Madang Sustainable Development: A Ridges-to-Reefs Gap and Priority Analysis

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Madang Sustainable Development:

A Ridges-to-Reefs Gap and Priority Analysis

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Foreword

Madang Province is the most popular location in Papua New Guinea for divers and many other visitors including local tourists. It is culturally, geographically and biologically diverse. It consists of reef-fringed lowlands, backed by some of the most rugged mountains in Papua New Guinea covered in tropical rain forests and offshore volcanic islands. The colourful Madang Township has been called the "prettiest town in the South Pacific". Its peninsula setting is a show-place of parks, waterways, luxuriant shade trees and sparkling tropical islands.

Most of the Provinces population of 487,460 is rural based where their livelihood and daily sustenance is dependent on the environmental resources and continue to live in isolated communities. As more people are drawn into the modern cash economy, my Provincial Government sees the development of our natural resources as an alternative way of creating employment and income earning opportunities for our people in the rural areas, including, improvement in service delivery. I understand that such decision in favour of economic growth has negative social and ecological consequences for the future that needs to be taken into consideration.

Upon assuming my role as the Governor on 21 August 2012, I have realised there is a lack of a comprehensive development policy framework for the Madang province to serve as a guide in the development of resource management plans and allocation of budgetary resources. This includes the lack of strategies for the sustainable management of our environmental resources including the protection of ecosystems, biological diversity and climate change measures.

As we are living in the computer age, reliable and up-to-date information is a prerequisite for sustainable development planning. As land and its associated resources are owned by the people of Madang, I have asked the Nature Conservancy to coordinate a land use gap analysis through a bottom up stakeholder participatory process that allows for technocrats to work with the custodians of our natural resources, the landowners and other stakeholders. The successful outcome of this participatory process is presented in this report.

On behalf of the Madang Provincial Government and the people of Madang, a big thank you to those who were involved in the scientific and local data collection, analysis and compilation of this report. I urge the public servants of Madang and other stakeholders to use the findings and recommendations of this report in finalising the Kalibobo Vision 2020, the revision and update of the Madang Medium Term Development Plan, and the production of the State of Madang Environment and Natural Resources for sustainable management of our environmental resources and for addressing climate changes mitigation and adaptation issues in Madang.

Hon. JIM KAS, MP
Governor for Madang
Madang Provincial Government

Acknowledgements

This report is a synthesis of expertise, knowledge and views of a broad range of Madang stakeholders and representatives including clan and district leaders, the Madang Provincial Government and Divisions within the Provincial Government, Community Based Organisations, Civil Society Organisations and church and youth group leaders. The authors would like to thank and acknowledge the contributions made by 228 individual participants as reflected in Annex 1.

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We also acknowledge the role and input provided by our civil society organizational partners in networking, facilitation and ensuring logistical support and effective participation by community leaders and representatives. The role played by TNC Madang team and especially Clement Kipa and Theresa Kas is also acknowledged.

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Table of acronyms

CARR	Comprehensive, Adequate, Representative, Resilient
CBD	Convention on Biological Diversity
CBO	Community Based Organizations
CTI	Coral Triangle Initiative
DAFF	Department of Agriculture, Fisheries and Forestry, Australian Government
DEC	Department of Environment and Conservation
FIM	Forest Information System
FPCD	Foundation for People's Community Development
IGES	Institute for Global Environmental Strategies
ITTO	International Tropical Timber Organization
LEAF	USAID Regional Development Mission for Asia's Lowering Emissions in Asia's Forest program
LLG	Local level Government
LMMA	Locally Managed Marine Area
LUMP	Land Use Management Plans
MRV	Monitoring, Reporting, Verification
mtpa	million tonnes per annum
NBSAP	National Biodiversity Strategic Action Plan
NEC	National Executive Committee
NFA	National Fisheries Authority
NGO	Non-Government Organization
NRI	National Research Institute
OCCD	Office of Climate Change and Development
P3DM	Participatory 3-D Modelling
PEC	Provincial Executive Council
PNG	Papua New Guinea
PNGFA	Papua New Guinea Forest Authority
PNGRIS	Papua New Guinea Resource Information System
PoWPA	Program of Work on Protected Areas
PWM	Partners with Melanesians
RAFT	Responsible Asia Forest and Trade
RAPPAM	Rapid Assessment and Prioritization of Protected Areas Management
REDD+	Reduced Emissions from Deforestation and Degradation
SABL	Special Agriculture Business Leases
SRTM	Shuttle Radar Topography Mission
TNC	The Nature Conservancy
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WMA	Wildlife Management Area

Executive Summary

The Ridges-to-Reefs Gap and Priorities for Madang Province described in this document can be used to revise and update both the terrestrial and marine conservation component of the Kalibobo Vision 2020 and the Madang Medium Term Development Plan. The analysis allows stakeholders to visualize the location of conservation values and priorities within the Madang Province, to identify the threats to biodiversity, and to compare what a successfully implemented protected areas network across Madang could look like under several different scenarios. It provides an important tool for establishing a network of conservation areas under internationally supported initiatives that include; the Bismarck Solomon Seas Eco-region, the Coral Triangle Initiative, and the National Conservation Areas Program. Such a network would support future food and freshwater security, preserve the remarkable Madang biodiversity and reduce stresses on terrestrial and marine environments, thereby increasing the resilience of natural systems to the effects of climate change and other external forces.

The study was undertaken using a bottom-up consultative process involving a range of stakeholders, including government, civil society partners and community representatives. Key national government agencies included Department of Environment and Conservation (DEC), PNG Forest Authority (PNGFA), National Research Institute (NRI), and the Office of Climate Change and Development (OCCD). Four stakeholder workshops were convened in several locations in 2013; at the Jais Aben Resort in May, in Bogia in August, in Brahman in September and the final workshop at the Jais Aben Resort in November. The workshops brought together community members from every District of Madang, along with representatives from provincial and national governments, NGOs and the private sector. The workshops began with presentations from church leaders, government officials, NGOs and scientists on the status of Madang's environment and the need to protect it for the future prosperity of the people of Madang. Workshop facilitators then presented the best available national scale data on various marine and terrestrial resources and land uses including forest types of Madang, and described existing environmental threats.

Stakeholders used participatory mapping techniques to identify additional local features within customary owned lands and seas that are of high conservation value to them, representing important biological and cultural resources that would benefit from protection or active management. Examples of such features included sources of freshwater, cultural heritage sites, turtle nesting beaches, and other wildlife habitats.

Participatory mapping was also used to identify threats to biodiversity (e.g. negative impacts from logging and mining operations and areas susceptible to climate change) and to map potential conservation areas, including sites that are proposed as protected areas but not yet managed as such. The conservation features were digitized and put into a Geographic Information System (GIS) for analysis. Conservation targets, based on the Convention on Biological Diversity (CBD), which Papua New Guinea (PNG) is a signatory to, were set at a minimum of 17% for all terrestrial conservation features and 10% for all marine conservation features. These targets represent the percentage area of each feature that should be protected across Madang to meet PNG's international obligations.

An analysis was completed using Marxan decision support software to help identify areas suitable for conservation management whilst considering the development aspirations and needs of the Province. The resulting products and recommendations are termed "Interim" as they provide direction and guidance for the Government of Madang regarding the consideration of new conservation proposals and industrial developments in the Province until such time as better products are available.

A number of recommendations for Provincial leadership and communities alike are as follows:

1. The provincial administration admitted that conservation and environmental protection aspects are not being adequately catered for in current provincial plans. Therefore the discussions and analysis undertaken through this project should be incorporated into future provincial development plans.

2. As new information becomes available this analysis should be revisited and updated as appropriate. The priority analysis presented in this report can only be used as a guide for decision making. As development projects or conservation areas are put forward the priority map should be consulted along with local stakeholders and communities.

3. The Province should establish a conservation and environment office. Such an office would be responsible for maintaining records on existing and proposed conservation areas. This information would enable the province to make wise decisions about placement of new developments and conservation areas alike. The office should also be charged with advising on policy or legislation for environment and conservation issues.

4. The Madang province needs to build on this report by undertaking a comprehensive state of the environment report on a regular basis to highlight status of development in the province and its opportunities and threats on the renewable resources sector.

5. Build capacity at the provincial level for planning and resource management. Tools and skills in GIS mapping, database management, socio-economic issues, and biological data would greatly enhance the Provinces ability to implement the outputs of this report.

6. Develop provincial research protocols and repository in consultation with national government, including NRI and other institutions for data and benefit sharing.

7. Increase awareness on threats to natural resources and the sustainable functions of ecosystems, particularly focusing on the threats posed by changing climatic patterns.

8. Conduct a comprehensive review on the effectiveness of the existing management areas. Detailed surveys should be completed which profile the range of land uses, biodiversity, and threats.

9. Utilize public - private partnerships to technically and financially implement the outcomes and recommendations of this analysis.

10. It is recognized that the data relating to marine resources used in this analysis is limited. Looking ahead, however, there is opportunity to improve this through collaboration with DEC as they develop the national marine gap and priority analysis in early 2014. Madang provincial government should work with DEC to address data gaps in the Province to improve the knowledge base of the marine environment.

11. As most of the natural resources of the country are customarily owned by the people, conservation priority needs addressed at the community level will have been better chance of success if done at Provincial, District, and/or community scales.

12. Madang Province has the opportunity to collaborate with DEC to effectively establish a CARR protected area system in PNG. Madang needs to consider proposed conservation areas to evaluate whether it contributes to the CARR protected area system.

13. As there are many more existing, proposed and other areas of high biodiversity significance, this list needs to be regularly updated and incorporated into the short to medium term development plans including the provincial forest plan while under revision to embrace relevant and significant aspects of this report.

14. The Madang provincial Government should commit technical and financial resources to the implement the recommendations contained in this report.

15. This report and the associated maps should be presented to communities through focused workshops to ensure that the inputs, outputs, and recommendations are clearly understood by communities.

As well as providing background information and guidance for conservation and development within Madang Province, this report represents constructive progress regarding PNG's commitment to implementing the Convention on Biodiversity (CBD) and the identification of terrestrial and marine priorities. This report also represents progress on some priority activities to be undertaken under the National Marine program as part of the Coral Triangle Initiative for Madang Province, and on activities agreed to by all PNG's Maritime Provincial Governors in their Declaration dated 6th November 2013, which concerns land use planning and marine conservation as well as climate compatible development strategies.

1. Introduction

Sustainable development is defined as development that meets the needs and aspirations of the present generation without compromising the ability to meet those of the future generations (WCED, 1987). This development approach advocates a process that integrates economic, social and ecological issues with the objective of ensuring optimal, non-declining social welfare. Such integration is fine however no ideal recipe exists for designing and implementing sustainable development strategies. This leaves the responsibility to respective countries and societies to formulate their own sustainable development strategies taking into account their respective social, cultural, political and economic circumstances.

1.1. PNG Sustainable Development Framework (PNG Vision 2050)

The sustainable development concept is not entirely new to Papua New Guinea (PNG). It is enshrined in its national goals and directive principals that place emphasis on equal opportunities and participatory approaches to development; political and cultural development; and conserving natural resources and the environment for now and for the future. Despite these provisions, actual development planning and resource management has been undertaken on an ad hoc basis. After 34 years of political independence, the country has not progressed well in managing its resources efficiently. Its economic performance has been poor and, even after a decade of positive economic growth; it has failed to provide the level of expected broad-based economic and social opportunities for the majority of the population, retaining some of the worst social indicators in the Asia-Pacific region (Barker, 2012).

The PNG Vision 2050 was formulated in 2009 with the vision for a smart, wise, fair, healthy and a happy society by 2050 (GoPNG, 2009). Vision 2050 also provides a policy framework for the design of short to medium term development plans and for the allocation of resources over the next 40 years. Planning and implementation of programs under Vision 2050 fall under seven strategic focal areas, referred to as the pillars:

- Human Capital Development, Gender, Youth and People Empowerment
- Wealth Creation
- Institutional Development and Service Delivery
- Security and International Relations
- Environmental Sustainability and Climate Change
- Spiritual, Cultural, and Community Development
- Strategic Planning Integration and control

All state agencies and development partners have been directed by the Government to align their ongoing activities and future strategic plans to the PNG Vision 2050, PNG Development Strategic Plan (2010-2030) and the Medium Term Development Strategy (2010-2015). Some agencies have already successfully aligned their strategic development plans. Examples include the Draft Climate Compatible Development Plan (2013-2015), and plans for the Department of Agriculture & Livestock, Department of Works, Department of Natural Resources, the University of Goroka and the broader Education Sector. Whilst there is a need for improvement in the overall coordination of the preparation, approval, financing and monitoring of the respective plans, the onus is on all

respective agencies to formulate their integrated development plans under this development framework. The analysis and recommendations on Madang's conservation gaps and priorities will assist the Madang Province in positively contributing towards achieving the development objectives of PNG Vision 2050 for a healthy, happy, wealthy and prosperous society.

1.2. Madang Kalibobo Vision 2020

In compliance with the government directive for improved natural resources management including improved service delivery, the Madang Province embarked on a bottom up planning process in 2010 for the development of its medium term development plan, referred to as the Kalibobo Vision 2020. This draft ten year plan provides a broad framework for improved provincial planning, natural resources management and budgetary resource allocation. The Kalibobo Vision 2020 development objective is for Madang to be a peaceful, prosperous and a happy province by 2020 through effective planning and implementation of priority activities under ten thematic areas identified by the Province as follows:

- Spiritual growth, ethical leadership, youth and civic duties
- Education – informed, educated, empowered people
- Health – healthy, productive and happy people and community
- Lands, Agriculture, Fisheries and Forestry – sound broad-based economic empowerment
- Mining Resource Development – for fair equitable participation and benefit sharing
- Commerce ,Tourism and Industry – preserve and share culture and environment
- Law and Justice – fair and just people and community
- Infrastructure – for access and equitable service delivery, including disaster management
- Institutional Strengthening – cultural, community and government institutions
- Partnerships with private industry, NGO and the donor community

The Kalibobo Vision 2020 is presently undergoing a final review before approval by the Madang Provincial Executive Council (PEC). Implementation is planned to start in 2014. The data provided in this report is intended to assist in finalizing the natural resources management and conservation component of the Kalibobo Vision 2020, which includes climate change strategies.

1.3.Objective of the Report

The Nature Conservancy (TNC) was requested by the Madang Provincial Government to lead and conduct a conservation gap analysis for the Province and to identify high biodiversity areas and 'climate vulnerable' forest and marine areas that must be conserved whilst balancing the needs for commercial development and other land uses.

The objective of this report is therefore to use local knowledge and spatial information to identify 'gaps' in the Province's conservation planning and targets and to present recommendations on priority areas for action. It is also expected that the data and analysis completed for this report will also assist in updating and finalizing the Kalibobo Vision 2020, revising the Madang Medium Term Development Plan, especially related to natural resources management, biodiversity conservation and climate change, and revision and formulation of the Madang Provincial Forest Plan.

There are seven sections to this report. This section outlines the report objectives and key policy frameworks that have guided the development of this report. Section 2 provides an overview of the economy, biodiversity and threats of PNG. Section 3 covers these topics with a focus on Madang

Province. Sections 4 reviews the workshops held as part of the project. Section 5 covers the methods and results of the spatial analyses. Section 6 and 7 conclude the report and present recommendations. Note that outputs from this analysis are based on the best available national and international data sets at the time of writing. But it is recognised that there are limitations in the data sets used (which are outlined in this report) and therefore the analysis and recommendations made could be considered 'interim'. A recommendation is that this analysis is reviewed and updated as more accurate and precise data becomes available.

2. Papua New Guinea

2.1. Economy

Papua New Guinea comprises the eastern part of the island of New Guinea and a spread of smaller islands to the north and north east. It is categorized as a middle-income country with an area of 461,690 square km and a population of 7 million people. Eighty five percent of the population is largely rural based that continues to live in isolated communities, many of whom are dependent on the biological resources for their livelihoods. It is one of the world's most diverse countries, with over 850 indigenous languages. Agriculture is the most dominant activity in PNG and it continues to provide for the bulk of the population, and will continue to do so for the foreseeable future.

The performance of the PNG economy has steadily improved over the past decade due to a resources boom, mainly in the extractive mineral and hydro-carbon sectors and the strong prices of PNG's export commodities. It is also partly due to reforms introduced early this decade combined with generally prudent fiscal and monetary management, which have in turn contributed to conducive and relatively stable macro-economic conditions. The Gross Domestic Product (GDP) has improved from 5.5 to 7 percent in 2009 – 2010. There are many more new development projects coming into operation in both the renewable and non-renewable resources sectors that are anticipated to provide income and employment opportunities. The construction, production and export of gas from the Southern Highlands starting 2014 from the liquefied natural gas project (PNG-LNG) will be the single largest investment in the country's history. It is projected to triple the country's export revenue by 2020. With a potential 25 per cent boost in GDP, political leaders will be under pressure to use public finances for sustainable and equitable gains for all Papua New Guineans (UNDP, 2013).

PNG's budgetary resources are met mostly by revenues generated from the exploitation of its natural resources. In terms of GDP contribution, the renewable resources sector (agriculture, forestry and fisheries) accounted for 34% of GDP in 2009 compared to 13.5% from the non-renewable resource sector (mining, oil and gas). Whilst the contribution of the minerals industry (including oil and quarrying) to GDP in 2011 was still only 18.7%, and forecasted to slip to 14.9% in 2013, it is however expected to rise to 27.6% of GDP in 2015 when the LNG project is in full production. In regard to export earnings, the mineral/oil sectors provided 88% of export earnings in 2007, 78% in 2009, and 71% in 2011. By contrast, the renewable resources sector contributed only 19% to export earnings in 2007, rising proportionately to 21% in 2009, and 26% in 2011 (Barker, 2012).

The exploitation of the country's natural resources has led to the development of a dualistic economy characterized by a monetized sector and a subsistence sector in which cash plays a limited role. The monetized sector is capital intensive and is mostly dominated by foreign investments. Because of the capital intensive nature of many of these projects, especially in mining, they have very little linkage with other sectors of the economy.

Many observers have suggested that PNG's economy is suffering from the phenomenon known as the 'Dutch Disease' – a situation whereby a sudden surge in an enclave sector (for example, oil, gas or base metals) depresses output and employment in other trade sectors, causing appreciation in real exchange rates (World Bank, 1993). The recent decline in agricultural production is partly due to labour being drawn away from agriculture to the mining and petroleum sector where wages are relatively higher. The challenge is for the country, and the provinces such as Madang, to take advantage of its recent economic gains and diversify investment in other sectors especially the primary industry sector and human resource capital for improved resources utilization as managers and beneficiaries of land and its associated resources. This will contribute to achieving the PNG Vision 2050 objective of reversing the development trend and for the country to sustain its growth based on the primary industry sector including productive use of customary land.

2.2. Biodiversity

Papua New Guinea hosts a wide range of forest ecosystems, ranging from mangroves, swamp forests, savannahs, to montane forests and continuously wet cloud forest. PNG has one of the largest and most diverse blocks of tropical forest remaining in the world. The island of New Guinea as a whole (combining mainland PNG and Indonesia's Papua and West Papua regions) has the largest contiguous area of forest in Asia-Pacific and the third largest tropical rainforest on the planet, after the Amazon and Congo forests. PNG is both regionally and globally significant in terms of forests area and diversity of forest types.

Papua New Guinea has this extraordinary range of ecosystems because of its geographical and geological complexity. It ranks in the top 20 most biologically diverse countries in the world, with a wide range of remarkably diverse environments that supports a great variety of different habitats rich in species. Between 5 and 7% of the world's total number of animal and plant species are found in Papua New Guinea, even though it occupies less than 1% of world's total land area. Some forests of Papua New Guineas are known to be amongst the richest in the world in terms of their biodiversity (the different number of species they contain), and represent an important natural gene pool for future generations of Papua New Guineans, particularly as many of these species are endemic to the country, or the island of New Guinea. It is also the home to the beautiful bird of paradise and the Birdwing butterfly, the world's largest butterfly.

2.3. Threats

The country's rich biodiversity is under serious threat through rapid social and economic change. The population is increasing by 2.3 % (UNDP, 2013) annually and projected to reach 9 million by 2020. Major projects have been developed for commercial agriculture, forestry, fisheries, minerals and petroleum extraction and many communities are undergoing the transition from a purely subsistence system to a cash economy. These changes have profound implications for the country's biologically rich resources. At the same time, as the scale and range of resource exploitation

activities are escalating, the close relationship between people and the environment is being eroded.

At the national level, the growth in the mining and logging industries have exposed weaknesses that have led to some localized but severe environmental degradation. For instance, the management of the Ok Tedi Mine led to significant damage to riverine systems, the Bougainville Copper Mine created environmental damages and civil unrest and the granting of Special Agriculture Business Leases (SABLs) over large areas has contributed to deforestation. These experiences and others, demonstrate that the "business as usual" approach to development in PNG is neither sustainable, climate compatible, nor socially appropriate.

2.4.Current Conservation Management in PNG

Several conservation assessments have been done to inform action plans for national biodiversity conservation. The notable ones are the Conservation Needs Assessment (1993), BIORAP (2001), and the Interim National Terrestrial Conservation Assessment for Papua New Guinea: Protecting Biodiversity in a Changing Climate (2010). These assessment reports present information on existing and potential protected areas for a national protected areas system. However, most of the findings and recommendations of these reports have yet to be fully implemented.

As a signatory to the Convention on Biological Diversity, each country is required to set aside 17 per cent of terrestrial and 10 per cent of marine areas for biodiversity conservation. However, the recent National Terrestrial Conservation Assessment for PNG (2010), reveal that only 4% of the country's terrestrial area is protected in 53 Protected Areas (Lipsett-Moore et al., 2010). There are also a number of small marine conservation areas scattered across PNG. However they cover less than 5% of the near-shore marine habitats with varying degrees of success. The broad categories of managed areas from the national perspective and the area of each type are presented in Table 1 below.

Table 1: Nationally Registered Managed Areas in PNG

Protected Area Type	Count	Hectares	%
Wildlife Management Area (WMA)	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%

Source: PNG DEC

Nationally the 53 managed areas encompass approximately 4% of PNG's terrestrial area (Lipsett-Moore et al., 2010) (see Figure 1). Since Independence in 1975 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 the YUS

Conservation Area). Given that 97% of the land in PNG is under customary ownership, it is appropriate that protected areas are inclusive rather than exclusive of people.

Figure 1: Nationally recognized managed areas in PNG

A review for the World Bank/WWF Alliance for Forest Conservation and Sustainable Use showed that 73% of PNG's Protected Areas have minimal or no management structure, 16% had no management at all, 8% had a management structure but there were serious gaps and only 3% were well managed with good infrastructure (IUCN, 1999:26). The lack of effective management of existing protected areas was reiterated in the more recent PNG Rapid Assessment and Prioritization of Protected Areas Management Report (RAPPAM) (Chatterton et al. 2009). In a recent study by Shearman et. al. (2008) in 32 protected areas in PNG (excluding Crater Mountain and Hunstein WMA), 25% of their forests were cleared or degraded during the period from 1972 - 2002 (Shearman et al. 2008). This again demonstrates the lack of effective management, protection or conservation within existing protected areas.

2.5.National Policy and Legislative Framework for Conservation

Knowing the threats are indeed real, Madang Provincial aims to embrace the the fourth goal of the country's National Constitution which calls for the use and conservation of natural resources for the collective benefit of all, and for these resources to be replenished for the benefit of future generations. Based on that goal, PNG has developed legislation and action plans at the national level. In doing so, PNG has also partnered with the global community through the ratification of various multi-lateral environmental agreements.

There are several policy and legislative frameworks in place for the conservation and sustainable utilization of the country's terrestrial and marine ecosystems, including those that address climate change. Responsibilities for these have been allocated to various government agencies including the Department of Environment and Conservation (DEC), PNG Forest Authority (PNGFA), National Fisheries Authority (NFA), and the Office of Climate Change and Development (OCCD). Table 2 presents the names of key government agencies, their legislative responsibility and policy objectives.

Table 2: International Obligations & Legislative Responsibilities of key Government Agencies

Name of Organization	International Obligations	Policy/Legislation	Objective
PNG Forest Authority	PNG is member of ITTO	1991 National Forest Policy 1991 National Forestry Act and Amendment Act 1993, 1996, 2000, 2005, 2007 and 2010 National Forestry Development Guidelines 2009 2010 Forestry and Climate Change Development framework	Sustainable management of the forest resources as a national renewable asset for the benefit of current and future generations.
National Fisheries Authority	Torres Strait Treaty 1985 Bilateral & multilateral Access Treaties	National Fisheries Management Policy National Fisheries Management Act 1998 Torres Straight Protection Zone Act 1986	Sustainable management of fisheries and marine resources but focusing on commercial fisheries.

Name of Organization	International Obligations	Policy/Legislation	Objective
Department of Environment and Conservation	2010 CBD Nagoya Aichi targets (17% terrestrial and 10% Marine) PNG is a signatory to about 14 different international convention including: Convention on Biological Diversity, 1993, Convention to Combat Desertification 2000, Convention for Protection of World Cultural and Natural Heritage, Party to the Coral Triangle Initiative, Convention on International Trade in endangered Species of wild fauna and Flora (CITES, 1973)	Draft Protected Area Policy 2013, Proposed Conservation Protection Authority Bill. Environmental Act 2000, National Parks Act 1984 Conservation Areas Act (1978) Fauna (Protection and Control) Act 1966 International (Fauna and Flora) Act (1978) Crocodile Trade (Protection) Act 1978	DEC was established in 1985 and vested with powers to protect the environmental value of air, water, soil, and biodiversity and sustainable natural resources as mandated by Goal 4 of the National Constitution.
Office of Climate Change and Development	Kyoto Protocol 1997 but ratified in 2002, Emission reduction pledge made under the Copenhagen Accord Coalition of Rainforest Nations	NEC Policy Decision No. 126/2009 Climate Compatible Development Policy 2013-2015	OCCD is responsible for climate change mitigation and adaptation measures

2.6.Draft National Criteria for a CARR Protected Area System in PNG

Under Goal 4 of the PNG Constitution, DEC has the mandate to conserve natural resources and the environment for the collective benefit of all, and for the benefit of future generations. A key conservation strategy is to ensure an effective balance between the protection of a representative sample of biodiversity and effective management of the remaining landscape. In order to fulfill its mandate and assist in conserving a representative sample of PNG's natural resources (referred to as protected areas), DEC requires clear criteria for guiding the establishment of protected areas. The following criteria represent a starting point for the development of a National set of criteria for the establishment of a protected areas system in PNG and in Madang Province. These are based broadly

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

The development of a National Protected Area System for PNG should embrace the principles of Comprehensiveness, Adequacy, Representativeness and Resilience (CARR), where:

- **Comprehensiveness** - includes the full range of communities recognized by an agreed national classification at appropriate hierarchical level.

The principle of comprehensiveness requires that the protected area system samples the full range of biodiversity including: ecosystems, species and genetic variation. Our knowledge of PNG's or Madang's biodiversity is patchy. In order to effectively sample biodiversity, surrogates of biodiversity such as different vegetation types or environmental domains are often used. Some species have distributions that are not readily predicted by either forest types or environmental domains. These species require special consideration.

- **Adequacy** - the maintenance of ecological viability and integrity of populations, species and communities.

The principle of adequacy addresses the difficult issue of "how much" and in what spatial configuration. Specifically, the principle seeks to achieve levels of protection that will ensure that species remain viable in the long term. This is a particularly difficult and contentious when considering space demanding species such as Cassowaries or larger predators. The protected area system should be of suitable size, number and configuration to ensure that those elements of biodiversity dependent on protected areas will persist in the long term.

Replication across the geographic, environmental and biotic range also improves the adequacy of protected area systems. Replication spreads the risk of the failure of any one protected area in maintaining species or community viability in the event of unforeseen catastrophic events such as forest fire, drought or tsunamis, all of which occur in PNG.

- **Representativeness** - those sample areas that are selected for inclusion in reserves should reasonably reflect the biotic diversity of the communities.

Representativeness relates to diversity within communities or vegetation types. Again our knowledge of biodiversity in Madang is incomplete. In order to ensure that we have effectively sampled the full range of biodiversity, different vegetation types need to be sampled across their environmental and geographic range.

- **Resilience** - The areas sampled consider the impacts of climate change and allow natural ecosystems to adapt to climate change (UNFCCC – Article 2)

Although many forests and terrestrial ecosystems have proved resilient to past changes in climate, today's fragmented and degraded forests and ecosystems are more vulnerable. Adaptation of species to climate change can occur through phenotypic plasticity, evolution, or migration to

suitable sites, with the latter probably the most common response in the past. Among the land-use and management practices likely to maintain forest biodiversity and ecological functions during climate change are: (1) representing forest types across environmental gradients in reserves; (2) protecting climatic refugia at multiple scales; (3) protecting primary forests; (4) avoiding fragmentation and providing connectivity, especially parallel to climatic gradients; (5) providing buffer zones for adjustment of reserve boundaries; (6) practicing low-intensity forestry and preventing conversion of natural forests to plantations; (7) maintaining natural fire regimes; (8) maintaining diverse gene pools; and (9) identifying and protecting functional groups and keystone species. Good forest management in a time of rapidly changing climate differs little from good forest management under more static conditions, but there is increased emphasis on protecting climatic refugia and providing connectivity (Noss 2001).

The existing national protected area system, including Madang's protected areas, does not comply with the principles described above. The current system is not based on the efficient representation of samples of biodiversity but rather has been developed through the opportunistic protection of areas where land holders were supportive. Although past assessments were available to inform choices regarding areas to protect, the actual choices were largely based on expert opinion, rather than an analysis of the representation of biodiversity across PNG (Alcorn 1993, Beehler 1993). Some of the areas selected for WMA's such as the Hunstein, Tonda and Kikori WMA's, reflect an informed choice based on expert opinion.

With the ongoing degradation of forests as described in section 2.3 above, there is an immediate need to establish and effectively manage a system of protected areas in PNG and Madang Province that complies with the criteria described in this section.

3. Madang Province

3.1. People and Culture

Madang Province is a relatively large region, approximately 300 km east to west and 160 km north to south, with four large offshore islands and many smaller offshore islands. The province area is about 29,000 square km and has a population of 487,460 (PNG National Statistical Office, 2011). Culturally and linguistically, the Province is one of the most diverse in the country, with 175 languages spoken within the Province. Population densities are highest on the off-shore island of Karkar (up to 110 people/km^2) but approximately half of the Province is unoccupied due to very remote and inaccessible areas particularly in the west, such as the Simbai Local Level Government (LLG) in the Bismarck Ranges. The diverse geographical nature of Madang province is reflected in the make-up of its people who can, by virtue of lifestyle be broken into four distinct groups - islanders, coastal people, river people and highland mountain people.

Figure 2: The Districts of Madang Province

3.2. Economy

The Province is also highly diverse economically. The districts of Middle Ramu and Usino-Bundi are ranked within the top three of PNG's most disadvantaged districts while Sumkar District is one of PNG's most advantaged districts (Hanson et al 2001). The economic opportunities that are emerging within the districts are leading to important migration trends with in-migration in the Aiome area and coastal plains from Cape Gourdon to Madang and out-migration occurring around the Simbai area and the upper Ramu Valley around Bundi, Brahman and Walium.

Subsistence agriculture is still the dominant livelihood activity for majority of the Province's rural communities. Food crops and betel nut provide important cash income for those close to markets, with vanilla and coffee production increasingly important as cash crops. Several wage earning opportunities are available in the town of Madang, which is one of PNG's major tourist centres. Direct paid employment is also available at the Ramu Sugar estate, the Ramu nickel mine, the Coconut Oil Production Madang Ltd, the Jant/Gogol woodchip factory, and in other forestry operations as well as the expanding palm oil estates being established in the lower reaches of the Ramu Valley.

Revenue generated from commercial logging has been one of the major commercial industries in the province. The forests of Madang have traditionally provided a source of export revenue to local communities, contractors, timber processors and international traders. The forested portion of Madang Province is estimated at 86% or 2.1 million hectares, with the broad forest types shown in Table 3.

Table 3: Forest and Land Types within Madang Province

Forest/Land Type	Area (hectares)
Forest	2,110,904
Grassland	136,815
Woodland	16,239
Swampland	208,912
Mangrove	843
Water	23,731
Urban	2,095
TOTAL	2,889,983

Source: Areas calculated from FIMS

While there is considerable debate in PNG regarding the rates and drivers of deforestation, the commonly quoted drivers include traditional subsistence activities, unsustainable logging, commercial agriculture, mining and infrastructure and fire, all present in Madang. While trying to reach agreement on the relative rates of deforestation across PNG and within Madang has been difficult, the LEAF project has estimated that between 2000 and 2005, 3,845 hectares of Madang's forests were cleared per year, emitting approximately 2.4 million tonnes of carbon dioxide per year (Petrova et al., 2012). There are 384,980 hectares of forest under current timber concessions that are potentially contributing to carbon dioxide emissions (PNG Forest Authority, 2011).

3.3.Biodiversity

Madang Province is incredibly diverse in terms of its geography and its biological diversity. Geographically the Province's environments range from the alpine meadows on top of Mt Wilhelm, to the extensive flood plain of the Ramu River, through to the dry seasonal hills inland of Bogia, onto the coastal limestone plains and finally the volcanic offshore islands. The active volcanoes on Manam, Karkar and Long islands continue to present imminent dangers to the local populations living on these islands.

Surveys and reports compiled by TNC identify 973 plant species and the province is home to tree kangaroos, giant bandicoots, alpine wallabies and Bougainville monkey-faced flying foxes. The province's iconic fire-maned bowerbird — the country's rarest bird — is found only in the lower-lying forests of the Adelbert Mountains. As an example of the rich biodiversity, within the Almami LLG, The Nature Conservancy has identified 57 mammal species, 336 bird species, 423 butterfly species and 103 reptiles and amphibian species. The biological diversity is internationally significant, but also culturally and economically important for the people of Madang. These include:

- Plants with food value – 22 species.
- Medicinal or psychoactive plants – 14 species.
- Plants for construction or implements – 22 species.
- Plants for ceremonial, ritual or spiritual purposes – 14 species.
- Plants with special value for wildlife – 28 species.
- Plants to improve the hunting performance of dogs – 5 species.
- Plants with other cultural applications – 21 species.

3.4. Threats

As people are increasingly drawn in to participate in the modern cash economy to meet daily requirements coupled with the need to create employment and improve public services, the Madang people and their political leaders are looking at the exploitation of natural resources to meet their development aspirations. This presents a challenge for development planners and leaders if they are to achieve a balanced approach that places equal emphasis on economic, ecological and social development. There are many ongoing development projects as well as new ones scheduled to be operational soon within the Province; these are briefly highlighted in the following paragraphs.

The Ramu Nickel - Cobalt mine is located south of Ramu River at Kurumbukari in the Usino-Bundi District, in the foothills of the Bismarck Range approximately 75km south west of the provincial capital of Madang. The mine is accessing a lateritic nickel-cobalt deposit containing an estimated 143 million tonnes of nickel-cobalt. Currently the annual output is 31,000 tonnes of nickel and 3,300 tonnes of cobalt. This output can be sustained for more than 20 years. The mine exports high value mixed hydroxide intermediate products that can be refined later to produce saleable nickel and cobalt products. The ore slurry is pumped through a 134 km pipeline to a high pressure acid leach processing facility at Basamuk Bay on the Rai coast. The residue from the processing plant is then discharged through a pipe outlet at 150m depth below sea level (PNG Chamber of Mines and Petroleum, 2009).

The other major mine in Madang Province is also located in Usino-Bundi District. Under development by Marengo Mining, the Yandera Copper-Molybdenum mine is on track to begin production in the next couple of years. A feasibility study is near completion that describes a large-scale open pit mining operation, with an initial life of 20 years, processing 25 million tonnes per annum (mtpa) with capacity to increase to a long term output of 50 mtpa (Resources PNG, 2010). The disposal of the mine's waste is still under consideration by the Madang Provincial government which prefers a land based disposal system from the Yandera mine and not deep sea tailings like the Ramu Nickel and Cobalt mine (PNG Mine Watch, 30th of October 2013).

The Ramu Agro project in the eastern end of the Ramu valley, has established 4,500 hectares of palm oil plantation. Although this project is not expected to result in substantive deforestation, there are other commercial logging operations that are resulting in deforestation and degradation of the tropical lowland rainforest from the 384,980 hectares of allocated timber concessions in the Madang province (PNG Forest Authority, 2011).

The ongoing volcanic activity on Manam Island displaced more than 20,000 people in 2004/2005 forcing them to move to the mainland. There is a plan to relocate these people permanently to Andarum, in Bogia District. It is estimated that 60 hectares will be required for the resettlement scheme (Obunghai, 2010) and proper land use planning is necessary to minimize environmental damage and conflicts amongst the local communities.

The current RD Tuna Cannery and the proposed Pacific Marine Industrial Zone pose a significant threat to the ecological integrity of Madang Lagoon and the communities living nearby. A recent study described the Madang Lagoon as an "idyllic tropical lagoon" (Thomas, 2013) that was highly resilient with "animals found in the lagoon as special and unusual". But with the many

environmental threats from land based activities such as the tuna cannery and tailings from the Ramu Nickel and Yandera Copper mine, there are considerable challenges to maintain this pristine and plentiful lagoon and the livelihoods that depend on it.

3.5. Sustainable Natural Resource Management and Development Challenges

The sheer diversity of the Madang Province makes land use planning and natural resource management a challenging task. Development and economic growth is inevitable but finding the right balance to minimize negative impacts on community livelihoods and biodiversity remains to be addressed. Appropriate natural resources data and well established investment policy guidelines are a prerequisite for planning and management.

The National Government has identified Madang Province as one of ten priority provinces for integrated rural development. According to the PNG Development Strategic Plan 2010-2030, Madang Province falls within three economic corridors; Madang-Baiyer-Karamui-Gulf corridor, the Morobe-Madang and Momase corridor (focusing on Madang) and the East Sepik and West Sepik corridor (GoPNG, 2009). The economic corridor concept is intended to bring major infrastructure development projects to the Province that will have a positive multiplier effect on the provincial economy that includes improved access to education, improved health facilities, provision of safe and clean water, and improvement in market access.

3.5.1. Forest Planning and Conservation Areas

The terrestrial and marine conservation areas of Madang Province have not been clearly identified and documented. There are only six terrestrial conservation and wildlife management areas that are officially identified and listed as per the Madang Provincial Forest Plan 2008-2013 (PNG, 2008). The list is reproduced as per Table 4 below.

Table 4: Existing Terrestrial Protected Areas

Name of Area	Area (Ha)	Reason for Protection
Bigai	13,760	WMA (Marine/Terrestrial)
Balek	470	Wildlife Sanctuary
Crown Island	58,969	Wildlife sanctuary
Ranba	15,724	Terrestrial Fauna Sanctuary
Ranba	41,922	Marine/Terrestrial Sanctuary
Adelberts Range	17,999	Local land use management planning with a range of designated use zones

Source: Madang Provincial Forest Plan, 2008-2013

In addition to the above list, the National Forest Plan for 2006 identified Manam Island, Ramu Wetlands, Schrader Range, Long island, Bismarck Range and Finnisterre Range as proposed conservation areas for the Province. During the consultative workshops for this report a number of additional existing and proposed conservation areas and other areas of high biodiversity significance were also identified (see Annex 2) suggesting the list presented in Table 4 needs to be significantly updated.

3.5.2. Reducing Emissions from Deforestation and Degradation (REDD+)

As outlined in the sections above, climate change presents a number of challenges for the sustainable protection and management of Madang's natural resources. Section 8.7 of the Madang Provincial Forest Plan makes a general statement on climate change, the carbon trade and REDD+. However, it does not specify any climate change mitigation or adaptation strategies. Although Madang province has not been identified by the National Government (PNGFA, OCCD) as a REDD+ pilot site, the Madang provincial government has made a policy announcement to undertake climate change and REDD+ activities and continues to liaise with the National Government, particularly OCCD and PNGFA and other stakeholders on developing a climate change strategy for the province. This is very much in line with the Vision 2050, whereby the National government has made a commitment to reduce greenhouse gas emissions by 90% to a 1990 level (PNG Government 2009).

In order to address climate change mitigation and adaptation, the Madang Provincial Government has embraced the combined efforts of TNC and LEAF to provide technical assistance on REDD+ activities and low carbon development pathways for nine communities of the Almami LLG that have signed conservation agreements. LEAF and TNC will work with these communities to ascertain the positive changes in forest carbon stocks from improved land management practices and the conservation efforts of these communities. It is expected that this work will be scaled-up across the Almami LLG and possibly Bogia District. Already a number of meetings and training events with civil society organisations from Madang and Bogia district have been completed in preparation for this work. The lessons learned, capacity built and guidelines developed from the work with the communities of the Almami LLG will allow for the replication of similar systems across Madang Province.

The work at the community level will however come too little, if a similar parallel effort to build knowledge and capacity on REDD+ and low carbon development pathways for the Province of Madang is not supported. The assessment of conservation gaps and priorities for Madang Province is an excellent start to understand development pressures and the impact on resource management but further technical knowledge is required for Madang Province to make informed decisions on REDD+ and how it would like to interact with emerging national and international systems.

LEAF and The Nature Conservancy can, if requested by the Province of Madang, support processes to: document and quantify historical land use change patterns and examine implications for future development scenarios; build capacity to measure forest biomass and carbon stocks allowing emissions from historical and future land use transitions to be calculated; provide guidance and support on developing a 'first-order' provincial reference level from which future mitigation outcomes can be measured against; explore with Provincial authorities how community led efforts (such as those in the Adelbert Ranges) can be linked into a Provincial, and ultimately a national REDD+ system; and how REDD+ activities can be incorporated into the Madang Provincial Forest Plan.

Already some positive lessons from the current collaboration between The Nature Conservancy, LEAF and Madang Provincial authorities are emerging. The spatial planning process completed illustrates the absolute necessity for a solid, participatory and bottom-up approach to planning for REDD+, but this can be enhanced by targeted, expert-led inputs. The participatory land use planning

work started by The Nature Conservancy starts this process, but the emission reduction potential of this work could be further expanded by adding value to the Fair Trade cocoa agreement with Adleberts Cooperative Society. The outcomes of this work are important for supporting other rural cooperatives throughout Madang Province.

The Madang Provincial Forest Plan states that REDD+ is a new concept and therefore a much greater understanding, by a wide range of stakeholders, is required before a thorough assessment of the risks and potential benefits from REDD+ can be made. Managing expectations will be an on-going task as will the need to build awareness and strengthen capacity and at the local, LLG, district and provincial level. As the capacity and knowledge of civil society organisations, community based organisations, and all level of government grows, they will have an important role in continuing to communicate with rural communities and the private sector how REDD+ may play a role in economic development, the sustainability and wise use of natural resources, social and cultural progress and a lower emission profile for Madang Province.

3.5.3. Marine Conservation Areas

The coastal and the marine resources, especially coral reefs, are impacted by destructive harvesting practices, sedimentation coming from land based development projects and impacts of climate change. The coastal and the marine resources that provide basic needs for the coastal regions need to be managed wisely, including active conservation of threatened and priority areas. There are several ongoing national and international programs that aim at conservation and sustainable utilization of these resources at the Madang Provincial level.

Madang Province's coastal and marine areas fall under two globally significant programs; the Bismarck Solomon Seas Ecoregion covering Western Pacific (PNG, Solomon Islands and Papua Province of Indonesia), and secondly, the Coral Triangle Initiative that aims to address threats to marine, coastal and small island ecosystems within the Coral Triangle region (PNG, Indonesia, Philippines, Malaysia, Timor Leste, and the Solomon Islands). There are ongoing project initiatives undertaken in the province that relate to capacity building, conservation area surveys and conservation area establishment that aim at furthering the objectives of these two respective programs whilst at the same time furthering the development objectives of the province. These programs are undertaken with financial and technical assistance from bi-lateral and multi-lateral organizations and other interested stakeholders such as conservation NGOs.

Madang Province recently played a host role in convening the first PNG Maritime Provincial Governors Roundtable meeting in Madang on the 6th and 7th of November 2013, held under the Coral Triangle Initiative. The meeting was attended by seven Provincial Governors who agreed to work collaboratively with the national government and other development partners in the planning and implementation of coastal and marine resource conservation and climate change programs under the auspices of the PNG Coral Reefs, Fisheries and Food Security program, 2014-2017. This political commitment at the Provincial level was concluded with the joint execution of the Madang Declaration in PNG on 6th November 2013 by the governors (Hon. Jim Kas, Madang; Hon. Gary Jufa, Oro; Hon. Amkat Mai, Sandaun; Hon. Titus Philemon, Milne Bay; Hon. Kila Haoda, Central and Hon. Joe Lera, Autonomous Region of Bougainville). The declaration is attached to this report as Annex 5.

This provides an opportunity for annual dialogue, review and development of localised marine conservation, and climate change initiatives.

Figure 3: Maritime provincial Governors

4. Participatory Bottom-Up Planning Approach

The goal of the planning process was to provide the Madang Provincial Government, Districts, LLGs, and communities with a spatially based land use plan to help guide and balance future economic development with the conservation and natural resource needs of all stakeholders in a sustainable and equitable way. It is envisioned that the outcomes of the plan will be incorporated into the Madang Provincial Development Planning process and used to revise the Kalibobo Vision 2020 and Madang Medium Term Development plans.

The bottom-up participatory process gives equal opportunity to all stakeholders to contribute in terms of discussion, data collection, identification of conservation areas, high biodiversity areas, government development priorities and culturally significant areas. This process follows three core principles:

1. Inclusiveness and partnership;
2. Transparency; and
3. Provincial and Community Ownership

These three principals were consistently applied throughout the development of the gap and priority analysis. As the project is a joint initiative, it places the onus on all stakeholders to commit resources towards implementation of the findings and recommendations.

4.1. Stakeholder Partnerships

The Government has recognized the important role of the civil society sector in terms of improved service delivery to rural areas and economic growth. It has also recognized civil society as a key partner in development and its important role is recognized under pillar six of PNG Vision 2050 relating to Spiritual, Cultural and Community Development.

The Governor of Madang province, Honorable Jim Kas, initiated the planning exercise by dedicating funds to support the project. This is the first time in the history of the province that financial assistance was dedicated to support a provincial wide planning exercise with a multi-level group of stakeholders. This was formalized through a memorandum of understanding (MOU) that was executed on the 27th May 2013 (see Figure 4 and Annex 4). In addition to supporting this project, the MOU provides a framework for future collaboration to implement the findings and recommendations of this report.

Figure 4: Governor Jim Kas and TNC Country Program Director Francis Hurahura after signing the MOU

4.2. Workshops

A series to workshops were held throughout the Province to engage with stakeholders, inform communities of the project, and to gather locally important features to include in the analysis. The workshop schedule is presented in Table 5:

Table 5: Workshop schedule

Workshop	Date	Location	Description
1	28-30 May, 2013	Jais Aben Resort, Madang	Inception workshop
2	20-22 August, 2013	Bogia Catholic Parish, Bogia	District Level Workshop for Bogia, Sumkar and Madang Districts
3	3-5 September, 2013	Brahman Catholic Parish/High School	District Level Workshop for Usino-Bundi, Rai Coast and Middle Ramu Districts
4	13-14 November, 2013	Jais Aben Resort, Madang	Review and presentation of draft outcomes

The agenda for each of the workshops consisted of introducing the program of work undertaken by parties to the MOU and the objectives of the workshop. Presentations were given covering climate change, reducing emissions from deforestation and degradation (REDD+) and natural resource management. A key activity at each workshop was to give participants maps of each LLG so that they could learn about what information would be included in the study and importantly so that they could add locally important features.

4.2.1. Summary of Workshop 1

The first workshop focused on bringing together officials from Madang Provincial Government and Administration, District leadership, civil society organization officers, and other key stakeholders (i.e. National Government and industry representatives). The goal of the workshop was to brief these representatives on the objectives of the project, to give them an overview of important threats and

opportunities that would be addressed, and to encourage open communication. The MOU described above was signed at this workshop.

Figure 5: Participants at Workshop 1

The following points provide a brief overview of the presentations and discussions:

- Madang Provincial Administration gave a presentation regarding the development of Kalibobo Vision 2020, its alignment to PNG Vision 2050 and the PNG Development Strategic Plan 2010-2030. It was noted that Kalibobo Vision 2020 was only a policy guideline for the development of the medium term development plans that was undergoing refinement.
- DEC gave a presentation reviewing their current initiatives within the department including: a review of current biodiversity conservation based legislation and acts, an overview of the National Biodiversity Strategy & Action Plan (NBSAP), and a review of the status of current declared and gazetted protected areas in the country.
- OCCD gave a presentation on their climate compatible development strategy which includes REDD+, Measuring, Reporting and Verification (MRV), adaptation, mitigation and national communication. They also highlighted their collaborative work with PNGFA and engagement with REDD+ initiatives.
- The LEAF program gave a presentation on the impacts of climate change to the environment and possible mitigation actions under REDD+. They also outlined their working collaborations with stakeholders at different levels including policy development at national level, capacity building at Provincial level and threat assessment and carbon monitoring at the community level.
- Partners with Melanesia gave an overview of the Participatory 3-Dimensional Modelling (P3DM) tool and their plans to facilitate the development of a model working with communities from Almami LLG, Bogia District. This activity was scheduled to coincide with Workshop 2 as part of the larger project.
- Madang Civil Society Organization provided an update on work in the province that included health education and natural resource management.
- Ramu Nico Company, the primary mining company in the province, gave a presentation on the history of the mine, its mining operations and products, as well as their community development partnerships.

- The Nature Conservancy gave a presentation and provided an overview on the spatial planning and gap analysis process to inform stakeholders on the expected outcomes of the project. Examples of spatial planning conducted by TNC with partners at a National level (Terrestrial Gap Analysis for PNG's Program of Work on Protected Areas), sub national level (Bismarck Sustainable Development Planning) and also within the region (Ridges to Reef Conservation Plan for Isabel Province, Solomon Islands) were shown. The specific of use of GIS and Marxan conservation software was also explained and highlighted as an integral part of the analysis and planning processes.

4.2.2. Summary of Workshop 2 and 3

The second and third workshops had the common objective to meet with local communities and District and LLG representatives at workshops held in regional centers. Workshop 2 was held in Bogia to reach the northern Districts and Workshop 3 was held in Brahman to reach the southern and eastern Districts (see Table 5). At both workshops presentations on climate change and REDD+, development activities, and overall project objectives were given to raise awareness on these issues and opportunities.

In addition to raising awareness on these topics, the primary activity was to conduct a participatory mapping exercise with workshop participants. For this exercise participants were given provincial, district and LLG level maps illustrating land cover, coral reefs, logging areas, mining sites, and existing managed areas. After familiarizing themselves with the maps (at a scale of 1:115,000) participants then worked in geographical groups to develop a list of additional features that should be included on the maps. These features included major development activities (both existing and proposed) including logging, palm oil, mining, key wildlife habitat areas, managed areas, unique natural features (i.e. caves, waterfalls and lakes), schools, aid posts, churches, roads and bridges. Participants in Bogia listed 90 features, with participants in Brahman adding 35 more features, for a total list of 135 different local features (see Annex 2). The local features were number coded and formed the legend for the mapping exercise.

The participants then commenced plotting their locally important features. Using pencils and the list of features, participants marked the features as either *points* (i.e. mine sites), *lines* (i.e. proposed roads) or *polygons* (i.e. forest type). Participants were given two to three hours on the first day and an additional two hours the next day. The exercise was concluded by having each group come forward and present the major features they mapped as well as providing comments on the exercise.

Figure 6: Participatory mapping at Bogia

Figure 7: Participatory mapping at Brahman

Figure 8: Mapping report in Brahman

The information gathered was then incorporated into a GIS to create a dataset which would, along with other key datasets, form a basis for conducting a gap analysis (to identify missing, invalidated and/or out of date data) and a priority setting analysis (identifying areas for sustainable management) for Madang Province.

Highlights from Workshop 2

- Official opening by Mr John Nobi (District Administrator for Bogia District)
- Coinciding with Workshop 2 in Bogia, stakeholders working with Partners with Melanesians completed a P3DM for Alami District. Representatives from each of the 37 Wards in Almami LLG contributed their knowledge to the P3DM by marking and painting locally important features onto the model (see Figure 9).
- At the closing ceremony for Workshop 2 the P3DM for Almami LLG was officially handed over by TNC and Partners with Melanesians to the Governor of Madang for use in natural resource management and future planning purposes. This occasion was witnessed by the Honorable Benjamin Poponawa member for Tambul Nebilya and chairman for Constitutional Law Reform Commission.

Figure 9: Launch of the P3DM for Almami LLG on 22 August, 2013

Highlights from Workshop 3

- Official opening of the workshop by Mr Robert Howisa, Acting District administrator for Usino Bundi district.
- Considerable time was spent on the discussions on the likely impact by the non-renewable resource sector especially, Ramu Nickel and Yandera mine and the actions that needed to be undertaken to minimize detrimental impacts on the environment and its people.
- A clan group from Brahman gave a presentation on a REDD+ pilot program in their community that is supported by Foundation for People Community Development and the Institute of Global Environmental Strategies, especially in relation to site level land use planning, biomass measurement and carbon assessment.

4.2.3. Summary of Workshop 4

Workshop 4 focused on gathering Provincial government representatives as well as key participants from the other workshops. The objective of this final workshop was to report back to Provincial representatives on the outcomes of the workshops, to present the initial results from the spatial analysis and to discuss options for implementing the recommendations.

TNC presented the gap analysis and illustrated initial results from the priority analysis. The key data layers used in the study were also presented. These materials were presented to ensure the Provincial representatives and other stakeholders were familiar with the inputs, methods, and output products.

Figure 10: Participants of Workshop 4

Highlights from Workshop 4

The fourth workshop was officiated by Acting Provincial Administrator, Mr Galun Kassas and the deputy Governor, Mr Rama Marisan. In the opening speech given by Mr. Kassas he reinforced the need to align Kalibobo Vision 2020 to PNG Vision 2050 and other national development strategies. He emphasized the need to prioritize the protection and conservation of natural resources in the context of provincial planning. He also acknowledged that the Kalibobo Vision 2020 was still in a draft status that required finalization with technical data from all stakeholders. As such he said the Madang gap and priority analysis would provide vital information in refining the natural resource management component, including conservation and climate change issues.

In order to facilitate discussion, participants were divided into three groups: (1) Madang provincial administration, (2) northern (Bogia, Sumkar, Madang) and (3) southern districts (Usino Bundi, Middle Ramu and Rai Coast). Discussion was focused on the following three questions:

1. What is the potential for implementing the outcomes and recommendations of the Madang gap and priority assessment?
2. What are the key policy, institutional and other enabling issues that need to be addressed for the outcomes and recommendations for the Madang gap and priority assessment to be implemented?
3. What actions needed to be taken to commence the process of implementing the outcomes and recommendations for the Madang gap and priority assessment?

Following the group discussions each group gave a presentation on the issues discussed and their recommendations:

- The provincial administration admitted that conservation and environmental protection aspects were not adequately addressed in previous provincial plans. Therefore the discussions and work undertaken through the gap and priority analysis exercise provided a

good opportunity to incorporate these issues into the provincial development plans and for actual responsibilities to be housed within the provincial forestry division.

- Develop and institutionalize provincial policy and legislation on environment and conservation that would facilitate the establishment of a conservation and environment office at the provincial level.
- Build capacity at the provincial level for planning and resource management including GIS and database management and focused research on socio-economic and biodiversity issues.
- Develop research protocols and an information repository within the Province. This should be done in consultation with the national government, including the National Research Institute to facilitate data and benefit sharing.
- Continue to increase awareness on threats to Madang's natural resources and opportunities through such mechanisms as payment for ecosystem services and REDD+.
- Conduct a comprehensive review on the effectiveness of the existing management areas (i.e. conservation areas, WMA, National Parks).
- Utilise Public and Private Partnership Policy to address technical, research and financial support to implement outcomes and recommendations of the gap and priority assessment.

The agreed way forward from the final workshop was to complete a finalized draft for review by the Madang Provincial Administration by the end of November 2013 and to launch the report in February 2014.

5. Gap Analysis and Priority Analysis

Two key objectives of this project were to complete a "gap analysis" to assess limitations of the Province's current conservation management system and then to build on this with a "priority analysis". The priority analysis serves to identify potential areas for additional conservation management with consideration to existing and proposed development activities. The analysis methods and results are presented below.

5.1. Gap Analysis

A "gap analysis" is a method to identify biodiversity that is not adequately conserved within a protected area network (Scott et al., 2000). The following section addresses the gap analysis component of the project. Specifically, it includes a simple assessment of which landscape features are represented, and those not represented, in the current managed areas of Madang Province.

5.1.1. Managed Areas

Tracking and categorizing the numerous "managed areas" in PNG is a complicated endeavour. Historically and nationally the most common type of "managed areas" has been Wildlife Management Areas (WMAs). Legislation supporting WMAs is found in the Fauna (Protection and Control) Act 1966. In recent years managed areas have been established on both land and sea that allows for a range of uses and have a range of management guidelines. Examples of "managed areas" include strict "No-Take" zones within Locally Managed Marine Areas (LMMAS), "Cultural Sites" within Land Use Management Plans (LUMPs), and Conservation Areas allowing for a range of uses but with specific wildlife species in mind. Madang has a selection of WMAs, LMMAs, LUMPs, Conservation Deeds, and a portion of the YUS Conservation Area. As presented in Section 3.5.1, there are six managed areas in Madang. However, through this project and collective experience in the Province we can report that there are in fact a total of 40 managed areas in the Province in various states of establishment with a range of management guidelines.

The following maps and brief comments provide an overview of the managed areas in Madang Province. A map for each district highlights the managed areas and a table lists them with their size reported in hectares.

Within the Almami LLG (Figure 11) of Bogia District nine communities have established Land Use Management Plans (LUMPs), each of which has specific zones set aside under strict conservation rules. On the coastline of Almami LLG the Simbine Locally Managed Marine Area (LMMA) has been established and is governed by a management plan.

Count	Managed Area	Hectares
1	Avipa LUMP	987
2	Dumudum LUMP	582
3	Gurube LUMP	587
4	Itatawat LUMP	2,494
5	Iwarame LUMP	2,180
6	Musiamunat LUMP	5,572
7	Turutapa LUMP	1,870
8	Urumarav LUMP	1,056
9	Yavera LUMP	2,672
10	Simbine Coast LMMA	542
	Total	18,542

Figure 11: Existing managed areas in Bogia District

Moving into Sumkar District (Figure 12) there are five coastal areas designated under Conservation Deeds with the primary goal being to project endangered leatherback turtles and their nesting sites. In the nearby forested hills three conservation areas have been established. Offshore from the mainland, Karkar Island has the Baigai Wildlife Management Area (WMA).

Count	Managed Area	Hectares
1	Bagiai WMA	16,876
2	Karkum-Mirap Conservation Area	508
3	Kimadi Conservation Area	550
4	Magubem Conservation Area	924
5	Tokain Conservation Area	773
6	Yadigam Conservation Area	736
7	Simbukanam Conservation Area A	109
8	Simbukanam Conservation Area B	212
9	Simbukanam Conservation Area C	794
	Total	21,482

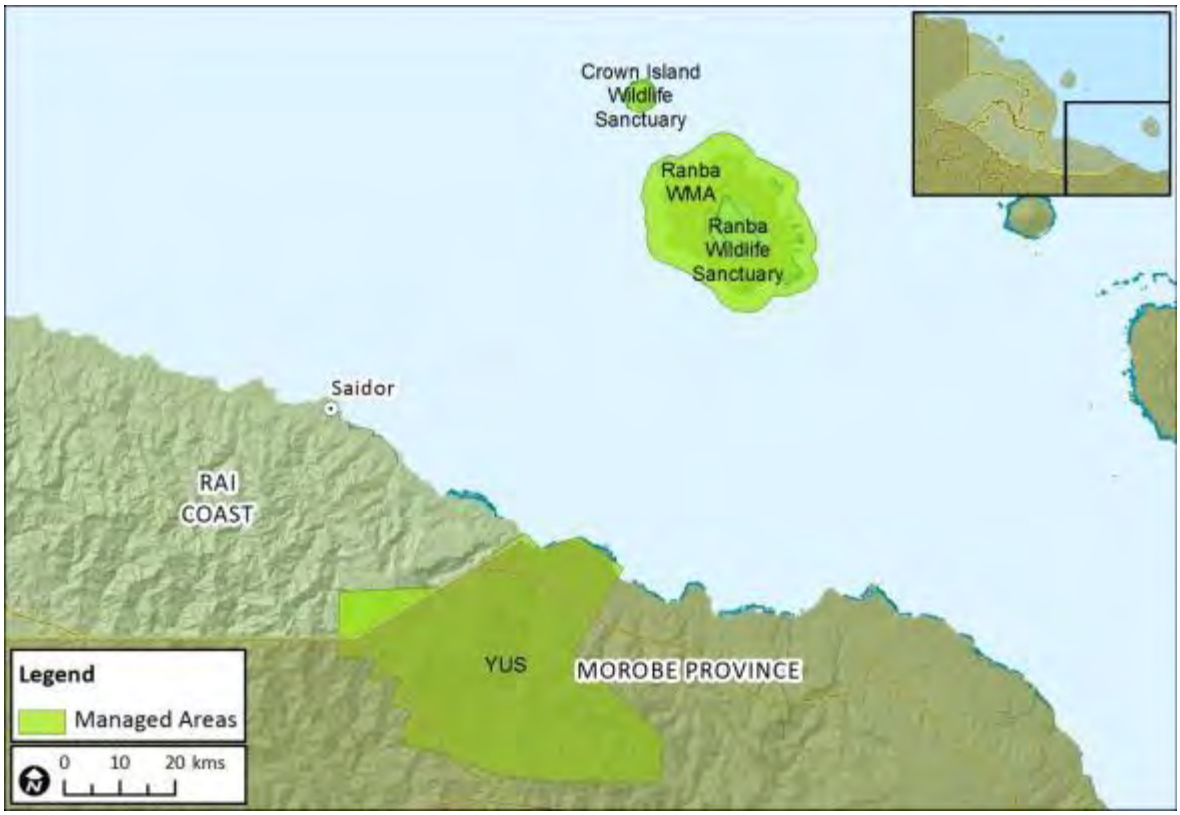
Figure 12: Existing managed areas in Sumkar District

Coming down the coast into Madang District (Figure 13) there are a number of smaller LMMAs within the Madang Lagoon. In addition there are forested areas under conservation management including Ohu Community Conservation Area, Kau Wildlife Area, Balek Wildlife Sanctuary, and the Garim WMA

Count	Managed Area	Hectares
1	Balek Wildlife Sanctuary	575
2	Doilon LMMA	144
3	Garim WMA	539
4	Idawan LMMA	18
5	Kau Wildlife Area	421
6	Laugum LMMA	87
7	Ohu Conservation Area	72
8	Tab Island Wildlife Management Area	970
9	Tabad Wildlife Management Area	17
10	unknown LMMA	35
11	Sagazig Reef LMMA	4
12	3 Liklik Island LMMA	6
13	Malpatun Natun LMMA	53
	Total	2,941

Figure 13: Existing managed areas in Madang District

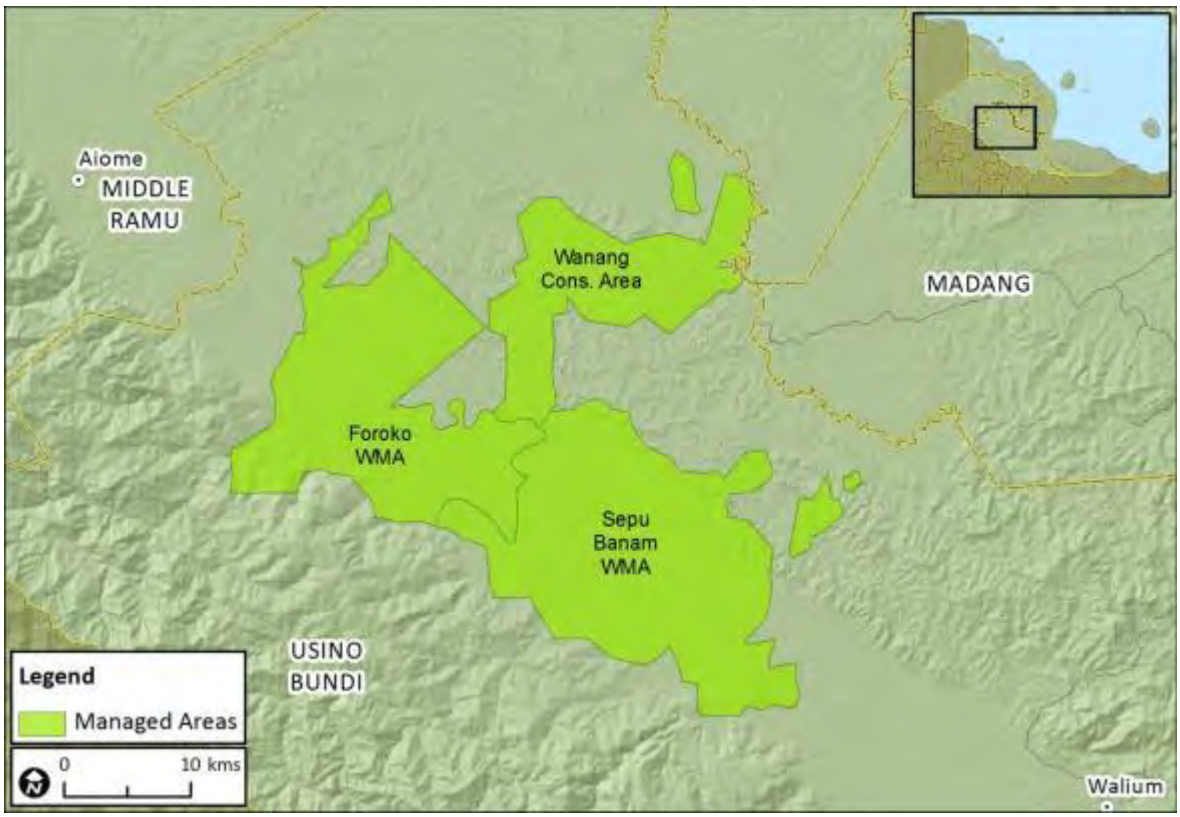
Continuing on to the east, offshore from the mainland portion of Rai Coast District (Figure 14), both Long Island and Crown Island have had long running management areas. These include the Crown Island Wildlife Sanctuary and the Ranba WMA on Long Island. To the south of Long Island and lying mostly in Morobe Province is the YUS Conservation Area. A small portion crosses into Madang Province.



Count	Managed Area	Hectares
1	Crown Island Wildlife Sanctuary	1,390
2	Ranba Wildlife Sanctuary	4,240
3	Ranba WMA	36,834
4	YUS Conservation Area (portion in Madang Province)	10,630
	Total	53,094

Figure 14: Existing managed areas in Rai Coast District

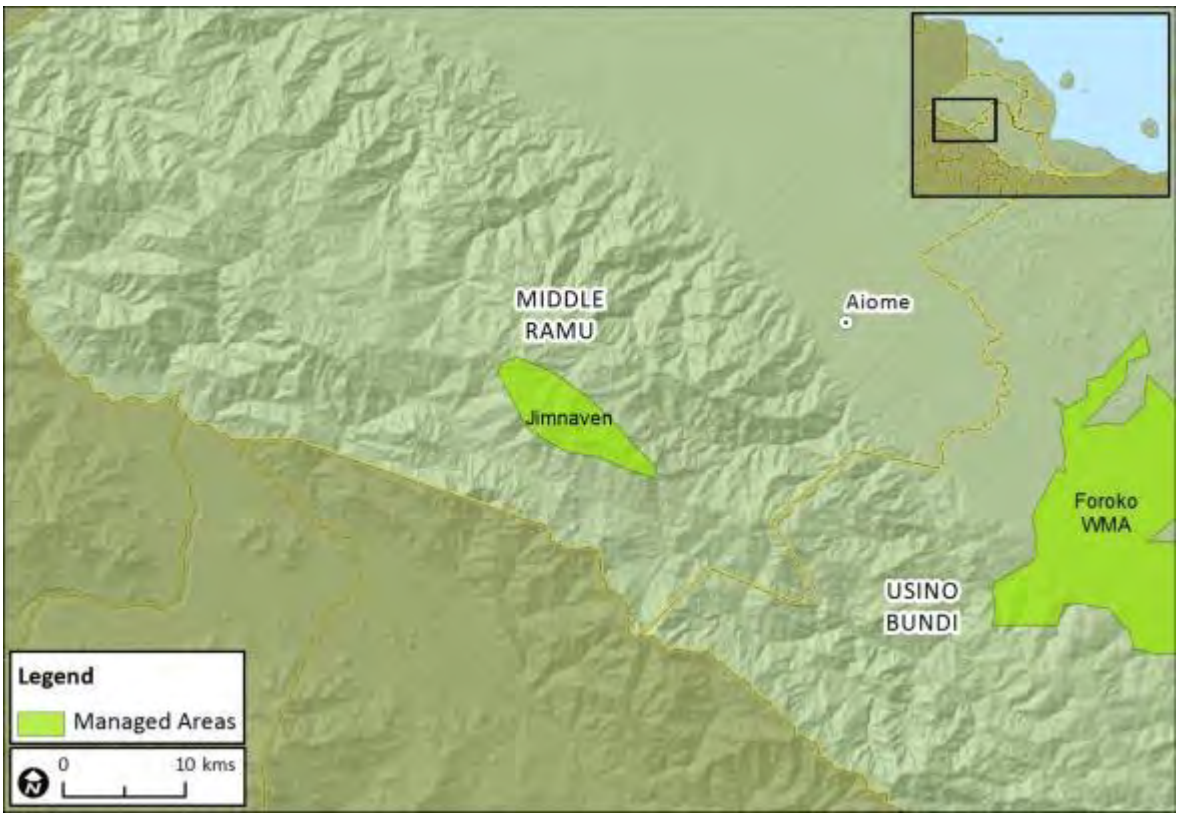
The interior bush lands of Madang Province also support a selection of conservation areas. In the Usino Bundi District this includes the Wanang Conservation Area, Foroko WMA, and Sepu Banam WMA (Figure 15).



Count	Managed Area	Hectares
1	Wanang Conservation Area	17,910
2	Foroko WMA	30,176
3	Sepu Banam WMA	38,427
	Total	86,513

Figure 15: Existing managed areas in Usino Bundi District

In the southeast corner of the Middle Ramu District (Figure 16) lies a conservation area known as Jimnaven. This area was identified by participants at workshop held in Brahman, however little is known about the management or conservation status of the area.



Count	Managed Area	Hectares
1	Jimnaven	5,109

Figure 16: Existing managed areas in Middle Ramu District

5.1.2. Vegetation types

The Forest Information Management System (FIMs) currently 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). Across all of PNG the 1:100,000 classification includes a total of 59 vegetation types including: 36 Forests, 6 Woodland, 3 Savannah, 3 Scrub, 11 Grasslands, 1 Mangrove and 4 Non Vegetation Types. Within Madang Province there are 36 types including: 19 Forests, 1 Woodland, 2 Scrub, 9 grasslands, 1 mangrove, and 4 Non Vegetation Types (Table 6 and graphically presented in Figure 17).

Table 6: Vegetation types of Madang Province

Id number	Structure	Type	Hectares
1	Forest	Large to medium crowned forest below 1000m plains and fans	14,104
2	Forest	Medium crowned forest below 1000m uplands	871,889
3	Forest	Medium crowned forest with Araucaria common below 1000m uplands	50,541
4	Forest	Medium crowned depauperate/damaged forest below 1000m uplands	422,776
5	Forest	Small crowned forest below 1000m uplands	8,032
6	Forest	Small crowned forest below 1000m plains and fans	94,377
7	Forest	Small crowned forest above 1000m	431,010
8	Forest	Small crowned forest with conifers above 1000m	17,377
9	Forest	Small crowned forest with Nothofagus above 1000m	34,900
10	Forest	Very small crowned forest above 1000m	801
11	Forest	Very small crowned forest with Nothofagus above 1000m	434
12	Forest	Very small crowned forest above 3000m	16,118
13	Forest	Open forest below 1000m plains and fans	146,436
14	Forest	Forest with Casuarina equisetifolia	432
15	Forest	Riverine mixed successions	4,675
16	Forest	Riverine successions with Casuarina grandis	886
17	Forest	Mixed swamp forest	92,520
18	Forest	Mixed forest	1,665
19	Forest	Volcanic successions	1,399
20	Woodland	Swamp woodland	86,002
21	Scrub	Scrub	146
22	Scrub	Volcanic successions dominated by scrub	955
23	Grassland	Grassland	46,202
24	Grassland	Alpine grassland	4,518
25	Grassland	Grassland with some forest	76,861
26	Grassland	Subalpine grassland	841
27	Grassland	Grassland reverting to forest	5,911
28	Grassland	Riverine successions dominated by grass	9,577
29	Grassland	Swamp grassland	26,273
30	Grassland	Volcanic successions dominated by grass	1,949
31	Grassland	Herbaceous swamp	4,118
32	Estuarine	Mangrove	843
33	Non-veg	Lakes and larger rivers	23,731
34	Non-veg	Agricultural land use	390,441
35	Non-veg	Larger urban centres	2,095
36	Non-veg	Bare areas	8
		Total	2,890,843

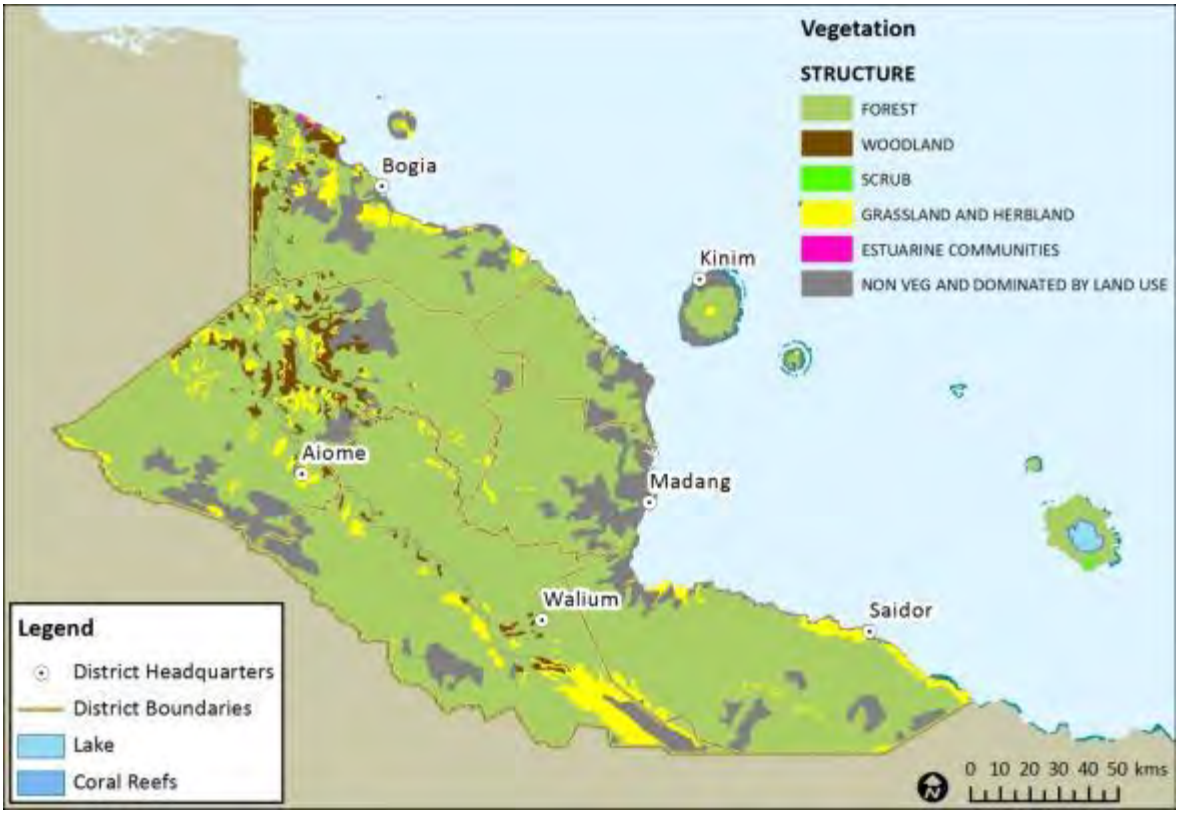


Figure 17: Vegetation types of Madang

5.1.3. Land Systems

Land Systems are areas or groups of areas throughout which there is a recurring pattern of topography, vegetation, and soils. Using land systems as conservation targets ensures that areas are selected across the full range of regional ecological gradients. Most boundaries of land systems are abiotic ecotones, hence likely to remain in the same locations even as climate change drives alterations in the ecosystems within each land system. Building off the land system classes from Bellamy and McAlpine (1995), Sheppard and Saxon (2008) combined the land systems of Papua New Guinea (Bellamy and McAlpine 1995) with similar land units in Papuan provinces of Indonesia (RePPProT, 1990) to create a comprehensive data layer of land systems across the New Guinea archipelago.

The Land System data were acquired from the Papua New Guinea Resource Information System (PNGRIS) digital data set maintained by the PNG Forest Authority. Pre-processing steps included clipping the coverage to a standard PNG coastline and repairing a small number of mismatched labels in polygons crossing provincial boundaries. Significantly finer upland units were produced by replacing the original descriptive slope classes with slope classes derived automatically from a 90m digital elevation model (SRTM) (Farr et al. 2007).

In PNG the upland land systems are characterized by distinctive topography and bedrock type. The lowland land systems are characterized by their distinctive terrain form and hydrology (Sheppard and Saxon 2008). Within Madang Province the foothills and ridgelines drain into Ramu-Markham River Valley. The coastal plain feature wraps around the base of the Adelbert Range and fades into the wetlands and swamps of the lower Ramu River. The Finisterre Range in Rai Coast is dominated by rugged terrain underlain by limestone (see Figure 19).

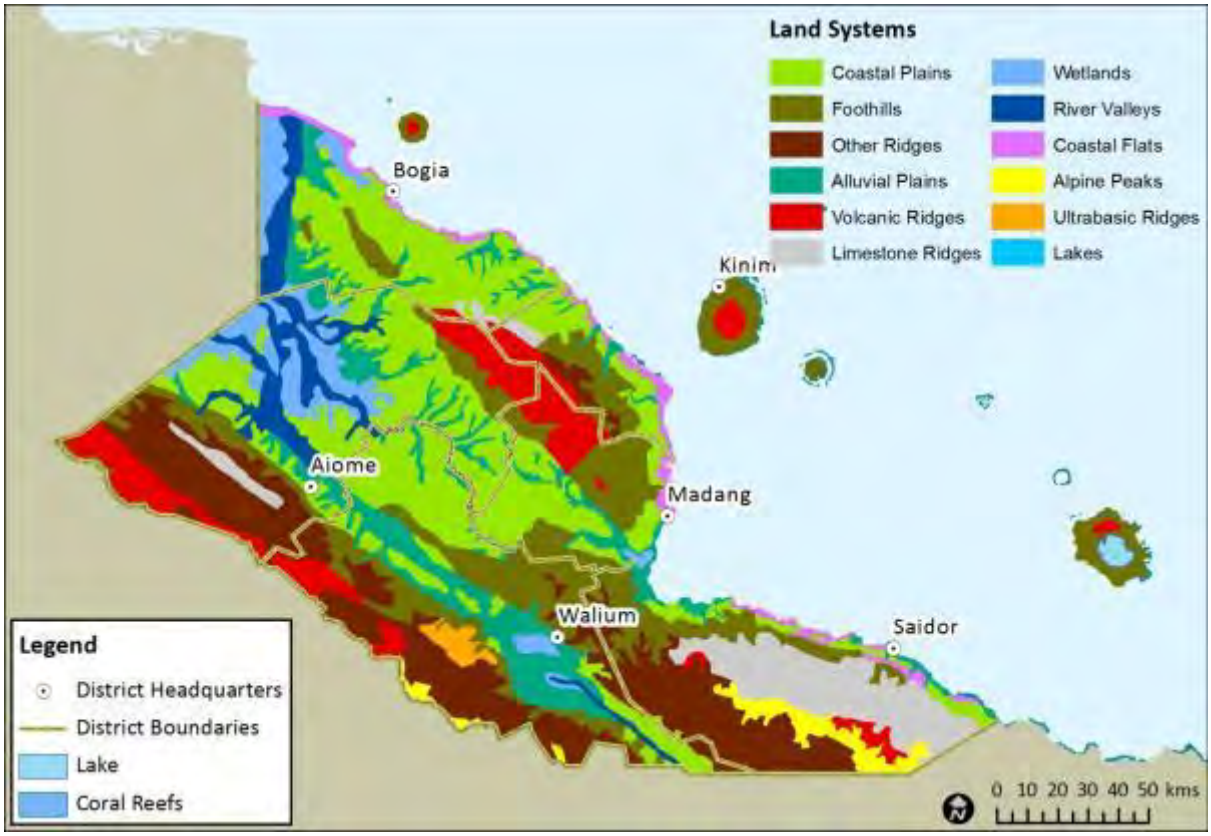


Figure 18: Land System data clipped to Madang Province

5.1.4. Results: Gap Analysis

The managed areas in Madang Province consists of 40 managed areas totaling 218,093 ha and accounts for less than 6% of the land base and less than 2% of the marine environment. These values are short of the 17% CBD target.

To further assess how representative the current managed area system in Madang is, an assessment of vegetation types and land systems under management status was made. Both the vegetation types and land systems could be considered as surrogates for levels of biodiversity. Each surrogate was therefore intersected with the existing protected area system in GIS to determine the area contribution of each Vegetation and Land System type. It was assumed that if more than 17% of the area of the unique Vegetation or Land System were within an existing protected area, that the conservation feature was effectively represented.

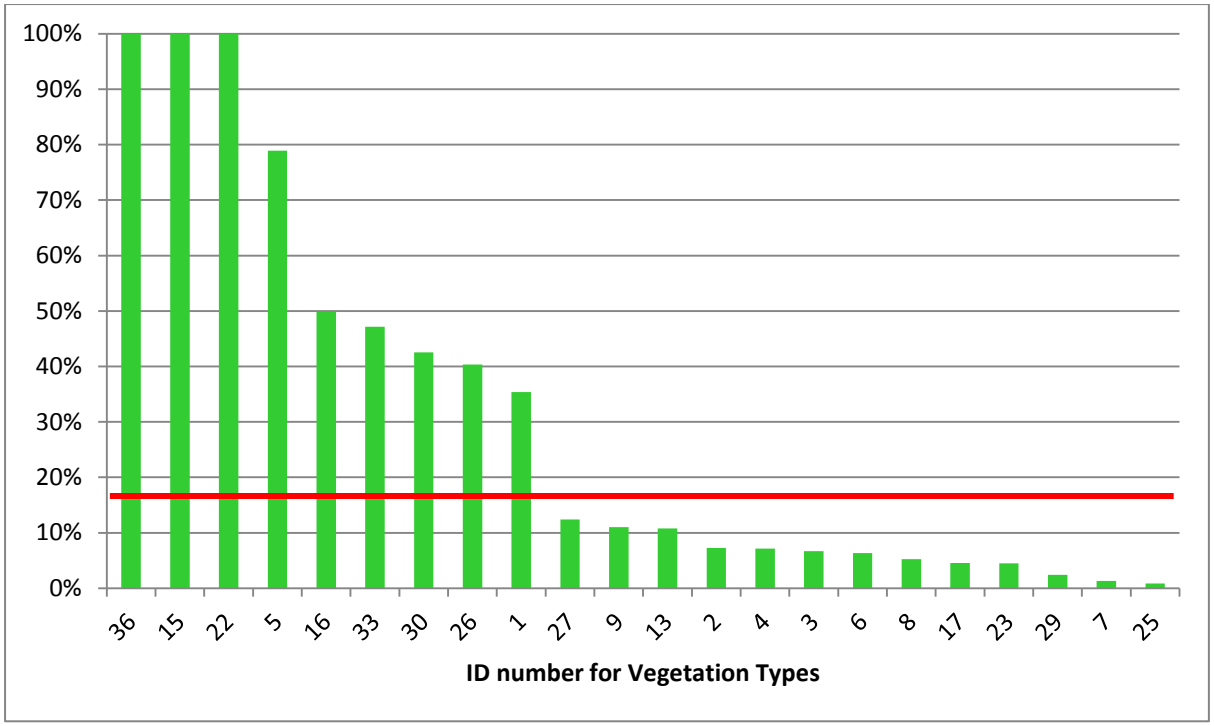


Figure 19: Representation of vegetation types within the existing protected area system. ID numbers on this figure correspond to the list of vegetation types in

6.

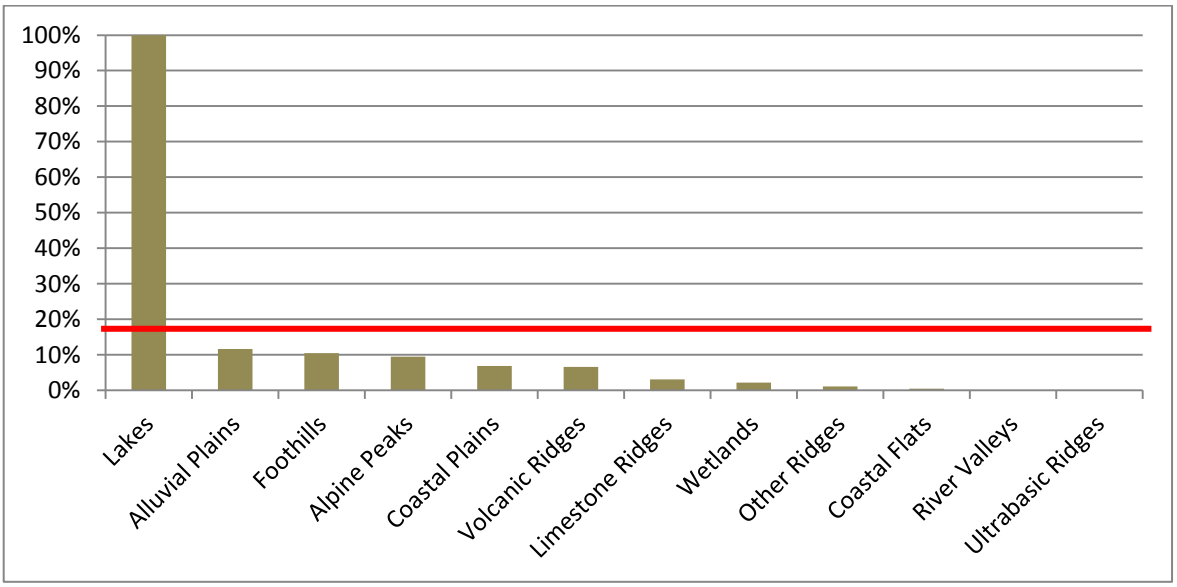


Figure 20: Representation of Land System types within the existing protected area system.

When evaluating the degree of representativeness of the existing protected area system, only 9 of the 34 Vegetation Types were effectively represented (> 17% protected) within the existing protected area system (Figure 19).

When evaluating the degree of representativeness of Land Systems within the existing protected area system, only one of the twelve Land System types was effectively represented (> 17% protected) within the existing protected area system (Figure 20).

5.1.5. Discussion: Gap Analysis

The existing protected area system is not based on the efficient representation of samples of biodiversity but rather the opportunistic protection of areas where land holders were supportive. Although past assessments were available to inform choices regarding areas to protect, these were largely based on expert opinion, rather than an analysis of the representation of biodiversity across Madang and PNG (Alcorn 1993, Beehler 1993).

With ongoing degradation and deforestation from the rapidly expanding human population and associated expansion of subsistence agriculture and demand for cash crops, expanding impact of industries including logging, mining, oil and gas, oil palm and other industrial agriculture, there is an immediate need to establish and effectively manage protected areas in Madang to reduce the loss of biodiversity.

If Madang Province is to work with partners to effectively establish a CARR protected area system, it needs to make informed choices regarding the areas to protect and areas to be developed. Madang needs to evaluate each new area proposal to determine whether it contributes to the CARR protected area system. In this way Madang ensures the efficient use of limited Government resources to establish protected areas that meaningfully contribute to a National CARR protected area system. The next section provides options to inform Madang regarding these choices.

5.2. Priority Analysis

The assessment of the opportunities for potential protected area systems that also effectively serve as refugia for climate change required detailed and systematic analysis. The approach used is described in this section and includes:

- Introduction to the Marxan decision support software
- Establishment of a planning units layer (the units of selection),
- Overview of input data sets for analysis
    - Inclusion of climate change probabilities to enable the approximation of climate change refugia,
- Selection of surrogates of biodiversity and conservation features that meaningfully reflect biodiversity in Madang
- Development of a cost surface that would broadly reflect threatening processes and areas inaccessible to logging
- Setting of conservation targets in accordance with the PNG Draft National CARR Criteria,
- Exploration of options using the decision support tool, Marxan to enable the determination of the best options to inform the Province regarding marine and terrestrial conservation priorities in Madang.

5.2.1. Marxan - Decision support

Systematic conservation planning requires the consideration and comparison of complex and interacting features on the landscape. Marxan is a decision support software program designed to help synthesize and automate the selection process so that many different scenarios can be developed and explored. One way of dealing with often conflicting biodiversity and socio-economic criteria is to have well defined goals for all of the conservation targets and well defined measures of the likely economic impact of the reserve system. The conservation goals are then sought in a way that the protected area network results in minimal impact on community interests. The selection process uses an objective function whereby any collection of planning units is given a score. The Marxan program then attempts to find protected areas networks (i.e. collections of planning units) which have the lowest scores (socio-economic cost) and highest biodiversity benefit. This means that the scenarios produced try to meet the most conservation goals while simultaneously having the least impact on socio-economic values (Ball and Possingham 2000).

5.2.2. Input data sets

A number of core data sets are necessary to utilize Marxan. For this analysis we used the following:

1. Planning Units
2. Locally mapped features used in analysis
3. Forest Information Management (FIMS) as biotic features (Hammermaster and Saunders 1995)
4. Land Systems as abiotic features (Sheppard and Saxon 2008)
5. Biodiversity features mapped in the participatory mapping exercises
6. Development features mapped in the participatory mapping exercises
7. Climate Change Refugia
8. Above ground biomass
9. Human Footprint
10. Constraints to logging from the FIMs database

These data sets provide the best available data for a preliminary gap analysis in order to meet some of the key criteria outlined under the CARR criteria listed in Section 2.6. The following sections explain each of these inputs. Maps are presented to illustrate these datasets, with each map having a small inset to provide a finer scale view of the data.

5.2.3. Planning Units

The study area for the priority analysis is based on the provincial boundary and extending 12 nautical miles into the sea. Within this extent, a uniform set of planning units were developed. These 100 ha hexagons form the basic unit of the analysis and ultimately are used to focus conservation actions (Figure 21). There are a total of 46,038 planning units. While planning units can be virtually any size in Marxan, 100 ha was selected because it matched the size of some of the smaller managed areas in Madang and was thought to be of sufficient size to assist community level planning and implementation.

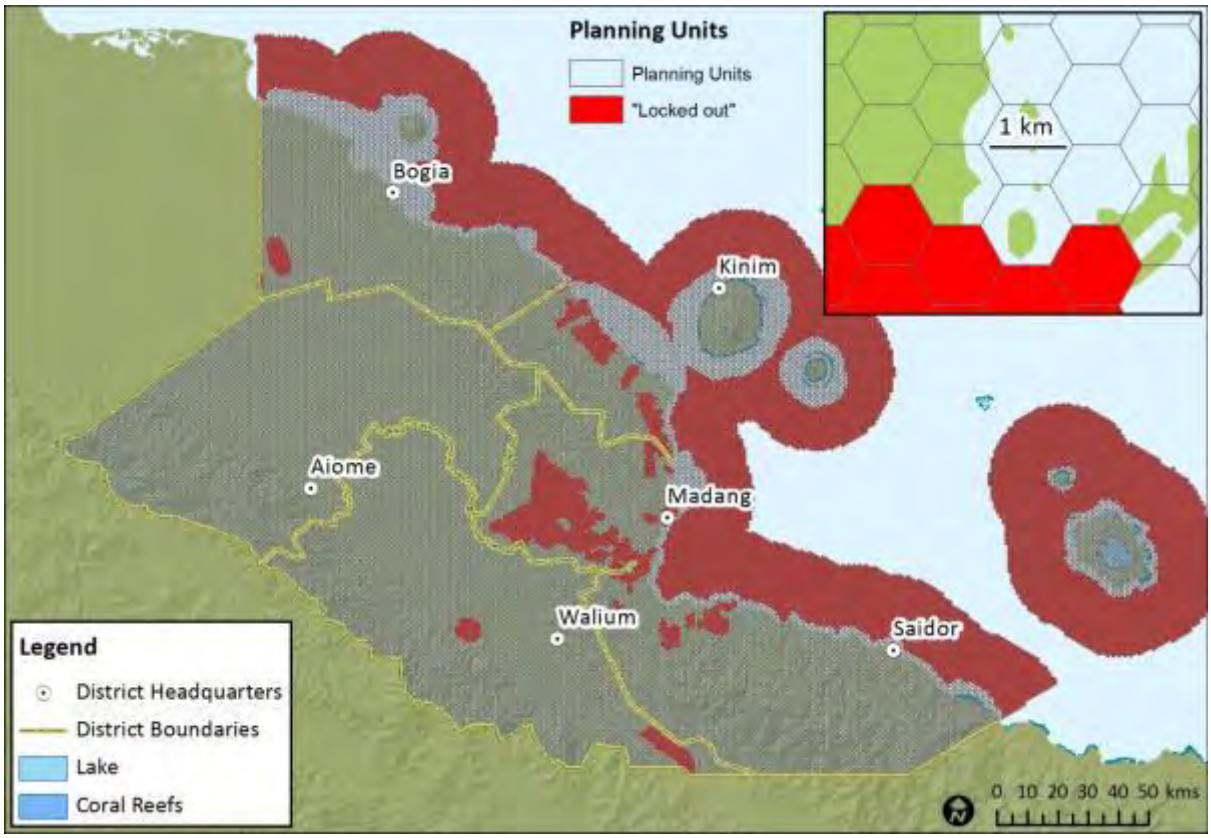


Figure 21: Planning Units. Inset illustrates shape of units north of Madang on the shores of the Madang Lagoon. Red areas are "locked out" from the analysis

As part of this analysis a number of planning units were "locked out" so that they were never available to be identified as priority conservation areas. These areas include: logged areas, Ramu Nickel mining site, nickel processing facility at Basamuk, large urban areas, large scale palm oil plantations, the Pacific Marine Industrial Zone site, and much of the off shore marine area. We locked out the off shore marine area because we did not have information on this area. These "locked out" areas are illustrated in Figure 21 above. Of the 46,038 planning units, only 30,999 are available for selection in the analysis. Readers, and especially those working to plan for the future of

Madang, should note that these "locked out" areas may in fact be suitable for conservation or development alike. They are removed from this analysis based solely on what the TNC team has interpreted from the available information.

5.2.4. Local features

A wide range of features were mapped by participants at the first three workshops as part of this project. In total 1,354 individual features across the 134 categories were identified on the maps and transferred to the GIS system.These features represent a vast and wide range of knowledge and values from stakeholders across the Province. However we were only able to use a selection of these data for inclusion to the analysis. The full list of features mapped at the workshops is presented in Annex 2. Figure 22 below offers a very simple view of the 1,354 features as it is not possible to present all the fine detail in such a small graphic. Therefore Figure 22 is provided to illustrate the areas within the Province where features were identified by stakeholders at the consultative meetings and mapped.

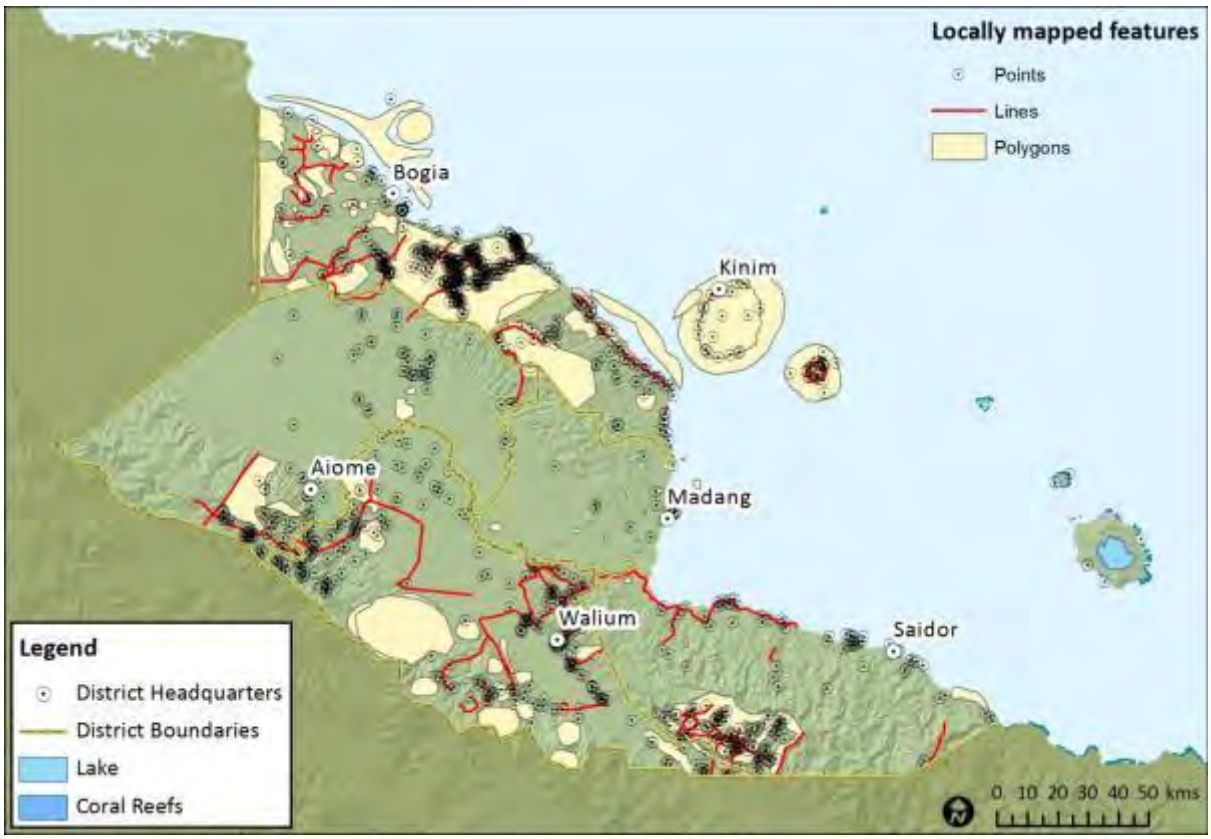


Figure 22: Locally mapped features (points represent such features as mine sites, lines represent such features as proposed roads and polygons represent such features as significant or locally protected forests or marine sites).

5.2.5. Climate Change Refugia

"Refugia" were defined as the areas with a projected future environment similar to their current environment, including both physical attributes and climate variables (Saxon et al. 2005). Projected refugia in the year 2100 were identified under climate scenario A2 (Nakicenovic and Swart 2000), using the HadCM3 general circulation model (GCM) (Gordon et al. 2000). HadCM3 is a highly

climate-responsive GCM and scenario A2 assumes limited climate mitigation action. These choices were made in order to develop a set of protected areas that would include refugia under severe future conditions, a precautionary approach given the uncertainty around the likely effectiveness of climate mitigation.

In order to preferentially identify conservation areas in locations of likely climate change refugia, the climate refugia data was analyzed to find the median value. Then using the areas above the median we divided this into two categories: “high probability for refugia” and “medium value for refugia”. These two categories were then used as target in the analysis.

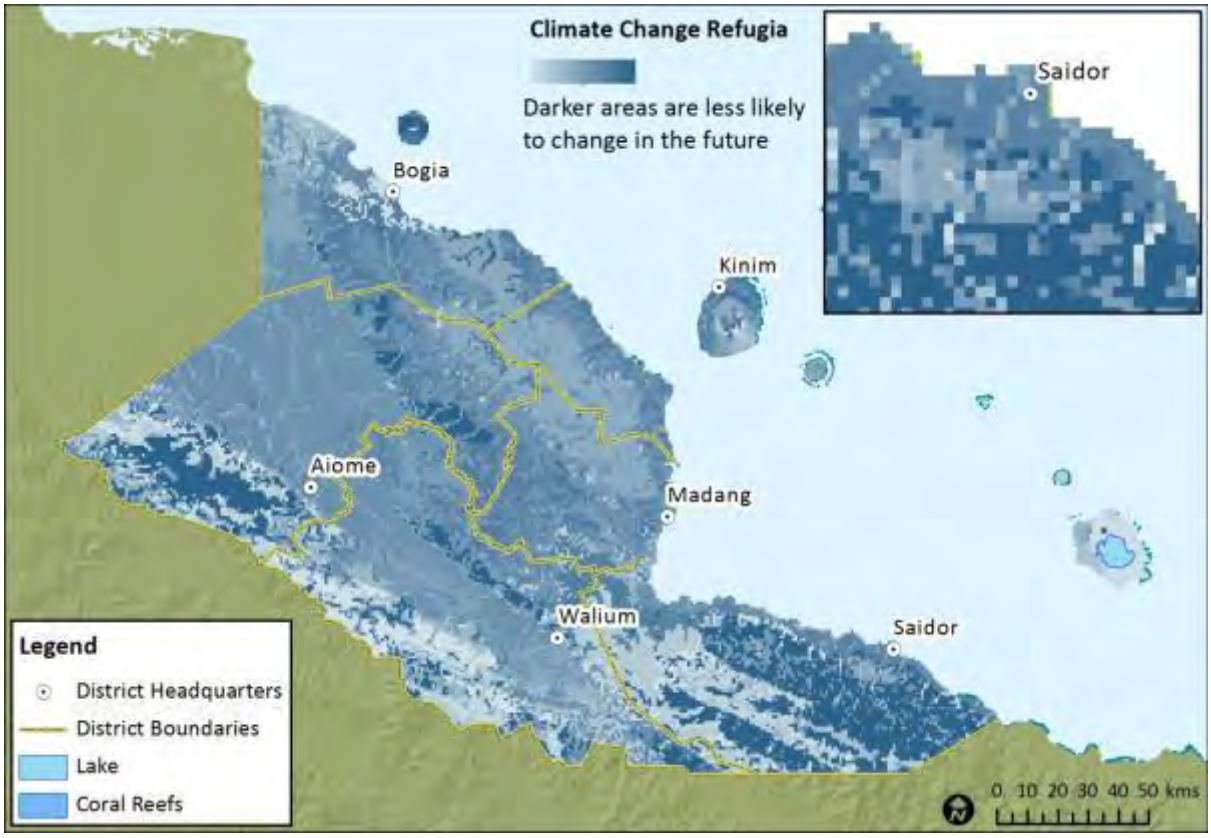


Figure 23: Climate change model clipped to the boundary of Madang Province

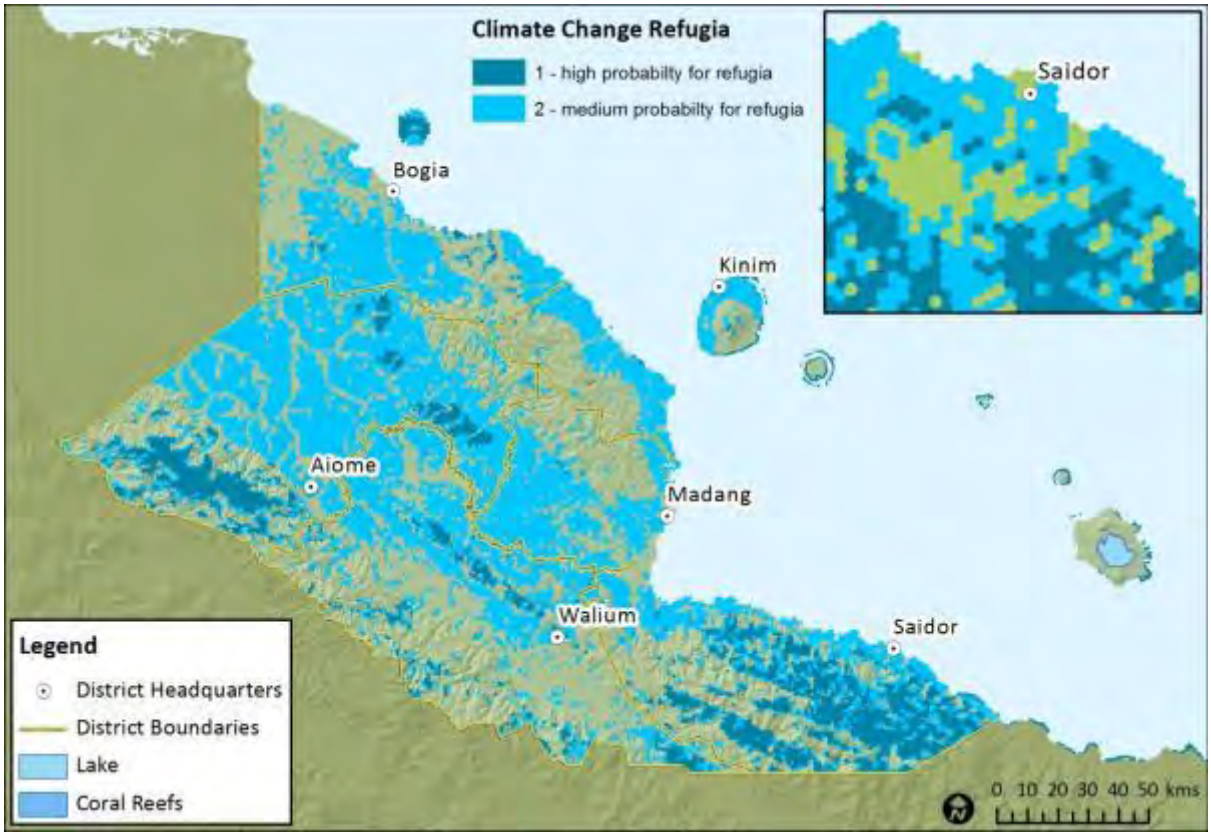


Figure 24: Climate Change refugia target areas for analysis

5.2.6. Above ground biomass

Recognizing that the FIMs database is quite out of date and no alternative vegetation classification is available for this study we had to look for alternative. A dataset on above ground biomass from the Woods Hole Research Centre is freely available and offers a reasonable measurement of biomass for this study. Full details on this dataset and the processing involved in creating it can be found on the Woods Hole Research Centre website: http://www.whrc.org/mapping/pantropical/modis.html. The primary value for the Madang project is that this data provides a measurement of biomass that is much more recent (2005) than the FIMs vegetation classification (1975). Figure 25 illustrates the biomass data and then Figure 26 shows the target areas of high and medium biomass used in the analysis.

Figure 25: Above ground biomass

Figure 26: Above ground biomass as used in analysis

5.2.7. Targets

Data sets described in the sections above are used as the primary basis to identify priority conservation areas. The decision support software used, Marxan, reads all of these data and calculates the most efficient areas (planning units) to mark as priority areas. The final piece of the puzzle is to develop a meaningful set of targets (or goals) that Marxan attempts to meet while avoiding the higher "cost" areas. The key target features include vegetation (FIMs), Land Systems, climate change refugia, and a subset of the locally identified features. However, given that the FIMs vegetation data represents vegetation types from 1975 it was essential to augment these data with a more current land cover datasets. We did this in two ways: First we combined the Land Systems data with the FIMs vegetation data which serves to refine the classification by including topographic and geological characteristics. This combined classification was then used in the priority analysis. Secondly we used above ground biomass to capture areas of higher biomass, which is interpreted as having denser canopy cover and thereby less disturbed vegetation types.

As a baseline target value we used 17% for terrestrial features and for 10% for marine features. We also evaluated the total extent of features and increased target value for restricted range features (i.e. cassowary habitat, birds of paradise, mangroves, and others). For the above ground biomass feature we set a nominal target of 10% the "medium biomass" and 20% for the "high biomass". The climate change refugia were treated in a similar fashion: 10% for "medium refugia" and 20% for "high refugia". Recognizing the critical role that mangroves and coral reefs play in the marine environment, and their limited area in Madang Province we elevated these targets to 50%. The full table of targets is reported in Annex 3 in both percentage and hectares.

5.2.8. Cost Surface

This provides the appropriate gradient for Marxan to work with, from populous areas where it is "expensive" to create and manage protected areas, to less populous areas where it is less "expensive" to create and manage protected areas and where human threats tend to be lower. The "constraints" features from FIMs were included as well. Due to the topography and land cover in these areas they are ranked as less expensive to set aside for conservation because they are not readily accessible for logging or other development interests.

5.2.8.1. Human Footprint

In order to estimate the relative impact of human activity on the landscape we used the Global Human Footprint (WCS and CIESIN, 2005) data available from the Wildlife Conservation Society and the Center for International Earth Science Information Network. This dataset is based on a number of inputs including human population distribution, urban areas, roads, navigable rivers, and various agricultural land uses. Further details on this dataset are available online (http://sedac.ciesin.columbia.edu/data/collection/wildareas-v2).
This dataset was used as an input to the priority analysis which is discussed in the following section of the report.

Care should be taken when interpreting these data. Partly because the data sources are very coarse and do not accurately represent activities at the village level. It's also important to remember that protected areas have a range of guidelines and some are designed to work in human impacted areas.

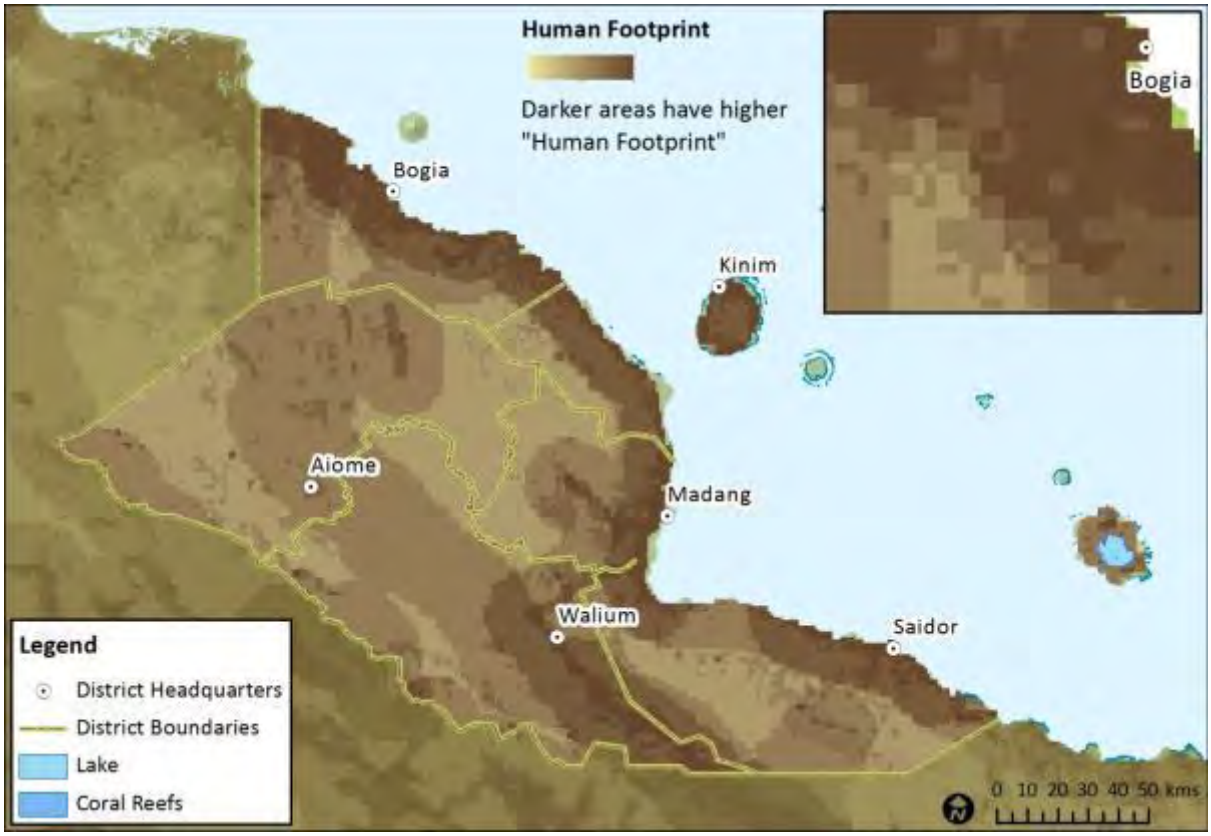


Figure 27: Human Footprint within Madang

5.2.8.2. Logging Constraints

The FIMs database is primarily used for its vegetation classification. However it also contains two data layers representing “constraints”. These are steep, rugged, or swampy areas on the landscape that limit access for development or logging activity. Specifically, the FIMs database defines areas categorized as “Extreme constraints” as forests on land of greater than 30 degrees slope, or above 2400m altitude, or comprising tower karst landform, or whose area is more than 80% permanently or near permanently inundated. “Serious constraints” are forests on land with 20-30 degree slope and very high to high relief, or land whose area has 50-80% permanent or near permanent inundation.

In this project we combined the areas with “constraints” with the Human Footprint data described above to develop a “cost” layer. The cost layer is a key input in the priority analysis which is described in the following sections.

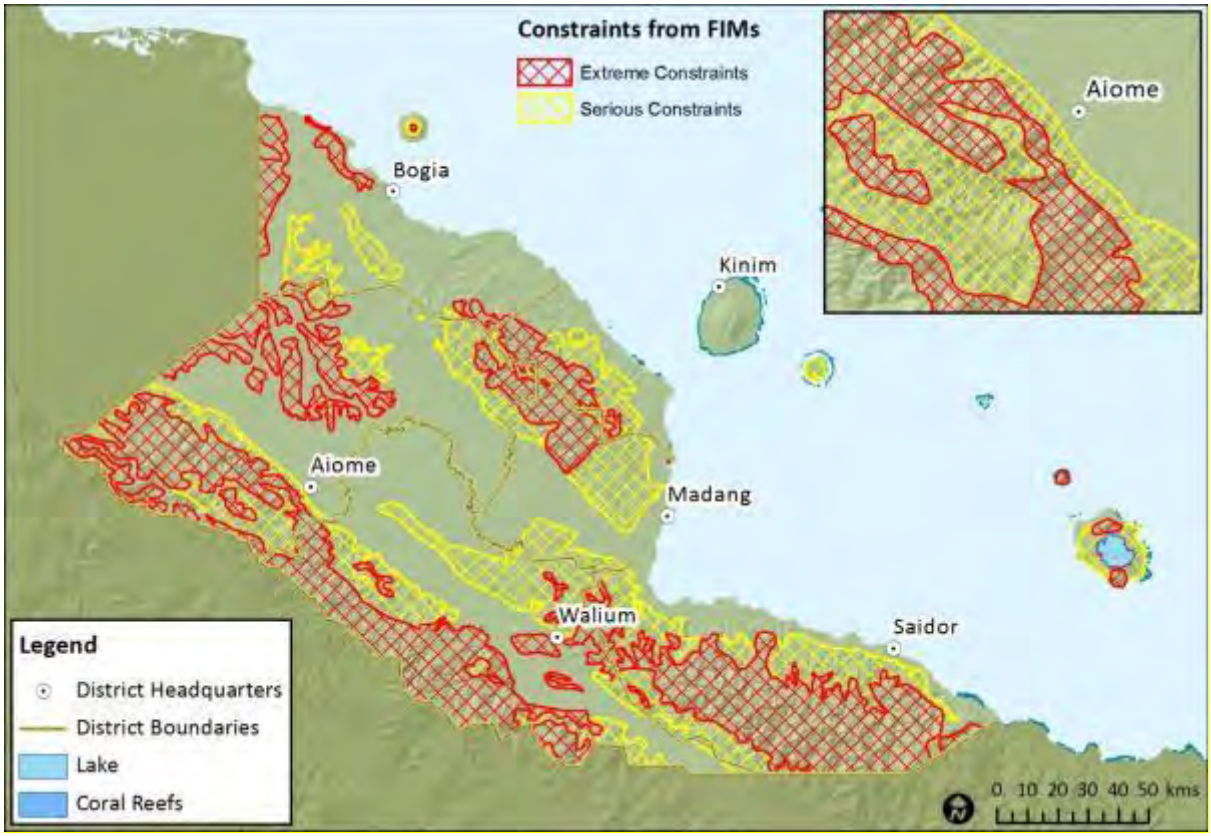


Figure 28: Constraints from FIMS used in analysis

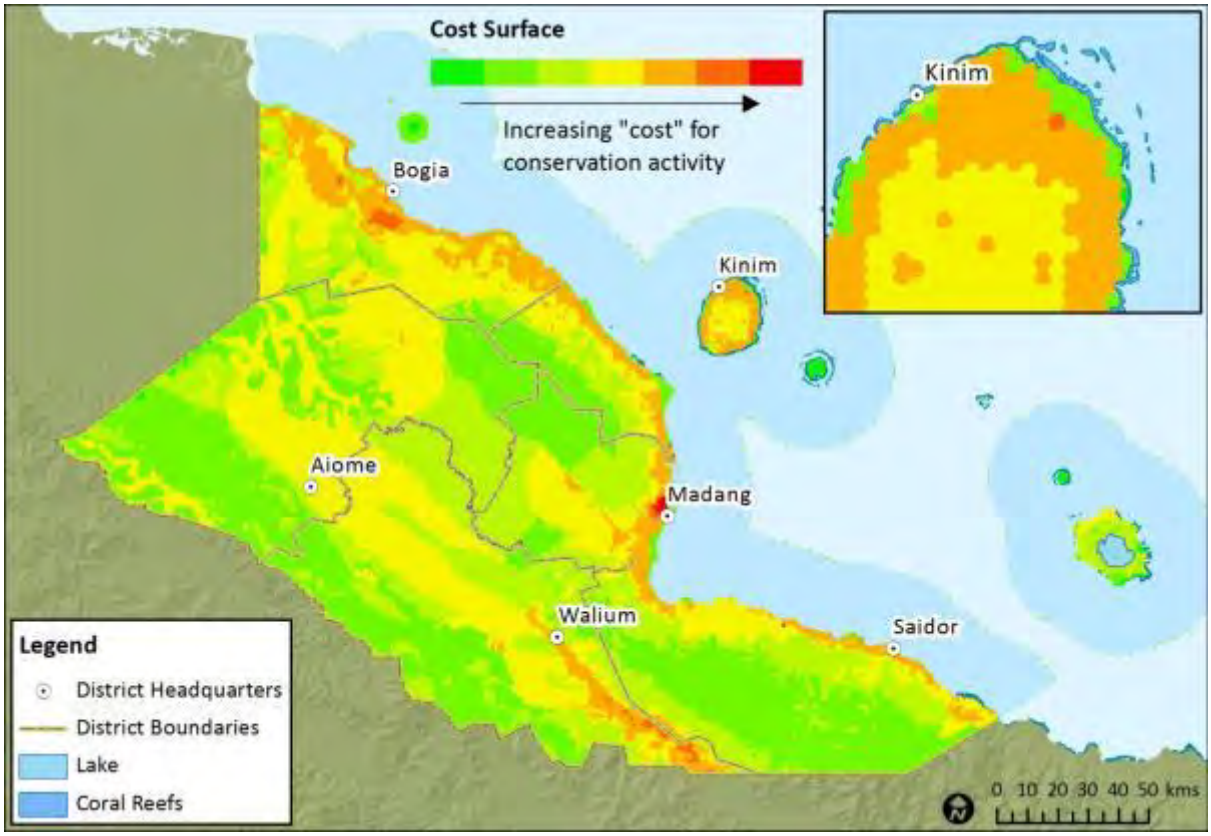


Figure 29: Cost surface is a compilation of “human footprint” and constraints from the FIMs database, and locally identified development projects

5.2.9. Marxan Inputs

The key inputs used in the Marxan runs were:

- Total planning units = 46,038
- Each planning unit = 100 ha
- For option exploration = 10 runs, where the "Best" run was chosen for inclusion
- 100 runs = sum solutions for final runs
- Number of iteration/run = 10,000,000 iterations
- Boundary Length Modifier = 0.1 (With testing between 0.01 - 5)
- Penalty Cost = 0.5 – 3 (unique features with limited range were assigned a higher penalty to ensure their targets were met
- Temperature decreases 10,000
- Adaptive annealing "on"
- Using simulated annealing

For a complete description on the use of Marxan see (Game and Grantham 2008).

5.2.10. Results: Priority Analysis

Numerous Marxan scenarios were explored as part of this study, with a minimum of 20 unique scenarios. Initially we developed scenarios that divided the Province by Districts to ensure that each District had priority areas identified within their area, but we found that this was not necessary. In fact this produced some challenging results, especially for Madang District because a majority of the District is "locked out". Additionally the District boundaries do not follow any ecological gradients. A common practice when running Marxan is to force the inclusion of existing managed areas. However, given the range of management practices in the current managed areas we found that the results were more reasonable when we did not set up the model in this manner. Rather we used an alternative setting whereby we set the existing and proposed managed areas as "seed" for which Marxan to build on. Using this setting Marxan puts these areas into the solution at the start and then as the program continues through the run these areas may or may not be included in the final solution. In the end the best results were found by using a basic structure where priority areas could be selected from the entire Province.

In the interest of giving the communities and leaders of Madang clear guidance from this analysis a single priority conservation scenario from Marxan is presented in Figure 30 below. Readers will appreciate a few comments to help explain the figure:

1. All known existing managed areas are show in purple and contribute the conservation goals in this analysis.
2. A number of proposed managed areas, show in red, were identified in the workshops and also contribute to the conservation goals of the analysis
3. The Conservation Priority areas that were derived from the Marxan analysis are illustrated in a color ramp from yellow to blue. While all of these colored areas were identified as priority areas, the darker blue areas came out as the most important. Therefore establishing conservation management practices in these areas will be the most efficient in terms of adding to the conservation goals of the Province.

Bearing in mind that there are already many areas set aside for conservation management in the Province, the conservation priority areas illustrated are meant to be complimentary. That is, existing

areas should remain as they are because they contribute to the conservation goals. Proposed areas should be seriously considered for official establishment as they have local support and are likely to benefit those local communities. Collectively, the existing and proposed areas, in combination with priority areas identified in this analysis will greatly contribute to the overall conservation goals of Madang Province.

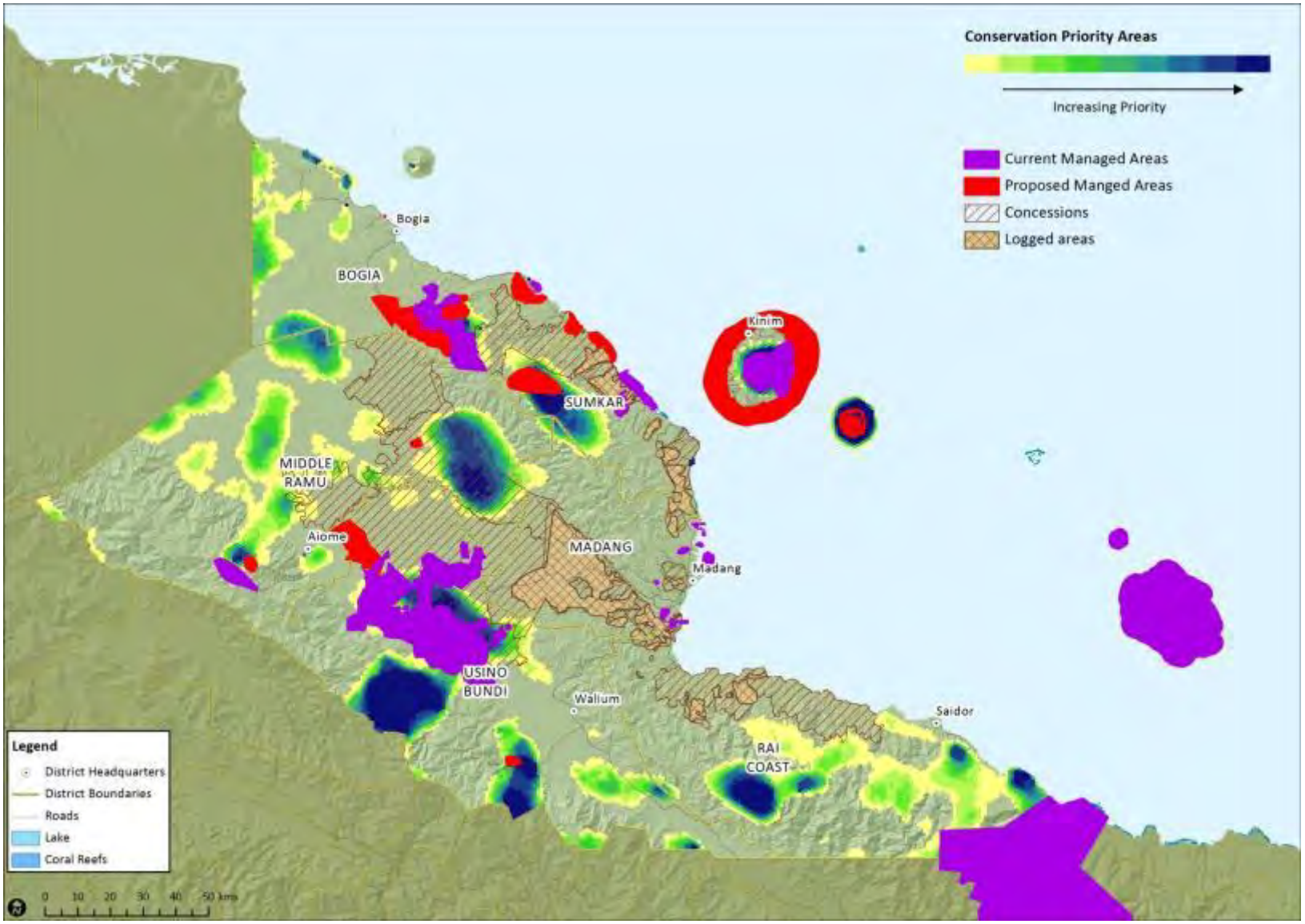


Figure 30: Conservation priority map

6. Discussion

The completion of the spatial analysis of Madang Province allows stakeholders to visualize the locations of conservation priorities for Madang Province, threats to biodiversity and what a successfully implemented protected area network across Madang could look like. The participatory process utilized the best available national scale data on terrestrial and marine features and the local knowledge of multiple stakeholders. All of this information was put in to a GIS format and analyzed with Marxan software to produce one conservation priority map for Madang Province where the internationally accepted CBD conservation targets of 17% for all terrestrial areas and 10% for all marine areas was used.

The gap analysis component of the project included a simple assessment of the effectiveness of the representativeness of the current managed area system in sampling biodiversity (using the proxy of vegetation types and land systems) in Madang Province. Current managed areas in Madang Province consists of 40 conservation and protected areas totaling 218,093 ha and accounts for less than 6% of the land base and less than 2% of the marine environment. These values are short of CBD targets outlined above.

It is important to note that there are limitations to the analysis including:

- Some LLGs were not adequately represented at the workshops;
- There are likely threats and opportunities not included in the Marxan analysis;
- The impacts and severity of future threats such as climate change are unknown;
- The marine environment are poorly represented; and
- The FIMs vegetation database is quite out of date and alternative international data sets were used.

The resulting products are termed "Interim" as they will provide interim direction for Madang regarding the consideration of new conservation proposals and industrial developments in the Province until such time as better products are available. It also recognizes that as new data becomes available Madang stakeholders and decision makers will need to revisit the analysis to compare past assessments and revise future planning scenarios. Technical and financial support from development and other interested partners will be needed to also build capacity in the Province to incorporate these new data into subsequent and improved products.

A key achievement of this project has been bringing all key stakeholders together in a discussion and analysis of information that has identified existing conservation and protected areas as well proposing additional conservation sites in the province. Such information should assist the provincial government to update its Kalibobo Vision 2020 and other medium term development plans.

Madang is at the cross road and is now entering a new period of change. The Madang government has ongoing partnership arrangements with international donors and other partners through which both technical and financial resources can be sourced for the successful and timely implementation of the Kalibobo Vision 2020. Other recent positive endeavors include the maritime provincial governor's declaration dated 6th November 2013 that provides a framework for collaboration and sustainable management of coastal and marine resources for PNG.

This spatial planning process was truly a bottom-up, participatory approach that allowed for all parties to work together in production of this report and which aligns with the development aspiration of the Madang provincial government and its people. Certainly more workshops would have been beneficial and would have enriched this assessment, however the scope and time frame placed a limit on what was possible. Looking ahead, consultation with local communities will be essential in order to implement any conservation or development actions arising from this gap and priority analysis. It should also be noted that further social and economic datasets should be incorporated into this analysis to further assist the Madang Government in the development of a balanced and a comprehensive development plan that guides the provincial economy on a sustainable basis.

The challenge facing PNG and provinces like Madang is how to achieve social and economic development while ensuring that its natural resources are managed sustainably and the environment is protected for the benefit of the future generations. Therefore a primary need for all communities of PNG is to identify existing natural resource values and to incorporate this information into participatory planning approaches, similar to what has been presented in this report. An inclusive approach like this can integrate stakeholder interests and equitably and sustainably balance conservation and development aspirations of all citizens of Madang Province and ultimately PNG.

7. Recommendations

Throughout the workshops and based on the outputs from this report a number of recommendations can be suggested for the Province:

1. The provincial administration admitted that conservation and environmental protection aspects are not being adequately catered for in current provincial plans. Therefore the discussions and analysis undertaken through this project should be incorporated into future provincial development plans.

2. As new information becomes available this analysis should be revisited and updated as appropriate. The priority analysis presented in this report can only be used as a guide for decision making. As development projects or conservation areas are put forward the priority map should be consulted along with local stakeholders and communities.

3. The Province should establish a conservation and environment office. Such an office would be responsible for maintaining records on existing and proposed conservation areas. This information would enable the province to make wise decisions about placement of new developments and conservation areas alike. The office should also be charged with advising on policy or legislation for environment and conservation issues.

4. The Madang province needs to build on this report by undertaking a comprehensive state of the environment report on a regular basis to highlight status of development in the province and its opportunities and threats on the renewable resources sector.

5. Build capacity at the provincial level for planning and resource management. Tools and skills in GIS mapping, database management, socio-economic issues, and biological data would greatly enhance the Provinces ability to implement the outputs of this report.

6. Develop provincial research protocols and repository in consultation with national government, including NRI and other institutions for data and benefit sharing.

7. Increase awareness on threats to natural resources and the sustainable functions of ecosystems, particularly focusing on the threats posed by changing climatic patterns.

8. Conduct a comprehensive review on the effectiveness of the existing management areas. Detailed surveys should be completed which profile the range of land uses, biodiversity, and threats.

9. Utilize public - private partnerships to technically and financially implement the outcomes and recommendations of this analysis.

10. It is recognized that the data relating to marine resources used in this analysis is limited. Looking ahead, however, there is opportunity to improve this through collaboration with DEC as they develop the national marine gap and priority analysis in early 2014. Madang provincial

government should work with DEC to address data gaps in the Province to improve the knowledge base of the marine environment.

11. As most of the natural resources of the country are customarily owned by the people, conservation priority needs addressed at the community level will have been better chance of success if done at Provincial, District, and/or community scales.

12. Madang Province has the opportunity to collaborate with DEC to effectively establish a CARR protected area system in PNG. Madang needs to consider proposed conservation areas to evaluate whether it contributes to the CARR protected area system.

13. As there are many more existing, proposed and other areas of high biodiversity significance, this list needs to be regularly updated and incorporated into the short to medium term development plans including the provincial forest plan while under revision to embrace relevant and significant aspects of this report.

14. The Madang provincial Government should commit technical and financial resources to the implement the recommendations contained in this report.

15. This report and the associated maps should be presented to communities through focused workshops to ensure that the inputs, outputs, and recommendations are clearly understood by communities.

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Annex 1: Participants Listing

Name	Organization	Position	Workshop #1	Workshop #2	Workshop #3	Workshop #4
Steven Gewe	Gatik Community Base Organisation	Program Coordinator	X	X		X
Peter Moikia	Madang Civil Society Organisation	Chairman	X	X	X	X
Clement Kipa	The Nature Conservancy (TNC)	Forest Program Manager	X	X	X	X
Benjamin Sipa	Tree Kangaroo Conservation Project (TKCP)	Program Coordinator	X			X
Yati A. Bun	Foundation for People and Community Development (FPCD)	Executive Director	X	X		
Salaiau Posangat	MENAR Development Network - Manus	Program Coordinator	X			
Francis Hurahura	The Nature Conservancy (TNC)	Country Program Director	X	X	X	X
Manuai Matawai	The Nature Conservancy (TNC)	Conservation Coordinator	X			
Jenny Daing	Almami LLG Counci-Bogia District	Women's Representative	X	X		
John Kosi	Adelberts Conservation Cooperative	Forest Resource Owner	X	X		X
Cosmas Apelis	The Nature Conservancy (TNC)	Conservation Science Officer	X	X	X	X
Angela Bugatar	Madang Civil Society Organisation	Treasurer	X	X	X	X
Andrew Mapio	Madang Civil Society Organisation	Executive Member	X	X	X	X
Nate Peterson	The Nature Conservancy (TNC)	GIS Manager	X	X	X	X
Kelly Basebas	Conservation Advisory Committee - Almami LLG	Vice Chairman	X			

Name	Organization	Position	Workshop #1	Workshop #2	Workshop #3	Workshop #4
Nidatha Martin	Office of Climate Change and Development	Policy Analyst	X			
Patrick Vuet	Partners With Melanesia (PWM)	Conservation Coordinator	X	X		
Kenn Mondiai	Partners With Melanesia (PWM)	Executive Director	X	X		X
Eric Pekah	Almami LLG Counci-Bogia District	President	X			
Joe Waguba	Adelberts Conservation Cooperative	Chairman	X			
Ted Mamu	World Wide Fund for Nature (WWF)	Terrestrial Program Manager	X			
Roy Banka	LEAF PNG	REDD+ Coordinator	X	X	X	X
Kamas Kuyan	RAI COAST District Administration	Health Administrator	X		X	X
James Sabi	Department of Environment and Conservation	Manager Terrestrial Ecosystem Management	X			
Theresa Kas	The Nature Conservancy (TNC)	Manus Program Manager	X			
Joseph Kua	New Guinea Binatang Research	Research Technician	X			
Markus Manubor	New Guinea Binatang Research	Research Technician	X	X		X
Matthew Lem	Ramu Nico (MCC)	Community Affairs	X			
Brodney Seip	Ramu Nico (MCC)	Community Affairs	X			
Michael Tataki	Office of Madang Governor	Special Projects Officer	X	X	X	
Alois Yabon	Almami LLG Counci-Bogia District	Manager	X			X
Frex Mambul	Gama LLG-Middle Ramu District	Executive Officer	X		X	
Ruth Konia	The Nature Conservancy (TNC)	Director Communications	X	X		

Name	Organization	Position	Workshop #1	Workshop #2	Workshop #3	Workshop #4
Thomas Warr	Office of Madang Governor	Research Officer	X	X	X	X
Peter Sagerom	Madang Provincial Administration -Commerce	Director	X			
Robert Howisa	Usino Bundi District Administration	Deputy District Administrator	X		X	
Nick Hamni	Madang Provincial Administration -Planning	Planning Officer	X			X
Eunice Dus	Office of Climate Change and Development (OCCD)	Policy Analyst		X	X	
Lydia Bobola	United Nations REDD+ Programme (UNREDD)	Programme Administrative Assistant		X		
Mary Kamang	Madang Provincial Council of Women	President		X		
Amanda Malagui	Transparency International, PNG	Project Manager –Forest Anti-corruption Solutions and Advocacy (FASA)		X		
Riknai Alfred	Kwaidama CBO	Coordinator		X		
Moses Oram	Almami LLG Counci-Bogia District	Former President		X		
John Nombi	Bogia District Administration	District Administrator		X		
Rose Rave	Almewo Group	Executive Officer		X		
Jack Masu	Madang Provincial Administration	A/Director Forestry		X	X	X
Roslyn Nambiong	Olamba CBO	Coordinator		X		
Evelyn Mullul	Madang District Administration	Community Development Officer		X		
Lawrence Pitor	Madang District Administration	District Administrator		X		

Name	Organization	Position	Workshop #1	Workshop #2	Workshop #3	Workshop #4
Jimmy Sekum	Sumkar District Administration	District Administrator		X		
Ben Keith	Sumkar District Administration	SDO		X		
Alphonse Wogem	Sumkar District Administration	Ward Member		X		
Alfred Kaket	Sumkar District Administration	C/F		X		X
Gerald Robinson	Sumkar District Administration	LLG		X		
Stanley K.	Sumkar District Administration	DPI		X		
Enthus Sekum	Sumkar District Administration	LLG		X		
Ruth Arek	Sumkar District Administration	Women's Rep.		X		
Ruth Naguri	Olamba CBO			X		
Moyang Okira	Sumgilbar LLG	Keki Eco Lodge Owner		X		
Ged Abaien	Madang District Administration	DM-Works		X		
Scholastica Memke	Bogia District	HEO		X		
Sobbie Giok	PNG Forest Authority	Projects Supervisor		X		
Dr. Gae Gowae	MARSH Program	Deputy Chief of Party		X		
Maria Tati	LEAF PNG	Program Finance and Admin.		X		X
Esekia Warvi	National Land Development Program	Manager		X		
Caroline Imun	PNG FSC Inc.	Program Officer		X		
Vero Waila	Almami LLG	Resource Owner		X		
Rabien Tamir	Almami LLG	Resource Owner		X		
Seblong Kobson	Almami LLG	Resource Owner		X		
David Gubia	Almami LLG	Resource Owner		X		

Name	Organization	Position	Workshop #1	Workshop #2	Workshop #3	Workshop #4
Micheal Apengan	Mikira CBO	Secretary		X		
Alex Korom	Labasia Theatre CBO	Chairman		X		
Luak Magu	Madang Deputy Governor's office	F/Assistant Secretary			X	X
Sirax Kawaki	Usino LLG	Ward Member			X	
Simon Warr	Madang Civil Society Organisation-Raicoast CBO	Member CBO-Chairman			X	
Eddie Idagotar	Middle Ramu District Administration	Community Development Officer			X	
Samuel Nessau	Nahu Rawa LLG	President			X	
Elizah Kas	Gama LLG	LLG President			X	
John Kari	Usino-Bundi District Administration	Sub. District Administrator			X	
Maino Virobo	Department of Environment and Conservation (DEC)	Deputy Secretary-Policy.			X	
Zachariah Unama	Usino LLG	Ward Member			X	
Steven Gongi	Gama LLG	Village Recorder			X	
Alois Bimbis	Usino LLG	LLG Coordinator			X	
Peter Sapia	Nahu Rawa LLG	Community Leader			X	
Peter Stephen	LEAF Regional	Forest Management and Climate Change Technical Advisor			X	
Michael Avosa	LEAF PNG	Country Manager			X	X
David Ganz	LEAF Regional	Chief of Party				X
Bernard Makari	Bundi LLG	Village Recorder			X	
Raphael Tepa	Bundi LLG	Village Recorder			X	
Joseph G. Kumun	Usino LLG	President			X	

Name	Organization	Position	Workshop #1	Workshop #2	Workshop #3	Workshop #4
Joel Angini	Simbai LLG	Vice President			X	
Tobias Tuweni	Bundi LLG	Ward Member			X	
Robert Taion	Usino LLG	Ward 30 Member			X	
Father Arnold Warangim	Josephstall LLG- Ramu Block 2	Chairman-Land group			X	
Camillus Sim	Josephstall LLG- Ramu Block 2	Ward Member			X	
Gregor Pind	Josephstall LLG	Resource Owner			X	
Kuriean Kutuw	Josephstall LLG	Ward Member			X	
Bonny Wara	Gama LLG	Ward 7 Member			X	
John Minge	Bundi LLG	Brahman Village Court Magistrate			X	
Teddius Dolbanz	Gama LLG	Village Recorder Ward 3			X	
Albert Opan	Gama LLG	Youth Rep			X	
Alex Idama	Gama LLG	Village Recorder			X	
Nelson Kapal	Gama LLG	Ward 11 Member			X	
Peter Niunamb	Gama LLG	Ward Member			X	
Joshua Kupp	Simbai LLG	Village Court Clerk			X	
Vincent Lazarus	Arabaka LLG	Community Health Worker			X	
Robin Suarkia	Department of Agriculture and Livestock	Rural Dev. Officer			X	
Joseph Toure	Bundi LLG	Youth Rep			X	
Max Yowe	Bundi LLG	Ward 19			X	
Dickson Gima	Usino LLG	Ward 13			X	
Mitase Kiu	Aiome	Women’s Rep.			X	
Elizah Kiu	Aiome	Health			X	
Kenny. P	Bundi LLG	Resource owner			X	
George Gimbo	Bundi LLG	Resource owner			X	

Name	Organization	Position	Workshop #1	Workshop #2	Workshop #3	Workshop #4
Anton Yarope	Bundi LLG	Yate Clan ILG FMA Secretary			X	
Melchior Yumave	Bundi LLG	Yate Clan ILG FMA Treasurer			X	
Albert Izomo	Bundi LLG	Community Leader			X	
Robert Gwane	Bundi LLG	Resource Owner			X	
Wala Kaul	Usino Bundi District Administration	District Lands Officer			X	
Banaga Bene	Madang Provincial Administration	District Mines			X	
David H. Philkasim	Usino LLG	Land Mediator			X	
Richard Khav	Arakaba LLG	Aiome Community Rep			X	
Cecilia Angia	Bundi LLG	Women's Rep.			X	
John Yama	Bundi LLG	Brahman Manager			X	
John Asse	Bundi LLG	Brahman Local Leader			X	
Marcus Onga	Nahu Rawa LLG	Ward Member			X	
Bufunge Esoke	Nahu Rawa LLG	Ward Member			X	
Genesius Yaka	Nahu Rawa LLG	Ward 4 Member			X	
Andrew Sangi	Usino LLG	Ward 15 Member			X	
Desline Gaga	Bundi LLG	Education			X	
Pius Sanam	Brahman	Local Resource Owner			X	
Antonia Kumbukia	Bundi LLG	Women's Group (Yandera)			X	
Lambert Wagi	Bundi LLG	Brahman Stn Mechanic			X	
Joseph Tonfina	Bundi LLG	Brahman Health Centre Board Chairman			X	
Suckling Gi	Middle Ramu District Administration	Program Manager – Community Development			X	
John Gomorai	Bundi LLG	Ward 21 Member			X	

Name	Organization	Position	Workshop #1	Workshop #2	Workshop #3	Workshop #4
Pauline Tege	Bundi LLG	Observer			X	
Cathy Moru	Bundi LLG	Women's Group			X	
Joseph Yuara	Brahman	Church Pastor			X	
Arthur Angiva	Brahman	Observer			X	
Willie Ulanai	Madang Government	Driver			X	
Albert Yuara	Brahman	Village Leader			X	
Cyril Tapasia	Brahman	Village Leader			X	
Wences Magun	Makata Community Based Organisation	Coordinator				X
Peter A. Nombo	Saidor LLG	Farmer				X
Frank Agaru	PNG Forest Authority	Aid Coordinator				X
Dick Silandu	Madang Provincial Administration	Project Manager – Natural Resources				X
Kris Sengo	Sumkar District Administration	A/Deputy District. Administrator				X
Kelly Kalit	The Nature Conservancy (TNC)	Director – Government Relations				X
Gary Miller	WWF	Interim Country Manager, PNG				X
Markus Kachau	Madang Provincial Administration	Director Health				X
Francis Irara	Madang Provincial Administration	Director – Natural Resources				X
Peter Torot	Madang Provincial Administration	Director – Local Level Affairs				X
Ailai Valaunia	Madang Provincial Administration	Provincial Village Court Officer				X
Martin Hanibal	Raicoast District Administration	District Administrator				X
Moses Sariki	Madang Provincial Administration	Director Education				X

Name	Organization	Position	Workshop #1	Workshop #2	Workshop #3	Workshop #4
Mary Lilih	Madang Provincial Administration	Agriculture A/Assistant Director				X
Rama Marisan	Madang Deputy Governor's office	Deputy Governor				X
Hilary Ambuk	Madang Deputy Governor's office	Project Officer				X
Simon Simoi	Madang Provincial Administration	Director Planning				X
Levi James	Madang Provincial Administration	Admin. Officer				X
Frederick Doli	Madang District Administration	Deputy District Administrator				X
Fr. Arnold Warangina	Ramu Block 2	Spokesman				X
Chris Torot	NEF Madang Provincial Administration	Executive Officer PCMC				X
Rudolph Mongallee	Madang Provincial Administration	Assistant Director-Disaster				X
Hood Kasas	Madang Provincial Administration	Works - A/ Director				X
Galun Kasas	Madang Provincial Administration	Deputy Provincial Administrator				X
Jimmy Ugiro	Usino-Bundi District Administration	District Administrator				X
Father Itzo	Catholic Church	Parish Priest		X		X
Ben Gewa	Niugini Binatang Research	Research Officer				X
John Simoi	Madang Civil Society Organisation Forum	CBO Member		X		X
Total number per Workshop			**37**	**55**	**85**	**51**

Annex 2: Locally Mapped features

Mapcode	Description	Mapcode	Description	Mapcode	Description
1	Logging - current	50	Mission Stations	99	Rural Banking Service
2	Logging - expired TRP/FMA	51	Bible translation centre	100	Coconut Blight
3	Logging - proposed TRP/FMA	52	Cemetary	101	LLG Station - Proposed
4	Forest planation / reforestation	53	Sacred Sites / Ples Tambu	102	Walkabout Sawmill
5	Forest - virgin untouched	54	WWII wrecks	103	Illegal rural settlements
6	Bamboo forest	55	Public park	104	Cash Crop - Coffee
7	Balsa woodlots	56	Guesthouse	105	Community Carbon Accounting
8	Veneer mill - proposed	57	Surfing site	106	Fruit and Veggie farming
9	Mining - current	58	Grasslands	107	Tourist tracks
10	Mining - proposed	59	Mangrove	108	Ward Boundary
11	Mining - small scale alluvial	60	Swamps	109	Ward - Proposed
12	Deep sea bed mining area - proposed	61	Sago palm area / swamp	110	Village court
13	Palm Oil - proposed	62	Lagoons/Bays	111	Recreational Area
14	Palm Oil - existing	63	Coral reef	112	Beetle Nut Farm
15	Industrial area - PMIZ	64	Fishing zones - marine	113	Foot Bridge
16	Industrial area - Basamuk	65	Water catchment	114	Bird Sanctuary
17	Sustainable development centre (Community Centre) - proposed	66	Fresh water lake	115	Hunting Zone
18	Conservation Area - Marine	67	Waterfalls	116	Limestone
19	Conservation Area - Marine - proposed	68	Caves	117	Pandanus - Karuka
20	Conservation Area - Terrestrial	69	Rivers - big	118	Pandanus - Marita
21	Conservation Area - Terrestrial - proposed	70	Rivers - small	119	Spice Project - Cardomon - expired
22	Wildlife Mngt Area (WMA)	71	Swimming holes	120	Deep sea tailing
23	Cassowary habitat	72	Reservoir / water supply	121	Slurry pipeline
24	Birds of Paradise display site	73	Hydro electric power - proposed	122	Wharf - existing
25	Cus Cus habitat	74	Gardens	123	Reforestation - proposed
26	Tree Kangaroo habiat	75	Crocodile farms	124	Lake
27	Turtle nesting beach - marine	76	Cattle farm / Pig farm / Chicken farm	125	Gas Field
28	Bower bird habitat	77	Fish farm/pond	126	Gas Field outlet
29	Villages (missing names/location)	78	Rice farm - proposed	127	Proposed container depot

30	Resettlement area (from natural disaster)	79	Cash crops - cocoa	128	Police Station - Proposed
31	Resettlement area (Manam care centers)	80	Cash crops - coconut	129	Apple development project - Proposed
32	Illegal urban settlements	81	Cash crops - Vanilla	130	Commercial centre - Proposed
33	External land boundary	82	Introduced crops	131	Bridge - Proposed
34	Electoral boundary - proposed	83	Invasive species affected areas	132	Turtle nesting beach - freshwater
35	State land / Govt land	84	BCS affected areas	133	Fishing zone - freshwater
36	Primary School (E/T/HS)	85	Rice mill - proposed	134	Industrial Area
37	Aid Post	86	Disaster affected area		
38	Health Centre	87	Research sites		
39	Lighthouse	88	Certified Community Forest		
40	Police Stations	89	Rundown Government Station		
41	Markets	90	Geothermal station - Proposed		
42	Shopping centre	91	Fish Aggregation Devise (FADs)		
43	Digicell tower	92	Dugong Habitat		
44	FM Station transmitter - proposed	93	Health Post - Proposed		
45	Airstrip	94	Township - Proposed		
46	Airport - proposed	95	District Hospital - Proposed		
47	Wharf - proposed	96	Roads - existing but not on map		
48	Roads - proposed	97	Cultural Centre - Proposed		
49	Bridge	98	National Highway - Proposed		

Annex 3: Target Table

Features with targets other than 17% have been highlighted.

Feature Name	Total area	Target (%)	Target (ha)
High refugia	295,200	20%	59,040
Medium refugia	1,203,100	10%	120,310
Medium biomass	878,000	10%	87,800
High biomass	599,600	20%	119,920
Mangrove	1,244	50%	622
Mixed forest - Coastal Flats	1,659	17%	282
Mixed forest - Wetlands	6	17%	1
Forest with Casuarina equisetifolia - Coastal Flats	432	17%	73
Riverine mixed successions - Foothills	4,526	17%	770
Riverine mixed successions - Volcanic Ridges	148	17%	25
Riverine successions with Casuarina grandis - Alluvial Plains	883	17%	150
Riverine successions with Casuarina grandis - Foothills	4	17%	1
Mixed swamp forest - Alluvial Plains	39,969	17%	6,795
Mixed swamp forest - Coastal Flats	368	17%	63
Mixed swamp forest - Coastal Plains	1,971	17%	335
Mixed swamp forest - Foothills	20	17%	3
Mixed swamp forest - River Valleys	16,660	17%	2,832
Mixed swamp forest - Wetlands	33,531	17%	5,700
Volcanic successions - Foothills	535	17%	91
Volcanic successions - Volcanic Ridges	863	17%	147
Medium crowned forest LT 1000m uplands -	1,363	17%	232
Medium crowned forest LT 1000m uplands - Alluvial Plains	30,461	17%	5,178
Medium crowned forest LT 1000m uplands - Coastal Flats	11,686	17%	1,987
Medium crowned forest LT 1000m uplands - Coastal Plains	165,508	17%	28,136
Medium crowned forest LT 1000m uplands - Foothills	348,499	17%	59,245
Medium crowned forest LT 1000m uplands - Lakes	50	17%	8

Feature Name	Total area	Target (%)	Target (ha)
Medium crowned forest LT 1000m uplands - Limestone Ridges	66,918	17%	11,376
Medium crowned forest LT 1000m uplands - Other Ridges	138,952	17%	23,622
Medium crowned forest LT 1000m uplands - River Valleys	761	17%	129
Medium crowned forest LT 1000m uplands - Ultrabasic Ridges	7,349	17%	1,249
Medium crowned forest LT 1000m uplands - Volcanic Ridges	100,343	17%	17,058
Medium crowned forest with Araucaria common LT 1000m uplands - Alluvial Plains	1,649	17%	280
Medium crowned forest with Araucaria common LT 1000m uplands - Coastal Plains	2,926	17%	498
Medium crowned forest with Araucaria common LT 1000m uplands - Foothills	35,079	17%	5,963
Medium crowned forest with Araucaria common LT 1000m uplands - Other Ridges	7,737	17%	1,315
Medium crowned forest with Araucaria common LT 1000m uplands - Ultrabasic Ridges	3,150	17%	535
Medium crowned depauperate/damaged forest LT 1000m uplands - Alluvial Plains	34,122	10%	3,412
Medium crowned depauperate/damaged forest LT 1000m uplands - Coastal Flats	79	10%	8
Medium crowned depauperate/damaged forest LT 1000m uplands - Coastal Plains	337,491	10%	33,749
Medium crowned depauperate/damaged forest LT 1000m uplands - Foothills	29,681	10%	2,968
Medium crowned depauperate/damaged forest LT 1000m uplands - Other Ridges	0	10%	0
Medium crowned depauperate/damaged forest LT 1000m uplands - River Valleys	7,131	10%	713
Medium crowned depauperate/damaged forest LT 1000m uplands - Wetlands	14,272	17%	2,426
Small crowned forest LT 1000m uplands - Foothills	4,993	17%	849
Small crowned forest LT 1000m uplands - Lakes	238	17%	40
Small crowned forest LT 1000m uplands - Volcanic Ridges	2,802	17%	476
Small crowned forest GT 1000m - Alpine Peaks	32,437	17%	5,514
Small crowned forest GT 1000m - Coastal Plains	291	17%	49
Small crowned forest GT 1000m - Foothills	572	17%	97
Small crowned forest GT 1000m - Limestone Ridges	93,944	17%	15,970
Small crowned forest GT 1000m - Other Ridges	216,181	17%	36,751
Small crowned forest GT 1000m - Ultrabasic Ridges	7,475	17%	1,271
Small crowned forest GT 1000m - Volcanic Ridges	80,110	17%	13,619
Small crowned forest with conifers GT 1000m - Alpine Peaks	1,455	17%	247

Feature Name	Total area	Target (%)	Target (ha)
Small crowned forest with conifers GT 1000m - Limestone Ridges	4,080	17%	694
Small crowned forest with conifers GT 1000m - Other Ridges	11,184	17%	1,901
Small crowned forest with conifers GT 1000m - Volcanic Ridges	659	17%	112
Small crowned forest with Nothofagus GT 1000m - Alpine Peaks	2,187	17%	372
Small crowned forest with Nothofagus GT 1000m - Limestone Ridges	11,741	17%	1,996
Small crowned forest with Nothofagus GT 1000m - Other Ridges	16,088	17%	2,735
Small crowned forest with Nothofagus GT 1000m - Volcanic Ridges	4,885	17%	830
Very small crowned forest GT 1000m - Other Ridges	790	17%	134
Very small crowned forest GT 1000m - Volcanic Ridges	11	17%	2
Very small crowned forest with Nothofagus GT 1000m - Other Ridges	434	17%	74
Very small crowned forest GT 3000m - Alpine Peaks	15,796	17%	2,685
Very small crowned forest GT 3000m - Limestone Ridges	11	17%	2
Very small crowned forest GT 3000m - Other Ridges	284	17%	48
Very small crowned forest GT 3000m - Volcanic Ridges	28	17%	5
Large to medium crowned forest LT 1000m plains and fans - Alluvial Plains	6,162	34%	2,095
Large to medium crowned forest LT 1000m plains and fans - Coastal Plains	4,233	34%	1,439
Large to medium crowned forest LT 1000m plains and fans - Foothills	627	34%	213
Large to medium crowned forest LT 1000m plains and fans - River Valleys	3,083	34%	1,048
Open forest LT 1000m plains and fans - Alluvial Plains	54,500	17%	9,265
Open forest LT 1000m plains and fans - Coastal Flats	526	17%	89
Open forest LT 1000m plains and fans - Coastal Plains	9,802	17%	1,666
Open forest LT 1000m plains and fans - Foothills	413	17%	70
Open forest LT 1000m plains and fans - River Valleys	62,543	17%	10,632
Open forest LT 1000m plains and fans - Wetlands	18,653	17%	3,171
Small crowned forest LT 1000m plains and fans - Alluvial Plains	65,562	17%	11,145
Small crowned forest LT 1000m plains and fans - Coastal Plains	23,689	17%	4,027
Small crowned forest LT 1000m plains and fans - Foothills	1,318	17%	224
Small crowned forest LT 1000m plains and fans - River Valleys	2,219	17%	377

Feature Name	Total area	Target (%)	Target (ha)
Small crowned forest LT 1000m plains and fans - Wetlands	1,589	17%	270
Grassland - Alluvial Plains	11,042	17%	1,877
Grassland - Coastal Flats	2,525	17%	429
Grassland - Coastal Plains	19,583	17%	3,329
Grassland - Foothills	5,765	17%	980
Grassland - Other Ridges	1,588	17%	270
Grassland - River Valleys	3,870	17%	658
Grassland - Wetlands	1,829	17%	311
Alpine grassland - Alpine Peaks	4,302	34%	1,463
Alpine grassland - Limestone Ridges	54	34%	18
Alpine grassland - Other Ridges	162	34%	55
Grassland with some forest - Alluvial Plains	12,331	17%	2,096
Grassland with some forest - Coastal Flats	5,562	17%	946
Grassland with some forest - Coastal Plains	34,668	17%	5,894
Grassland with some forest - Foothills	12,396	17%	2,107
Grassland with some forest - Limestone Ridges	1	17%	0
Grassland with some forest - Other Ridges	8,346	17%	1,419
Grassland with some forest - River Valleys	222	17%	38
Grassland with some forest - Volcanic Ridges	1,349	17%	229
Grassland with some forest - Wetlands	1,986	17%	338
Subalpine grassland - Alpine Peaks	67	34%	23
Subalpine grassland - Other Ridges	774	34%	263
Grassland reverting to forest - Alluvial Plains	822	17%	140
Grassland reverting to forest - Coastal Plains	5,089	17%	865
Riverine successions dominated by grass - Alluvial Plains	2,785	17%	473
Riverine successions dominated by grass - Coastal Plains	995	17%	169
Riverine successions dominated by grass - Foothills	659	17%	112
Riverine successions dominated by grass - River Valleys	4,709	17%	801

Feature Name	Total area	Target (%)	Target (ha)
Riverine successions dominated by grass - Wetlands	430	17%	73
Swamp grassland - Alluvial Plains	3,109	17%	529
Swamp grassland - Coastal Flats	116	17%	20
Swamp grassland - Coastal Plains	1,347	17%	229
Swamp grassland - River Valleys	4,978	17%	846
Swamp grassland - Wetlands	16,723	17%	2,843
Volcanic successions dominated by grass - Foothills	577	17%	98
Volcanic successions dominated by grass - Volcanic Ridges	1,372	17%	233
Lakes and larger rivers	23,731	17%	4,034
Herbaceous swamp - River Valleys	26	17%	4
Herbaceous swamp - Wetlands	4,092	17%	696
PNGRIS agricultural land use	390,441	0%	0
Scrub - Foothills	146	17%	25
Volcanic successions dominated by scrub - Foothills	955	17%	162
Swamp woodland - Alluvial Plains	11,523	17%	1,959
Swamp woodland - Coastal Flats	2,688	17%	457
Swamp woodland - Coastal Plains	5,663	17%	963
Swamp woodland - Foothills	53	17%	9
Swamp woodland - River Valleys	15,346	17%	2,609
Swamp woodland - Wetlands	50,729	17%	8,624
Forest virgin untouched	193,957	50%	96,978
Bamboo forest	2,853	17%	485
Sago palm area swamp	65,224	17%	11,088
Cassowary habitat	11,037	50%	5,519
Birds of Paradise display site	545	50%	273
Cus Cus habitat	25,502	50%	12,751
Tree Kangaroo habitat	29,553	50%	14,776
Turtle nesting beach marine	223	50%	111

Feature Name	Total area	Target (%)	Target (ha)
Bower bird habitat	49,257	50%	24,628
Turtle nesting beach freshwater	76	50%	38
Lagoons and Bays	829	17%	141
Coral reef	4,433	50%	2,217
Fishing zones - marine	78,372	17%	13,323
Fishing zone - freshwater	1,616	17%	275
WWII wrecks	5,440	17%	925

Annex 4: Memorandum of Understanding (MOU)

The Nature Conservancy
Protecting nature. Preserving life.

The Nature Conservancy
Papua New Guinea Program

Madang Provincial Government
Office of the Governor

Civil Society Organization
Forum of Madang

A MEMORANDUM OF UNDERSTANDING (MOU)

BETWEEN

MADANG PROVINCIAL GOVERNMENT (MPG),
P O Box 2139,
Madang 511
Madang Province

AND

CIVIL SOCIETY ORGANISATION (CSO) FORUM OF MADANG
P O Box 217
Madang 511
Madang Province

AND

THE NATURE CONSERVANCY (TNC),
PNG Program
P O Box 2750,
Boroko
National Capital District

SUSTAINABLE COMMUNITY RESOURCE MANAGEMENT, CLIMATE CHANGE & REDD+ MODEL PROJECTS IN MADANG PROVINCE

2013 – 2018

The Nature Conservancy
Protecting nature. Preserving life.

The Nature Conservancy Papua New Guinea Program	Madang Provincial Government Office of the Governor	Civil Society Organization Forum of Madang

A MEMORANDUM OF UNDERSTANDING (MOU)

BETWEEN

MADANG PROVINCIAL GOVERNMENT (MPG),
P O Box 2139,
Madang 511
Madang Province

AND

CIVIL SOCIETY ORGANISATION (CSO) FORUM OF MADANG
P O Box 217
Madang 511
Madang Province

AND

THE NATURE CONSERVANCY (TNC),
PNG Program
P O Box 2750,
Boroko
National Capital District

SUSTAINABLE COMMUNITY RESOURCE MANAGEMENT, CLIMATE CHANGE & REDD+ MODEL PROJECTS IN MADANG PROVINCE 2013 – 2018

1. **PARTIES**:

The Parties to this Agreement are The Madang Provincial Government (MPG), The Madang Civil Society Organization (CSO) Forum, and, The Nature Conservancy (TNC).

1.1 **The Madang Provincial Government** is established as the second tier of Government for the 600,000 plus people of Madang Province. The Provincial Government System in Papua New Guinea (PNG) was established by law, within and under the Organic Law on Provincial Government and Local Level Government (OLPG&LLG) 1995. Madang is one of the 22 provinces in PNG, and has 6 districts and 19 Local Level Governments (LLG).

1.2 The **Civil Society Organization Forum of Madang** is a formally registered umbrella organization for international non- government organization, (NGO), national NGO, community based organization (CBO), women, church and community enterprise groups established in Madang Province. The mission of CSO Forum is to advocate for constructive cultural and sustainable development for Madang people/province.

1.3 **The Nature Conservancy** ("TNC") is an international non-profit, non-governmental organization whose mission is to preserve plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

2. **AUTHORITY**

2.1 Madang Provincial Government as a mandated Government is required under the Organic Law on Provincial and Local level Government (OLPG&LLG 1995) to develop and implement the Provincial Plan and its Priorities, and therefore recognizes that;

- the **bottom up planning** by local people through the development of wards, LLG, and the District Plan is integrated through its administrative planning process
- the social, economic, political, spiritual, infrastructure, and environmental development will only occur through wider and proper **consultation and participation by people**
- **sustainable utilization of all the natural resources** within Madang Province are sustainably **managed for the public benefit**
- **working collaboration** between non-government partners, government agencies, multi and bilateral organizations' is a very important factor in **effective delivery of goods and services to people**

3. **MUTUALITY OF INTEREST**

Madang Provincial Government, CSO Forum and TNC, all share an interest in the conservation and effective management of the natural resources and rich biodiversity of both the flora and fauna. The Provincial Government is required under the OLPG&LLG 1995 to plan, develop and

implement the Provincial Plan, while supporting Districts and LLG to formulate, develop and implement wards, LLG, Districts and Provincial Plans in Madang Province. To this end, MPG, CSO Forum and TNC shares interests to implement the Provincial Spatial Planning Project, that will enable sustainable community resource management in which the outcome will assist to integrate climate vulnerable areas, high biodiversity areas, and REDD+ programs into the government planning from the ward, LLG, District and to the Provincial level.

4. STATEMENT OF PURPOSE

This MOU is between Madang Provincial Government (MPG), Civil Society Organization (CSO) Forum of Madang, and The Nature Conservancy (TNC), building on our history of close partnership and cooperation. It is intended to provide a framework and sets out areas of cooperation and agreed mechanisms to facilitate the processes and activities pursuant to the development and implementation of the sustainable development plan for Madang Province. This partnership will be further complemented through the USAID funded Lowering Emissions in Asia's Forests (LEAF) program, with which TNC has developed a separate MOU outlining collaborative efforts focused on REDD+ in PNG.

It is not intended to limit the activities or flexibility of either party, but is meant to ensure that existing areas of partnership and cooperation continue, while new initiatives are developed in a way that triggers positive approach to the sustainable development planning and development for the province. It does not restrict either party from entering into other partnerships or working closely with others. Furthermore, it does not limit the existing routine roles and responsibilities of all parties.

This MOU and work plan does not create any financial obligations on the part of the Conservancy. Any financial obligations shall arise only pursuant to negotiation of and entry in to a subsequent written grant agreement or agreements.

5. OBJECTIVES/GOALS

This MOU is intended to bind the parties to collaborate effectively, and in great partnership to be able to share resources to support implementation of the Spatial Planning Project to be conducted for Madang at the provincial scale. The outcome of the spatial planning project will assist MPG to make wise decision on planning, programming and implementation of sustainable community resource management, promote climate change adaptation and mitigation actions, promote village REDD+ models, and ultimately the implementation of Provincial Sustainable Development Plan for Madang Province for five years. The Agreement binds the parties to specific aims, expectations and deliverables. Therefore, MPG, CSO Forum and TNC desire to work together to:

5.1 Implement specific actions identified in the work plan attached as Annexes 5
5.2 Oversee the effective implementation of the Spatial Planning project
5.3 Advocate for climate change adaptation and mitigation at the community and district level

5.4 Advocate for effective forest, land, water catchment and marine resources to be managed at the community level through sustainable community resource management
5.5 Advocate for community REDD+ models to be developed and be replicated

6. Responsibilities of the Parties

MPG, CSO Forum and TNC specific aims, expectation, and responsibilities are outlined in Annex 1, Annex 2, Annex 3 and 4 respectively.

7. Affectivity and Amendments

This MOU shall take effect upon signing by the three Parties and shall remain in effect for a period of five (5) years from that date. The MOU will be renewed at the end of this period by mutual agreement by three Parties and signature by three Parties.

The MOU may be amended at any time and for any reason by mutual agreement by all Parties and signature by all Parties. Any Party may terminate this MOU at any time and for any reason by giving thirty (30) days prior written notice to the other Parties.

8. Dispute Resolution

If any disputes arise between the parties relating to this MOU, the parties shall attempt to resolve the dispute through good faith discussions either by themselves or through the assistance of an independent mediator.

9. Risk and Responsibility

Each Party agrees that it will be responsible for its own acts and the results thereof, and shall not be responsible for the acts of the other Parties or the results thereof. Each Party, therefore, agrees that to the extent it may legally do so, it shall assume all risk and liability to itself, its officers, employees or agents, under this MOU, for any claims, damages, losses, judgments, expenses or other costs including litigation costs and attorney's fees, arising out of, in connection with, or resulting at any time from any and all causes due to any act or acts, negligence, or failure to exercise proper precautions, of or by itself, or its own officers, employees or agent, in the performance of this MOU.

10. SIGNATURES

By: _____

Title: Honourable Jim Kas, MP
Governor for Madang Province
Madang Provincial Government

By: _____

Title: Mr Peter Moikia
Chairman
Civil Society Organization Forum

By: _____

Title: Mr Francis Hurahura
PNG Country Director
The Nature Conservancy

Witnessed this day

By: _____

Title: Mr Galun Kasas
Deputy Administrator, Communnity & Government Affairs
Madang Provincial Administration

This MOU is signed on the 27th day of May 2013, at Jais Aben Resort, in Madang, Madang Province. Papua New Guinea.

ANNEX 1: Madang Provincial Government Terms Of Reference (TOR) and Responsibilities

Madang Provincial Government will:

1. Provide the Political will and leadership required to support public private partnership, and in facilitating this MOU

2. Honour its commitment made under this MOU for a period of five years, but this MOU is to be reviewed annually commencing in May 2014.

3. Provide funding, as referred to in clause 4 below, in the Annual Provincial Government Budget, and/or from the Provincial Support Improvement Program (PSIP) to commence in 2013, and for subsequent years until 2018.

4. A funding of K400,000.00 will commence in 2013 to support spatial planning exercises; climate change adaptation and mitigation community initiatives, as well as community forest and marine management programs. The funding for 2013 is to be facilitated in this manner;

    a. The funding of K400,000.00 is for use in the 2013 financial year only
    b. Funds will be managed by the provincial government through the office of the Regional MP, and Provincial Treasury with support from Provincial Finance office
    c. Out of the K400,000.00, a total of K100,000.00 will be expended by CSO Forum as a partner to this MOU for the purpose of implementation of the proposed Provincial Legislation on Environment and Conservation
    d. Out of the K400,000.00, a total of K200,000.00 will be expended for expenses relating to the three phase workshops as proposed in the work plan in Annex 4
    e. Out of the K400,000.00, a total of K100,000.00 will be expended on local CBO partners, the Local level Government (LLG), and community groups to support community forest and marine conservation, sustainable development programs, and community adaptation and mitigation programs
    f. Payment will be upon invoices, sent by service providers, as well as parties to this MOU, to the Office of the Regional MP.
    g. Invoices from services providers or parties to this MOU must be related to the work plan as attached in Annex 5 of this MOU.
    h. Amount in figures for the Annual Funding of the MOU from 2014 to 2018 will depend on the six monthly briefs and progress report, with partners to this MOU submission of annual budget to Madang Provincial Government beginning in November 2013, and thereafter until November 2017.

5. The Office of the Regional MP/ Governor is responsible for Coordination of this funding, and payments made in relation to activities related to the purpose of this MOU

6. Make the Connection and links through the provincial government structures to the Local Level Government, Ward Development Committee, and ward/community level

7. Support the existing appropriate government processes to enact appropriate policies on climate change, REDD+, sustainable development, eco systems approach to fisheries management, coastal zone management, protected areas, and locally managed areas

8. Review current environmental policies and legislations and Adhere to the existing processes and legislate appropriate Environment & Conservation Law for Madang Province

9. Provide assistance to obtain necessary spatial datasets from relevant PNG National Government offices (i.e. Department of Lands, PNG Forest Authority, Department of Environment and Conservation, and OCCD

10. Liaise with other relevant national, provincial, and local level government agencies for effective participation and support to the spatial planning exercises and other programs related to environment and conservation

11. Agree that the lead agency to lead the partnership, and coordinate on behalf of the Provincial Government/Administration is the Planning Division.

12. Identify provincial administration personnel to work with partners, and specifically TNC, who will build their capacity with GIS skills

ANNEX 2: Civil Society Organization (CSO) Forum Terms of Reference (TOR)

Civil Society Organization (CSO) Forum of Madang will:

1. Advocate for replication of best environment and sustainable development management practices to the higher legislative agencies

2. Advocate for Climate Change Adaptation and Coral Triangle Initiative programs within the Bismarck Sea provinces, and to the country level

3. Facilitate and advocate for consultation and meetings that will assist to make decisions, policies, and legislations that relate to environment and sustainable development

4. Advocate for "Environment Champion" at the LLG and Provincial level through the CSO government representative in the Provincial Assembly

5. Facilitate and engage other development partners to support Spatial planning exercises, and community conservation, climate change adaptation and mitigation and other environment programs for Madang province

6. Take the lead and engage in public private partnerships (PPP) with other development partners to support for funding and other resources to implement work plan related to the term of this MOU

7. Coordinate effective communication and liaison support amongst relevant provincial assembly members and local level government assembly members in the six Districts of Madang Province

8. Make relevant submissions and policy papers to educate the Provincial Government assembly members on Madang Provincial Law, and advocate for endorsement at the provincial government level through the CSO Forum Government representative

9. Engage CSO Forum members to participate in the spatial planning project, community climate change and adaptation programs, village REDD+ programs, and community conservation and sustainable development programs

10. Facilitate six monthly progress review meeting by all parties to this MOU

11. Facilitate the **formulation and enactment** of relevant and appropriate Provincial Bills, Provincial Policies and Legislation amendments with the Provincial Government.

12. Advocate for **Endorsement and implementation** of provincial legislations and provincial policies through the Provincial legislature with the support of the CSO Forum Representative

ANNEX 3: The Nature Conservancy (TNC) Terms of Reference (TOR)

The Nature Conservancy will:

a. Take Lead and facilitate the Spatial Planning Exercise for Madang Province with relevant partners
b. Meet the costs of its staff that spent time working on activities related to the purpose of this MOU
c. Meet the costs of partners invited at TNCs invitation to implement the objectives and TOR of this MOU
d. Share relevant and useful data sets it has available
e. Provide GIS products such as:
    a. Madang Provincial Map highlighting major areas of importance for biodiversity conservation, areas for human settlement, and areas for infrastructural and economic development
    b. District Maps of the six Districts of Madang: Madang, Sumkar, Bogia, Rai Coast, Usino Bundi and Middle Ramu Districts
    c. Other feasible and practical GIS products that may be relevant and useful to the Provincial Government
f. Provide a summary to the Governor's office and the lead agency of the Provincial Administration, the Planning Division, and other relevant administration office after each of the three workshops, and full report after final workshop

g. Provide to the Governors' Office, Planning Division and other relevant division, the narrative report of the spatial planning project, and make recommendations on best way forward

h. Provide as far as practical technical expertise and necessary advice on community conservation, climate change adaptation and mitigation, REDD+ and sustainable resource management programs when required and requested by the partners of this MOU

i. Facilitate and support capacity building for relevant provincial administration staff, and partners, with required GIS skills

j. Facilitate and Coordinate the Learning and Training amongst CSO members through the Bismarck Sea Learning & Training Network (BSLTN), and facilitate BSLTN activities in Madang in relation to implementation of the objectives and TOR of this MOU

k. Support with coordinating activities related to Bismarck Sea Governors Learning & Development Network (BSGLDN), to replicate the spatial planning project to other Bismarck Sea Provinces.

ANNEX 4: Joint Responsibilities / Joint Terms of References of all Parties

i. Communicate effectively with each member of the Party when the need arises

ii. Communicate, Coordinate and Collaborate on activities related to this MOU on a regular basis through effective links to the Office of Planning Division, and Office of the Regional MP / Governor for Madang

iii. Submit 6 monthly, and/or progressive reports to the lead agency as required

iv. Provide required and requested reports to parties of the MOU if/when requested

v. Provide joint reports to the Provincial Management Team (PMT) when requested

vi. Support the Provincial Government to formulate policies if /when requested

vii. Stage consultative forums with agenda related to the purpose of this MOU when requested

viii. Collaborate, Support and facilitate awareness on climate change, sustainable forest and marine management, and biodiversity conservation to local communities in Madang province when requested

ix. Support with building capacity of local community based groups with agenda related to the purpose of this MOU when requested

x. Meet regularly as a group per the TOR of this MOU to formulate work plan, and budget when requested

xi. Facilitate support and coordination with the Bismarck Sea Governors Learning & Development network to foster replication of spatial planning project, and implementation of climate change and coral triangle initiative programs in the Bismarck Sea Provinces

ANNEX 5: WORK PLAN FOR SPATIAL PLANNING, FORESTRY & CLIMATE CHANGE

May 2013 – May 2014

Key Objectives

a. Collaborate with Lowering Emissions in Asia's Forests (LEAF) for carbon accounting,
b. "Partners with Melanesia" will complete a Participatory 3D Model (P3DM) in part of Bogia District.
c. Improve capacity of partners in PNG to carry work forward and implement conservation priorities.
d. During workshops engage with participants to define key products (maps, guidebooks, etc) they will require to use in all levels of planning.
e. Assessment of high carbon and high biodiversity areas, and appropriate areas for logging and other land uses in Madang, PNG
f. Key decision makers contacted and informed about the results and implications of the assessment in Madang Province, PNG
g. Collaborate in partnership with relevant partners and Provincial Government to implement climate change awareness, and coral triangle initiative (CTI) in Madang Province
h. Building capacity of local community based partners to enable community resource management planning and community adaptation and mitigation programs

Objective/Main Activity	Activities	Date & Location	Responsible	Costs PGK 000
Introduce project, methods, partners, schedule	Provincial level participatory mapping	27th – 31st May 2013 Madang town	TNC, LEAF, MPG, MCSO	100,000
Focus on Bogia, Sumkar and Madang districts	Participatory mapping at districts/ LLG scale. Complete P3DM	22nd – 26th June 2013 Bogia district headquarter	TNC,LEAF, PwM, MPG, MCSO	125,000
Focus on Middle Ramu, Usino/Bundi, Rai Coast districts/ LLGs	Participatory mapping at districts/ LLG scale.	2nd – 6th Sept 2013 District headquarter, Walium	TNC,LEAF,MPG,CSO	75,000
Present draft reports/ products	Present draft products for comments and finalisation	11th – 15th Nov 2013 Madang town	TNC,LEAF,MPG, MCSO	50,,000
Review and finalise Madang provincial Forest Law	Law on Sustainable resource management enacted by Madang	Oct 2013	TNC, MPG, CSO	50,000

	Provincial Assembly			
Implementation	Capacity building (ie; Technical trainings, GIS), Advocacy & Awareness, Key products, Reporting	2014	MPG, TNC,MCSO	100,000
Advocacy, Awareness and Consultation / Provincial Law Consultation	Partnership & Consultation with local community partners & LLG	June 2013 – May 2014	CSO Forum	100,000
Community Resource Management Program, Community REDD+, LMMA	Community REDD+ project documented, Community resource management plan	July 2013 – June 2014	CSO Forum	100,000
TOTAL				**700,000**

Annex 5: Maritime Governors Declaration

PAPUA NEW GUINEA's 1st MARITIME GOVERNORS' ROUND TABLE
"MADANG DECLARATION"

We, the six maritime Governors on behalf of 15 maritime Governors, attending the First Maritime Governors' Round Table: *Coming Together for Marine Governance* on 6 November 2013 in Madang:

1. **Recognize** and appreciate the importance of our coastal and marine resources to the livelihood of our coastal and island communities;
2. **Acknowledge** our coastal and marine resources are vulnerable to man-made and natural forces;
3. **Commit** to protect and sustainably manage our provincial and national coastal and marine resources through strong political will and by applying best practices;
4. **Commit** to raise the priority of coastal and marine issues at the provincial and national levels to achieve their appropriate level of support and attention;
5. **Support** the Minister for Environment and Conservation to create the Conservation and Environment Protection Authority, including the Protected Area sustainable financing mechanism and the biodiversity trust fund initiative;
6. **Endorse** the PNG Marine Program on Coral Reefs, Fisheries and Food Security 2014-2017;
7. **Commit** to serving as role models and partners by incorporating relevant actions of the PNG Marine Program 2014-2017 into our Provincial Development Plans;
8. **Task** our Provincial Administrators to incorporate activities under the PNG Marine Program into the Provincial Development Plans by defining mechanisms, roles and responsibilities horizontally
9. **Agree** to seek a joint funding mechanism that continues the partnerships between maritime provinces and implementing partners;
10. **Agree** to have an annual Maritime Governors Round Table, continuing in 2014 to be co-hosted by Milne Bay Provincial Government and partners;
11. **Resolve** to prioritize special and valuable geographies in our provinces for conservation and resource management as a start to the development of marine spatial planning;
12. **Resolve** to work collaboratively with national government agencies to improve monitoring and surveillance of marine and coastal activities - particularly illegal, unreported and unregulated fishing (IUU);
13. **Resolve** to work with national government agencies to define a revenue generating mechanism for users of coastal waters (e.g., shipping lanes, cruise ships, ports, mining, fishing) to manage the interests of, and the risks to the province and its communities;
14. **Resolve** to work with relevant national government agencies to make mining safer for our marine and coastal ecosystems and communities, while increasing the benefit to people of PNG;
15. **Encourage** the National Government to draft or amend legislation to mitigate the impact of Seabed Mining based on mine-impact studies, and the review of the Mining Act of 1992 before approving full-scale seabed mining;

16. **Resolve** to increase the returns from mining activities to the people of Papua New Guinea from the current rate of 2% to be 10% or more, consistent with global standards, and encourage an independent analysis to define appropriate rates; and

17. **Welcome** the development of a new coastal partner organization of the "Coastal Women's Leadership Forum" to work with us in implementing the PNG Marine Program for women and by women, launched by the spouses of the Maritime Governors.

Furthermore, we call on our CTI National Coordination Committee, through the leadership of the Department of Environment and Conservation, the National Fisheries Authority, the Office of Climate Change and Development and the Department of Provincial and Local Government Affairs, to:

1. **Coordinate**, support and vertically integrate our actions under the PNG Marine Program;
2. **Conduct** intensive information, education and communication campaigns about coastal resource management and the PNG Marine Program, its benefits, best practices and actions;
3. **Conduct** a legislative review and assessment of all relevant national marine, coastal and related laws to determine priority action (such as amendment or enforcement);
4. **Mobilize** resources and channel funds directly to the provincial and local governments towards achieving the goals of the PNG Marine Program and to monitor our field implementation;
5. **Provide** guidance and technical inputs on how to access or develop alternative sources of income for coastal and island communities, and enforce coastal and fishery laws;
6. **Support** development of the technical capacities of provincial and local governments to undertake integrated coastal resource management, climate change, marine protected area management and ecosystem management;
7. **Invite** our partners to support our provincial activities in implementing our marine actions;
8. **Extend** our offer to the CTI-CFF Regional Secretariat and the CTI-CFF Local Government Network Secretariat (Philippines) to host the 2014 CTI-CFF Regional Local Government Network meeting.

Signed on 6 November 2013 in Madang, Madang Province by:

Madang Province

Hon. Jim Kas, MP
Governor

Autonomous Region of Bougainville

Hon. Joe Lera, MP
Governor

Central Province

Hon. Kila Haoda, MP
Governor

Milne Bay Province

Hon. Titus Philemon, MP
Governor

Oro Province

Hon. Garry Juffa, MP
Governor

Sandaun Province

Hon. Amkat Mai, MP
Governor

New Ireland Province

Dr. Bruce Harris
Chief Advisor to the Governor
On behalf of Rt. Hon. Sir Julius Chan GCL. GCMG. KBE. MP.