

National Action Program to Combat Land
Degradation

Republic of Palau

Koror, Palau
December 2004

Executive Summary

As a party to the United Nations Convention to Combat Desertification and Land Degradation (UNCCD) Palau is committed to combating land degradation not only on the national level, but also on the global level. Palau's work on this issue began many years ago, receiving a new impetus in the late 1990's with accession to UNCCD. In July of 1999, Palau ratified the UNCCD thus formalizing the work on land degradation in Palau. Since ratifying the convention, Palau has taken a number of actions and has implemented a number of activities to combat land degradation.

The project to develop this National Action Program (NAP) began in December of 2001 when Palau held its first National Awareness Seminar on Combating Land Degradation and Mitigating the Drought Effects in Palau. As a result of this seminar, the Office of Environmental Response and Coordination (OERC) developed a National Report to the UNCCD, which was completed and submitted in April of 2002. As follow up to that National Report, OERC, together with other key stakeholders, have been gathering information, conducting assessments, and analyzing key issues, which have lead to the development of this NAP.

The NAP is intended to be a working document. Already it has generated discussion that has led to the building of consensus on the major causes and consequences of land degradation in Palau. Furthermore, it has provided an enabling environment whereby a comprehensive framework was developed by an inclusive group of key stakeholders. This NAP will further guide the planning, implementing, and monitoring of land degradation and sustainable land management projects in Palau.

Acronyms

BOA	Bureau of Agriculture
BMR	Bureau of Marine Resources
BPOA+10	Barbados Plan of Action +10
CBO's	Community Based Organizations
CCD	Convention to Combat Desertification
CRE	Cooperative Research and Extension
DMNAP	Drought Mitigation National Action Plan
ENSO	El Niño Southern Oscillation
EQPB	Environmental Quality Protection Board
GDP	Gross National Product
GEF	Global Environmental Facility
GNI	Gross National Income
GO's	Government Organizations
MCA	Marine Conservation Area
MGD	Millennium Development Goal
NGO's	Non-Governmental Organizations
NAP	National Action Program
NBSAP	National Biodiversity Strategy and Action Plan
NCB	National Coordinating Body
NEPC	National Environmental Protection Council
NFP	National Focal Point
OERC	Office of Environmental Response and Coordination
OP	Operational Programme
PALARIS	Palau Automated Land Resource Information System
PCC	Palau Community College
PICRC	Palau International Coral Reef Center
PPLA	Palau Public Land Authority
SIDS	Small Island Developing States
SLM	Sustainable Land Management
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
USDA	United States Department of Agriculture
WSSD	World Summit on Sustainable Development

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1. Introduction

1.1 Background Information on UNCCD

Land degradation imposes an important constraint in achieving sustainable development. The World Summit on Sustainable Development (WSSD) recognized that the achievement of the Millennium Development Goal (MDG) of eradicating extreme poverty depends on tackling land degradation. Poverty in developing countries is often rural poverty, which means marginal lands, highly susceptible to land degradation.

Land degradation not only results in loss of productivity and reduced income, but also threatens the survival of communities and the nutritional status of populations as well as the food security of the nation. The negative impacts of land degradation undermine the structure and function of ecological systems. Land degradation often leads to soil and water resource degradation and a reduction in flora and fauna bioactivity. Changes in land cover and vegetation status contribute to climate change, as well as alter biodiversity and modify hydrological cycles. Land degradation is a problem that crosses geopolitical boundaries and must be dealt with in a holistic and integrated way. Fortunately, there are activities that can contribute to reversing land degradation trends and consequently natural recovery. The United Nations Convention to Combat Desertification (UNCCD) entered into force on December 26, 1996, with Palau ratifying the UNCCD in July of 1999. Originally, the Convention emphasized the need to coordinate research efforts and action programs for combating desertification and promoted a coordinated approach to managing dry-land ecosystems.

Realizing that prevention of desertification through land degradation mitigation and sustainable land management practices is critical, the CCD expanded the scope of its program to encompass activities to combat land degradation, making land degradation a Global Environmental Facility (GEF) focal area. Furthermore, the Second Assembly of the GEF designated land degradation, primarily desertification and deforestation, as a new focal area as a means to support the implementation of UNCCD, in October 2002. The GEF operationalized the aforementioned decision by approving a specific framework for intervention on sustainable land management (SLM) in May 2003. The main objective of this framework, as outlined in GEF Operational Programme 15 (OP15), is: “to mitigate the causes and negative impacts of land degradation on the structure and functional integrity of ecosystems through sustainable land management practices as a contribution to improving people’s livelihoods and economic well being”.¹ Under the operational program, countries are expected to address land degradation issues, using integrated and cross-sectoral approaches, within the framework of sustainable development at the local, national and/or regional level. This mandate has not only provided an incentive for countries to develop plans to prevent land degradation, but it has also provided a mechanism for development aid cash flow.

¹ GEF. 2003. Operational Programme on Sustainable Land Management (OP#15)

Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and major groups in every area in which humans impact on the environment. Chapter 12 of Agenda 21 lists seven specific program areas that countries can address in the management of fragile ecosystems, specifically in combating desertification and drought. Of the seven program areas the three areas relevant to Palau are:

1. (B) Combating land degradation through, *inter alia*, intensified soil conservation, afforestation and reforestation activities.
2. (E) Developing drought preparedness and drought relief streams.
3. (F) Encouraging and promoting local community participation and environmental education, focusing on management of drought.

The Convention to Combat Desertification (CCD), in regard to Palau, will be implemented through a set of action programs. These programs are the core of the Convention at the national level. The National Action Program (NAP) addresses the underlying causes of land degradation and drought and identifies measures to prevent and rehabilitate degraded land areas. The NAP is considered as the focus for the actions, and the consolidation of projects and activities identified for an integrated solution in combating land degradation in Palau. In line with the scope of the convention, the focus of the program is directed at solving land degradation challenges, developing strategies for drought mitigation and relief, and encouraging partnership with local communities to combat land degradation in the areas most affected.

The NAP strives to bring together stakeholders, GO's and NGO's at all levels, in a joint effort to achieve sustainable land management. While the Office of Environmental Response and Coordination (OERC) is charged with developing and coordinating implementation of the NAP, the Bureau of Agriculture (BoA) will be the primary implementing agency. However, if the goal of mainstreaming is to be realized, then implementation of the NAP must involve all partners including policy makers, government institutions, community-based organizations, local communities, NGO's, professional organizations, academic communities and private groups and associations.

1.2 Basic Country Profile

The Republic of Palau is an archipelago in the Western Pacific located between 7° North latitude and 134° East longitude. Palau consists of over 500 islands covering a land area of 535 km². Out of the hundreds of islands in the Republic, only 9 are currently inhabited. There are four distinct geological islands types found in Palau: reef and atoll islands (Kayangel, Ngaruangel, Ngemelis, Helen, Southwest Islands), high limestone islands (Rock Islands), low platform islands (Peleliu, Angaur), and volcanic islands (Babeldaob with 10 watersheds, Ngarekebesang, Malakal, western Koror. The hundreds of islands of Palau contain a rich diversity of habitat types, all of which are susceptible to damage caused by land degradation:

- ♦ Forests (upland forests, swamp forests, limestone forest, atoll forests, mangroves)

- ♦ Savanna and grasslands (Babeldaob, Ngarekebesang)
- ♦ Freshwater habitats (rivers, streams, lakes, swamps, taro patches) (Babeldaob, taro patches on all inhabited islands)
- ♦ Brackish water habitats (wetlands, coastal lagoons) (Babeldaob, Peleliu, Angaur, Southwest Islands)
- ♦ Marine lakes (some Rock Islands)
- ♦ Nearshore habitats (mudflats, seagrass beds, sandy beaches) (all islands)
- ♦ Coral reefs (barrier, patch and fringing) (all islands)

The Republic of Palau is situated close to the global center of marine biodiversity. There are at least 10,000 species of living organisms in Palau. The marine life consists of nearly 1,500 species of reef fishes and over 300 scleractinian corals. Approximately 1,000 endemic organisms are found in Palau, the bulk of them from the terrestrial environment. Terrestrial endemics include about 200 endemic plants, of which 60 are orchids, 300 terrestrial gastropods, 500 insects, 16 birds, 12 amphibians and reptiles, two freshwater fishes, and two species of bat. All of these organisms are directly affected by droughts, soil erosion, land degradation, and unsustainable development.

1.2.1 Climate

The Republic of Palau boasts a maritime tropical rainy climate; annual mean humidity level is 82% and annual mean temperature of 27° C (81° F). However, temperature rarely varies more than 10 degrees throughout the year. Annual mean rainfall is about 3,810 mm, or 150 inches per year, with seasonal variation.² February, March and April are the driest months with an average of 6-8 inches of precipitation per month. The rest of the year averages between 10-20 inches per month. Palau has two seasons during the year, wet and dry. The wet season typically begins in May and peaks in September. Dry season prevails from February to April and October to December. Predictions indicate that the Caroline Islands, along with some South Pacific Islands, may be a region of decreased precipitation in the near future due to the enhanced greenhouse effect, though other models projections predict increased rainfall by 2099.³

1.2.2 Vegetation

1.2.2.1 Forest and Woodland

While all of Palau may have been covered by forest at one time, at present approximately 75 percent of Palau is covered in native forest.⁴ With probably more than 1200 species of plants, Palau's forests are the most species-diverse in Micronesia. A wide range of plant and animal species rely on these native forests for their survival. In addition to their direct

² National Climatic Data Center et al, 1996

³ Morrissey and Graham, 1996; Shea et al, 2001

⁴ Cole, T.G., et. al.

biodiversity values the forests provide vital services that help to maintain the health and ecological integrity of all of the terrestrial and marine ecosystems (e.g. sediment trapping, climate stability, nurseries for reef fish, soil production and conservation, etc.).

Table 2 below shows the major forest types in Palau, based on vegetation maps derived from 1976 aerial photography.

Table 2 Major Forest Types in Palau⁵

Forest Type	Hectares	Percent of natural forest cover
Upland (volcanic) forest	21,891	70
Mangroves	4,708	15
Swamp forest	1,680	5
Limestone forest	1,232	4
Rock Island forest	1,116	4
Casuarina forest	451	1
Atoll, plantation, palm forest	182	<1
Total Forest Cover	31,259	100
Agroforest	1,109	-

Since 1976 there has been some additional clearing of forests, mainly in southern Babeldaob, but also some regeneration of forest in previously cleared savanna areas. For most of Babeldaob, rates of forest loss are unknown due to a lack of updated maps and records.

Palau is home to the greatest amount of undisturbed forest area in Micronesia. There are over 75,000 acres of forest cover throughout the islands. Nine types of forest are found throughout Palau including; Upland Native Forest, Low Coastal Island Forest, Raised Limestone Island Forest, and Mangrove Forest. Forests cover 77,248 acres.⁶ Agro-forest covers 2,700 acres and is dominated by coconut stands.⁷ Palau's forests are highly valued as watershed areas, for preventing soil erosion, as sources of firewood, medicines, building materials, and as areas to forage and hunt for food.

1.2.2.2 Grassland/Savanna

The 1976 vegetation map of Palau categorizes wild areas without a continuous tree canopy as savanna. This category includes areas of: predominantly bare soil, fern lands, grasslands, and savanna shrub lands. Much of this open land results from human activities such as land clearing, repeated burning and mining. Some areas dominated by grass are lands that were formerly cultivated. Savanna shrub lands however, support a variety of native and even some endemic plant species. Some of these species are found only in savannas. Another set of plant species have the potential to grow into large forest trees under favorable conditions, but are also adapted to savanna conditions and can mature, flower, and fruit as shrubs.

⁵ Cole, T.G., et. al.

⁶ Otebed and Maiava, 1994; Cole et al, 1987

⁷ Otebed and Maiava, 1994; Cole et al, 198

1.2.2.3 Freshwater Wetlands

Freshwater marshes occur slightly above sea level and are surrounded by mangroves or located in depressions in upland areas. There are also many freshwater marshes cultivated for taro and here the edible vine *Ipomoea aquatica* may be found.

Palau's swamp forests are the most diverse in Micronesia, but are also Palau's most limited forest type in terms of area, making up only 2 percent of the forest and 1 percent of Palau's land area. Swamp forests are particularly vulnerable to siltation resulting from road building activity, and to clearing for taro patches.

1.2.2.4 Mangroves

One of the most significant ecosystems found in Palau are the mangrove forests. Mangroves cover over 48 km² of Palau, accounting for approximately 11 percent of the vegetation.⁸ Mangroves are ecologically important because they help stabilize coastal areas by trapping and holding sediments washed down from inland areas and local watersheds. The most extensive areas of mangrove forests occur along the west coast of the big island, Babeldaob, covering approximately 80 percent of the shoreline.

1.2.3 Water Resources

The primary source of fresh water in Palau is from the atmosphere in the form of precipitation. The pattern of late afternoon rain, rainy season, and yearly variations related to global climate changes such as the ENSO, all affect the availability of rainwater as a resource. Ground water is found in Palau, though the ground water lens is thought to be fairly thin and most water pumped from the ground is non-potable. The majority of fresh water used is surface water.

Lake Ngardok is the largest freshwater lake in Micronesia encompassing 0.18 km² with a storage capacity of 15 million gallons. The longest river in Palau, Ngerdorch River, drains from Lake Ngardok and flows 10 kilometer to its mouth. The Ngermeskang River is the second largest river, and part of the Ngeremeduu, the largest watershed on the west coast of Babeldaob. The Ngerikiil watershed, located in southern Babeldaob is the main source of water for Palau's population, supplying 4 million gallons of water a day. These watershed areas are highly valued due to freshwater that is collected here. They are also ecologically valuable, supporting wetland flora and fauna. Constraints on water usage are inadequate storage capacity and lack of well-established infrastructures for distribution. The current water treatment plant in Airai pumps 4 million gallons per day, of which 35-45% is lost through transmission.

Threats to Palau's water resources include man-made contamination and climate change. Uncontrolled development, poor land uses, and deforestation in combination with intense

⁸ Crombie and Pregill, 1999

rainfall may lead to rapid soil stripping and severe land degradation. There is also the potential for a decrease in precipitation over the next century.

1.2.4 Energy

While Palau is a relatively small consumer of energy, in terms of the global picture, it relies almost exclusively on fossil fuels. In 2003, Palau used 82,419,079 KwHr of electricity; of that total, businesses and commercial establishments consumed 33,030,931 KwHr, government and public buildings consumed 20,238,276 KwHr and private residences consumed 29,221,872 KwHr. All of these figures represent energy generated by diesel power.⁹ There is a very small amount of solar energy being generated. Most of the solar energy is generated in small, outlying islands, where solar energy is the only energy source. A few private individuals also generate small amounts of solar energy, mostly to decrease their commercial consumption.

1.2.5 People and Economy

The population of Palau, in 2002, was 19,121. Of this population, 69.5% of the people are concentrated in the urban center of Koror, while the remaining 30.5% are rural population that is spread throughout the Republic. The overall population density for Palau is 110 people per square mile. This figure is somewhat misleading, since nearly 70 percent of the population is concentrated in the urban center of Koror. The population growth for the same year was 2.1%. The average population growth from 1991 to 2000 was 2.3%.¹⁰ In 2002, the GDP, in current US\$, was 118,206 with a GNI of US\$ 6,127.

1.2.6 Human development

While many statistical indicators would lead one to view Palau as a lesser-developed nation, the main education indicators more closely mirror levels of development of industrialized nations. For example, Palau has a primary school completion rate of 96.9%. The illiteracy rate is only 3.1%, with a rate of 2.1% for males and 3.4% for females. The unemployment rate in Palau is 2.3%. Finally, the youth employment rate (individuals aged 15-24) is much lower than other lesser-developed countries at 9.6%. When one looks at the main health indicators, the scenario is similar. The average life expectancy in Palau is 70.5 years with an infant mortality rate is 16.2 per 1,000 live births.

1.2.7 Science and Technology

Palau has a number of institutions, both government and private, that are engaged in sustainable land management related work. The government agencies and semi governmental agencies engaged in SLM include the Office of Environmental Response and Coordination (OERC), Bureau of Agriculture (BoA), the Bureau of Marine

⁹ Office of Planning and Statistics, Republic of Palau

¹⁰ All statistics are from the Office of Planning and Statistics, unless noted otherwise.

Resources (BMR), Palau Community College-Cooperative Research and Extension (PCC-CRE), the Army Corps of Engineers, and the United States Department of Agriculture (USDA). Private Non-Governmental Organizations (NGO's) and Community Based Organizations (CBO's) engaged in SLM include Palau Conservation Society (PCS), and The Nature Conservancy (TNC) and Palau International Coral Reef Center (PICRC). There is one institute of higher education in Palau, Palau Community College (PCC), and they have been engaged in land restoration projects, primarily reforestation, afforestation and invasive species clean ups. However, there are no institutions currently conducting terrestrial research.

1.3 National Focal Point (NFP)

1.3.1 Palau National Focal Point Institution

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1.3.2 Linkages and Synergies with other Environmental Conventions

The Focal Point institution for all UN environmental conventions in Palau is the OERC. Presidential Executive Order 189 created the OERC in January 2001, to coordinate and implement the mandates of the United Nations Convention on Climate Change (UNCCC), United Nations Convention on Biodiversity (UNCBD) and United Nations Convention to Combat Desert (UNCCD). The OERC is also mandated to develop a broad and coordinated planning approach to issues of environmental response; integrate governmental environmental programs into Executive Branch environmental response planning; establish a coordinated grant writing capacity on environmental issues faced by the Republic; and assist environmental support agencies in the development of funding assistance for environmental programs in Palau.

In January 2002, the National Environmental Protection Council (NEPC) was created via Presidential Executive Order 205, with the OERC acting as Secretariat. This Council provides coordinated planning and staffing for the Nation's response to issues of global climate change; biodiversity management, land degradation and other internationally and nationally identified issues. The NEPC includes stakeholders from National and State agencies, NGO's and CBO's that have environmental components and concerns in Palau. The Council will serve as the National Coordinating Body (NCB) for the NAP.

Since all of the UN conventions on the environment are closely linked to each other, consolidating the policy and planning work required to carry out the responsibilities of the conventions allows for maximum efficiency and synergy in planning. Thus, the UNCCD strategies and priorities are aligned with the National Biodiversity Strategy and

Action Plan (NBSAP), the First National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), the Barbados Plan of Action +10 (BPOA+10), and the World Summit on Sustainable Development (WSSD). Finally, since the OERC is part of the Office of the President, this allows for maximum alignment between the NAP and the National Master Development Plan (NMDP).

While the focal point agency for CCD is the OERC, it is important to note that the OERC's role is primarily one of coordination and policy recommendation. The main government agency responsible for implementation of the strategies identified in the NAP is the Bureau of Agriculture, under the Ministry of Resources and Development. Additionally, other GO's such as the EQPB, BMR, and Division of Environmental Health may assist with certain implementing strategies. Finally, in order to attain a mainstreamed, integrated and holistic approach, a number of communities, state governments, male and female traditional leaders, and NGO's will be actively involved in implementing strategies.

1.4 Development of NAP

The consultative process in support of the preparation and implementation of the NAP began with the successful completion of the first awareness seminar in December 2001 and was continued through a second National Planning Workshop in December 2004. The seminar's objectives were to review the status of land use, land degradation, drought, and its environmental and socio-economic impacts and to develop and prioritize strategies and programs to combat land degradation.

2. Land Degradation, its Causes and Consequences

2.1 Definitions

The UNCCD Convention defines land degradation in Article 1 as:

“reduction or loss in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rain fed crop land, or large, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as:

- i) soil erosion caused by wind and/or water
- ii) deterioration of physical, chemical and biological or economic properties of soil; and
- iii) long term loss of natural vegetation”¹¹

In October 2002, the GEF Assembly in Beijing, designated land degradation, primarily desertification and deforestation, a GEF focal area. Land degradation issues were previously addressed through their relationship to the original GEF focal areas. The

¹¹ Training Handbook: Global Environment Facility's Sustainable Land Management Approach

Operational Programme on Sustainable Land Management (OP-15) was elaborated to operationalize land degradation as a focal area. It adopts a narrower, but more operational definition of land degradation. Thus the GEF OP-15 defines land degradation as:

“any form of deterioration of the natural potential of land that affects ecosystem integrity either in terms of reducing its sustainable ecological productivity or in terms of its native biological richness and maintenance of resilience”.¹²

For the purpose of understanding land degradation in the OP-15 framework, the following summary definition is helpful:

“A reduction in land productivity that affects the integrity of an ecosystem through erosion, salinization, loss of soil fertility and the like. Prevention and control of land degradation, especially desertification and deforestation, are critical to achieving sustainable development at the national and global environmental levels.”¹³

2.2 The State of Land Resources

The most serious environmental, social and economic peril to the Republic is the impact of Climate Change and Climate Variability. The 1998 El Niño Southern Oscillation (ENSO) induced drought caused nearly complete loss of the taro crops (traditional food supply) in several States, valued at US\$ 0.75 million. On low-lying coral islands, the water lens was displaced upward by the rise in sea level, causing flooding of taro patches by saltwater intrusion. These taro areas have been slow to recover. During March of 1998, uncontrolled fires burned on a daily basis and destroyed 20% of Palau’s forest, savannah and agricultural lands. Recent climate change studies have projected that ENSO extremes are likely to increase with increasing greenhouse gas concentrations.

The second greatest threat to the Republic is land degradation caused by population growth and development. The annual population growth rate is 2.3 %, primarily composed of foreign labor to build new infrastructure, including a 53-mile road on the large island of Babeldaob (409 km²). Building the Compact Road is the largest infrastructure project in Micronesian history. The road construction has caused the loss of vegetation totaling at least 3.087 km² from 1995-2001. Vegetation loss is due to road alignment, stockpile areas, labor camps and quarry sites. Fires are also causing vegetation loss from slash burning by farmers and landowners building new homesteads. Sustainable land-use planning is crucial to ensure Palau’s natural resources are available for future generations. Moreover, a recent study conducted in Palau by PICRC showed severe impacts of soil erosion on lagoon ecosystems. Furthermore, this study emphasized the importance of mainstreaming SLM practices in order to maintain ecosystem integrity. The study further states that, “Sedimentation associated with poor land-use practices has been identified as a dominant problem by the U.S. Coral Reef Task Force.”¹⁴

¹² Ibid

¹³ Ibid

¹⁴ Yimnang Golbuua, et. al.

2.3 Major Causes of Land Degradation in Palau

2.3.1 Lack of Land Use Planning

A lack of land-use planning, and the poorly planned, piecemeal development that results, are the major threats to forests in Palau. Threats relate to both direct loss of forests through clearing of forests for various types of development, and fragmentation of forests, opening them up to the threat of invasive species and increased fire risk.

The island of Babeldaob (the second largest island in Micronesia) has the largest intact native upland forest in all of Micronesia and large-scale development of the island was limited in the past by poor road access. Until the early 1990s, most of the ten States in Babeldaob could only be reached by boat. However, within the past 10-15 years, all of them have become accessible by land, and the new “Compact Road” project will result in a 53-mile (85 kilometer) road that will circumnavigate the island and make access much easier and quicker. Once the Compact Road’s construction is complete (by mid-2005), expanded development is expected to follow as new areas open up and new opportunities for development arise. In addition to this, part of the population in Koror is expected to move to Babeldaob because the Government Capital (currently in Koror) will be relocating to Melekeok State in Babeldaob upon completion of the road. This will inevitably cause an increase in the need for housing and building materials and will attract further development to Babeldaob.

As development occurs in Babeldaob, and elsewhere, land use planning is critical. Landslides are becoming an increasing problem. Damage caused by landslides after Typhoon Utor was severe. Additionally, there is an imminent need for improved zoning regulations and construction site planning. Currently, people are able to build residences almost without regard to environmental concerns. This occasionally leads to homes being constructed in areas prone to landslides, or contributes to the causes of landslides as homes are built on land with slopes that are unsuitable for construction.

While there is considerable community support for the Compact Road and the development opportunities expected to follow, there is also community recognition that there are negative impacts that will need to be managed. For example, recent consultations undertaken by Palau Conservation Society for the National Biodiversity Strategy and Action Plan (NBSAP) project found concern in every State about the impacts of sedimentation on reefs and fisheries following road construction and other development activities (PCS, 2003). The Association of Governors has also recognized the need for land-use planning and in 2001 contracted a consultant to develop land-use master plans for each state in Palau. Unfortunately, completion of the first phase of developing these land-use master plans was delayed by over a year and the final product was simply a set of land-use constraint maps, rather than a comprehensive land-use plans as many people expected. Considerable community consultation will be required to develop land and resource use planning more fully.

Fragmentation of forest through road building is already having a negative impact. For example, the native invasive vine *Merremia peltata* has spread extensively because of the increased amount of land clearing and construction of new roads providing new opportunities for colonization. Expanded secondary road building, following completion of the Compact Road, can be expected to exacerbate this problem of land degradation.

2.3.2 The Compact Road

Construction of the Compact Road, a 53-mile road that will encircle Babeldaob, began in 1995. This road is the most significant infrastructure project in recent history. The road will open development opportunities that are unprecedented in Babeldaob. Existing planning guidelines for Babeldaob stress an ecosystem approach that protects watersheds, mangroves, arable lands and cultural or historical sites. Key issues are soil erosion, wetland destruction, and impacts to habitats of rare, endemic, or endangered species. To date, there are limited land use plans for the individual states in Babeldaob. In 2001, Typhoon Utor caused major landslides along existing roads and especially along the Compact Road in Airai State. The storm resulted in estimated damages of US\$ 4.0 million. Effective rehabilitation of these watersheds is a challenge. Major dredging of inner reefs for coral sub-base material and filling of wetlands and mangroves are occurring throughout Babeldaob because of the road and other developments.

2.3.3 Drought

Due to climate change trends, drought and the reduction of Palau's freshwater resources are major issues in Palau. Over the past 10 years, drought has caused significant degradation to terrestrial ecosystems that in turn are closely related to marine ecosystems. The country has an annual rainfall of about 3,800 mm, yet it has limited storage, distribution and treatment capacity for water. During the 1998 ENSO event, Palau had the lowest rainfall recorded in 100 years. Moreover, the Republic experienced drought conditions again in 2002-2003 as a new ENSO event occurred. Water shortages are a frequent event in the main city of Koror and therefore rationing has been implemented whenever a prolonged drought period occurs. It is critical to improve storage and distribution of water for the current and upcoming drought(s) as well as to develop an action plan for fire prevention.

The 2001 National Drought Mitigation Action Plan (DMNAP) has been developed around a drought management infrastructure and incorporates both public and private sector activities to mitigate and/or adapt to the changing global climate. The DMNAP assesses the Republic's current water resources and potential infrastructure development options to manage and expand, where possible, water storage capabilities. It also includes the assessment of agricultural practices and identification of salinity resistant crops and potential agricultural sites to sustain nationwide food security during subsequent ENSO events and associated drought. The DMNAP identifies the Public Health capabilities to manage the anticipated health effects expected during subsequent ENSO events. Funding to fully implement this Action Plan is critically needed.

2.3.4 Sea Level Rise

In 2001, the third assessment report by the International Panel for Climate Change (IPCC) estimated a 50-90 mm rise in sea level within the next 50-100 years. The report states that climate change is attributed significantly to human activities. The single greatest threat to Palau's sustainability is climate change and subsequent sea level rise. In Palau, causeways, seawalls and other coastal infrastructure are slowly being degraded by sea level rise. The States of Angaur and Peleliu, as well as much of the western coast of Babeldaob sustained significant losses to much of their taro crops during the 1998 ENSO event. These losses were caused by saltwater intrusion and prolonged drought stemming from sea level rise associated with climate change and climate variability. Taro is an essential part of Palau's food base and plays a unique role in its culture. Taro is used as a major component of food exchange in all traditional customs. Palau has at least 40 varieties of taro of which many are resistant to specific pests and diseases. It is important that these varieties are safeguarded from sea level rise, drought and land degradation. The lost taro crop represented US\$ 0.75 million, or 0.7% of the Gross Domestic Product for 1998. Sea level rise also threatens Palau's mangrove forests, beaches, and coastal communities where most of the infrastructure and economic development activities are located.

2.3.5 Loss of Soil Fertility

Eighteen types of soils are found in Palau. Up to 93% of Palau's soils are considered infertile, acidic and have high aluminum content, and therefore are a poor soil for agriculture. Less than 18% of Palau's land is suitable for agriculture (has a slope less than 12%). In 1994, 22% of Palau's arable soil was being used for agroforestry or crop production. The value of total fruit and crop production for that year was US\$ 0.70 million.

Savanna or grassland covers 25% of the land area and is subject to frequent fires during the drought periods. The cycle of burning and erosion results in the depletion of vegetation. This, in turn, causes high sedimentation downslope with deleterious effects in low-lying areas, mangrove forests and the reefs. Burning vegetation also tends to spread invasive plant species. According to a recently released IUCN report on invasive alien species, Palau is host to 9 of the worst invasive plants worldwide. Watershed management is also a major focus of the Bureau of Agriculture to ensure that sustainable agroforestry does not conflict with water quality in Palau.

2.3.6 Watershed Degradation

In 1997, the State of Melekeok set up the Ngardok Nature Reserve covering an area of 4 km² and encompassing Lake Ngardok, the largest freshwater lake in Micronesia. This lake and the surrounding wetlands are home to endemic plants and birds, and are an important breeding ground for the endangered saltwater crocodile. The Ngardok Nature Reserve is an important piece of Palau's second largest watershed, the Ngerdorh

Watershed. In 2003, Lake Ngardok was recognized as a Wetland of International Importance under the Ramsar Convention for the Protection of Wetlands.

The Ngerikiil River watershed provides the majority of drinking water for approximately 80% of the people of Palau. Waters from the Ngerikiil watershed drain into Airai Bay, a small (3 km²), semi-enclosed, mangrove-fringed coral lagoon on the southeast coast of Babeldaob. Until the 1970s the land was largely undisturbed in the watershed. However, since that time, construction of the Palau International Airport, extensive land clearing for agriculture in the lowlands, destruction of mangroves and riparian buffer zones along the banks of the Ngerikiil River and most recently construction of the Compact Road and residential developments have caused significant sediment loads into the river and the bay. The Ngerikiil Watershed Project is a collaborative effort to develop a community-based management plan and implementation of the plan that results in sustainable land use practices “from ridge to reef.” Palau Conservation Society and other technical partners provide technical guidance to the Airai Watershed Working Group, a state-appointed board, who can then use that information as a basis for management decisions.

2.3.7 Invasive Species

Invasive species are considered to be a serious threat to sustainable land management practices in the Pacific Islands, and in Palau they are another major threat to forest resources.

Palau has many invasive weeds. A recent report on invasive weeds of environmental concern in Palau found:¹⁵

- ❖ 4 species that are presently subjects of eradication programs
- ❖ 53 species that are in Palau are known to be invasive or potentially invasive.
- ❖ 95 species that are invasive or weedy elsewhere and are common, weedy or cultivated in Palau.
- ❖ 15 native species (or Micronesian introductions) that exhibit aggressive behavior.
- ❖ 249 species that are invasive elsewhere in similar ecosystems but not currently known in Palau (potentially invasive).

The four species of invasive plants currently being eradicated are: *Imperata cylindrica* (kasoring, blady grass, cogon grass), *Mikania micrantha* (teb el yas, mile-a-minute weed), *Schefflera actinophylla* (octopus tree), and *Spathodea campanulata* (orsachel kui, African tulip tree). At least 3 of these has potential to cause serious damage to forest environments and habitats in Palau, and ongoing control efforts will be needed to fully eliminate them and prevent re-introduction.

Of the other invasive plants already widespread in Palau, Space et al (2003) note that eradication or extensive control is out of the question for all of these species, but that control in sensitive, natural and protected areas such as the national parks and reserves

¹⁵ Space, James et. al.

may be required. In addition, they stress the need to make every effort to keep out all the species listed as potentially invasive, to monitor for their occurrence and to eradicate them immediately if found. These are all well-documented problem species that have had a major impact on natural ecosystems elsewhere. The potential impact of these species, if they are introduced and become established, can be severe.

An Invasive Species Committee of the Palau National Environmental Protection Council has been established to coordinate action on invasive species and the Bureau of Agriculture now has a full-time Invasive Weed Control Officer committed to working on invasive plants issues in Palau. There is, however, a major lack of resources and staff to undertake extensive invasive control or prevention programs.

2.3.8 Uncontrolled Fires

Most of Babeldaob was believed to be forested at one time, and fire is considered to be one of the main reasons why grasslands are now a more prominent vegetation type on the island. Although forests in Palau do not easily burn, and fires burning into forested areas burn out fairly quickly, adjoining grassland areas are burnt regularly. This means that forest species are unable to regenerate in the grasslands and fires gradually impact the edges of the forests. Grasslands originating from abandoned agricultural land have thus failed to return to forest cover, and in many cases have been subject to loss of vegetation cover and subsequent soil erosion.

2.3.9 Unsustainable Development Activities

While climate change, sea level rise and drought cause long-term threats to Palau's security, human activities cause the greatest short-term threat. Overuse and misuse of marine and terrestrial resources lead to sea and land pollution that directly impacts human and ecosystem health. Dredging of inshore reef areas, addressed below, is of particular concern. Palau's recent moves toward globalization, and lack of adequate quarantine enforcement staff to accommodate this trend, have caused significant introductions of invasive species. According to a recently released IUCN report, Palau is host to many of the one hundred worst invasive species. Finally, as climate change continues to become more pronounced, flooding events seem to be on the rise. While there is no specific data on this, anecdotal evidence seems to suggest that flooding due to already degraded land will become a much more serious problem in the future if mitigation and restoration efforts are not implemented.

Currently there is very limited capacity for fire management in Palau, at both national and state level. The Fire and Rescue Division of the Bureau of Public Safety is mandated to suppress both urban and rural fires, but is understaffed and has very limited resources (both equipment and manpower). In general it is unable to respond to forest fires on most of Babeldaob. State governments and other national agencies also have limited capacity, for example the Forestry Unit of the Bureau of Agriculture currently has almost no fire management or suppression capacity.

3. Strategies established within the Framework of Sustainable Development

The strategy outlined in this document is one of adhering to the principle of attacking the causes of degradation, rather than curing the symptoms. In order to do so it stresses the importance of preventive measures. Since causes of degradation often are linked to human activities, effective participation is a leading orientation, notably for field projects. Another important orientation in this context is the emphasis on watershed management. If results are to be sustainable, activities leading to them must be integrated in their physical environment as well as their socio-economic and institutional setting. An integrated approach means that all factors of influence on land degradation and mobilization of resources to combat it are to be considered. Measures may then be taken to alleviate certain bottlenecks. Before an approach for the sustainable management of Palau's land and water resources on a large scale can be launched in the field, a number of activities are needed in the short run that develop local capacity and test potential tools and create an enabling institutional environment.

3.1 Vision

Palau will achieve sustainable development and all activities will be oriented to strengthen efficiency of sustainable land management and utilization of natural resources to meet the demand of social development at an appropriate level. Management, scientific and technological capacity will be fully developed and will work in a synchronous process with all sectors and at all levels.

Priorities will be given to programs and activities that aim to achieve:

- (a) a sustainable land usage plan based on establishing a balance between forest resource use and ecologically safe forest coverage,
- (b) a sustainable land use management plan that engages stakeholders at all levels and is based on the principle of upholding the biological productivity of the land with all its ecological and socioeconomic value for the present and the future generations,
- (c) a proper reclamation/rehabilitation plan for degraded land to mitigate its negative effects and give back its original values as a fundamental property for human existence,
- (d) a significant improvement in watershed management to ensure quality water supply for various purposes under different circumstances, especially in periods of drought
- (e) a strengthened and updated management capacity and technical ability to monitor and evaluate land degradation challenges.

3.2 Strategies

As a means of addressing land degradation challenges, within the UNCCD framework, Palau has identified the following strategies:

1. Strengthen institutional and community capacities in sustainable land management, and mainstream SLM into development strategies and programs as well as on-the-ground interventions.
2. Develop partnerships with local institutions, community and nongovernmental organizations for an effective implementation of land degradation prevention.
3. Coordinate implementation of UNCCD with UNFCCC, UNCBD and other appropriate action programs to maximize synergies, alignment and balance the required supports and resources.
4. Strengthen cooperation with related regional institutions, regional CCD Thematic Program Networks and international organizations.
5. Develop the capacity to be better consolidated, manage and deploy existing financial resources and strengthen the capacity to negotiate with international and national agencies for increased financial support.
6. Establish priorities and develop action plans through active involvement in the decision-making by local communities for implementation, monitoring and evaluation.
7. Use best practice knowledge and robust technologies including traditional knowledge and wisdom to formulate planning, implementation and M&E strategies.
8. Implement public awareness campaigns that target improving knowledge of sustainable land management and sustainable agriculture development.
9. Develop local capacity to establish baseline information and conduct benchmark studies on degraded land and SLM implemented activities.

4. Priority Program Activities

Any consideration of land degradation must address the root causes of the degradation and ultimately seek ways in which the damaging activities can be reversed. Since the problems leading to land degradation are complex and rooted in the socio-economic context as well as the environment, the response in terms of sustainable land management must be equally complex and all encompassing. Thus, Palau will prioritize projects that focus on meeting the following goals, including but not limited to the specific activities listed.

4.1 Planned Activities

4.1.1 Providing Enabling Conditions

- a. Reviewing existing legislation related to LD and SLM, both at national and state levels
- b. Based on the review, strengthening existing legislation to support the programs and/or enacting new laws (if necessary) as needed where the existing legislation is insufficient to accommodate and support the implementation of programs
- c. Developing Human Resources to enhance local knowledge and benefits from the implementation of the programs
- d. Strengthening institutional capacity of institutions and organizations to effectively to address LD and SLM.
- e. Promoting public awareness aimed all related stakeholders making sure they are aware of the importance of the program, contribute to, and become involved in, the programs
- f. Providing scholarships, and opportunities for education and training
- g. Conducting studies to collect and provide baseline information on Palau’s terrestrial ecology to enhance SLM efforts

4.1.2 Land Degradation Inventory and Monitoring

- a. Monitoring of soil erosion, sedimentation and fire
- b. Inventory and mapping of degraded land using appropriate technology
- c. Identification and classification of degraded land, including mangroves
- d. Management of land degradation data and information systems
- e. Identification of the root causes and impacts of land degradation on socio-economic and socio-culture conditions

4.1.3 Promoting of Agroforestry

- a. Developing agroforestry demonstration areas for different soil types and land conservation goals.
- b. Promoting local knowledge and technology utilization in Agroforestry practices.
- c. Providing high quality seed/planting material especially for drought resistant species of locally grown crops.
- d. Promoting indigenous species for multi purpose plantations in marginalized areas.
- e. Establishing and maintaining collections of agrobiodiverse germplasm

4.1.4 Monitoring and Mitigating the Impact of Drought

- a. Strengthening research activities in attaining drought-resistant crops
- b. Improving early warning systems
- c. Formulating drought contingency plans
- d. Monitoring of water availability
- e. Monitoring of climate change impacts

4.1.5 Prevention of Land Degradation

- a. Extending and strengthening local participation in land degradation prevention projects
- b. Promoting soil conservation through trainings and workshops
- c. Developing campaigns on the dangers of land degradation and the benefits of soil conservation, including fire prevention
- d. Providing guidelines and standards for soil conservation techniques
- e. Improving fire prevention and response capacity
- f. Improving and promoting urban and community forest/greenspace activities

- g. Promoting and supporting full integration of the nationwide network of protected areas with SLM activities
- h. Promoting and supporting proper solid waste management practices

4.1.6 Rehabilitation of Degraded Lands

- a. Review of completed and ongoing projects of land rehabilitation carried out by the government, private, NGOs, and CBOs
- b. Rehabilitation of degraded forests and lands
- c. Development of intercropping of food, herbal, medicinal, and or horticultural crops under tree stand on degraded lands
- d. Develop coastal erosion mitigation action plans with states most severely affected by coastal erosion
- e. Extending and strengthening local participation in reforestation/afforestation programs
- f. Rehabilitating improper solid waste disposal sites

4.1.7 Improving Water Delivery System and Increasing Water Conservation Activities

- a. Conserving and rehabilitating of watersheds through protection of existing forests, and implementation of reforestation, afforestation, and agroforestry activities
- b. Improving/rehabilitating existing water storage and delivery systems, to sustainably use water resources, and prevent loss during delivery, especially during periods of water shortage/scarcity
- c. Improving water quality monitoring
- d. Ensuring that water delivery systems use appropriate technology to serve community needs without exceeding the capacity of the water resources

4.1.8 Monitoring and Evaluating Climatic Variation

- a. Expanding and improving the existing weather stations and data base systems
- b. Developing detailed trend analysis documenting climate variability
- c. Conducting targeted research on the impact of climate variability related to land degradation
- d. Documenting the impact of the global phenomena of future ENSO events

4.1.9 Empowerment of Local Communities and Local Institutions

- a. Facilitating the development of state level SLM plans
- b. Empowering existing communities and institutions to address land degradation issues
- c. Recognizing and documenting and supporting use of traditional knowledge and wisdom related to the prevention and control of land degradation.
- d. Supporting inclusive community visioning activities

4.1.10 Establishment of Sustainable Land Management Plans

- a. Establishing demonstration plots for sustainable agriculture, in differing soil types and conditions
- b. Provide assistance and capacity building to state and traditional leaders, as well as individual landowners, on the benefits and techniques of development of sustainable land use plans.

- c. Conducting state planning workshops to lead state leaders in the development of SLM plans.
- d. Promote wise SLM practices, both traditional and modern

5. Project Proposals and Project Ideas

5.1 Building local capacity

1. Project Title: Building capacity of local communities for development and management of terrestrial, coastal and mangrove protected areas on Babeldaob Island, Palau

2. Background

The Palau Conservation Society (PCS) is the leading local non-government organization dedicated to the conservation of Palau's unique natural heritage. PCS's mission is to work with local communities to preserve the nation's unique natural environment and perpetuate its traditional conservation ethic. Much of PCS's past efforts have focused on direct protection of the marine environment by working with states and local communities to establish marine protected areas. However, many of the threats to the marine environment in Palau are land-based activities such as poorly planned or unplanned development and construction. To address these threats, over the next five years PCS will focus its efforts on conservation activities that will lay the foundation for effective land-use planning and management at the state and community levels. A major component of this initiative is to work with local communities to effectively manage and monitor terrestrial protected areas. The specific focus of these activities will be Babeldaob Island, Palau's largest and Micronesia's second largest island. This island is undergoing rapid change: the relocation of the National Capital and the completion of the Compact Road (a 53-mile road around the island) in 2005 will officially open the island for development and increased accessibility. Already impacts are being seen: sedimentation is suffocating nearshore marine habitats, mangroves are being cut and filled, destructive fires have become more pervasive, invasive weeds are spreading, and pristine native forests are being exposed to the threats of development.

Although traditionally Palauan communities and their chiefs took care of the local environment and controlled use of local resources, much of the traditional structure to do this has lost its strength and effectiveness. Now there is a serious lack of capacity (trained people, equipment, and financial capacity) at the local level to successfully and independently manage resource problems. Palau has a very small population, and most states on Babeldaob Island do not have more than several hundred residents. Although the island and its ten states are relatively small, resources are managed locally and tend to become partitioned among the states. As a result scarce resources such as dedicated staff and equipment are spread very thin. To help alleviate this problem, there is the need to build bridges among communities and to develop more ecosystem- and island-based management systems. In this way scarce human resources can be shared so that shared environmental resources can be effectively managed. The Palau Conservation Society is

working with local communities to rebuild local resource management capacity and to facilitate cooperative ecosystem-based management.

3. Objectives:

- ♦ To protect critical terrestrial, coastal and mangrove habitats from land and resource degradation on Babeldaob Island
- ♦ To build local capacity to develop, monitor and manage protected areas
- ♦ To build local capacity to enforce protected area rules and regulations
- ♦ To encourage and support cooperative efforts among states, key agencies and communities to manage resources

4. Priority addressed: 4.1.5. Prevention of land degradation; and 4.1.9. Empowerment of local communities and local institutions

5. Location: Babeldaob Island, Palau. Key areas include places with existing protected areas, such as Ngardok Nature Reserve, Mesekelat Conservation Area, Ngermeduu Bay Conservation Area and Ngaraard Conservation Areas, as well as areas that have begun to develop strategies to cooperate to protect resources such as Ngarchelong, Ngardmau and Ngaraard states.

6. Duration: 3 years (January 2005 to December 2007)

7. Activities

- ♦ baseline assessments and mapping of terrestrial, coastal and mangrove habitats and species
- ♦ demarcation and mapping of boundaries
- ♦ identification, technical training, business skills training and support for protected area personnel, management boards, etc.
- ♦ coordination of protected area personnel activities
- ♦ training and support for monitoring techniques, data management and analysis, presentation of results
- ♦ coordination of monitoring and data analysis activities among partner organizations
- ♦ community education and involvement activities
- ♦ production of educational materials (videos for local broadcast, printed materials and maps, etc.)
- ♦ interpretive sign creation and installation
- ♦ protected area development (such as sustainable enterprise development, trail construction, infrastructure development)
- ♦ support and training for enforcement, with an emphasis on coordination among partner organizations

8. Implementing Organizations

Palau Conservation Society
State governments

Traditional leadership
 Community organizations (such as Ebiil Society, traditional men's and women's groups)
 Palau Bureau of Marine Resources
 Palau Bureau of Agriculture
 Palau Division of Fish and Wildlife Protection
 Protected area boards (such as Ngardok Nature Reserve Board)

9. Cost Estimates

	<i>Cost (US\$)</i>
baseline ecological assessments (\$10,000/area/year)*	120,000
conservation area demarcation, management and monitoring (\$17,500/area/year)	210,000
community education and outreach (\$8,400/area/year)	100,800
personnel (\$15,000/area/year)	180,000
training and personnel development (\$9,000/area/year)	<u>108,000</u>
TOTAL	\$ 718,800

* Note: costs are estimated for work in four protected areas over three years.

This project has received partial funding (until 2006) for some components through Palau Conservation Society's terrestrial conservation program, with grants through BirdLife International, US Department of the Interior and the US Fish and Wildlife Foundation. Additional funding for specific aspects of the project is also being sought through Ramsar Small Grants Fund, Urban and Community Forest Program, David and Lucile Packard Foundation, and others.

10. Expected Outcomes

- ♦ baseline ecological assessments on key coastal, terrestrial and mangrove areas and species
- ♦ critical ecosystems and habitats identified for protection
- ♦ key people identified and trained in small enterprise development, resource monitoring, resource management, data management and communications
- ♦ cooperative agreements for resource management drafted and signed by state and national government, traditional leaders, local communities and support agencies

5.2 Sustainable Land Use Planning

1. Project Title: Sustainable Land Use and Resource Management Planning for Babeldaob

2. Background

General Condition and Features of Babeldaob

Most of Palau's land area is contained in the largest island, Babeldaob, where the majority of the country's endemic plant and animal species are found. In Babeldaob's 158 mi² (410 km²) lie a diversity of habitats: native upland forest, swamp forests, wetlands, savannas and grasslands, freshwater lakes, streams, waterfalls, and mangroves. Coastal areas include nearshore seagrass beds, and miles of fringing and barrier reefs. There are generally considered to be 5 major watersheds in Babeldaob – Ngerikiil, Ngermeduu, Ngerdorch, Diongradid and Ngetmelas.

Second largest of all islands in Micronesia, Babeldaob has experienced tremendous change throughout its history. While the present population is about 18,000, prior to European contact an estimated 40,000 people lived in Palau. By the turn of the 20th century the population was severely diminished, mainly due to introduced diseases which left the total number of Palauans at just under 3,000. During World War II Palau was administered by Japan and many areas were bombed on Babeldaob by American military. Soon afterwards, most of the island was abandoned as the Japanese left and the resettled Palauans returned to their original homes in other parts of the country or moved to Koror for work. The United States took over administrative control until Palau's formal independence in 1994. With only a relatively small human population to disturb it, Babeldaob Island returned to its lush and diverse natural beauty. Today, Babeldaob Island is sparsely populated: in 2000 there were less than 5000 people living there; 43% of these people are in Airai, the developed southern portion of the island. The others live in coastal villages scattered throughout the rest of the island. Many of the people living in Babeldaob lead subsistence or semi-subsistence lifestyles. They depend upon the abundance of natural resources close to their homes. They live in villages along the coast, fishing the reefs and farming taro, tropical fruits and vegetables on small plots of land.

In 2000, construction began on a 53-mile road around Babeldaob, which will make all of Babeldaob much more accessible to the main population center in Koror. People living in Babeldaob see great opportunities with that increased accessibility. In addition, people currently living in Koror, where most of Palau's jobs are, want to go back to their homes on Babeldaob. Palauans want to retain their culture with its close relationship to the natural environment. To most, this is what having a good standard of living means. They see a return to Babeldaob as a return to a good life.

While the road will bring many positive benefits, communities fear the potential negative impacts. With the road half completed, they already see increased soil erosion, forest clearing, burning, dredging, rock quarries and many new houses. People blame the road for these changes. They also sense that many of the environmental changes on land are affecting the sea. For instance, people know that soil erosion and dredging have affected nearshore fishing grounds. This is being seen most dramatically in Airai state, where most of the initial unplanned development is taking place.

Once the road opens there will be increased access to ecologically sensitive and remote areas, and these areas will be subject to more pressure from human activities. This is already occurring in some villages in Babeldaob and people have become concerned that

their local resources will be plundered by others. People in many areas have noticed serious declines in some fish and invertebrate species and have enacted laws restricting harvest of some of the locally important species. There is a fear that if something is not done now, the situation will become much worse later on.

Historical and present management frameworks

Historically, land and natural resources were managed mainly through traditional leadership and clan tenureships. Today, a complex and layered natural resource management framework has evolved, which includes communities, State governments, State and National agencies and local, national and international NGOs. Coordinating efforts remains a key challenge for improving the existing management framework. Additionally, strategic planning for use and conservation of land and natural resources is needed to prevent destructive and unplanned development activities.

Carrying out the needed land use and natural resource management planning for Babeldaob is an immense undertaking that agencies and communities in Palau are presently unable to see through effectively. This is in a large part due to very limited community capacity as well as the lack of human and financial resources currently available. Land-use planning was initiated in 2001 by State Governors and led to the development of land-use constraint maps, however the process is currently incomplete and additional resources and coordination are needed to ensure completion.

Additional planning processes that have begun but need additional resources to ensure completion include mangrove management planning, forest management planning, watershed management planning and a community visioning and strategic planning initiative that is aimed at bringing communities in Babeldaob together to agree on a long term vision for sustainable development. The community visioning and strategic planning process is anticipated to feed into the land-use planning process. Because of the socio-political structure of the Babeldaob community, it will be necessary to facilitate collaborative planning for Babeldaob that can meet the needs and expectations of each State and community while also ensuring wise use and conservation of the island's resources and biodiversity through an eco-system based approach. Achieving this will require coordinated and participatory planning, review and improvement of the current management framework, capacity building and education.

3. Objectives

The overall objective for this project is that by 2015, all new developments shall comply with sustainable land use and resource management plans in all 10 States in Babeldaob.

The strategic objectives are as follows:

- a. Complete community visioning and strategic planning
- b. Draft and implement management plans for 5 major watersheds beginning with Ngerikiil
- c. Draft and implement national mangrove management plan
- d. Map existing land uses for use in land use planning
- e. Develop comprehensive best management practices for land use
- f. Draft land use plans for all 10 States in Babeldaob

- g. Build Capacity in States to implement land use plans
- h. Integrate sustainable land use, watershed, mangrove and forest management plans into existing traditional and national regulatory framework

4. Priorities addressed: Prevention of land degradation; Empowerment of local communities and Local Institutions; Establishment of Sustainable Land Management Programs

5. Location: Babeldaob Island, Palau.

6. Duration: 5 years (2005 – 2010)

7. Activities: Activities to be implemented include:

- Community Visioning and Strategic Planning
- Land Use Planning and Mapping
- Watershed Management planning for five major watersheds
- National Mangrove Management Planning
- National Forest Management Planning
- Legislative and regulatory review
- Develop guidelines and educational materials on best management practices for land use
- Training workshops for States on developing and implementing land use plans

8. Implementing Organizations

Palau Conservation Society
 The Nature Conservancy
 PICRC
 Ministry of Resources and Development
 EQPB
 OERC
 PPLA
 Governors’ Association
 Council of Traditional Chiefs

9. Cost Estimates

Personnel			<i>Total</i>
Land use planner	5 years	\$ 30,000 \$	150,000
Terrestrial Scientists	5 years	\$ 30,000 \$	150,000
Educator	5 years	\$ 25,000 \$	125,000
Facilitators	5 years	\$ 20,000 \$	100,000
Legal Advisor	5 years	\$ 30,000 \$	150,000
Activities			
Resource Assessments for 10 states	10 states	\$ 10,000 \$	100,000
Community visioning and strategic planning for 10 states	10 states	\$ 5,000 \$	50,000
		\$ 10,000	
land use planning and mapping	10 states	\$	100

Watershed management planning	5 watersheds	\$ 15,000	\$ 75,000
Mangrove	1 plan	\$ 50,000	\$ 50,000
Forest	1 plan	\$ 50,000	\$ 50,000
Legislative and Regulatory review	1 review	\$ 25,000	\$ 25,000
BMPs and Educational Materials on BMPs	1 program	\$ 50,000	\$ 50,000
Training for communities and implementing agencies for planning and implementation of sustainable land and resource use	10 states	\$ 10,000	\$ 100,000
			\$ 1,175,100

10. Expected Outcomes

Expected outcomes from this project include:

- Community Visions and Strategic plans for all States in Babeldaob
- Key people trained in land use planning and implementation
- Land use plans for all ten states in Babeldaob
- National mangrove management plan
- National Forest management plan
- Increased awareness and adherence to best management practices for land use
- Maps of existing land uses
- Improved national regulatory framework for regulating land use and terrestrial resource management

5.3 Documenting the Forests of Palau

1. Project Title: The Forests of Palau

2. Background: Palau is home to the most extensive and species diverse forests in Micronesia, with probably more than 900 native species of plants growing in them. A wide range of plant and animal species, including many that are endemic to Palau, rely on these native forests for their survival. The forests also provide vital services that help maintain the health and ecological integrity of all of the terrestrial, freshwater, and marine ecosystems in Palau. Babeldaob Island is home to the greatest areas of upland, swamp and mangrove forests in Palau, while sizeable areas of limestone forest and Rock Island forest are found on Peleliu, Angaur, and the Rock Islands respectively. The forests of Babeldaob are the most diverse in Micronesia, but many of the species here can also be found growing on some of the limestone islands, which are less well known but also diverse with many endemic species of their own.

Overall the plant species composition of Palau’s forests is relatively well known, but much of the baseline information needed to maintain their integrity over time has not been collected. This information will be vital in allowing the national and state governments to plan for future land uses and manage their forests appropriately in response to impending threats such as development associated with the completion of the “compact” road, invasive species, and fire-related damages. Studies aimed at documenting the occurrence and range of rare and endemic species, the composition,

location, and distribution of different forest types and sub-types, and the identification of forest areas of cultural/historical/practical/biological importance, would be extremely useful in providing information necessary to plan and manage Palau's forests sustainably, including the establishment of a network of protected areas. Longer term studies looking at the flowering and fruiting cycles of plants, plant-pollinator relationships, fire ecology, forest regeneration and the effects of climate change on all of these phenomena will add to the body of practical information needed to wisely plan for the future of Palau's forests.

3. Objectives:

- To identify forest areas of cultural/historical/practical/biological importance in Palau.
- To identify the plant species' communities associated with each forest type in Palau, and locate diverse representatives of these forests.
- To determine the occurrence and range of the endemic and rare plant species in Palau.
- To document the flowering/fruiting cycles and pollinator relationships of the plant species in Palau's forests.
- To investigate the role of fire and regeneration in the ecology of Palau's forests.

4. Priority addressed: Providing Enabling Conditions

5. Location: Republic of Palau, Principle studies aimed at Babeldaob Island, long-term studies extend to include all other islands within principal archipelago.

6. Duration: 3 years overall. Funding is available for the first 12 months of the study, beginning in early 2005, which will focus on forest surveys of Babeldaob Island and the development of Palau's herbarium and plant database. Additional funds are needed to extend the survey to include additional islands and to set up long term studies looking at the effects of fire damage and the possibilities of reforesting degraded areas.

7. Activities: (Activities build on existing information including plant species lists, forest assessment data, lists of candidate endemic species, and preliminary forest surveys).

- Field Survey of Palau's Forests and Community Visits and Consultations
- Herbarium and Plant Database Development
- Herbarium Visits and Consultations
- GIS Mapping
- Pollinator Survey and Inventory
- Fire Ecology and Revegetation Study

8. Implementing Organizations:

- Belau National Museum
- Bureau of Agriculture (Forestry Unit)
- PALARIS
- The Nature Conservancy
- Palau Conservation Society

- The Environment, Inc.

9. Cost Estimate: \$75,000

Year 1: \$25,000 Initial Study Funded by The Nature Conservancy

Year 2: \$25,000

Year 3: \$25,000

10. Expected Outcomes:

- GIS Maps of the distributions of endemic and rare plant species, locations of locally important forest sites, and good representatives of the different forest types in Palau. These will be used for planning in the development of the Protected Area Network and assisting states with land use and development planning.
- An up-to-date database with recent information and photos of the plant species collected in Palau.
- Botanical determination and written report documenting the occurrence and endemic/native status of the potentially endemic plant species in Palau.
- A system in place for ongoing study and collection from permanent study sites on Babeldaob and other islands.
- An expanded, functional herbarium at the Belau National Museum, with collected specimens from the field survey and a system in place for exchange and consultation with other herbariums.
- Up-to-date information on the forests of Palau for use in environmental education and awareness campaigns.
- Baseline information on the fruiting and flowering of Palauan plant species.
- Permanent reference collection of insect pollinator and pollen specimens, housed in the Belau National Museum.
- Written report containing an inventory of pollinator species observed at each site and a summary of the pollinator-plant relationships documented during the study.
- Methodologies for studying the effects of fire damage on Palau's forests and recommendations on forest regeneration strategies.

5.4 Promoting of Agroforestry

1. Project Title: Promoting of Agroforestry- Agroforestry demonstration farms in Ngeruluobel and Ngetkib. Submitted by Ann Kitalong, The Environment, Inc.

2. Background: The Debkar Clan has 2 taro/agroforest farms in Ngetkib and Ngeruluobel Hamlet in Airai. The Natural Resource Conservation Service has developed conservation plans for the Ngetkib farm (DeMeo, 2003) and the Ngeruluobel farm (DeMeo, 2004). The Debkar Clan has a taro/agroforest farm in Ngetkib Hamlet with silt loam and silty clay loam soil with a 6 to 30% slope, and limestone outcrop soil with 80 to 150% slope. The limestone outcrop soil is a rare soil in Babeldaob that has mostly volcanic soils. The Ngetkib farm has a total area of 0.076 acres; and consists of 4 taro patches surrounded by a mixture of fruit and medicinal plants and limestone forest trees. See Figure 1. This farm is part of a network taro patches and agroforest maintained by the women of Ngetkib. The weight of each crop harvests was in 2004, with a

yield of 1,040 lbs /acre (Kitalong, 2004.) The potential production is 13 times greater (Bolt and Hunter, 1997.)

The Debkar Clan has a second taro/agroforest farm into Ngeruluobel Hamlet at the base of a fertile valley within mucky silt loam soil and adjacent to mangrove forest and the main road. The Ngeruluobel farm consists of 42 taro plots with a total area of 0.8 acres. The adjacent wetland agroforest has a total area of 0.6 acres and predominately with coconut trees and Nypa palm. See Figure 2. The Ngeruluobel agroforest-taro farm is also part of a community network of taro patches surrounded by fruit trees and swamp forest and mangrove forest. The 2004 production from the Ngeruluobel farm was 639 lbs/acre or 20-fold less than estimate crop budgets (Bolt and Hunter, 1997.)

The Debkar Clan has a third upland farm in Ngeruluobel Hamlet at the top of the ridge leading down to the watershed of the Ngeruluobel taro/agroforest farm. During the Japanese administration, the Japanese intensively farmed much of this area. The farms described in the paragraphs above are along streams within the ravine forest with fertile, productive, saturated soils. In contrast, this upland farm is not near a stream, ct to uncontrollable fire outbreaks, that has resulted in unfertile soils dominated by savanna grassland. Attempts to plant fruit plants such as avocado, banana, mango, and soursap have failed due to poor soils. Tapioca has been eaten by rats. Chronic fires have wiped out the small plantations on numerous occasions. In late November 2004, a fire spread extensively within the grasslands, burning most of the plants along the edge of the farm, including newly sprouting rambotang seedlings. Yet, several hardy crops including pineapple and betelnut and a few hardy lemon trees have managed to produce fruits. Maintenance of the plants by repeated applications of grass cuttings prevents fire from spreading within the farm plot.

It is national policy to promote agroforestry in Palau. In order to do so, young people must get involved in home agroforestry projects. The current trend is that more and more young people are not participating in farming activities. Farming is perceived as being a low paying and undesirable career or hobby. It is important to improve the image of agroforestry and instill pride in especially young women about the traditional agroforestry practices that have been passed down through the generations. Many of the problems with low fertility, pests and low yields have been solved long ago by generations of women experimenting with a variety of plants and methods. The intent of this project is to work with the young girls and women tending community gardens and farmers to share and exchange skills and knowledge about agroforestry practices in Palau.

Currently it is costing the Debkar clan twice the value of the yield of taro and fruit. (The clan pays \$160/mo or \$1,920/yr.) The crop's market value is small compared to its value for distribution during traditional custom and as a regular source of healthy food for the table. It is important to work more closely and more often with the farmer to implement the soil conservation plan and produce more compost. In addition there is a need to coordinate training between the clan, the farmer, the women's group, the Bureau of Agriculture and NRCS. We believe that once we train by doing and demonstrate that higher yields can be produced; more women and farmers will practice soil conservation using both traditional and modern

agroforestry methods. This project will serve as a demonstration for other farms in Airai and Palau.

4. Objectives:

The Debkar Clan objectives are three-fold:

- 1) To implement the soil conservation plans provided by Natural Resources Conservation Service to improve agroforestry production and minimize plant diseases and protect property from road
- 2) Develop demonstration plots in the lowland taro/agroforest and the upland savanna in Ngetkib and Ngeruluobel that result in more fertile soil with higher yields using organic compost.
- 3) Train at least two high school aged girls in traditional agroforestry techniques.

5. Location: Ngetkib and Ngeruluobel Village, Airai State

6. Duration: 2 years

7. Activities

- a) Implement the NRCS plan for mulching, nutrient management, pest management, tree and shrub establishment, pruning, and windbreak shelter establishment.
- b) Gather information from agriculture and local farmers and mechas producing compost to learn traditional and modern techniques being used in other farms in Airai.
- c) Obtain plant material for compost and start compost piles at the 3 locations.
- d) Obtain a variety of taro plants and fruit plants and native plants recommended by Agriculture
- e) Set up a log book and data sheets for each plot.
- f) Implement production studies using a variety of compost mixes and taro, fruit and native tree species. (Several compost pits and trenches have been left behind at the upland farm by the Japanese farms that will be used to produce compost.)
- g) Once compost is ready, begin planting within the mapped out plots.
- h) Maintain & monitor plants over 8-months for taro and 2 years for fruit trees
- i) Train at least two high school aged girls in either the Ngetkib or Ngeruluobel community in agroforestry techniques.
- j) Develop a step by step handbook from this project

8. Implementing Organizations

The Environment, Inc., the Natural Resource Service, Bureau of Forestry and Agriculture, Palau Community College/CRE, Palau High School internship program.

9. Cost Estimates

Indirect Costs

Farmer salary	\$4,800.00
Student stipends (\$20/day x 100 days)	\$2,000.00

Direct costs

Fuel and transportation	\$ 1,000.00
Fruit trees, taro plants, native plants	\$ 250.00
Potting material	\$ 250.00

Planting equipment (2 shovels, 2 sets of boots, 2 sets of gloves)	\$ 250.00
Refreshments for demonstrations for women	\$ 250.00
Office supplies	\$ 250.00
Printing costs	\$ 500.00
Communications	\$ 50.00
Total Cost:	\$9,600.00

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