Northern Gulf of Papua, Papua New Guinea by Sherman P; 2008 shows that a substantial gross changes between 1973 and 2002 occurred —an estimated gross loss of 7,191 ha and a gross gain of 6,199 ha. In total, only 30 ha of loss and 13 ha of gain occurred within regions\1 ha in size, suggesting that the influence of boundary error is minimal. However, it is suggested here that further analysis and improved technique are required to get better information.

1.6. Main threats to biodiversity in Papua New Guinea

◇ **Rapidly expanding human population** - PNG's human population was estimated at 6,057,263 in 2009[1]. The population growth rate between 2000 and 2005 was estimated at 3.2% per annum with rates of 2.2% and 3.9% in urban and rural areas respectively (Shearman et al. 2008).

◇ **Industry** - PNG has a nominal GDP of $8.2 billion USD. Major Industries include: Mining, Oil and Natural Gas, Forestry, Fisheries, palm oil, coffee, cocoa, coconuts, palm oil, timber, tea and vanilla. Almost all of these industries as well as small scale cash cropping by landowners are expanding.

◇ **Forest Conversion and Degradation** - PNG Forests are being degraded at a rate of 1.41%/year (Sherman 2008). For the period from 1972 to 2002, 48.2% of forest change was due to logging (0.9 million ha deforested; 2.9 million ha degraded) and 45.6% (3.6 million ha) was cleared for subsistence agriculture (Shearman et al 2008). It is estimated that by 2021 most commercially accessible forests will be degraded (Shearman et al 2008). Most accessible forests are under logging concessions and the remaining accessible areas are subject to industrial agriculture or the impacts of a rapidly expanding human population.

◇ **Climate Change** – The predicted impacts of climate change on biodiversity are many. The vulnerability of an ecosystem to climate change depends on its species' tolerance of change, the degree of change, and the other stresses that are already affecting it. [2]

These includes:

- Loss of Habitat
- coastal areas to sea level rise and coral bleaching
- high elevation habitats such as mountain tops
- moving - migrating upward or poleward
- increase - because of more favourable climate

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[1] World Statistics Pocketbook Small Island Developing States - United Nations New York 2003

[2] Climate Change 2007: *Impacts, Adaptation and Vulnerability*. IPCC Summary for Policymakers. (2007)

- decrease - due to limited migration potential, dispersal or shrinking suitable areas
- New pressures - disease and invasive species
- Loss of key species - migratory, keystone, pollinators, predators, etc
- Extreme events - drought and increased fire risk and flood

CHAPTER TWO: THE CURRENT STATUS OF THE NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN (NBSAP)

2.1. Introduction

The national efforts to implement the Convention are outlined in the NBSAP developed and launched by the Minister for Environment and Conservation in 2007. This document is central to all the programmes, projects and activities that Papua New Guinea has developed or been involved in respect of biodiversity conservation. However, in the last three years since its launching, although not very much has been achieved, but the government has developed a number of very important strategic documents and initiatives that have implications on the implementation of the NBSAP which is shown in figure 2.1-1 marked with a different colour and are further discussed in this chapter below.
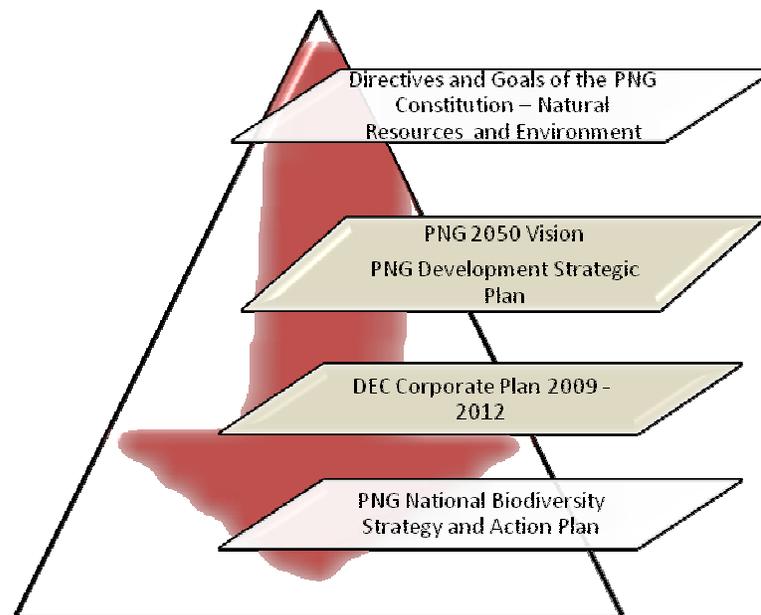
Figure 2.1-1 PNG Planning hierarchical framework that was used in the development of the NBSAP for Papua New Guinea. The PNG 2050 and the DEC Corporate Plan 2009-2013 were not yet developed and are missing from the current NBSAP and needs to be considered in the review. The planning framework promotes the both the top down and bottom up planning process.

Foremost, the national goals of the strategic action plan for biodiversity conservation is derived from the Fourth Goal of the Papua New Guinea Constitution as shown in figure 1 and promotes the following directive principles;

❑ Wise use to be made our natural resources and environment in and on land or sea bed, under the land and in the air, in the interest of our development and in trust for future generations

❑ The conservation and replenishment for the benefit of ourselves and prosperity, of the environment and its sacred, scenic and historical qualities; and

❑ All necessary steps to be taken to give adequate protection to our valuable birds, animals, insects, plants and trees.

The other important planning document used as a guide to the development of the NBSAP 2007 was the Medium Term Development Strategy (MTDS) 2005-2010 which is expired. Currently the government is working on the Medium Term Development Plan (MTDP) 2010 – 2015. The new MTDP 2010 – 2015 identifies indicators, deliverables and costing specified. It is envisaged that the deliverables will be addressed through the Sector Plans, Provincial Plans, District plans etc. Public sector plans, private sector partnerships, CSO-Public partnership, development partners. There are also mechanisms identified for policy and mainstreaming, programme and activity and legislation in terms of compliance and enforcement.

Most recently in 2010 and after the successful launching of the Papua New Guinea Vision 2050, the PNG recognized the climate and environmental sustainability as its fifth pillar of the vision. The government for the first time has developed the Papua New Guinea Development Strategic Plan, 2010-2030 (PNG DSP) in implementing the vision. The PNG DSP is a strategic planning document that articulates long-term national goals and formulates strategies that provide guidelines for action plans and resources programming.

Although DEC has led the preparation of the NBSAP, it has not been able to fully implement many of the activities because of resource and capacity constraints. DEC one year ago developed its Corporate Plan 2009 – 2012 which proposes a number of strategic actions and objectives that are not well articulated in the current NBSAP and has implications in implementing it.

These are the corporate objectives of DEC 2009 – 2012 which are have implications in the implementation of the NBSAP;

✧ To design and establish a new organisation to strengthen environment regulation and landscape wide environmental management practices to ensure economic development proceeds in an environmentally sustainable manner.

✧ To improve the administrative performance of the Department and extent of compliance with relevant legislation through strengthening the key corporate activities.

✧ To develop policies, indicators and a reporting framework to ensure effective implementation of the Government's ESEG Agenda.

✧ To improve the efficiency and effectiveness of environment regulatory processes and recent amendments including through partnership with other levels of Government and the private sector, and,

✧ To demonstrate on-ground improvement in both environment and economic outcomes through implementing large scale pilot projects in partnership with other levels of Government and external stakeholders.

DEC recognizes the need to update the NBSAP to include the above priority actions as outlined in the DEC Corporate Plan, 2009 – 2013 and other existing key sectoral development plans. The NBSAP needs to be in consistent with these plans. Especially in the areas of the ESEG policy framework, lessons learned from on-the-ground large scale pilot projects are essential for strengthening environmental regulation and management practices to ensure economic development proceeds in an environmentally sustainable manner.

For the first time the government of PNG has set a clear vision statement at the PNG National Constitution level and the PNG Vision 2050, that will no doubt be used to guide the development when reviewing the NBSAP.

2.2. International agreements and programs

Papua New Guinea has signed and ratified the following international Conventions which relate to the goals of the NBSAP. These include the Convention on International Trade in Endangered Species of Wild Fauna (CITES) and Convention on Wetlands of International Importance especially as waterfowl habitats (the Ramsar Convention); the United Nations Framework Convention on Climate Change (UNFCCC); Vienna Convention on the Protection the Ozone Layer; the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Convention on Biological Diversity (CBD).

2.3. Integration of biodiversity into national programs

The Papua New Guinea government agencies are sectoral driven and maintaining that PNG's biodiversity is central but also confusing when it comes to implementing and enforcing the sectoral policies and legislation that they administer - See table 2.3-1. At the same time, there are some good planning tools for example under table 2.3-1, The National Forest Act,1991 - Part III, Section 48, and Section 49, promotes the development of the National and Provincial Forest Plans and the opportunity for mainstreaming biodiversity conservation identification of important biodiversity areas can be identified and can be protected by this Act. Similarly, the table identifies the Organic Law on Provincial and Local-Level Governments (OLPLGL) that provides an important institutional framework for the planning process in Papua New Guinea. It provides the foundation for a system of bottom-up planning for provinces, to ensure the delivery of better and more appropriate services to the local people in a more efficient manner.

Table 2.3-1: Roles and Responsibilities of key government agencies and appropriate sections of the legislation that promotes integration of biodiversity into national programs

Agency	Responsibility	Legislation	Section	Level
National Planning and Monitoring	▪ National Planning Guidelines and policies development ▪ Financial and management and monitoring	▪ OLPG&LLG 1995 ▪ OLPG&LLG 1995 ▪ OLPG&LLG 1995 ▪ OLPG&LLG 1997	✓ S25 ✓ S33A ✓ S38 ✓ S34	✓ Provincial ✓ District ✓ LLG ✓ Ward
Dept. Lands & Physical Planning	Lands	▪ Physical Planning Act 1989	Part VII Section 67	✓ National ✓ Provincial
Department of Environment and Conservation	Environment & Conservation (Protected Areas) on Terrestrial and Marine	▪ Fauna(Protection & Control) Act	Part IV, V & VI	✓ National
		▪ Conservation Areas Act	Part III Section 12-17	✓ National
		▪ National Parks Act	Section 4 & 5	✓ Provincial ✓ National
		▪ Environment Act 2000	Part 5, Division 1 Section 41	✓ National

National Forest Authority	Forest	▪ Forest Act	Part III, Section 48 Section 49	✓ National ✓ Provincial
National Fisheries Authority	Fisheries	▪ Fisheries Act	Part III, Section 28	✓ National ✓ Provincial
Department of Mining	Mining	▪ Mining Act	Section 3 Section 7 & 8	✓ National

In a recent review of the extent of mainstreaming of protected areas (Kula and DEC staff, 2009) into national and provincial strategic documents, for example, these are some of the impediments identified as why integration is difficult and further discussed in chapter 3 of this report;

1) Complex social and land and sea tenure system that requires much more attention in planning for local participation and involvement, benefit sharing,
2) There is no incentives for protection and management,
3) There is ever increasing demand for natural resources including: logging, mining, industrial agriculture which are more attracted as they provide incentives,
4) A centralized National Government and highly decentralized population, and the needs of rapidly expanding largely rural population (85%) who still lead largely subsistence existence supplemented by cash crops.

Importantly, much still remains to be done, in particularly regarding the development of appropriate national conservation plan, policies, strategies and processes to integrate protected areas into the broader landscape, seascape and sectoral plans. Such integration is essential if protected areas are to become relevant in PNG and seen as essential elements of the country's effort to achieve sustainable development

2.4. Obstacles and challenges in the implementation of the convention

The following are examples of obstacles encountered and lessons learnt:

• The CBD was ratified in 1994 and is not yet well articulated into the main streams of government planning framework compared to the Millennium Development Goal 7 and the new global initiatives like the Climate Change.
• The National Executive Council (NEC) endorsed the following policies and projects which well defined and articulated into the various sectors;
  ❑ Creation of the long term organizational arrangements for managing Climate Changes and Environmental Sustainability
  ❑ Establishment of Millennium Development Goal (MDG) 7 Initiative on Environmentally Sustainable Economic Growth. The MDG 7 is well incorporated into the national planning system and are;
  ❑ Implementation of Coral Triangle Initiative (CTI) on Coral Reefs, Fisheries and Food Security, and
  ❑ Protection of the Brown River Catchment to Secure Port Moresby's Future Water and Power Supplies. Such endorsement gives the recognition of political support to the initiative, provision for funding, and clear directions to the sectors in terms of the roles and responsibilities.

- Otherwise, the PNG NBSAP was never submitted nor had the endorsement of the NEC, subsequently, it does not get proper recognition which it should have. It is critical that the revised NBSAP go through a similar process and obtain the endorsement of the NEC.
- Significant human capital, time and financial resources are required to build the necessary links between communities, industry and government for the successful regional delivery of DEC programs.
- The partnership between the bilateral countries like the Australian Government has been instrumental in leading effective regional delivery of the joint programmes like the Protection of the Brown River Catchment to Secure Port Moresby's Future Water and Power Supplies.
- Many DEC issues require a sustained, long-term commitment to address environmental degradation and repair, and to develop a more sustainable approach to the use of PNGs natural resources.

2.5.   Papua New Guinea National Biodiversity Strategy and Action Plan (NBSAP)

2.5.1. Goals and Objectives

The NBSAP is a strategic plan that aligns, strengthens and ensures the implementation of the government's environmental commitments espoused by the major national development policies, in particularly the Medium Term Development Strategy 2005-2005, replaced by the Long Term Development Goal (LTDG) and most recent development of the PNG 2050 Vision Strategic Plan launched by the Prime Minister of Papua New Guinea. The plan is yet to be reviewed and does not incorporate the DEC Corporate Plan – 2010-2013 and the 2050 strategic plan because the NBSAP was developed earlier than these documents. Never-the-less, these are the main goals of the PNG NBSAP:

1.   To conserve, sustainably use, and manage the country's biological diversity,
2.   To strengthen and promote institutional and human capacity building for biodiversity conservation, management and sustainable use,
3.   To strengthen partnership and promote coordination for conserving biodiversity,
4.   To strengthen existing protected areas and ensure that protected areas for terrestrial species and marine species are increased to 10% by 2010 and 2012 respectively,
5.   Ensure a fair and equitable sharing of benefits arising out of genetic and ecosystem resources,
6.   Promote and strengthen research of the country's biological diversity and the sustainable development of the country's biological resources,
7.   Measures of sustainability of biodiversity use, and incentives and alternatives
8.   Education and public awareness

The NBSAP developed nine (9) broad programmes to be implemented over the next five (5) years and beyond. These Programmes were prioritized into four (4) different categories and these are;

Priority	Programmes
1	1. Policy, legislation and administration 2. Financial and technical resources 3. Human capacities
2	4. Access and Benefit Sharing
3	5. Research and information on biodiversity 6. In-situ and ex-situ biodiversity conservation

| 4 | 7. Measures of sustainability of biodiversity use, and incentives and alternatives
8. Education and public awareness |

Program nine (9): Monitoring and Evaluation applies equally across the breadth of the four different priority areas.

2.5.2. Analysis of Effectiveness of National Biodiversity Strategy and Action Plan

The update on the progress of the NBSAP status is given in the National Capacity Self Assessment Project by SPREP 2010. This is first report to align the CBD Articles to the PNG NBSAP and assessed the progress made on each of the programmes, projects and activities. Not all CBD Articles are implemented evenly and not all NBSAP programmes are implemented in a systematically and coordinated fashion. For the purpose of this report, I have tried to provide a summary on each of the articles and provide some supporting policy statements and case studies where appropriate.

Table 2.5-1: Article 6 – General Measures for Conservation and Sustainable Use

Articles and Section	Status, Issues and Considerations
Article 6 (a), (b) PNG NBSAP Program 1, 5,6,7,8,	Currently no National Policy on Biodiversity, no Marine Policy is in existence. Current policies include – forest, DAL policy on species, and NARI has a Plant Genetic Resources Strategic Plan which covers the Conservation of Biodiversity of agricultural plants, collection, documentation and sustainable utilization.
	PINBio was established by DEC and the status is currently confusing. There are recommendations for its re-strengthening and establishment for effective implementation.
	PowPA, EIA process, CITES through the regulatory process eg Issuance of Permits for Wildlife Trade. Good examples are the Crocodile Trade – Mainland Holdings, Orchid Society, Working with NBPO. Forestry – Kwila Management Insect Trade Plan. Tavolo WMA – Business plan/ WMA management Plan. Adelbert – Cocoa /CI QABB project funded by Hargy
	Adelbert – Cocoa /CI QABB project funded by Hargy. WWF and Oil Search/LNG – Conservation Awareness programme

2.5.2.1 Other Policies and programs relating to Articles 6(a) and (b) and Article 8 (a – m)

The National Forest Service (NFS) is the implementing arm of the Papua New Guinea Forest Authority (PNGFA) and is responsible for implementing the PNG Forest Policy, 1991 with the objective of the management and protection of the nation's forest resources as a renewable natural asset and for the utilization of the nation's forest to achieve economic growth, employment creation, greater PNG participation in industry and increase viable onshore processing.

The policy recognizes; Resource Ownership, Forest Classification, Sustainable Yield Management, Reforestation, and Environment.

In terms of the Forest management strategies, the policy calls for the followings;
- ✧ Resource Inventory
- ✧ The National Forest Plan
- ✧ The Planning process
- ✧ Feasibility Study

◇ Resources Acquisition and Tenure
◇ Resources Allocation
◇ Timber Permits and Authorities
◇ Forest Management Control
◇ Forest Resource Replacement
◇ Environmental Management and
◇ Community Forestry

Table 2.5-2: Article 7 – Identification and Monitoring

Articles and Section Section	Status (How is your organization contributing to these NBSAP Activity and What is the status?)
Article 7 (a), (b), (c), (d) PNG NBSAP Goals and Programmes – 4, 5, 6, 7,8	Most of the activities requires the PINBIO
	See NARI Above – Passport data for Ex-situ collection. Insitu –On farm surveys. Documentation (work in Progress 2012) Major drivers of change – economics . Inventory of wild foods.
	National Collections –UPNG, NARI, NAQIA, BINATANG, CCRI, PNG National Museum, Macarthur Museum, FRI, UNITECH. Collections not accessible. They need to be data-based and incorporated into a biological survey that is accessible to all partners
	FRI – Flora of PNG, tree species Database, Needs lower plants Case studies

Table 2.5-3: Article 8 –In-situ Conservation

Articles and Section	Status
Article 8 (a), (b),(c), (d), (e), (f), (g), (h), (i), (j), (k), (l), (m) PNG NBSAP Goals and Programmes – 1, 2,4, 6,	Started on POWPA Phase 1. Gap analysis – representativeness of ecosystems, Phase 2. Review of National Conservation laws for conservation of biodiversity and the development of a interim National Biodiversity Conservation plan up for discussion Phase 3. Guidelines and Process in establishment for PAs.(Marine and Terrestrial) Work closely with NFA to include 10% From each FMA and with NGO Ecoreions/HVF/KBA/Heritage sites **See the Appendix III of this report for more information on the POWPA Phase 1 implementation.**
	In Progress - / Fisheries Act/ Maritime Zoning Act/Existing Conservation Acts.
	NFA Buffer zones (50m buffer
	ICAD – Conservation Areas Policy. Sustainable Landuse management, e.g Kokoda Track – Vanapa Brown River
	PNG Mama Graun /NGOs, NAQIA, NARI
	NGOs have programs .: Mama Graun runs a capacity building program to support PA management and communities.

	• NARI – internal funds, regional frameworks eg SPC PAPGREN
	• Climate change – screening Taro for Climate tolerant – dry and salinity Crop Diversity Trust (FAO)
	• Mama Graun conservation Trust provides funds for the following programs: Protected Areas, Infrastructure development, Capacity Building for PA management, Turtles, Internship program to train young conservationist.

Table 2.5-4: Article 9 – Ex-situ Conservation

Articles and Section	Status
Article 9 (a, b,c,d,e) PNG NBSAP Program: 6,	NARI - Field Gene Banks : Laloki, Bubia, Aiyura, Keravat Invitro – Aiyura and Karavat NARI – Reintroduction of rice, ICRICAT – Pulses eg beans and Peanuts, DPI for Shoghum, SIP – Potato and Corn

2.5.2.2   Other Policies and programs relating to Articles 9 (a,b,c,d,e)

National Agricultural Research Institute (NARI) is conserving genetic diversity of sweet potato, taro, banana, yam, cassava, aibika, traditional vegetables and fruits & nuts in field collections. The rich diversity of these crop species are conserved and maintained in National Germplasm Collections in field gene-banks at four NARI Research Centres in the country. Banana, cassava, yam and aibika national germplasm collections are conserved and maintained at NARI Southern Region Research Centre, Laloki 28km outside Port Moresby.

The national taro germplasm collection is maintained at NARI Momase Region Research Centre, Bubia outside Lae, while the highlands sweet potato collection is maintained at NARI Highlands Regional Research Centre, Aiyura outside Kainantu and the lowlands collection is held at the Islands Regional Research Centre, Keravat in East New Britain province. The collection of traditional and exotic fruits and nuts species and traditional vegetables are also maintained at Keravat. A small field collection of recently collected wild rice, wild *Vigna* and three accessions of sago are maintained at Laloki and the duplicate collection of wild rice is maintained by University of Technology (Unitech), Department of Agriculture (DOA).

A lot of information and data has been generated from the national germplasm collections held by NARI, but the system for storing and managing this information is not fully developed and appropriate for easy access by the general public. All PGR information is stored in Excel Spreadsheet files in computers held by various gene-bank curators. The collected germplasm are conserved in field-gene banks at ten plants per accessions in single rows and are re-located to new sites every six months for crops like aibika, sweet potato and taro, nine months for yam and cassava and every two years for banana

In vitro storage
Some cultivars of staple food crops of sweet potato and taro and introduced crop varieties of banana and potato are maintained under *in vitro* slow growth storage at NARI Keravat and Aiyura. PNG has no

cryo-preservation facility. In the South Pacific Region the cryo-preservation activity is only undertaken by the Secretariat of the Pacific Community (SPC) at the Regional Centre for the Pacific Crops and Forestry (CePaCT) in Fiji.

The germplasm conserved under tissue-culture storage in PNG are sub-cultured every six months and the seed crops are re-generated every two years for viability. Germplasm stored in tissue culture and in seed storage conditions are working collections except for the taro 'core' collection (20%) that is maintained by the Biotechnology Centre at University of Technology, in Lae.

Seed gene-bank (active collection)

NARI's National Grain & Rice Research Programme introduced some superior and elite rice varieties from the International Rice Research Institute (IRRI) in the Philippines and some elite varieties of pulses including soybean, mungbean, yardlong bean and cowpea high yielding open-pollinated maize varieties and peanuts for testing under PNG conditions. These varieties are kept as seeds under cool room seed storage facility at NARI Bubia, operating at 10-15°C.

Table 2.5-5: Article 10 – Sustainable Use of Components of Biodiversity

Articles and Section	Status
Article 10 (a, b,c,d,e,) PNG NBSAP Program: 1,2,6,7,	Not much progress has been made on this article except at project levels by various institutions like the Mama Graun programmes

Table 2.5-6: Article 11 – Incentive Measures

Articles and Section	Status
Articles 11 PNG NBSAP Program: 6,7,	Policy
	Mama Graun

Table 2.5-7: Article 12 – Research and Training

Articles and Section	**Status**
Article 12 – (a), (b), (c)	Existing Institutions and NGOs – UPNG, Wildlife Conservation Society
	FRI/UPNG and National Museum
PNG NBSAP Programmes – 3, 5,7,2,6,	DEC Corporate Plan 2009 -2013 – Demonstration projects, Kokoda and Owen Stanley Ranges Initiative,

Table 2.5-8: Article 13 – Public Education and Awareness

Articles and Section	Status of NBSAP Activity
Article 13 – (a), (b)	NARI – Nari Talk Post , all media , National News paper. Outreach and Liaison Program
PNG NBSAP Programme: 1,3,8	Environment Day – 5th June each year
	UPNG, UNitech, Divine Word, Vudal University

Table 2.5-9: Article 14 – Impact Assessment and Minimizing Adverse Impacts

Articles and Section	Status

Article 14: (a), (b), (c), (d), (e)	This Article is very much implemented by applying the Environment Act 2000. See Chapter 3 for more information on the Act.
PNG NBSAP Programmes: 6,5,	NEC has given the approved to DEC to design & establish a new organisation to strengthen environment regulation and landscape wide environmental management practices to ensure economic development proceeds in an environmentally sustainable manner.

Table 2.5-10: Article 15 – Access to Genetic Resources

Articles and **Section**	Status
Article 16 –	IPO – trade related patents do not cover biological material. Continue to exchange material through International Material Transfer Agreements.
PNG NBSAP – 1,4,5,	
	NARIs – MOUs and MOA – work well- joint publication PINBIO funding of PGR information management system (data Base) for NARI.
	Bill in progress.

Table 2.5-11: Article 16 – Access to and Transfer of Technology

Articles and Section	Status
Articles 16 – (a), (b), (c) **PNG NBSAP Programme: 5,**	See above, PINBIO/Pacific Roundtable

Table 2.5-13: Article 17 – Exchange of Information

Articles and Section	Status
Articles 16 – (a), (b), (c) **PNG NBSAP Programme: 3,6,8,**	

Table 2.5-12: Article 18 – Technical and Scientific Cooperation

Articles and Section	Status
Article 18 – (a), (b), (c), (d), (e)	NARI- See above
	National Institutions : UPNG, Unitech, Uni of Goroka, Divine Word, Vudal
PNG NBSAO Programmes: 2, 3, 5	NARI- local CRI (Through PINGBIO), CRI and CCI – Global plan of Action, Ramu Sugar –Maintenance of Sugar germplasm

Table 2.5-13: Article 19 – Handling of Biotechnology and Distribution of its Benefits

Articles and Section	Status
Article 19 – (a), (b) PNG NBSAP Programme: 4	Most of the PNG NBSAP program is 4 is PINBIO's responsiblity. Unfortunately the PINBIO is not well coordinated lacks resources. The status is unclear currently.

Table 2.5-14 Article 20 – Financial Resources

Articles and Section	Status

Article 20 – (a), (b) PNG NBSAP Programme: 2,5	✧ DEC has a number of projects funded from GEF and supported by institution such as ADB, UNDP, UNPD and others ✧ PNG Mama Graun Conservation Started operations in 2007. It supports 12 small and Medium sized PAs through a grant program and capacity building. By the end of 2012 PNGMGCTF will be supporting 21 PAs including 5 large PAs.

Table 2.5-15: Article 21 – Financial Mechanism

Articles and Section	Status
Article 21 – (a) PNG NBSAP Programmes: 2	Mama Graun – Innovative Partnership.

Table 2.5-16: Article 26 – Reports

Articles and Article	Status
Article 26	IUCN/Pacific Round Table

CHAPTER THREE: SECTORAL AND CROSS-SECTORAL INTEGRATION OF BIODIVERSITY CONSIDERATIONS

3.1. Introduction

There are major constraints facing the conservation of biodiversity and this is due to the fact that;

✧ There are uncoordinated efforts to develop a Regional Approach to Conservation,

✧ The complexity of Customary Ownership of land/sea and the social structures in Papua New Guinea,

✧ The lack of coordination in Administrative Planning Framework presented in Figure 3.1-2 and the requirements by the different natural resources policies and legal instruments that governs the government agencies as shown in Table 2.3.1.

3.1.1. Regional Approach to Conservation

For the first time the eco-region (see Figure 1.2-1) will become the reporting unit for assessing the status of species and ecosystems and their protection in PNG's Protected Area System, once endorsed by the National Executive Council. The eco-region will also be used in the monitoring and evaluation framework for the Papua New Guinea Government's current natural resource management initiatives. The eco-region is a cooperative approach and will continue to be refined as more detailed information on ecosystems or other base layers comes to hand.

3.1.2. Complex of Customary Land/Marine Ownership

The regional approach to identifying priority areas for protection and integrated management in PNG also needs to ensure the effective consideration of the PNG people, the traditional and customary landowners of PNG. Customary Landowners in PNG own the land and sea and are an integral part of the landscapes and seascapes of the Nation. An equal consideration when identifying priorities for protection and management is to ensure the effective consideration of the customary land owners. As a first step towards this, a second frame work is also crucial when considering implementing outcomes in PNG - a customary ownership Framework. To date 815 language groups have been mapped across PNG (Figure 3.1-1 below).
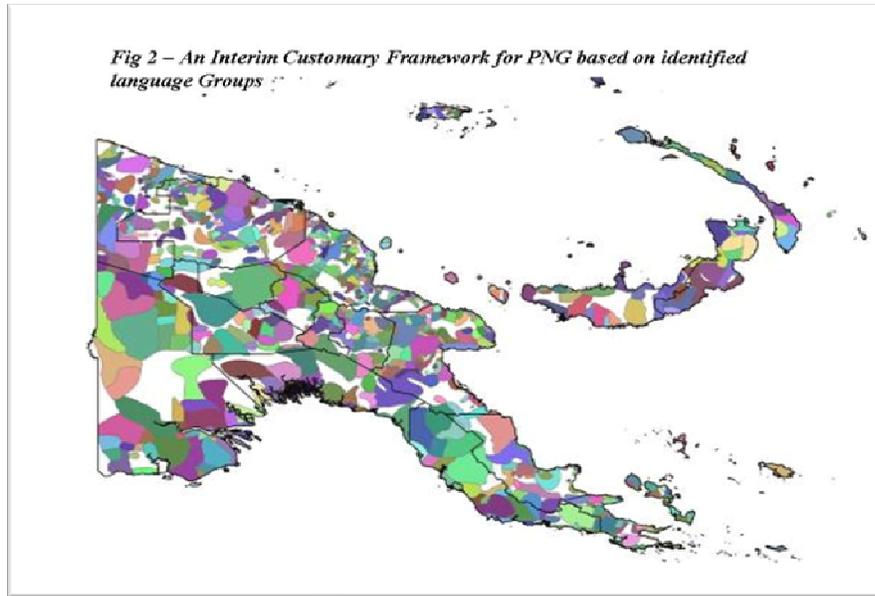
Figure 3.1-1 An Interim Customary Framework for PNG based on identified language Groups

The greater challenge is conducting the necessary consultation with the customary landowners, many of whom live in remote rural areas without ready access or are absent from their traditional lands.

3.1.3. Administrative Planning Framework
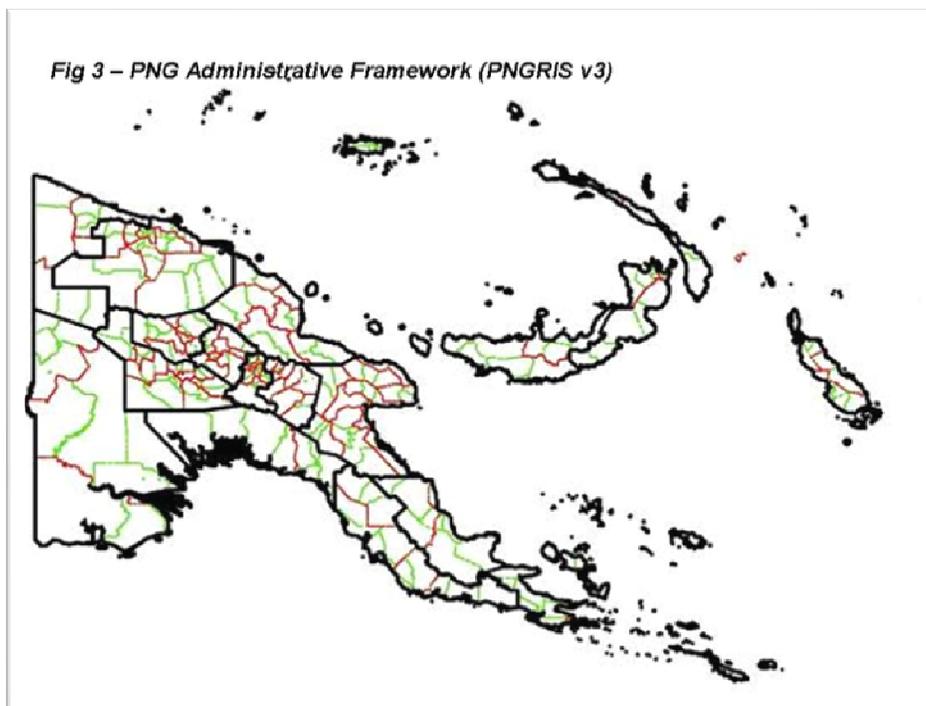
Figure 3.1-2: PNG Administrative Framework (PNGRIS v3)

A national framework, adding to the complexity of PNG's biodiversity, cultural and social frameworks, is the existing administrative framework which includes: Province – District –LLG and Ward levels of Administration (see Figure 3 above). This administrative structure was developed in an attempt to support the highly decentralized nature of the PNG rural community.

The New Organic Law on Provincial and Local-Level Governments (NOLPGLG) provides the institutional framework for the planning process in Papua New Guinea. It provides the foundation for a system of bottom-up planning for provinces, to ensure the delivery of better and more appropriate services to the local people in a more efficient manner. The reforms brought in by the new law are aimed at:

✧ Improving the delivery of services, particularly in the rural areas;
✧ Increasing participation in government at the community and local levels;
✧ Strengthening local government by decentralising powers and responsibilities to the local levels of government;
✧ Increasing funding to local levels of governments to support this strengthening;

3.2. Integration of biodiversity into sectoral strategies and plans

The Department of Environment is yet to develop a clear process for effectively implementing and integrating biodiversity and protected areas outcomes into the wider landscape, seascape and sectoral plans and strategies framework as required by the CBD Programme of Work on Protected Areas and the Millennium Goal 7 and on sustainable development. Given the complexity of PNG's social, cultural, legislative and administrative setting, without an effective planning and implementation framework and process it would be impossible to deliver such outcomes.

However, there are number of strategic planning document and framework where mainstreaming process has been encouraged and plan implemented.

Case Study 1 – Papua New Guinea Vision 2050 and the Strategic Development Plan 2010 – 2030

The broad objectives of the PNG DSP, 2010-2030

Guided by the directives and goals of the National Constitution, the Papua New Guinea Development Strategic Plan (PNG DSP) elaborates how PNG can become a prosperous, middle income country by 2030.

GOAL
A high quality of life for all Papua New Guineans

VISION
Papua New Guinea will be a prosperous
middle-income country by 2030

The directives and goals of the Constitution form the broad objectives of Papua New Guinea's Development Strategic Plan in the following ways;

Integral human development -Integral human development is essential to provide all citizens with the opportunity to achieve their potential. Quality education for all and a world class health system are key elements of the PNG DSP for human development, helping to develop a highly skilled workforce and equipping PNG's entrepreneurs with the skills they need to grow their businesses.

Equality and participation - All citizens should have equal opportunity to participate in and benefit from the nation's development. Prosperity in rural areas of PNG is a major emphasis of the PNG DSP, because the vast majority of citizens live in rural PNG. The PNG DSP specifies how service delivery to rural PNG will be achieved, including transport services, electricity, education, health and business assistance.

National sovereignty and self reliance - PNG's national sovereignty will be strengthened by PNG's economic and political success. Good governance and broad based growth will help build PNG into a prosperous nation including by facilitating PNG investors. Among other things, PNG's prosperity will alleviate the country's reliance on aid.

Natural resources and environment - PNG is well endowed with a wealth of natural resources. These resources must be managed sustainably to ensure they benefit both future and current generations. In particular, resource revenues need to be focused on nation building, while at the same time protecting the environment.

Papua New Guinea ways - PNG has a rich heritage of traditional wisdom and knowledge, reflecting the greatest cultural diversity of any nation of the world. PNG's development will be fostered in ways that learn from and build upon PNG's cultural heritage. The PNG DSP policy measures for law and order, land, education and health, for example, draw on PNG ways to improve the effectiveness of service delivery in these sectors.

The PNG DSP also translates the focus areas of the Papua New Guinea Vision 2050 into concise directions for economic policies, public policies and sector interventions with clear objectives, quantitative targets, and baseline indicators. It is envisaged that Papua New Guinea will have two Development Strategic Plans under the Vision 2050, each covering a 20 year period.

PNG vision 2050 recognises the climate change and environment sustainability as the seventh pillar of the vision and is further analysed below by different colour. Adopted from the PNG Strategic Development Plan 2010-2030.

The above broad directives of the Constitution and the Vision 2050 is diagrammatically shown in Flow Diagram below. The environment stream is shaded for easy reference.
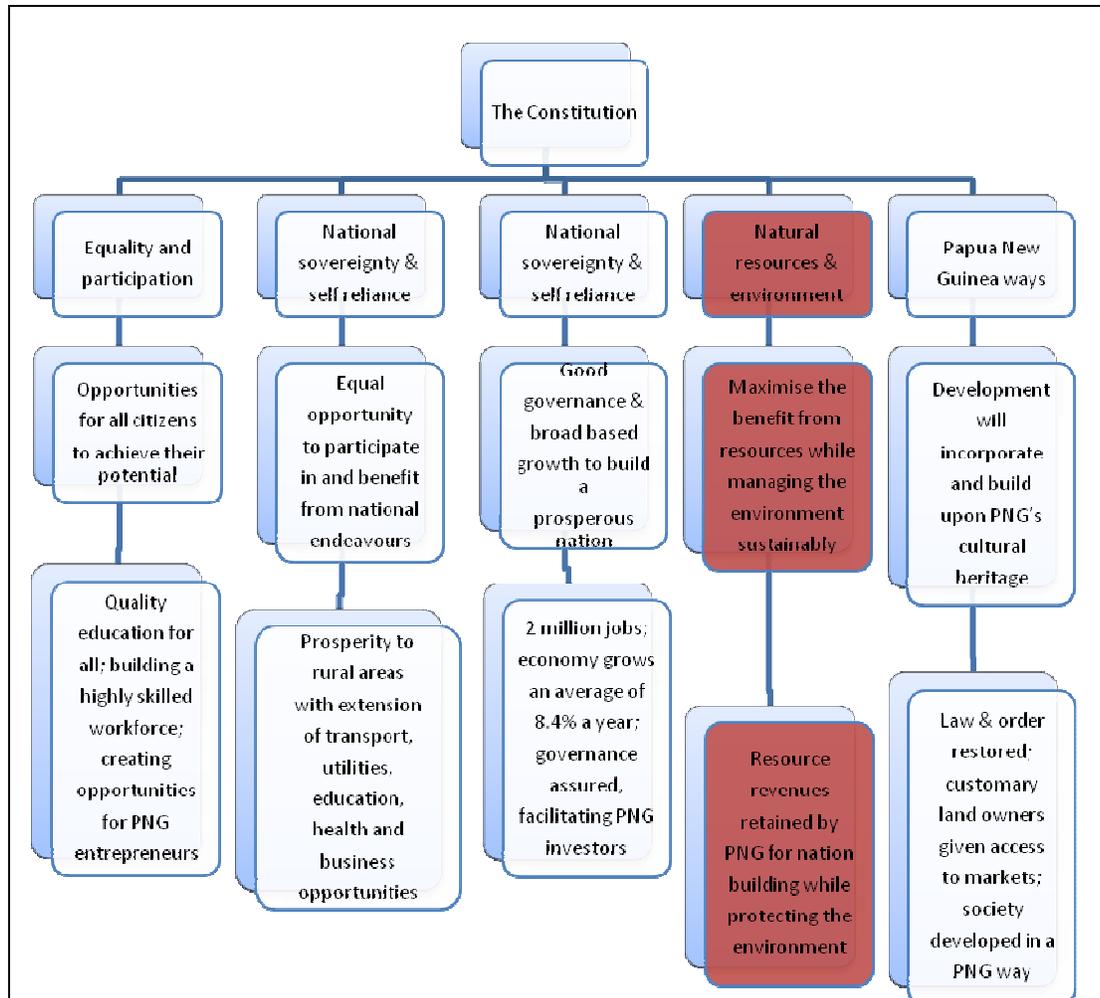
The PNG DSP strategizes the aspirations of the PNG Vision 2050 in line with the following core objectives:

1. Strategic planning
   - The PNG DSP is a strategic planning document, which articulates long-term national goals and formulates strategies that provide guidelines for action plans and resources programming. If applicable, the goals are quantitatively targeted and scenarios derived, using the PNG Government's computerised general equilibrium model (PNGGEM).
   - strategic plan acts as a road map for achieving long-term results. Strategic planning anticipates changes in the environment that implicitly suggest radical moves away from current practices.
   - Four five-year Medium Term Development Plans (MTDPs) are envisaged to be aligned to the PNG DSP 2010-2030. This implies that an MTDP's action plans, objectives, resources programming and implementation protocols should be in conformity with the strategic direction of the PNG DSP. Similarly, other statutory plans, such as the lower level government plans, line departments and agencies plans and corporate plans, as well as the annual budgets, must be aligned to the MTDP.

2. Systems and institutions
   - The PNG DSP dedicates a section to ensuring that good governance principles are upheld and that current institutions become more effective.
   - The PNG DSP outlines exactly how development stakeholders will partner and cooperate with the Government to enable achievement of the expected outcomes.
3. Human development
   - The PNG DSP is heavily focused on how investment in human resources can accelerate the development process. It considers the development of human resources to be an issue which cuts across all sectors.

4. Wealth creation
    - The PNG DSP sets the direction for the economy to move from an economy heavily dependent on non-renewable natural resources to one which has a broader base with dynamically developed industries in both secondary and tertiary sectors and with well connected and vibrant markets. The PNG DSP specifically addresses the manufacturing and tourism industries.
5. Security and international relations
    - The PNG DSP contains specific directions for defence and security, and states the broad objectives and strategies for foreign policy and foreign aid.
6. Environment and climate change
    - The PNG DSP will be pursued with consideration to environmental issues such that the health of the environment will not be compromised. Strategies under the extractive sectors as well as energy sectors are designed to be pursued with clear consideration for environment sustainability as well as addressing the issues of climate change in ways that best suit PNG's developmental needs.
7. Partnership with churches for integral human development
    - The PNG DSP recognises churches and other organisations as important partners in development and will rely on them to work towards achieving the PNG DSP goal of a quality life for all Papua New Guineans. Churches play an important role in meeting the spiritual needs of the people.

Case Study 2: Owen Stanley Ranges, Brown River Catchment & Kokoda Track Region Development Program.

by James Sabi, Department of Environment and Conservation

Background Information

The Kokoda Track and Owen Stanley Initiative is very important undertaken by the Department of Environment and Conservation on behalf of the Government of Papua New Guinea.

In 2008, a Joint Understanding between PNG and Australia on the Kokoda Track and the Owen Stanley Ranges was signed.

The Kokoda Track and Owen Stanley hold a special importance for Papua New Guinea and Australia.

- The Kokoda Track has iconic status for the people of both PNG and Australia. It represents the bond forged between our people at a time of war,
- The Kokoda Track has contemporary significance as a tourist attraction, has potential to widen the base of PNG's tourism industry, and is an important person-to-person linkage between people from PNG and Australia,
- The Owen Stanley Range region, including the Brown River Catchment, is important as a future water and power supply opportunity for Port Moresby.
- The Owen Stanley Rangers are one of PNG's carbon stores and will be assessed along with other locations as a potential sites for demonstration Reduced Emissions from Deforestation and Degradation (REDD) activities within Papua New Guinea – Australia Forest Carbon Partnership.
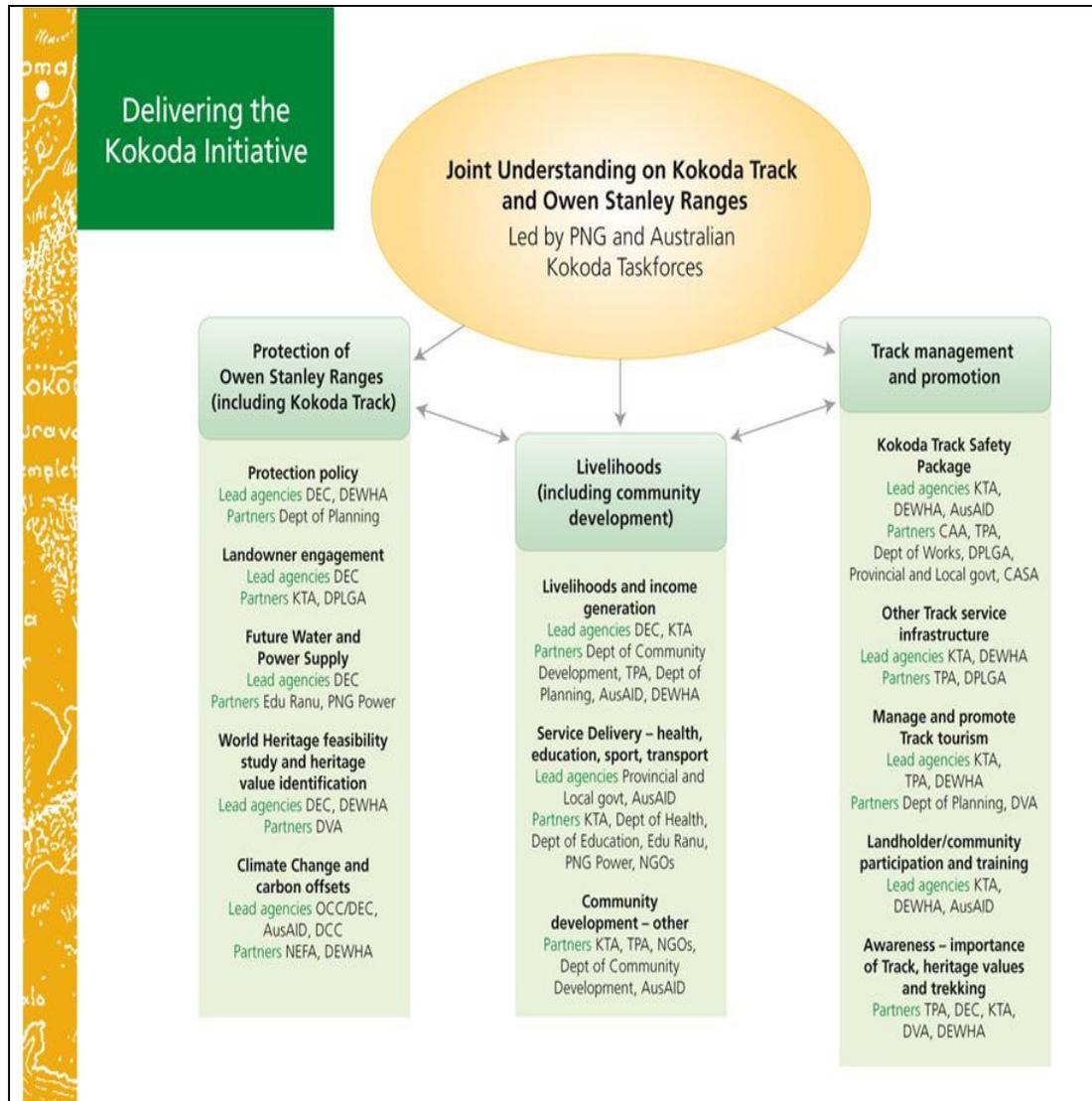
Figure 3.2-2: Project delivery for the Joint Understanding on Kokoda and Owen Stanley Rangers Project Outcomes and Partners.

The Owen Stanley Ranges are significant from a World Heritage perspective, and were included by the PNG Government on its World Heritage Tentative List in 2006.

The project is in its initial stages and ongoing research, data collecting and analysis is underway. During the Loloata Island Resort Workshop on the preparation of the 4th National Report to CBD, these are some of the assessments and negotiation taken place between the key government agencies, landowners, tour operators.

Step 1: Process for identification and delineation of the Protection Zone.
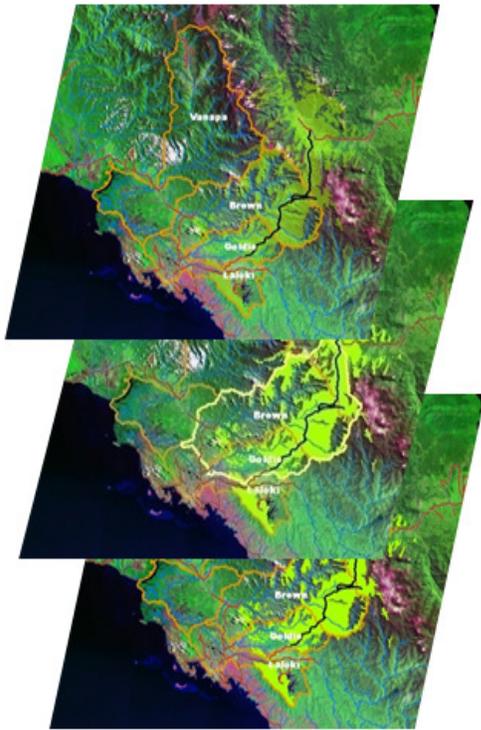
1. The Vanapa, Brown River and Goldie and Laloki river were assessed in terms of developing the catchment boundary
2. Computer assessment on the view shed due to the iconic status of the Kokoda Track. It represents the bond forged between our people at a time of war. Therefore such an assessment was taken so that the track maintains it tourist spectrum

3. Combining the assessment of the catchment area with view shed analysis, a Interim Protection Zone was identified and delineated as shown in the opposite figure.

Step 2: Assessing the Logging threat and removing them
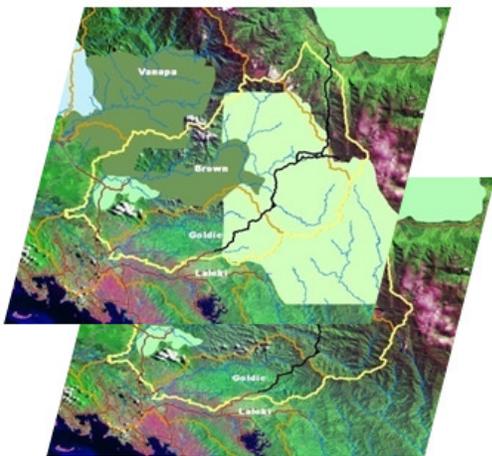
1. The 1996 National Forest Plan overlay onto the Interim Protection Zone. The southeast corner of the IPZ was allocated as a concession
2. The National Task force comprising of the key agencies including NFA agreed to removed the concession after the negotiations with the landowners

Step 3: Assessing the threats from Mining, PNG Power infrastructures and local villages to the Interim Protection Zone and removing the threats.
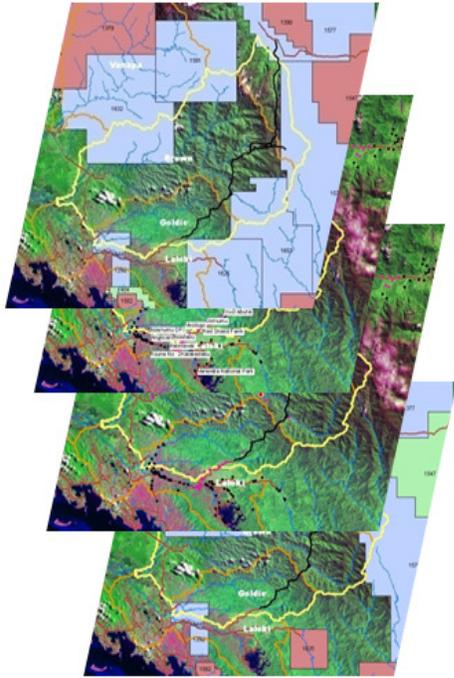
1. 2009 Mining Leases overlay onto the Interim Protection Zone. Leases all over the IPZ

2. The National Task force comprising of the key agencies including the Department of Mining agreed to removed the southeast mining leases

3. Overlay with PNG Power Infrastructure

4. Overlay with Villages found within the IPZ

Similar approach is to taken to assess the View Shed compatibility against the threats.
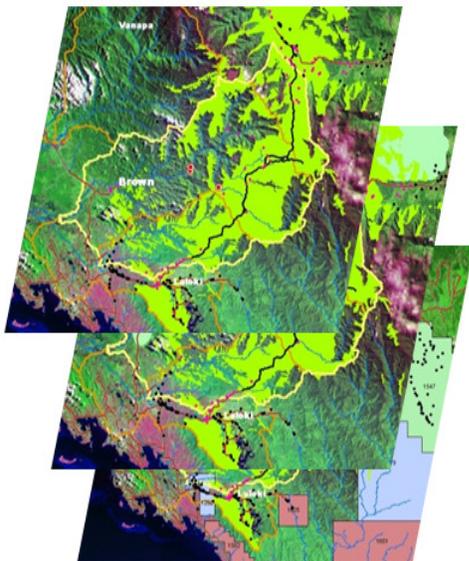
1. PNG Power infrastructure over the View Shed

2. Forest Operations 2009 and Power Infrastructure over the View shed

3. Mining Exploration Leases and Power Infrastructure over the View Shed

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Case Study 3: Torres Strait Treaty Between Australia and Papua New Guinea.

The Torres Strait Treaty between Australia and PNG provides for the management of the Torres Strait Protected Zone (TSPZ) that lies between the two countries. The Treaty covers a wide range of issues, including immigration, customs and defence, as well as fisheries and marine resources. Fisheries within the zone are jointly managed by the two countries, with arrangements for joint determination of management measures, catch-sharing and cross-licensing of vessels to operate in both countries' waters. To give effect to the provisions of the treaty, the PNG Government enacted the Fisheries (Torres Strait Protected Zone) Act in 1984. This was included in the recent review of the Fisheries Management Act, with the intention of bringing all of PNG's fishery law into one legislative instrument.

Case Study 4: The Bismarck Sustainable Development Planning Process The Bismarck Sustainable Development Planning Process

Geoff Lipsett-Moore, Theresa Kas, Francis Hurahura and Nate Peterson

Primary Objectives:

1. To take conservation and sustainable development efforts in Papua New Guinea (PNG) to scale

BISMARCK SUSTAINABLE DEVELOPMENT PLAN STUDY AREA

2. To assist PNG to meet it's International Commitments, particularly (1) Convention on Biodiversity and (2) Millennium Declaration – MDG 1 and 7.

3. To empower Provincial Governments and develop a process that strengthens effective conservation and sustainable development efforts

4. To embed sustainable development and effective conservation as an integral part of the development planning process in PNG and

5. To ensure the effective consideration of climate change mitigation and adaptation.
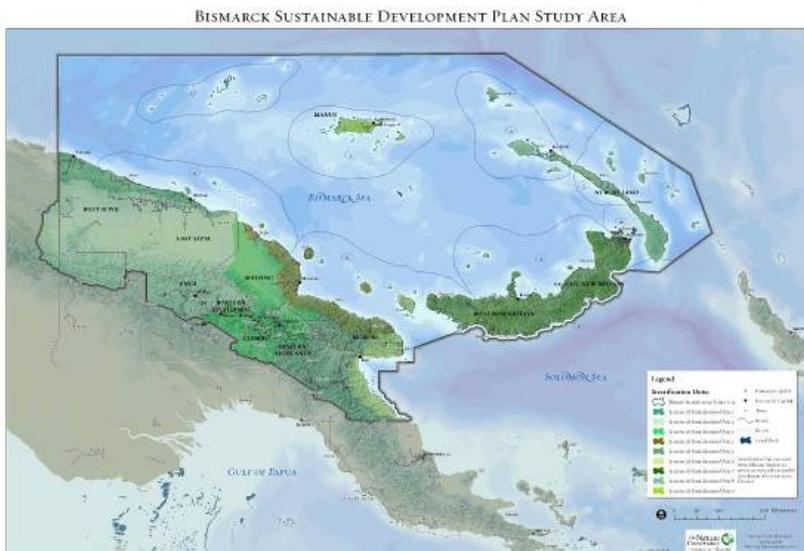
Key Participants:

Provincial Planners from 12 Provincial Governments across the Bismarck Study Area (Figure 1), TNC Melanesia Team and Brisbane and Advisors, Representatives from: The Department of Environment and Conservation, National Planning, National Fisheries, Mining, and Provincial and Local Level Government Affairs.

Process:

The Bismarck Sustainable Development Plan is a process that works systematically with PNG Provincial Governments through the development planning process to meet the above objectives. The process involves a series of workshops to engage, raise awareness, build capacity and ultimately empower Provincial Governments to pursue large landscape sustainable development initiatives (where sustainability includes a balance of protection and effectively managed development).

Synopsis of Workshops:

1. March 2008 - What is Environmental Sustainability and how do we implement it? Workshop one focused on: (a)

Introduction to Sustainable Development, PNG International Commitments under CBD and MDG and Medium Term Development Strategy (MTDS) (b) Proposed Study Area, (c) Sustainable Development Conceptual Model, (d) Participatory mapping of existing proposed developments for each Province and (e) Ranking of all threats and opportunities in terms of their likely impact on the persistence of biodiversity.

2. June 2008 - Reconciling conflict between Biodiversity Priorities and Development Priorities Workshop two focused on: (a) Identify existing biodiversity/conservation priorities based on existing assessments, (b) Overlaying existing conservation priorities with development priorities and (c) outlining a process (CAP) to develop strategies to mitigate the threatening processes (d) CAP breakout groups to develop strategies for three key areas.

3. September 2008 - Priority Sustainable Development Projects – Workshop three (a) Introduction to climate change adaptation and mitigation, (b) key National Issues from National Government Representatives (c) selection of projects on the basis of (i) Provincial Planner is proactive and (ii) Provincial Administration is supportive, (d) Development of draft priority projects and strategies (using CAP and Results Chains) to mitigate threatening processes and maximize environmental opportunities.

New Projects:

This series of workshops catalyzed the inclusion of large-scale sustainable development projects as an integral part of the 5 year development planning plans with 4 of the 12 Provincial Governments. These projects build on a foundation of platform sites already established within the Bismarck Region (i.e., Adelbert's Mountains and Kimbe Bay) (see Figure 2). Although the projects are in the concept phase, Provincial Governments are already endorsing the projects in principle and allocating significant financial resources in their budgets to support project development and implementation. These new projects are broadly outlined in Figure 1 and summarized below:

1. **East New Britain (ENB) – Mesulomato Sustainable Development Project** (Ridges to Reefs; ~710,000 ha; includes marine habitats to 3 nm's from shore) – The ENB Provincial Planner has been extremely proactive and the ENB Government has pledged funds to support this initiative, which requires that every Local Level Government (LLG) within the study area includes aspects of the sustainable plan within LLG plans and budgets. These conditions allow for widespread implementation of this project.

2. **East Sepik - Sepik Plains Integrated Development Project** (terrestrial, fresh water, marine; ~3,500,000 ha) – This project includes 3 Districts: Angoram (the Prime Ministers District), Wosera-Gawi and Ambuti. The Provincial planner has been extremely proactive and has secured funds from the Provincial Administration to support the development of this initiative (K$90,000) to be distributed evenly across the three Districts. There is also significant opportunity to expand the area with support from an Industry Partner, Xstrata (mining company).

3. **Manus – Manus Sustainable Development Project** (~2,100,000 ha) – This is a "ridges to reefs" project that includes all of Manus Island and its satellite islands and reefs bounded by the Conservation Needs Assessment; it excludes the Hermit Islands. The Manus Provincial Planner was unable to attend this workshop, so significant follow-up is required to fully detail this project. However, the Provincial Administration is highly supportive.

4. **Simbu and Eastern Highlands – Karamui/Lufa Integrated Development and Conservation Area (KIDCA)** (terrestrial; ~210,000 ha) includes Crater Wildlife Management area and other significant remaining high elevation forests.

Key elements of these projects include:

– These are Provincial Projects initiated and managed by Provincial Governments with support from the National Government and other partners.

– Levels of support by TNC and roles and responsibilities are defined in an MOU based on an initial scoping by TNC for each project.

– Provincial Governments require assistance with the completing documentation of each project and TNC resources (e.g. Fellows with strong writing and project skills) may be required to assist with this process.

– A first meeting will need to be held within each Province to commence the engagement of key Industry Partners and stakeholders to develop an overarching steering committee to enable the development and implementation of the projects in a collaborative, open and transparent manner.

– Provincial Budgets have been allocated for projects and will be approved as part of the Development Planning Process for each Province.

BSDP Provincial Project Boundaries - DRAFT -

Next Steps:
The proposed Provincial Sustainable Development Projects are part of the 5 year rolling development plan process. The projects will span the period from 2008-12. Most of the key strategies identified in the draft projects require working with Industry at scale (Forestry, Oil Palm, Bio-fuel and Mining) to develop best management practices. The projects will also require that climate change adaptation and mitigation (REDD) measures are effectively considered, as part of a National Gap Analysis Process driven by DEC.

1. Scoping and MOU - (December 2008) – The preliminary project scoping was conducted by Theresa Kas to determine the capacity of Provincial Government to manage and implement the proposed projects. It also enabled TNC to identify any potential risks, clarify roles and responsibilities, manage expectations and determine our level of involvement. These details will help frame the content of the MOU.

2. Stakeholder Meeting and Steering Committee development - (Jan – Feb 2009) – A first stakeholder meeting was held with each Province to engage key industry partners, landowners, CSO's and Government departments. This meeting provided an overview of proposed projects and also enable the establishment of steering committee's to oversee the development, funding, management and implementation of projects. It is expected that a TNC will assist with the facilitation of meetings and that a TNC representative will sit on this committee and that the committee will meet quarterly.

3. Technical Support – (Feb – Jun 2009)
−   **Project Management and Documentation -** It is expected that the Provinces will need assistance with project management and documentation of projects. It is envisaged that we will seek support more broadly within TNC to support this through the use of Fellows on three month assignments, but also by providing appropriate training to Provincial Government staff (e.g. TNC Project Management course).
−   **GIS -** Most Provinces have extremely limited GIS capacity. Most spatial planning in PNG is done at the National level. However, there is little or no communication between departments responsible for specific areas. For example, Forest Plans for forest management units are developed by the National Forest Authority. Agriculture Plans are developed by National Department of Agriculture. These plans span significant landscapes but are not integrated. The development of National Gap Analysis of existing Protected Areas and the consideration of climate change mitigation and adaptation will also provides a powerful opportunity to integrate plans, and inform decisions regarding tradeoffs that will maximize biodiversity benefits, ecosystems services and REDD considerations. TNC will work with the PNG National Government

and other partners to assist with the delivery of this process.

4. Industry Engagement – (Oct – Jun 2009) – Engaging Industry as part of the solution represents a cornerstone strategy for all projects. Engaging with key large landscape and seascape industries has many inherent risks, but equally powerful opportunities to secure results at scale. Immediate industry engagement within the Bismarck Region includes:

- NBPOL (Significant holdings in West New Britain, Madang Province and Solomon Islands) - Exploratory meeting held 21 October to scope a broader TNC/NBPOL working relationship
- Xstrata (Frieda Mine – most of the Sepik Catchment) – Exploratory meeting 8 December

5. Amendments to the National Planning Guidelines

The development planning process is one of the few decentralized processes in the country and works in a hierarchical manner with the development of Provincial, District, LLG and Ward Development Plans. In a perfect world this process involves a rollup of plans from the Ward to the Province. In reality it is more a top down assimilation of the many requests under the guidance of the Medium Term Development Strategy (MTDS). At the present time there is little if any guidance regarding Sustainable Development within the existing Guidelines. As part of the next Medium Term Development Strategy 2010 – 2015, protected areas and sustainable development guidelines should be incorporated within the revised National Planning Guidelines.

3.2.1. The Ecosystem Base Approach

Case Study 5: Ecosystem Base Approach Project, Kimbe Bay, Papua New Guinea.

Kimbe Bay is a large, well-defined bay (140km x 70 km in area) comprised of one of the world's most diverse tropical marine environments, including shallow (coral reefs, mangroves, and seagrasses) and deepwater marine habitats (oceanic waters and seamounts) in close proximity. These diverse habitats are part of the global centre of marine biodiversity, the Coral Triangle, and are home to at least twelve species of marine mammals and other rare and threatened species. Additionally, Kimbe Bay's inclusion of both shallow and deepwater habitats within close proximity to each other provides an ideal opportunity to protect a range of marine environments.

Like many coastal areas throughout the world, Kimbe Bay's rich marine biodiversity is at risk from local threats such as overfishing, sedimentation, pollution, and increasing human populations. Additionally, global threats such as rising sea temperatures associated with climate change have already led to coral bleaching in the bay. Sea levels are also rising, threatening critical coastal habitats such as mangroves and turtle nesting areas.

http://www.reefresilience.org/Toolkit_Coral/C8_Kimbe.html

Currently, the UNEP and DEC is implementing a Ecosystem Base Management (EBM) aimed to Support integrated policy and management development through national consultations, assessment of key ecosystem drivers and development of cross-sectoral policy and management responses, introducing and tailor-making key concepts of integrated environmental.

1. Understand and work towards the concept of EBM
2. Analysis information from the study site site by clustering of the major elements of Kimbe Bay that relates to the natural resources, economic development and cultural factors. This clustering exercise will assist in developing the EBM plan as it is based on direct and indirect relationship and depencies of other elements to provide sustainable ecosystem services while recognizing economic nececcities
3. Identify present and potetial impacts
4. Develop potential mitigation to impacts
5. Use the above information to collate climate vulnerability and possible adaption measures
6. Construct a potential EBM plan for Kimbe Bay
7. Use the approach and information to support other national and marine programs in PNG

3.2.2. Biodiversity in environment impact assessment

Papua New Guinea Environment Act 2000 has the following objectives and recent amendment

a)   to promote the wise management of PNG natural resources for the collective benefit of the whole nation & ensure renewable resources are replenished for future generations;

b)   to protect the environment while allowing for development in a way that improves the quality of life and maintains the ecological processes on which life depends;

c)   to sustain the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations, and safeguard the life-supporting capacity of air, water, land and eco-systems;

d)   to ensure that proper weight is given to both long-term and short-term social, economic, environmental and equity considerations in deciding all matters relating to environmental management, protection, restoration and enhancement;

e)   to avoid, remedy or mitigate any adverse effects of activities on the environment by regulating in an integrated, cost-effective and systematic manner, activities, products, substances and services that cause environmental harm;

f)   to require persons engaged in activities which have a harmful effect on the environment progressively to reduce or mitigate the impact of those effects as such reductions and mitigation become practicable through technology and economic developments;

g)   to allocate the costs of environmental protection and restoration equitably and in a manner that encourages responsible use of, and reduced harm to, the environment;

h)   to apply a precautionary approach to the assessment of risk of environmental harm and ensure that all aspects of environmental quality affected by environmental harm are considered in decisions relating to the environment;

i)   to regulate activities which may have a harmful effect on the environment in an open and transparent manner and ensure that consultation occurs in relation to decisions under this Act with persons and bodies who are likely to be affected by them; and

j)   To provide a means for carrying into effect obligations under any international treaty or convention relating to the environment to which Papua New Guinea is a party.

3.2.3. Way Forward

- o   There is urgent need for improved coordination among national and international institutions, adoption of policy measures that protect the environment. There is need to strengthen existing institutions responsible for biodiversity conservation and to harmonize and integrate their activities.
- o   Establish a Coordinating body for the NBSAP?
- o   Establish a POWPA Taskforce in the department to implement the process above
- o   Integrating Biodiversity Conservation into the National and Provincial Planning Process Framework,
- ✧   Incorporate the PNG National Biodiversity Strategy and Action Plan Goals into the next Medium Term Development Strategy 2010 – 2015.
  - o   Integrating Protected Areas into Sectoral Development Strategies and Action Plans by taking into account the followings;
- ✧   DEC Regional eco-regional planning framework, (see TNC and DEC map),

- ✧ The implementation and monitoring of the administrative management framework, and
- ✧ Culture in recognising the sacred sites and other important landscape features.
  - o Maintenance of a good database system equipped with capable and efficient capacity and funding,
  - o Support and provide funding for the management of these areas,
  - o Monitoring and Evaluation the achievement of eco-regional planning framework

CHAPTER FOUR: CONCLUSIONS

4.1. A. Assessment of Actions Towards Biodiversity Goals, Targets and Outcomes

Terrestrially, PNG contains more than 5-7% of the worlds terrestrial biodiversity in less than 1% of the land area (Ausaid 2010). PNG has more than 18,894 described plant species, 719 birds, 271 mammals, 227 reptiles, 266 amphibians, 341 freshwater fish and unknown number of invertebrate species (Vie et al. 2009). The current status of species in PNG includes: 1 extinct, 36 critically endangered, 49 endangered, 365 vulnerable, 288 near threatened, 1289 Least Concern. Moreover, 1 in 5 assessed species in PNG is endemic, with the highest number of endemic mammals globally (Vie et al 2009).

And as for PNG waters, they are considered part of the coral triangle, the area of highest known marine biological diversity. Its coral reefs are amongst the most diverse in the world and support an abundance of coral reef associated fauna. Almost all reef types found in PNG waters are within fringing and/or barrier reefs, with an estimated area of 40,000 km². In addition, PNG has some of the largest unpolluted tropical freshwater systems in the Asia Pacific region.

At the same there is lack of scientific and social data. The Conservation Needs Assessment in 1994 recognized the location of 16 major geographic areas within Papua New Guinea for which the present lack of scientific information is particularly serious. While this does not mean that the rest of the country is adequately surveyed, the sites listed were considered important areas for future study. Since, than there has been a number wildlife surveys conducted however these species data needs to be complied and managed for monitoring of species and ecosystems.

For the first time the terrestrial and marine ecoregions (Figure 1.2-1 and 1.2-2 in chapter 1) will become the reporting unit for assessing the status of species and ecosystems and their protection in PNG's Protected Area System once endorsed by the National Executive Council, and for. The ecoregion will also be used in the monitoring and evaluating framework for the Papua New Guinea Government's current natural resource management initiatives.

The ecoregions are aligned to the terrestrial, wetlands and marine biodiversity priority areas as identified in the Conservation Needs Assessment as shown in Table 1.3-2, Status of terrestrial and wetland priority areas and Table 1.4-1 on Marine Priorities align to the Marine ecoregions defined in Figure 1.2-2 of the chapter 1. The ecoregions is a cooperative approach and will continue to be refined as more detailed information on ecosystems or other base layers comes to hand.

In Papua New Guinea, biodiversity conservation requires the effective consideration of Biodiversity, Climate Change Customary Land/sea owners and ecosystem services upon which people depend on.

The progress in implementing the NBSAP from the review shows that the implementation of the NBSAP is not coordinated, not implemented in a systematic fashion and rather slow. This may be due to a number of barriers such as;

⬧ Lack of capacity and funding year marked and allocated for the implementation of the NBSAP,

⬧ Change of departmental status from a implementing agency to policy development one

⬧ Restricting of the department and the development of the new Corporate Plan not considered in the current NBSAP,

⬧ The current NBSAP lacks, key outputs, time bound, budget allocation, identifying responsible agencies, and developing clear reporting and monitoring guidelines.

While the government is serious about environment, the Organic Law on Provincial and Local-Level Governments (OLPLLG) provides the institutional framework for the planning process in Papua New Guinea. It provides the foundation for a system of bottom-up planning for provinces, to ensure the delivery of better and more appropriate services to the local people in a more efficient manner. The reforms brought in by the new law are aimed at:

⬧ Improving the delivery of services, particularly in the rural areas;
⬧ Increasing participation in government at the community and local levels;
⬧ Strengthening local government by decentralising powers and responsibilities to the local levels of government;
⬧ Increasing funding to local levels of governments to support this strengthening;

Most recently, the launching of Papua New Guinea Development Strategic Plan, 2010- 2030, that has moved away from the past traditional planning approaches and sets forth new directions and parameters for development planning in this country. It has finally translated the Five Directive Principles of the National Constitution, the Eight Point Improvement Plan and the Vision 2050 so that the aspirations of our leaders can be achieved through the annual planning, programming and budgetary processes. This is outlined in the Chapter three of this report.

Chapters 2 and 3 summarize some of the most significant results achievements in support of PNG's mainstreaming. These include integrated, ecosystem-based initiatives, significant direction to the additions to PNG's networks of protected areas, addressing the climate change issues, restoration of degraded ecosystems, legislation for the protection of species at risk, habitat stewardship programs, sustainable resource management and a variety of ecosystem, species and genetic research and assessment initiatives.

Sustainable resource use and management are also extremely important to ensure that exploration, harvesting and extractive activities do not cause net loss of biodiversity. PNG needs to develop and ensure in helping sustainable production and consumption of biological resources. Greater efforts to mainstream biodiversity into sector-based strategies are needed, given their potential to align economic, social and ecological objectives and achieve better overall results. Chapter 3, includes examples where different levels of government, and NGOs, working towards the integration and incorporating biodiversity in their actions.

The following table provides an assessment of the actions taken in Papua New Guinea to address the CBD goals and targets and PNG's biodiversity outcomes. Indicators and trends related to these goals are

summarized where available. The PNG Government consideration on each of the Targets are given below each table that identifies the goals and the targets.

Table 4-1: Assessment of Actions Toward Biodiversity Goals, targets and outcomes

1. Reducing rate of loss of the components of biodiversity		
Goal 1. Promote the conservation of the biological diversity of ecosystems, habitats and biomes	Target 1.1: At least 10% of each of the world's ecological regions effectively conserved.	✧
	Target 1.2: Areas of particular importance to biodiversity protected Target 2.2: Status of threatened species improved.	✧
Goal 2. Promote the conservation of species diversity	Target 2.1: Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups	✧
Goal 3. Promote the conservation of genetic diversity	Target 3.1: Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained.	✧

Target 1.1

Approximately 4% of PNG's terrestrial areas are protected in 53 protected areas (see Table 4-1 below). Since Independence there has been a significant shift in protected areas from those that exclude people (e.g. National Parks) to those where people are a part of the protected area system (Wildlife Management Areas and more recently a Conservation Area (YUS)).

Table 4-1: Existing Protected Areas in Papua New Guinea

Protected Area Type	Count	Hectares	%
Wildlife Management Area	30	1,631,360	84%
Conservation Area	1	164,070	8%
Sanctuary	5	58,353	3%
Memorial Park	3	39,567	2%
National Park	8	28,025	1%
Protected Area	2	20,068	1%
Provincial Park	1	198	0%
Reserve	2	126	0%
District Park	1	3	0%
	53	1,941,771	100%

PNG has made limited progress toward meeting the CBD terrestrial goal and NBSAP Goal of 10% of land area under protection by 2010 (CBD; PNB_NBSAP). In an IUCN review in 1999 for the World Bank/WWF Alliance for Forest Conservation and Sustainable Use (IUCN, 1999) showed that 73% of PNG's protected areas have minimal or no management structure. Sixteen percent had no management at all, 8% had a management structure but there were serious gaps and only 3% were well managed with a good infrastructure (IUCN, 1999:26). The lack of effective management of existing protected areas was reinforced in the more recent RAPPAM Report 2009 (WWF 2009).

Target 2.2; Species

Mapping restricted range endemic species data from the Bishop Museum represents the best estimates for the current distribution of each species. Focused on the use of RRE's, as these species have the most narrow geographic and climatic ranges and are therefore most vulnerable to the impacts of climate change.

Table 4.2: Restricted range endemic species from Bishop Museum

Group	Source	Number of species
1. Restricted range endemic reptiles and amphibians	Allen Allison- (Bishop Museum)	123
2. Restricted range endemic mammals	Allen Allison - (Bishop Museum)	25
Total number of species		148
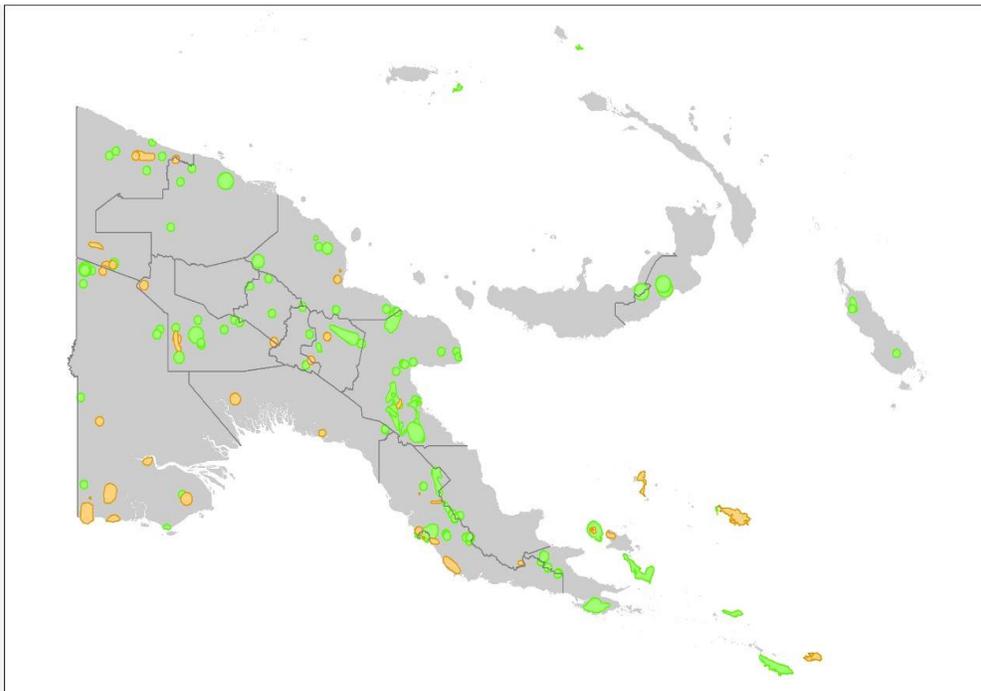
Figure 4.1: Restricted range endemic reptiles and amphibians (green), and restricted range endemic mammals (orange). : Adopted from the PNG POWA report

 Target 1.2, 2.1 and 2.2; See Table 1- 3 and 1- 4. The YUS Conservation Area is used here as a Case Study for these 2 targets.
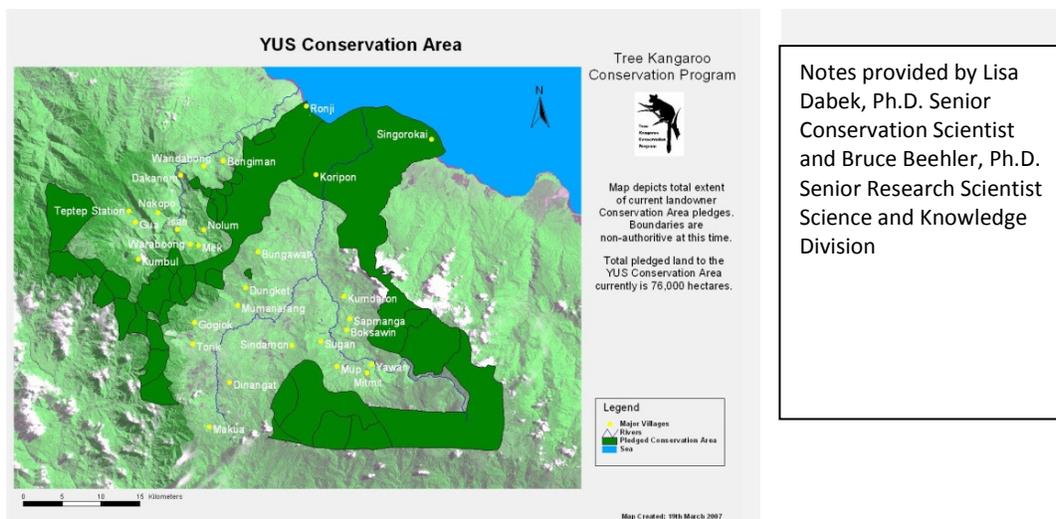
Notes provided by Lisa Dabek, Ph.D. Senior Conservation Scientist and Bruce Beehler, Ph.D. Senior Research Scientist Science and Knowledge Division

Selecting the Area: The area was identified as significant for biodiversity by the PNG *Conservation Needs Assessment* (1993) conducted by the Department of Environment and Conservation in partnership with Conservation International and the Biodiversity Support Program of the US Agency for International Development.

For over a decade, the Tree Kangaroo Conservation Program (TKCP) has been partnering with local landowners on the Huon Peninsula in Papua New Guinea (PNG) to create and manage the country's first Conservation Area, encompassing over 187,000 acres of cloud forest and Matschie's tree kangaroo habitat. TKCP works within the YUS Local Level Government in Morobe Province, PNG.

YUS stands for the three main watersheds in the region: Yopno, Uruwa, and Som. The population of YUS is approximately 10,000 with over 35 villages. The people of YUS are subsistence farmers and hunters who rely on the land and understand the importance of protecting the forest and wildlife.

The YUS Conservation Area extends from sea level to 4,000 meter mountain ranges, thus preserving a complete altitudinal spectrum of Huon Peninsula habitats, including the home of the endemic and endangered Matschie's tree kangaroo. The tree kangaroo has important cultural significance for the local indigenous people, and serves as a flagship species for the YUS Conservation Area.

Climate and Biodiversity Research
The climate change science project is examining the impacts of climate change on the biodiversity along a forested elevational transect in the YUS transect (0-3000 m) of northern Papua New Guinea. Among other issues, we will be looking at (a) lowland biotic attrition, (b) elevation resorting and extirpation produced by rapid upward range shifts, (c) shift in the cloud line and forest humidity, (d) movement of the treeline and changes in the distribution of the high elevation vegetation, and (e) its influence on anthropogenic disturbance of the native vegetation, especially at middle and high elevations.

The main research focus of this study will be an elevational transect from the coastal lowland forests to the upper montane forests above 2500 m elevation along the northern slopes of the Saruwaged Mountains.

The specific focus of the YUS elevational transect study shall be:
- Establishing a current baseline of species abundance and occurrence by elevation for the following taxa: woody plants, geometrid moths, frogs, microchiropteran bats, and forest birds through repeated sampling at 19 stations along this single line transect over a three-year period. Thus plant and animal taxa will be censused at ca. 150 m intervals along the YUS Transect. Initial results from a

> late-2009 field season recorded 11 species of forest birds recorded singing on territory at elevations substantially above their known global ranges. This initial finding is indicative of the importance of establishing new baselines as soon as possible.
>
> • Comparing the current distribution and abundance of selected taxa (especially birds) along the YUS transect today against a compilation of data synthesized from elevational survey data for New Guinea collected from the 1930s-1970s, looking for evidence of elevational range shifts in sets of focal species.
>
> • Documenting local environmental change through analysis of historical imagery and landcover data (pre-WW II aerial photography, WW II-period Army Map Service aerial photography, 1972-75 Australian Air Force aerial photography, LandSAT and SPOT satellite imagery, FIMS, National Land Cover Map for PNG).
>
> • Adapting and downscaling localized data from global circulation models to predict future (2050, 2100) local climate change (rainfall, temperature, seasonal drought) for the YUS ecosystem and using these data to model range shifts in restricted range and endemic taxa inhabiting the YUS ecosystem.
>
> • Documenting extinction/extirpation or abundance diminution of local YUS plant/animal populations with narrow elevational distributions (following up on the predictions generated by the preceding modeling activity).
>
> • Modeling geographic range shifts of restricted range bird species under a regime of climate change.
>
> • Examining climatological phenomena (cloud line, forest humidity) and anthropogenic fire and its impact on the existing treeline and the impacts these have on current distribution of the vegetation.

In addition to research and conservation, TKCP has worked in recent years to build capacity of the local communities who have been dedicated to promoting conservation in YUS. These community improvement projects include addressing health care access, providing education opportunities, and creating a Community Based Organization to manage the Conservation Area.

Target 3.1
The PNG government has mandated the National Agricultural Research Institute (NARI) to be a custodian to all agro-biodiversity of the country. The sweet potato is a central component of the Papua New Guinean diet, and an estimated 5,000 cultivars of this staple are found within the country (Government of Papua New Guinea 1992). Numerous other plant species have traditionally been cultivated, including more than 30 root crops, 21 legume species, 40 leafy green vegetables, 60 other vegetables and roots, 43 varieties of nuts, 102 fruits, and 89 other plants used for food or for seasonings (Unisearch 1992). This traditional knowledge has already been tapped by the outside world: the winge-bean (Psophocarpus tetragonolobus), which is nutritionally similar to the soybean and is an important part of the diet in Papua New Guinean forest regions, is now cultivated in some 50 developing countries (Spears 1988).All main staple food crop species and fruits and nut species of the country have been collected over the years and are now conserved in 'living collections' or field gene-banks at various NARI Research Programme Centers throughout the country. The genetic diversity of major cash crop species such as sugarcane, coffee, cocoa, coconut, palm oil, rubber and tea are maintained by their own R&D institutes or companies at different locations in the country. Most of this diversity is introduced from over sea's gene-banks.

(b) Promoting sustainable use of biodiversity

Goal 4. Promote sustainable use and consumption.	Target 4.1: Biodiversity-based products derived from sources that are sustainably managed, and Production areas managed consistent with the conservation of biodiversity.	✧
	Target 4.2 Unsustainable consumption, of biological resources, or that impacts upon biodiversity reduced.	✧
	Target 4.3:No species of wild flora or fauna endangered by international trade	

Targets 4.1, 4.2 Fisheries Management Plans
Under the CTI initiative the National Fisheries Authority plans for more effective management and sustainable trade in live reef fish and reef-based ornamentals achieved.

2.1 Develop a national management plan for the ornamental fishery.

2.2 Update the national Live Reef Food Fish (LRFF) management plan.

2.3 Conduct analysis of current situation and opportunities.

2.4 Educate and train fishermen to understand LRFF trade and ornamental fish.

2.5 Promote and encourage protection of spawning areas for species target by ornamental and LRFF

Target 4.3 International Trade (Fauna and Flora) Act 1979,

Being an Act to implement the State's obligations as a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora by controlling and regulating the exportation and importation of certain species of fauna and flora, and for related purposes.

(c) Addressing the major threats to biodiversity		
Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced.	Target 5.1: Rate of loss and degradation of natural habitats decreased	✧
Goal 6. Control threats from invasive alien species	Target 6.1: Pathways for major potential alien invasive species controlled.	
	Target 6. 2: Management plans in place for major alien species that threaten ecosystems, habitats or species	✧
Goal 7. Address challenges biodiversity from climate change, and pollution	Target 7.1: Maintain and enhance resilience of the components of biodiversity to adapt to climate change	
	Target 7.2: Reduce pollution and its impacts on biodiversity	

Target 5. 1 Forest
Rapid and substantial deforestation and logging related degradation has occurred in PNG's forests over the past 30 years (Shearman *et al.* 2009). Between 1972 and 2002, a net 15% of PNG's tropical forests were cleared and 8.8% were degraded through logging. While Shearman *et al.* (2009) focused on the distribution of this change according to measures of accessibility and within three altitudinal classes (lowland, lower montane and upper montane), the manner in which it has impacted on the different floristically, climatically and geologically distinct landscapes of PNG.

✧ Alien Species – Not much work and research on the alien species

Target 7.1 Climate Change

The predicted impacts of climate change on biodiversity are many. The vulnerability of an ecosystem to climate change depends on its species' tolerance of change, the degree of change, and the other stresses that are already affecting it.

In PNG when considering options for protected areas in the context of adapting to climate change, we considered the followings:

- Identifying robust investments (including climate change refugia (Saxon 2008);
- Conserving the geophysical stage (those abiotic features that underpin species distributions);
- Enhancing connectivity;
- Sustaining ecosystem processes and functions; and
- Taking advantage of emerging opportunities (Game et al. 2009)

With climate change, PNG has opted for additional 10% to achieve the above target as shown in figure4-2.
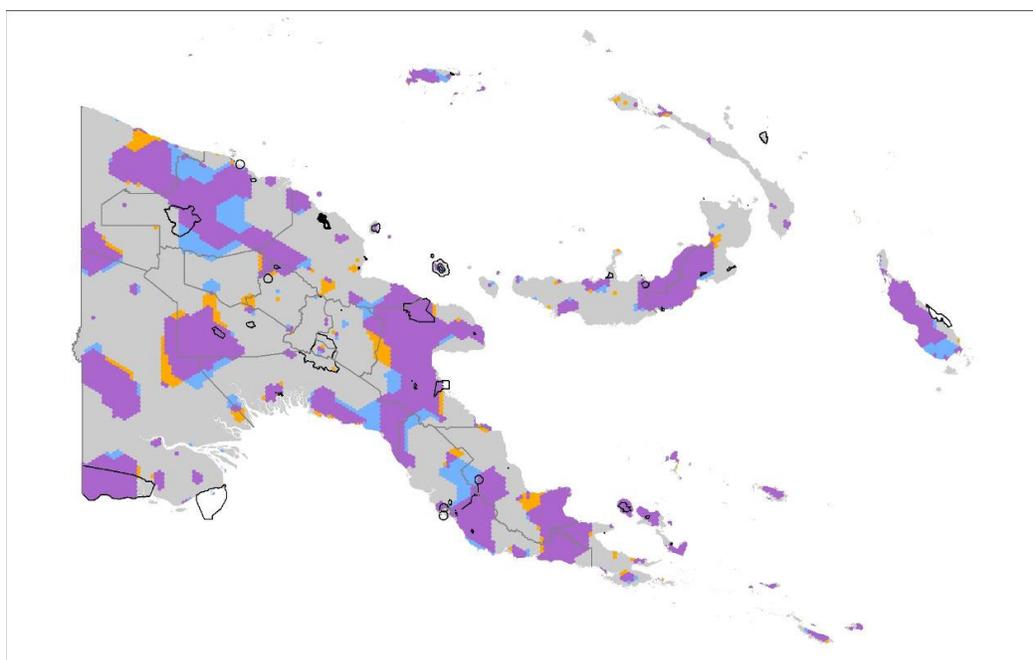

Figure 4-2: 20% Target for Land Systems & FIMS, 50% Target for Rare and Restricted Range Endemi without protected areas. Marxan run without climate change in blue, with climate change in orang common to both in purple. Protected areas in black outline.

(d) Maintaining ecosystem integrity, and the provision of goods and services provided by biodiversity in ecosystem, in supp of human-well being		
Goal 8. Maintain capacity of ecosyste to deliver goods and services a support livelihoods	Target 8.1: Capacity of ecosystems to deliver goods and servi maintained.	
	Target 8.2: biological resources that support sustainable livelihoods, lo food security and health care, especially of poor people maintained	

(e) Protecting traditional knowledge, innovations and practices		
Goal 9 Maintain socio-cultural diversity indigenous and local communities	Target 9.1 Protect traditional knowledge, innovations and practi innovations and practices, including their rights to benefit sharing	✧

Target 9.1 Customary Landowners

As discussed in Chapter 3 people own the land and the sea and are an integral part of PNG's land and sea, whether protected or managed. Boundaries should be set in a cultural context and where possible and as practical, should be within a single language group

Customary Ownership Guideline – As protected area boundaries are developed and refined, boundaries should be set within an appropriate cultural context, including: consideration of language group, customary land ownership and land/sea boundaries and appropriate governance systems (e.g. Incorporated Land Groups, Conservation Cooperatives, WMA/CA Committee's - Formal and recognized customary governance systems in PNG).

(f) Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources		
Goal 10. Ensure the fair and equita sharing of benefits arising out of the use genetic resources	Target 10.1: All transfers of genetic resources are in line with the Convent on Biological Diversity, the International Treaty on Plant Genetic Resour for Food and Agriculture and other applicable agreements	
	Target 10.2: Benefits arising from the commercial and other utilization genetic resources shared with the countries providing such resources	

Target 10.1 Access and Benefit Sharing (ABS) – Policy and Legal implications

A study on Access and Benefit Sharing (ABS) – Policy and Legal implications for Papua New Guinea carried out by E.Kwa in 2006, found that that;

✧ there is no single national, provincial or local policy on ABS.
✧ there is no existing law on ABS.
✧ no attempts have been made by the government previously to deal comprehensively with ABS.

Although there are one or two institutions that have made some attempts to address ABS their focus is limited to these institutions. Also there are snippets of ABS spread widely in the legal system. The absence of a national ABS framework is however apparent and the need to develop one is obvious. However, designing the 'best' ABS framework in a country such as PNG with complex and intricate cultural, social and political systems is not an easy task. The present work serves as a guide to policy and law makers in fashioning an appropriate ABS framework. The document provides an indepth analysis of the socio-cultural aspects of ABS; international aspects of ABS; the relevant policy and legal framework associated with ABS in PNG; research and development and ABS; and intellectual property rights aspects of ABS. The team recommends that:

• a national ABS Policy be developed immediately; and an ABS Bill be formulated and enacted soon.

(g) Mobilizing financial and technical resources, especially for developing countries, (small island developing States amo them)

Goal 11: Parties have improved financ human, scientific, technical a technological capacity to implement Convention†	Target 11.1: New and additional financial resources are transferred developing country Parties, to allow for the effective implementation their commitments under the Convention, in accordance with Arti 20.	✧
	Target 11.2: Technology is transferred to developing country Parties, allow for the effect implementation of their commitments under the Convention , accordance with Article 20, paragraph 4	

Target 11.1

Name of the Project	Donor	Total (US$)
Coral Triangle Initiative for Co *Reefs, Fisheries and Food Security*	ADB	US$ 200,031
	GEF	US$3.8 million
	Government (in-kind)	US$1,000,000
Ecosystem Base Management	UNEP/GEF	US$ 50,000
Community-based Forest a *Coastal Conservation and Resou* *Management Project& Protect* *Areas Management*	UNDP/GEF	US$7.7 millions
Programme on Work on Protect *Areas*	UNDP/GEF	US$150,00
Preparation of the 4ᵗʰ Natio *Report to CBD*	UNEP/GEF	US$20,000
5ᵗʰ GEF Allocation		US$15.6 million

4.2. B. Progress towards the Goals and Objectives of the Strategic Plan of the Convention

The Department of Environment and Conservation is the focal point for the CBD. It is also responsible for implementing other Multilateral Environment Agreements as mentioned in Chapter 2. Current initiatives by government especially in launching the Vision 2050, developing the PNG SDP will provide the strategic framework in implementing the CBD in the country.
Some of the achievement made includes the followings;

✧ Integration of the Millennium Development Goal 7 into the government planning framework and has become DEC's mandate to establish the task force which comprise of multi-disciplinary and sectoral,

✧ Implementation of DEC Corporate Plan 2009 – 2013

✧ Gap analysis of protected areas and development of a draft policy and 10% and 20% Interim Conservation for Papua New Guinea.

✧ Completion of the Assessing the Capacity of Papua New Guinea to Implement the United Nations Convention on Biological Diversity (UNCBD), the United Nations Convention to Combat Desertification (UNCCD), and the United Nations Framework Convention on Climate Change

✧ Development of the Cartagena Protocol on Biosafety policy white paper.

On the other hand there are challenges and lessons learned.

✧ There is no implementation plans to report and monitor the progress on the CBD Strategic plan,
✧ The CBD Strategic plan is not well known

Appendix 1: Information concern reporting Party

Contracting Party	**PAPUA NEW GUINEA**
N A T I O N A L F O C A L P O I N T	
Full name of the institution	*Department of Environment and Conservation*
Name and title of contact officer	*Dr. Wari Iamo – CBD Focal Point* Secretary of Department of Environment and Conservation
Mailing address	*PO Box 6601, BOROKO. National Capital District, Port Moresby*
Telephone	*(675) 3250180*
Fax	*(675) 325 3551*
E-mail	*wiamo@dec.gov.pg*
CONTACT OFFICER FOR NATIONAL REPORT (IF DIFFERENT FROM ABOVE)	
Full name of the institution	*Department of Environment and Conservation*
Name and title of contact officer	*John Michael, Executive Manager*
Mailing address	*PO Box 6601, BOROKO. National Capital District, Port Moresby*
Telephone	*(675) 3250180*
Fax	*(675) 325 3551*
E-mail	*jmichael@dec.gov.pg*
Signature	
S U B M I S S I O N	
Signature of officer responsible submitting national report	
Date of submission	*2th June, 2010*

Appendix 2: Process of preparation of National Report

The process involved the following steps:

- Review of existing and relevant literature on biodiversity,

- Identifying and engaging PNG experts on each of the chapters identified by the fourth report guideline,

- Workshop held a Loloata Island Resort from the 8 -9th May 2010

- Circulation of the draft report to the key stakeholders groups, NGOs involved in conservation organistaions;

- Collating the input into a first draft and then seeking further PNG's Government agency comments and input

- A first major edit for style, consistency, and readability

- Finalise and submit by the Minster for Environment and Conservation and the Secretary.

Timing was the major constraint which did not allow the full consultancy process as envisaged. However the document was widely distributed to the key stakeholders, NGOs involved in conservation for inputs and comments.

Appendix 3-Progress towards Targets of the Global Strategy for Plant Conservation and Programme of Work on Protected Areas

A: Progress towards Targets of the Global Strategy for Plan Conservation

Overview of Progress

PNG is yet to develop a programme to implement the targets of the Global Strategy for Plan Conservation. The analysis below was developed during the preparation workshop on the 4th National Report at Loloata Island Resort from the 8 – 9th May 2010

Global Strategy for Plant Conservation

Strategy Targets	Comments
a. Understanding and documenting plant diversity:	
1. A widely accessible working list of known plant species, as a step towards a complete world flo	For regional efforts, the Flora Malesiana covers major groups, but for nationa (PNG) Flora only limited coverage (three volumes) of some families mostly of vascular plants. For the non-vascular plants there is very little work done to date.
2. A preliminary assessment of the conservation status of all known plant species, at national, regional and international levels;	Partly for some of the common plants, such as weeds and invasive species an exotic commercial trees and a few ornaments at national and regional and al international levels, but still very minimal
3. Development of models with protocols for plar conservation and sustainable use, based on research and practical experience	Some work has been done, esp. for food crops and some commercial tree species
b. Conserving plant diversity	
4. At least 10 per cent of each of the world's ecological regions effectively conserved;	• Only 4% is under protection • National target of 20% for terrestrial ecosystems taking into account the climate resilent areas. t extent this is implemented is unknown.
5. Protection of 50 per cent of the most importan areas for plant diversity assured;	Not sure. There is no list of plants species and complete list of fauna species each protected areas
6. At least 30 per cent of production lands manag consistent with the conservation of plant diversity;	Forestry at least 10-30% is protected. Food crop diversity is maintained on-farm, but percentage of area is not known.
7. 60 per cent of the world's threatened species conserved in situ;	In agriculture food crops yes, but not in forestry
8. 60 per cent of threatened plant species in accessible <i>ex situ</i> collections, preferably the country of origin, and 10 per cent of them included in recovery and restoration programmes;	In agriculture food crops , but in forestry very small <0.1%
9. 70 per cent of the genetic diversity of crops an other major socio-economically valuable plant species conserved, and associated indigenous and local knowledge maintained;	In agricultural crops and for some commonly traditional used plants.
10. Management plans in place for at least 100 ma alien species that threaten plants, plant communities and associated habitats and ecosystems	Plans are in place for some alien species including invasive weed spps,pests & diseases

| c. Using plant diversity sustainably	
11. No species of wild flora endangered by international trade;	Not known
12. 30 per cent of plant-based products derived fro sources that are sustainably managed;	Represent only a small percentage, especially for some of the commercial timber species
13. The decline of plant resources, and associated indigenous and local knowledge, innovations a practices that support sustainable livelihoods, local food security and health care, halted;	No major actions taken, except for species under IUCN classification. Our current IP and other legislations have yet to capture this issue.
d. Promoting education and awareness about plant diversity:	
14. The importance of plant diversity and the need for its conservation incorporated into communication, educational and public-awareness programmes;	Being conducted for agriculture crops, but for others is very limited.
e. Building capacity for the conservation of plant diversity	
15. The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this Strategy;	Very limited
16. Networks for plant conservation activities established or strengthened at national, region and international levels	NARI, FRI, PINBio, COGENT, SPC (PAPGREN), FAO, BAPNET, APFRI, Biodiversity International, ITC, ACIAR, EU, AAPARI, CGIAR

B: Programme of Work on Protected Areas (POWPA)

At the request of the Papua New Guinea (PNG) Department of Environment and Conservation (DEC), the Nature Conservancy worked with DEC to assist with the completion of a National Terrestrial Gap Analysis, as part of PNG's commitment to the Program of Work on Protected Areas (PoWPA). The project involved: (1) An assessment of the effectiveness of the representativeness of the "existing" protected area system (2) Identification of "potential" protected area systems that best capture representative samples of ecosystems and plant and animal species, (3) Identification of areas that have the potential to serve as climate refugia for the biodiversity of PNG, and (4) Building the capacity of DEC staff to conduct the analyses, interpret the results and define a process to enable the effective implementation of the results.

As a result, the DRAFT - Interim National Terrestrial Gap Analysis for Papua New Guinea: Planning for Climate Change report is the product. This document is the main reference used in the POWPA analysis.

Goals & Targets with Key evaluation questions and Considerations	
Goal 1: To establish and strengthen national and regional systems of protected areas integrated into a global network as a contribution to globally agreed goals.	
Target**: Establish a global network of comprehensive, representative and effectively managed national and regional protected ar system**s.	
▪ Is the existing national protected area system comprehensive, ecologica representative and effectively managed (provide number of existi	1. PNG has made limited progress towards meeting the CBD terrestrial goal and NBSAP Goal of 10 of land area under protection by 2010 (CBD; PNB_NBSAP). 2. The Marine Protected Areas is yet to be assessed and the information is missing 3. Approximately 4% of PNG's terrestrial areas are protected in 53 protected areas . Since Independence there has been a significant shift in protected areas from those that exclude people (e.g. National Parks) to those where people are a part of the protected area system

|	

protected areas, total are covered, and type and percentage of biomes covered)?	(Wildlife Management Areas and more recently a Conservation Area (YUS)).
	
	4. The recent gap analysis conducted by DEC and TNC found the followings;
	    • When evaluating the degree of representativeness of Land Systems within the existin protected area system, 10 of the 59 Land System Types were effectively represented 10% protected) within the existing protected area system
	    • Similarly when evaluating the degree of representativeness of the existing protected area system, 6 of the 57 Vegetation Types are effectively represented (> 10% protected) within the existing protected area system
	    • When evaluating the degree of representativeness of different fauna species within t existing protected area system, for restricted range endemic reptiles and amphibians 17 of 123 species (<14%) were effectively protected (>10% of their defined area) with existing protected areas. For restricted range endemic mammals 7 of 37 (<19%) of species were protected at greater than 10% of their defined area

What are the definitions of 'comprehensive', 'ecologically representative' and 'effectively managed' in your country?	1. Currently there are no definitions developed for a protected area system in the country. However, the recent Gap analysis developed the following definition and if accepted by NEC wi become the PA policy;
	2. **The objectives of biodiversity conservation:**
	    • to maintain ecological processes and the dynamics of ecosystems in their landscape conte
	    • to maintain viable examples of ecosystems throughout their natural ranges;
	    • to maintain viable populations of native species throughout their natural ranges;
	    • to maintain the genetic diversity of native species, and
	    • To allow natural ecosystems to adapt to climate change (UNFCCC – Article 2)
	3. The following principles provide a starting point for the development of a National set of principles for the development of a Comprehensive, Adequate, Representative and Resilient (CARR) protected area network in PNG:
	    • **Comprehensiveness -** includes the <u>full range of communities</u> recognized by an agreed national classification at appropriate hierarchical level.
	    • **Adequacy -** the maintenance of ecological viability and integrity of populations, species an communities.
	    • **Representativeness -** those sample areas that are selected for inclusion in reserves should reasonably reflect the biotic diversity of the communities.
	    • **Resilient -** The areas sampled consider the impacts of climate change.

What is the progress made in quantitative and qualitative terms against the national targets relating to 'comprehensiveness', 'ecologi representation', and 'effective management'?	A number of core data sets were used in the gap analysis including:
	    • Land Systems (abiotic)
	    • Forest Information Management (biotic) - Hammermaster and Saunders 1995
	    • Restricted Range Endemic Species, Birds of Paradise and Tree Kangaroos (special features)
	These data sets provide the best available data for a preliminary gap analysis in order to meet some the key criteria.
	When all three surrogate were combined (FIM, Land System and RRE), as might be expected, the spatial requirements in order to effectively meet all targets also increased. The final option to meet 10% and 20% target for all conservation features without including the protected areas and includin climate change probability required 22% and 32% of the land based respectively.

Appendix Figure 1: Sum solution. 10% Target for Land Systems & FIMs, 50% for Rare a[...] Restricted Range Endemics, without protected areas, with climate change, BLM = 0.5. Protected areas in black outline.
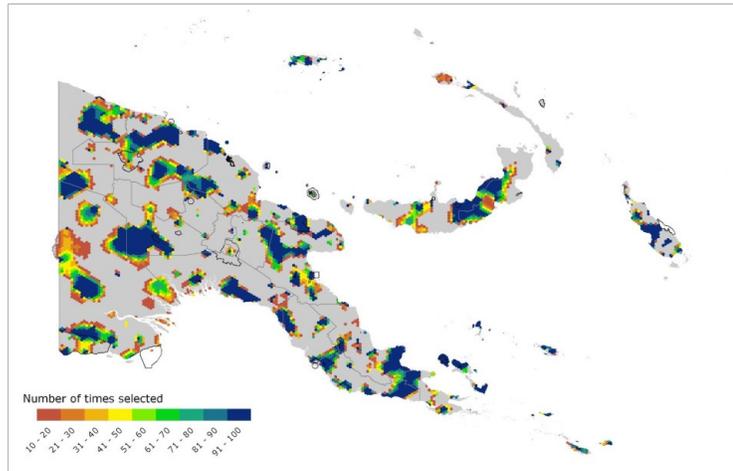
Appendix Figure 2: Sum solution. 20% Target for Land Systems & FIMs, 50% for Rare and Restrict[...] Range Endemics, without protected areas, with climate change, BLM = 0.5. Protected areas in bla[...] outline.

What biomes are adequately represented?	The Forest Information Management System (FIMs) mapping provides the best available vegetation data for PNG. FIMs was based on the interpretation of SKAIPIKSA air photography taken in 1973-75 (Hammermaster and Saunders 1995). The 1:100,000 classification includes a total of 59 vegetation types including: 36 Forests, 6 Woodland, 3 Savanna, 3 Scrub, 11 Grasslands, 1 Mangrove and 4 Non Vegetation Types. See below figure.

Forest types: 34 varieties in total

Grassland and Woodland types: 16 varieties in total
Mangrove

Scrub and Savanna types: 6 varieties in total
Areas dominated by land use

	When evaluating the degree of representativeness of the existing protected area system, 6 of the 57 Vegetation Types are effectively represented (> 10% protected) within the existing protected area system
What biomes are underrepresented or not represented?	See the above

Goal 2: To integrate protected areas into broader land- and seascapes and sectors so as to maintain ecological structure and function.
Target: All protected areas and protected area systems are integrated into the wider land- and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity and the concept, where appropriate, of ecological networks.

What measures have been taken for developing enabling environment (legislation, policies, tools) for integrating protected areas into broader land and seascapes and sectoral interests (i.e. agriculture, infrastructure, energy)?	See chapter 2 – PNG Planning Hierarchy Figure 2.1-1
Are the needs of protected areas taken into account in the wider land and seascape to address the need for connectivity, including ecological networks?	On Ad-hoc approach rather than through policy and planning requirements.
Has the concept of the 'ecosystem approach' been applied while developing protected area system	See chapter 3 on the case study in Kimbe Bay. This approach once accepted will be applied to other areas.

Goal 3: To establish and strengthen regional networks, transboundary protected areas (TBPAs) and collaboration between neighbouring protected areas across national boundaries.
Target: Establish and strengthen by transboundary protected areas, other forms of collaboration between neighbouring protected areas across national boundaries and regional networks, to enhance the conservation and sustainable use of biological diversity, implementing the ecosystem approach, and improving international cooperation.

· What collaboration across national boundaries has been implemented in relation to protected areas?	The Treaty between Australia and the Papua New Guinea concerning matters of sovereignty and maritime boundaries in the area known as the Torres Strait, and related matters, is commonly known as the "Torres Strait Treaty". The Tri-national Wetlands Initiative is a commitment by the three nations to work together to achieve sustainable management of 3 million ha of tropical wetlands identified as global priorities for conservation - demonstrating environmental leadership and cooperation within the region, and

	underlining the importance of protecting freshwater ecosystems.
Has any consultation process bee established to identify potential transboundary, including marine, protected areas?	Nil
How many protected areas featu in regional networks and how ma of these are transboundary?	54 nationally and no transboundry Protected areas
Has the potential for regional cooperation under relevant conventions been utilised for the establishment of migratory corridors?	Indonesia, Papua New Guinea (PNG) and Solomon Islands have signed a Memorandum of Understanding (MoU) on conservation and management of western Pacific leatherback turtle nesting sites, feeding areas and migratory routes in the three states. The three countries reached the agreement in a workshop of the 3rd Meeting of Tri-National Partnership to the Conservation and Management of Leatherback Turtles which was being held in Bali`s popular tourist resort of Jimbaran on August 28-30,st Ministry said in a statement made available to ANTARA here Monday (8/28).

Goal 4: To substantially improve site-based protected area planning and management
Target: All protected areas have effective management using participatory and science-based site planning processes that incorporate clear biodiversity objectives, targets, management strategies and monitoring programs, drawing upon existing methodologies and a long-term management plan with active stakeholder involvement.

.What percentage of protected areas (area and number) have up to-date science-based management plans that	PNG has recently developed a Interim Conservation Plan that will need to be endorsed by the National Executive Council. The plan for 10% and 20% option is to allow for; • Represent a broad range of biodiversity by sampling two different sets of major habitat type o FIM a biotic surrogate and land systems an abiotic surrogate o Capture the most climate vulnerable elements of biodiversity (a subset of restricte range of endemic species o Ensure the effective inclusion of climate refugia, by incorporating those areas with the least probability of change. • By combining the three surrogates of biodiversity we avoid the failure of any one surrogate i capturing and representing biodiversity. • By including
(a) Are under development?	The Interim Conservation – 20% in Appendix Figure 1 and 2.
(b) Are under effective implementation?	Not yet implemented
· Have consultation been undertaken involving protected area functionaries, local stakeholders and researchers to identify science-based biodiversit conservation targets?	Plans are under way to discuss with key stakeholders at the national level, provincial level and loc level. This approach needs the approval of the NEC

Goal 5: To prevent and mitigate the negative impacts of key threats to protected areas.
Target: Effective mechanisms for identifying and preventing, and/or mitigating the negative impacts of key threats to protecte areas are in place.

What measures have been put in place to identify, prevent and/or mitigate the negative impacts of threats?	Once the Interim Conservation Plan is endorsed by NEC, the DEC will map the potential protected area boundaries considering the biodiversity and climate change factors. Identify threats and resolve the threats by discussions between key line agencies and resolving them or coming up wit options. This is discussed in Case Study 2 in chapter 3.
What measures have been taken restore and rehabilitate the ecological integrity of protected areas?	PNG still have the opportunity conserve its pristine environment and this may become a low priority.

Goal 6: To promote equity and benefit sharing?
Target: Establish mechanisms for the equitable sharing of both costs and benefits arising from the establishment and manageme of protected areas.

What legislative or policy frameworks for the equitable sharing of costs and benefits aris from the establishment and management of protected areas?	The Department of Environment and Conservation (DEC), together with the Global Environment Facility (GEF) and UNDP PNG will be implementing the *Community-based Forest and Coastal Conservation and Resource Management Project in Papua New Guinea*. The objective of the Project is to establish a system of terrestrial and marine protection which builds upon existing community-based resource management structures in PNG. To achieve this objective, the following three broad outcomes will be required: 1) National and local policies and capacities to support community managed protected areas (PAs); 2) Community Conservation Are strengthened or established in selected sites; and 3) Conservation-compatible livelihood generati opportunities. The key impact indicator associated with this objective will be the extent of high conservation valued terrestrial and marine area which is brought under community-based conservation at targeted sites. The Policy Analyst of t
Have assessments been made o the economic and socio-cultural costs and benefits of protected areas, particularly for Indigenous and local communities?	The above project will address this question
What measures have been taken avoid and mitigate negative impacts on Indigenous and local communities?	If and when an issue such as this comes up, following mechanisms may be used to mitigate negat impacts the Environment 2000 Act • Conservation Areas Act • Fauna (Protection and Control) Act
What mechanisms have been pu place to identify and recognize community conserved areas and how many such areas have been integrated into the national protected areas system?	Once approved by the NEC, the policy will recognize the the other forms of Protection and Management that contribute to a National Network of Protected and Managed areas (that can enforced) Protected Areas established under the Organic Law (OLPLLG) which includes; o marine (LMMA's - Locally Managed Marine Areas) terrestrial (CMA's - Community Managed Areas) o Voluntary agreements (Conservation Deed - private arrangement under contr law) An in addition the results of the *Community-based Forest and Coastal Conservation and Resource Management Project in Papua New Guinea will assist and develop the appropriate mechanisms*.

Goal 7: To enhance and secure involvement of Indigenous and local communities, and relevant stakeholders. **Target: Full and effective participation of Indigenous and local communities, in full respect of their rights and recognition of the responsibilities, consistent with national law and applicable international obligations, and the participation of relevant stakeholders, in the management of existing, and the establishment and management of new, protected areas.**

What mechanisms have been implemented to ensure full and effective participation of Indigenous and local communitie in full respect of their rights and recognition of their responsibiliti consistent with national law and applicable international obligations, in the management existing, and the establishment a management of new, protected areas?	See chapter 3 on Community involvement ▪ Identifying priority areas for protection and integrated management in PNG needs to ensure the effective consideration of the PNG people, the traditional and customary landowners of PNG. Customary Landowners in PNG own the land and sea and are an integral part of the landscapes and seascapes of the Nation. An equal consideration when identifying priorities f protection and management is to ensure the effective consideration of the customary land owners. ▪ The greater challenge is conducting the necessary consultation with the customary landowners, many of whom live in remote rural areas without ready access or are absent fro their traditional lands. ▪ The Organic Law on Provincial and Local-Level Governments (NOL) provides the institutional framework for the planning process in Papua New Guinea. It provides the foundation for a system of bottom-up planning for provinces, to ensure the delivery of better and more appropriate services to the local people in a more efficient manner. The reforms brought in the new law are aimed at: ✓ Improving the delivery of services, particularly in the rural areas; ✓ Increasing participation in government at the community and local levels; ✓ Strengthening local government by decentralising powers and responsibilities to the lo levels of government; ✓ Increasing funding to local levels of governments to support this strengthening;

What measures have been taken support areas conserved by indigenous and local communitie	▪ Information awareness on the Biodiversity Priorities in PNG have made some impact and it approved by NEC and adopted by DEC, the Interim Conservation Plan will no doubt support these areas.
Goal 8: To provide an enabling policy, institutional and socio-economic environment for protected areas. **Target: By 2008 review and revise policies as appropriate, including use of social and economic valuation and incentives, to provi a supportive enabling environment for more effective establishment and management of protected areas and protected area systems.**	
Are the appropriate policy, institutional and socio-economic frameworks in place to value goo and services and enable more effective establishment and management of protected areas?	Currently to be developed under the *Community-based Forest and Coastal Conservation and Resource Management Project in Papua New Guinea*.
What kind of social and econom valuation methods and incentive for more effective establishment and management of protected areas are developed and incorporated into national policie institutional and socio-economic structures?	As an objective of the *Community-based Forest and Coastal Conservation and Resource Management Project in Papua New Guinea*, an analysis on conservation-compatible livelihood generation opportunities in short-listed project site areas. This analysis will assist in the project design of the above-mentioned Project.
What are the main impediments effective establishment and management of protected areas? Have measures been taken to overcome these?	
Goal 9: To build capacity for the planning, establishment and management of protected areas. **Target: comprehensive capacity-building programs and initiatives are implemented to develop knowledge and skills at individua community and institutional levels, and raise professional**	
· Has a comprehensive capacity-needs assessment for protected areas management been carried out?	See Appendix 4
· What capacity-building program have been undertaken or are bei undertaken. How successful have the completed programs been?	
▯ Does your country consider a multidisciplinary approach to protected areas management?	
Goal 10: To develop, apply and transfer appropriate technologies for protected areas. **Target: development, validation, and transfer of appropriate technologies and innovative approaches for the effective management of protected areas is substantially improved, taking into account decisions of the Conference of the Parties on technology transfer and cooperation.**	
· What new innovative approaches and technologies hav been identified, developed and implemented for protected areas establishment and management the national and regional level?	At the request of the Papua New Guinea (PNG) Department of Environment and Conservation (DEC), the Nature Conservancy worked with DEC to assist with the completion of a National Terrestrial Gap Analysis, as part of PNG's commitment to the Program of Work on Protected Areas (PoWPA). The project involved: (1) An assessment of the effectiveness of the representativeness of the "existing" protected area system (2) Identification of "potential" protected area systems that best capture representative samples of ecosystems and plant ar animal species, (3) Identification of areas that have the potential to serve as climate refugia the biodiversity of PNG, and (4) Building the capacity of DEC staff to conduct the analyses, interpret the results and define a process to enable the effective implementation of the results.

Has there been collaboration within the country and/or with other countries to share information and technologies?	Australia – Department Environment and Heritage provided training on GIS, information management Allen Alison of Bishop Museum provided restricted range endemic species data.
Goal 11: To ensure financial sustainability of protected areas, and national and regional systems of protected areas. **Target: Sufficient financial, technical and other resources to meet the costs to effectively implement and manage national and regional systems of protected areas are secured, including both from national and international sources, particularly to support the needs of developing countries and countries with economies in transition and small island developing States.**	
· Have financial needs been identified? What are the results of this needs assessment (quantitat and qualitative)?	The existing terrestrial protected area system in PNG consists of 54 protected areas totalling 1.9 million ha and accounts for less than 4% of the land base, a long way short of 10% CBD Goal. Less than 11% of the vegetation types, 19% of the land system types and 14 % of the fauna evaluated represented within the existing protected area system at greater than 10%. This project will seek to double the protected area system in PNG in the next 5 years, by mainstreaming the establishment of five National Priority Areas identified in the National Terrestr Gap Analysis, that account collectively for 80% of the major habitat types in PNG that are also supported by payments for ecosystem services. Requires: US$6 million
· What strategies are in place t meet these needs, and in particu to secure long-term funding for t national protected areas system?	A proposal has been developed and planned to be submitted to Lifeweb or from the GEF 5.
⬚ What financial support has bee given to developing countries an countries with economies in transition and small island developing States?	
⬚ What proportion of the budge dedicated to supporting the national protected areas system (What proportion of the total funding for the national protecte areas comes from private and public funding sources, and how much from the state budget?)	No funding from private and public funding. Some local NGOs do receive funds have funding 200 Government Funding
⬚ Have studies been made on th efficient use of the resources	No
Goal 12: To strengthen communication, education and public awareness. **Target: Public awareness, understanding and appreciation of the importance and benefits of protected areas is significantly increased.**	
· Is there a review mechanism public education programs to measure if they have been effect in communicating the basic biodiversity values of protected areas?	Nil
⬚ What education measures and programs have been developed and implemented regarding protected areas, including for raising public awareness?	Nil
Goal 13: To develop and adopt minimum standards and best practices for national and regional protected area systems. **Target: Standards, criteria, and best practices for planning, selecting, establishing, managing and governance of national and regional systems of protected areas are developed and adopted.**	

· Have standards, criteria and best practices for a) site selection b) management, c) governance, and d) long-term monitoring of outcomes been applied and documented? (Please provide a reference).	In PNG protected areas require the effective consideration of: Biodiversity, Climate Change, Customary Landowners and the Ecosystem services upon which people depend.
	The Gap Analysis report identifies the following criteria will be considered in the development and establishment of a ptotected areas policy, management guidelines and the selection of sites;
	10% of the <u>original</u> extent of Ecosystems (based on 1975 – benchmark (FIM (biotic) and Land systems (abiotic)) **20% of the <u>original</u> extent** of Ecosystems (based on 1975 – benchmark (FIM (biotic) and Land systems (abiotic)). **All remaining occurrences** of <u>rare and endangered</u> ecosystems should be reserved or protected by other means as far as is practicable: - A rare ecosystem is one where its geographic distribution involves a total range of generally less than 10,000ha per Ecoregion, - Rarity is adjusted depending on the size of the Ecoregion as follows: <250,000 (500 ha) 250,000 – 500,000 ha (1,000 ha) 500,000 – 1,000,000 ha (2,000 ha) >1,000,0000 ha (10,000 ha) - a total area of generally less than 1000 ha or patch sizes of generally less than 100h where such patches do not aggregate to significant areas. - An endangered ecosystem is one where its distribution has contracted to less than 10% of its former range or the total area has contracted to less than 10% of its former area, or where 90% of its area is in small patches which are subject to threatening processes and unlikely to persist.
	While the Gap Analysis process identifies an interim set of conservation priority areas to fill the remaining gaps in the National Protected Areas network for PNG, the formal gazettal of areas under law or other secure arrangements requires negotiation and refinement of boundaries at many levels. The following guiding principles provide a check list of some of the key additional considerations required when formalizing the boundaries of protected areas.
	The way in which a protected area is designed can influence not only the protection of conservation values, but the efficiency and effectiveness of subsequent management for conservation within the protected area. The following criteria should be considered when finalizing the boundaries of a protected area including: - Boundaries should be also be set in a landscape context with strong ecological integrity, such as catchments or watersheds; - Large protected areas are preferable to small protected areas, though a range of sizes may be appropriate to adequately sample conservation values; - Boundary-area ratios should be minimized and linear reserves should be avoided where possible except for riverine systems and corridors identified as having significant value for nature conservation; Protected areas should be developed across the major environmental gradients if feasible, but only if these gradients incorporate key conservation attributes which should be incorporated in the CARR system; - Each protected area should contribute to satisfying as many reserve criteria as possible; - Protected area design should aim to minimize the impact of threatening processes, particularly from adjoining areas; *Protected areas should be linked through a variety of mechanisms, wherever practicable across the landscape.*
Goal 14: To evaluate and improve the effectiveness of protected area management.
	Target: Frameworks for monitoring, evaluating and reporting protected areas management effectiveness at sites, national and regional systems, and transboundary protected area levels adopted and implemented by Parties.
· Has your country evaluated management effectiveness of protected areas in a systematic way? If yes,	In the early 1990s, WWF and DEC conducted a review of the protected area system of PNG. This review resulted in a preliminary register of PNG's protected areas (WWF and DEC, 1992), and an unimplemented design for a protected area strengthening program (WWF and DEC, 1993). In 2006, DEC and WWF again review of the protected area system of PNG using the WWF's internationally recognized Rapid Assessment and Prioritisation of Protected Area Management, (RAPPAM) methodology was selected as an appropriate tool to assess the management

	effectiveness of PNG's protected areas at a system level. An IUCN review in 1999 for the World Bank/WWF Alliance for Forest Conservation and Sustainabl Use (IUCN, 1999) showed that 73per cent of PNG's protected areas have minimal or no management structure. Sixteen percent had no management at all, 8 per cent had a managemen structure but there were serious gaps and only 3 per cent were well managed with a good infrastructure (IUCN, 1999:26).
a) What percentage of nationa protected area system surface ar has been evaluated?	All 52 areas were evaluated covering 1,642,826 ha. (3.5%)
b) What are the conclusions for the national protected areas system, and to what extent were results incorporated into management plans and strategie	The analyses conducted showed that the PA system in PNG is very weak and there is a drastic nee to improve management planning in PNG. The management problems: lack of funding, low staff capability, insufficient resources (manpower and financial) and infrastructure is a common situati across developing countries. While there is the major problem of continued diminishing funding from the National Governmen to the lead agency for Protected Areas (DEC), it is essential for action and activity from other concerned organisations.

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LIST OF ACRONYMS

ABS	Access and Benefit Sharing
BioRAP	Biodiversity Rapid Appraisal
BSSE	Bismarck and Solomon Sea Ecoregion
CBD	Convention on Biological Diversity
CTI	Coral Triangle Initiative
CNA	Conservation Needs Assessment
DAL	Department of Agriculture and Livestock
DEC	Department of Environment and Conservation
DNPM	Department of National Planning and Monitoring
PNG DSP	PNG Development Strategic Plan
EIA	Environmental Impact Assessment(s)
ESEG	Environmental Sustainability and Economic Growth
FAO	United Nations Food and Agriculture Organization
FIM	Forest Inventory Mapping
FMA	Forest Management Agreement(s)
IUCN	International Union of 'Conservation of Nature' or World Conservation Un-ion
MDG-7	Seventh Goal of the Millennium Development Goals
MTDP	Medium Term Development Plan
NARI	National Agriculture Research Institute
NBSAP	National Biodiversity Strategy and Action Plan
NCSA	National Capacity Self Assessment
NGO	Non-Governmental Organization(s)
PA	Protected Area(s)
PES	Payment(s) for Ecosystem Services
PINBio	Papua New Guinea Institute of Biodiversity
PINGRIS	Papua New Guinea Resource Information System
POWPA	Program of Work on Protected Areas
PNGFA	Papua New Guinea Forest Authority
PNG-FRI	Papua New Guinea Forest Research Institute
PNGMGCTF	Papua New Guinea Mama Graun Conservation Trust Fund Inc
TNC	The Nature Conservancy
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UPNG	The University of Papua New Guinea
WWF	World Wide Fund for Nature

References

[1.] Alcorn, J. B. (ed), 1993. Papua New Guinea Conservation Needs Assessment Vol. 1. Biodiversity Support Program, Government of Papua New Guinea, Department of Environment and Conservation. Corporate Press Inc., Landover, Maryland.

[2.] Anderson, M., and C. Ferree. 2010. Conserving the Stage: climate change and the geophysical underpinnings of species diversity. PLoS One in press.

[3.] *Australian Agency for International Development (AusAID). 1999. Department of Environment and Conservation Institutional Strengthening Project, Papua New Guinea Project Completion Report. Port Moresby: Australian Agency for International Development.*

[4.] *Australian Agency for International Development (AusAID). 2000. PNG Sustainable Forest Management/Forestry and Conservation Project — Feasibility and Design Study. http://www.ausaid.gov.au/business/tender/summary.cfm?tenderid=99/096*

[5.] Ball, I. R. and H. P. Possingham, 2000. MARXAN (V1.8.2): Marine Reserve Design Using Spatially Explicit Annealing, a Manual pdf (267KB)

[6.] Beehler, B. M. (ed), 1993. Papua New Guinea Conservation Needs Assessment Vol. 2. Biodiversity Support Program, Government of Papua New Guinea, Department of Environment and Conservation. Corporate Press Inc., Landover, Maryland.

[7.] Bellamy, J. A. and J. R. McAlpine. 1995. Papua New Guinea: inventory of natural resources, population distribution and land use handbook. 2nd edition. Papua New Guinea Resource Information System (PNGRIS) Publication 6. Australian Agency for International Development (AusAID): Canberra, Australia.

[8.] Bryan, J., Shearman, P.L., Ash, J., and Kirkpatrick, J.B., (2010). Estimating rainforest biomass stocks and carbon loss from deforestation and degradation in Papua New Guinea 1972-2002: best estimates, uncertainties and research needs. Journal of Environmental Management. 19, 995-1001

[9.] *Carew-Reid, J., R. Prescott-Allen, S. Bass and B. Dalal-Clayton. 1994. Strategies for National Sustainable Development. A Handbook for their Planning and Implementation, IUCN and IIED. London: Earthscan.*

[10.] Chatterton, P., Yamuna, R., Higgins-Zogib, L., Mitchell, N., Hall, M., Sabi, J., Jano, W., Duguman, J., Mogina, J., Mowbray, D., Melick, D. and Leggett, M. (2009) An assessment of the effectiveness of Papua New Guinea's Protected Areas using WWF's RAPPAM Methodology. WWF.

[11.] Christian, C. S., and G. A. Stewart. 1953. General report on survey of Katherine-Darwin Region, 1946. Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australian Land Research Service 1. Commonwealth Scientific and Industrial Research Organisation (CSIRO): Canberra, Australia

[12.] Commonwealth of Australia (1997) Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia.

[13.] Department of Environment and Conservation and Department of Foreign Affairs. 1992. *The PNG Response to Rio. Report of the Post-United Nations Conference on Environment and Development (UNCED) Seminar for Sustainable Development in Papua New Guinea*. Port Moresby.

[14.] Department of Environment and Conservation and National Forest Authority. 1995. Key Standards for Selection Logging in Papua New Guinea. In *Towards Sustainable Forest Management*, ed. National Forest Authority. Port Moresby: National Forest Authority.

[15.] Department of Environment and Conservation, 2007, National Biodiversity Strategy and Action Plan

[16.] Department of Environment and Conservation, 2007, New Strategic Directions

[17.] Department of Environment and Conservation. 1996a. *Managing Papua New Guinea's Unique Environment — Strategic Directions 1996–1998*. Port Moresby: Department of Environment and Conservation.

[18.] Department of Environment and Conservation. 1996b. *Proposed Environmental Regulation Framework*. A Discussion Paper. Port Moresby: Department of Environment and Conservation.

[19.] Department of Environment and Conservation. 2004a. *Environment Act 2000 Operational Manual*. Port Moresby: Department of Environment and Conservation.

[20.] Department of Environment and Conservation. 2004b. *Guideline for Conduct of Environment Impact Assessment and Preparation of Environment Impact Statement*. Information Guideline DEC Publication GL-Env/02/2004. Port Moresby: Department of Environment and Conservation.

[21.] Department of Environment and Conservation. 2004c. *Guideline for Preparation of Environment Inception Report*. Information Guideline DEC Publication GL-Env/01/2004. Port Moresby: Department of Environment and Conservation.

[22.] Department of Environment and Conservation. 2004d. *Notification of Preparatory Work on Level-2 and Level-3 Activities*. Information Bulletin DEC Publication IB-ENV/01/2004. Port Moresby: Department of Environment and Conservation.

[23.] Department of Environment and Conservation. 2006. National Implementation Plan for Management of Persistent Organic Pollutants in PNG. A plan of action for Government of Papua New Guinea in fulfilling its obligations under the Stockholm Convention in POPs. Draft Report. Port Moresby: Department of Environment and Conservation.

[24.] Department of Environment and Conservation. 2009, DEC Corporate Plan 2009 – 2010

[25.] Department of Environmental Science, University of Papua New Guinea and Policy Co-ordination and Monitoring Committee, Department of the Prime Minister and NEC. 1993. *Stretim Nau Bilong Tumora* (in English, Tok Pisin and Hiri Motu editions). Port Moresby: Salvation Army Press.

[26.] Department of National Planning and Monitoring, 2010. Papua New Guinea Development Strategic Plan 2010- 2030.

[27.] Department of National Planning and Rural Development. 2004. *Medium Term Development Strategy 2005–2010. Our Plan for Economic and Social Advancement*. Port Moresby: Department of National Planning and Rural Development.

[28.] Department of Planning and Monitoring. 1999. *Papua New Guinea National Population Policy 2000–2010*. Port Moresby: Population and Human Resource Branch, Department of Planning and Monitoring.

[29.] Dudley, N. Stolten, S. Belokurov, A. Krueger L. Lopoukhine N., MacKinnon K, Sandwith T. and Sekhran N (eds) (2010); Natural Solutions: Protected Areas helping people cope with climate change, IUCN-WCPA, TNC, UNDP, WCS, the World Bank and WWF, Gland Switzerland, Washington DC and New York, USA.

[30.] Ellis, J. -A. 1997. *Race for the Rainforest II. Applying Lessons Learned from Lak to the Bismarck-Ramu Integrated Conservation and Development Initiative in Papua New Guinea*. Port Moresby: Department of Environment and Conservation (PNG) and UNDP-GEF UNOPS-PNG/93/G31.

[31.] Ervin, J., J. Mulongoy, K. Lawrence, E. T. Game, D. Sheppard, P. Bridgewater, G. Bennet, S. Gidda, and P. Bos. 2009. Making Protected Areas Relevant: A guide to integrating protected areas within wider landscapes, seascapes and sectoral plans and strategies. CBD Technical Series. Secretariat of the Convention on Biological Diversity, Montreal.

[32.] Faith, D. P. and Walker, P. A., 1996a. DIVERSITY - TD. In: BioRap, rapid assessment of biodiversity. Volume three, tools for assessing biodiversity priority areas (ed. D. P. Faith and A. O. Nicholls), pp. 63-74.

[33.] Faith, D. P. and Walker, P. A., 1996b. Integrating conservation and development: effective trade-offs between biodiversity and cost in the selection of protected areas. Biodiversity and Conservation 5, 417-429.

[34.] Faith, D. P., Margules, C. R. and Walker, P. A., 2001b. A Biodiversity conservation plan for Papua New Guinea based on biodiversity trade-offs analysis. Pacific Conservation Biology.

[35.] Faith, D. P., Margules, C. R., Walker, P. A., Hutchinson, M. and Nix, H. A., 1999. Biodiversity conservation planning and implementation. in Papua New Guinea: from targets and trade-offs to environmental levies and carbon-offsets ed anon. Pacific Science Congress, Sydney.

[36.] Faith, D. P., Walker, P. A. and Margules, C. R., 2001c. Some future prospects for systematic biodiversity planning in Papua New Guinea - and for biodiversity planning in general. Pacific Conservation Biology.

[37.] Faith, D. P., Walker, P. A., Ive, J. R. and Belbin, L., 1994. Integrating conservation and forestry production: effective trade-offs between biodiversity and production in regional land-use assessment. In: Conserving biological diversity in temperate forest ecosystems - towards sustainable management pp. 74-75. 50

[38.] Faith, D. P., Walker, P. A., Margules, C. R., Stein, J. and Natera, G., 2001a. Practical application of biodiversity surrogates and percentage targets for conservation in Papua New Guinea. Pacific Conservation Biology.

[39.] Farr, T. G., et al. (2007), The Shuttle Radar Topography Mission, Rev. Geophys., 45, RG2004, doi:10.1029/2005RG000183.

[40.] Filer, C. 2002. Sustainable Development in Policy and Sustainability Planning Framework for the Mining Sector in PNG — Policy Development Framework — draft. Port Moresby: Department of Mining.

[41.] *Filer, C. and N. Sekhran. 1998.* Loggers, Donors and Resource Owners, Papua New Guinea Country Study. London: IIED (UK) and National Research Institute, Papua New Guinea.

[42.] Food and Agricultural Organization (FAO). 2003. *International Code of Conduct on the Distribution and Use of Pesticides*. Rome: FAO.

[43.] Gordon, C.; Cooper, C., Senior, C.A., Banks, H., Gregory, J.M., Johns, T.C., Mitchell, J.F.B., and Wood, R.A. (2000). "The simulation of SST, sea ice extents and ocean heat transports in a version of the Hadley Centre coupled model without flux adjustments". Climate Dynamics 16**:** 147–168.

[44.] Game, E. T. and Grantham, H. S.. 2008. Marxan user manual; for Marxan version 1.8.10. The University of Queensland and Pacific Marine Analysis and Research Association Brisbane.

[45.] Game, E. T., C. Groves, M. Anderson, M. Cross, C. Enquist, Z. Ferdaña, E. Girvetz, A. Gondor, K. Hall, J. Higgins, R. Marshall, K. Popper, S. Schill, and S. L. Shafer (2009) Incorporating climate change adaptation into regional conservation assessments. The Nature Conservancy. Arlington, Virginia.

[46.] Game, E. T., Watts, M. Wooldridge, S., and Possingham, H. 2008. Planning for persistence in marine reserves: a question of catastrophic importance. Ecological Applications 18:670-680.

[47.] Game, E.T. and Segan, D. (2009) - PNG PoWPA Marxan Manual

[48.] Geoff Lipsett-Moore, Edward Game, Nate Peterson, Earl Saxon, Stuart Sheppard, Allen Allison, John Michael, Rose Singadan, James Sabi, Gaikovina Kula and Roselyn Gwaibo (2010) Interim National Terrestrial Conservation Assessment for Papua New Guinea: Protecting Biodiversity in a changing Climate; Pacific Island Countries Report No. **1/2010.**

[49.] Gladman, D., D. Mowbray and J. Duguman. 1996. From Rio to Rai: Environment and Development in Papua New Guinea. Six volumes. Port Moresby: University of Papua New Guinea Press.

[50.] Gonzales, P. Neilson R.P., and Drapek R.J (2005) Climate change vegetation shifts across global ecoregions. Ecological Society of Ammerica Annual Meeting Abstracts 90: 228

[51.] Government of Papua New Guinea and United Nations in Papua New Guinea. 2005. Millennium Development Goals — Progress Report for Papua New Guinea 2004. Port Moresby.

[52.] Government of Papua New Guinea. 2004. Papua New Guinea's National Assessment Report on the Implementation of the Barbados Programme of Action for the Sustainable Development of Small Island Developing States. Port Moresby.

[53.] Hammermaster, E. T. and Saunders, J.C. (1995) Forest Resources and Vegetation Mapping of Papua new Guinea. PNGRIS Publication No 4. (Ausaid: Canberra.) 294 pp, 1 mapsheet 51

[54.] Hunnam P. (1992) Papua New Guinea Protected Areas Program: Register of Protected Areas. WWF South Pacific Program, Port Moresby.

[55.] Hutchinson, M. F., Belbin, L., Nicholls, A.O., Nix, H. A., McMahon, J. P. and Ord, K. D, 1996. BioRap. Volume Two. Spatial Modeling Tools, The Australian BioRap Consortium, Canberra, 142 pp.

[56.] IUCN, 1999: Threats to Forest Protected Areas, Research Report for World Bank/WWF Forest Alliance,IUCN, Available from http://iucn.org/themes/wcpa/themes/wcpa.

[57.] Kula, G.R., John, M., Geoff, L,M,. (2009), Review of the Extent of Mainstreaming of Protected Areas into National and Provincial Strategic Documents(pages 11-44); and Legislation and Institution gaps and barrier (pages 45 -58) (DEC unpublished report).

[58.] Kwa, E. 2004. Biodiversity Law and Policy in Papua New Guinea. Port Moresby: Papua New Guinea Institute of Biodiversity.

[59.] Kwa, E. 2005. Papua New Guinea Biodiversity Strategy and Action Plan Working Draft. Port Moresby: Department of Environment and Conservation.

[60.] Margules, C. R., Redhead, T. D., Faith, D. P. and Hutchinson, M. F., 1995. Guidelines for Using the BioRap Methodology and Tools. CSIRO Australia, 70 pp.

[61.] Margules, C.R., Pressey, R.L. (2000). Systematic conservation planning. Nature. 405: 243-253.

[62.]   Martin, R. 1999. Integrating Conservation and Development in a Papua New Guinean Community. Monash Publications in Geography and Environmental Science Number 52. Melbourne: Monash University.

[63.]   McAlpine J.R, and Quigley J. (1998) Forest Resources of Papua New Guinea - Summary Statistics from the Forest Inventory Mapping (FIM) System. Prepared by Coffey MPW Pty Ltd for the Australian Agency for International Development and the Papua New Guinea National Forest Service.

[64.]   McAlpine J.R. and Freyne D.F. (2003) Land Use Change and Intensification in Papua New Guinea 1975–1996 Asia Pacific Viewpoint Volume 42 Issue 2&3, Pages 209 - 218L E S

[65.]   McCallum R. and N. Sekhran. 1997. Race for the Rainforest: Evaluating Lessons for an Integrated Conservation and Development 'Experiment' in New Ireland, Papua New Guinea. Port Moresby: Department of Environment and Conservation (Papua New Guinea) and UNDP-GEF UNOPS-PNG/93/G31.

[66.]   McNeely J.A., and Miller K.R. (1984) National Parks, Conservation and Development: The role of protected areas in sustaining society. Proceedings of the World Congress on National Parks held on 11-22 October 1982 in Bali, Indonesia. Smithsonian Institution Press, Washington, DC.

[67.]   Melnick, D., J. McNeely, Y. K. Navarro, G. Schmidt-Traub and R. R. Sears. 2005. Environment and Human Well-being: A Practical Strategy. Summary Version. New York: UN Millennium Project Task Force on Environmental Sustainability.

[68.]   Mittermeier, R.A., Myers N., Thomsen J.B., da Fonseca, G.A.B. and Olivieri, S. (1998) Biodiversity Hotspots and Major Tropical Wilderness Areas: Approaches to Setting Conservation Priorities. Conservation Biology, Vol. 12(3):516-520

[69.]   Mowbray, D. 2000. Papua New Guinea National Profile of Chemical Management 1997–2000. Canberra and Port Moresby: National Centre for Development Studies, Australian National University and Department of Environmental Science, University of Papua New Guinea.

[70.]   Mowbray, D. 2005. Papua New Guinea National Profile of Chemical Management 2000–2004 (draft). Prepared for PNG POPs Project. Port Moresby.

[71.]   Nicholls, S. 2002. The Priority Environmental Concerns of Papua New Guinea. Draft Report. Strategic Action Programme for the International Waters of the Pacific Small Island Developing States. Port Moresby: Global Environment Facility, United Nations Development Programme and South Pacific Regional Environment Programme.

[72.]   Nix, H. A., D. P. Faith, M. F. Hutchinson, C. R. Margules, J. West, A. Allison, J. L. Kesteven, G. Natera, W. Salter, J. L. Stein and P. Walker. 2000. The BioRap Toolbox. A National Study of Biodiversity Assessment and Planning for Papua New Guinea. Consultancy Report to the World Bank. Canberra: Centre for Resource and Environmental Studies, Australian National University.

[73.]   Norman Myers, N., Russell A. Mittermeier R.A., Cristina G. Mittermeier C.G., da Fonseca G.A.B and Kent J (24 February 2000) Biodiversity hotspots for conservation priorities Nature 403, 853-858

[74.]   Office of Environment and Conservation. 1976. Environment and Conservation Policy — A Statement of Principles. Port Moresby: Office of Environment and Conservation.

[75.]   Office of National Planning. 1999. Papua New Guinea Human Development Report 1998. Port Moresby: Government of Papua New Guinea and United Nations Development Programme.

[76.] Olson, D.M, Dinerstein, E, Wikramanayake E.D., Burgess N.D. , Powell, G.V.N, Emma C. Underwood, Jennifer A. D'amico, Illanga Itoua, Holly E. Strand, John C. Morrison, Colby J. Loucks, Thomas F. Allnutt, Taylor H. Ricketts, Yumiko Kura, John F. Lamoreux, Wesley W. Wettengel, Prashant Hedao, and Kenneth R. Kassem (2001) Terrestrial Ecoregions of the World: A New Map of Life on Earth BioScience 933 Vol. 51 (11) 933-938

[77.] Papua New Guinea Conservation Trust Fund Limited. 2000. Papua New Guinea Mama Graun Conservation Trust Fund. Operations Manual. Port Moresby.

[78.] Piest, U. and J. Velasquez. 2003. Environmental Governance in Papua New Guinea: A Review — Interlinkages: Synergies and Coordination among Multilateral Environmental Agreements. Tokyo: United Nations University.

[79.] Quarrie, J. ed.) 1992. Earth Summit '92 The United Nations Conference on Environment and Development Rio De Janiero 1992. London: The Regency Press.

[80.] Saulei, S. and J. -A. Ellis. 1997. The Motupore Conference: ICAD Practitioner Views from the Field. Port Moresby: Department of Environment and Conservation and UNDP.

[81.] Saxon E.C. (2008) Noah's Parks: A partial antidote to the Anthropocene extinction event Biodiversity 9.3-9.4) 5-10

[82.] Saxon, E. C., Baker, B., Hargrove, W., Hoffman, F. and Zganjar, C. (2005). Mapping environments at risk under different global climate change scenarios. Ecology Letters 8: 53–60.

[83.] Sekhran, N. and S. Millar. 1994. Papua New Guinea Country Study on Biological Diversity. Port Moresby: Conservation Resource Centre, Department of Environment and Conservation and Africa Centre for Resources and Environment (ACRES).

[84.] Shearman, P.L, (2008). Recent Change in the Extent of Mangroves in the Northern Gulf of Papua, Papua New Guinea

[85.] Shearman, P. L., Bryan, J. E, Ash, J., Hunnam, P., Mackey, B., and Lokes, B. (2008). The state of the forests in PNG: Mapping and condition of forest cover and measuring the drivers of forest change in the period 1972-2002. Port Moresby: University of Papua New Guinea

[86.] Shearman P.L. Ash J., Mackey B., Bryan J.E., Lokes B. (2009). Forest conversion and degradation in Papua New Guinea 1972 – 2002. Biotropica. 41, 379-390.

[87.] Shearman, P.L. and Bryan, J. (2009). A Bioregional analysis of the distribution of rainforest cover, deforestation and degradation in Papua New Guinea. Austral Ecology. In Press.

[88.] Shearman, .L., Bryan, J.E, 2010, A bioregional analysis of the distribution of rainforest cover, deforestation and degradation in Papua New Guinea. Austral Ecology (2010)

[89.] Sheppard, S., and Saxon E. C. 2008. Land Systems of the New Guinea Archipelago. ESRI Map Book **23**. Redlands, California: ESRI Press. Available on line at http://conserveonline.org/workspaces/NG_LandSystems.

[90.] Sivusia-Joyce, B. 2005. Environment policies hopes dashed. PNG has poor record of regulations, monitoring and compliance. Papua New Guinea Post-Courier 13 July 2005, 11.

[91.] South Pacific Environment Programme, Frank Wickham, Jeff Kinch, David Mitchell, Michael Bongro, Rose Alphonse, Gwen Sissiou, Gwen Maru, Gai Kula and Steven Nicholls, 2010, Assessing the Capacity of Papua New Guinea to Implement the United Nations Convention on Biological Diversity (UNCBD), the United

Nations Convention to Combat Desertification (UNCCD), and the United Nations Framework Convention on Climate Change (UNFCCC).

[92.] United Nations Development Programme (UNDP). 1994. Yumi Wankain: Report of the United Nations Joint Inter-Agency Mission to Papua New Guinea on Sustainable Development. Port Moresby: United Nations Development Programme.

[93.] University of Papua New Guinea, 2002. Papua New Guinea National Assessment Report: Response to Rio and Agenda 21. In From Rai to Johannesburg, ed. D. Mowbray. Port Moresby: University of PNG Printery.

[94.] Van Heldon, F. 1998. Between Cash and Conviction: the Social Context of the Bismarck-Ramu Integrated Conservation and Development Project. The National Research Institute (Papua New Guinea) and UNDP Global Environmental Facility. UNOPS-PNG/93/G31. Port Moresby.

[95.] Vié, J.-C., Hilton-Taylor, C. and Stuart, S.N. (eds.) (2009). Wildlife in a Changing World – An Analysis of the 2008 IUCN Red List of Threatened Species. Gland, Switzerland: IUCN. 180 pp.

[96.] http://data.iucn.org/dbtw-wpd/edocs/RL-2009-001.pdf

[97.] World Statistics Pocketbook Small Island Developing States Department of Economic Series V No. 24/SIDS and Social Affairs Special Issue Statistics Division Preliminary -2007 update.

[98.] World Wide Fund for Nature (WWF) and Department of Environment and Conservation (DEC). 1992. Review of the Management and Status of Protected Areas and Action Plan. Papua New Guinea Protected Areas Programme. Port Moresby: World Wide Fund for Nature and Department of Environment and Conservation.

[99.] World Wide Fund for Nature (WWF) and Department of Environment and Conservation (DEC). 1993. Papua New Guinea Conservation Areas Strengthening Project 1994–2000, Project Document. Port Moresby: World Wide Fund for Nature, South Pacific Program and Department of Environment and Conservation.