Federated States of Micronesia

State-Wide Assessment and Resource Strategy

2010 – 2015 +

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Glossary of terms and acronyms

AON	Forest Legacy Assessment of Need
BSAP	Biodiversity Strategic Action Plan
CE	Conservation Education
CFAA	Cooperative Forestry Assistance Act
COM-FSM	College of Micronesia - FSM
CRE	Cooperative Research & Extension - COM-FSM
CWPP	Community Wildfire Protection Plans
DLNR	Department of Lands and Natural Resources (Pohnpei)
FSM DRD	FSM Department of Resources and Development
YDRD	Yap Department of Resources and Development
DREA	Department of Resources and Economic Affairs (Kosrae)
EQIP	Environmental Quality Incentives Program
EPA	Environmental Protection Agency (Pohnpei, Chuuk, or Yap not US)
F&AM	Fire & Aviation Management
FS	USDA Forest Service
FSM	Federated States of Micronesia
FSP	Forest Stewardship Program
GIS	Geographic Information System
NRCS	USDA Natural Resources Conservation Service
RNGR	FSP Reforestation, Nurseries & Genetic Resources
S&PF	State & Private Forestry
S&WCD	Soil & Water Conservation District
SAP	Spatial Analysis Project
SDP	FSM Strategic Development Plan
SFSCC	State Forest Stewardship Program Coordinating Committee
STC	State Technical Committee = TAC (NRCS)
SWARS	State-Wide Assessment and Resource Strategy
TAC	Technical Advisory Committee = STC (NRCS)
U&CF	Urban & Community Forestry
USDA	United States Department of Agriculture
USFS	United States (Department of Agriculture) Forest Service

I. FSM NATIONAL GOVERNMENT

Introduction

State-Wide Assessments and Resource Strategies (SWARS) are a tool for islands to identify their highest priorities for forest resource management and seek implementation of their strategies, with on-island partners and with assistance from the United States Department of Agriculture (USDA) Forest Service (FS).

State assessments and resource strategies are integral to the Forest Service's State and Private Forestry (S&PF) Redesign and required as an amendment to the Cooperative Forestry Assistance Act (CFAA), as enacted in the 2008 Farm Bill. Each State is required to complete a State Assessment and Resource Strategy within two years after enactment of the 2008 Farm Bill (June 18, 2008) to receive funds under CFAA.

This SWARS includes two components to the assessment and planning required by the S&PF Redesign approach to identify priority forest landscape areas and highlight work needed to address national, regional, and state forest management priorities:

State-wide Assessment of Forest Resources—provides an analysis of forest conditions and trends in the state and delineates priority rural and urban forest landscape areas.

State-wide Forest Resource Strategy—provides long-term strategies for investing state, federal, and other resources to manage priority landscapes identified in the assessment, focusing where federal investment can most effectively stimulate or leverage desired action and engage multiple partners.

The SWARS provides a basis for subsequent annual grant proposals, as authorized under several CFAA programs. The Redesign deemphasizes program-by-program planning and emphasizes program integration to meet island priorities, which are in turn tied to one or more broad national themes and objectives (Table 1).

FSM Table-1: National Themes and Objectives

U.S. National Themes	FSM Issues	Relevant FSM SDP Sector Goals
1. Conserve Working Forest Landscapes	1. Food security (agroforest) in response to climate change impacts 2. Coastal stabilization (strand forest and mangrove forest) in response to climate change impacts 3. Biodiversity conservation (relates to Forest Legacy, invasive species control, protected areas management, gap analysis, etc.) 4. Watersheds (high islands) 5. Production and sustainable harvesting of forests 6. Urban and community forestry (utilities cooperators, hazard trees, arboriculture) 7. Capacity-building – overall (recruiting new generation of natural resource managers)	Agriculture Sector Strategic Goal 1: A well resourced and properly focused agriculture sector operating within a stable and consistent policy framework Agriculture Sector Strategic Goal 2 Increase production of traditional farming systems for home nutritional and traditional needs and cash incomes Agriculture Sector Strategic Goal 3: Increased volumes of saleable surpluses to be marketed by the private sector into local and regional markets Agriculture Sector Strategic Goal 4: Promote environmentally sound and sustainable production. Environment Sector Strategic Goal 1: Mainstream environmental considerations, including climate change, into national policy and planning as well as in all economic development activities Environment Sector Strategic Goal 3: Reduce energy use and convert to renewable energy sources / Minimize emission of greenhouse Gases Environment Sector Strategic Goal 4: Enhance the benefits of sustainable use of the FSM's genetic resources and ensure benefits derived are fairly shared amongst stakeholders Environment Sector Strategic Goal 5: Manage and Protect the Nation's Natural Environment/Protect, conserve, and sustainably manage a full and functional representation of the FSM's marine, freshwater, and terrestrial ecosystems Environment Sector Strategic Goal 6: Improve environmental awareness and education and increase involvement of citizenry of the FSM in conserving their country's natural resources Environment Sector Strategic Goal 7: Establish effective biosecurity (border control, quarantine and eradication) programs to effectively protect the FSM's biodiversity from impacts of alien invasive species Environment Sector Strategic Goal 9: Enhance and Employ In-Country Technical Capacity to Support Environmental Programs
1.1. Identify and conserve high priority forest ecosystems and landscapes		
1.2. Actively and sustainably manage forests		
2. Protect Forests from Harm		
2.1. Restore fire-adapted lands and reduce risk of wildfire impacts		
2.2. Identify, manage, and reduce threats to forest and ecosystem health		
3. Enhance Public Benefits from Trees and Forests		
3.1. Protect and enhance water quality and quantity		
3.2. Improve air quality and conserve energy		
3.3. Assist communities in planning for and reducing forest health and wildfire risks		
3.4. Maintain and enhance the economic benefits and values of trees and forests		
3.5. Protect, conserve, and enhance wildlife and fish habitat		
3.6. Connect people to trees and forests, and engage them in environmental stewardship activities		
3.7. Manage and restore trees and forests to mitigate and adapt to global climate change		

The Federated States of Micronesia (FSM)[1] is the largest and most diverse part of the greater Micronesian sub-region of the vast Pacific region. It is a federation of four semi-autonomous island States, in geographic sequence from west to east - Yap, Chuuk, Pohnpei and Kosrae - comprised of 607 islands with land elevation ranging from sea level to the highest elevation of about 2,500 feet (760 m). FSM's total landmass is 438 square miles (702 km2), with a declared Exclusive Economic Zone covering over 1 million square miles (1.6 million km2). Its marine and terrestrial biodiversity are the nation's living wealth in which species endemism is high among the terrestrial biota. The high endemism within the nation is a direct result of the isolation of the islands to one another and to other landmasses in the greater Micronesian region. The conservation and preservation of endemic species is of particular importance to the FSM's natural heritage and globally significant. The marine and terrestrial significance are the foundation of the country's long term economic self-sufficiency as articulated in its National Biodiversity Strategic Plan (NBSAP) and subsequently its Strategic Development Plan 2004-2026 (SDP). Maintaining the habitats and ecosystems that nurture this diversity is crucial to sustaining the country's rich ethnobiological traditions while improving Micronesians' quality of life since sixty percent (60%) of its population is dependent on subsistence livelihoods (ADB, 2004). Further inventory and monitoring of the FSM terrestrial and marine biodiversities are integral and priority to a thorough understanding and appreciation of the island's biodiversity. The spread of invasive species is a continual threat due to increased movement of people and machinery between the islands, and needs to be carefully monitored and controlled.

Ownership of land and aquatic areas varies between States. In Kosrae and Pohnpei, land is both privately and State owned, while aquatic areas are managed by the State as public trusts. In Chuuk, most land and aquatic areas are privately owned and acquired through inheritance, gift or, recently, by purchase. In Yap, almost all land and aquatic areas are owned or managed by individual estates and usage is subject to traditional control. In all States, land cannot be sold to non-citizens of the FSM, thus these land and aquatic ownership patterns greatly influence the strategies and actions required to sustainably manage the biodiversity of the nation. The responsibility for environmental issues is shared between the FSM National Government and the individual FSM State governments. The sharing of responsibility has at times resulted in legislation that appears duplicated at the State and National levels. It has also resulted in gaps in legislation and areas in which the location of responsibility between the State and National Governments has been less than clear. Each State has made efforts to control development and manage natural resources through the creation of land use plans, coastal zone plans, legislation and regulations. The National Government provides guidance and technical assistance to the States when needed and requested on matters related to planning, economic development, natural resources, fisheries, and the environment.

[1] http://www.lib.utexas.edu/maps/islands_oceans_poles/statesmicronesia.jpg

A Basis for future program, agency, and partner coordination

Consolidated Grants	Competitive Grants
Subsequent to the funding advice from the USDA FS Regional State & Private Director, the FSM Forestry Agency liaises with two of its four counterpart local Forestry Agencies[2] to develop their respective 2-fiscal year duration proposal under a FSM Consolidated Grant Proposal on a rotational basis to achieve their local priorities/objectives under the USDA FS Forest Cooperative and Forest Health Programs[3] aligned to the National themes and objectives (Table 1). Sub-granting to NGOs, landowners or community groups is dependent on the approval language of each program/grantor	Subsequent to National/Regional Competitive Grant notifications, FSM Forestry Agency invites all its cooperators and/or eligible entities to submit a proposal articulating their project goal(s) and objective(s) in line with the National themes and objectives (Table 1). All submitted proposals are ranked internally by a review panel in accordance with selection criteria menu. The top four ranked proposal applications are submitted by the FSM Forestry Agency to enter into the competitive grant cycle Sub-granting to NGOs, landowners or community groups is dependent on the approval language by the grantor

[1] Chuuk and Kosrae State Forestry Divisions are on even-fiscal year rotation while Pohnpei and Yap State Forestry Divisions are on odd-fiscal year rotation

[2] Urban & Community Forestry Program, Forest Stewardship Program, Forest Legacy Program, Forest Health Protection Program, Forest Health – Invasive Plants Program and Conservation & Education Program

This SWARS will be regularly monitored quarterly/annually in accordance with the annual consolidated and/or competitive grant cycles' reporting procedures. Note that the FSM Forestry Agency (Department of Resources and Development) is the lead agency for State Forester, Forest Legacy, Fire, etc.

1. State Forest Stewardship Coordinating Committee

A new committee began to be formed with passage of the Farm Bill, and is known as the FSM Stewardship Council. Its membership reflects the coordinating role of the national FSM government (eligible as a "state" in the Farm Bill), and the primary role of the FSM's four States in handling land management and land issues. Members and state-level subgroups of this Council were consulted at all stages of developing this SWARS. A SWARS inception workshop launched in March 2009 where State and National Forestry Agencies and cooperators conducted its first series of consultations and developed outcomes outlining the milestone developments of the FSM SWARS, AON and establishment of the FSM National Forest Stewardship Committee with State and National cooperators up until May 2010. Because of the expense of interisland travel, it is anticipated that most Council business will take place in state-level subgroups, by email and by telephone; the first full face-to-face meeting is likely to take place in August 2010 at the 3rd FSM National Environment Summit slated for August 23 – 27, 2010. A program-level

strategy for the FSM is to complete membership of the Council and conduct its business according to Forest Stewardship guidelines.

FSM Table-2: Membership of State Forest Stewardship Coordinating Committee

Interest or agency required by law "if feasible"	Name, Title, Affiliation
Forest Service	Kathleen Friday, USFS
NRCS	NRCS Pohnpei Field Office
Farm Service Agency	Not in the FSM
Cooperative Extension Service	Jim Currie, Vice President, COM-FSM Cooperative Research and Extension
Local Government	Maheta Kilafwasru, Chairman, Council of Mayors, Kosrae State Pintas Kenneth, Mayor Rep, Chuuk State Mike Peterson, Chairman, Pohnpei Council of local Chief Executives (Intend to add local government representatives from Yap Traditional Leadership Focal Points)
Soil and Water Conservation District	(To be added when and if a Pohnpei or other S&WCD is established by USDA NRCS)
Consulting foresters	Francis Ruegorong, Waab Land & Wildlife Coordinator Erick Waguk, State Forester, Kosrae State Basiente Atan, UCF Coordinator, Chuuk State Mayoriko Victor, Forester, Pohnpei State
Forest products industry	Dr. Tholman F. Alik, Yela Environmental Landowners Authority, Kosrae State Mr. Claudio Panuelo, Chairman, Pohnpei Farmers Association (Intend to add Yap, Chuuk and Kosrae Farmers associations[4] and ecotourism representatives)
Private Forest landowners	Mr. Barton Musrasrik, Kosrae Farmers Representative Mr. Namio Nahnpei, Chairman Nahnpei Estates (Intend to add Chuuk and Yap Farmers representatives)
Land-trust organizations	Mr. Robinson H. Timothy, Principal Judge, Kosrae Land Court Kaster Sisam, Division of Land Management, Chuuk State Mr. Largo Edwin, Chairman, Pohnpei Board of Trustees (Intend to add Yap State Land Commission Focal Points when designated)-Mr. Claudio Panuelo represents Pohnpei above
State lead agency for Forest Legacy	Mr. Gibson Susumu, State Forester
Environmental/ Conservation organizations	Mr. Marston Luckymis, Acting Executive Director, Kosrae Conservation Safety Organization Bradford Mori, GIS Specialist, Chuuk EPA Curtis Graham, Chuuk Conservation Society Patterson Shed, Executive Director, CSP Mr. Albert Roby, Director, Pohnpei EPA

[4] Local farmers associations mostly practice agroforestry methods

State fish & wildlife agency	Robert Jackson, Director, Kosrae Island Resource Management Authority Romeo Osiena, Director, Dept of Marine Resources, Chuuk State Yap State Dept of Resources and Development [already represented by Francis Ruegorong, Waab Land & Wildlife Coordinator, above, and Michael Gaan, Director, below] Yosuo Phillip, Director, DLNR, Pohnpei
Tribal representatives (chiefs)	Henry Nedlic, Traditional Chief, Chuuk State (Intend to add representatives from: Yap Council of Pilung and Tamol Hon. Kepert Hebel, Chairman, Council of Traditional Leaders (Mwoalen Wahu of Pohnpei) Council of Mayors of Chuuk and Kosrae State already represented above
Other (Departments of Agriculture)	Innocente Penno, Director Dept of Agriculture, Chuuk State Julian Sivas, Chief of Forestry, Chuuk State Steven L. George, Director, DREA, Kosrae State Michael Gaan, Director, DLN&R, Yap State Saimon Lihpahi, Chief, Forestry Division, PNI Adelino Lorens, Chief, PNI Division of Agriculture
Other	Furasi Bonochou, Dept of Public Safety, Chuuk State

2. State Technical Committee

The "State" Technical Committee convened by the NRCS in the Pacific is intended to cover all Pacific islands by quarterly videoconference meetings, but in fact its membership and agenda tends to focus on Hawaii. The NRCS suggested that SWARS consultation be conducted through the FSM Local Working Group convened by NRCS Pohnpei Service Center staff. To comply with this requirement, DRD consulted with the USDA Natural Resource and Conservation Service Pohnpei Service Center extensively and the Resource Conservationist will be provided with a final draft copy to facilitate the STC review process.

3. State wildlife agency

Responsibility for terrestrial and marine wildlife rests with the Chuuk State Departments of Marine Resources and Agriculture; Kosrae Island Management Authority; Pohnpei State Department of Lands and Natural Resources; and Yap State Department of Resources and Development. In most cases these are the head agencies which house the forestry agencies and thus were completely engaged in SWARS development.

4. Applicable Federal land management agencies

Not applicable. No "federal" (US) agency owns or manages land in the FSM.

5. State Urban Forestry Council

The FSM National Stewardship Council will play the role of the "FSM-wide" Urban Forestry Council in advising the FSM concerning U&CF as well as FSP programs. It was consulted as explained above. In addition, the following state-level councils were engaged throughout the series of consultations from May 2009 – May 2010:

- Chuuk State Urban & Community Forestry (U&CF) Council
- Kosrae State U&CF Council
- Pohnpei State U&CF Council
- Yap State U&CF Council

6. Tribes (indigenous people)

Majority of the stakeholders listed and local communities are indigenous people, especially in the non-urban centers.

7. State lead agency for the Forest Legacy Program

This is the same as the state forester: FSM Department of Resources and Development, Division of Resource Management and Development, Agriculture Program.

Plans consulted and/or attached:

1. Wildlife Action Plans

Because the FSM is not part of the US, there was no single Wildlife Action Plan previously required by the US Fish & Wildlife Service. Documents serving this purpose were extensively used in the development of the SWARS, especially the mapped Areas of Biological Significance in "A Blueprint for Conserving the Biodiversity of the FSM" (The Nature Conservancy, 2003), "The Federated States of Micronesia National Biodiversity Strategy and Action Plan: (FSM 2004) and subsequently the state-level BSAPs.

2. Community Wildfire Protection Plans

Because the FSM only recently became eligible for Fire & Aviation Management assistance, no Community Wildfire Protection Plans exist yet. Lying at the western end of the FSM where wildfires are a greater problem due to climatic conditions, Yap State has developed a wildfire program. The Yap State Fire Management Assessment is incorporated and referenced in the Yap chapter, and the Yap State Second Five-Year Wildfire Plan is appended to that chapter. Currently the other three States have no similar plans however, F&AM issues are incorporated into their State Chapters. In all States, efforts will lead to working with communities to develop Community Wildfire Protection Plans within the SWARS period. FSM DRD will serve as the coordinating/lead agency for any F&AM assistance.

3. Forest Legacy Assessment of Need

See chapter above for Assessment of Need establishing Kosrae Forest Legacy Area.

4. Other

See plans referenced at the end of each State chapter.

FSM SWARS Process

The FSM SWARS' development has been a collaborative effort and iterative consultation process from July 2009 – May 2010 coordinated by FSM DR&D with assistance from TNC and USFS in cooperation with the Chuuk, Kosrae, Pohnpei and Yap State Forestry agencies and their

key cooperators and stakeholders. At the initial process, identification of issues that addresses the three National themes were identified in consultation with the states forestry agencies along with their stakeholders. Through coordination by FSM DR&D with the FSM states, several consultation processes and trainings were done to develop the assessment component of this SWARS. Several agencies and other key partners, including conservation NGOs, Tribes and natural resource related entities were involved in this SWARS process. During the assessment process, several data gaps were identified which were provided by the FSM GIS team. The development of the AON presented in this SWARS involved consultations by FSM DR&D and a consultant from TNC with Yap, Chuuk, Pohnpei and Kosrae which provides a comprehensive case for the usefulness of a Forest Legacy Program (FLP) for FSM that would act as a pro-active forest resource conservation tool and a framework for program implementation that is needed to preserve the threatened forestland in the FSM. In addition, there were several potential forest legacy projects in each of the FSM States were identified that have critical conversion pressure and/or harbor unique and threatened habitat that is in need of protection and long-term forest management.

Acknowledgements

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- College of Micronesia - FSM
- Chuuk State Department of Agriculture
  - Division of Forestry
- Chuuk EPA
- Chuuk Conservation Society
- Kosrae Island Resource Management Authority
  - Division of Forestry
  - GIS Unit
- Pohnpei State Department of Lands and Natural Resources
  - Division of Forestry and Marine Conservation
  - Division of Survey and Mapping, GIS Unit
- Dr. Reed Perkins, Colleagues, and Students of Queens University – North Carolina
- Yap State Department of Resources and Development
  - Division of Agriculture and Forestry
  - Division of Land Resources
- Yap EPA
- Yap Institute of Natural Science
- Secretariat of the Pacific Community, Pohnpei Office
- TNC
- USFS

Summary of Major Points made by all FSM States

While the order of sequence of the 7 FSM Issues in response to the U.S. Themes varied among the four states of the FSM, a number of shared major issues relating to these themes emerge from the State chapters. These cross-state issues are presented below.

Cross-cutting Issue: A need for up to date aerial photography & LIDAR data

The basis for most data for forest assessments in this SWARS are vegetation maps based on aerial photography from 1976. Only for Pohnpei have more recent vegetation maps been made based on more recent aerial photography. These maps indicate a serious decline in upland native forest. There is no data on overall forest trends for the rest of the FSM. All 4 states have requested assistance to obtain current aerial imagery in their respective chapters. The availability of such imagery combined with increasing GIS capacity, will enable even local foresters to develop updated vegetation maps to compare with earlier vegetation maps to determine trends, and to serve as baselines from which to measure progress in forest stewardship. An FAA certified airline experienced in the precision flying needed for such aerial photography is based on Yap, and the U.S. Forest service or other agencies have the cameras and professional staff for such work.

In addition to current aerial photography, LIDAR imagery is greatly needed in order to more accurately assess vulnerability to sea level rise and storm surge throughout Micronesia. This is especially important for low-lying outer island that are close to sea level.

Food security

This was a major concern of all 4 states, especially with respect to climate change and Sea level rise. At the same time, the conservation of biodiversity and protection of ecosystem integrity is a high priority of all 4 states. A general strategy for achieving both objectives is to enhance agroforests and expand food production activities upland into already disturbed areas of secondary vegetation, while conserving areas of native forests: upland forests and coastal mangroves. This general strategy is expressed on the landscape maps as enhancing the warm colored areas (agroforest & secondary vegetation, color-coded red and orange respectively), and protecting the cool colored areas (mangroves and native forests color-coded blue and green respectively).

Food production via agroforestry was seen by all states as a way to maintain ecosystem integrity while producing food. A further need to preserve “agrobiodiversity”, the wide range of species and sub-specific varieties of traditional crops that provide genetic resilience in the face of climate change. In addition, all states wanted to protect agroforests and other forests from invasive species, pests and diseases.

Unfortunately, it was noted that most all outer island islets lie within the 2 meter zone of potential sea level rise, and all lie within a 5 meter zone of storm surge. This brings up a need for a 4th theme: that of adaptation to sea level rise that is not included in this SWARS, and is recommended as a theme for the next iteration of SWARS. The high islands of the FSM will need to begin now to pre-adapt to rapid population increase in the form of climate change

refugees from low-lying islands, while at the same time, enhancing and adapting their own food production systems. The Yap State map showing that the islands most fertile alluvial soils are all vulnerable to salt water inundation indicates the magnitude of this challenge.

Biodiversity conservation: maintaining ecosystem integrity, conserving native species and major biosecurity issues of invasive species and wildfires. All 4 states have indicated areas of special biodiversity significance, and keystone habitats (such as mangroves and sea turtle and seabird rookeries), and keystone species such as fruit bats (flying foxes). The conservation of these areas involves addressing forest health "biosecurity" issues of invasive species and wildfires as well as the establishment of protected and wisely managed areas.

The Forest Legacy program is a great source of assistance in conserving privately owned lands that are under threat. Kosrae State, with its world class *ka* swamp forest will be the pilot Forest Legacy project for the FSM and an Analysis of Need for this project is included in this SWARS. The other three states of the FSM do not have the capacity to carry out a Forest Legacy project yet, however it is hoped that some of the 12 million dollars pledged by TNC and Conservation International in support of the Micronesia Challenge will contribute to an increase in Forestry staff needed to carry out both Forest Legacy and Micronesia Challenge projects in the near future.

Watersheds

All 4 states recognize and request assistance in managing watersheds on a landscape basis, and the states with the highest mountains, Pohnpei and Kosrae are already working on central watershed reserves. The states of Chuuk and Yap have more scattered, smaller watersheds and will be developing proposals for competitive grants to evaluate and begin working in high priority watersheds. On low-lying atoll islets, the issue is not watersheds, but the thinning of fresh water lenses.

Production and sustainable harvesting

All 4 states face problems of unsustainable harvest of forest resources. The unsustainable harvesting of mangroves for firewood is greatest in Kosrae and Chuuk. Ironically, the most unsustainable exploitation of upland trees for lumber is in Yap which has the least amount of forest with big trees. Yap is already experiencing an unsustainable number of sawmills, and a foreign owned sawmill has recently been set up in Kosrae. All 4 states are requesting an assessment of the level of timber that could be sustainably supported (or the lack of such potential). Such information is urgently needed in Yap and Kosrae, and it is important that other states have information from such an assessment up front, before timber extraction projects are proposed or just initiated.

There is also a need to plant more trees to provide a sustainable supply of timber, tree crops and forest habitat, and to protect the best tree planters: fruit bats and birds.

Coastal Stabilization

Coastal stabilization is a great concern of all 4 States, especially on low-lying islands where the existence of a whole culture of *Rematau*, "people of the deep sea" adapted to life on small islets

and to traditional seafaring is threatened. On high islands it is essential to protect mangroves as a hedge against storm winds and surge. Mangroves sequester more than their share of atmospheric carbon and store it in deep mud, adding prospects of revenue from carbon credits to the ecosystem service value of these marine forests. Unfortunately mangroves are under great threat throughout the FSM. Most States have developed or are working on, or planning to develop mangrove management plans. Negotiations for carbon credits will help increase incentives to preserve mangroves. We are already seeing how some efforts to protect coastlines serve to telescope the problem to adjacent areas. Expert advice on coastal management is urgently needed to guide activities in the FSM.

Urban Forestry

Urban Forestry supports both activities and a U&CF staff that provide a link between government Forestry agencies and communities. This is a very important program as it is the main avenue to address the need to "turn forestry from a small government agency into a community concern." Now that communities have access to assistance from the UNDP Small Grants Program State forestry agencies can assist communities in developing and implementing quality projects. Funding available through U&CF program thus has considerable leverage.

Capacity building

There are three needs for capacity building in Forestry. The first is in the number of staff. As shown in Table 2 of State chapters current staff levels are low. With the advent of the TNC Micronesia Challenge and other expectations, Forestry staff currently finds it difficult to both carry out work under performance based budgets as well as to accommodate these additional programs and visitors. It is anticipated that some of the 12 million dollars pledged by Then Nature Conservancy and Conservation International will help increase the number of persons working in Forestry.

The second need in capacity development is for training relevant to work at hand. Forestry agencies are interested in opportunities for scholarships to develop Forestry professionals, internships and relevant training resulting in certification in needed skills. The Yap State chapter describes a potential training and internship program with mainland U.S. firefighters.

The third need in capacity development is to assist communities in understanding environmental issues and in developing and implementing quality projects.

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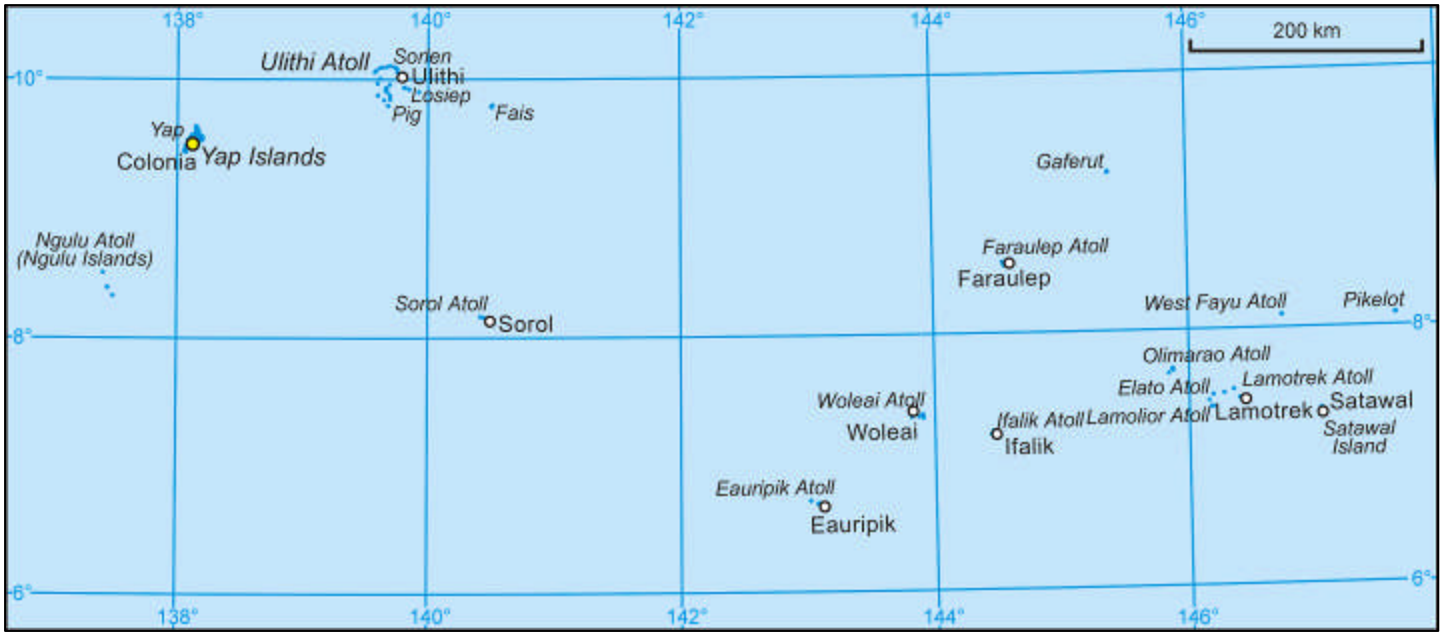
UNEP World Conservation Monitoring Center, Protected Areas Database. <http//sea.unep-wcmc.org/wdbpa/>

II. YAP STATE

Introduction

Yap State spans some 100,000 square miles of ocean. Its land area of about 50 square miles consists of some 134 islands and atolls, 22 of which are populated. The State has a population of approximately 12,000 people with at least 60% from the main islands and the remaining from small neighboring islands and atolls. Lying at the western end of the FSM, Yap differs from Eastern Micronesia in a number of ways. Climatically, it lies in an area that generally experiences a monsoon climatic pattern with more frequent periods of drought. Geologically, mainland Yap is the oldest island in the FSM with some soils derived from continental rock and others from old volcanic activity with limited areas of coralline soils on mainland Yap. The islands of mainland Yap are small and closely clustered resulting in condensed natural communities from ridge top (174m) to reefs. Neighboring atolls and islands are significantly smaller and all but Fais are low-lying atolls and islands with very limited soil and fresh water resources. The majority of land on Yap, including mangrove forests, is privately owned under a complex traditional tenure system and used and managed through a mix of traditional and modern technologies.



Map Y-1: Yap State

Yap islands are small, and with closely linked ecosystems in a small area, there is little leeway for ecological mistakes. Once ecosystems are disrupted they are difficult to re-establish. It is thus important to link ecosystem integrity with the production of food, timber, fiber, and other goods as well as ecological services for people. There is thus a close connection between our stakeholders' priority issue of food security, especially in this era of climate change and sea-level rise, and the Biodiversity issue that relates to the protection of ecosystem integrity, biosecurity (including threats of invasive species and fire), and the Micronesia Challenge and Forest Legacy

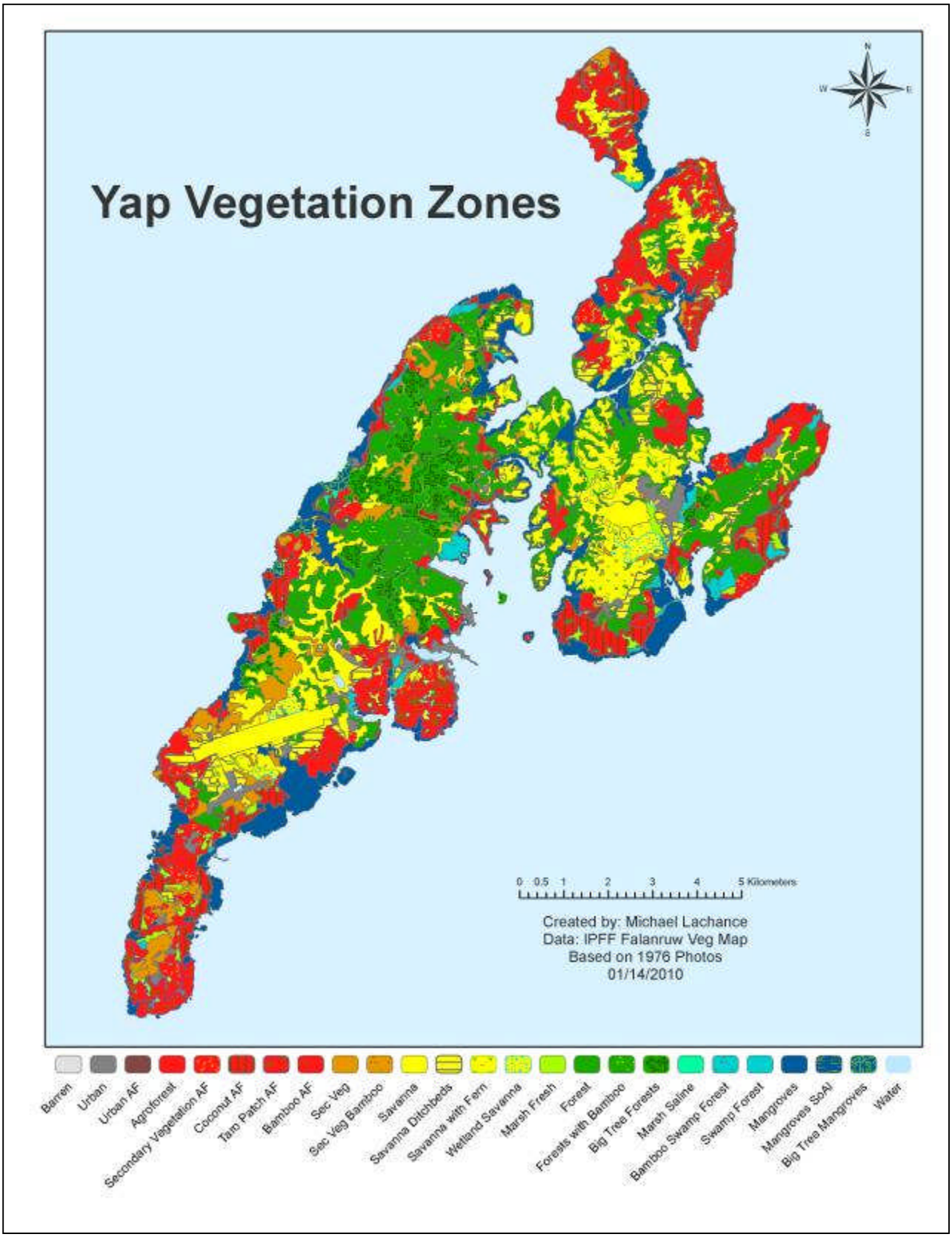
programs. Taking a watershed approach is not only ecologically sound but will help people to see their place in the ecological landscape and the connection between ecological integrity (biodiversity), food production and need for sustainable production and harvest. With fading traditional regulation of natural resource exploitation and the current availability of new technologies such as bulldozers and sawmills, natural resources are being exploited on an unsustainable basis. The issue of Production and sustainable harvest are thus particularly urgent. The development of urban centers outside of the bounds of traditional stewardship, results in a need to address the stewardship of these "commons". Last, only because it is non spatial in nature, is the great need for local capacity development both in the number of forestry staff and their knowledge and skills, and in the development of Public and community awareness and capacity. These issues are listed in Table Y-1 that follows.

Pre-SWARS Plans that were consulted include the Yap State Summit (1996), FSM National Biodiversity Strategy and Action Plan (NBSAP) (2000), Yap State Biodiversity Strategy and Action Plan (YBSAP) (2004), Blueprint for conserving the biodiversity of the FSM (Blueprint) (2003) FSM Strategic Development Plan (SDP) (2008), Yap State Division of Agriculture and Forestry 5-Year Plan (DAF) (2009), Yap State 5-Year Wildfire Plan (2008), Yap State Invasive Species Plan (2008), a Terrestrial Ecological Assessment of Yap State (2010) and other literature listed in the Reference section. Yap State has no Wildlife Plan per se, however projects relating to wildlife are included in the NBSAP and in the forestry section of the Division of Agriculture and Forestry Plan (2009), and the position of the Land Stewardship Coordinator (DAF 2009) was changed to "Waab Land and Wildlife Conservation".

I. Forest Assessment

This section provides a qualitative, quantitative, and geospatial assessment of Yap's forest resources and major issues of forest stewardship referenced to USFS National themes. It includes a discussion of priority landscapes, trends, values of these forest resources, threats, and opportunities. The term "geospatial" is interpreted literally as the use of GIS data and maps rather than the more narrow sense of doing analyses with the ESRI Arc View supplementary geospatial analysis tool. The use of GIS is new in the FSM and while local staff are able to learn geospatial analysis, this would take time away from other ongoing assignments under the performance based budget, and add the cost of purchasing the program to already strained budgets. The use of such a tool before data layers have been thoroughly geo-referenced could give erroneous results, and in a small island setting where all ecosystems are limited in size and closely integrated it could result in fragmentation of ecosystems and efforts. Successful forest resource management involves the actions of the people who own and/or use these resources and aerial imagery and regular GIS maps are more useful than abstract spatial analyses in helping resource owners assess their resources. This first SWARS therefore utilizes standard GIS maps as well as a geospatial analysis generated at a USFS workshop in Hawaii. Should they be helpful in the future, additional geospatial analyses will be generated.

Map Y-2 gives a generalized picture of Yap's forest resources. There have been no major assessments of the forest resources of the Outer Islands of Yap State except for a rapid ecological assessment of a few uninhabited islets (YINS 2010). Issues related to Yap's forest resources are presented in Table Y-1.



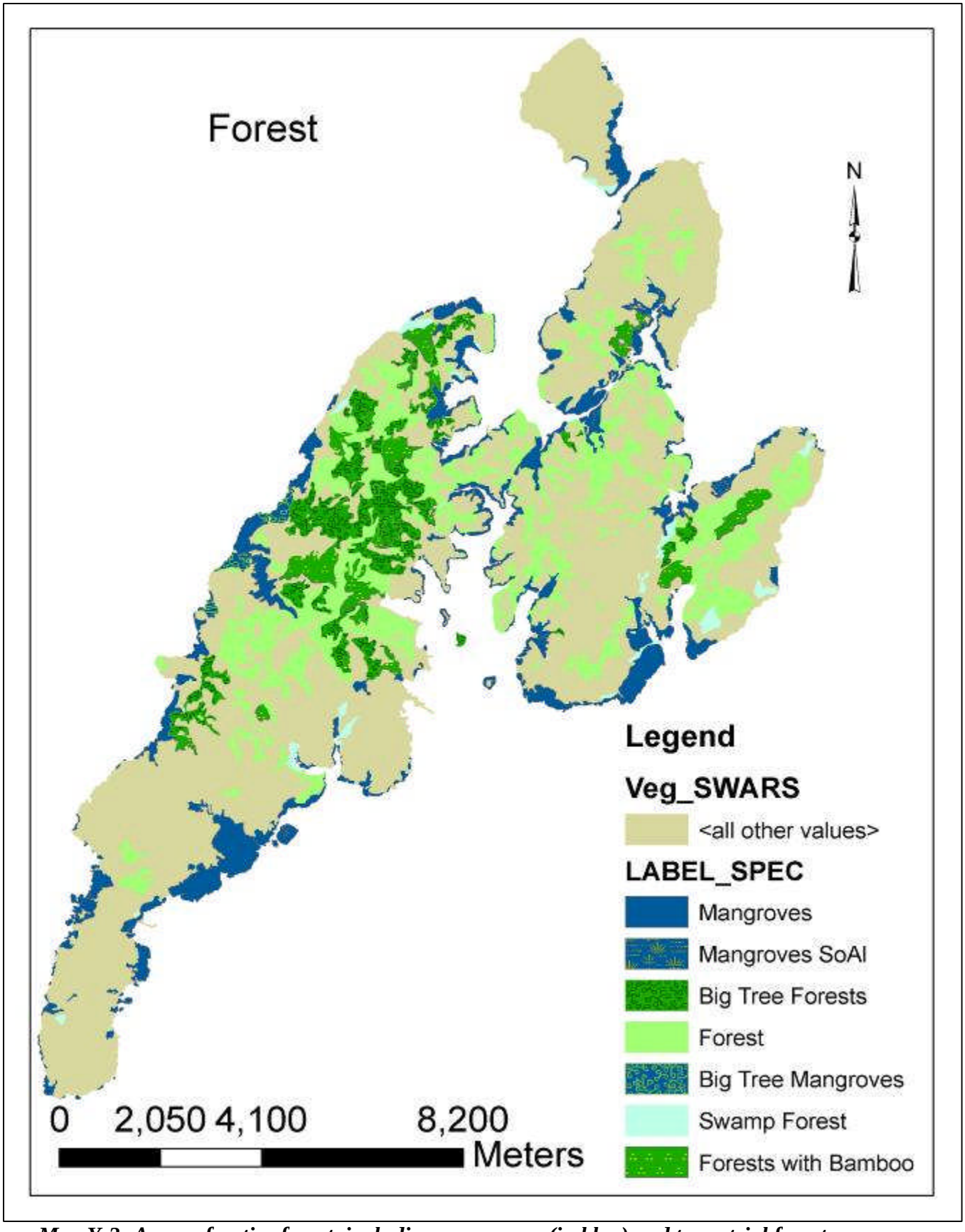
Map Y-2: The Vegetation of Yap based on data from Falanruw et al 1987 color coded to show major types and some important sub-types

The general forest types of mainland Yap include: “Upland Forest”, Swamp forest, mangrove forest, atoll forest, Fais limestone forest, and agroforests. All of these forests are threatened by many factors (NBSAP 2000, YBSAP 2004).

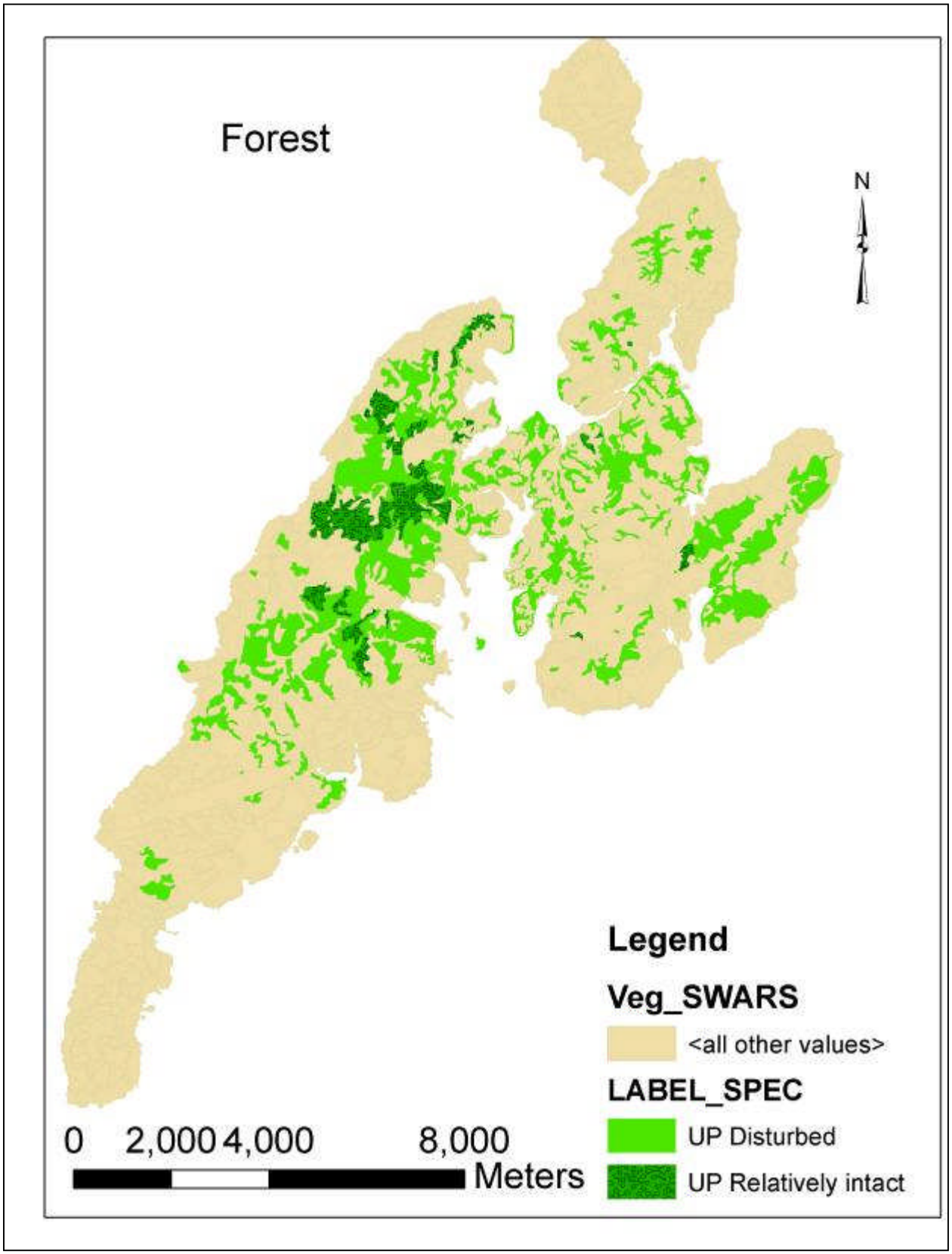
Upland forests provide habitat for biodiversity including a number of endemic species. They are also very important for their watershed services. Mangrove forests have multiple values for fisheries habitat, wood production, trapping sediment, and shoreline protection. Mangrove forests significantly buffer the force of waves, including storm surges, and thus protect the coastline from erosion. The “fringe” (seaward) mangrove is especially valuable for this coastal protection function. Preliminary results of recent studies of carbon sequestration by Kauffman & Donato (2009) have shown that while they make up about 12% of the vegetation of Yap, mangroves sequester about 34% of the carbon taken up by Yap’s vegetation! They are thus important for mitigation of climate change. Coastal forests occurring above high tide mark, especially on the coasts of atoll islets, help to stabilize the coastal dunes and reduce the extent of beach erosion during storm surges. Strand forests also provide a windbreak protecting the forests behind them from strong winds, desiccation and salt spray and help to stabilize the crest of the beach and reduce the extent that a high-water event overtops the beach crest and deposits salt water in the island interior. Native atoll forest trees provide roosting and nesting sites that are critical to the survival of sea birds that aid fishermen in finding fish.

While small sized, large scale maps such as the "historical vegetation" map produced by FIA give the impression that much of mainland Yap is forested, enlargement of the maps and display of mapped subtypes shows the degraded nature of these forests. Map Y-2 shows Yap's vegetation with subtypes within the major types and therefore indicates the mixed nature of Yap's forest.

Map Y-3 shows areas of native forest, including mangroves and disturbed forest. Map Y-4 shows Yap's forest pared down to the limited areas of relatively intact native forest (forest without secondary subtypes). This is the priority landscape for forest biodiversity conservation, and one of the areas demarcated as a major terrestrial Area of Biodiversity Significance (ABS) in the Blueprint (2003) (Map Y-14). This map was produced through the Yap State/Queen's University GIS program with data from Falanruw et al (1987), which was based largely on aerial photos taken in 1976. It is likely that this area of forest has since been altered by wildfires, typhoons, bulldozing activities, sawmills and outer island sea level rise refugee settlements.



Map Y-3: Areas of native forest, including mangroves (in blue) and terrestrial forests including disturbed forests but excluding agroforests. Some important subtypes such as forests with some big trees and forests with bamboo are included



Map Y-4: Mainland Yap areas of relatively intact native forest (forest without secondary inclusions) based on data from Falanruw et al 1987, based on aerial photos of 1976

Map Y-2 provides useful baseline data and illustrates the mixed nature of Yap's forest. Should new aerial imagery become available, an updated vegetation map would make it possible to determine changes over a 30-year or more interim. It is likely that areas of intact forest shown in Map Y-4 have become more disturbed due to bulldozing, agricultural burning, wildfires during intervening ENSO drought years, several strong typhoons, an increase in smothering vines and the recent proliferation of sawmills. Nonetheless, while forests are increasingly secondary in nature, most of the tree species, with some exceptions, are native. A number of areas of dieback have appeared in Yap's mangroves. These areas of dieback were greatly damaged by Typhoon Sudal and some have not recovered. Disturbances such as typhoons can affect the species composition of mangroves as *Rhizophora spp.* are killed and do not regenerate, while *Sonneratia alba* readily resprouts and regrows (YINS 2005). Some areas of predominantly *Sonneratia* shown on Map Y-3 may have resulted from past typhoons. Swamp forests have almost all been converted to taro patches or *Nypa* palms used for thatch.

Map Y-2, published in (1987), is based on black and while aerial imagery taken in 1976. While the more recent Forest Inventory Assessment (2009/10) provided considerable data on sampled areas, the mixed nature of Yap's vegetation would require a considerable intensification of the sample in order to yield data and maps that could provide statistically defensible data or be compared with the 1987 maps. A "historical vegetation map" produced by the FIA is "trained" based on the 1987 vegetation map, and has modified some types, so that the two maps may not be compared to quantify trends.

Critical Data Gaps

The most crucial information needed to determine vegetation change is up to date high-resolution aerial photos, especially of Yap Outer Islands. Such imagery would provide an updated baseline and enable even local staff to determine trends and monitor progress in resource stewardship. An important added benefit is that such aerial images could be shared with communities. Having an intimate knowledge of their surroundings and a vested interest in their natural resources, such imagery would be very valuable to the development of community awareness and natural resource stewardship plans (the "Municipal Plan" process included in the DAF 5-Year plan).

In addition, LIDAR imagery would enable natural resource planners to evaluate threats of sea level rise and storm surge and to plan for adaptation to sea level rise. Aerial photography and LIDAR imagery from which elevation and hydrological profiles can be developed, are an especially critical need for Yap's low lying Outer Islands, most of which are within the 2 meter zone of sea level rise and the 5 meter zone of storm surge.

Data on soil fertility and treatments or amendments to improve the fertility of soils is needed as are programs for producing food on atolls experiencing salt-water intrusion.

Discussion of Issues

Table Y-1 summarizes Yap State issues in relation to FSM National Themes and USFS National Themes; and indicates Priority Landscape Areas. The sequence is somewhat arbitrary as all issues are important and would be prioritized differently by different stakeholders depending on their orientation. Our main stakeholders, the Yap Women's Association, placed highest priority

on food security. Biodiversity (ecosystem integrity) is also a top priority because it is the source of all production. A watershed approach is essential to Public understanding and landscape scale stewardship. Coastal stabilization is of great concern, especially to inhabitants of Outer Islands, but it is a difficult issue to address without expert input, and in some cases, it will not be possible. The issue of sustainable harvest is especially urgent. The issue of capacity building is last only because it is non-spatial in nature.

Table Y-1: Summary of Yap State Issues arranged by FSM & National Themes and Issues

FSM National Issues	Priority Landscape Areas	3 U.S. National Themes
A. Food security	High islands: agroforest and secondary forest, with higher priority on fertile soils and lower priority on low elevations Atolls: all arable land Tree garden/ taro patch agroforests and lands that can be reconditioned into agroforest production systems, shown in red (agroforests) and orange (secondary vegetation) on Map Y-2; especially areas of better soil (Map Y-7) away from zones vulnerable to sea level rise (Map Y-8).	Conserve 1.1 ID & conserve high priority forest ecosystems & landscapes Conserve 1.2 Actively & sustainably manage forests Protect 2.2 Protect forests from harm (forest health) Enhance 3.4 Maintain & enhance economic benefits & values of trees & forests
B. Biodiversity (Ecosystem integrity, Bosecurity, Protected areas, Forest Legacy	Areas of forest with highest intact natural forests and areas that can be restored or revert to intact forest (Maps Y-3&4). Roosting & nesting sites of wildlife. Flight paths of fruit bats. Map series Y-14 "areas of biodiversity significance"	Conserve 1.1 ID & conserve high priority forest ecosystems & landscapes Enhance 3.5 Protect, conserve & enhance wildlife habitat & fish habitat. Enhance 3.3 Assist communities in planning for & reducing wildfire/forest health risks Protect 2.1 Restore fire-adapted lands & reduce risk of wildfire impacts Protect 2.2 ID, manage & reduce threats to forest & ecosystem health
	Areas most vulnerable to wildfires, especially those adjacent to forests of high natural integrity and areas being restored (Maps Y-10 & 11). Areas with targeted invasive species. This issue is not easily mapped because of the dispersed nature of most invasive species, however Map Y-9 provides data on Imperata, a more map able species.	
C. Watershed	Map Y-12 shows watersheds, rivers, riverine buffer zones and wetlands. Yap forestry will submit a competitive grant proposal on a watershed project that will help prioritize important watersheds and develop a watershed project. Map Y-13 shows the vegetation types and areas burnt by wildfires in an important watershed.	Enhance Public Benefits from Trees and Forests: 3.1 Protect & enhance water quality & quantity, Enhance 3.5 Protect, conserve & enhance wildlife habitat & fish habitat.

D. Production & sustainable harvesting	Areas suitable for reforestation, timber and fuel production, shown in yellow in Map Y-2.	Enhance 3.4 Maintain & enhance economic benefits and values of trees & forests
E. “Urban” forestry	Urban areas: and Urban/agroforest areas, shown in grey in Map Y-2.	Enhance 3.2 Improve air quality & conserve energy Enhance 3.6 Connect people to trees & forests & engage them in environmental Stewardship activities
F. Coastal stabilization,	All Mangroves, shown in blue in Maps Y-2 & 3 and coastal areas within 1, 2 & 5-meter zones shown in Maps Y-5, 6, & 8.	Enhance 3.7 Manage & restore trees & forests to mitigate & adapt to global climate change
G. Capacity building	Non-spatial	Enhance 3.6 Connect people to trees & forests & engage them in environmental Stewardship activities Enhance 3.3 Assist communities in planning for & reducing wildfire/forest health risks

Analysis of Issues
This section provides a qualitative (descriptive), quantitative, and geospatial (map) analysis of the issues summarized above, including: the condition of the priority landscape, trends, values (benefits and services), threats and opportunities, and some critical information needs.

A. Food Security

The Yap State Summit of 1996 stated: "Yap's agriculture and forest resources will be used to provide food supplies, healthy livelihoods, and other resources to the people of the State and opportunities for cash and export income, while protecting the ecological integrity of Yap." The FSM Strategic Development Plan of 2004 stated in its Agricultural section: "The agriculture sector, including forestry, shall provide: (i) food security, cash income, and healthy livelihoods; and (ii) opportunities for domestic and export markets, while promoting environmentally sustainable production within a stable and consistent policy framework".

Yap's most sustainable food production system is the traditional Taro Patch Tree Garden Agroforest system. The agrobiodiversity of these agroforests is quite high and very important. Because it is an anthropocentric forest type, "agrobiodiversity" is considered under issue A: Food security. A description and discussion of Yap's food production system is provided in Falanruw (1994). The 1987 vegetation map reports 5 categories of agroforest.

Food production in the Outer atolls of Yap State is also dominated by agroforestry and taro patch culture. Atoll taro patches are especially vulnerable to sea level rise, storm surges and salt-water intrusion that are already occurring. The thinning of fresh water lenses, desiccating winds, and drought also threaten agroforests on Outer Islands. Rising levels of greenhouse gasses, climate change and sea level rise has already sealed the future collapse of fresh water resources and food production on these islands unless innovative bio and eco- engineering adaptations can be developed in time to allow the inhabitants of these islands to remain on their beloved home islands. The migration of Outer Islanders to mainland Yap has already begun and is increasing pressure on forest resources of Yap.

Trends: Observations and market data suggest that the traditional food production system of mainland Yap has been reduced in extent and productivity. Recent high waters have damaged or destroyed taro production areas in low lying areas of mainland Yap and most taro patches in the outer islands. The current deterioration of food security will be exacerbated by climate change and sea level rise, especially in the low-lying Yap Outer Islands. It is necessary to enhance food production systems to adapt to climate change and sea level rise and to pre-adapt on mainland Yap in order to provide for the large percentage of Yap's population from the low-lying Outer Islands who will eventually become climate change refugees. Food security will be evaluated with respect to climate change and sea level rise, main food production areas will be enhanced and a program developed to adapt to sea level rise. Almost all of Yap's Outer Islands except Fais lie within the 2 - 5 meter zone of sea level rise and storm surge, so an associated downward trend in food production can be expected.

Benefits: Agroforests serve as food production areas, sources of fiber and medicines while providing the ecosystem services of forests. Agroforestry is practiced on both Mainland and Outer Islands of Yap state.

Threats: Population growth and people's desire to be able to drive up to their houses and to have power and water have resulted in the settlement of families away from their traditional agroforestry estates or bulldozing of agroforest areas. Water management systems have not been maintained as well as in the past, and weedy species are replacing food-producing trees. Invasive species invade shifting garden areas so that they do not revert to forest, making this gardening system even less sustainable. Atoll agroforests are threatened by sea level rise, coastal erosion, and salt-water intrusion.

The availability of schools and jobs remove people from agroforestry habitat decreasing the daily stewardship of agroforests. The monetary economy enables people to live more independently of traditional agroforestry production. With a high population of young children and school and wage opportunities for young women, most experienced agroforesters have become babysitters and the intergenerational transfer of agroforestry technology skills is threatened. Associated with this trend is a loss of agrobiodiversity, the diversity and sub-specific variation in food crops adapted to local conditions, and associated ethnobotanical knowledge.

Opportunities: The cost of imported food is increasing, so people may need to turn to traditional food production. The movement of Outer Islanders to Mainland Yap increases both the need for more food production as well as a potential labor force to recondition and expand food production systems, if social arrangements can be made and appropriate technologies can be identified and transferred in time. If food production in priority areas could be enhanced, it could also reduce pressure on natural forests.

Priority landscapes to address issue: Map Y-2 addresses both food security and biodiversity. It provides a color-coded map of major vegetation types of Mainland Yap with textures showing some subtypes. Inasmuch as all of Yap is utilized in some aspect of food or other production, all vegetation types are included. The map is color-coded to indicate the appropriate strategy/ activities throughout Yap. In general, these are: Enhance, and rehabilitate the warm colored areas (red agroforest & orange secondary vegetation), and Protect and conserve the cool colored areas (green forests & blue mangroves). This map therefore addresses both Issues A. (Food security), and B. (Biodiversity conservation). This 8 ½ x 11" rendition of the map is too small to display the array of data adequately, but it can be overlaid with estimated areas of village and municipalities and areas selected for the printing of larger maps for use by particular community groups, and in the development of Municipal plans (DAF 2009) further discussed in the Strategy section. Priority areas for agroforest intensification are agroforest (red) areas above the zones of sea level rise and storm surge, and priority areas for agroforest expansion are areas of secondary vegetation (colored orange) on Map Y-2. Priority areas for adaptation to sea level rise and storm surge are areas (other than mangroves), lying below the zones of sea level rise and storm surge shown in Maps Y-5, 6, and 8, especially areas of more fertile alluvial soils (other than mangrove soils), shown in Maps Y-7 and 8.

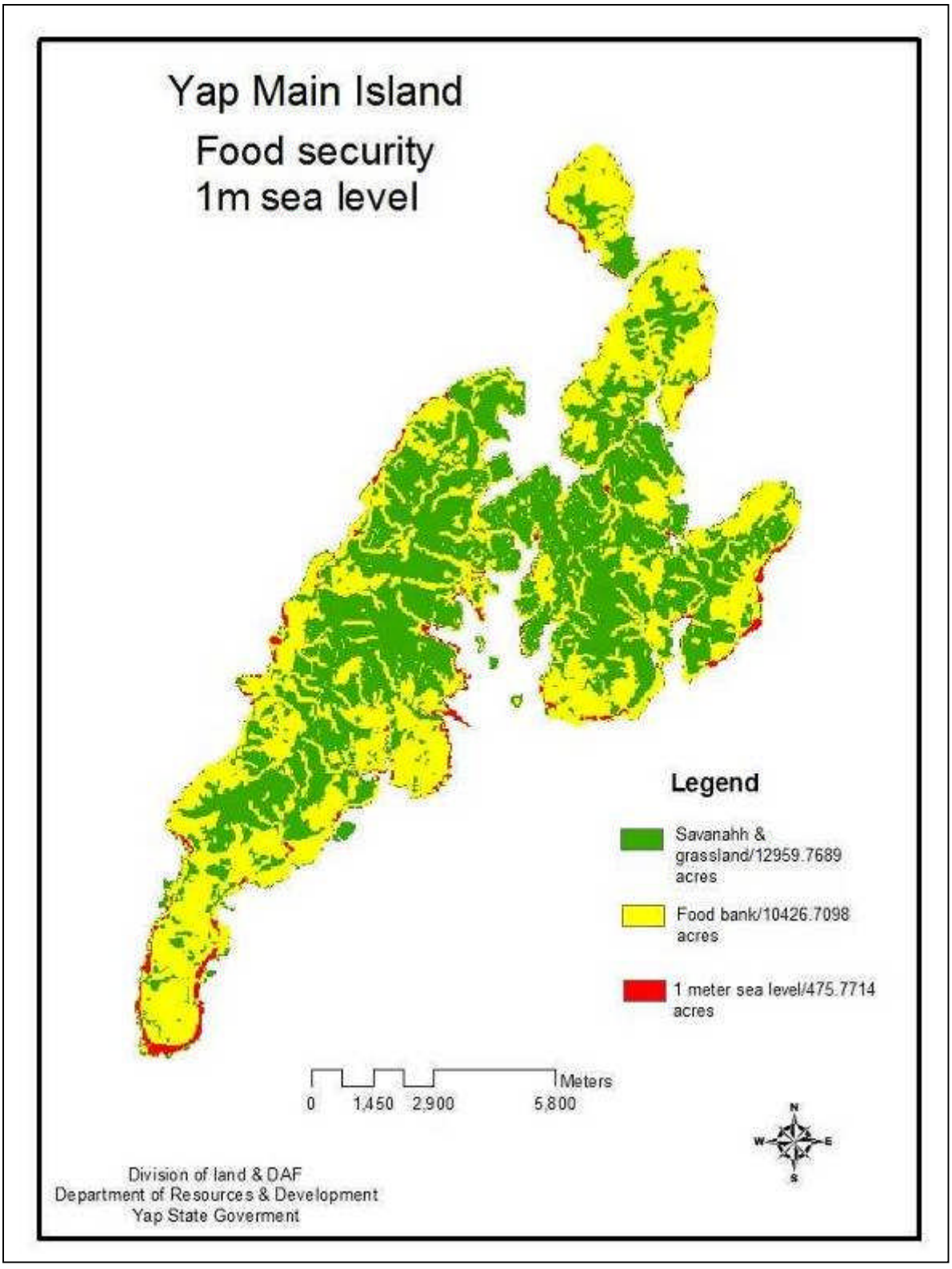
Priority landscapes for food security enhancement are the agroforestry type, colored red, and areas of secondary vegetation, colored orange, in Map Y-2. The agroforest type is further subdivided into agroforests with a high percentage of coconut trees and agroforests with a high percentage of taro patches as shown by textures. The incidence of taro patches is under represented as many could not be seen below the agroforest canopy.

Map Y-5 is a spatial analysis of the impact of a 1-meter rise in sea level on areas more suitable for food production. It utilizes layers on vegetation, soil, rivers and riparian buffer zones, and slope. Areas of Mangrove have been masked out. The remaining layers are ranked and then attributes are weighted to give a composite picture indicating areas more suitable for food production in yellow and areas less suitable for food production in green. Ranking and weighting factors for Map Y-5, below, are provided in the Appendix.

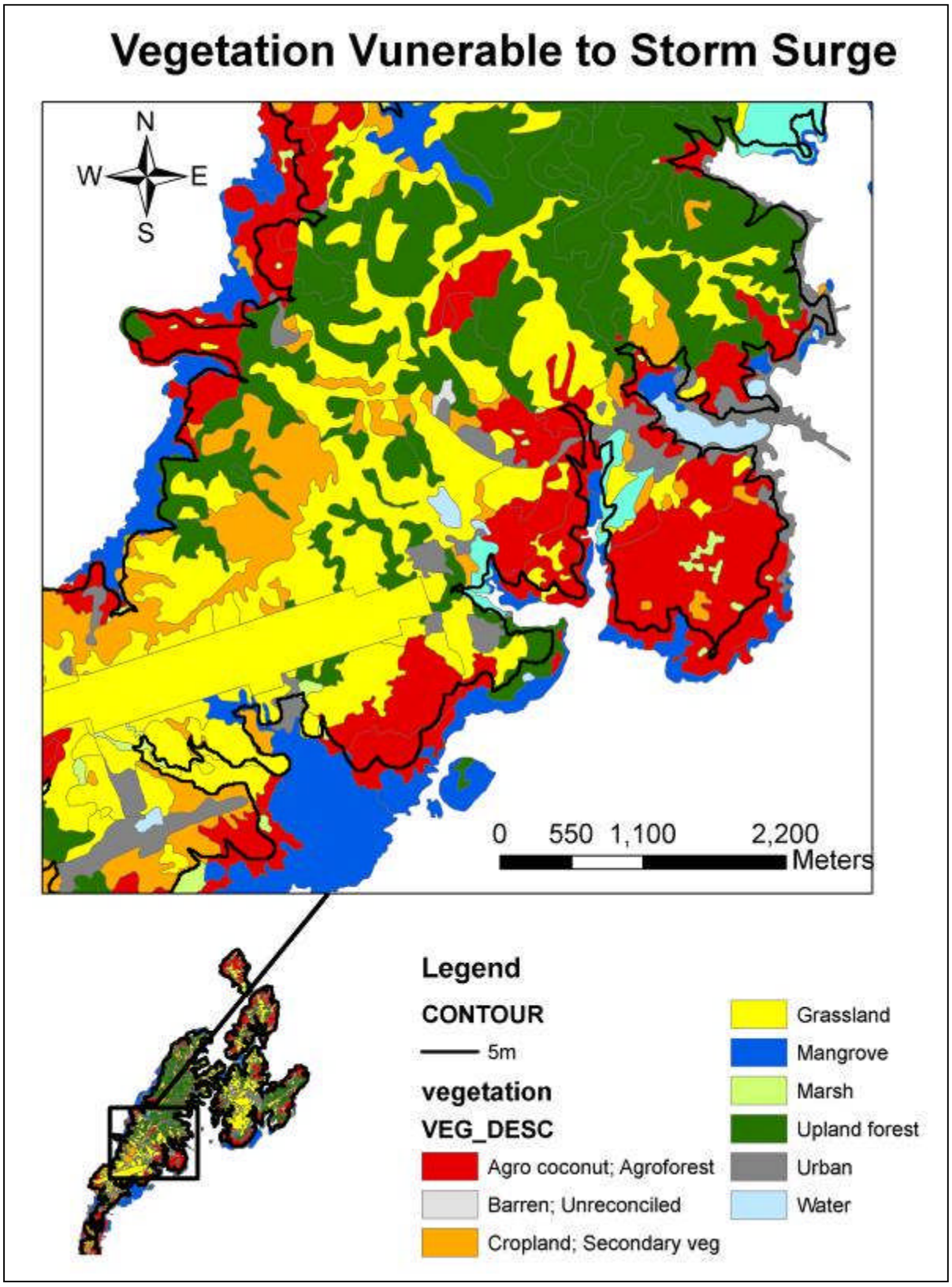
Map Y-6 shows an enlarged section of a map of mainland Yap showing the impact of potential storm surge on areas suitable for food production. The figure of 5 meters is based on observed storm surge associated with Typhoon Sudal and increases in storm intensity and sea level rise expected to occur as a result of climate change (IPCC 2007). It should be noted that almost all of Yap's Outer islands (with the exception of Fais), are within the 5 meter zone of potential storm surge.

Map Y-7 shows general soil types. While most all of Yap’s soil is poor, the Gagil soils are mostly highly degraded and the alluvial Ilachetomel soils of mangroves are saline. Yapese have developed techniques for food production from most other soils even when poor. In general, volcanic soils are more fragile and subject to laterization and should be managed with care. Within the priority area for agroforestry, higher priority is given to more fertile soils.

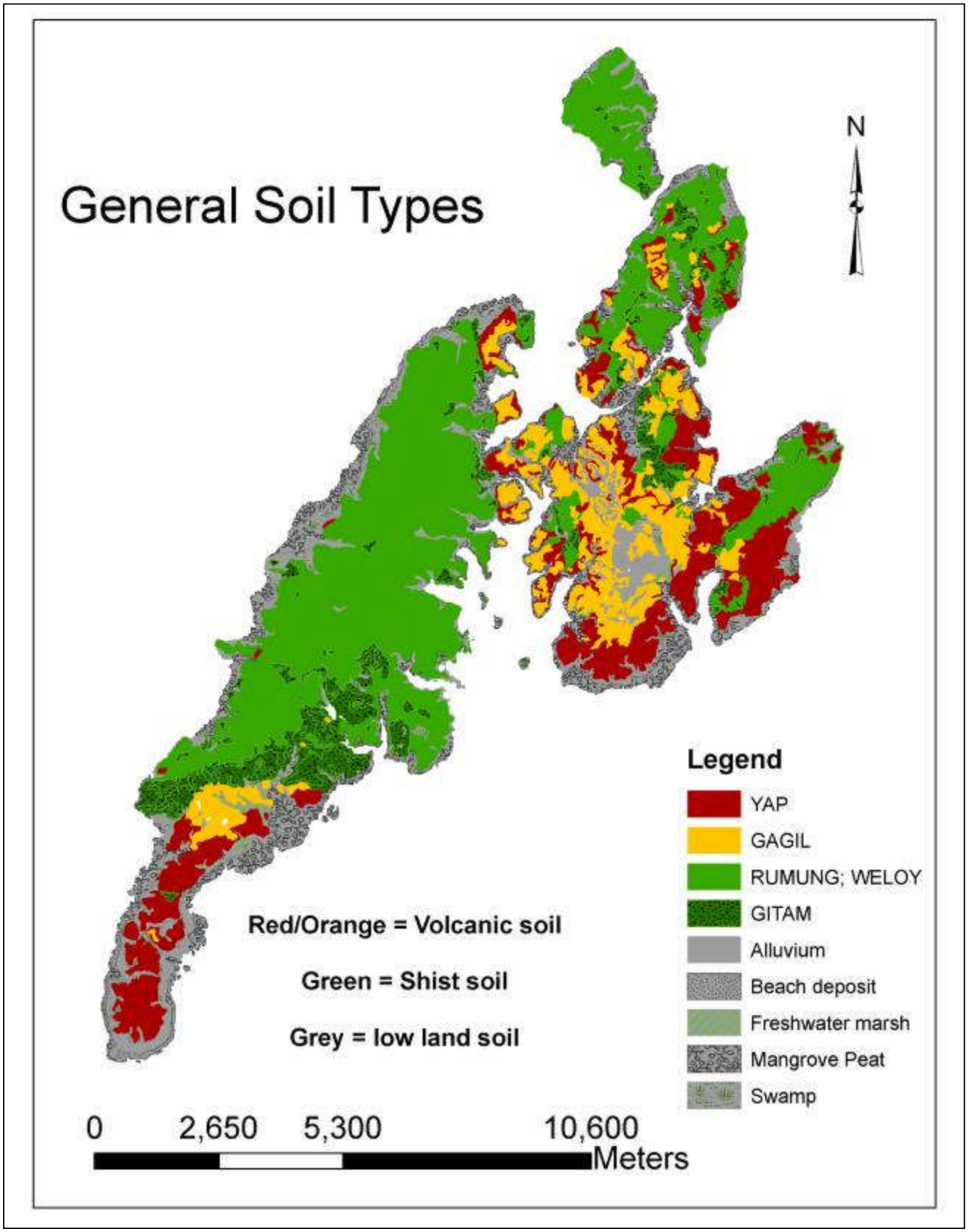
Map Y-8 shows the general soils types displayed in Map Y-7 with a blue overlay indicating the zone of 1 meter sea level rise (in dark blue), and the areas vulnerable to a 5 meter storm surge. Typhoon Sudal generated a storm surge of 11 feet in some parts of Yap. The 5-meter zone is estimated on the basis of predictions of 1-2 meter rise in sea level and increased intensity of storms expected by the end of this century. This map indicates that most of Yap's most fertile (alluvial) soils are vulnerable to storm surge. High priority for adaptation to sea level rise is placed on areas of fertile soil within the 1 and 5-meter zones shown in Maps Y-5, 7, and 8, while high priority for intensification of agroforestry systems (red in Map Y-2), and expansion of agroforestry into areas of secondary vegetation (orange in Map Y-2), are placed on areas away from the 1 meter zones shown in maps Y-5, 7, and 8.



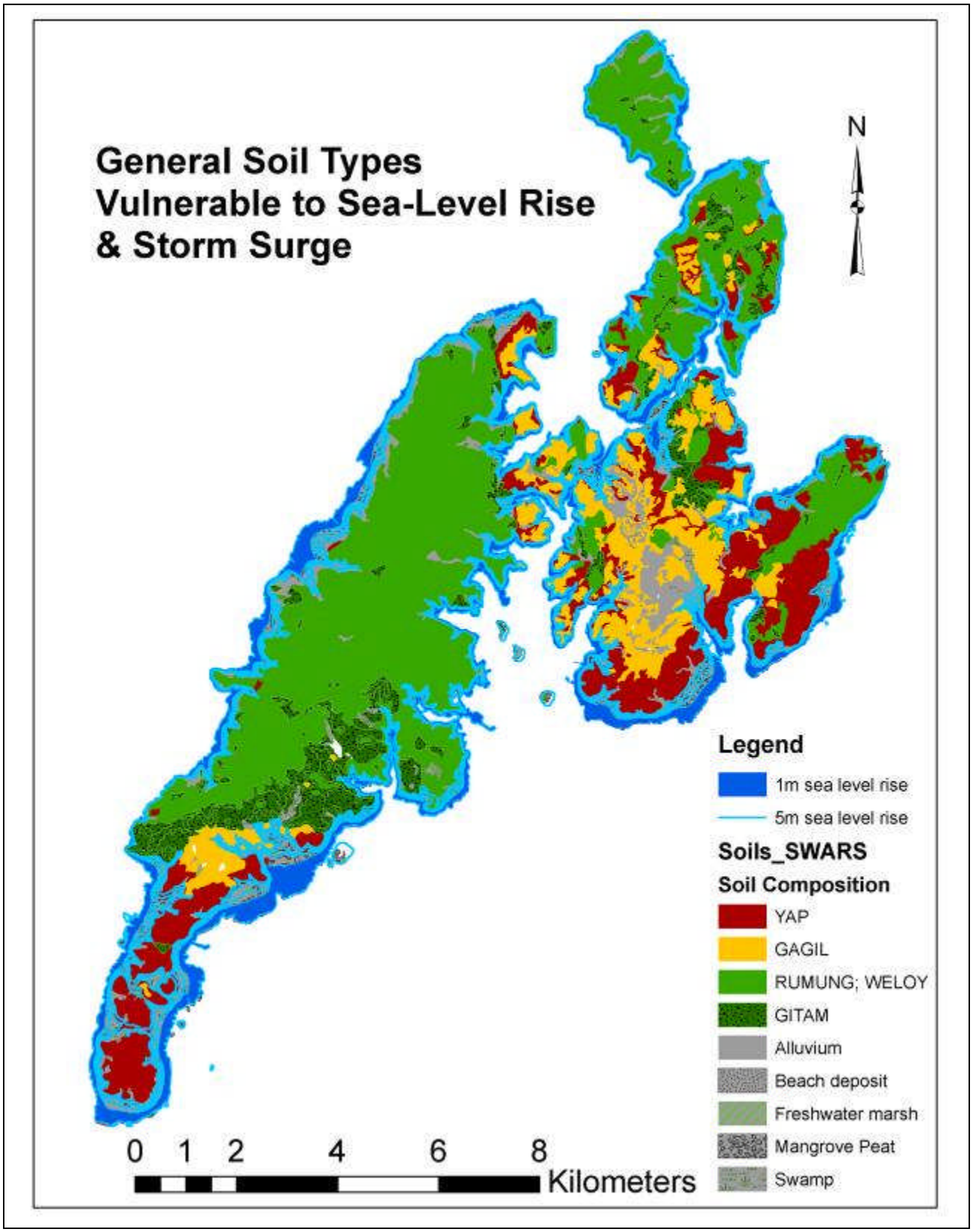
Map Y-5: Spatial analysis of the impact of a 1-meter rise in sea level on areas suitable for food production. Mangroves have been removed and remaining terrestrial areas grouped into areas more suitable for food production in yellow) and less suitable for food production (in green). Red zones are subject to a 1-meter rise in sea level. Map produced at Hawaii workshop by Leo and John Waayan



Map Y-6: Vegetation vulnerable to storm surge. This map shows the impact of 5-meter storm surge on areas suitable for food production on mainland Yap. All of Yap's Outer Islands (with the exception of Fais) are mostly within the 2-meter zone of sea level rise, and within the area of potential storm surge



Map Y-7: General Soil types. (Derived from data in (Smith 1983). The least fertile soils are shown in orange. The most fertile alluvial soils are shown in grey (except for saline soils of mangroves that are textured). Map 8 shows potential for salt water intrusion of these soils



Map Y-8: Shows the general soils types displayed in Map 7 with a blue overlay indicating the zone of 1 meter sea level rise (in dark blue), and the areas vulnerable to a 5 meter storm surge. This map indicates that most of Yap's most fertile (alluvial) soils are vulnerable to storm surge.

Map Y-1 shows the location of Yap's Outer Islands. Only Fais lies above the zone that may be affected by storm surge. The emerging policy of Yap State seems to be to assist Outer Island communities to adapt to sea level rise so that they may remain on their beloved homelands as long as possible, while pre-adapting conditions on mainland Yap to be able to accommodate relocation of Outer Islanders to mainland Yap when the Outer Islands become uninhabitable. Inasmuch as coconut trees grow up to edges of the coast on many atoll islets, all inhabited atolls are currently considered part of the priority area for agroforest adaptation to sea level rise if possible. Imagery and analysis is not available to refine maps of individual atolls and islets. At this time, no policy decision has been made to de-emphasize atoll agroforest extension (in anticipation of sea level rise and abandonment.)

B. Biodiversity Conservation

The resilience inherent in intact forest ecosystems provides the best insurance against climate change, and helps ensure that forests meet the needs of present and future generations (UNCBD, 2010.) The FSM Strategic Development Plan (2004) Environment Sector goal states: "Recognizing the critical importance of the FSM's natural environment to the health and prosperity of this and future generations of Micronesians, the Environment Sector shall support the protection of the Nation's Environment and achieve sustainable development of its natural resources". In addition, the TNC Micronesia Challenge has pledged to effectively protect 20% of terrestrial areas and 30% of near shore marine areas. It is thus important to conserve a significant percent all of Yap's intact forests types, including additional area of mangroves that are also important to coastal stabilization (issue E).

Threats: Upland forests are threatened by: bulldozing roads, agricultural areas and house sites, agricultural burning, wildfires during extreme droughts, Sawmills, Aggressive smothering vines, especially after typhoons, extreme droughts, decreases in seed dispersers such as fruit bats, Micronesian pigeons and other birds, and immigrants settling in some forested areas resulting in the deforestation of some of the few remaining intact forests

Mangroves are threatened by roads, fill, and conversion. Roads are an especially urgent threat as when roads are made between mangroves and marshes without sufficient and properly located culverts, water circulation between the systems is interrupted to the detriment of both mangroves and marshes. This is a threat to both biodiversity and also food security as mangroves support fisheries and marshes provide habitat for taro patches. There is a demand for coastal land and mangroves are being filled in. Mangroves are cut for firewood to use in the production of the lime used in betel nut chewing, and to open boat channels to individual's land. Mangrove areas where dieback had begun were greatly damaged by Typhoon Sudal and some have not recovered. Other threats include oil spills, especially if the spill is a more toxic volatile oil such as diesel and dredging operations. Mangroves may be threatened or their composition changed by sea level rise. While mangroves are likely to migrate into present-day freshwater marshes as they become saline, people tend to keep mangroves from moving inland. Yapese managed mangrove forests in the past and some of our stakeholders are interested in research to determine the optimal balance of sea grass and mangrove habitat for fisheries and are thus important to food security as well as biodiversity.

Beach strand is likely to be eroded by sea level rise and storm surges as shown in a recent survey of some uninhabited Outer Islands (YINS 2010). Atoll strand forest and atoll forest are being crowded out by coconut trees. This is a threat to sea birds that need native trees such as *Pisonia grandis* for nesting. Seabirds aid fishermen in finding fish.

Opportunities: The TNC and Conservation International have pledged 6 million each to support the Micronesia Challenge. Should this funding become available, it could support the unfilled position of Micronesia Challenge Coordinator at the Division of Agriculture and Forestry (DAF 2009), and a program to advance progress towards meeting the Micronesia Challenge, as well as to make use of the Forest Legacy program.

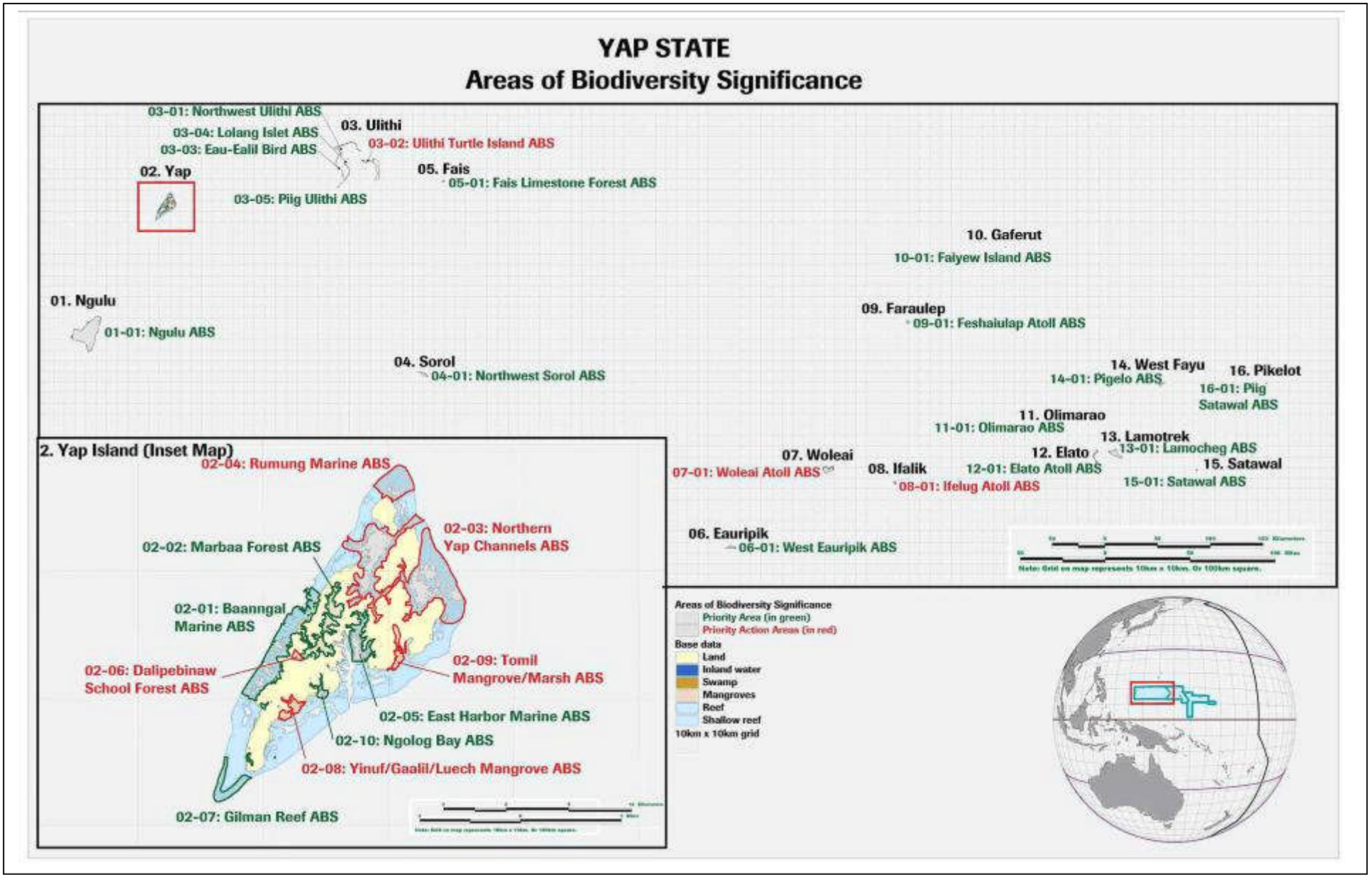
If agroforestry practices can be enhanced and made more productive, it should relieve some of the pressure of agricultural burning on upland forests. The recent trend towards greater rainfall and shorter and less severe droughts will also make it difficult to burn forests (YINS 2010).

With the passage of the Farm Bill in 2008, the FSM has become eligible for assistance through the Cooperative Fire and Aviation Program. This grant program includes access to surplus fire control equipment, including fire trucks, and training. Training opportunities include training in the Incident Command System that has become a prerequisite for disaster assistance. While the recent upward trend in rainfall has resulted in a lower incidence of wildfires in the last 9 years, it is also resulting in an increase in the fuel load, should a drought occur before more fire resistant forests develop. It is thus important to put a fire prevention and suppression program in place.

There may be opportunities to combine the protection of priority forest sites with historic preservation sites.

Priority landscapes to address issue: Map Y-2 addresses both food security and biodiversity. It provides a color-coded map of major vegetation types of mainland Yap with textures showing some subtypes. The map is color-coded to indicate the appropriate strategy/ activities throughout Yap. For Biodiversity Conservation, the priority areas are the cool colored areas (green forests & blue mangroves). This 8 ½ x 11" rendition of the map is too small to display the array of data adequately, but it can be overlaid with estimated areas of village and municipalities and areas selected for the printing of larger maps for use by particular community groups, and in the development of Municipal plans (DAF 2009) discussed in the Strategy section.

Maps Y-3 and 4 further define forested areas important to Biodiversity conservation. More intact upland forests shown in dark green on Map Y-4 are especially high priority areas for protection as are forested areas with potential to regenerate into better-developed natural forests. Because they are keystone habitats, all mangroves are priority areas for protection. Atoll forests on uninhabited outer islands are priority areas for restoration by controlling invasion by coconut trees. The removal of feral pigs, chickens, monitor lizards, and rats will help protect important turtle rookeries and nesting areas for sea birds and provide habitat for seed populations of coconut crabs and endemic species (YINS 2010). Map Y-4 shows "areas of biodiversity significance" defined in the Blueprint (2003). Yap State does not currently have the capacity to carry out a Forest Legacy program but is interested in this program for the future.

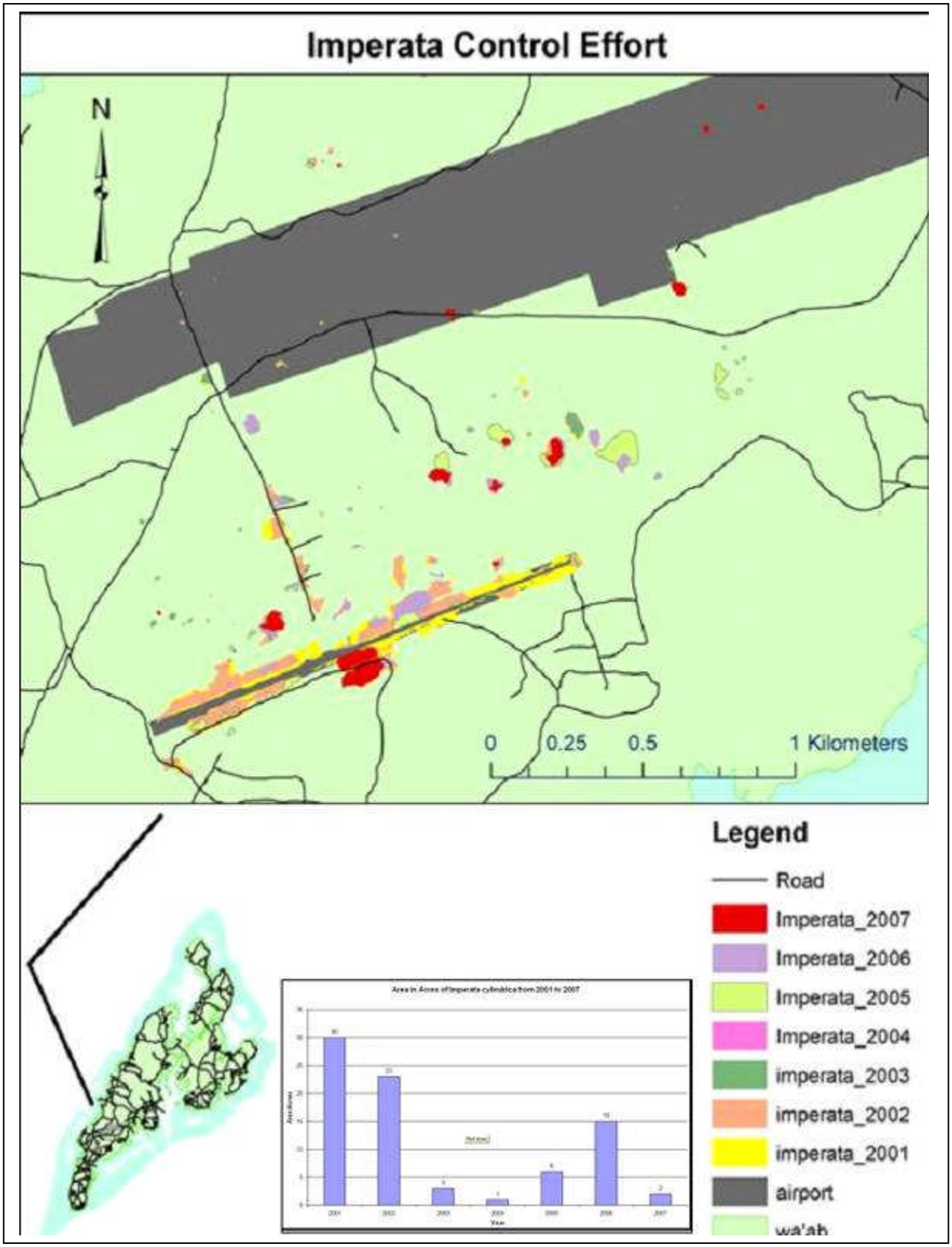


Map Y-14: Yap State "areas of biodiversity significance" and protected areas as demarcated in a series of workshops and published as TNC (2003), "the Blueprint"

Biosecurity: Invasive species & Wildfires: Invasive species are a great threat to biodiversity. Yap first obtained funding for an invasive species program in 1997 and has had a successful invasive species program since. While the number of organizations providing advice on invasive species has greatly increased, the only consistent source of support for the ongoing program is the USFS Region 5 S&P Forest Health program. The FSM National Biodiversity Strategic Action Plan was endorsed in 2002, and the Yap Biodiversity Strategic Action Plan (YBSAP) was endorsed in 2004. Invasive species are highlighted in the YBSAP Strategic Direction 4.4, in which bio-security is addressed concerning invasive species issues and other threats to biodiversity. The YBSAP also identifies the need to develop a 5-year invasive species plan. To address YBSAP recommendations, Yap created a position for an Invasive Species Coordinator and a Spray Technician, and in February 2008, the Yap Invasive Species Task Force (YIST) was officially organized and the first draft of a Strategic Action Plan (SAP) was developed. The YIST SAP (included in Appendix) was completed in December 2008. The Executive Summary of the YIST SAP is given below.

"The YIST identified four thematic areas of concern for invasive species management in Yap State to be implemented over a four year period (2009 – 2012), which include: capacity building, coordination, public awareness, and funding. This 4-year SAP focuses on eighteen priority invasive species: ten plant species, two reptile species, two rodent species, feral cats and dogs, and two aquatic species. The YIST SAP includes goals, objectives, activities, collaborations, time frames, funding sources, and estimated costs of activities. A primary objective of the YIST SAP is to eradicate three of the nine targeted invasive plant species by 2011. Another objective is to eradicate rats from at least one outer island and eradicate monitor lizards from Loosiep Island, Ulithi Atoll."

One considerable achievement of this program is the near eradication of one of the world's most invasive grasses, *Imperata cylindrica*. Map Y-9 shows the main area of infestation only as the inclusion of outlying infestations would result in a map at a scale that would make it very difficult to demonstrate the progression of control methods. Between the first mapping and time that funding for a control program was obtained, the mapped acreage about doubled. The color-coded areas show the areas treated each year. The graph shows the total area infested by *Imperata* each year. This acreage declined dramatically between 2001 and 2004. Then in 2004 Yap was struck by Typhoon Sudal that destroyed the project's pickup truck and disrupted the program for some time as staff were given administrative leave to rebuild homes and island-wide recovery was underway. By the time a new vehicle was obtained and it was possible to resume the project, the acreage of *Imperata* had increased dramatically. This demonstrates the importance of a continuing effort. Mop up operations are currently underway with a high priority on areas of previous infestation lest a resurgence occur.



Map Y-9: Control of invasive Imperata grass, 2004-2008.

Other invasive species are more dispersed and not as amenable to mapping. There are more invasive species than can be addressed with current support, therefore Yap's invasive species program must focus on newly introduced incipient species for which there is some hope of eradication or control. Additional support would be needed for an expanded effort, and technical assistance in the control of aggressive vines is needed. Assistance is also needed to address insect and disease problems that occasionally affect Yap's forest resources, such as an outbreak of beetles that occurred after Typhoon Sudal that had a serious impact on the recovery of breadfruit trees, *Artocarpus altilis*.

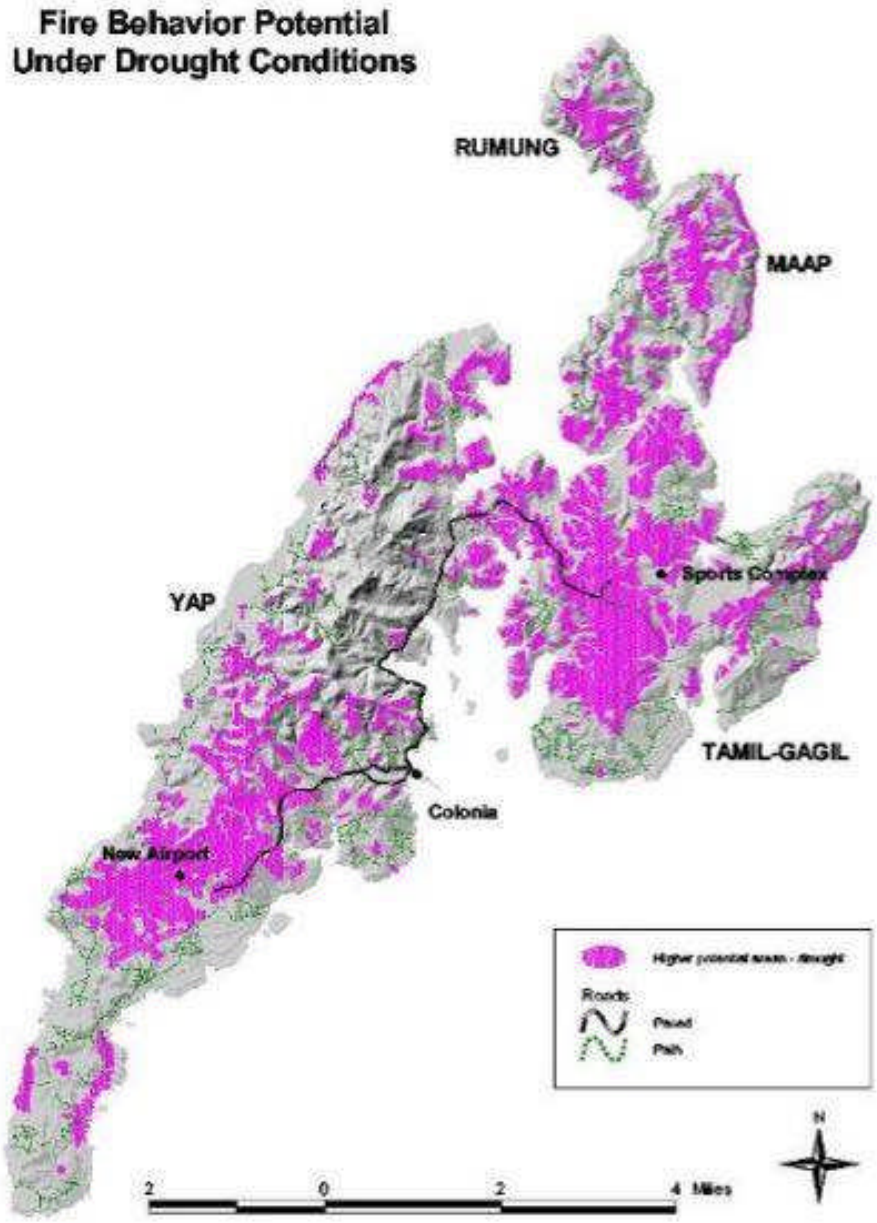
Wildfires

Mainland Yap experiences chronic wildfires on years with dry periods and acute wildfires that burn valuable forest lands on years with ENSO related droughts. On two occasions in the last 30 years, at least 22% of Yap has been burnt during drought periods. Additional background on wildfires on Yap is provided in the attached Yap State five-year Wildfire Plan (Appendix) and YINS (2010).

Region 5 Fire and Aviation Management has long worked with Yap State to develop its wildfire program, including the provision of a number of training workshops on fire prevention and suppression, as well as on the Incident Command System (ICS). The Incident Command System was utilized just days after completion of the 2004 training session to respond to Typhoon Sudal. By the time FEMA officials arrived, Yap State had already set up a Command Post and organized response using ICS organization. ICS is now the official response system used by Yap State.

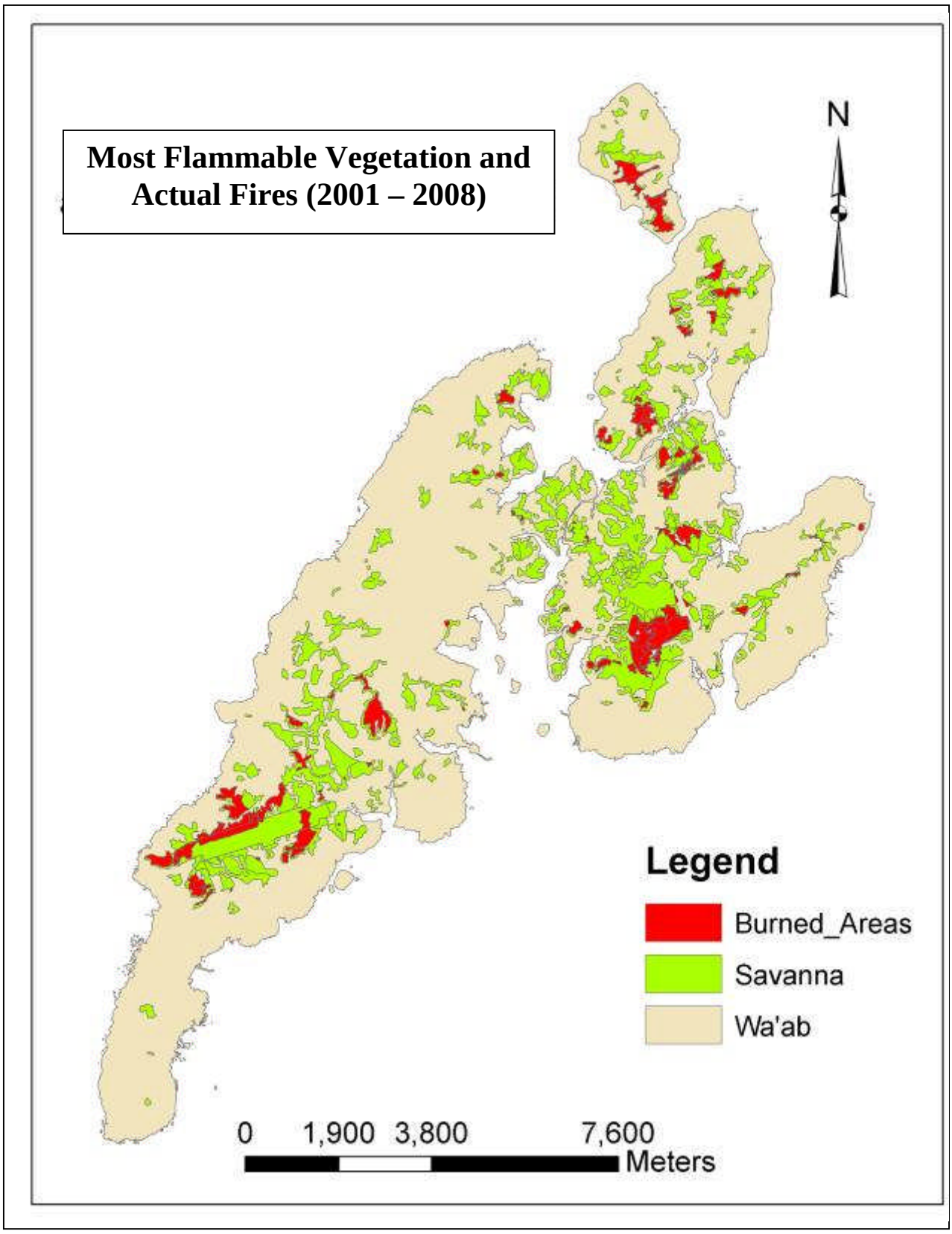
In 2002, Region Five Fire and Aviation Management (FAM) staff worked with Yap Forestry to produce a fire vulnerability map using fire models and a preliminary assessment of the flammability of Yap's vegetation (Neill, Rea & Falanruw 2002). Map Y-10 shows the FAM map of the area of Yap vulnerable to wildfires during an extreme drought. It is likely that the Region Five FAM assisted fire prevention and suppression program has contributed greatly to the decreased incidence of wildfires, as the incidence of wildfires during the 97-98 ENSO drought, when there were over a hundred volunteer fire fighters, was much less than expected based on past droughts.

In 2004, Yap State began mapping areas burnt by wildfires as part of the Yap State/Queen's University GIS program. Map Y-11 shows the most flammable vegetation types (savanna lands) and areas actually burnt by wildfires between 2001 and 2008.



Map 10. Yap Wildfire Vulnerability. This map shows areas vulnerable to wildfires on a drought year. It was produced using a USFS Region 5 Fire & Aviation Management computerized fire modeling program, along with Yap's vegetation map and field observations. From Neil, Rea and Falanruw (2002).

Map Y-10: USFS Fire vulnerability map



Map Y-11: Areas of most flammable vegetation & areas burnt by wildfires 2001-2008

The incidence of wildfires during these years has been less than on previous years. Factors contributing to this decline in the incidence of wildfires include the ongoing wildfire prevention and suppression program and a period of increased rainfall. During this period of increased rainfall and decreased incidence of wildfires, sapling trees have grown up in a number of savannas. This positive development toward reforestation is also creating increased fuel should a severe drought occur before secondary forests grow tall enough to become more fire resistant. A well-developed program of wildfire prevention and suppression is critical to protecting this progress toward reforestation.

In 2007, the second five-year Yap State Wildfire Plan was developed (Appendix), and Yap State submitted a successful application for a Cooperative Fire grant in 2009. Future plans include working with communities to develop Community Wildfire Protection Plans (CWPPs). Additional information on Yap's wildfire program, which is a cooperative effort between Yap State Public Safety and Yap State Division of Agriculture and Forestry, Forestry section, is described in the section of this SWARS on "program integration", and in the attached Yap State Wildfire Plan.

C. Watersheds

An understanding of watersheds enables people to see how they fit into the landscape, and watershed projects can be landscape in scale. They can thus be a most effective way to provide good environmental stewardship. Yap has a number of priority watersheds and need to evaluate and these watersheds in order to undertake projects that will be most effective on a landscape scale. A competitive grant proposal for a watershed project will be submitted to evaluate and rank watersheds and to carry out a pilot project in the highest priority watershed. Map Y-12 shows Yap's watersheds and Map Y-13 shows a high priority watershed.

Most of Yap’s riverine valleys are forested and most of Yap’s forest lies in valleys. Riverine forests include some characteristic riverine trees. Many watersheds have been impacted by construction activities such as roads, airstrips, earth moving activities, and dredging. The impact of such activities is generally unappreciated by the Public. Soil erosion originating in upland areas is transferred to downstream habitats through riverine and watershed areas. This has resulted in the siltation of near shore marine habits including areas important for the dive trade and other ecotourism, areas of biological significance and marine protected areas. Watersheds integrate natural habitats from ridge to reef and greatly affect the quality of downstream habitats.

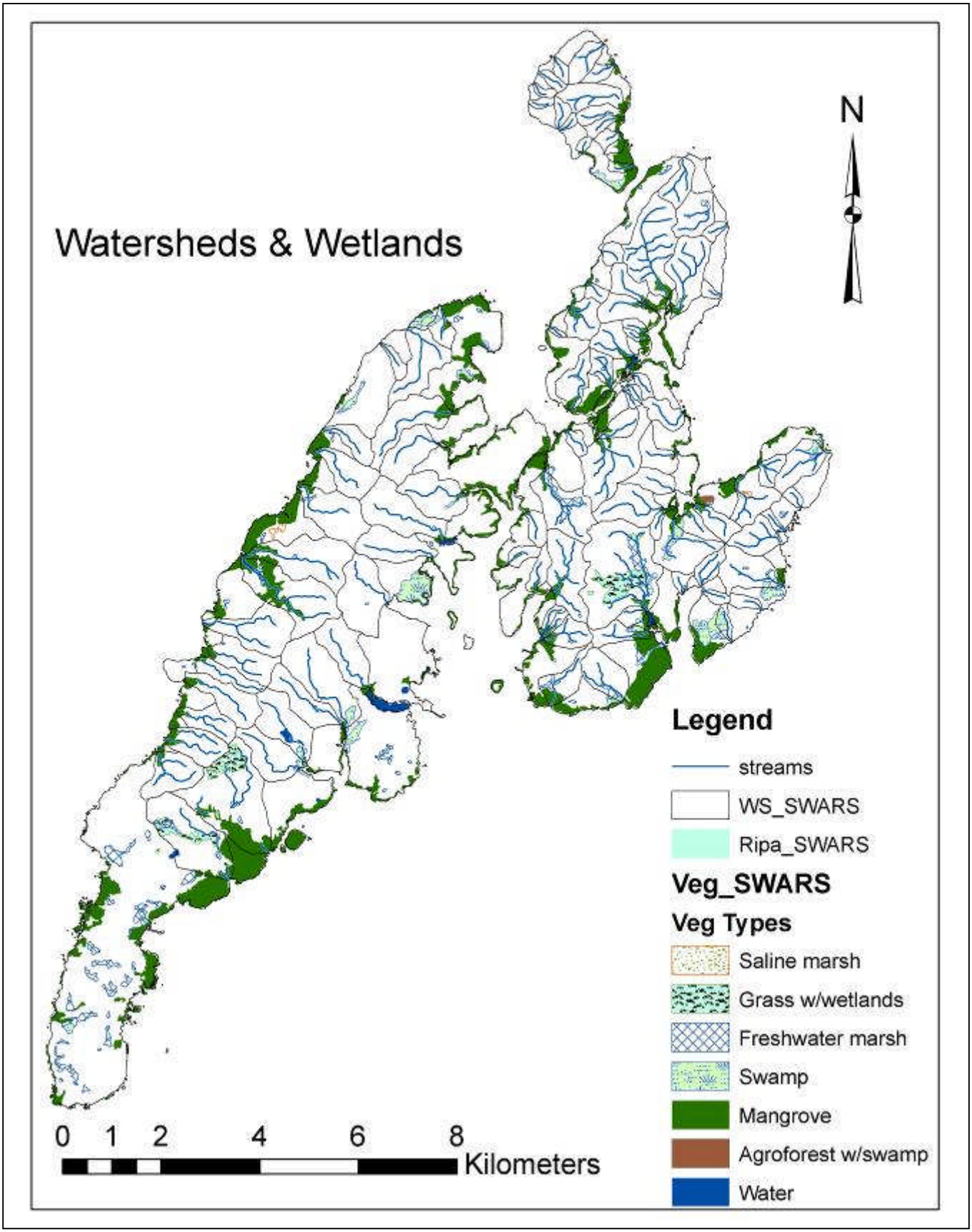
Threats: Bulldozing, dredging, landfills, deforestation, wildfires, sawmills, and storms. Fire, exposed soils, and removal of woody vegetation may cause soil compaction, reduced infiltration rates and therefore reduced groundwater recharge and reduced stream flow during the dry season.

Opportunities: Yapese traditionally managed water runoff and systems of ditched beds, drained paths and house sites, and taro patch systems permeate most of the island. This provides a precedent for continued stewardship of watersheds. If we can evaluate and prioritize our watersheds we have a chance to take part in a ridge to reef, terrestrial and marine monitoring and stewardship project.

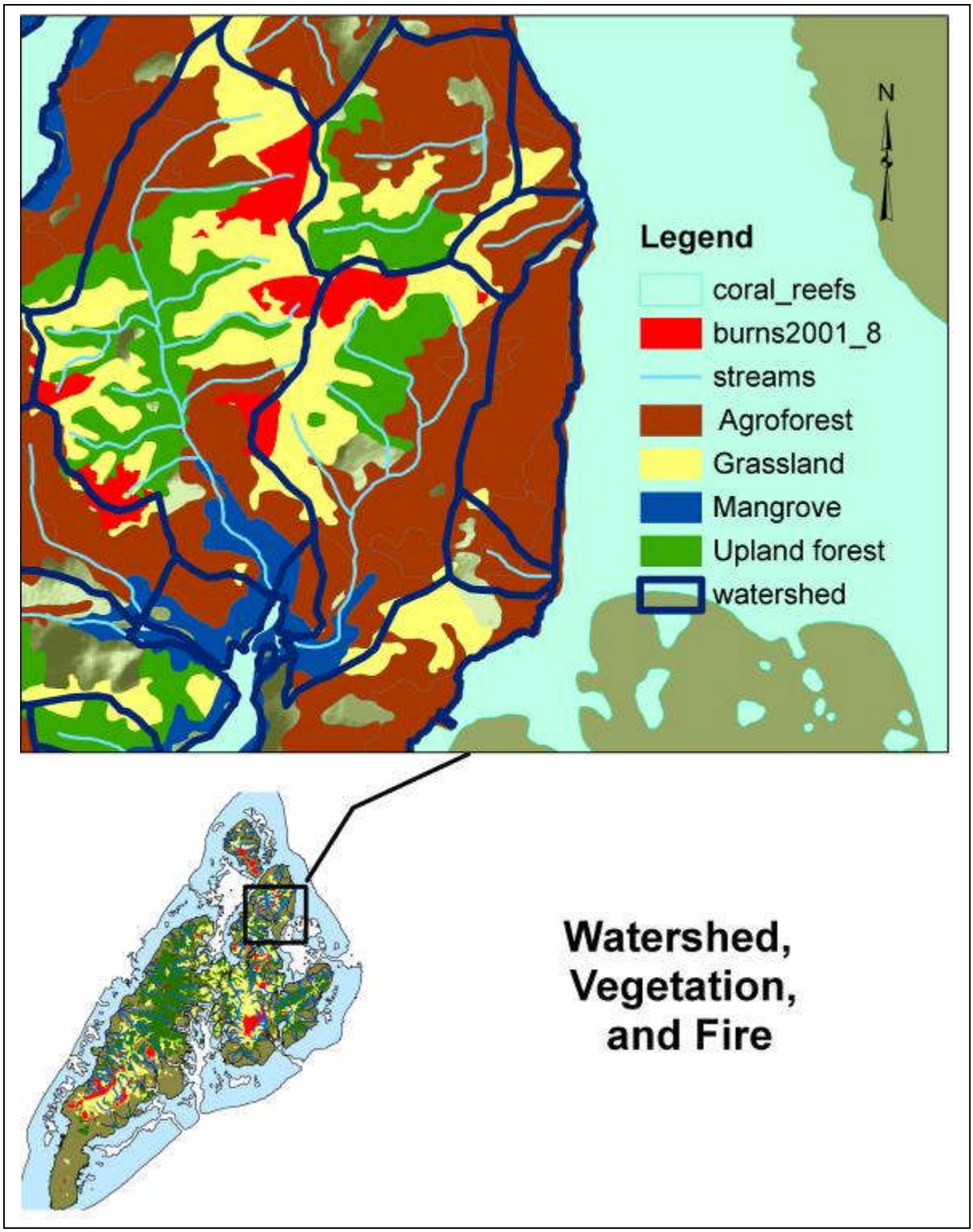
The availability of the competitive grant program gives Yap a chance to obtain support for a multi-year project to assess and prioritize watersheds and initiate a pilot project to restore watershed quality on an important watershed. This will give us an opportunity to link land and marine stewardship and to take part in a ridge to reef watershed-monitoring project.

Priority landscapes to address issue: Yap's watersheds, rivers, riverine buffer zones and wetlands are shown on Map Y-12. Yap State Forestry will be submitting a proposal for a competitive grant project to evaluate and prioritize watersheds; and to conduct stewardship and monitoring of conditions from ridge to reef of a selected watershed. Map Y-13 shows an enlargement of one section of a map showing a high priority watershed with major vegetation types along with areas burnt by wildfires. The enlarged section shows the vegetation types and impact of wildfires in the watershed of Yap's longest river, and an adjacent watershed that flow into an important marine area indicated as an "ABS" in Blueprint (2003).

Map Y-13 shows watershed, vegetation and fire within an enlarged area, showing vegetation types and incidence of fire within the watershed of Yap's longest river and an adjacent watershed that flow into an important marine "ABS" that provides habitat for Yap's famous Manta Rays and an important site for the dive industry on Yap.



Map Y-12: Yap streams, watersheds and wetlands. Blue areas along coast are mangroves.



Map Y-13: Watershed, Vegetation and Fire within an enlarged area, showing vegetation types and incidence of fire within the watershed of Yap's longest river and an adjacent watershed that flow into an important marine "ABS" that provides habitat for Yap's famous Manta Rays and an important site for the dive industry on Yap. This is a priority watershed for investigating connections between wildfires and downstream effects.

D. Production & sustainable harvesting

Traditionally Yaps' culture managed the exploitation of natural resources through a hierarchical system of estates. This cultural appropriation of resources reduced the "tragedy of the commons", where resources available to all are used up and destroyed. This system is now fading, and the availability of powerful machinery that does not come with a label that its misuse may be damaging to the health of the environment, has resulted in environmental impacts that were not previously possible. The recent promotion of sawmills by a Baptist minister has resulted in unsustainable felling for large trees.

Powerful machinery helps people to make big changes faster and easier in order to make conditions more comfortable for people, and to enable economic development. In general, the link between a healthy environment and a healthy economy is not yet realized. Resources appear to be deteriorating but there is no system to monitor environmental indicators.

Trends: Natural resources appear to be exploited unsustainably but there is no system to monitor their status. With the current trend of increased rainfall that is more evenly dispersed throughout the year so there are fewer periods of drought, wildfires are less common and trees are beginning to grow up in savanna lands. A second iteration of the FIA survey is expected to be conducted during the period of this 5-year plan and will provide detailed data on change in surveyed sites.

Values, benefits and services: The integrity of Yap's culture is ultimately dependent on its natural resource base.

Threats: Threats to forest resources include bulldozing, unsustainable timber harvest for recent increase in sawmills, deforestation by sea level rise refugees, loss of habitat for birds and fruit bats and subsequent forest decline due to lack of seed dispersal. Overexploitation of forests threatens the very survival of mangrove forests; threatens the biodiversity value of intact upland native forests; and reduces the woody component and watershed value of agroforests.

Opportunities: Since the government manages most funding for large projects, the government could do a lot to prevent damage to forest resources. Savanna reclamation projects could produce fuels and eventually timber. Since the government owns and operates the field trip ships, the government could control the exploitation of sea turtles, sea birds and coconut crabs by field trip ships. Protection and production and sustainable harvesting efforts could be tied in with ecotourism.

Priority landscapes to address issue: Map Y-2 shows the distribution of savanna lands in yellow. Four categories of savanna land are color-coded and additional types are demarcated on the original map. The strategy for restoration and conservation of some native savannas would be different for each subtype. Many of these are priority areas for conversion to fuel and timber lots. The further prioritization of areas for rehabilitation will be based on community interest and commitment as shown in through Municipal Plans and an overlay of village and Municipal areas over Map Y-2 and quality of soil (Map Y-7).

Critical information gaps: Information is lacking on possible sustainable harvest of trees for timber. As industrialized countries exhaust their timber resources, foreign business interests are likely to turn to less wary countries for timber. The FSM is such a country as it is without a timber management program. Information on sustainable levels of timber harvest is needed in order to establish a program to certify timber as sustainably harvested, pass legislation to make the sale of unsustainably harvested timber illegal, and to purchase excess sawmills from local people. Presumably the USFS could derive some advice from the MacLean et al timber survey of 1988 and the recent Forest Inventory Assessment (2009/10). There is an urgent associated need for information on the en situ value of forest resources for their ecosystem and carbon sequestration values. This would provide information needed for landowners to make wise decisions on the use of Yap's very limited forest resources.

E. Coastal stabilization

Reports of the International Panel on Climate Change and other groups acknowledge climate change and predict more severe ENSO events and storms and predictions of sea level rise that could inundate more coastal taro patches and other productive lands, and greatly impact fresh water resources and food production on Yap's low lying outer islands to the point that they are uninhabitable. About 35% of Yap's population is from the Outer Islands. In the last three years especially, Yap has experienced high sea levels that have resulted in considerable coastal erosion, and inundation of taro patches, and provided a glimpse into the future of sea level rise.

Areas of mangrove dieback have been observed in a number of areas. Typhoon Sudal greatly damaged areas where dieback had already begun. We do not know the cause of the original dieback. Coastal erosion in the Outer Islands has removed areas of beach strand and even caused the loss of coconut trees and atoll forest trees.

Trends: The recent high tides may be related to increased gravitational pull of the moon and sun while they are at their closest approach to Earth, and to an extended "La Nina"; however sea levels are rising, and even if the recent high waters have been exacerbated by these factors, these high seas do give a glimpse into the future of sea level rise.

Benefits: Coastal forests and especially mangroves help reduce coastal erosion.

Threats: Dredging operations, road construction, and the killing and filling of mangroves and other coastal forests and vegetation. Construction of sea walls exacerbate coastal erosion in adjacent areas.

Opportunities: People's concern over recent high waters may result in less damage to mangroves and coastal forest, and possible willingness to plant trees for coastal protection. Recent data on the high levels of carbon sequestration by mangroves and the potential for income for "carbon credits" may induce coastal landowners to protect their mangroves.

Sensitive engineering and the incorporation of gated culverts (with valves) when developing climate-proofed roads could also provide a system for managing water flow and protecting critical agricultural lands by managing fluxes in the freshwater/ saltwater interface.

Priority landscapes to address issue: The priority areas for consideration includes all mangroves and coastal areas lower than 5 meters elevation. Map Y-5 shows areas (other than mangroves) that lie within a 1-meter zone of sea level rise. Map Y-6 shows vegetation types that would be impacted by a 5-meter storm surge in an enlarged section of Yap. Map Y-8 shows soil types that would be impacted by a 1-meter sea level rise and 5-meter storm surge. Note that most of Yap's alluvial soils, the best soils for agriculture, would be affected. Maps Y-2and 3 show areas of coastal mangrove that should be conserved to provide protection against typhoon damage and storm surge. There is urgent need to protect mangroves in areas of coastal roads. Most all land in Yap's Outer Islands, with the exception of the raised limestone island of Fais, lie mainly within the areas sea level rise and storm surge.

Critical information gaps: There is urgent need for a survey to determine sources of land rocks that can be quarried as an alternative to dredging which is very damaging to natural habitats.

There is urgent need for site-specific information and recommendations for coastal protection. New watershed-wise and coastal adaptation engineering practices are needed, particularly in areas where roads pass between wetland and mangrove habitat.

F. "Urban" Forestry

The Yap State Urban and Community Forestry 5-Year Plan defines community forests as: "trees, forests, secondary forest, agroforests, tree garden/taro patch systems, watersheds and associated animal life and other natural resources in the areas where we live, work and play. Our urban and community area extends from town and village centers through agroforests and into the natural forests where we collect medicines. Community Forestry is the management of this resource".

Previous generations of Yapese developed the surrounding landscape into a food production and living system and that landscape in turn sustained Yapese culture. It is important to maintain and enhance this connection while progressing into the future. There is need to foster an improved environment for all people in Yap by organizing and encouraging the planting and maintenance of trees so that communities will be cooler, have cleaner air and water, quieter streets and paths, more peaceful neighborhoods, improved nutrition, sources of materials for artisans as well as building materials and medicines; stronger village economies and more pleasant surroundings in the places where we live, work and play.

Yap's efforts in Urban and Community Forestry (U&CF) are carried out through the U&CF council whose membership includes: Representatives of the Council of Mainland Yap Chiefs (Piilung), and "Tomol", Outer Island chiefs; the Yap Women's Association, the Historic Preservation Office, an NGO, the State Forester, the Waab Wildlife Coordinator and private citizens. The program is implemented by a U&CF coordinator and a Coordinator of Volunteers.

Yap's Urban and community forestry Council has now completed two 5-year plans and has served for the steering committee for this SWARS. The Yap U&CF program is the largest forestry program in Yap and contributes to other ongoing programs, and has carried out many projects with communities.

Trends: At one time most urban areas were surrounded by agroforest. Today trees are being cleared to make way for development activities. Yapese women generally replant cleared areas to useful plants and trees in village areas, however such caretakers are not available for Colonia town. Trees growing in Yap's most urbanized areas, especially in Colonia town and along roads are cleared for new constructions. The U&CF program has provided tools for communities to beautify roads and paths, and a variety of projects. In addition this program initiated Yap's invasive species program prior to the availability of support for invasive species. The U&CF Council also served as the steering committee for this SWARS.

Benefits: Trees are needed so that communities will be cooler, have cleaner air and water, quieter streets and paths, more peaceful neighborhoods, improved nutrition, sources of materials for artisans as well as building materials and medicines; stronger village economies and more pleasant surroundings in the places where we live, work and play.

Threats: Trees are often sacrificed for infrastructure development when they could be pruned.

Opportunities: A need for tree-trimming and removal services is developing. The training of Yapese in proper maintenance of urban trees would benefit Yap by making it possible to prune rather than remove trees in many areas. It could also provide an opportunity to develop a private-sector workforce, providing employment on Yap and skills to Yapese who emigrate to Guam, Hawaii and other locations.

Priority landscape to address issue: Map Y-2 shows urban areas in grey.

Critical information gaps: It would be useful to have a master plan for Colonia town.

The most crucial information needed to determine the impact of sea level rise and storm surges on urban areas. LIDAR imagery would enable the development of DEM models showing what areas would be affected by these threats.

G. Capacity-building

Building capacity of Forestry staff:
The numbers of forestry staff are low. Yap currently has 3 forestry staff (including Invasive species coordinator) and 1 contract staff supported by the State government; and 5 forestry staff supported by USFS State & Forestry grants. Two positions are currently unfilled.

Trends: There are increasing expectations and demands on the time of Yap Forestry staff as a result of a number of initiatives such as the Micronesian Challenge and frequent, often unanticipated workshops given by a variety of outside agencies whose funding includes providing assistance to the FSM. This often makes it difficult to accomplish assigned tasks under local performance based budgets. On the positive side, opportunities for leveraging the impact of S&P funding are also increasing. Region 5 S&P grants are the only reliable ongoing source of support to enable Yap Forestry to respond to growing needs. It is thus important that the base level of the S&P grant program remains stable so that Yap forestry will not lose the employees supported by these grants within this planning period.

Values, benefits and services: The local forestry staff is needed for ongoing programs and also to provide expertise in order to enable communities to make use of new funding becoming available to communities for environment work. This provides opportunity for considerable leverage of S&P funding. In the long-term, Yap forestry is needed transform "forestry" from the work of a small government agency into a community concern and endeavor.

Threats: Threats include declines in funding and many demands on the time of the limited staff. The FSM government currently operates on a performance-based budget system. The ability of local forestry staff to achieve budgeted work is often limited by other demands on their time such as attendance at unanticipated workshops, off-island training or assisting visiting members of outside agencies.

Opportunities: The Institute of Pacific Islands Forestry (IPIF) provides an intern program, to develop capacity of local staff. The TNC and Conservation International have each pledged 6 million U.S. dollars to support the Micronesia Challenge. Should some of this support become available to local forestry agencies it would help maintain and perhaps increase the number of positions and develop local capacity.

Communities are eligible for funding for environmental projects under the UNDP Small Grants Program. This provides a more motivated clientele for forestry staff, and considerable opportunity for leveraging S&P funding.

Outside agencies could adapt their programs to the needs of local forestry staff and schedule workshops and trips well enough in advance that they could be fit into the year's performance objectives. In addition, it would be helpful if workshops resulted in certification of attendees in needed skills that would contribute to Individual Development Plans.

Critical information gaps: It would be helpful to tap the expertise of an established institution with successful experience in natural resource stewardship programs in "developing" nations for advice on the most complementary mix and match of government agencies and NGO organizations and how the two might work most effectively together. Assistance with the FSM government's fiscal process for managing grants and projects and recommendations on how to make it work better would also be helpful.

Building capacity of the Public and communities: With increased availability of funding for "community-based" projects, there is increased need and opportunity to build capacity of communities to undertake forestry projects. This makes it important to maintain base level funding for forestry staff so that they can turn "forestry" from the work of a small government entity into a community concern and endeavor, thus leveraging the effectiveness of S&P funding.

II. Resource Strategy

Long-term Desired conditions

A healthy environment that provides for people's needs while maintaining ecological systems and Yap's biodiversity heritage. By the year 2014, Yap State will have an adequately staffed and supported land stewardship program working cooperatively with other relevant government and

non-government organizations, individuals and communities to fulfill its mission. Current high-resolution aerial photographs of mainland and Outer Island Yap will be available to assess forest resources and monitor and adapt stewardship efforts. An assessment will have been made of the capacity of mainland Yap to accommodate the needs of the Outer Island population who will at some point need to relocate from their home islands, and a program to prepare for this eventuality will be in place. Individuals and families will have access to the information and planting material they need to enhance and expand agroforests up slope. Citizens of Yap will be aware of the implications of climate change and sea level rise. Residents and local businesses will have access to local produce raised either by them or purchased from the private sector. By the year 2020, the people of Yap will have fewer health problems related to an unhealthy diet. A Forest Legacy assessment of needs and a Forest Legacy program will have been developed. All existing intact native upland forests and mangroves will be under effective stewardship. By the year 2048, there will be enough timber and good soil to meet each generation's needs; streams will run clear, representatives of all natural communities will be present, intact and made up of native and non-invasive species. There will be at least 20% native upland forest, 15% healthy mangroves and swamp forest, 25% diverse and productive agroforest, 10% productive timberland or croplands rotated with an enhanced fallow, and 5% native savanna.

General and Long-Term Strategies

In order to achieve these conditions, it will be necessary to increase Public and Community awareness and the means to protect the ecological integrity of Yap while providing for food supplies and healthy livelihoods, and to turn "Forestry" from a small government agency into a community concern.

To build on traditional land management using both traditional and modern best practices. The strategy would identify general trends in vegetation dynamics on Yap and areas where intervention could shift trends toward improved conditions (YINS2010).

A portion of the twelve million in funding pledged by The Nature Conservancy and Conservation International will be utilized to support a Forest Legacy and Micronesia Challenge coordinator and program on Yap. The TNC Micronesia Challenge commits to effectively protecting 30% of near-shore coastal areas and 20% of land areas by 2020. Priority Landscapes for protection, termed Areas of Biological Significance were identified in a series of meetings conducted by TNC and are reported in the Blueprint for Conservation in Micronesia (2003). These "ABS" are shown in Map series Y-14.

Map Y-3 provides general guidelines for appropriate actions throughout mainland Yap. In general habitats color coded in warmer colors should be enhanced to address Issue A, (Food Security), and those coded with cooler colors should be protected to address Issue B as well as the Micronesia Challenge. Many areas coded yellow (savanna lands) should be rehabilitated for sustainable production or to improve their productivity.

Strategies for the next 5 years

Natural resource strategies for Yap's terrestrial areas in the near future are described in the YBSAP (2004) and in the Yap State Division of Agriculture and Forestry 5-Year Plan (2009),

the Yap State 5-Year Wildfire Plan (2009) and the Yap State Invasive Species 5-Year Plan (2009) that are appended.

Almost all land on Yap is privately owned through the traditional land ownership and resource appropriation system. As a result, the biggest factor in prioritizing landscapes on which to carry out projects is an interested, willing and able community. This SWARS has thus mapped classes of landscapes where different types of programs are best carried out. When landowners and communities request projects, maps of their areas will be overlaid on the GIS maps of natural resources in order to define the best specific areas for projects. Thus for example, if a community wants to carry out a savanna reforestation project, the savanna vegetation in their area will be overlaid with the soils, fire and other relevant maps to select the best site for the project. Once the community understands and selects the parameters of the project, a spatial analysis may be carried out to define the best site for the project if this would be helpful.

The identification of specific areas for conserving, protecting and enhancing of Yap's forest resources will be carried out through the DAF Municipal planning program (DAF 5-Year Plan). For about the last 5 years with support from the S&P FRM program and other sources, the DAF in partnership with Queen's University and the Yap Division of Land Resources has been gathering data on Yap's natural resources into a GIS system that can be used to display the natural resources lying within village, municipal and watershed boundaries. At the same time, assistance is being sought to obtain updated aerial imagery of Yap to produce updated natural resource maps on island. These maps will then be compared with earlier maps to determine trends. At the same time, DAF staff is gathering information on best management practices.

Under the Municipal planning program, this information, aerial imagery and maps will be shared with communities to assist resource owners in assessing the natural resources in their area. At the same time, the range of traditional and western concepts and practices to use land for its highest use (including ecosystem services), and optimal production will be discussed. DAF staff and a team of facilitator/ mentors will then work with resource owners and communities to develop plans for their areas. It is likely that this program will initially involve villages and the spread to groups sharing watersheds and to Municipalities. Projects identified in the plans will be matched with appropriate S&P and other programs for support and implementation. It is anticipated that this effort will generate written plans meeting Forest Stewardship program standards so that the full resources of that program may be accessed in the future.

The Municipal Planning program will address all major issues outlined in Table Y-1. It will also address the Micronesian Challenge by defining "locally effectively managed terrestrial areas" (LEMTAs) that would eventually add up to at least the 20% of the island required by the MC. At this point, a gap analysis would be done to determine if there is effective conservation and sufficient coverage of a representative sample of natural habitats, and keystone/critical habitats for maximizing biodiversity protection and ecological functioning and productivity that would ensure high levels of ecosystem services and production. If gaps in coverage are determined, then incentives for protecting the needed components would be developed, ranging from traditional negotiations to subsidies from outside of Yap. At some point, compensation for "carbon credits" may contribute to conservation objectives as well.

One of the biggest outstanding needs in support of the Municipal Planning program is updated aerial imagery of Yap State. Yap is fortunate in having a Yap-based FAA certified airline capable of the precision flying needed to obtain such photography, and a relatively level topography that minimizes problems of distortion of scale due to changes in elevation. It is anticipated (based on earlier photography done in Kosrae and Pohnpei), that the U.S. Forest Service will provide the specialized cameras and personnel to do the photography, or that these services will be contracted by TNC or Conservation International (CI). Once current aerial photography is available, updated vegetation/ habitat maps can be developed by local staff working with Queen's University and the Division of Land Management, and incorporated into the Yap State GIS system. These maps will then be compared with earlier vegetation maps to determine trends and to serve as a baseline for measuring progress. The resulting aerial photographs and maps will be invaluable in engaging communities in improved stewardship of natural resources.

It is anticipated that the Municipal planning program will be phased in beginning in 2011, with the program going into full swing once updated aerial imagery is obtained and DAF is fully staffed.

Resources for addressing Strategy

Human resources and sources of funding for addressing this SWARS are summarized in Table Y-2. The first column and row of this table shows Yap Forestry and associated positions. The number of staff are indicated in parentheses with those funded by Yap State Government shown in underlined bold and those funded by the USFS S&P program in plain font. While each section of DAF has its individual responsibility and work, all related sections also work cooperatively to carry out special events, funded projects and to populate workshops. Column 2 of the first row of Table Y-2 lists main cooperating agencies within Yap State. Column 3 shows off-island agencies and groups whose funding includes mandates to assist the FSM. A comparison of the resources in line 1 (people and advisory groups), and line 2 (sources of financial support), shows that Yap's small forestry staff has access to much technical and other advice but limited off island financial support. It is important that the base level of S&P funding remain level as about 50% of the Yap State forestry staff is supported by this funding. The maintenance of base level funding will support the work of applying for, monitoring and reporting on S&P grants, which would otherwise not be possible. Support from the competitive grants and the Forest Legacy program would then enable Yap to carry on bigger projects.

Row 2 of Table Y-2 shows sources of funding available for addressing this SWARS. As can be seen in Table Y-2, the USFS S&P program is one of the few sources of funding available to Yap forestry. In contrast, there are many agencies and groups available to provide technical and other advice. There is thus much opportunity for Yap forestry to leverage USFS S&P funding.

Table Y-3 lists strategies by FSM issues, funding from S&P and other sources; cooperators, and performance measures. This table shows S&P funding will leverage additional funding and actions. Links with U.S. Themes are established in Table Y-1. S&P programs and other sources that contribute funding are shown in columns 2 & 3; and column 4 gives performance measures and desired outputs and outcomes. Section 3 that follows describes the integration of these strategies into an optimized program. This list of strategies and description of an optimal

program is ambitious and its implementation will depend on levels of support for staff and programs and unforeseen demands that are made on staff.

Table Y-2: Resources available for addressing overall SWARS

Type of Resource	Yap Forestry and other DAF Staff (staff paid by Yap Government in bold & underlined, staff paid by S&P grants in plain font)	On Island Cooperators & Stakeholders	Off-island Agencies and Groups available to give advice & workshops (first row); and financial assistance (2nd row)
People & programs	State Forester (Forestry Operations) Land Stewardship Coordinator* (Ecosystem Stewardship) U&CF Coordinator U&CF Coordinator of Volunteers Nurseryman Nurseryman Other related programs & staff in Div. Ag. & Forest. Invasive Species Coordinator Invasive species technicians (2) Sustainable Agricultural Production	Div. Land Resources (Yap State GIS Node) Department of Public Safety, Fire & Rescue Section EPA Department of Administrative Services, Div. Of Media Department of Education U&CF Council YINEC YIST Council NGOs	USFS PSW & PNW Stations, NRCS, College of Micronesia (COM), COM Land Grant Universities of Queens, University of Hawaii (UH), University of Guam (UOG) Other Universities Water & Energy Resource Institute (WERI) , Secretariat of the Pacific Community (SPC), South Pacific Regional Environment Program (SPREP) SOPAC The Nature Conservancy (TNC) & Micronesia Challenge Regional Invasive Species Council (RISC) PIILN (invasive species) PIER (invasive species) TNC invasive species network PIMPAC And others
Funding	Yap State Government funds positions in bold		USFS Region 5 S&P & FAM programs

* also called Waab Land & Wildlife Conservation Coordinator. Note: this is a contracted (not permanent) position.

Table Y-3: Strategies and Actions

FSM Issue	Strategies & activities for 5-year SWARS plan	Possible Funding Sources		Implementing partners	Outputs/ outcomes
		Forest Service	Other		
A) Food security	A.1. Obtain current high resolution aerial imagery & carry out surveys & produce updated vegetation map to determine trends	S&PF IP	MC(?)	R&D & ROAs*	Updated vegetation & resource maps & analyses
	A.2 Evaluate agroforestry resources with respect to climate change & Sea Level Rise (SLR) (both mainland Yap (WAAB) and Outer Islands (OI)	S&P, PF	FAO, SPC, SOPAC, MC(?)	DAF, LR, ROA, NGOs	Maps showing agroforest that are susptible to sea-level rise
	A.3 Develop profiles of elevation and habitats of OI		YDAF, YLM, SOPAC, MC(?)	DAF, LR, ROA	Elevation and habitat profiles of the O.I.
	A.4. Provide extension to communities on relationship of agroforestry to watershed and island's ecosystem in Waab and to profile, water lens and habitats in OI	FSP, U&CF	YDAP, MC(?)	LSC, Forestry Outreach (FO) Sustainable Agriculture Production/Extension (SAP), Cs	Establishment of watershed/hydrology extension program / 3.6a. # people/ environmental literacy
	A.5 Work with communities to develop best practices for enhancing & expanding agroforestry & other food production systems adapted to SLR	FSP, U&CF	SLM(?)	LSC, SAP, Forestry Outreach (FO) Farmers Coop (FC) Relevant outside agencies (ROAs), Cs	Agroforest enhancement and expanding plan
	A.6. Survey genetic resources	RNGR	YDAF,	SAP, LSC,FC, Cs,	Propagation and distribution

	& select priority varieties for propagation & distribution to enhance & expand agroforestry systems	(FSP)		ROAs	of prioritize agroforest key plant species
	A.7. Work with communities to develop proposals and projects to enhance & expand agroforests & other adaptive food production systems	U&CF	YDAF, MC(?)	SAP, FO, Cs, FC	Forestry/Agroforestry community driven instead of small government forestry,/ 3.b6b. # people/ stewardship, 1.2 # acres managed
B) Biodiversity	B.1. Obtain current high resolution aerial imagery , carry out surveys & produce updated vegetation map to determine trends	S&P, IP	MC(?) YDLR	LSC, LR, QU, ROAs	Updated vegetation & resource maps & analyses
	B.2. Develop the information base and capacity to assist communities with developing Municipal Natural Resource Stewardship Plans	U&CF	YDAF	LSC, LR, Cs, QU, ROAs	Establish information base essential for development of municipal plan
	B.3. Develop capacity of Public Safety Fire Unit to address wildfires: obtain fire truck & training	F&AM		LSC, LR, Cs, QU, ROAs, NGOs	Certified staff. 2.1c. community capacity
	B.4. Develop wildfire vulnerability maps and prioritize community eligibility for development of wildfire plans, training & equipment	F&AM	DAF, YDLS	LSC, LR, Cs, ROAs, NGOs	Prioritize Wildfire vulnerability map2.1 community capacity, 3.3 CWPP
	B.5. Work with advisor from Region 5 FAM to determine most effective system of fire breaks to break up large	F&AM		YINS, DAF, YDLM	Establishment of fire breaks, 3.3 CWPP

	flammable areas				
	B.6. Develop opportunities for local firemen to train with California firemen with potential for employment on mainland U.S. of those who accomplish training and return to serve on home island.	F&AM		YINS, DAF	Yap-California cross training program, 2.1 community capacity
	B.7. Develop program to assist communities with forestation of areas burnt by wildfires	F&AM, U&CF, FSP		Communities, private landowners	Savanna reforestation program, 2.1a. acres restored
	B.8. Carry out program described in YIST 5-Year Plan	FHM		Refer to the YIST Plan	2.2 Forest Health programs: number and location of acres treated & number and location of acres surveyed or inventoried
	B.9. Hire Micronesia Challenge coordinator to review TNC ABS and updated forest resource assessment & work with communities to establish Effectively Protected Terrestrial Areas (EPTAs)		The Nature Conservancy (TNC) and Conservation International (CI)(??)	Micronesia Challenge Coordinator (MCC), LSC, FO, Cs, ROAs & NGOs	Updated forest resource assessment Establishment of EPTAs
C) Watershed	B.1. Obtain current high resolution aerial imagery , carry out surveys & produce updated vegetation map to determine trends	S&P IP		DAF, LR, ROA, NGOs	Updated vegetation & resource maps & analyses
	B.2. Evaluate and prioritize watersheds & develop best practice guides for watersheds, forests, agroforest & mangroves	FSP, U&CF		LSC, LR, QU, ROAs	Development of watershed plan

	B.3. Provide extension to communities to enable them to evaluate their watersheds, make use of GIS database and develop Municipal Plans and proposals for projects	FSP, U&CF		DAF, LR, ROA, NGOs, QU	Development of municipal plans
	B.4. Conduct a pilot watershed monitoring and improvement project on a high priority watershed	S&P, U&CF		LSC,LR,QU, ROAs, NGOs	Watershed projects on high priority watersheds
D) Coastal stabilization	D.1.Obtain assistance of expert road engineer(s) to evaluate use of land quarried rock as alternative to dredged material for road construction	IP		LSC, Cs, ROAs	Evaluation report of quarried rock as alternative to dredged material
	D.2. Obtain assistance of expert road engineer(s) for watershed and mangrove – wise road engineering	S&P IP,		DAF, LR, ROA, NGOs, USFS	Detailer to work with Yap Public Works on environmentally sound road development
	D.3. Conduct surveys & work with ROAs & communities to identify and develop best coastal stabilization practices	S&P IP, U&CF, FSP, Research		DAF, LR, ROA, NGOs, EPA	Develop coastal stabilization plan
	D.4. Evaluate mangrove dieback and develop methods for restoration	S&P IP	Univ. Brisbane	DAF,ROA,USFS, NGOs	Develop mangrove restoration plan
	D.5. Work with community(ies) to conduct mangrove restoration & coastal stabilization projects	FSP, U&CF		Public works (PW) and ROAs including USFS Road engineers	Restoration of mangrove dieback and stabilization of the coastline
E) Production & sustainable harvesting	E.1. Obtain assistance to determine sustainable timber harvest and develop program to	Research, S&P IP	SPC	DAF, ROA, NGOs, USFS	Establishment of timber annual sustainable cut

	certify timber as sustainably harvested and legislation prohibiting the sale of timber not certified as sustainably harvested, along with a program to buy excess sawmills.				
	E.2. Develop program of sustainable indicators	FSP, S&P IP		DAF, ROA, NGOs, USFS, SPC	List of sustainable indicators
	E.3. Develop trails and other ecotourism projects (note: trails can serve as firebreaks)	S&P IP, FAM	Nat. Park Service, HPO	DAF, ROA, NGOs, USFS, Communities/private landowners	Development of ecotourism project and trail
	E.4. Convert some savanna lands to fuel and timber production	F&AM, FSP		DAF, NGOs, USFS, Communities/private landowners	Conversion of Savanna into fuel/timber land
	E.5. Convert some savanna lands to croplands with enhanced fallow			DAF, NGOs, USFS, Communities/private landowners	Conversion of savanna into cropland
F) Urban forestry	F.1. Develop landscaping plan for Colonia Urban center & Sports facility. Implement plans as part of Tree Planting Day	U&CF		R&D, OPB, ROA, NGOs, USFS	Landscape plan of Colonia Urban and Sport facilities
	F.2. Provide "utility training" for chainsaw safety and ISA certification of tree workers and arborists, and chainsaw safety	U&CF		ROA	Certified tree worker and ISA arborist
G) Capacity-building	G.1. Increase number of forestry staff Capacity of Yap State Forestry	S&PF	TNC, CI (??), MC	R&D, ROA	Adequate staff
	G.2. Provide capacity	S&P IP		R&D, ROA, NGOs	Qualify/certified forestry

	development that confers certification as forestry professional such as the arborist certification offered by ISA.				staff
	G.3. Manage work disruptions that do not contribute to budgeted performance objectives or development of local capacity.			R&D, ROA, NGOs	Adequate staff and hiring of the Micronesia Challenge coordinator
	G.4. Develop Community awareness through Annual Cycle of Eco-events	S&PF		DAF, ROA, NGOs	

* ROAs = Relevant Outside Agencies

Program Integration

The following narrative describes an optimal program that integrates the strategies and activities outlined in Table Y-2 to achieve the long-term objectives described in section 3.A. It presumes that DAF is successful in obtaining multiyear funding through the competitive grant program in order to expand its activities and leverage S&P grant support through cooperative efforts with other groups. Map Y-13 provides an example of a potential area for an integrated project involving watersheds, forestry, agroforestry, restoration of savannas, management of wildfires, and, potentially, monitoring of downstream effects on an important marine area.

This program would tap relevant research and expertise of USFS PSW Station, NRCS and other USDA expertise as well as inputs from other relevant local, U.S and international agencies, institutions and NGOs. It would build coordination and cooperation between local government agencies and NGOs in order to support landowners and communities in obtaining support from programs such as the UNDP Small Grants Program. Without a reprioritization of FSM government support for a paradigm of ecologically sustainable development and adaptation to climate change and sea level rise, it is likely that local funding for forestry will decline with Compact funds. It is therefore important to "turn “Forestry” from the work of a small government agency into a community concern.”

The work of Forestry units, especially the Land Stewardship Coordinator and Sustainable Agricultural Production units will be tightly integrated and linked with main cooperating Government agencies: Land Resources, Fire & Rescue, EPA, and Media; Traditional Leaders, NGOs, including the Yap Women’s Association; and concerned individuals, traditional estates and communities. Coordination with communities is largely through the U&CF program and its advisory Council as U&CF is the only program with its own coordinator and coordinator of volunteers. In addition, all members of DAF work with communities in their respective areas, and work together to carry out the annual cycle of eco-events. Other outreach efforts occur through media programs such as the Governor’s recent multilingual program on invasive species that involved most of DAF’s multilingual staff.

The strategies and activities listed in Table Y-2 above will be carried out in roughly the order listed for each issue as well as consecutively as is possible between unanticipated visits, meetings, trips and other unanticipated activities. The Biodiversity and Food Security programs are complimentary with the LSC gathering data and GIS layers and developing these into Public awareness materials. These materials will be shared with communities through the U&CF program and Sustainable agriculture program to address the Yap State Summit (1996), YBSAP (2004), and SDP (2009) mandates for increasing food production while protecting the ecological integrity of Yap. The general progression will be for the WLCL to work with Land Resources, the Queen’s University program and other partners to develop GIS and other background information and materials needed for natural resource stewardship plans, and to adapt to climate change and sea level rise using sustainable practices. This effort would be greatly assisted by up to date high-resolution aerial imagery of Yap. At the same time the U&CF program and the SAP program will work with communities on projects, including those related to food security. On occasions such as Yap Day, Earth Day, Tree Planting Day, Earth Day and FSM Environment Day that are now combined into Environment Week; or when communities are ready and DAF

staff are not addressing other urgent matters, DAF staff will conduct a "traveling road show" to share information with communities. As possible DAF staff and NGOs will also work with individual estates (landowners), and communities to develop community or municipal plans and projects.

Yap's Invasive species program which is largely supported by the Forest Health program will complete the eradication of the three current target species and activities described in YIST (2009), and begin shifting focus to the involvement of the Public in invasive species management and control as S&P funding dwindles.

The DAF nursery, largely supported by the RNGR program will produce tree seedlings in support of all Forestry activities especially those of the SAP and Tree Planting Day observance. As funding from the RNGR program decreases more emphasis will be placed on the development of community nurseries. One such community nursery has already been established in the Municipality of Tomil.

For the past 9 years, areas burnt by wildfires have been mapped by the Yap State/ QU GIS program. This data will be used to enhance a fire vulnerability map prepared by Region 5 FAM. The resulting spatial analysis will be overlain with a GIS layer of approximate village and municipal boundaries to prioritize communities for the development of community wildfire plans. These communities will also be eligible for safety and fire suppression training and a cache of hand tools for controlling wildfires. In 2009 the FSM became eligible for the FAM grant program under the Farm Bill. The Yap State Public Safety Fire and Rescue Unit completed its second 5-year plan in 2009 and also submitted a successful proposal under the grant program. As a result, Yap State Fire and Rescue was able to take part in the California Nevada and Hawaii Forest Fire Council meeting and will be obtaining a small fire engine for use in addressing wildfires and other assistance to get an enhanced wildfire program rolling. Future plans could include assistance from an experienced fire behavior specialist from Region 5 FAM to work with local F&R, DAF, LR and Communities to develop recommendations for "green belts", paths, and other forms of fire breaks to reduce the size of wildfires. In addition, a program is envisioned to enable Yap F&R staff passing qualifying tests to train with Region 5 fire staff. Those who successfully complete this training will be required to return to work on Yap for a specified period after which they will be eligible for employment as fire fighters in the U.S. during peak fire seasons. (Bad fire years in Region 5 are counterpoint to those in Yap: when California is burning, Yap is raining, and vice-versa.) The wildfire program will contribute greatly to efforts to restore productivity to Yap's savanna lands to adapt to impacts of climate change.

The project to restore savanna lands to more productive condition will include a number of projects to be undertaken when there is sufficient availability of DAF and F&R staff and community interest and people power to carry out relevant projects. Relevant projects could include the care of woody savanna species that resprout and the planting of additional trees in areas recently burnt by wildfires. Other forms of savanna restoration would involve the establishment of fuel lots, especially in areas adjacent to Outer Island settlements where the availability of fuel lots would take pressure off wild forest; and the establishment of timber plantations. Another more complex type of restoration of savanna productivity for areas having established ditch-bed systems would be the establishment of fast-growing secondary species to

rehabilitate soil conditions, followed by the establishment of traditional mixed gardens which would be followed by a sweet potato crop and then the replanting of the area to a woody fallow. Another variation of this strategy would involve a traditional method of planting deeply mulched banana trees to be followed by a yam crop and then replanting the site to a woody fallow (that could also be pruned for fuel wood.) An associated savanna project would identify areas of native savanna that are high in endemic species or important as native wetlands, for protection as areas of special biodiversity significance.

Efforts to establish a program to certify timber as sustainably harvested and legislation to prohibit the sale of unsustainably harvested timber and the purchase of excess sawmills will be initiated when assistance is available to determine sustainable harvest. Ecotourism projects such as trail development will be carried out in partnership with Yap Visitors Bureau (YVB) communities, and possibly the Historic Preservation Office (HPO). Past projects have already resulted in three trails.

The watershed program will begin with the preparation of a competitive grant proposal evaluate and prioritize Yap's watersheds and identify best management practices both traditional and as indicated by modern science. The division will partner with Queen's University for the initial GIS and watershed evaluation work and incorporate traditional knowledge into the evaluation of best practices. When the products of this effort are ready, they will be presented to communities that are ready to do watershed projects, and one or more on the ground pilot projects will be initiated. Monitoring of downstream effects of the project will be carried out in cooperation with a University of Hawaii and Palau International Coral Reef Center project. Assistance with annual increments of activities and monitoring will be coordinated with the Yap State Queen's University GIS program.

Coastal stabilization is a big concern of communities in mainland Yap and especially in Yap Outer islands. Unfortunately climate change and sea level rise makes this a challenging undertaking, and we will need expert assistance in planning for coastal stabilization projects. In some cases it will not be possible to stabilize coasts. Most urgent is a need for engineering expertise to determine if land-based sources of construction rock are available as the current practice of dredging for coral material is damaging to coastal ecosystems. In addition expertise in watershed and mangrove- wise road engineering is very urgently needed as is practical expertise in the maintenance and restoration of mangroves to protect coasts. Mangroves and sea grass beds were traditionally managed to promote desired fisheries and a consortium of coastal engineers, marine scientists and traditional practitioners is needed to determine optimal management of the mangrove/ sea grass meadow/ coral reef ecosystems.

Long-term Monitoring

Reporting on results of S&P programs will follow the reporting protocols of each program and reporting requirements described in grant awards. Training in reporting on wildfires and the use of inexpensive GPS units to map burnt areas will be conducted through the Yap State/QU program in 2011. Thereafter F&R personnel will carry out the field mapping and enter data into the Yap GIS system with the assistance of personnel of Land Resources to generate required annual reports on areas burnt.

The TNC has developed a number of "tools" for monitoring progress of the MC and future iterations of monitoring such as Marxan gap analyses are likely to be applied to progress made once funding pledged by TNC and Conservation International becomes available to Yap Forestry, NGOs and communities. A second iteration of the FIA forest assessment should occur within this plan period and provide detailed data on the sampled areas.

Should current high resolution aerial photography of Yap become available, local staff will, work with the Queens University/ Yap GIS program to develop updated vegetation maps and an analysis of trends in vegetation change since the mapping of Yap's vegetation based on 1976 aerial photos. In addition, the availability of this imagery in combination with the developing GIS capability under the Yap/QU program will enable the monitoring of progress toward outcomes of activities in priority forest landscapes and determine how actions might be modified if needed. In the case of mainland Yap and especially Yap Outer Islands, high resolution and LIDAR imagery will enable Yap to plan for adaptation to sea level rise, and the eventual uninhabitability of Outer Islands that will contribute to the world's understanding of climate change and sea level rise and be essential to the survival of Yapese culture.

List of Yap Maps

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Statement of Stakeholder involvement

This SWARS was prepared with stakeholder involvement. The Yap Urban and Community Forestry Council served as the steering committee for the effort and additional meetings were held with a consortium of local environmental agencies and NGOs. Additional meetings were held with other stakeholders and NGOs such as the Yap Women's Association. Yapese women are the traditional stewards of the land. This SWARS also draws heavily upon an ecological assessment of Yap by a local environment NGO (YINS 2010), and a series of 5-year plans: The DAF 5-year plan, Yap State Invasive Species plan, and Yap State Second 5-year wildfire plan.

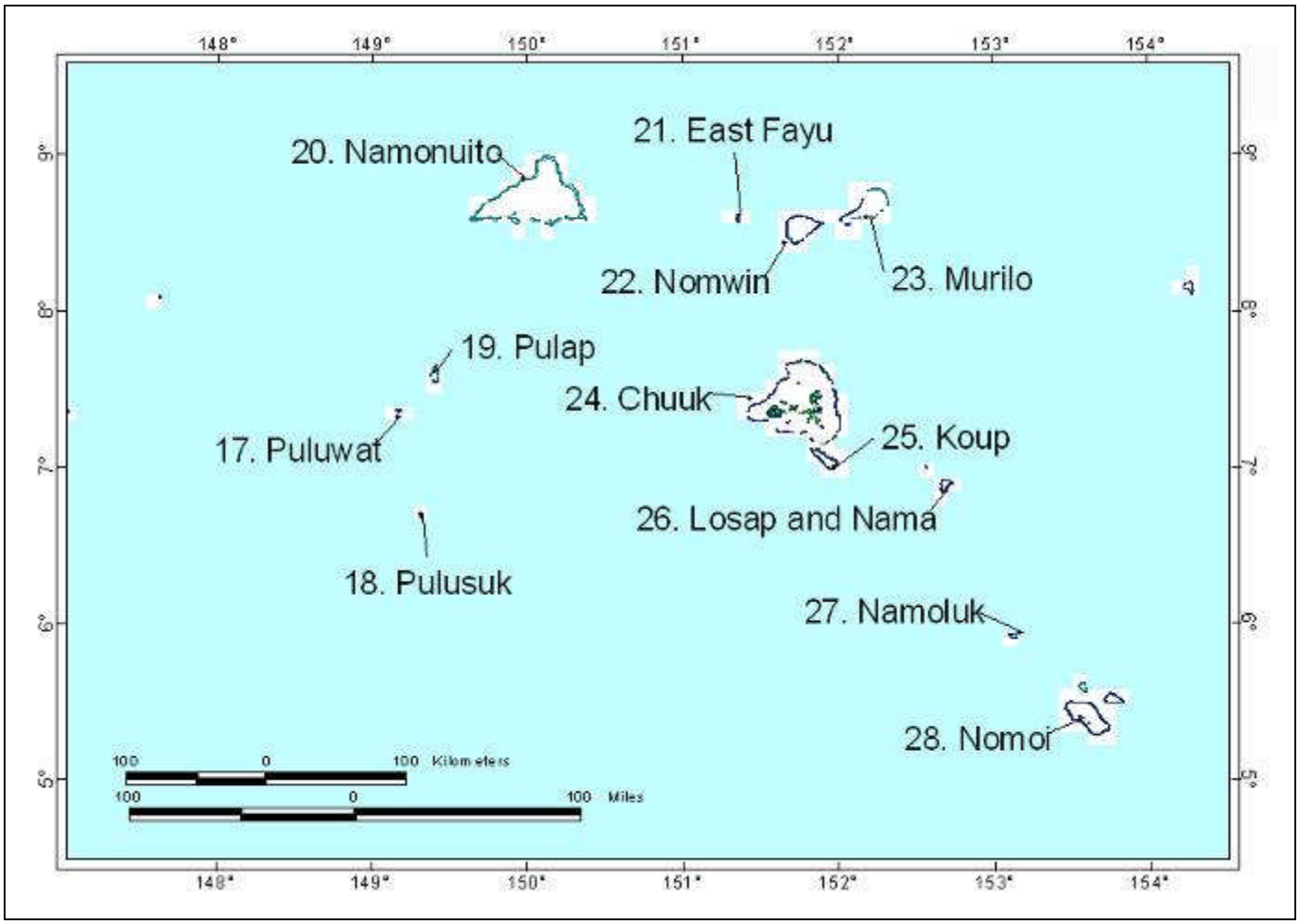
Several meetings/ workshops were provided by the FSM National Government in the early preparation of the SWARS, and then again prior to the 2010 PIC meeting in Chuuk. A series of

workshops were provided by USFS FIA on the production of GIS and spatial analysis maps in Pohnpei and Hawaii resulting in Map Y-5. Several workshops associated with the Queen's University/Yap GPS/GIS program resulted in most of the other GIS maps.

III. CHUUK STATE

Introduction

The State of Chuuk consists of a group of partially sunken volcanic islands surrounded by a barrier reef about 63 km in diameter, and a number of coral atolls and islands outside the barrier reef, located about 5,713 km southwest of Hawaii. The islands are characterized by steep uplands, which comprise about 73% of the total land area. The maximum elevation on Weno Island is 370m, Dublon 344m, Fefan 300m, and Tol 443m. The climate of Chuuk is hot and humid with an average temperature of 27 C (81 F) with little variation throughout the year, and average annual precipitation of about 3,650mm (144 in.) with the months of January to March being drier. Map C-1 shows Chuuk Lagoon and the Outer Islands of Chuuk.



Map C-1: Chuuk Lagoon (number 24) and Outer Islands of Chuuk State

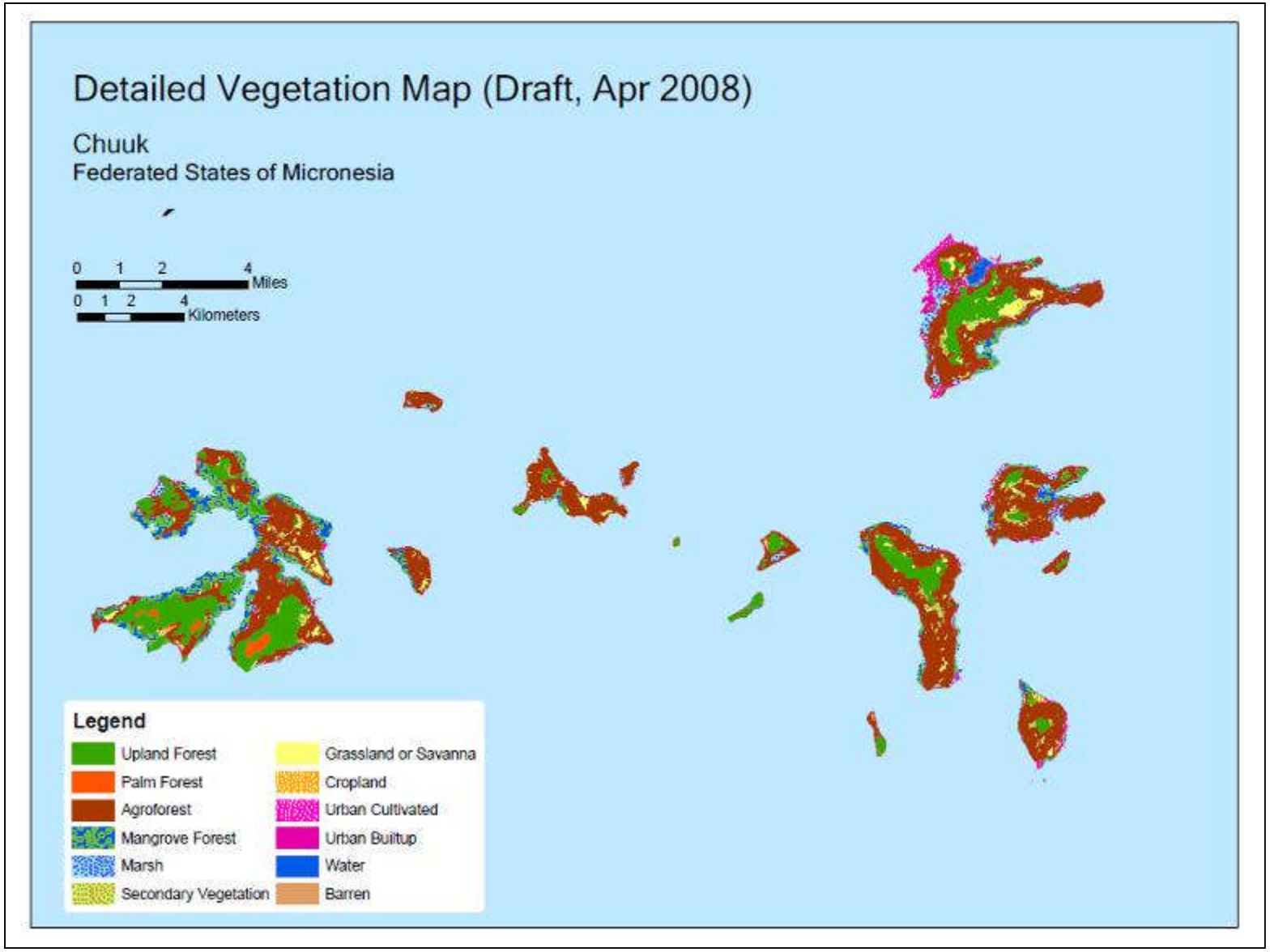
Chuuk is the most populated state in the Federated States of Micronesia (FSM). The State is made up of the Chuuk Lagoon and the Outer island regions of Nomwunweito, Halls, Patti, and Mortlocks. Chuuk Lagoon has a land area of 49 square miles and a very high population density of 1,094 per square miles (Chuuk Census, 2002). In comparison to the other three states of Pohnpei, Kosrae and Yap, Chuuk makes up half of the whole FSM population. Due to Chuuk's population, its environment is facing a lot of threats. These threats range from conversion and degradation of habitat and ecosystems, invasive organisms and pests, to over-exploitation and unsustainable harvesting of resources (FSM, 2002). In addition, there is very limited management and control of such activities (Albert & Nakayama 2004).

I. Forest Assessment

Chuuk was once a much bigger island than it is now. Given Chuuk's location and rainfall pattern, it is likely that this large mountainous island was once covered with native forest that included numerous endemic species adapted to this unique place on earth. With time, the island sunk, leaving just the mountain peaks surrounded by a barrier reef: the islands of the Chuuk Lagoon as we know them today. When people came to these islands, they mainly utilized the lower lying lands, and the unique forests were pushed further uphill where they now persist as small caps of forest perched precariously on the tops of mountain peaks: some of the most unique and endangered forest in Micronesia. The rest of Chuuk State consists of low lying atolls lying precariously close to sea level, with vulnerable water resources stored in fresh water lenses.

This section provides a qualitative, quantitative and geospatial assessment of Chuuk's forest resources and major issues of forest stewardship referenced to USFS themes. It includes a discussion of priority landscapes, trends, values of these forest resources, threats and opportunities. The term "geospatial" is interpreted literally as the use of GIS data and maps rather in the more narrow sense of doing analyses with the ESRI Arc View supplementary geospatial analysis tool. The use of GIS is new in the FSM and while there are local staff able to learn geospatial analysis, this would take time away from work assigned under the budget based performance plan. It would also be ineffective to utilize such a tool before data layers have been thoroughly georeferenced and rasterized. In addition, the use of the geospatial tool in a small island setting where all ecosystems are limited in size and closely integrated could result in fragmentation of ecosystems and efforts. Most all forest lands, including mangroves, are privately owned on Chuuk. Inasmuch as successful forest resource management involves the actions of the people who own or use these resources, it is not wise to omit community areas that are integral parts of the whole Chuuk islands ecosystem. It would also be difficult to explain maps created through the geospatial tool to stakeholders in villages and communities. This SWARS therefore mainly utilizes standard GIS maps along with some ESRI geospatial analyses. Should more geospatial analyses be helpful in the future, as monitoring of progress of this SWARS indicates a need for revision, they will be made.

Map C-2, produced by the FIA, gives a generalized picture of the forest resources of the lagoon islands of Chuuk State. Vegetation types as reported in the vegetation survey of Moen, Dublon, Fefan and Eten (Falanruw et al 1987) include Upland forest with 4 subtypes, Palm forest (forest dominated by native palms), Mangrove forest, with a subtype with Nypa palms; Secondary vegetation with 3 subtypes; Agroforest with 6 subtypes; Strand vegetation, Freshwater marsh with 3 subtypes, Grasslands with 4 subtypes; Cropland, Urban land, and Barren land.



Map C-2: Vegetation of high islands of Chuuk lagoon showing general vegetation types. General forest resource strategies are to protect more intact native forest within the areas indicated in dark green, as well as areas of native palm (not coconut) forest (orange, and mangroves (In blue). Areas that should be enhanced for food security include agroforests (reddish brown), secondary vegetation (light green), cropland (too limited to show); and marsh (light blue) for taro patches

The lagoon islands of Chuuk State have the highest percent of agroforest of the high islands of Micronesia. Information on the composition of the forests of the high islands of Chuuk State can be found in Falanruw et al (1987), and FIA (2009.)

Upland forests provide habitat for biodiversity including a number of endemic species. They are also very important for their watershed services. Mangrove forests have multiple values for fisheries habitat, wood production, trapping sediment and shoreline protection. Mangrove forests significantly buffer the force of waves, including storm surges, and thus protect the coastline from erosion. The "fringe" (seaward) mangrove is most valuable for this coastal protection function. Preliminary results of recent studies of carbon sequestration by Kauffman & Donato (2009) have shown that mangroves sequester very significant amounts of carbon. They are thus important for mitigation of climate change. Coastal forests occurring above high tide mark, especially on the coasts of atoll islets, help to stabilize the coastal dunes and reduce the extent of beach erosion during storm surges. Strand forests also provide a windbreak protecting the forests behind them from strong winds, desiccation and salt spray. While strand forests will not affect the rate of sea level rise, it is possible that by stabilizing the crest of the beach, they will reduce the extent that a high-water event overtops the beach crest and deposits salt water in the island interior. Native atoll forest trees are critical to the survival of sea birds that aid fishermen in finding fish.

Trends

Vegetation maps published in (1987) were based on black and white aerial imagery taken in 1976. While the more recent Forest Inventory Assessment (2009) provided considerable data on sampled areas, the "detailed vegetation map of Chuuk", Map C-2 produced by the FIA, is largely based on the 1987 vegetation map, and has modified some types, so that the two maps may not be compared to determine trends. While there is little actual data, observations of forest trends over the years indicate a decline of native forest and good quality agroforest and an increase in areas covered by aggressive vines. Observations during an over flight of Chuuk in 1983 during a severe ENSO drought indicated widespread damage from wildfires. Another over flight of Tol in 2003 revealed large gaps in the mangrove said to be due to the over-harvest of firewood. Insects, diseases, and invasive species affect biodiversity, food security, coastal stabilization, watershed, production and sustainable harvesting, and capacity building in the following ways: insects feed on plants and trees competing for nutrients and eventually killing plants. Diseases affect food production by injuring and killing plants/trees. Invasive species compete with economic flora for water, nutrients, and space; hence, decrease production. Capacity building in pests and diseases identification, prevention and control is needed. The insects and diseases infest many vegetables, staple crops and fruit trees as well as ornamentals.[5]

[5] Pests and diseases include: Insects: On banana: Coconut scale, bag worm, spiraling white fly, leaf hopper, mealy bugs; On breadfruits: Egyptian fluted scale, coconut scale, Caroline fruit fly, breadfruit twig borer; On citrus: orange spiny whitefly, leaf miner, black citrus swallow tail butterfly, black citrus aphid, scale; On coconut: coconut scale, red coconut scale, Marianas coconut scale, bag worm, termite, white scale; On vegetables: melon aphids, mealy bugs, leafhopper, leaf miner, white fly, and others. The above also infest sweet taro, g. taro, sweet potato and cassava. Some even infest ornamentals. Diseases include: Leaf blight, citrus canker, bunchy top, dieback, elsinoe batatas, sooty molds, and others. Other pest/diseases include nematodes

The most crucial information needed to determine vegetation change since 1976 are up to date high-resolution aerial photographs of both mainland Chuuk and especially the Outer Islands of Chuuk State. Such imagery would provide an updated baseline and enable even local staff to determine trends and monitor progress in resource stewardship. Such aerial photos could also be used with communities to help develop stewardship plans. LIDAR imagery would enable the mapping of elevation that is critical for determining vulnerability to sea level rise, especially in Chuuk's low-lying outer atolls.

Issues, Priority Landscapes, and National Themes

Chuuk islands are small, and with closely linked ecosystems in a small area, there is little leeway for ecological mistakes. Once ecosystems are disrupted they are difficult to re-establish. It is thus important to link ecosystem integrity with the production of food, timber and other goods and ecological services for people. There is thus a close connection between stakeholder's priority issue of food security, especially in this era of climate change and sea-level rise, and the health of the island's ecosystem. The high seas of recent years have resulted in a high priority being placed on coastal stabilization. The "Biodiversity" issue relates to the protection of ecosystem integrity, biosecurity (including threats of invasive species and fire), and the Micronesia Challenge and Forest legacy programs. Taking a watershed approach is not only ecologically sound but will help people to see their place in the ecological landscape and the connection between ecological integrity (biodiversity), food production & need for sustainable production & harvest. The issue of Production and sustainable harvest are urgent, and the reconstruction of the main road in Weno provides an opportunity for associated urban landscaping. Last, only because it is non spatial in nature is the great need for local capacity development both in the numbers of staff and their knowledge and skills, and in the development of Public and community awareness and capacity.

Table C-1 summarizes Chuuk State issues in relation to FSM National Themes and issues and U.S. National Themes and Objectives

Table C-1: Summary of FSM Issues, Priority Landscapes, and national themes

Issue	**Priority landscape area(s)**	**Primary U.S. National Themes**
A. Food Security	Current agroforest on Chuuk lagoon islands (Map C-2 & C-3), plus all inhabited atolls,.	Enhance, Protect
B. Coastal Stabilization	Mangrove forests and low-lying coastal areas Map C-4., C-2 (blue colored mangroves),	Conserve, Enhance
C. Biodiversity	Terrestrial Areas of Biological Significance, Maps C-7 & C-8	Conserve
D. Watershed	All riparian zones, with first highest priority on Onongoch watershed on Fefan	Protect, Conserve, Enhance
E. Production & sustainable harvesting	Appropriate areas shown on Map C-5.	Enhance
F. "Urban" forestry	Urban areas on Chuuk lagoon islands, shown in red on Map C-6.	Enhance
G. Capacity-building	Non-spatial	Enhance

Analysis of Issues
This section provides a qualitative (descriptive), quantitative, and geospatial (map) data analysis of the issues summarized above.

A. Food Security

The FSM Strategic Development Plan (2004) states: "The agriculture sector, including forestry, shall provide: (i) food security, cash income, and healthy livelihoods; and (ii) opportunities for domestic and export markets, while promoting environmentally sustainable production within a stable and consistent policy framework".

Most locally produced food in Chuuk is produced through traditional agroforestry and taro patch systems. Chuuk has the most extensive, area of land classified as "agroforest" in the FSM. The vegetation maps produced in 1986 (Falanruw et al) indicate that some 57% of the 4 islands surveyed consisted of coconut/ breadfruit agroforest. Chuuk is especially well known in the FSM for the range of local varieties of breadfruit that produce in succession so that breadfruit is available throughout most or all of the year. Chuuk is also rich in coastal marshlands suitable for use as taro patches. The island of Fefan is known as being especially productive of food. While the production of locally grown food links deemed to be generally decreasing in the FSM, locally produced food is available in the capital of Weno from morning to after work hours in small stores, and locally grown and processed food is even exported to Guam where there is a large Chuukese population.

Traditional agroforests, dominated by woody species, are good watershed cover. Population growth and the immigration of people to the capitol island of Weno for work and modern conveniences have led to conversion of agroforest to residential areas. Population and economic pressure have also led to over cutting for firewood. In some areas this has compromised watershed protection and destabilized steep slopes leading to landslides and a tragic loss of lives following an especially heavy period of rainfall.

Freshwater marshes are today filled with tall *Phragmites* grass that is difficult to convert back into taro cultivation. Most of these freshwater marshes occur along low-lying coasts, and may be vulnerable to sea-level rise.

Food production in the Outer atolls of Chuuk State is also dominated by agroforestry and taro patch culture. Atoll taro patches are especially vulnerable to sea level rise, storm surges and salt-water intrusion that are already occurring. The thinning of fresh water lenses, desiccating winds and drought also threaten agroforests on Outer Islands. Rising levels of greenhouse gasses, climate change and sea level rise will result in the eventual collapse of fresh water resources and food production on these islands unless innovative bio and eco- engineering adaptations can be developed in time to allow the inhabitants of these islands to remain on their beloved home islands. The development of increased food security on Chuuk's Outer islands is an especially high priority of this SWARS.

Aggressive vines such as *Merremia peltata* and invasive species pose management problems especially on the high islands of Chuuk where large areas of forest have been smothered by a

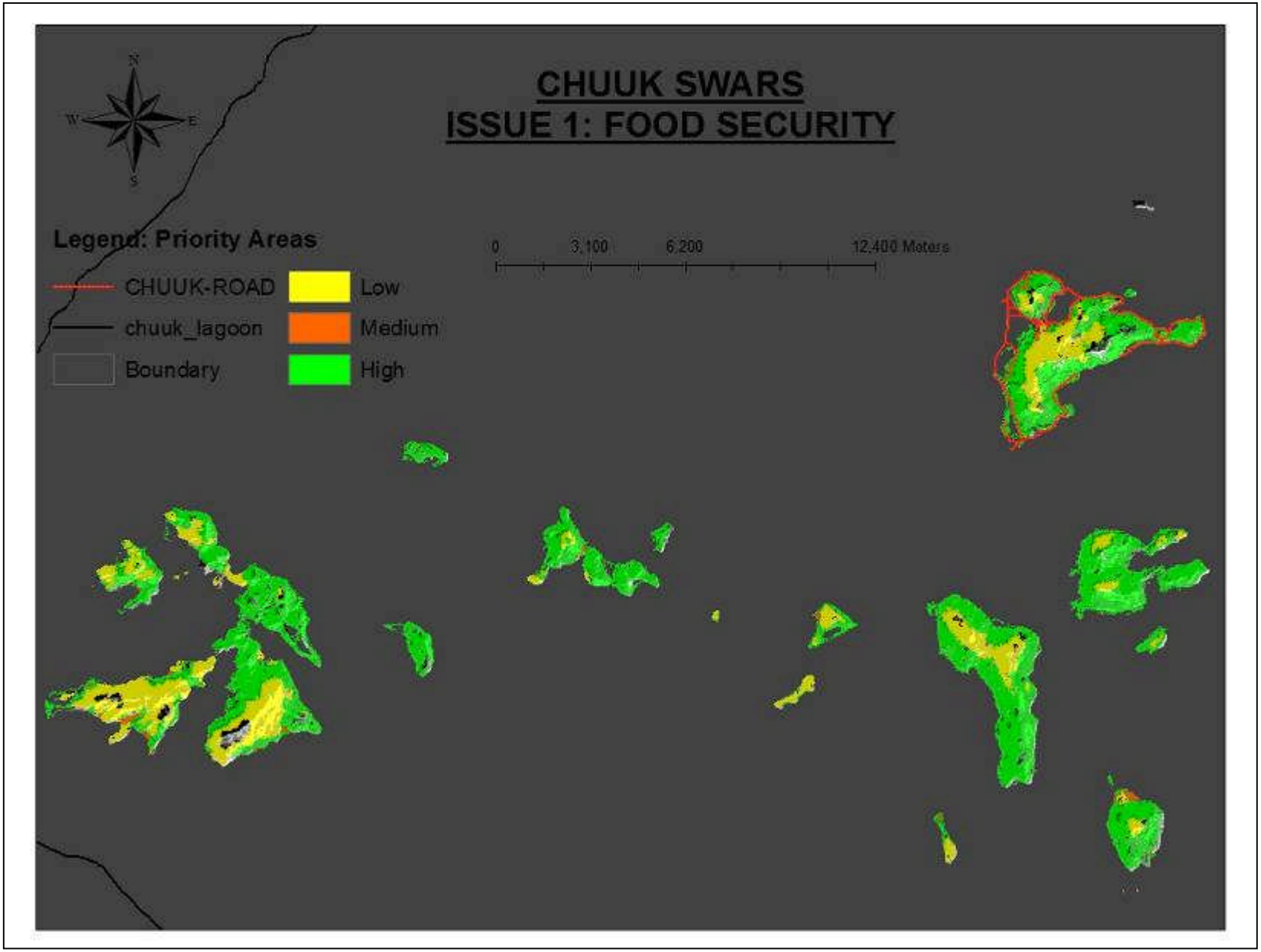
heavy growth of vines. Wildfires are a threat on years with more pronounced drought, as they burn unchecked, erode the forest edge, and prevent weedy and grassland areas from growing back to forest. Arson is said to have become less common however as youth have moved to urban areas.

Priority landscapes for Issue A: Food Security:
Map C-2 addresses both food security and biodiversity. It provides a color-coded map of major vegetation types of Chuuk high islands. Inasmuch as most of the island is utilized in some aspect of food or other production, all vegetation types are included. The map is color-coded to indicate the appropriate strategy/ activities throughout the island. In general, these are: Enhance, and rehabilitate agroforest areas (in red), and Protect and conserve the cool colored areas of upland forest (green) and mangroves (blue). LIDAR imagery would be useful to determine the elevation and vulnerability of freshwater marshes to seawater intrusion and provide a basis for determining what areas might be most suitable for conversion to taro culture.

Map C-3 shows land currently in agroforest and therefore a priority area for agroforestry enhancement to improve agroforest productivity. A higher priority is placed on agroforest extension to lands with less than 30% slope. Lower priority is placed on coastal agroforests of the lagoon islands, where saltwater intrusion is beginning to take place and landowners have the option to shift production inland (higher). Grasslands and secondary vegetation were given were given second priority agroforestry enhancement because they often overlie poor or rocky soils. For these areas, restoration efforts are in order so that they can be made more productive.

All atolls are currently considered part of the priority area for agroforest extension however imagery is not available to provide a map. At this time, no policy decision has been made to either de-emphasize atoll agroforest extension (in anticipation of sea level rise and abandonment) or intensify atoll agroforest extension (to adapt to anticipated sea-level rise and droughts).

Opportunities: The cost of imported food is increasing, so people may need to turn to traditional food production. The movement of outer islanders to mainland Chuuk increases both the need for more food production as well as a potential labor force to recondition and expand food production systems, if appropriate technologies can be identified and transferred in time.



Map C-3: Food Security. In general, areas of high priority for food security are shown in green and include agroforest and secondary vegetation. This is a spatial analysis map and the method of its production is described in Appendix.

B. Coastal stabilization

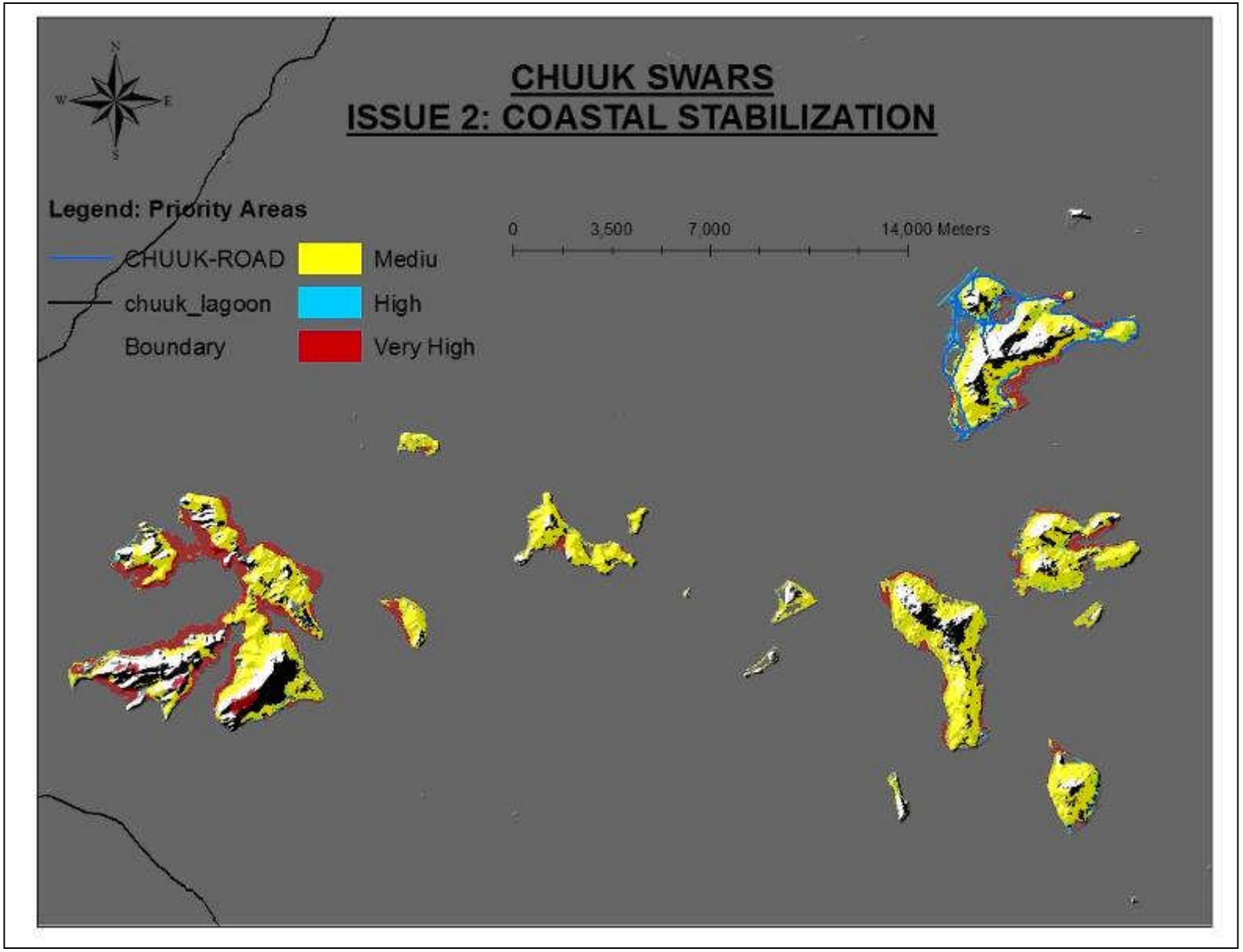
Reports of the International Panel on Climate Change and other groups acknowledge climate change and predict more severe ENSO events and storms and rises in sea level that will result in erosion and inundation of coastal areas of Chuuk, especially in the low lying Outer islands. This damage is exacerbated by damage to coastal ecosystems such as mangroves, through road building, landfills and dredging operations. Mangrove forests have multiple values: for fisheries habitat, wood production, trapping sediment and shoreline protection. Mangrove forests significantly buffer the force of waves, including storm surges, and thus protect the coastline from erosion. The "fringe" (seaward) mangrove is most valuable for this coastal protection function. Strand forests occupy sandy coastal areas above high tide mark, especially on the coasts of atoll islets. They stabilize the coastal dunes and reduce the extent of beach erosion during storm surges. Strand forests also provide a windbreak protecting the forests behind them from strong winds, desiccation and salt spray. They may also help stabilize the crest of the beach and reduce the extent that a high-water event overtops the beach crest and deposits salt water in the island interior. Coastal erosion in the Outer Islands of Chuuk is especially severe and of considerable concern. Map C-4 shows priority landscapes for coastal stabilization.

Threat: Mangroves, important for coastal stabilization are threatened by: fill & conversion: People are moving from inland areas to the coast to facilitate travel to other islands and these areas are much simpler to build on using cement and concrete; Over cutting is most dangerous in the fringe mangrove, where gaps may allow increased wave energy to enter the mangrove ecosystem and wash away sediments that form the substrate for regeneration, oil spills, mangroves themselves will be affected by sea level rise. Mangroves' landward edges are constrained from inward migration where topography is steep or people build seawalls. They may migrate into present-day freshwater wetlands as they become brackish.

Opportunities: People's concern over recent high waters may result in less damage to mangroves and coastal forest, and possible willingness to plant trees for coastal protection. Recent data on the high levels of carbon sequestration by mangroves and the potential for income for "carbon credits" may induce coastal landowners to protect their mangroves.

Priority Landscapes to address issue

Priority areas for coastal stabilization includes all mangroves and all coastal and strand forest. While data does not permit precise mapping of strand forest, especially on the atolls, all land less than 5 m above sea level should be considered part of the priority area. Map C-4 shows priority areas for coastal stabilization in Chuuk Lagoon islands. Almost all of Chuuk's Outer atoll islets lie within 5 meters of sea level and are therefore of high priority for coastal stabilization.



Map C-4: Coastal Stabilization, showing highest priority areas for coastal stabilization in red, area of the airstrip and roads in blue as medium priority, and lower priority in yellow. This is a spatial analysis map. The method for producing it is included in the Appendix

Critical information gaps
There is urgent need for site-specific information and recommendations for coastal protection. New watershed-wise and coastal adaptation engineering practices are needed, particularly in areas where roads pass between wetland and mangrove habitat.

Aerial images of Outer islands are critical. In addition, LIDAR imagery would enable an evaluation of taro patch resources for planning and adaptation to Sea Level Rise.

C. Biodiversity Conservation

The resilience inherent in intact forest ecosystems provides the best insurance against climate change, and helps ensure that forests meet the needs of present and future generations (UNCBD, 2010.) The FSM Strategic Development Plan Environment Sector states: "Recognizing the critical importance of the FSM's natural environment to the health and prosperity of this and future generations of Micronesians, the Environment Sector shall support the protection of the Nation's Environment and achieve sustainable development of its natural resources". In addition, the TNC Micronesia Challenge has pledged to effectively conserve 20% of terrestrial areas, forests or representative areas of all terrestrial natural vegetation habitats; 30% of near shore marine habitats. If Chuuk is to meet the Micronesia Challenge, all remaining areas of intact natural forest will need to be conserved as well as significant area of mangrove. It would also be wise to protect more mangroves than called for by the Micronesia Challenge because of the contributions of mangroves to fisheries and coastal stabilization (issue E.)

The small areas of intact native forest atop the peaks of some lagoon islands are rich in endemic species and represent some of the most endangered species and forests in Micronesia. Agrobiodiversity (the diversity and sub-specific variation in food crops) is also high and a valuable cultural heritage as well as a genetic hedge against climate change. Ethno botanical knowledge is also of great adaptive value. Upland forests provide watershed protection and mangrove forests provide coastal protection as well as carbon sinks and contribute to the productivity of coastal fisheries. Biodiversity is linked with local culture and history. Some historic/cultural sites have been documented and mapped. Several sites have been designated by US National Park Service as National Historic Sites through the Chuuk Office of Historic Preservation. There may be opportunities to combine priority forest sites with historic sites.

Threats: Upland forests are threatened by: bulldozing roads, agricultural areas and house sites, agricultural burning, wildfires during extreme droughts, aggressive smothering vines, especially after typhoons, extreme droughts, and decreases in seed dispersers such as fruit bats, Micronesian pigeons and other birds. Forest is being used for construction materials and for fuel for cooking taro and breadfruit. Some forest products are for sale. Certain species of trees are more desirable for fuel including mangrove. This even takes the form of poaching by people other than the landowner. Deforestation has contributed to landslides during storms and periods of especially heavy rainfall. Invasive species and aggressive vines threaten native forests. On years with more intense droughts, unchecked wildfires burn grasslands, erode forest edges and prevent weedy areas from reforesting by killing tree seedlings. Invasive Pennesetum grass is making open areas more susceptible to wildfires. People are moving their agriculture areas further inland impacting additional forest.

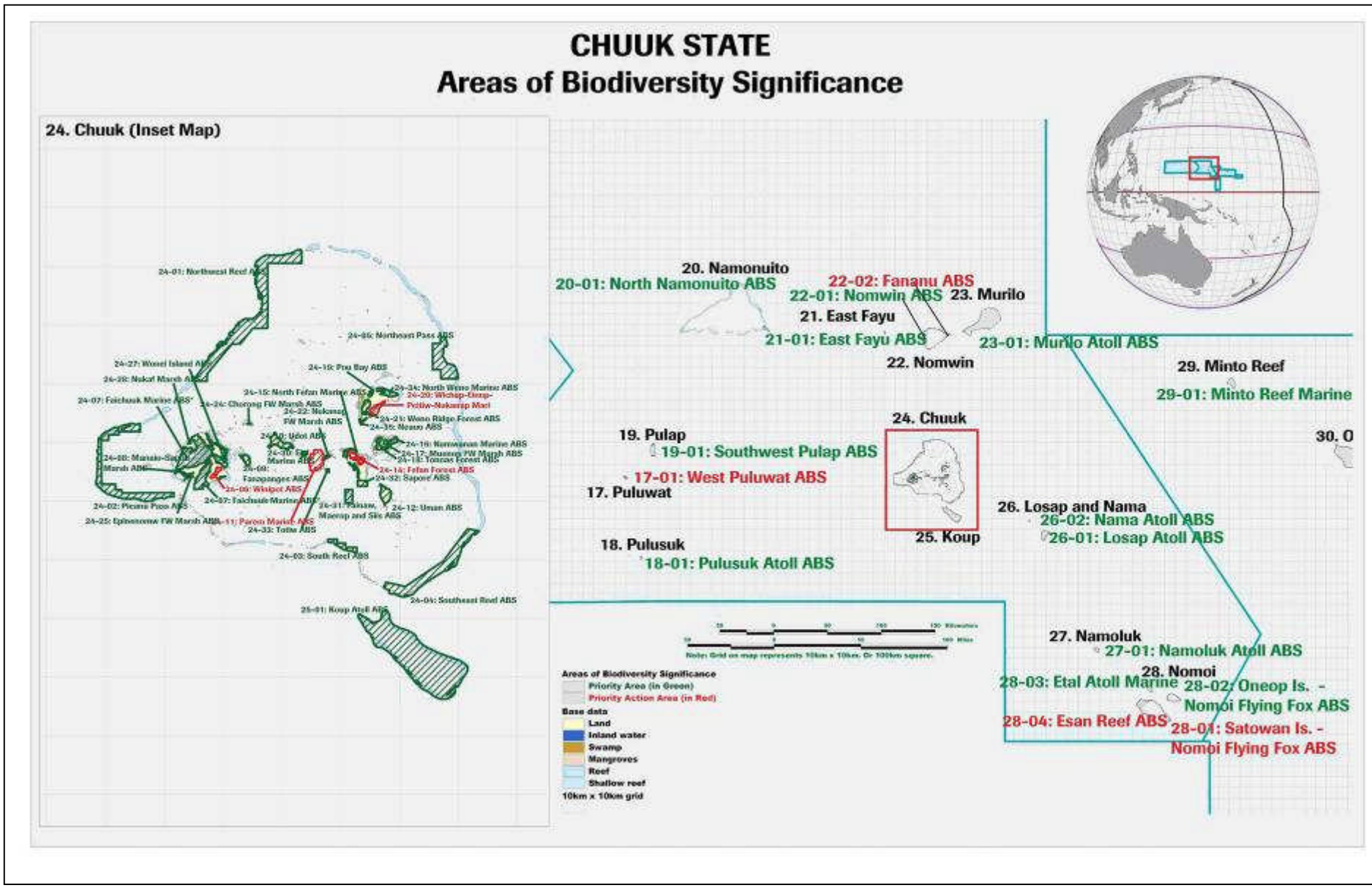
Mangroves are threatened by: fill & conversion; they are cut for firewood, and to open boat channels to individual's land. Other threats include oil spills, and dredging operations. Mangroves may be threatened or their composition changed by sea level rise. Beach strand is likely to be eroded by sea level rise and storm surges as shown in a recent survey of some uninhabited outer islands (YINS 2009). Atoll strand forest and atoll forest is being crowded out by coconut trees. This is a threat to sea birds that need native trees such as *Pisonia grandis* for nesting. Sea birds are needed by fishermen to locate fish.

Wildfires occur on most years during dry periods. During years with more severe droughts they burn most grasslands and damage forest as well. Wildfires were especially widespread during the drought of 1982-1983. In recent years the invasive "yellow tailed" Pennesetum grass has spread into open areas where it now grows thickly enough to make open areas more flammable and to carry fires into forested areas. There has been no program to gather data on areas burnt by wildfires, or major areas to suppress wildfires, which mainly occur on private property, but Chuuk Agriculture hopes to start such a program.

Opportunities: Some forest areas identified as potential conservation areas are already protected by traditional custom (Fefan). The TNC and conservation International have pledged 12 million to support the Micronesia Challenge. Should this funding become available, it could support more local staff working in forest stewardship and enable a program to advance progress towards meeting the Micronesia Challenge. With the passage of the Farm bill, the FSM has become eligible for assistance through the Fire and Aviation Program. This assistance could help Chuuk State address the problem of wildfires. While the recent upward trend in rainfall has resulted in a lower incidence of wildfires, it is also resulting in an increase in the fuel load, should a drought occur before more fire resistant forests develop.

With most all land being privately owned, the Forest Legacy program is quite relevant for Chuuk. While not ready for the Forest Legacy program, Chuuk is interested in this program and will be following the progress of the pilot project in Kosrae.

Priority landscapes to address issue: Chuuk's designated priority area for the biodiversity issue is the collective terrestrial "Areas of Biological Significance" identified for their high biodiversity values in Blueprint (2003), and shown in Map series C-7. Proposed areas for protection include the "UFO" drainage basin of the villages of Ununu, Fongen and Onongoch in Fefen; and the Orro stream watershed and historic site. The Ononguch site will be the first priority with a focus on the riparian zone within 200 feet of perennial streams and within 100 feet of intermittent streams. Chuuk Agriculture will develop a competitive grant proposal for this watershed. Other proposed sites include a mangrove crab preserve at Weichukuno on Tol Island, and Tonomwan on Tonoas Island. The fresh water marshes on Tol & Parem are indicated as ABS. The forest of Winipot, Tol is the most extensive area of native forest in Chuuk State and in addition to endemic plant species, provides habitat for the endemic Chuuk Monarch and a probable endemic sichon millipede found only in Chuuk in the FSM. Map C-7a shows ABS, protected/managed areas with general vegetation color-coded.



Map C-7: Chuuk Areas of Biological Significance. This map, from the blueprint (2003) shows areas considered to be of special biodiversity significance in Chuuk State, including the lagoon islands of Chuuk and the outer islands of Chuuk State

D. Watersheds

Watersheds integrate natural habitats from ridge to reef and greatly affect the quality of downstream habitats. An understanding of watersheds enables people to see how they fit into the landscape, and watershed projects can be landscape in scale. They can thus be a most effective way to provide good environmental stewardship. An assessment of a watershed on Fefan has been done by Chuuk EPA 2009). Watersheds are impacted by construction activities such as roads, airstrips land moving activities, and dredging. The impact of such activities is generally unappreciated by the Public. Soil erosion originating in upland areas is transferred to downstream habitats through riverine and watershed areas. This results in the siltation of near shore marine habits including areas important for the dive trade and other ecotourism, areas of biological significance and marine protected areas. The current renovation and paving of the road in Weno will affect patterns of runoff and water flow, and good eco-engineering practices are needed to avoid deleterious impacts.

Threats: Bulldozing, dredging, landfills, deforestation, wildfires, sawmills, and storms. Wildfires, exposed soils and removal of woody vegetation may cause soil compaction, reduced infiltration rates and therefore reduced groundwater recharge and reduced stream flow during the dry season.

Opportunities: The availability of the competitive grant program gives Chuuk a chance to obtain support for a multi-year project to link land and marine stewardship.

Priority landscapes to address issue

A high priority area for a watershed project is the Ununo, Fongen, Onongoch (UFO) watershed on Fefan. This watershed includes streams and buffer zones in a three-village drainage basin.

E. Production & sustainable harvesting

The integrity of Chuuk's culture is ultimately dependent on its natural resource base. Local forests provide needed fuel wood and poles for posts and rafters. Local mahogany plantings while not fast growing, could eventually provide some timber for local use. Powerful machinery helps people to make big changes faster and easier in order to make conditions more comfortable for people, and to enable economic development. In general, the link between a healthy environment and a healthy economy is not always realized. Resources appear to be deteriorating but there is no system to monitor environmental indicators.

Trends: Natural resources appear to be exploited unsustainably but there is no system to monitor their status. A second iteration of the FIA survey will indicate change in the sampled plots.

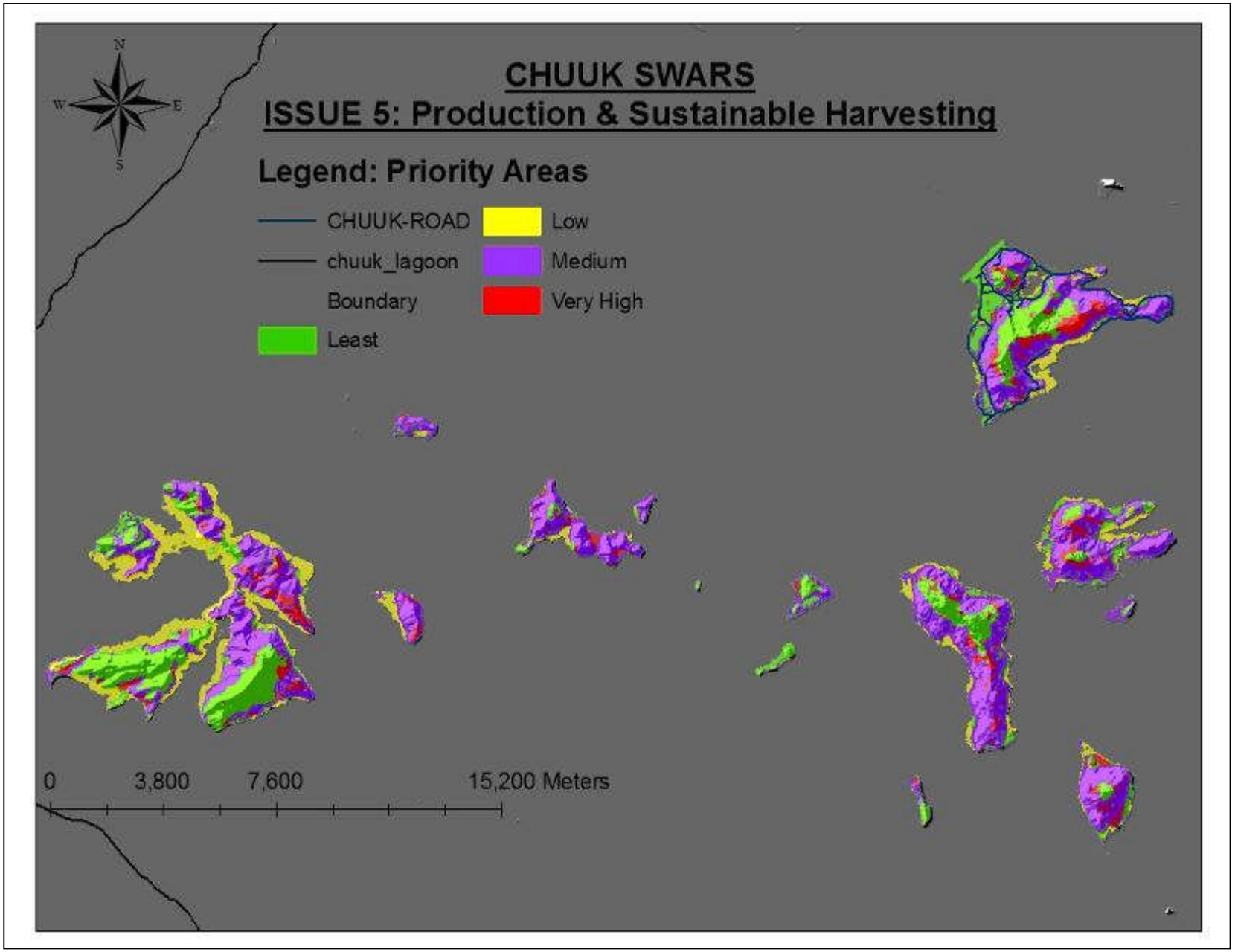
Threats: Threats to forest resources include bulldozing, deforestation, loss of habitat for birds and fruit bats that spread tree seeds. Overexploitation of forests threatens the very survival of mangrove forests; threatens the biodiversity value of intact upland native forests; and reduces the woody component and watershed value of agroforests.

Opportunities: Since the government manages most funding for large projects, the government could do a lot to prevent damage to forest resources. Savanna reclamation projects could produce

fuels and eventually timber. Since the government owns and operates the field trip ships, the government could control the exploitation of sea turtles, sea birds and coconut crabs by field trip ships. Production and sustainable harvesting efforts could be tied in with ecotourism. Unproductive lands (grasslands and secondary vegetation), if converted to woodlots, could provide needed wood products, diverting pressure from native forests and agroforests.

Priority landscapes to address issue

Map C-5 shows areas of high, medium and low priority for production and sustainable harvest.



Map C-5: Priority areas for development for production & sustainable harvesting. High priority areas for planting for sustainable production and harvest include grasslands, savanna and secondary vegetation. Medium priority are agroforests. This is a spatial analysis map. The method for producing it is included in the Appendix

Critical information gaps
Information is lacking on possible sustainable harvest of trees for timber. While there appears to be very little timber available in Chuuk, sawmills tend to be promoted in economic development schemes. It would be helpful to have a definitive statement on the amount of timber that might be harvested on a sustainable basis in Chuuk. Even if this assessment indicates a lack of timber that could be sustainably harvested, it is important to have this information on hand for consideration when proposals for sawmills arise. The FSM is without a timber management program and Chuuk is vulnerable to unsustainable cutting of the very limited number of trees. Presumably a statement on the prospects for sustainable timber harvest could be derived from the MacLean et al timber survey of 1988 and the recent Forest Inventory Assessment. There is an urgent associated need for information on the en situ value of forest resources for their ecosystem and carbon sequestration values. This would provide people with information needed to make wise decisions on the use of Chuuk's very limited forest resources.

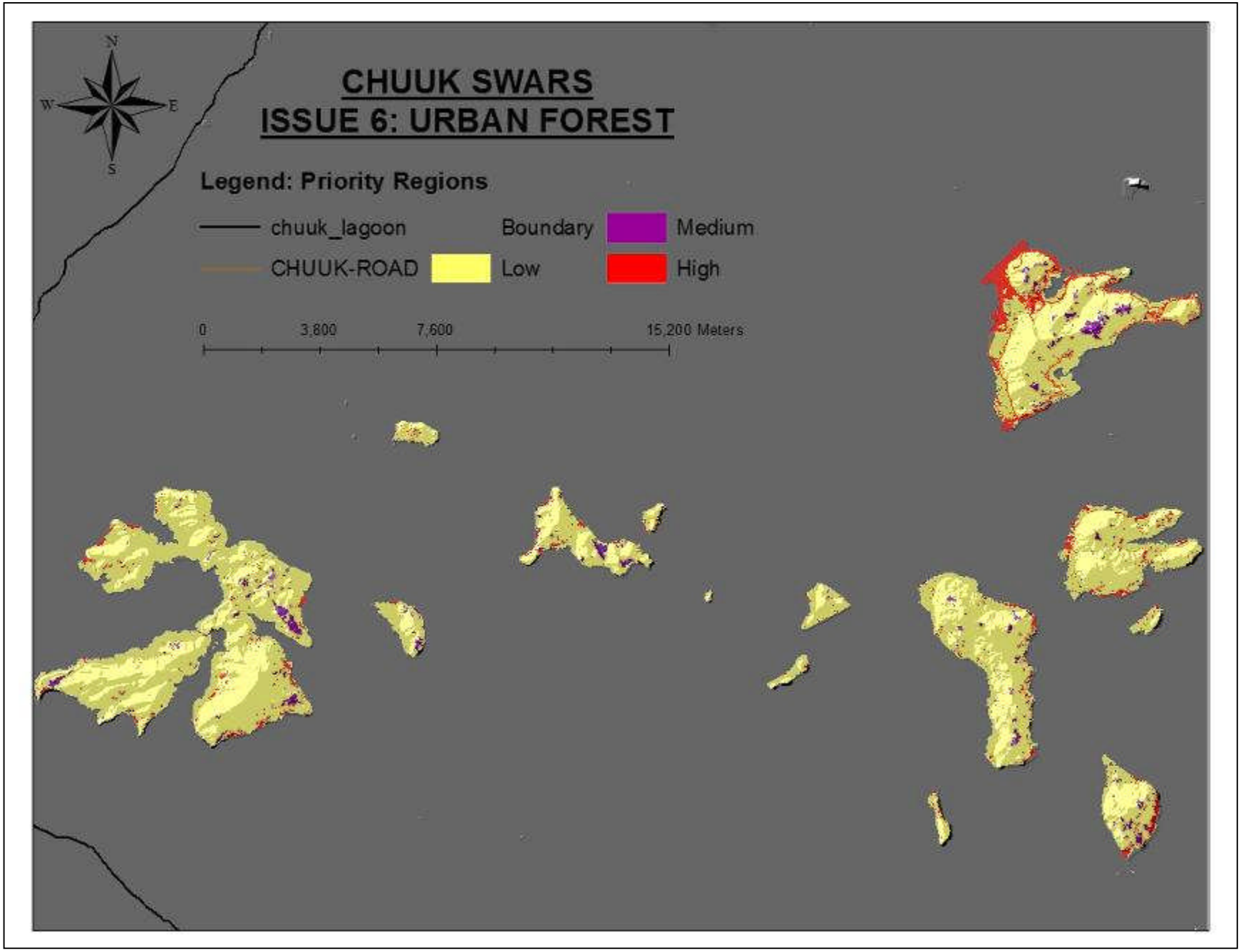
F. “Urban” Forestry

Previous generations of Chuukese developed the surrounding landscape into a food production and living system and that landscape in turn sustained Chuukese culture. It is important to maintain and enhance this connection while progressing into the future. There is need to foster an improved environment for all people in Chuuk by organizing and encouraging the planting and maintenance of trees so that communities will be cooler, have cleaner air and water, quieter streets and paths, more peaceful neighborhoods, improved nutrition, sources of materials for artisans as well as building materials and medicines; stronger village economies and more pleasant surroundings in the places where we live, work and play.

At the current time the Chuuk Invasive Species Task Force Council also serves as the Urban and Community Forestry Council. This group was consulted for the SWARS during meetings and workshops to identify issues, threats and stresses to the forest ecosystem, forest production, food security, and agroforestry. Members of the group were also involved with the writing workshop for the draft SWARS.

Today trees are being cleared to make way for development activities. In some places, trees pose a threat to power lines or houses and a need for tree-trimming and removal services is developing. The training of Chuukese in proper maintenance of urban trees would benefit Chuuk by making it possible to prune rather than remove trees in many areas. It could also provide an opportunity to develop a private-sector workforce, providing employment both on Chuuk and skills to Chuukese who emigrate to Guam, Hawaii and other locations.

Priority landscapes to address issue
Map C-6 shows priority landscapes for urban forestry.



Map C-6: Urban Areas, showing high, medium and low priority areas for urban forestry efforts. High priority areas are urban cultivated and urban built-up. This is a spatial analysis map. The method for producing it is included in the Appendix.

Critical information gaps
It would be useful to have a master plan for Weno.

The most crucial information needed to determine the impact of sea level rise and storm surges on urban areas. LIDAR imagery would enable the development of Digital Elevation Models showing what areas would be affected by these threats.

G. Capacity-building

The numbers of forestry staff are low (Table C-2), with the salary of about half of the staff dependant on USFS S&P grants (Table C-2). It is therefore important that S&P base level funding remain at a steady level[6]. With funding declining under the Compact of Free Association, additional funding of forestry positions is not likely. In addition to ongoing programs, the local forestry staff is needed to provide expertise in forestry needed by communities to obtain grants for forestry projects. The leverage capacity of S&P grants is therefore quite high.

Threats: Threats include declines in funding and many demands on the time of the limited staff. The FSM government currently operates on a performance-based budget system. The ability of local forestry staff to achieve budgeted work is often limited by other demands on their time such as attendance at unanticipated workshops, off-island training or assisting visiting members of outside agencies.

Opportunities: The IPIF has in the past provided an intern program to develop capacity of local staff. Chuuk Agriculture is interested in having its staff go to college and to have training to be delivered via COM-Chuuk Campus. The undergraduate summer internship program is good, but Chuuk would like to have staff enrolled in the Professional internship program, and could perhaps allow one or two staff to go for training at a time. The TNC and CI have pledged 12 Million U.S. dollars to support the Micronesia Challenge. Should some of this support become available to local forestry agencies it could help maintain or increase the number of positions and develop local capacity.

Communities are eligible for funding for environmental projects under the UNDP Small Grants Program. This provides a more motivated clientele for forestry staff.

Outside agencies could adapt their programs to the needs of local forestry staff and schedule workshops and trips well enough in advance that they could be fit into the year's performance objectives. In addition, it would be helpful if workshops resulted in certification of attendees in needed skills that would contribute to Individual Development Plans.

[6] At one time it was locally understood that S&P grants were to be decreased at the rate of 15% each year in order to fund the competitive grant program. It has since been learned (Friday, email of 3-29-2010) that the percentage taken out of "base" grants and awarded as competitive grants is flat at 15%.

II. Resource Strategy

Long-Term Desired Conditions and Strategies

The Chuuk State Biodiversity Strategy and Action Plan offers the following long-term vision, and a well thought out strategy:

"Vision"
The people of Chuuk will live in a clean and beautiful environment where biodiversity is resourceful and preserved, and where traditional knowledge and practices plus other modern knowledge and practices are utilized for the sake of sustainable development.

In terms of conservation and any other activities, it must be made clear that the land and the sea are basically owned by the people. It is, therefore, the people who are the key to the success of conservation because their consent and participation is needed before any conservation projects can be established, implemented, and continued. The Chuuk State BSAP priorities objectives and activities to reflect this fact so people-related is the first heading in the action plan, followed by assistance-related, management-related, and control-related. People-related is first because a good solid relationship needs to be established first. Once the people accept conservation as their responsibility, then assistance can be identified and accessed for conservation projects (Margoluis and Salafsky, 1998). After assistance has been accessed, then conservation activities in terms of management and control can then be implemented.

The heading 'people-related' deals with setting up an environmental NGO, environmental clubs in the schools, a curriculum on biodiversity conservation, and working with the communities to identify marine and terrestrial areas to be protected. The heading 'assistance-related' deals with increasing government funding for conservation programs to a 60/40 ratio, identifying outside and inside technical assistance, improving sources of funding, and establishing a system of resource user's fee. The heading 'management-related' deals with demarcation and registration of at least 2 ABS, creating legislation to support traditional conservation practices plus protecting our island species and biodiversity, establishing marine and terrestrial protected areas, and updating an inventory of marine and terrestrial plants and animals present in Chuuk. The heading 'control-related' deals with strict control of alien species and requirements prior to activities affecting our biodiversity." (from Albert & Nakayama 2004, Chuuk Biodiversity Strategy & Action Plan)

Objectives for terrestrial natural resources derived from the CBSAP are inserted into Table C-3 below. For more details, consult the CBSAP in the Appendix.

The color-coding of Map C-2 provides general guidelines for appropriate actions throughout the high lagoon islands of Chuuk. In general habitats color coded in warmer colors (red for agroforest), should be enhanced to address Issue A, (Food Security), and those coded with cooler colors (green for upland forest and blue for mangroves) should be protected to address Issue C. Biodiversity, as well as the Micronesia Challenge.

Resources

Chuuk State has access to two types of resources: 1) cooperators and 2) funding sources. Table C-2 below shows three main categories of cooperators and advisory agencies and groups. The number of funding sources is smaller and includes limited local government funding, the USFS S&P program and other potential grant sources.

Table C-3 below summarizes strategies for addressing each of the FSM issues and shows how S&P funding will leverage funding from other sources, and indicates performance measures (outputs and outcomes). The link between FSM issues and U.S. Themes is given in Table C-1. This list of strategies and description of an optimal program is ambitious and its implementation will depend on levels of support for staff and programs and unforeseen demands that are made on staff. Additional details on strategies are provided in numbered footnotes.

Table C-2: Resources available to carry out SWARS strategies

Chuuk Dept. of Agriculture; Div. of Forestry	**On-Island Cooperators**	**Off-Island Advisory Agencies & Groups**
5 full-time posts funded by Chuuk Government(1 Chief of Forestry, 1 forester, 3 extension agents shared with agriculture) 4 full-time positions funded by S&P grants (1 U&CF Coordinator, 1 Invasive Species Coordinator, 1 Nursery Supervisor, 1 Administrative Assistant)	EPA, Dept. of Marine Resources, Land Management, Dept. of Education, NGOs (Chuuk Conservation society, Chuuk Women's Council, Youth Groups and Church Groups), COM-FSM Chuuk Campus & Land Grant, Munic8ipal Governments	USFS PSW Station, Natural Resources Conservation Service, College of Micronesia, University of Hawaii & U.H. East-West Center, and U.H. Sea Level Rise Center, University of Guam, U.G. Water and Energy Institute (WERI), NOAA National Weather Service & Coral Ecosystem Monitoring, Palau International Coral Reef Center (PICRC), Pacific Is. Climate Change Cooperative (PICCC)[7], Regional Invasive Species Invasive Species Council (RISC), Pacific Invasive Partnership (PIP), Pacific Invasives Learning Network (PILN), Pacific Invasives Initiative (PII), Pacific Islands Ecosystems at Risk (PIER), and a number of other Invasive species advisory groups; Commission of Regional Organizations in the Pacific (CROP) Agencies – Secretariat of the Pacific Community (SPC), South Pacific Regional Environmental Program (SPREP), SOPAC; FAO, TNC, MCT and a number of outside NGOs, SGP, UN In-country Representative, FSM National Government
Sources of Funding		
State & FSM National Government support for staff and some operations from Compact Environment Sector funding	USFS S&P grants MCT small Grant Program funding for Community projects	

[7] PICC is a newly formed cooperative including the U.S. Fish & Wildlife Service, U.S. Geological Survey, National Parks Service, National Oceanic & Atmospheric Administration (NOAA), NRCS, U.S. Forest Service, U.S. Army, Office of Hawaiian Affairs, Hawai'I Department of Land and Natural Resources, University of Hawai'i, The Nature Conservancy, Kamehameha Schools & Hawai'I Conservation Alliance.

CHUUK STATE
RESOURCE STRATEGY

Table C-3: Strategies and Actions for 5-Year SWARS

Table 3: How the state proposes to invest federal funding, along with other resources, to address priorities

FSM Issue	Strategies & activities for 5-year SWARS plan	Resources / Funding		Main Cooperators	Performance Measures
		S&P	Other		
All issues	Obtain current high resolution aerial imagery & carry out surveys & produce updated vegetation map to determine trends				Development of new vegetation maps for use in determining trends and to serve as a baseline for measuring progress in resource stewardship
	Evaluate forest & agroforest resources with respect to climate change & Sea Level Rise (SLR) (both Chuuk Lagoon and Outer Islands (OI)	Forest Resource Management (FRM)	UNFCCC Mechanisms (e.g. SNC V&A assessment)	Dept. of Agri, COM Land grant, NGOs, SPC, EPA, Office of Disaster, Marine Resources, Dept. of Education	Develop GIS database needed to provide assistance to communities in the development of community natural resource stewardship plans
	Develop profiles of elevation and habitats of OI		UNFCCC Mechanisms (e.g. SNC V&A assessment) & CROP Agencies		Profiles of low-lying atolls needed to plan for sea level rise
A. Food security	A.1. Survey genetic resources & select priority varieties for propagation & distribution to enhance & expand agroforestry systems, Promote planting/retention of more agroforest trees in uplands, Train farmers in control of invasive species, Nursery Production & distribution of agroforest seedlings.	RNGR	SLM, JEMCO UNFCCC Mechanisms	Dept. of Agri, COM Land grant, NGOs, SPC, EPA, CROP Agencies	Enhanced and expanded agroforests

FSM Issue	Strategies & activities for	Resources / Funding		Main Cooperators	Performance Measures
	A.2 Work with land owners and communities to develop best practices for enhancing & expanding agroforestry & other food production systems adapted to SLR Develop Municipal extension plans, including Outer islands[8]	U&CF, FRM	MCT, SGP	COM-FSM CRE , TNC, PIMPAC, IWRM, CROP Agencies, FAO, UN Implementing Agencies, USDA-NRCS etc.	A.2. Use of best practices
	A.3. Provide extension to communities on relationship of agroforestry to watershed and island's ecosystem in Chuuk Lagoon and to profile, water lens and habitats in OI		U.G. WERI, IWRM, CROP Agencies, FAO, etc.	Dept. of Agri, COM Land grant, NGOs, SPC, EPA, Office of Disaster, Dept. of Education	A3. Communities aware of island's hydrology
	A.4. In the course of agroforest extension, include restoration of riparian vegetation and setbacks for piggeries and waste disposal in landowner management plans	U&CF, FSP		Dept. of Agri, COM Land grant, NGOs,	Cleaner waters, landowner management plans
B. Coastal stabilization	B.1 Obtain assistance with best methods on dredging and quarries	IF (?)	SOPAC	EPA, OEEM, etc.	B.1. Less damage to mangrove areas
	B.2. Obtain assistance of expert road engineer(s) for watershed and mangrove – wise road engineering; add-value to the monitoring of the design of infrastructure developments impacting natural resources		PICC?	TC&I, USDA-NRCS, IWRM	B.2. Watershed - wise road engineering
	B.3. Conduct surveys & work with relevant outside agencies (ROAs) & communities to identify and develop site specific best coastal stabilization practices	Road design evaluation training (IPIF)		TC&I, USDA-NRCS, IWRM, SOPAC, SPC, FAO, etc.	B.3. Better coastal stabilization practices
	B.4. Replant mangroves, Replant strand forest in atolls, Educate people to leave mangrove fringe intact to protect the coast	U&CF, FSP		EPA, CCS, CRE, etc. JEMCO, SPC, FAO, FSM R&D, COM-FSM, etc.	B.4. Enhanced coastal forests as a hedge against coastal erosion

[8] In FY 2010, Chuuk will utilize the FRM and RNGR components of the Forest Stewardship Program. After this, Chuuk may begin working with private land owners on Stewardship Plans that meet the Forest Stewardship program standards for individual or groups of adjacent landowners.

FSM Issue	Strategies & activities for	Resources / Funding		Main Cooperators	Performance Measures
C. Biodiversity	Production and Implementation of a biodiversity conservation curriculum in the private and public elementary schools.	U&CF, FRM		COM-FSM, Chuuk campus, lead; CSSS, Division of Curriculum (Lead Agency), COM-FSM, Chuuk campus, schools, ETS, EPA, DMR, PCV, DAF, HPO, Youth, Scouts, HESA, Church leaders, traditional leaders, women's group, village leaders, CBO, NGO	An Environmental curriculum Pre and Post surveys to determine effectiveness of curriculum
	Increase government funding for conservation			EPA (Lead Agency), DMR, DAF, Budget Office, HPO, Legislature, municipal government	Appropriate departments and agencies will be better able to fulfill their roles in conservation
	Identify and access technical assistance for biodiversity conservation activities			EPA (Lead Agency), DMR, DAF, CBO, women's group, churches, municipal government, TNC, MCT, MIC, USDA-NRCS, NGO	The availability of inside and outside technical assistance will be available for use when needed may increase success in establishing and implementing biodiversity conservation activities since most communities, agencies, and departments have the idea of starting up such activities but do not know the mechanisms of starting and successfully implementing such projects

FSM Issue	Strategies & activities for	Resources / Funding		Main Cooperators	Performance Measures
	Legislation for the protection of endemic, endangered and rare species, and for protected areas Future involvement in the Forest Legacy program	U&CF Forest Legacy		AG (Lead Agency), DAF, DMR, EPA, HPO, CBO, CSSS, ETS, COM-FSM, Chuuk campus, PCV, traditional leaders, village leaders, women's group, municipal government, NGO	The conservation of these species may increase their numbers thus decreasing the chances of becoming extinct. Community ordinances for protected areas
	Legislation that appropriate agencies work with communities to manage protected areas and to patrol areas under the traditional land-based conservation practice of 'pwau'.	U&CF Forest Stewardship		AG (Lead Agency), DMR, DAF, HPO, EPA, AG, PCV, traditional leaders, village leaders, women's group, municipal government, churches, NGO	This type of collaboration may also encourage many communities to continue with the traditional practice because there is available assistance from appropriate agencies and departments. Community ordinances
	Legislation to prevent bioprospecting and to regulate, monitor, and protect the use of our natural terrestrial resources from being overexploited by local people and outside people.	U&CF		AG (lead Agency), DMR, DAF, EPA, HPO, PCV, traditional leaders, village leaders, women's group, municipal government, NGO	Legislation will make people aware that is its important to protect natural terrestrial resources from being over-exploited Community ordinances

FSM Issue	Strategies & activities for	Resources / Funding		Main Cooperators	Performance Measures
	Improved strict control of alien invasive species into the state that may be detrimental to biodiversity. Improve biosecurity in the face of invasive species. Implement Chuuk Invasive Species 2 year plan (CIST) by 1) securing funding for operations, 2) conduct public education and awareness campaigns, 3) implement control, eradication and prevent measures 4) provide capacity building training for CIST members and partners 4) establish a working network of local and foreign partners [9] Develop program to monitor forest pests and diseases Begin collection of data on incidence of wildfires & develop a Chuuk State 5-Year Wildfire Plan to include working with communities to develop community wildfire protection plans (CWPPs)[10]	Forest Health	SPC	Quarantine (Lead Agency), EPA, HPO, DAF, DMR, DEA, municipal governments, CBO, CSSS, COMFSM, Chuuk campus, NGO, PCV, traditional leaders, village leaders, women's group, municipal government	Quarantine officers and other appropriate agencies and departments need to have legal authority to also patrol areas

[9] The main objectives of the Chuuk Invasive Species 2-Year Plan is alliances to prevent, control, minimize and/or eradicate invasive species." For more information and details see CIST in appendix.

[10] The Chuuk Agriculture Department will take the lead in developing a wildfire management program with a focus on Public Awareness in collaboration with other agencies and NGOs. The Agriculture Department does not, however, have a large enough staff or the equipment to suppress wildfires. During the first year of developing a wildfire program, meetings will be held with Public Safety and community leaders to work out responsibilities and strategies for fire suppression.

FSM Issue	Strategies & activities for	Resources / Funding		Main Cooperators	Performance Measures
	Prior to granting a permit for activities affecting terrestrial biodiversity all agencies concerned must be involved in the approval process.			DAF (Lead Agency), DMR, HPO, EPA, NGO,CBO, AG, PCV, traditional leaders, village leaders, women's group, municipal government	Establishment of a project review process
	All government departments and agencies will include biodiversity conservation in their planned activities.			EPA (Lead Agency), AG, DMR, DAF, HPO, NGO, Budget, CVB, CSSS, PCV, traditional leaders, village leaders, women's group, municipal government	All government departments and agencies will include biodiversity conservation in their planned activities.
	Communities will designate surrounding terrestrial areas to be protected. Increase protected areas.	FLP , U&CF, FSP (Tentative)	FSM R&D, JEMCO,SPC, FAO, MCT, TNC, PIMPAC, etc.	DAF (Lead Agency), COM-FSM, Chuuk campus, EPA, DMR, HPO, CSSS, ETS, CBO, PCV, USDA-NRCS, Churches, traditional leaders, women's group, resource owners, municipal government, NGO	Establishment, management of terrestrial protected areas
	Prevention, detection & control of incipient invasive species. as per CIST plan, including pesticide applicator certification	FH	JEMCO	CIST Partners, PII, PILN, RISC, etc. USGS,	CIST plan will be implemented
	Request research and assistance with control of Merremia peltata and Cayratia and other aggressive vines	USDA FS research, FHM		CIST Partners, FSM R&D, JEMCO, SPREP, SPC, FAO, etc.	Assistance will be available to control aggressive vines

FSM Issue	Strategies & activities for	Resources / Funding		Main Cooperators	Performance Measures
	Develop Chuuk Fire Plan including contingency plans for wildfires during drought years, obtain fire suppression equipment & training	FAM	OEEM, FAO, etc.	Coop. Fire Partners	Control of wildfires will enable reforestation
D. Watershed	Promote restoration of riparian zones	Competitive Grants		Dept. of Agri, COM Land grant, NGOs, SPC, EPA, Office of Disaster, Marine Resources, etc. USDA-NRCS, TNC, FSM R&D, OEEM, SLM, etc.	Rivers will run clear
	Improve Ununo Fongen Onongoch (UFO) watershed This watershed in western Fefan drains into a Marine Protected Area.	Competitive grants			Improved watershed with intact native forest
	Reforest Nantaku watershed *2	RNGR, U&CF			
	Promote planting/retention of more trees in uplands	RNGR			
	Education, technical transfer and management planning assistance to private upland landowners, including provision of planting materials				
E. Production & sustainable harvesting	Prior to commercialization of any natural terrestrial resource for exportation, approval must be granted by the appropriate agency (s).			AG (lead agency) DAF,.EPA, HPO, DMR, NGO, PCV, traditional leaders, village leaders, women's group, municipal government	Communities, agencies and departments involved in the commercialization of our natural resources will be aware of need for sustainable harvest.
	Obtain assistance to determine sustainable mangrove and timber harvest and develop program to raise awareness, promote and practice sustainably harvest for production	USFS PSW & PNW?		IPIF, FAO, SPC, SPREP	Families and communities will have the information they need for sustainable mangrove and timber
	Develop and promote alternate technologies for cooking stoves to alleviate pressure on mangrove harvesting			SPC & FAO	Less fuel wood will be needed
	Seek approaches to utilize senescent coconut trees and replant			SPC & FAO	More productive coconut trees while utilizing senescent trees that have been replaced

FSM Issue	Strategies & activities for	Resources / Funding		Main Cooperators	Performance Measures
	Develop program of sustainable indicators			SPC & FAO	Better understanding of true development
	Plant woody species valued for wood products, Plant mahogany as future resource for lumber	RNGR		Forestry & Communities	More wood products
	In grasslands and secondary vegetation: Establish pilot project to replace grasses and weeds with Glochidion and Hibiscus*3	RNGR, U&CF			Increased productivity of weedy areas
F. "Urban" forestry	Re-establish U&CF Council and develop a Five-Year U&CF plan to be integrate4d into the next SWARS				
	Public education: "right tree right place"	U&CF (& CE)		Forestry, NGO & Communities	More urban trees
	Promote Environmental Day & assist with Community Stewardship Plan(s) to meet CE goals	U&CF RNGR CE			Increased Public awareness
	Establish arborist certification	USFS			Better care for urban trees
G. Capacity-building	Provide "utility training" for chainsaw safety and ISA certification of tree workers and arborists, and chainsaw safety , also involvement in college training, interns and professional internships opportunities	USFS?	FAO & SPC	As above	Increased Public awareness
	Improve GIS data clearinghouse, work groups and training	USFS	CSP GIS Clearinghouse Project, FSM, COM-FSM,	NOAA, SOPAC & SPC	Better overview of resource conditions
	Provide capacity development opportunities for forestry staff	PSW intern training		COM-FSM Chuuk Campus	Profession Development Plan(s)/Strategic Development Plan
	Coordinate services of outside agencies so that they contribute to budgeted performance objectives or development of local capacity.			Director R&D	Better local focus & initiative & performance for performance based budget

FSM Issue	Strategies & activities for	Resources / Funding		Main Cooperators	Performance Measures
	Develop community awareness through observances such as Earth Day, Environment Week, World Food Day, State of the Union Statement, etc.	U&CF, CE		EPA, Marine Resources, NGO partners, COM-FSM, etc. MCT, TNC, CROP Agencies, etc.	Increased Public awareness
	Assist Communities with development of natural Resource Stewardship Plans	U&CF, FSP	.	Traditional Chiefs, Municipal Govt. Partners, EPA, Marine Resources, NGO partners, COM-FSM, etc. MCT, TNC, CROP Agencies, etc	Community Natural Resource stewardship plans

*1. Designation as Forest Protected Areas is achieved through negotiation with landowners or communities, offering assistance with marking boundaries, tree planting for restoration, etc.

Forest Stewardship Program funding is ideally suited for such landowner outreach, education, and assistance with management planning and restoration. U&CF funding is appropriate if there is community involvement in addition to the private landowner.

Forest Legacy program funding is a possibility, but is limited to parcels with (a) high value, such as biodiversity and cultural significance; (b) threatened by conversion to non-forest; and (c) "ready" for program enrollment, for example clear landownership and landowner understanding of the program. Forest Legacy funding is specifically for the purchase of permanent conservation easements and fee simple purchases. Some landowners are in fact attracted to the idea of selling development rights and keeping rights to harvest products from their land. On some tracts, such transactions will be difficult to achieve due to overlapping landownership rights and landowners' distrust of outsiders. At this time, the decision is to postpone inclusion of Chuuk in the Forest Legacy program until the Kosrae example is complete. It is important not to raise the expectations of landowners prematurely, since (a) many tracts will not have sufficient value/threat/readiness to compete nationally; (b) legal appraisal of the value of conservation easements (covering development rights) will not be high for inaccessible or difficult-to-develop parcels.

*2 According to Ismael Mikel, Director of EPA, there is an existing water delivery system (pipes), providing water to Moen, tapping a water source into which Nantaku drains. The area in need of reforestation has several landowners but no residents.

*3 One grassland area with five interested landowners has already been identified. Applied research would be useful to improve use of herbicides to control grasses, optimize seedling nutrition (similar research has been proposed but not yet funded for Guam and Saipan).

Long-term monitoring outcome of activities in priority forest landscape areas and how actions will be revised when needed

Lead agencies and partners will meet and agree on responsibilities and for accomplishing each of the activities within their target year. Updates on progress will be held as appropriate. Relevant S&P progress reports and other reporting as outlined in grant documents will be made. Should new aerial photography become available, it will be possible to assess trends and develop a new baseline map of resource condition. Strategies may be adjusted based on this new information.

List of Chuuk Maps

C-1: Map of Chuuk State
C-2: General vegetation types of high islands of Chuuk Lagoon
C-3: Food Security Map
C-4: Coastal Stabilization
C-5: Production & Sustainable Harvesting
C-6: Urban Forestry
C-7: Areas of Biological Significance

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Methodology for CBSAP

The Chuuk State BSAP or implementation plan was developed over a series of community consultations and expert meetings since 2001. In 2004, results of those community consultations and expert meetings were consolidated into an action plan outlining Chuuk State's vision, goal, priority based headings, objectives and activities. The action plan is based on the realities of Chuuk State and the most appropriate means of achieving the goal and objectives stated. Lastly, it has been agreed during the consultations that this action plan is biodiversity focused and will be part of Chuuk's overall environmental plan. Therefore waste management is not included in this particular plan since it falls under EPA and the Department of Public Works." (from Albert & Nakayama 2004, Chuuk State BSAP).

Methodology for Chuuk SWARS

Following an initial National Government to identify issues, Chuuk Forestry consulted with Stakeholders through community meetings, workshops, during cabinet meeting briefing, in developing management plan, during development of CIST SAP, and during consultation in writing proposal for SGP proposal on conservation of bio-diversity and adaptation measures. During consultations participants went through the process of SWOT analysis. Stakeholders include Chuuk conservation Society (CCS), College of Micronesia CRE, EPA, Chuuk Women Council, DOE, Local NGOs, Church groups, Youths, Public Safety, Agriculture staff and traditional and municipal leaders.

Katie Friday, the liaison between the FSM and Region 5 S&P program developed an outline for the FSM SWARS that would include all needed information, and worked with Chuuk Forestry to enter initial information. M. Falanruw was then tasked to work with FSM Foresters to complete the writing of the SWARS for each State. She streamlined the outline to avoid some formatting problems and worked with writing teams in each state to develop the first draft of the state's SWARS. The FSM National Government will then add an introduction and conclusion for the overall FSM SWARS.

IV. POHNPEI STATE

Introduction

Pohnpei State includes the high island of Pohnpei with a number of small islets within a large lagoon, and Outer atolls including Ngatik, Oroluk, Nukuoro, Kapingamarangi, Mokil, and Pingelap. There are 5 Municipalities in mainland Pohnpei, each with a local government and mayor as well as traditional leaders. The Outer Islands of Pingelap and Sapwuafik (Ngatik) retain traditional chiefs.

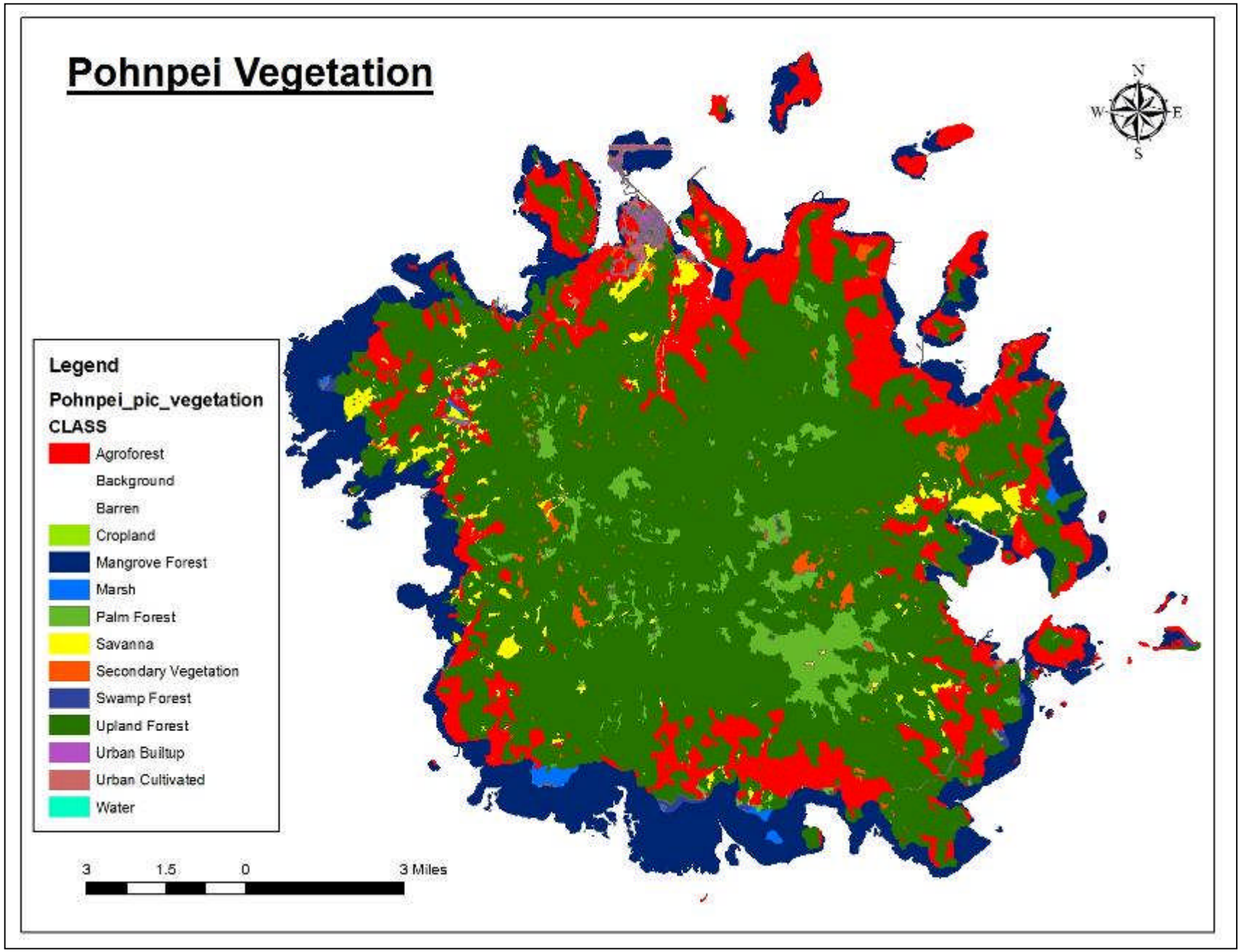
Pohnpei Island lies at 6 degrees Latitude and 158 degrees longitude, about 660 km north of the equator and about 4,983 km southwest of Hawaii. The island is roughly circular, with a land area of about 35,500 ha (87,693 acres). The island is mountainous and heavily forested in the interior. Eleven peaks rise more than 600 m above sea level. It is hot and humid, with a mean temperature at Kolonia, the capital, of 27C (81 F). Temperatures vary little from month to month. The mean annual rainfall is 4,820 mm (190 in), with January and February being slightly drier than average.

I. Forest Assessment

This section provides a qualitative, quantitative and geospatial assessment of Pohnpei's forest resources and major issues of forest stewardship referenced to USFS themes. It includes a discussion of priority landscapes, trends, values of these forest resources, threats and opportunities. The term “geospatial” is interpreted literally as the use of GIS data and maps rather in the more narrow sense of doing analyses with the ESRI Arc View supplementary geospatial analysis tool. The use of GIS is new in the FSM and while there are College of Micronesia and Land Management staff who can conduct geospatial analysis it would be misplaced sophistication to utilize such a tool before data layers have been thoroughly georeferenced and rasterized. In addition, the use of the geospatial tool in a small island setting where all ecosystems are limited in size and closely integrated could result in fragmentation of ecosystems and efforts. It also carries the danger of omitting some communities’ areas from consideration. Inasmuch as successful forest resource management involves the actions of the people who own or use these resources, it is not wise to omit community areas that are integral parts of the whole Pohnpei ecosystem. It would also be difficult to explain maps created through the geospatial tool to stakeholders in villages and communities. This SWARS therefore utilizes standard GIS maps along with some ESRI geospatial analyses. Should more geospatial analyses be helpful in the future, as monitoring of progress of this SWARS indicates a need for revision, they will be made.

Pohnpei State and the FSM have, in recent years, developed a number of natural resource plans, most of which are listed in the reference section. More details on topics included in this SWARS can be found in these references.

Map P-1 shows the distribution of general vegetation types on mainland Pohnpei. A description of vegetation types on Pohnpei may be found in MacLean et al (1986). The 1986 vegetation map reports some 12,548 hectares of upland forest and 5,525 hectares of mangrove. It also indicates some 1,945 hectares of native palm forest, 214 hectares swamp forest, 6 hectares plantation forest and 1 hectare of dwarf cloud forest. In addition some 19,683 hectares were mapped as agroforest, 9,796 hectares of agroforest with coconuts and 124 hectares of coconut plantation. The Forest Inventory Assessment (2009/10) provides additional data on the species composition and condition of measured plots. Areas of intact native upland forests are of special interest because of the high rate of endemism in mainland Pohnpei related to variation in elevation and to the isolated location of Pohnpei. The dwarf cloud forests of Pohnpei’s peaks are especially unique. Unfortunately, cloud cover prevented these special forests from being completely demarcated on the 1987 vegetation survey.

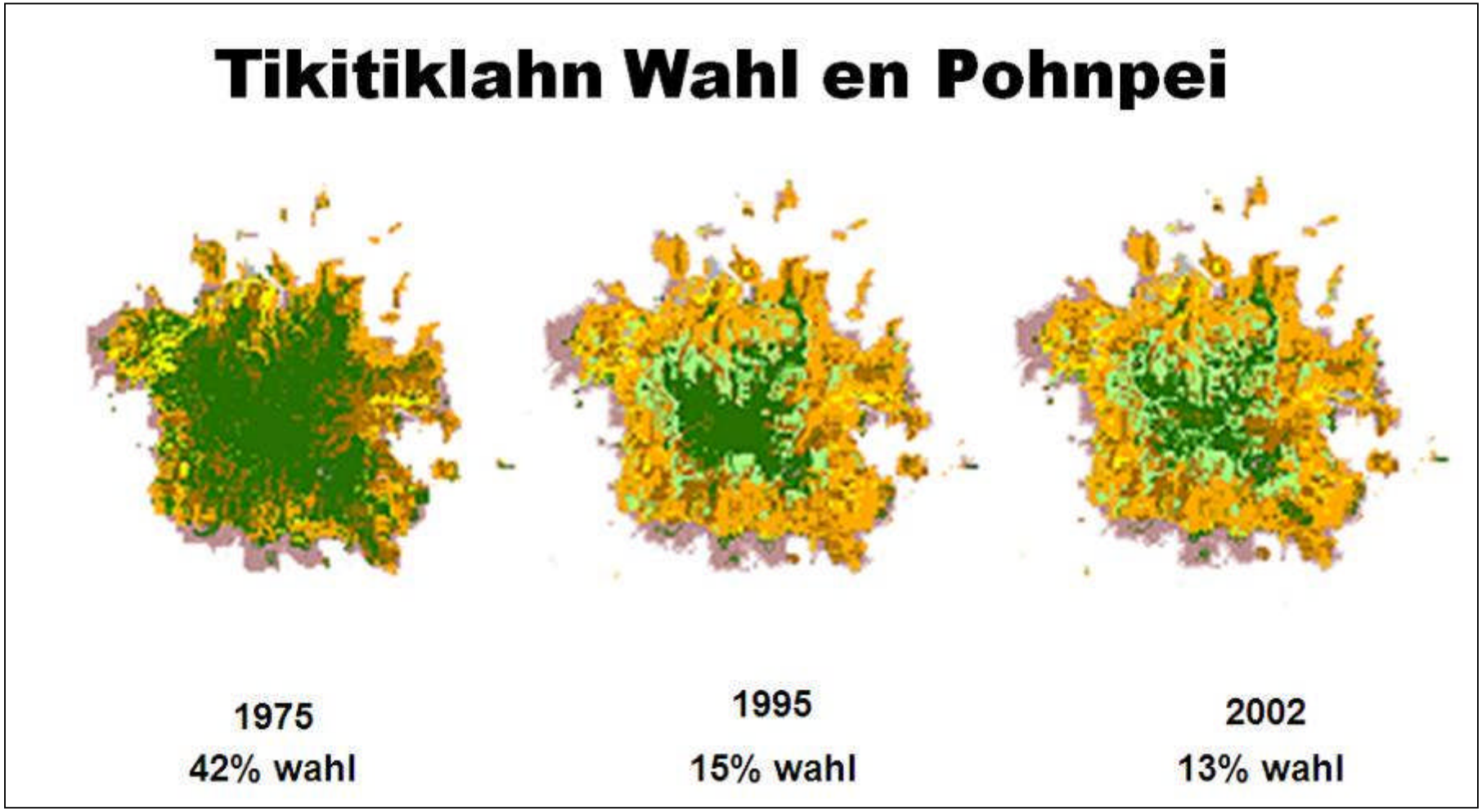


Map P-1: Vegetation of Pohnpei

Upland forests provide habitat for biodiversity including a number of endemic species. They are also important for their watershed services. Mangrove forests have multiple values for fisheries habitat, wood production, trapping sediments and shoreline protection. Mangrove forests significantly buffer the force of waves, including storm surges, and thus protect the coastline from erosion. The "fringe" (seaward) mangrove is most valuable for this coastal protection function. Recent studies (Kauffman & Donato 2009) have shown that mangroves sequester especially high levels of carbon that is stored in both tree biomass and in deep mangrove mud. They are thus important in reducing greenhouse gasses. Agroforests provide food, fiber, medicines and materials needed to support culture while at the same time providing the ecosystem services of forests. Coastal forests occurring above high tide mark, especially on the coasts of atoll islets, help stabilize coasts and reduce the extent of erosion during storm surges. Strand forests also provide a windbreak protecting the forests behind them from strong winds, desiccation, and salt spray.

No published descriptions of the forests of Pohnpei Outer Islands were available to the writing team. The general species composition of atoll beach strand and atoll forest and agroforest is fairly consistent; however there may be important variation at the sub specific and varietal levels that are potentially valuable in terms of adaptation to climate change and sea level rise. In addition uninhabited islets are refuges for native biodiversity such as sea turtles and sea birds, and even recently discovered endemic species such as the endemic giant Micronesian gecko, *Perochirus scuttelatus* thus far known only from Ulithi in Yap State, Kapingamarangi in Pohnpei State and possibly a few remote areas of Palau; and one or two endemic species of *Ramphotyphlops* snakes found in Ulithi in Yap State and more recently on Ant atoll in Pohnpei State.

Trends: Pohnpei is the only State for which there is data on the status of native forest. Maps P-2 (TNC 1975, 1995, 2002), based on aerial photos taken in 1975, 1995 and 2002, show a serious and progressive decline in the area of intact native forest on Pohnpei. Data on trends in plots measured by the FIA (2009/10) will be available after the next 10-year iteration of this survey. All native forests of Pohnpei are threatened by many factors (NBSAP 2002, PBSAP 2004), especially land moving operations such as clearing, road building and dredging and deforestation for agricultural use, including *sakau* (*Piper methysticum*), a high value crop.



Map P-2: Shows a serious progressive decline in native forest in Pohnpei from 1975 to 1995 to 2002

The most crucial information needed to determine vegetation change is up to date high-resolution aerial photos. Such photos would indicate the trend in forest change from 2002 to present, and provide an initial baseline view of Pohnpei Outer Islands. Such imagery would enable even local staff to determine trends and monitor progress in resource stewardship. An important added benefit is that such aerial images could be shared with communities. Having an intimate knowledge of their surroundings and a vested interest in their natural resources, such imagery would be very valuable to the development of community natural resource stewardship plans.

In addition, LIDAR imagery would enable natural resource planners to evaluate threats of sea level rise and storm surge and to plan for adaptation to sea level rise. Aerial photography and LIDAR imagery from which elevation and hydrological profiles could be developed, are an especially critical need for Pohnpei's low lying Outer Islands, most of which lie within the 2 meter zone of sea-level rise and/or the 5 meter zone of storm surge.

Major Issues

Table P-1 below summarizes FSM Cross-cutting issues and their Priority Landscapes in relation to USFS Primary National Themes. Maps of priority areas are indicated in this table and inserted with their respective issues. An overall listing is provided in the Reference Section.

Table P-1: Summary of National Themes, FSM Issues and Priority

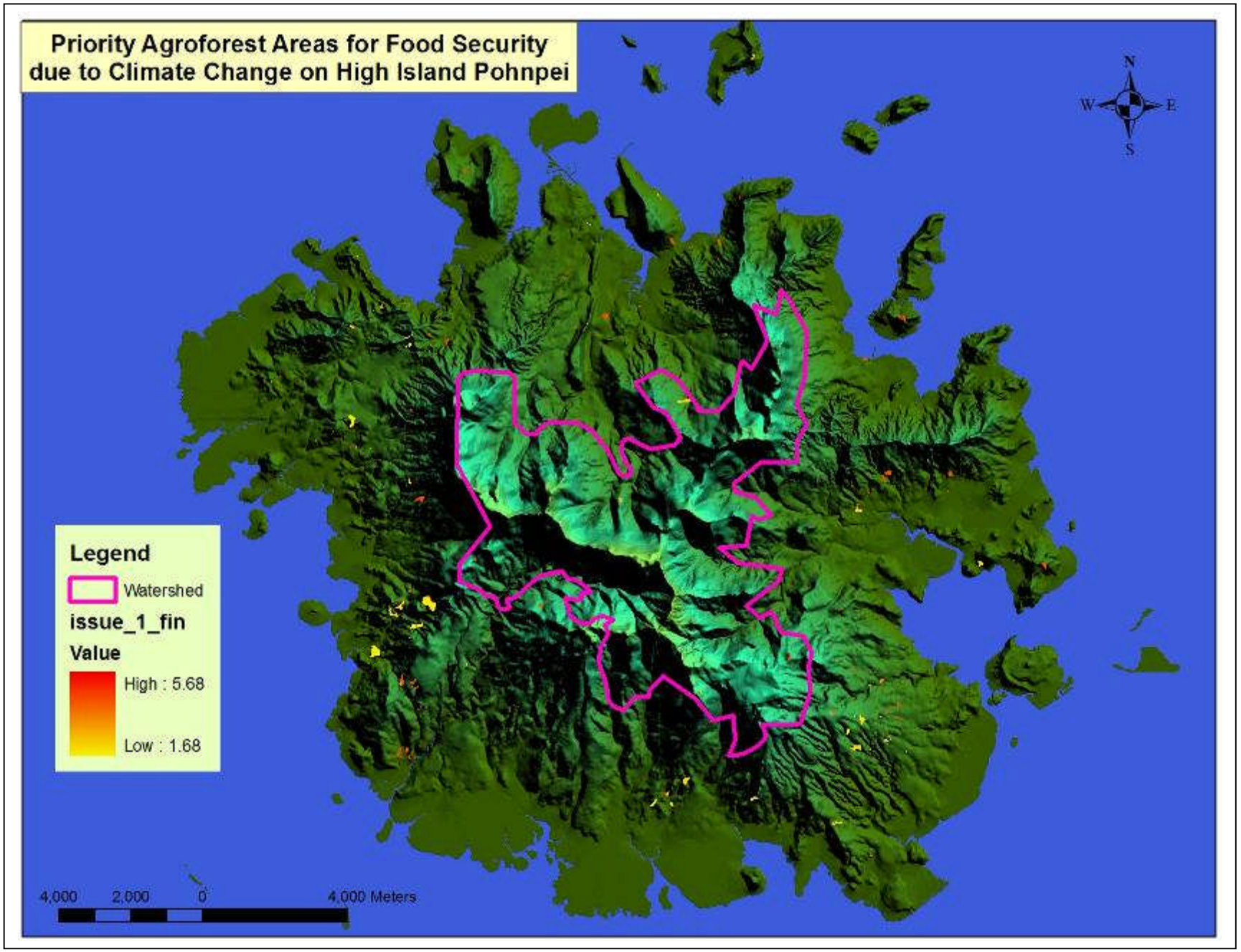
Issue	**Priority landscape area(s)**	**Primary National Themes**
A. Food Security in adaptation to climate change	Strong emphasis on atolls. In Mainland Pohnpei, priority landscape areas for food security are agroforests, shown in red, and areas of secondary vegetation shown in orange on map P-1, P-3.	Enhance, Protect
B. Coastal Stabilization	Eroding shorelines and mangroves, with priority placed on those areas overlap with Areas of Biological Significance, reference red (high) orange (medium) and yellow (low) areas on map P-4. All areas of Pohnpei Outer Islands are highest priority but maps are not available.	Conserve, Enhance
C. Biodiversity	Native forest and designated areas: see narrative.	Conserve, Protect
D. Watershed	Pohnpei Watershed Reserve, Map P-7 (blue polygon)	Enhance, Conserve, Protect
E. Production & sustainable harvesting	Mangrove forests. Reference map P-1 (blue areas along coast)	Enhance, Conserve
F. "Urban" forestry	Residential, commercial, historic, school and public park areas, and areas along road (Map P-7 road system), and "urban built-up" and "urban cultivated" from Reference maps P-1	Enhance
G. Capacity-building	(non-spatial)	Enhance

The methodology for spatial analyses is described in the Appendix.

A. Food Security

Traditional Ponapean forest management is agroforest management, providing tree crops and associated foods and medicines. The 1986 vegetation map of mainland Pohnpei indicated that some 33% of Pohnpei was under this type of land use. Agrobiodiversity, the range of species, subspecies and varieties incorporated into the traditional Pohnpei agroforestry system is quite high as has been documented in Balick (2008). Priority maps for this issue are Map P-1: Vegetation of Pohnpei shows the agroforest vegetation type in red, and secondary vegetation in orange. Map P-2 shows that the area of secondary vegetation has increased considerably since the 1986 vegetation map (that was based on 1976 aerial photos). Areas of secondary vegetation are a second priority for agroforestry development as they represent land that has already been disturbed and could be converted to agroforestry production without sacrificing more native forest, or assisted to revert to native forest.

Map P-3 on Food Security is a spatial analysis of areas more suitable for agroforestry based on soils, slopes and conservation considerations. Areas within the watershed conservation area were masked out and mangroves were color-coded as unsuitable. Soil categories include slope considerations.



Map P-3: Areas suitable for agroforestry production for food security

Forest Stewardship "Resource Management Plans" Pohnpei State Forestry is still committed to working with its' partners in developing written Resource Management Plans to meet the Forest Stewardshipn program standards. In collaboration with CSP, local governments, and communities, we have developed two different mangrove management plans & one terrestrial management plan for three communities. There are two in Kitti and one in Madolenihmw. As part of our SWARS consultation with our U&CF Council, there has been some revision on the selection and requirements of project proposals. Some of the new information that are being inserted for e.g. Community demographic information, land area/map, land use type, historical sites, socio-economics, invasive species, etc. We believe that including these kinds of information will improve on monitoring & evaluating project progress and impact, and at the same time use to develop a management/land use plan.

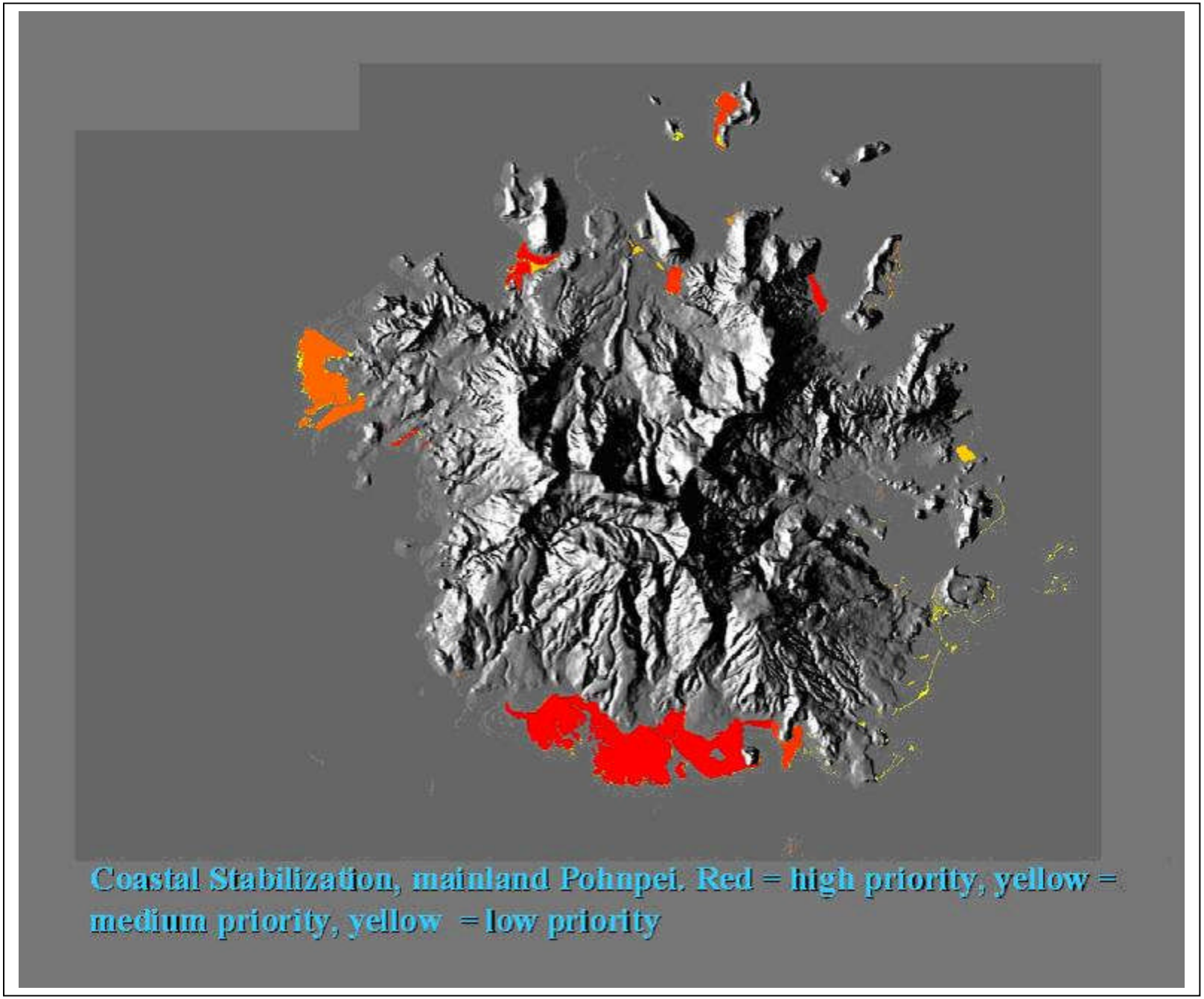
Actual data on trends of agroforests in mainland Pohnpei were not available, however in recent years, one of the main food crops, *Dioscorea* yams have been impacted by disease, and it is commonly believed that increases in lifestyle diseases such as diabetes and high blood pressure are related to a change from a traditional diet to less nutritious imported foods. There is however growing awareness of this problem and a vigorous program to encourage residents to "go local" and grow and eat more local foods. This, and increasing cost of imported foods, could result in increased agricultural and agroforestry production.

Food production on atolls is challenging due to thin, nutrient poor soils, limited supply of fresh water, desiccating sea breezes and storm winds, lack of a watershed gradient to wash out accumulated salt, occasional droughts, typhoons, sea level rise and storm surges. The difficulty of raising food on atolls, has led to an increasing reliance on imported foods, and a correlated decline in agrobiodiversity. Recent high sea levels and storm surges have seriously damaged food production systems on Outer Islands of Pohnpei.

B. Coastal Stabilization

Reports of the International Panel on Climate Change and other groups acknowledge climate change and predict more severe ENSO events and storms and rises in sea level that result in coastal erosion in coastal areas of mainland Pohnpei and especially in Pohnpei's Outer Islands. This damage is exacerbated by damage to coastal ecosystems such as mangroves through road building, landfills and dredging operations. Mangrove forests have multiple values for fisheries habitat, wood production, trapping sediment and shoreline protection. Mangrove forests significantly buffer the force of waves, including storm surges, and thus protect the coastline from erosion. The "fringe" (seaward) mangrove is most valuable for this coastal protection function. Strand forests occupy sandy coastal areas above high tide mark, especially on the coasts of atoll islets. They stabilize the coastal dunes and reduce the extent of beach erosion during storm surges. Strand forests also provide a windbreak protecting the forests behind them from strong winds, desiccation and salt spray. While strand forests will not affect the rate of sea level rise, it is possible that by stabilizing the crest of the beach, they will reduce the extent that a high-water event overtops the beach crest and deposits salt water in the island interior. Coastal erosion in the Outer Islands of Pohnpei is especially severe and of considerable concern. Map P-4, shows areas of concern for coastal stabilization in mainland Pohnpei. Lack of relevant elevation data precluded the development of a spatial analysis map.

It should be noted that while maps and exact elevation data are not available, most of the Outer Island atoll islets of Pohnpei State are very close to sea level and within a 5-meter storm surge zone.



Map P-4: Areas of moderate and high concern for coastal stabilization

Maps and data to support a spatial analysis of priority landscapes for coastal stabilization in Outer Islands of Pohnpei were not available. However, since these low lying islets are mostly below 5 meters from sea level (Liphai 2010), they are all priority areas for coastal stabilization, given rates of sea level rise and intensity of storm surges.

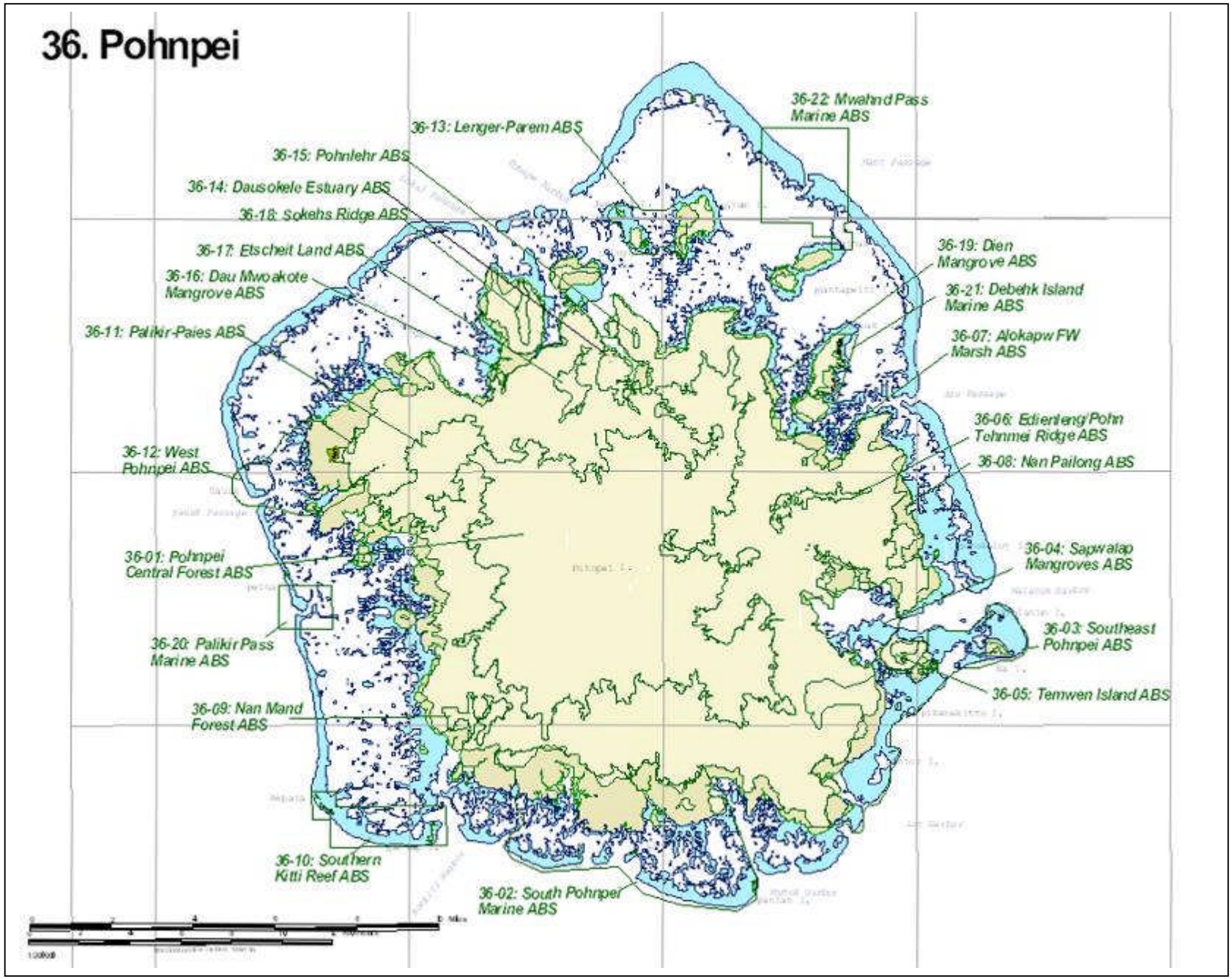
C. Biodiversity

As an isolated oceanic high island, Pohnpei is rich in endemic species, and the island's forests represent a valuable natural heritage. This heritage is, however threatened by many activities, including agricultural clearing, road building, and during extreme ENSO related droughts, wildfires that erode forest edges. Map P-2 shows a rapid reduction in the area of intact forest. Much of this change is attributed to forest clearing for growing *sakau*, *Piper methisticum*, a high value crop for cultural presentations and for commercial sale. *Sakau* is a profitable crop so farmers clear forested area for its production. Especially when aided by drought conditions, forest clearing for sakau production erodes threatens intact native forest. While the serious decline in intact native forest indicated in Map P-2 is generally attributed to clearing to grow high value *sakau*. It is likely that droughts, especially the severe drought of 1982-1983, made it much easier to clear forest with fire and contributed significantly to the decline of intact native forest. Once openings are made in forested areas, aggressive vines such as *Merremia peltata* overgrow trees, killing them and preventing seedlings and saplings from regenerating forests. Feral pigs and introduced deer are also a potential threat to seedlings of forest trees.

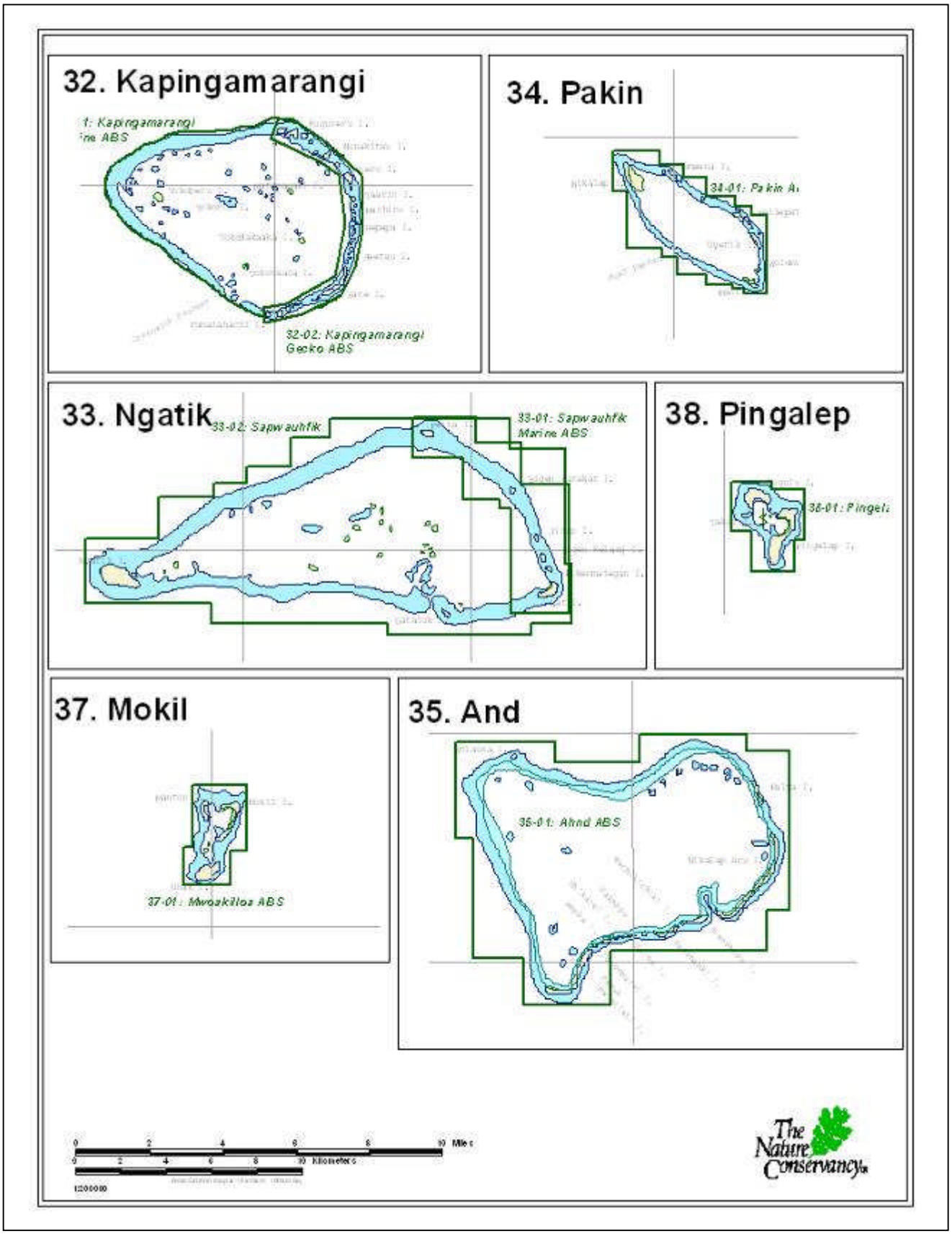
The TNC Micronesia Challenge calls for the protection of 20% of the land, or of forests or of a representative sample of native habitats by the year 2020, and the TNC Blueprint for conservation in Micronesia (2003), indicates a number of "areas of biodiversity significance" (ABS) as shown in Maps P-5 & 6, that follow. Ant Atoll has or is being established as a Biosphere Reserve. Among its biodiversity values are a sea turtle rookery and the locality of an as yet unnamed species of endemic snake. The atoll of Oroluk is also a sea turtle sanctuary. While Pohnpei State has no Wildlife Plan per se, there are a number of laws to protect wildlife such as the protection of the rare Pohnpei owl, fruit bats (by virtue of International and U.S. Endangered species laws), a closed season for grouper fish during their spawning season and the protection of mangrove crabs in mangrove sanctuaries. It appears that Pohnpei could achieve the goal set by the Micronesia Challenge by effectively protecting the proposed watershed reserve along with some areas of mangrove (blue areas in Map P-1). The appendix provides results of a recent Marxan gap analysis of Pohnpei's progress toward the Micronesia Challenge.

Priority area: all areas within any of the following categories, with higher priority for lands where more categories overlap.

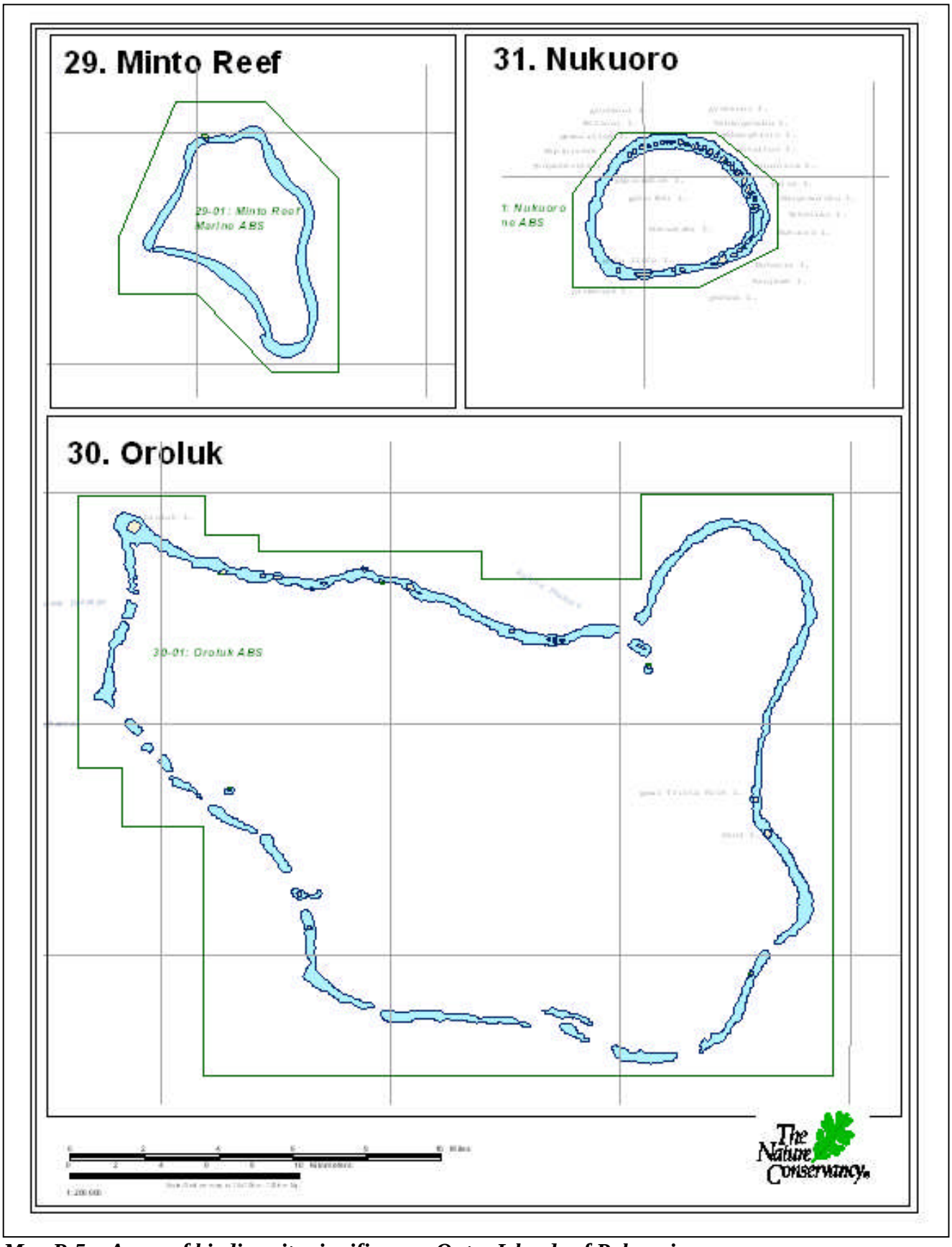
(a) Native forest (mangrove forest, upland forest, and palm forest) as shown on Map P-1
(b) Undisturbed upland native forest as shown by dark green on the 2002 inset of Map P-2
(c) Terrestrial Areas of Biodiversity Significance (Pohnpei or atolls) as shown on Map P-5a



Map P-5a: Pohnpei State areas of biodiversity significance



Map P-5b: Areas of biodiversity significance, Outer Islands of Pohnpei



Map P-5c: Areas of biodiversity significance, Outer Islands of Pohnpei

Biosecurity

Invasive alien species (IAS) have caused major biodiversity losses and ecosystem disturbance on islands worldwide. Islands are very vulnerable to biological invasions. IAS have directly or indirectly caused or contributed to the decline and extinction of many birds, reptiles, mammals and plants. Exotic invasive ants disrupt traditional outdoor lifestyles and cause harm to people and their crops. Invasive weeds compete with other plants for space, nutrients; and some overgrow and kill useful plants. Snakes like the brown tree snake in Guam cause significant economic losses due to power outages and biodiversity losses as a result of the extinction of several native bird species. In addition, feral pigs cause serious damage to people's gardens resulting in crop loss.

Islands present unique opportunities to manage Invasive species. Three main ways of managing IAS are prevention, eradication, or control. Preventing invasions of terrestrial species should be more achievable on islands than at land-locked sites. Eradication should be considered if an IAS is newly introduced and not wide spread.

Many invasive species in neighboring countries are not present in the FSM. Therefore a high priority must be given to prevention of the introduction of such invasive species.

Pohnpei State Forestry has stated that it has limited capacity to detect, monitor and control invasive plants and animals and pests early on, and need capacity building in this area. They will, however work with CSP and PIST on this issue.

The Pohnpei Invasive Species Taskforce (PIST) has identified a list of invasive species which have a potential for causing biodiversity losses and ecosystem disturbances. False kava, Mile-A-Minute, Chain of Love, Ivy Gourd, Honolulu Rose, and the Feral Pigeon have been identified for eradication. The Kerosene Tree, Tilapia and White Fly are currently being assessed.

In addition, assistance is needed to assess the impact of invasive vines, especially *Merremia peltata* that grow up in disturbed areas and then grow over adjacent trees, smothering them. Large areas of Pohnpei's uplands are covered with these vines.

The PIST Strategic Action Plan (SAP) establishes goals, objectives, activities, collaborators, timeframe, funding sources and estimated costs for control of specific species. The PIST SAP is divided into 4 thematic areas: Effective Coordination, Funding and Resources, Law and Policy and Government and Public Support. Work plans have been developed to address terrestrial plants, marine invasive species and feral pigeons. These work plans are linked to the goals and objectives of the PIST SAP and carry through to the end of 2008. For more details see PIST SAP in Appendix.

Wildfires

Wildfires are not common in Pohnpei with its high rainfall. Reoccurring fires are man induced along roadsides when fires set in grasslands and small farm lots get out of control and burn into adjacent forest area. During periods of extreme drought, such as the ENSO related drought of 1983-1984, however, considerable areas of savannas as well as forested areas were burnt. It is estimated that wildfires affected over 50% of the Pohnpei upland forest, with some areas smoldering for weeks. Many people remember the impact of this period. As ENSO events are predicted to become more severe, a program to gather data on the incidence of wildfires is needed, as well as a contingency plan for years of severe drought,

and a Pohnpei State wildfire plans as well as program to work with communities to develop community wildfire protection plans (CWPPs).

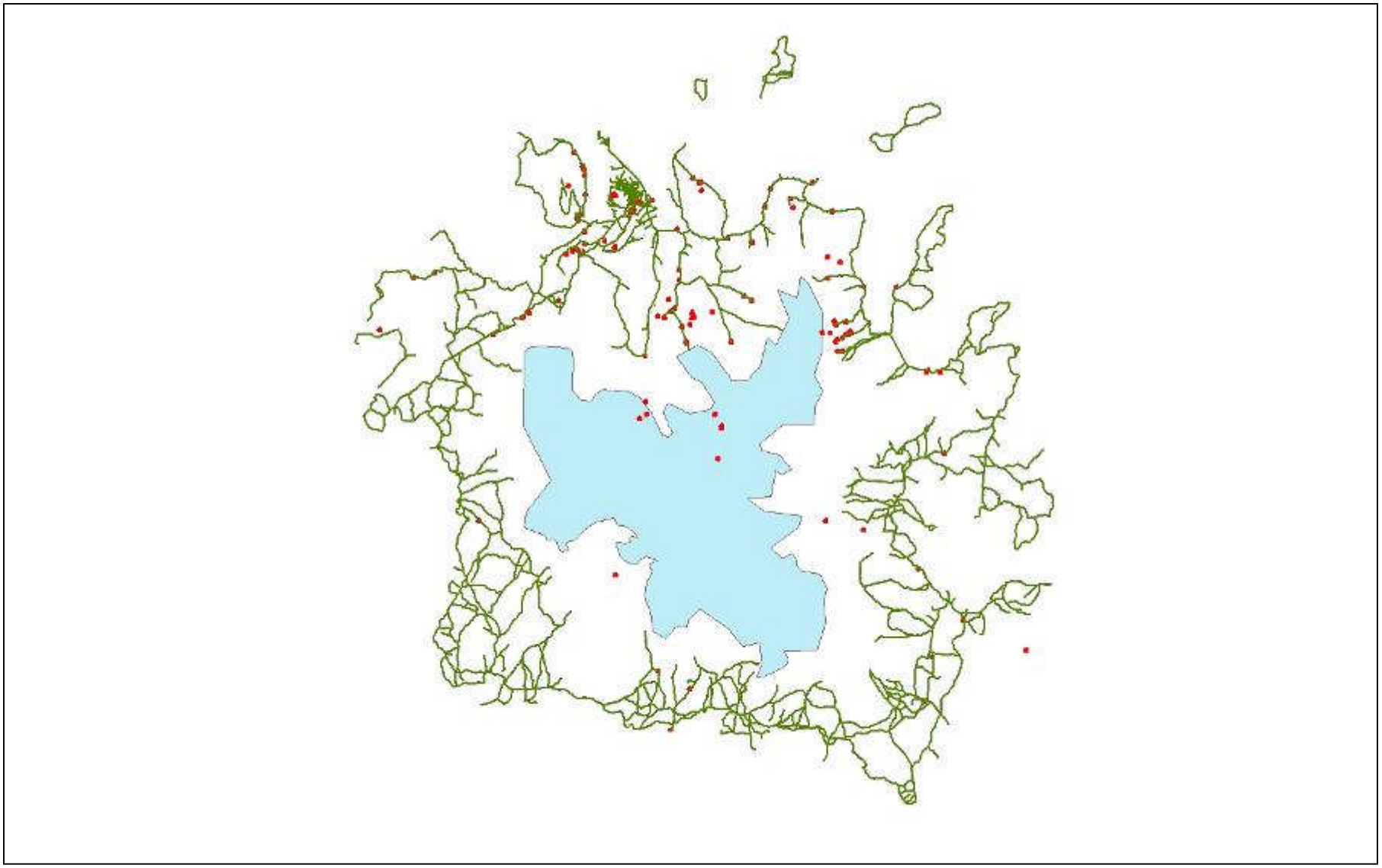
D. Watershed

The word "Watershed" in Pohnpei refers to the Pohnpei Watershed Reserve, at the interior of the island where many streams have their origins and where rainfall is highest. Maintaining forest cover on this area is a long-term goal in Pohnpei resource management. Map P-3 shows this watershed reserve. Map P-2 indicates that the condition of this watershed reserve is deteriorating. *Sakau* farming, road construction, squatting, wastes from small homestead piggeries, invasive species, and landslides impact this watershed. Map P-6 shows occurrences of targeted invasive species (as thus far detected by ground monitoring) with reference to roads and the watershed reserve, and Map P-7 shows private settlements within the watershed reserve.

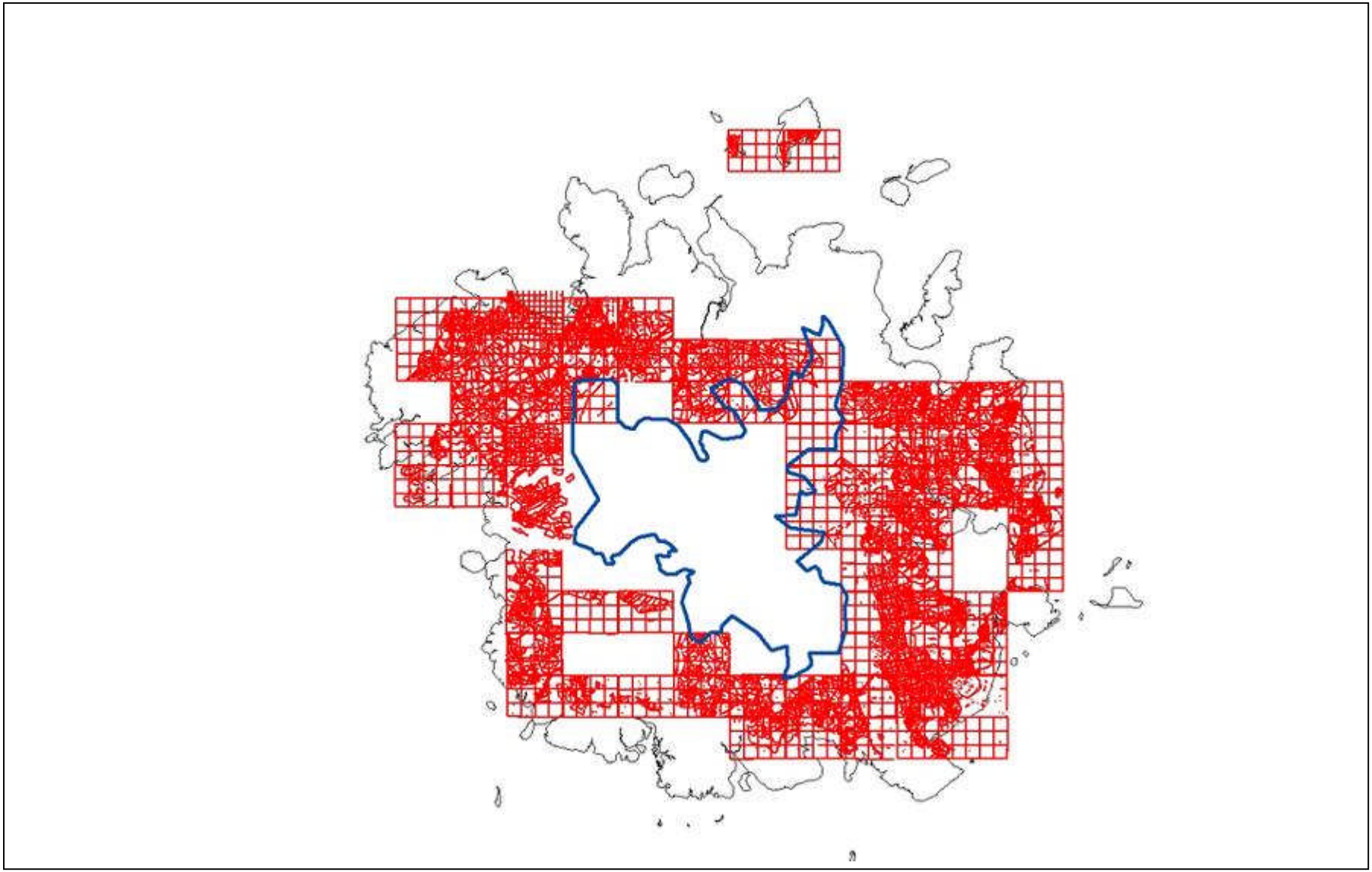
Condition and trend of the watershed reserve. The implementation attempt of the Pohnpei Watershed Reserve Boundary survey started in late 1989 & early 1990. The initial work was to get the GPS control points/coordinates on the ground before the actual survey, however, as the work progressed, we started to get a lot of resistance and misunderstanding among the community people especially in Nett Municipality. The team was virtually chased out of the forest in some of the communities in Nett. Therefore, Forestry decision was to stop this work and start a public concerted public awareness program that eventually reach over 165 communities on Pohnpei Island and the outer island. Thus, in 1991, the Pohnpei Watershed Steering Committee was created to give advice and help in carrying out the community awareness program. The membership included representatives from almost all offices and agencies that are involved in natural resource management, traditional leadership, consultants/NGO's and others. After the island wide public awareness program was completed, the committee continued its' function and changed the name to Pohnpei Resource Management Committee sometime in the mid 1990's. This committee is chaired by the Lt. Governor of Pohnpei from early 2000 up to now.

The proposed corners of the boundary line on the ground have not change since the passage of the Watershed Law. At the moment, only U and Madolenihmw have completed the boundary survey on the ground and about 1.7 miles of boundary line in Kitti Municipality. The last actual boundary survey was done in 2003. Since then, most of the work done is focused on the larges watershed of Pohnpei which is in Nett Municipality. As a result of this work, Nett Municipal Government and the traditional leadership are in the process of reviewing and finalizing their watershed ordinance that will support the Pohnpei State Watershed especially in the management & enforcement responsibilities of the parties involved. The negotiations involved now for the watershed is not too much on the boundary line but rather in incidences where the line happens to intersect private lands in the critical watershed areas. It will be similar to that of Nett Municipality where we anticipate there will some slight changes or concerns to management and enforcement roles of the parties. However, Sokehs and Kitti have indicated their strong interest in putting the boundary line on the ground first and do the negotiation later where there is a need in the first Pohnpei Watershed Summit last March 2010.

Pohnpei has a watershed and mangrove protection act of 1987, but no completed and implemented plan. A Pohnpei Resource Management Committee chaired by the Lt. Governor of Pohnpei State was established to oversee the watershed reserve (Lipahi 2010). Pohnpei is interested in applying for a Forest Legacy project and has identified some potential areas.



Map P-6: Occurrences of targeted invasive species (as thus far detected by ground monitoring) with reference to roads and the watershed reserve



Map P-7: Private settlements within the watershed reserve

1. “Forest Legacy Map” This map shows sample of private land parcels that can be assessed for Forest Legacy Program. Some of these land parcels have been given certificates of title and some are only given the determination of land ownership. The Pohnpei State Watershed Law promulgates that the boundary line will only run on public lands. It also further states that should the line happens to transect a private land, it will then traverse around the boundary of the land on the upslope and then traverse back to the original watershed boundary coordinates on the other side. In other word, the Watershed Line will not run on any private land parcels and there will be no private land within the watershed area. Thus, all private land parcels that are bordering the watershed boundary are critically important as to the integrity of the watershed reserve. If these upland forested areas are altered and or developed into other services and uses, then, we can expect adverse impact on the ecological services of our watershed reserve. Therefore, these landowners can be potential candidates for the Forest Legacy Program. If these landowners are interested in the program, then, development and alteration of these areas can be avoided and our watershed ecological functions will not be disturbed and degraded.

E. Production & sustainable harvesting

The integrity of Pohnpei’s culture is ultimately dependent on its natural resource base. Map P-4 indicates that Pohnpei’s natural resources are being exploited unsustainably. A second iteration of the FIA survey should show changes in surveyed plots. Since the government owns and operates the field trip ships, the government could control the exploitation of sea turtles, sea birds and coconut crabs by field trip ships. Production and sustainable harvesting efforts could be tied in with ecotourism.

A timber survey (MacLean et al 1988) and forest inventory assessment of Pohnpei (FIA 2009/10) have been conducted. While commercial milling of lumber is prohibited in Pohnpei (Liphai 2010), it would be helpful to have an analysis done to determine what, if any, level of timber harvest might be sustainable as the issue of timber harvest and sawmills is likely to arise and unsustainable cutting of trees could occur if such information is not readily available when such activities are first considered or initiated. A major concern is the over harvesting of mangroves. Metz (1996) describes a mangrove management plan and Devoe classifies areas of mangroves on the basis of their conservation and productivity values.

Map P-1 shows areas of mangroves and upland forest. The 1986 vegetation map also shows some 6 hectares plantation forest, 19,683 hectares of agroforest; 9,796 hectares of agroforest with coconuts and 124 hectares of coconut plantation.

F. “Urban” Forestry

Trees provide shade and beauty to the urban areas where people live, work and play, and urban forestry is important to quality urban environments. There is interest in beautification of urban areas and a women’s organization has planted trees along the road in Kolonia. The Forestry nursery provides seedlings and saplings for such efforts. Roadside trees can sometimes pose a threat to utility lines and safety in urban and residential settings. There is a lack of trained arborists to properly prune trees, so trees in urban areas tend to be cut down instead of pruned. Trained arborists are needed to manage urban forest. Map P-2 shows urban areas, and Map P-7 shows road network.

The Pohnpei urban and Community Forestry Advisory Council is made up of a subcommittee of the Pohnpei State Resource Management Committee formerly the Watershed Steering Committee.

Members of the sub-committee are appointed by the Chief of Forestry to renewable two-year terms; they will be replaced if they miss 4 consecutive meetings. Membership of the subcommittee (U&CF Council) currently includes:

- Mr. Valentine Santiago - CSP/Forestry
- Mayoriko Victor - U&CF Coordinator
- Kadalino Lorens - Division of Agriculture
- Gibson Santos - Natural Resource Conservation Service
- Jackson Phillip - College of Micronesia FSM
- Womens Rep. - *Vacant*
- Farmer - *Vacant*

The roles of the council are the following:

- Provide strategic leadership and advice
- Review & comment on draft U&CF annual proposals
- Review & approve projects to be funded with "flexible funding"
- Recruit, interview and help evaluate candidates for U&CF Coordinator
- Help with publicity, project planning, project monitoring, etc.

The council was consulted in one of their regular meeting in regards to the "SWARS". After the explanation of the requirements of the new farm bill, the council then decided not to go ahead with the revision and update of the existing U&CF five year plan but rather start incorporating some of these requirements in annual project proposals. Some of the required information are stated above and especially the geospatial analysis/information. Some of the members also attended and participated in SWARS consultation with our larger cooperating/collaborating group. Some of the offices and agencies involved in the consultation are as follows; Division of Survey and Mapping, Conservation Society of Pohnpei, Environmental Protection Agency, Natural Resources Conservation Services, Division of Agriculture, FSM Resource Management, Division of Agriculture etc.

G. Capacity-building

Table P-2 summarizes the numbers of Pohnpei Forestry staff, on-island cooperators and off island agencies and groups that are budgeted and/or mandated to provide assistance to the FSM. The proportion of funding sources is limited in comparison to the availability of technical and other advice. The small size of the Forestry staff in proportion to off-island advisory groups limits its capacity to absorb input from these groups, and to also fulfill commitments to local Government performance-based budgets and to serve communities. In contrast, however, the Conservation Society of Pohnpei, an NGO, is a relatively large and active organization that is able to tap both outside sources of funding and expertise. Strategies for increasing the capacity of Pohnpei Forestry are listed in Table P-3.

II. Resource Strategy

Long-Term Desired Conditions

Long-term objectives of Pohnpei Forestry are to finish demarcating the boundaries of the Pohnpei Watershed Reserve in the last three of Pohnpei's 5 Municipalities, enforce compliance, and establish a Forest Legacy program. The Public will be aware of the value and importance of forest resources and their ecological services, and the staff of Pohnpei Forestry will be able to provide information that communities need to wisely manage their forests. Communities will be engaged with the stewardship of forest resources, and assisted by Municipal officers. By 2020, at least 20% of the forest will be under effective management. The stewardship of agroforests will be intensified to prepare for an influx of Outer Island residents as sea levels rise.

A working second draft of the Pohnpei State Land Use and Zoning Master Plan (1996) refers to a Land Use and Zoning Act of 1993, with chapters on Conservation and Agriculture; and maps on existing land use, conservation and watersheds, parks and historic and cultural sites. Zones include: sustainable use, seasonal preserves, species preserves, watershed forest reserves, important watershed areas, and mangrove forests. The draft refers to a Mangrove Management plan of 1995 by the Division of Resource Management and a Watershed Forest Reserve and Mangrove Management Act. Also included are historic preservation sites that are to be left untouched. These could also serve as conservation areas.

Program Integration

Program goals and objectives will be more focused and complementary across the different programs. Long term monitoring results will be more attainable as management efforts will be more effective and efficient holistically. All partners and stalk holders will be aware of the "SWARS" goals and objectives and can take part in the management accordingly to their areas of interest and capabilities. Program funds and resources will be mobilized and utilized according to the "SWARS" priorities and issues. All projects will be carried out for a common goal of protecting, conserving and enhancing our limited forest resources strategically to benefit all the people of Pohnpei.

Resources

Table P-2 summarizes the resources available to Pohnpei Forestry in terms of 1) people and advisory groups and 2) Sources of financial support. Column 1 shows the number of Pohnpei's forestry staff, column 2 lists on-island cooperators, and column 3 lists off-island agencies and groups whose funding and/or mandates include assistance to the FSM. A comparison of the resources in line 1 (people and advisory groups), and line 2 (sources of financial support), shows that Pohnpei Forestry has a lot of on island cooperators and access to a lot of free technical advice but limited sources of financial support. The Region 5 State and Private Forestry Grant program is the only consistent source of support for land stewardship activities in the FSM, and enable considerable leveraging. It is thus important that the base level of S&P grant funding be maintained.[11]

[11] At one time it was locally understood that S&P grants were to be decreased at the rate of 15% each year in order to fund the competitive grant program. It has since been learned (Friday, email of 3-29-2010) that the percentage taken out of "base" grants and awarded as competitive grants is flat at 15%.

Table P-2: Resources

Resources: People & Groups		
Forestry Staff	**On-Island Cooperators**	**Off-island Advisory agencies & Groups**
Paid by Gov. Pohnpei Forestry has the following staff : Chief, Div. Forestry & Marine Conservation (1); State Forester & U&CF coordinator (1), Ag rep / watershed coordinator (1), nurserymen (3), farm laborer Ag/Forestry (1), Paid by S&P funding Admin. Staff (1) Total: 7 staff, 3 Forestry staff paid by Government, 1 Forestry Admin. Staff paid by S&P grant, and 3 staff shared with Marine Conservation or agriculture	Conservation Society of Pohnpei (CSP), EPA, NRCS, TNC, College of Micronesia-FSM CRE, Land Grant, IFCP- Island Food Community of PNI, Pohnpei Farmers Association (PFA), Local Governments, Traditional Leaders, SPC-Land Resource Staff (Invasive Control and Biosecurity Program), FSM Resources & Development (R&D), Office of Environment & Emergency Management (OEEM), Pohnpei Division of Agriculture, Pohnpei Invasive Species Taskforce (PIST), Micronesian Conservation Trust (MCT)	USFS PSW Station, NRCS, Univ. of Hawaii & East-West Center, University of Guam, Water and Energy Institute (WERI), NOAA National Weather Service & Coral Ecosystem Monitoring, UH/ UoG Sea Level Center, Palau International Coral Reef Center (PICRC), Pacific Is. Climate Change Cooperative (PICC)*[12], Regional Invasive Species Invasive Species Council (RISC), Pacific Invasive Partnership (PII&PILN) and a number of other Invasive species advisory groups; Commission of Regional Organizations in the Pacific (CROP) Agencies – Secretariat of the Pacific Community (SPC)*, South Pacific Regional Environment Program (SPREP), SOPAC; FAO, TNC, UNDP SGP, and a number of outside NGOs, and UN organizations including CBD, European Union, TNC Micronesia Challenge program, Venezuela Government, Japan Overseas Assistance (JICA), New York Botanical Garden, National Botanical Garden. and many others
Resources: Financial		
Pohnpei State Government	MCT (for projects done with communities)	USFS Region 5 S&P grant program***, GEF-UNDP (SLM)**, UNCCCD-Venezuela Fund

*[1] PICC is a newly formed cooperative including the U.S. Fish & Wildlife Service, U.S. Geological Survey, National Parks Service, National Oceanic & Atmospheric Administration (NOAA), NRCS, U.S. Forest Service, U.S. Army, Office of Hawaiian Affairs, Hawaii' Department of Land and Natural Resources, University of Hawai, The Nature Conservancy, Kamehameha Schools & Hawaii Conservation Alliance

*The SPC has an on-island Land Resources Division and is expecting a forester.

**The Sustainable Land Management (SLM) is a 3-year program to enhance ongoing efforts.

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***Pohnpei State has been successful in getting 3 S&P competitive grants. One of the challenges of this program is that the disbursement of funds for reimbursable grants must be authorized by a Congressional Resolution. This has resulted in considerable delays. Now that all parties are aware of the requirement, it may be possible to initiate Congressional approval with the initial competitive proposal or Letter of Funding Advice.

General Strategies for Addressing Threats

On a small island such as Pohnpei, all areas are important as ecosystems are closely linked in a small area and there is little leeway for ecological mistakes. Once ecosystems are disrupted, they are difficult to re-establish. It is thus important to link ecosystem integrity with the production of food and other goods and services for people, especially in this era of climate change and sea level rise. Map P-1 addresses multiple issues. It is color-coded to indicate the appropriate general strategies and activities throughout Pohnpei. In general, these are: Enhance the warm colored areas (red agroforests and orange areas of secondary vegetation), and protect and conserve the cool colored areas (green forests and blue mangroves that are important for biodiversity and ecosystem services.

Table P-3 lists Strategies by FSM Issues, Funding, and Cooperators & Performance Measures and shows how S&P funding will leverage additional funding and actions.

Table P-3: Strategies by FSM Issues, Funding, Cooperators & Performance Measures

POHNPEI ISSUES:	Strategies & activities for 5-yr SWARS Plan	Resources / Funding		Main Cooperators	Performance Measures
		S&PF	Others		
All issues	Awareness raising	CE		CSP, Department of Education, Municipal Governments	Public is aware of natural resource issues and makes wise decisions for their sustainable use
	Obtain up to date aerial photos, especially of Pohnpei Outer Islands Mapping & change detection	R5	SOPAC? TNC & CI?		Updated vegetation maps, updated analysis of forest trends in Pohnpei and baseline images for resource assessments of Outer Islands and scanned images to share with communities for developing community stewardship plans
A) Food Security	A.1. Establish comprehensive, intensive agro-forestry program that will promote utilize and sustain agro-biodiversity A.2. Identifying food production technologies for atolls and coastal areas affected by salt water intrusion and climate change A3. Inventory of traditional crops and varieties A4. Establish Gene banks A5. Identifying best practices for sustainable food production	CFHP, CFHP-IP, FRM/ FSP, CE, Western Competitive Grants…	FAO, GEF-UNDP, JICA, UNCCCD-Venezuela Gov't.	FSM Div. of Agriculture, COM-FSM Land Grant Program, Pohnpei Farmers Associations, SPC, IFCP	A.1. Enhancement and expansion of existing agro-forestry systems. A.2. On-site trials conducted A3. Inventory of traditional crops conducted A4. Gene banks established A5. Guidelines on best practices developed
B) Coastal Stabilization	B.1. Enhance costal vegetation, especially mangroves to reduce coastal erosion B.2. Enhance the capacity to conduct	U&CF, FRM/FSP, CE	SOPAC, TNC, Pohnpei Marine Resources	Local Municipal Governments, Resources Management Committees, Dept. of	B.1. Increase in coastal vegetation, reduce coastal erosion B.2. EIAs conducted

	EIA for dredging sites B.3. Enforcement and awareness B.4. To protect and maintain natural landscapes and ecosystems as roads are climate proofed			Transportation & Infrastructure, Office of the Attorney General, Pohnpei EPA, SPC, DLN&R, OEA-Agriculture Division, FSM DR&D	B.3. Enforcement and awareness raising in all municipalities B.4. Development of a sustainably developed climate-proof projects
C) Biodiversity	C.1. Establish conservation easements* C.2. Establish and monitor protected forest areas. C.3. Establish and monitor Forest Legacy Areas. C.4. Improve and strengthen Bio-Security quarantine protocols. C.5. Support implementation of the Pohnpei Invasive Species Taskforce (PIST) Strategic Action Plan: to prevent degradation of natural and working forests (agroforests).-Request assistance with control/eradication for invasive species that are more difficult to control C.6. Develop a Pohnpei State wildfire plan and program with contingency plan for years of extreme drought and begin working with communities to develop Community Wildfire Protection Plans (CWPPs)	Forest Legacy FRM/ FSP, Forest Legacy, CFHP, CFHP-IP, Cooperative Fire (FAM) CE, Western Competitive Grants…	NOAA, TNC,GEF-UNDP (SLM); MCT	TNC, Pohnpei Division of Agriculture, FSM Div. of Agriculture, FSM National Weather Station, CSP, TNC, SPC	C.1. Easements established % land area protected under Micronesian Challenge C.2. Existence and enactment of 'Protected Forest Areas' C.3. Existence and enactment of 'Forest Legacy Areas'. C.4. Increase in capacity of bio-security quarantine officers; and decrease in bio-security quarantine non-compliance incidents. C.5. Establishment of a permanent 'Invasive Control Program'. Availability of data/ information on control of especially aggressive vines and invasive species C.6. Existence of a wildfire plan and program with annual reports on wildfires and contingency plan for years with severe drought.
D) Watershed	D.1. Adopt and Develop Mangrove & Watershed Management Program. D.2. Delineation of watershed	FRM/ FSP, U&CF, CE, Forest Legacy,	TNC, JICA, Wallace Research	Dept. of Transportation & Infrastructure, Office of the Attorney General,	D.1. Adoption of management plan and development of

	boundaries in Sokehs, Nett and Kitti[13] D.3. Effectively manage and maintain native forest cover in watershed areas. D.4. Establish and manage 'Pohnpei Protected Watershed Areas' (include enforcement and rehabilitation/reforestation programs). D. 5. Erosion and sedimentation monitoring D.6. Develop guidelines and approach to demarcating and monitoring watershed areas, including the use of GIS.	CFHP, Western Competitive Grants…	Foundation, GEF-UNDP (SLM)	Dept. of Health Services-Sanitation Unit, Local Municipal Governments, CSP,	management regulations. D.2. Watershed boundaries delineated D.3. Increase in native forest cover in watershed areas; improvement in water quality. D.4. Existence of legally declared 'Protected Watershed Areas'. D.5. Watershed sedimentation assessments D.6. Guidelines developed
E) Production & Sustainable Harvesting	E.1. Determine amount of sustainable harvest for both upland and mangrove harvest E.2. Continue implementation of Community Reforestation Projects/ Tree Planting Projects. E.3. Assist communities establish timber lots	FRM/ FSP, CE, Western Competitive Grants…	MCT, SLM, Venezuela Gov't., FAO	Resource Management Committees, CSP, SPC, FAO, COM-FSM Land Grant Program	E.1. Upland/Mangrove harvest determined and program in place to limit unsustainable timber harvest E.2. Decrease in upland forest and mangrove gaps. E.3. Timber lots developed
F) Urban Forestry	F.1. Develop and implement community forest stewardship plans.[14]	U&CF, FRM/ FSP, CE	SLM, Venezuela	SPC, Local Municipal Governments, PMCs,	F.1. Existence of community forest plans.

[13] "Forest Legacy Map" This map shows sample of private land parcels that can be assessed for Forest Legacy Program. Some of these land parcels have been given certificates of title and some are only given the determination of land ownership. The Pohnpei State Watershed Law promulgates that the boundary line will only run on public lands. It also further states that should the line happens to transect a private land, it will then traverse around the boundary of the land on the upslope and then traverse back to the original watershed boundary coordinates on the other side. In other word, the Watershed Line will not run on any private land parcels and there will be no private land within the watershed area. Thus, all private land parcels that are bordering the watershed boundary are critically important as to the integrity of the watershed reserve. If these upland forested areas are altered and or developed into other services and uses, then, we can expect adverse impact on the ecological services of our watershed reserve. Therefore, these landowners can be potential candidates for the Forest Legacy Program. If these landowners are interested in the program, then, development and alteration of these areas can be avoided and our watershed ecological functions will not be disturbed and degraded.

	F.2. Establish/ expand public and private Nurseries. F.3. Establish and observe 'ARBOR DAY' F.4. Continue to implement outreach activities during Earth Day, Environment Day, Biodiversity Day, etc…		Govt, Pohnpei State government	CSP, TNC, SPC, PNI Agriculture,	F.2. Existence of private nurseries; increase in seedling production and distribution. F.3. Adoption an observance of a state 'Arbor Day'. F.4. Evident observation of environmental awareness-raising events.
G) Capacity Building	G1. ICS Training & Certification G2. Tree Worker Training & Certification G3. Arborist Training & Certification (ISA) G4. Develop 'Staff Development Plans' G5. Develop 'Forest Conservation Capacity-Building Network' that will serve as a vehicle for announcing or obtaining information on funding or training opportunities. G6. EIA Training G7. Assist Communities with development of natural resources stewardship plans. G8. GIS Training and equipment for utilization of old and new aerial	Cooperative Fire, U&CF, CE, CFHP, FSP, 'Western Competitive Grants'	JICA, TNC…	Office of the Attorney General, Local Municipal Governments, Resource Management Committees, PUC, SPC, Pohnpei State Legislature, COM	G.1. Development of ICS Training Program and existence of ICS Certified personnel G.2. Development of a Tree-Worker Training Program and existence of certified tree workers. G.3. Development of an Arboriculture Training Program and existence of certified arborists. G.4. Staff development plans in place. G.5. Improved dissemination of information on training or funding opportunities;

[14] Forest Stewardship "Resource Management Plans. Pohnpei State Forestry is still committed to working with its partners in developing written Resource Management Plans to meet the program standards. In collaboration with CSP, local governments, and communities, we have developed two different mangrove management plans & one terrestrial management plan for three communities. There are two in Kitti and one in Madolenihmw. As part of our SWARS consultation with our U&CF Council, there has been some revision on the selection and requirements of project proposals. Some of the new information that are being inserted for e.g. Community demographic information, land area/map, land use type, historical sites, socio-economics, invasive species, etc. We believe that including these kinds of information will improve on monitoring & evaluating project progress and impact, and at the same time use to develop a management/land use plan.

	photos, remote sensing, spatial imagery, geo-database development, G.9. Grant writing and project management G.10. Promote Natural resource management as a worthy career and place greater priority in natural resource programs including additional positions				increase in the number of training opportunities participated in; increase in funds received through grants. G.6. Development of EIA Training Program; Application of EIA Training in Development Projects. G.7. Development and existence of stewardship plans. G.8. Increase in availability and practical use of GIS Maps. G.9. Enhanced capacity in grant writing and management G.10. Increased number of staff working in natural resource stewardship fields

- C.1. Strategy: Establish Conservation Easements

Regarding Forest Legacy: the current approach is to observe Kosrae's experience with the Forest Legacy program and consider preparing a Forest Legacy Assessment of Need (as an amendment to the SWARS) in 2011 or later.
Potential Forest Legacy Area / specific parcels (high value):

a. Land parcels extending into watershed areas such as Kepine?
b. Nanpil water dam
c. Ant atoll and Nanpei estate is a possibility for a Forest Legacy (FL) funded conservation easement. The owners are currently exploring the protection of several of the islands.
d. Some historic/cultural sites have been identified and mapped. There may be opportunities to combine these sites with high quality forest for acquisition through FL.

Threats:

a. Agriculture is biggest threat to forest due to clearing and conversion to agriculture.

b. People are moving inland away from the coast. This is impacting forest directly through the clearing of forests for homes and agriculture and indirectly through the construction of roads and the additional changes that follow.
c. The municipal watershed is being encroached upon by private ownerships (Nett). This may be a potential area for FL funding.
d. Invasive species are impacting the forest. CSP has been mapping the location of some invasives.
e. Fire is a threat during years with extreme ENSO related droughts.
f. Mangrove is being cut and mangrove areas being filled to expand building areas. State permits are required for this but are not issued uniformly.

Land ownership:

a. Communication with and education of landowners about the FL program will be essential if FL is to succeed in Pohnpei.
b. Watersheds are not well defined in terms of ownership. Some land ownership will be in conflict when eventually mapped.
c. Complex land ownership by large extended families will complicate land acquisition
d. Mangroves are owned by the state.
e. State owns all rivers and streams, including a 50’ buffer on each side. Negative impacts by private activities are still occurring in these areas.
f. Threat of transfer of state owned lands to private ownership. Maximum area that can be privately owned through state transfer is one hectare making ownership more complex. Settlement in watershed areas (Nett and Kitti) but no certificate of title. There may be a possibility to relocate to squatters to other public lands such as Palikir.

Long-Term monitoring of outcomes of activities in priority forest landscape areas and how actions will be revised when needed

This SWARS is a living document that will be updated as warranted. GIS capacity will continue to be developed and resultant maps will be utilized in future updates. Should updated aerial photography become available, new vegetation maps for Pohnpei will be developed and an assessment of current conditions and trends of forest resources will be conducted. Aerial imagery will also be made available to community groups developing community stewardship plans. Aerial imagery of Pohnpei Outer Islands will provide a baseline for natural resource assessment. The availability of LIDAR imagery would enable the development of elevation profiles that are critical to planning for adaptation to sea level rise. Priority landscape areas for specific issues will be monitored and strategic actions will be revised as needed.

Program goals and objectives will be more focused and complementary across the different programs. Long term monitoring results will be more attainable as management efforts will be more effective and efficient holistically. All partners and stalk holders will be aware of the "SWARS" goals and objectives and can take part in the management accordingly to their areas of interest and capabilities. Program funds and resources will be mobilized and utilized according to the "SWARS" priorities and issues. All projects will be carried out for a common goal of protecting, conserving and enhancing our limited forest resources strategically to benefit all the people of Pohnpei.

List of Pohnpei Maps

P-1: Vegetation of Pohnpei
P-2: Tikitiklahn wahl en Pohnpei
P-3: Priority areas for agroforestry for food security (spatial analysis)
P-4: Priority areas for coastal stabilization (spatial analysis)
P-5a: Areas of biological significance in Pohnpei State
P-5b: Areas of biological significance in Outer Islands of Pohnpei
P-5c: Areas of biological significance and Outer Islands of Pohnpei
P-6: Occurrences of targeted invasive species
P-7: Private settlements within the watershed reserve

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Appendices

Process of Developing Pohnpei State SWARS

The process of developing the Pohnpei State SWARS was initiated in March 9, 2009 in an introductory workshop on the SWARS and geospatial analysis, and the identification of 7 crosscutting issues for the FSM. This was followed by several consultations with stakeholders at the State level, and workshops conducted by National Government staff, Gibson Susumu of the Division of Resource Management and Development, and Alissa Takesy, the Protected Areas Network Coordinator, to identify natural resource values and threats. These issues were shared with GIS specialists to initiate maps. Training in geospatial analysis was held in Hawaii, and later at the College of Micronesia in Pohnpei and in Chuuk for forestry and GIS personnel from FSM States. Katie Friday, serving as liaison between Region 5 S&P and the FSM developed an outline for the FSM SWARS and conducted interviews to initiate written SWARS. Margie Falanruw was then tasked with working with all four States of the FSM to complete the first draft of the FSM SWARS in time for the PIC meeting in Chuuk in March 8-12, 2010. The current draft Pohnpei SWARS is based on materials that were made available at the writing team workshop on 15 & 16 February 2010, and additional input on June 10 & 14 2010.

V. KOSRAE STATE

Introduction

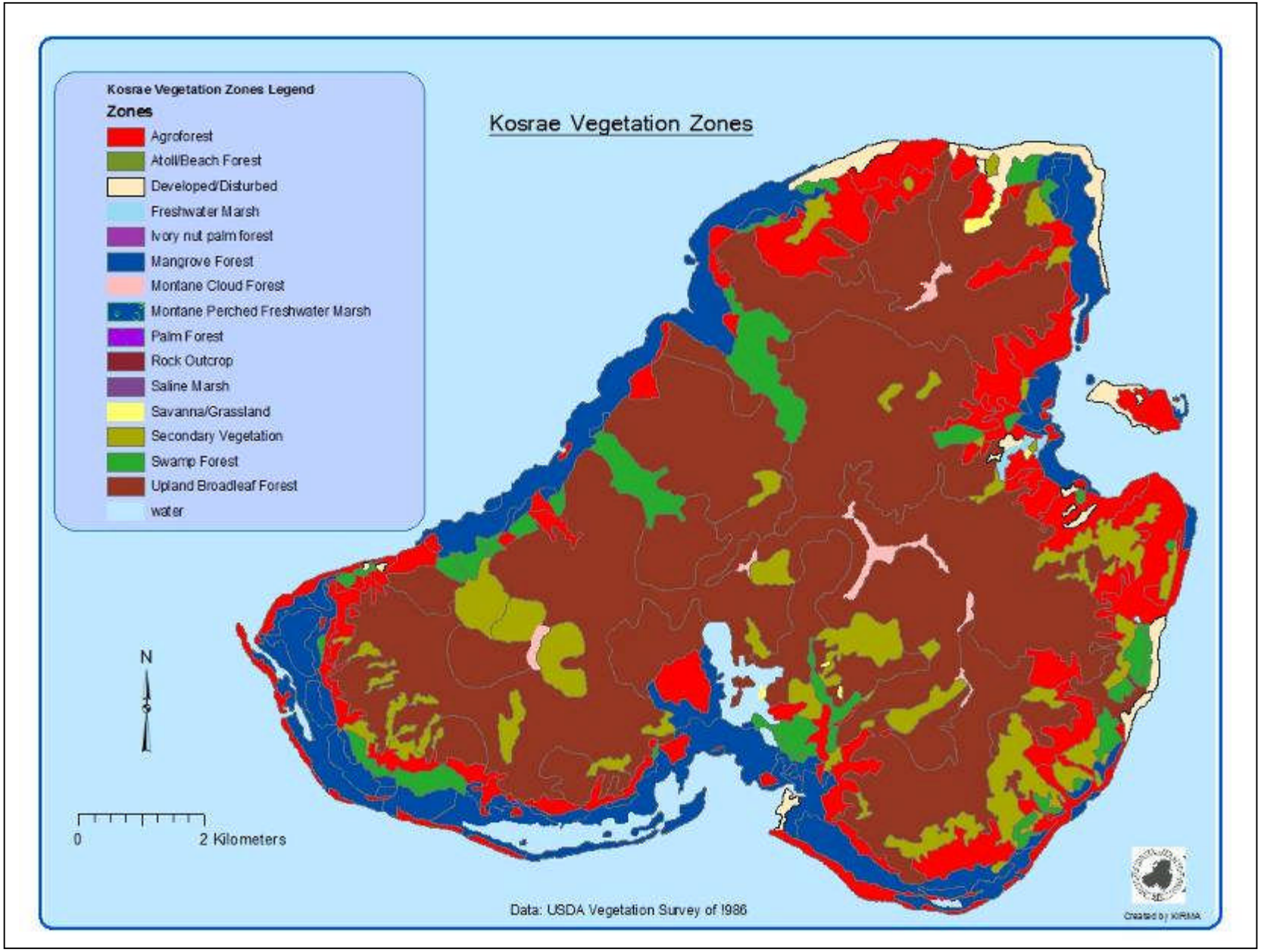
Kosrae is located at the eastern end of the Caroline Island group in the central Pacific at lat. 5 19'N. , long., 163 00'E, about 500 km (300 statute miles) north of the equator and about 4,501 km (2813 mi) southwest of Honolulu. The island is roughly triangular, with an area of about 11,186 ha (27.64 acres). The island's climate is characterized by high temperatures, heavy rainfall and high humidity. The average annual rainfall measured at the weather station in coastal Lelu is 5000mm (200in.) in the mountainous interior rainfall is estimated to be as high as 7,500mm (300 in) annually. Average temperature is 27 C (81 F) at sea level. Average monthly temperatures vary from the annual average by not more than 1 C, and the difference between the average minimum and maximum temperatures is less than 8 C. (14 F) throughout the year.

I. Forest Assessment

This section provides a qualitative, quantitative and geospatial assessment of Kosrae's forest resources and major issues of forest stewardship referenced to USFS National themes. It includes a discussion of priority landscapes, trends, values of these forest resources, threats and opportunities. The term "geospatial" is interpreted literally as the use of GIS data and maps rather than in just the narrow sense of doing analyses with the ESRI Arc View supplementary geospatial analysis tool. The use of GIS is new in the FSM and while local staff is able to learn geospatial analysis, this would take time and the availability of the program. It would also be ineffective to utilize such a tool before data layers have been thoroughly georeferenced so that layers will line up. The use of the geospatial tool in a small island setting where all ecosystems are limited in size and closely integrated could also result in fragmentation of ecosystems and efforts. Almost all land in Kosrae is privately owned. Inasmuch as successful forest resource management involves the actions of the people who own and/or use these resources, it is not wise to omit community areas that are integral parts of the whole Kosrae ecosystem. In addition, it would be difficult to explain maps created through the geospatial tool to stakeholders in villages and communities. This SWARS therefore utilizes standard GIS maps as well as some geospatial analysis. Should more geospatial analyses be helpful in the future as monitoring of progress of this SWARS indicates a need, and funding is provided for purchase of the equipment and software needed, they will be made.

Kosrae State and the FSM have, in recent years, developed a number of natural resource plans, most of which are listed in the reference section. More details on topics included in this SWARS can be found in these references. Map K-1 shows the general types of vegetation on Kosrae.

The island of Kosrae is characterized by steep mountains covered with dense forest. Several mountain peaks rise to 600 m (1,970 ft) above sea level, and Mt. Finkol is about 629m (2064 ft) high. Mountainous areas make up about 70% of the island, with foot slopes, alluvial fans, and bottomlands comprising 15% of the total land area. Approximately 14% of the island is vegetated by mangrove swamps, and only about 3% is classified as nonforest. Vegetation types described in Whitesell et al (1986) include 12 main vegetation classes, with 2 subclasses of upland forest, 6 subclasses of Swamp Forest, 4 subclasses of mangroves, Dwarf forest, 3 subtypes of secondary vegetation, 3 subtypes of agroforest, 3 subtypes of marsh, 4 subtypes of savanna grassland, cultivated areas, 2 subtypes of urban land, 2 subclasses of barren land, and areas of inland water. Forest classes also include 3 size and density classes. The species composition of these vegetation classes is described in Whitesell et al (1986). Additional information on the vegetation composition of a sample of forest plots can be found in an upcoming report based on a survey in 2005 on the Forest Inventory Assessment (FIA) by USFS Pacific Northwest Station (2009/10). Map K-1, gives a generalized view of the vegetation of Kosrae.



Map K-1: Generalized vegetation map of Kosrae. Map is color-coded to indicate general vegetation types. In general, the appropriate strategies and activities in these major vegetation types are: Enhance agroforests (in red), and areas of secondary vegetation (in light olive green), and protect and conserve mountain cloud forest (in pink), upland forest (in brown), swamp forest (in bright green) and mangroves (in blue)

Upland forests provide habitat for biodiversity including a number of endemic species. They are also important for their watershed services. Mangrove forests have multiple values for fisheries habitat, wood production, trapping sediments and shoreline protection. Mangrove forests significantly buffer the force of waves, including storm surges, and thus protect the coastline from erosion. The "fringe" (seaward) mangrove is most valuable for this coastal protection function. Recent studies in Yap (Kauffman & Donato 2009 & ongoing) have shown that mangroves sequester especially high levels of carbon that is stored in both tree biomass and in deep mangrove mud. They are thus important in reducing greenhouse gasses. Agroforests provide food, fiber, medicines and materials needed to support culture while at the same time providing the ecosystem services of forests. Coastal forests occurring above high tide mark, especially on the coasts of atoll islets, help stabilize coasts and reduce the extent of erosion during storm surges. Strand forests also provide a windbreak protecting the forests behind them from strong winds, desiccation and salt spray.

Trends

While there are anecdotal accounts of damage to Kosrae's upland forest, there is little data on changes in this forest. For mangrove forests, a survey by Hauff et al. (2006) determined that the rate of harvest of mangroves over the previous ten years averaged 10% for the island as a whole, but with heavier harvesting (up to 20%) in areas with more desirable size mangrove trees. There is much evidence of shoreline erosion, and a coastal assessment has been carried out (Ramsey 2000) and incorporated into the Kosrae Land-use Plan (KIRMA 2006). The vegetation maps presented in Whitesell et al (1986) are based on black and white aerial imagery taken in 1976. The more recent Forest Inventory Assessment (2009/10) provides considerable data on sampled areas, and when repeated in 10 years, should provide valuable information on change in the sampled areas. The "historical vegetation map", produced by the FIA is largely "trained" on the 1986 vegetation map, and has modified some types, so that the two maps may not be compared to determine trends.

The most crucial information needed to determine vegetation change since 1976 are up to date high-resolution aerial photographs of Kosrae. With such imagery and some training, local staff of KIRMA could produce an updated vegetation map that could be compared with the maps published in 1986 to determine forest trends. The aerial imagery would also be very helpful in working with communities. Communities have a vested interest in their area and the aerial photos would provide a bird's eye view that would contribute greatly to their awareness of the state of their resources. The updated vegetation map could then serve as a baseline from which to measure change and progress in forest resource stewardship. It is also important to obtain LIDAR imagery in order to determine areas that would be affected by sea level rise. Kosrae is a mountainous island with limited level land along the coast for food production and habitation. This low-lying land is vulnerable to sea level rise and storm surges and LIDAR data is critical to planning and adaptation to climate change and sea level rise.

Major Issues

Table K-1 summarizes Kosrae State issues in relation to FSM National Themes and USFS National Themes; and indicates Priority Landscape Areas in Kosrae. While roughly in order of priority, the sequence is somewhat arbitrary as all issues are important and would be prioritized differently by different stakeholders depending on their orientation. The issue of capacity building is last only because it is non-spatial in nature.

Table K-1: Summary of Kosrae State Issues and Priority Landscape areas arranged by FSM National Issues and linked with U.S. National Themes

FSM National Cross Cutting Issue	Priority Landscape Areas	U.S. National Themes
A. Biodiversity (Ecosystem integrity, Biosecurity, Protected areas, Forest Legacy	All terrestrial ABSs below and above the Japanese line (see explanation in Land use plan) marked with monuments to demarcate between public land above and private land below. - - this upper land may be transferred back to traditional owners) - - Map K-2, Map K-4 Kosrae Forest Legacy Map K-3 spatial analysis of food production areas and ABS Areas especially vulnerable to wildfires during years of extreme drought such as savanna/ grassland, secondary vegetation & adjacent forests, Map K-1 Targeted invasive species, Map K-11 showing incidence of 3 targeted invasive species. There are additional invasive species but this issue is not easily mapped because of the dispersed distribution of most invasive species	Conserve 1.1 ID & conserve high priority forest ecosystems & landscapes Enhance 3.5 Protect, conserve & enhance wildlife habitat & fish habitat. Enhance 3.3 Assist communities in planning for & reducing wildfire/forest health risks Protect 2.1 Restore fire-adapted lands & reduce risk of wildfire impacts Protect 2.2 ID, manage & reduce threats to forest & ecosystem health
B. Coastal stabilization, Climate change/ (coastal forest)	Map K-12, coastal forests agroforests and low lying agricultural lands, and Map K-6, coastal hazard zone (spatial analysis) Map K-10 Managed harvesting, reforestation & timber plantation areas (clear cut areas being reforested), mangrove gaps & timber plantations Map K-12 Urban areas, urban tree planting sites & development areas, community nurseries & agroforests	Enhance 3.7 Manage & restore trees & forests to mitigate & adapt to global climate change
C. Watershed	Maps K-2, K-4, K-7, K-8 and Map K-12 Managed harvesting, reforestation & timber plantation areas (clear cut areas being reforested), mangrove gaps & timber plantations	Enhance Public Benefits from Trees and Forests: 3.1 Protect & enhance water quality & quantity, Enhance 3.5 Protect, conserve & enhance wildlife habitat & fish habitat.
D. Food security (In relation to agroforests, climate change	Map K-10 spatial analysis of food production areas and ABS Map K-1, agroforest zones, secondary	Conserve 1.1 ID & conserve high priority forest ecosystems & landscapes Conserve 1.2 Actively &

and sea level rise)	vegetation and freshwater marshes and swamps* Map K-12 Urban areas, urban tree planting sites & development areas, community nurseries & agroforests	sustainably manage forests Enhance 3.4 Maintain & enhance economic benefits & values of trees & forests
E. Production & sustainable harvesting	Map K-11 Managed harvesting, reforestation & timber plantation areas (clear cut areas being reforested), mangrove gaps & timber plantations Map K-12 Urban areas, urban tree planting sites & development areas, community nurseries & agroforests	Enhance 3.4 Maintain & enhance economic benefits and values of trees & forests
F. "Urban" forestry	Map K-10 Managed harvesting, reforestation & timber plantation areas (clear cut areas being reforested), mangrove gaps & timber plantations Map K-12 Urban areas, urban tree planting sites & development areas, community nurseries & agroforests	Enhance 3.2 Improve air quality & conserve energy
G. Capacity building	Non-spatial	Enhance 3.6 Connect people to trees & forests & engage them in environmental Stewardship activities Enhance 3.3 Assist communities in planning for & reducing wildfire/forest health risks

* Freshwater swamp forests are used for food production in a system that alternates swamp forest with taro patches by cutting back species such as nunu (*Horsfieldia nunu*) and *Barringtonia racemosa Hibiscus tiliaceous* and sometimes *Terminalia carolinensis*, (*ka*) to open the canopy for taro patches. These trees then regrow in a fallow phase (R. Jackson & Katie Friday 2010 personal communication).

Discussion of Issues

On a small island such as Kosrae, all areas are important as ecosystems are closely linked in a small area and there is little leeway for ecological mistakes. Once ecosystems are disrupted, they are difficult to re-establish. It is thus important to link ecosystem integrity with the production of food and other goods and services for people, especially in this era of climate change and sea level rise. Map K-1 addresses multiple issues. It is color-coded to indicate general vegetation types. In general, the appropriate strategies and activities in these major vegetation types are: Enhance agroforests (in red), and areas of secondary vegetation (in light olive green), and protect and conserve mountain cloud forest (in pink), upland forest (in brown), swamp forest (in bright green) and mangroves (in blue).

A. Biodiversity

The resilience inherent in intact forest ecosystems provides the best insurance against climate change, and helps ensure that forests meet the needs of present and future generations (UNCBD, 2010.) The entire upland forest area of Kosrae (shown in brown on Map K-1, and in dark green on Map K-2), has been designated as an "area of biodiversity significance" (ABS) in TNC Blueprint (2003). In addition, Kosrae has two unique forest types. The upland Mountain cloud forest, shown in pink on Map K-1 is a unique dwarf moss cloud forest rich in endemic species. The magnificent lowland "ka swamp forest" shown in bright green on Map K-1, is dominated by endemic (*Terminalia carolinensis*) (*ka*) trees that represent the only relatively undisturbed stand of this endemic species found naturally only in Kosrae and Pohnpei.[15] These areas of special biodiversity significance are further discussed in the Kosrae Forest Legacy Chapter that follows. In addition, the TNC Micronesia Challenge has pledged to effectively protect 20% of terrestrial areas and 30% of near shore marine areas. It is thus important to conserve a significant percent all of Kosrae's intact forests types, including mangroves that are also important for coastal stabilization (issue B).

Threats: Forests are threatened by: Road building, clearing for agricultural projects and house sites, a sawmill that is already on island, aggressive invasive weeds and smothering vines, plant diseases, extreme ENSO-related droughts and associated wildfires, and decreases in seed dispersers such as fruit bats, Micronesian pigeons and other birds. Mangroves are especially threatened by overharvest for firewood and fill & conversion: With limited flat coastal land, there is a demand for coastal land and mangroves are being filled in; and cut for firewood. Other threats to native biodiversity include feral pigs, introduced monitor lizards and the threat of brown tree snakes being introduced from Guam. While Micronesian pigeons, a major disperser of tree seeds, are protected by law, there is poaching.

While wildfires not common on Kosrae given the high rainfall, they do occur during periods of drought when wildfires originating in more flammable savanna areas may erode away forest edges and do long-term damage. In addition, there is likely to be an increase in the burning of forest to clear land for growing *sakau*. The serious decline in intact native forest recorded in Pohnpei is generally attributed to clearing to grow this high value crop *sakau (Piper methysticum)*. It is likely that droughts, especially the severe drought of 1982-1983, made it much easier to clear forest with fire and contributed significantly to this decline. There is increased cultivation of sakau in Kosrae to sell in Pohnpei, and the combination of forest clearing for this purpose combined with drought conditions could result in increased damage to Kosrae's forests from agricultural burning and wildfires. During drought periods, Kosrae usually experiences at least 3 wildfires per year, resulting in at least one acre of burned area per fire, for a total of 3 acres per year. The development of a wildfire program and Community Wildfire Protection Plans (CWPPs) is thus included in this SWARS strategy.

Kosrae's agroforests and mangrove forests are more susceptible to plant diseases. Existence, spread, or introduction of plant diseases to the mangrove forests and agroforest areas can potentially impact the diversity of these forest ecosystems, and consequently its natural resources. A program for controlling and managing invasives and plant diseases is developed into the SWARS strategy, as it is also addressed in the appended Kosrae Invasive Species Taskforce (KIST) Strategic Action Plan (see Strategy section and Appendix).

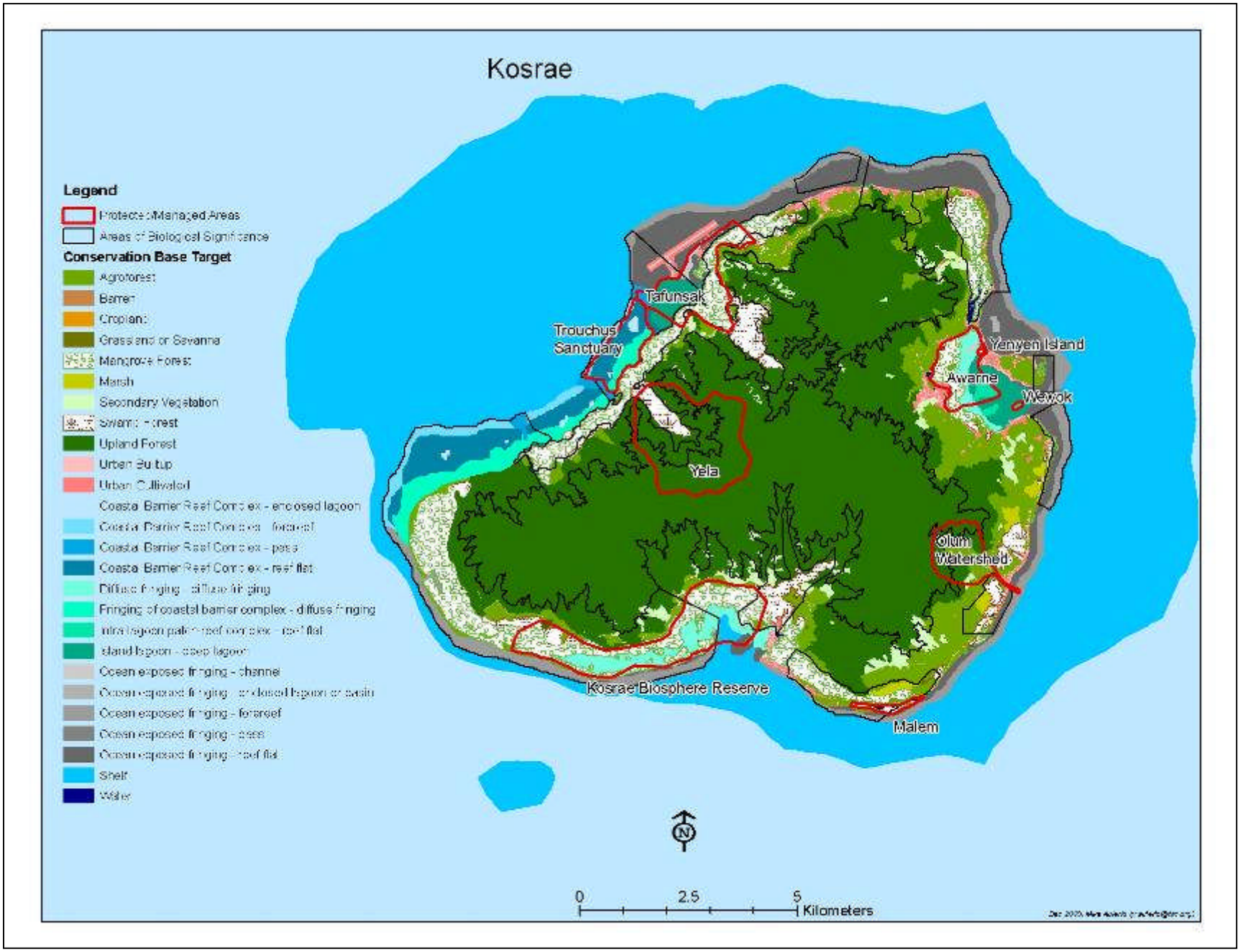
[15] M. Falanruw has observed a small stand of tall *Terminalia* trees in Palau that appear to be *T. carolinensis*. The trees were not in flower or fruit at the time of observation, so the species determination remains to be confirmed.

Opportunities: The USFS Forest Legacy program is available to Kosrae pending completion of an Assessment of Need (AON) included in this SWARS, to define the program and the Kosrae Forest Legacy Area (see Chapter VII). A proposal for one project, (Yela Valley) under this program has already been prepared and scored well nationally. In addition, The Nature Conservancy (TNC) and Conservation International (CI) have pledged $12 million to support the Micronesia Challenge. Should this funding become available, it could advance progress towards meeting the Micronesia Challenge. There may be opportunities to combine the protection of priority forest sites with historic preservation sites. Both Forestry and Historic Preservation are housed within KIRMA.

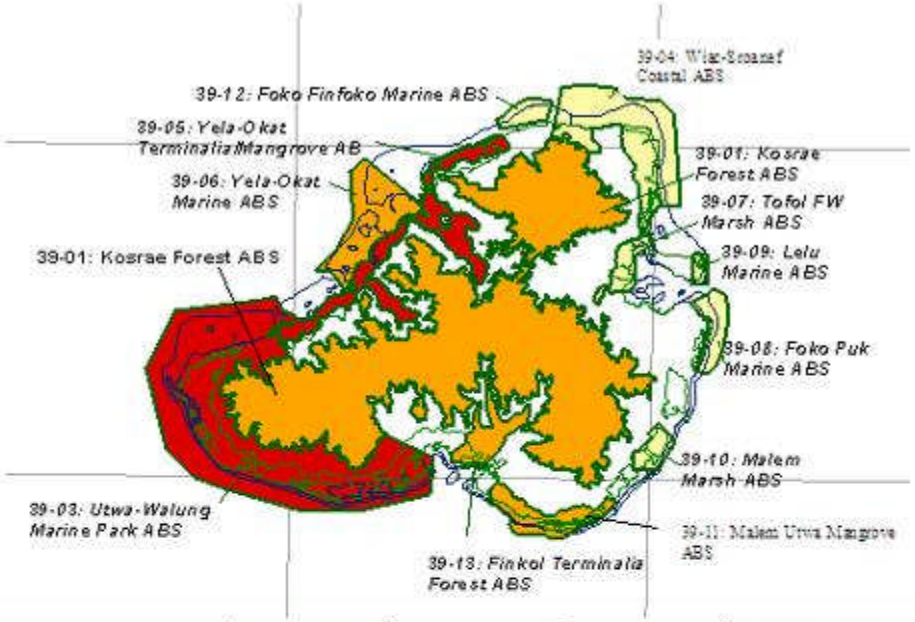
With the passage of the 2008 Farm Bill, Kosrae is eligible for assistance from the Cooperative Fire and Aviation Program and the Forest Legacy Program. The Cooperative Fire and Aviation grant program includes access to surplus fire control equipment, including fire trucks, and training. Training opportunities include training in fire suppression and the Incident Command System that has become a prerequisite for disaster assistance. This SWARS strategy includes the development of a Wildfire plan and program for Kosrae, in which KIRMA will be the lead agency; as a majority of its staff have already acquired some training in Incident Command System (ICS), Disaster Emergency Relief, and other relevant forestry and wildlife management trainings. Outreach programs addressing wildfires are integrated into KIRMA's environmental education strategies and continue to be implemented by KIRMA. The Forest Legacy grant program involves conservation easements which would entail the development of 'forest stewardship plans.' An Assessment of Need (AON) for the development of a Forest Legacy Program for Kosrae State is incorporated herein and requires qualified private land owners to develop 'forest stewardship plans' or 'management plans' for their Forest Legacy project areas (See Appendices).

Priority landscapes to address issue: Native upland forests are shown in brown on Map K-1, and mangroves are shown in blue and Swamp forests shown in light green. Because they are keystone habitats, important to coastal protection, all mangroves are priority areas for protection.

In addition, the entire upland forest is classified as an "area of biodiversity significance" TNC (2003) and recommended for protection. Of special concern for their biodiversity significance are Kosrae's Mountain cloud forests, shown in pink in Map K-1 but not shown on Map K-2. These areas are shown in Map K-3. Map K-3b is based on a TNC Marxxan analysis of Kosrae ABS to rank areas for priority action. Invasive species are a great threat to biodiversity. Map K-11 shows the incidence of targeted incipient invasive species in Kosrae. A number of other invasive species are more dispersed and not as amenable to mapping.

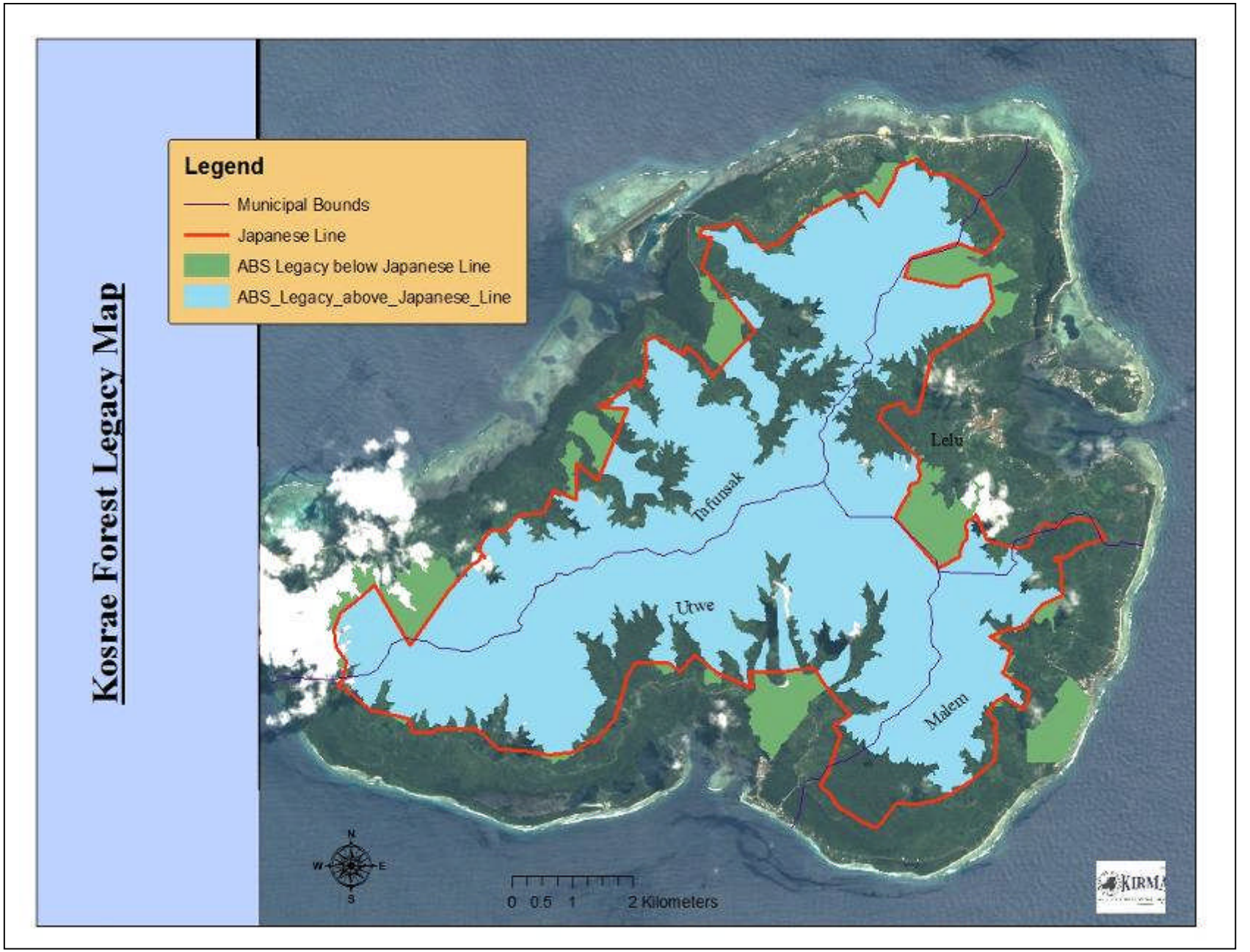


Map K-2: Kosrae "areas of biodiversity significance" from Blueprint (2003)



ABS	ABS Name	Urgency of threat	Feasibility	Leverage	Biological Value - A (Number & Diversity)	Biological Value - B (Ecological Integrity)	Total Value
39-03	Utwa-Walung Marine Park ABS	5	5	5	3	5	23
39-05	Yela-Okat Terminalia/Mangrove ABS	5	5	5	5	3	23
39-11	Utwa Mangrove ABS	3	3	3	5	3	17
39-01	Kosrae Forest ABS	1	5	1	3	5	15
39-06	Yela-Okat Marine ABS	3	2	5	1	3	14
39-13	Finkol Terminalia Forest ABS	3	5	3	1	1	13
39-04	Northeast Kosrae Marine ABS	1	3	1	1	5	11
39-12	Foko Finfoko Marine ABS	1	1	3	5	1	11
39-08	Foko Puk Marine ABS	1	1	5	1	3	11
39-09	Lelu Marine ABS	1	3	3	1	1	9
39-10	Malem Marsh ABS	3	3	1	1	1	9
39-07	Tofol FW Marsh ABS	3	1	1	1	1	7
					High	5	
					Meduim	3	
					Low	1	

Map K-3: A map with associated Marxxan analysis of Kosrae "areas of biodiversity significance. The Marxxan analysis is a method for ranking areas of special biodiversity significance for prioritized action. The highest ranked terrestrial area, the Yela-Okat Terminalia/Mangrove ABS is further discussed in Kosrae's Forest Legacy Chapter that follows



Map K-4: Kosrae Forest Legacy Map showing Municipal boundaries, the "Japanese line" designating upland watershed forest, "areas of biodiversity significance" (ABS) above and below the "Japanese line". The ABS above and below the "Japanese line" are discussed in the Kosrae Forest Legacy chapter that follows

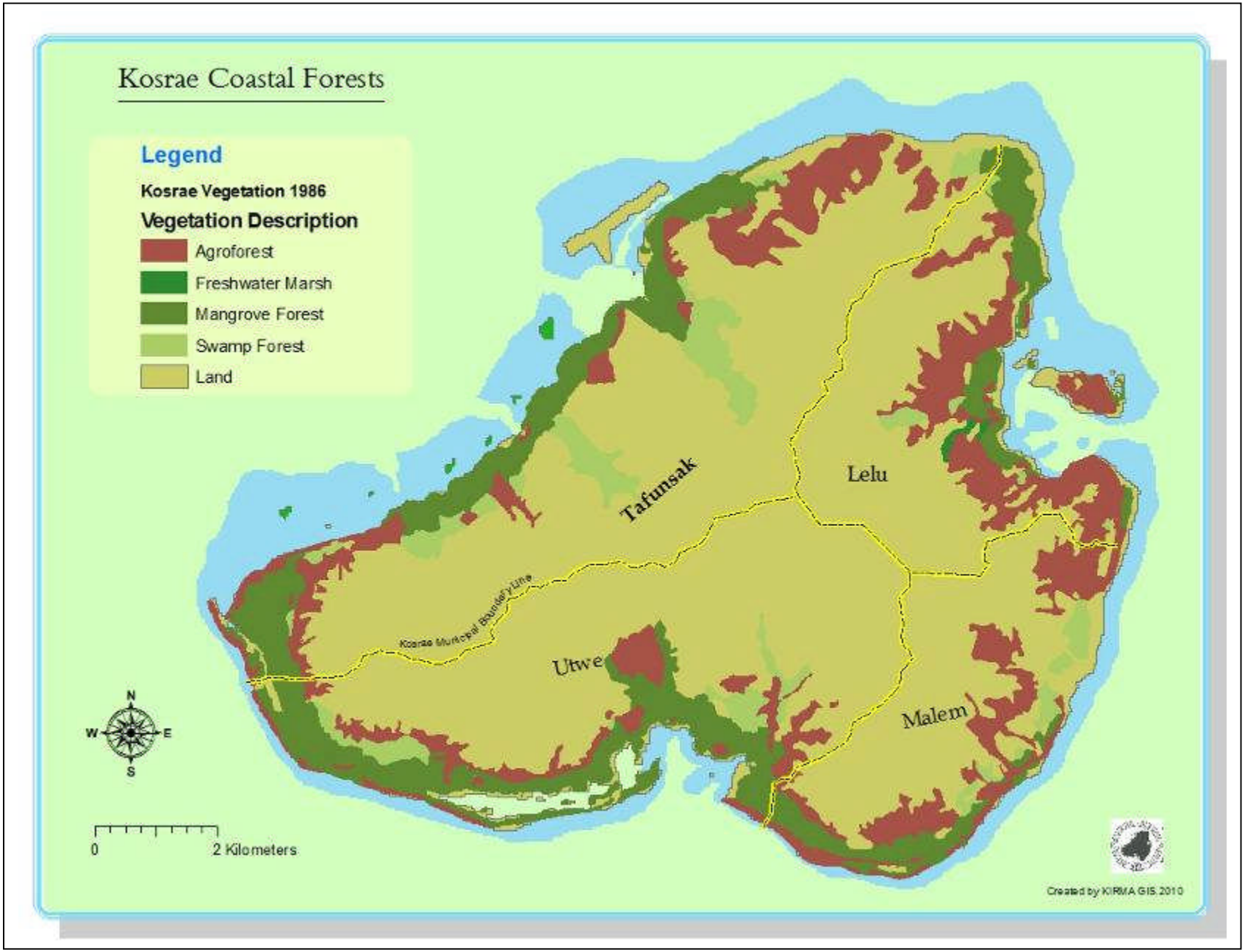
B. Coastal Stabilization

In recent years, Kosrae has been experiencing a great deal of coastal erosion, along with high sea levels and storm surges. Reports of the International Panel on Climate Change and other groups acknowledge climate change and predict more severe ENSO events and storms and sea level rise. Coastal erosion has removed areas of beach strand and even caused the loss of coastal trees and damage to coastal real estate. Dredging of the reef to use as fill in the construction of the airstrip may have caused coastal erosion. Recent high tides may be related to increased gravitational pull of the moon and sun while they are at their closest approach to Earth, and to an extended "La Nina"; however sea levels are rising, and recent events give a glimpse into the future of sea level rise. Ramsey (2000) provides more information on this issue.

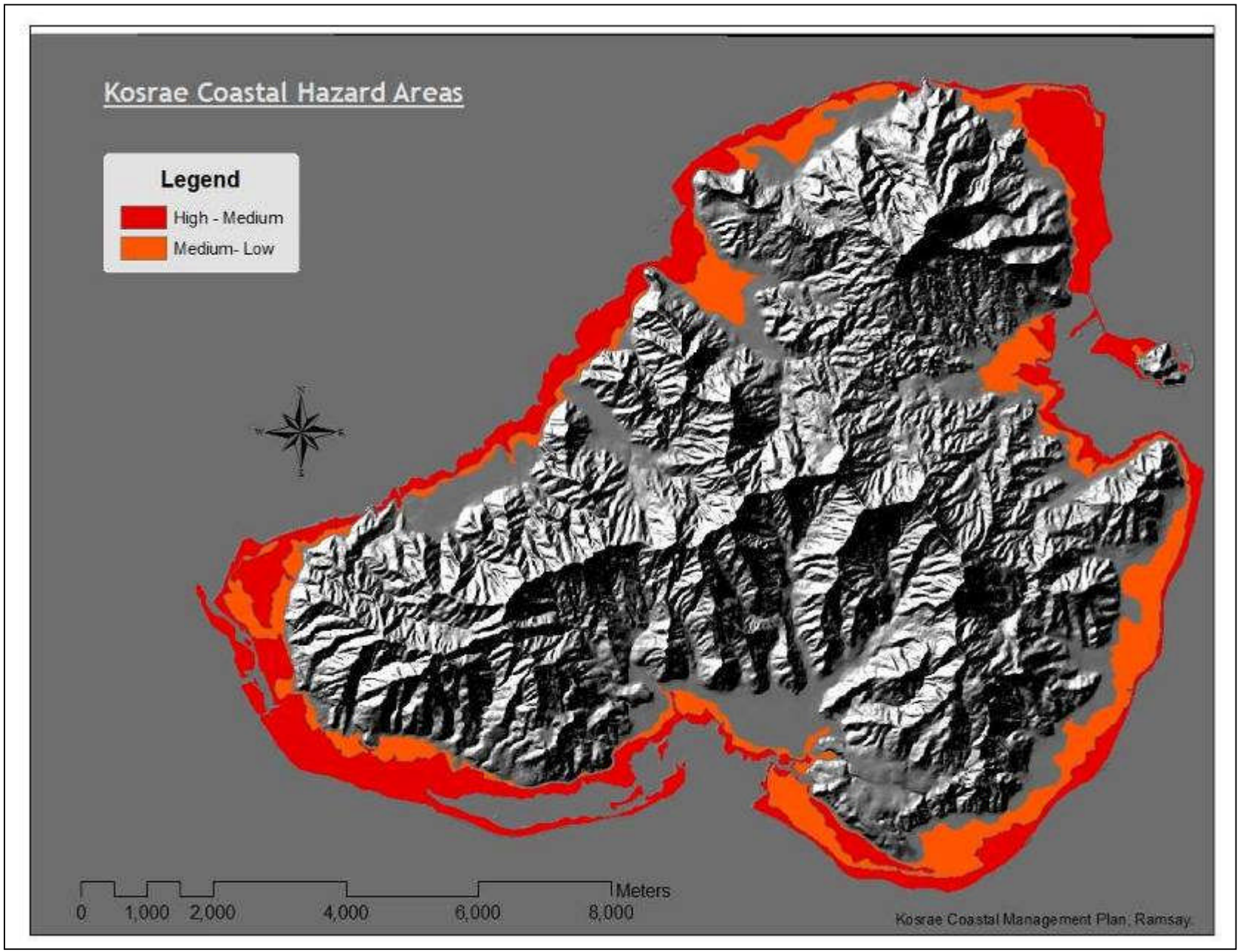
Threats: Coastal forests and especially mangroves help reduce coastal erosion but are threatened by construction activities. Seas are rising and ENSO events and storms are predicted to become more severe. It may not be possible to completely protect all coasts and food production areas from erosion and salt water intrusion. Adaptive strategies are thus also needed.

Opportunities: People's concern over recent high waters may result in less damage to mangroves and coastal forest, and more willingness to plant trees for coastal protection. Recent data on the high levels of carbon sequestration by mangroves and the potential for income for "carbon credits" may induce coastal landowners to protect their mangroves. The use of common and invasive upland trees for firewood instead of *Rhizophora* mangroves, and greater use of more efficient wood burning stoves could significantly reduce overharvest of mangroves.

Priority forest to address issue: Map K-5 shows coastal forests and low-lying agricultural lands of Kosrae. Map K-6 shows areas vulnerable to rising seas and storm surge.



Map K-5: Coastal Forests, including agroforest, mangrove forest, swamp forest, and areas of freshwater marsh



Map K-6: Coastal hazard zones of Kosrae. Areas in dark red are high to medium risk and areas in orange are medium to low risk

Critical Information gaps: Ramsey (2000) provides site-specific information and recommendations for coastal protection. New watershed-wise and coastal adaptation engineering practices consistent with these recommendations are needed, particularly in areas where roads pass between wetland and mangrove habitat. Most of Kosrae's best agricultural land occurs on low-lying alluvial areas that are vulnerable to sea level rise and storm surges. There is great need for LIDAR data on the elevation of these lands and for sensitive road engineering to protect both coastal mangroves and low lying agricultural lands inland of roads. It will be necessary to elevate roads to adapt to sea level rise. Based on findings from LIDAR imagery, it may be necessary to also install water regulation valves on culverts through these roads so that agricultural lands can be protected from sea water intrusion during high water events, and also drained of excessive freshwater runoff after heavy rains.

C. Watersheds

An understanding of watersheds enables people to see how they fit into the landscape, and watershed projects can be landscape in scale. The Hauff (2006) survey may have provided recommendations for a suggested system to monitor mangrove harvesting. A second iteration of this survey would indicate trends in mangrove exploitation. Being a mountainous island with some of the highest rainfall in the world, watershed management is very important in Kosrae. In addition, Kosrae's *Ka* swamp forests include the last remaining relatively undisturbed forests of the endemic *Terminalia carolinensis* Kaneh. (*ka*) in the world. An Analysis of Need (AON) for the Forest Legacy program to protect these world-class forests and their watershed is included in Chapter VI.

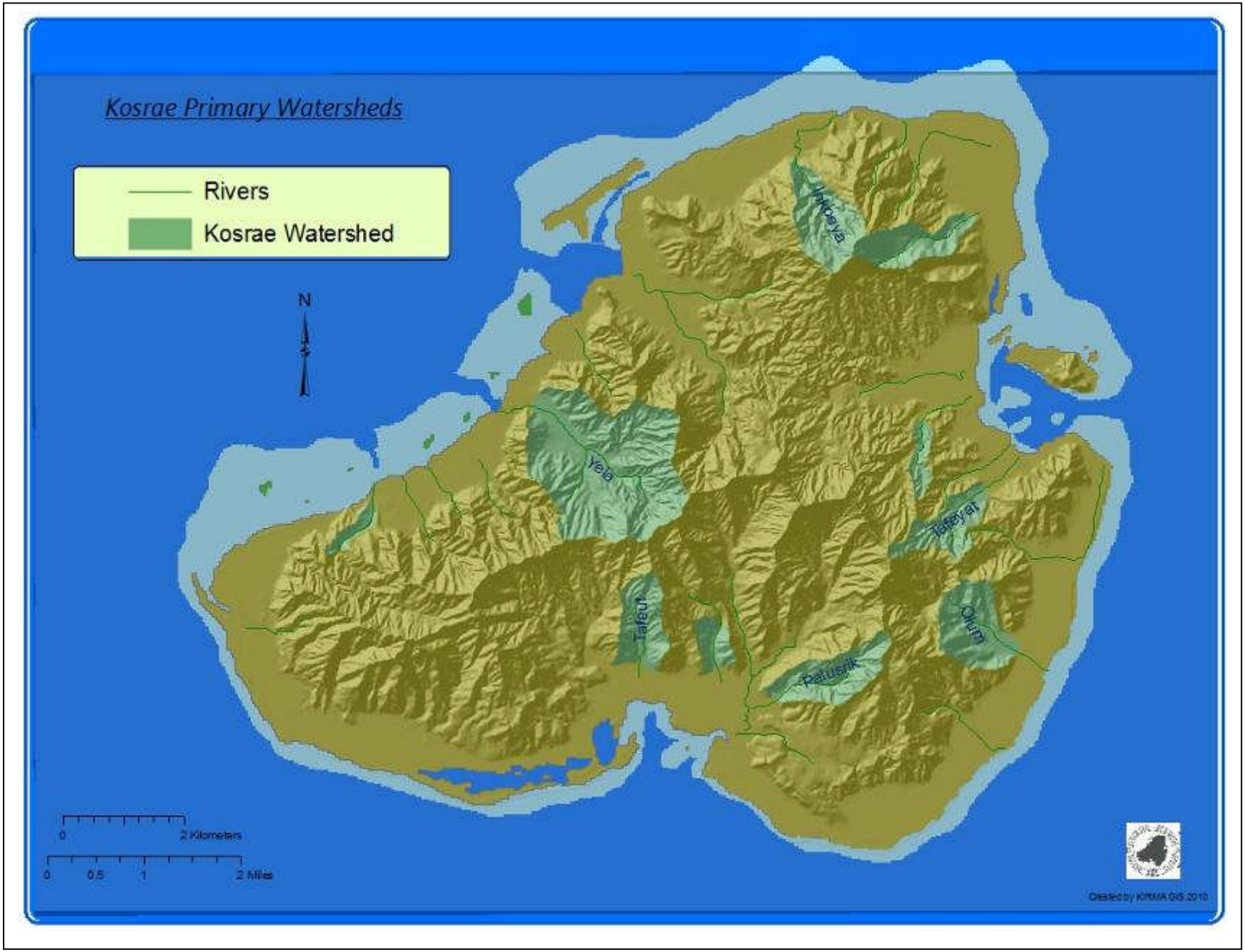
Trends: The magnificent *Ka* forests of Kosrae are threatened by a road-building project, and their protection under the Forest Legacy program is an urgent need. A draft watershed assessment (McKean 1994) discusses road erosion and some matters relating to watershed management. The land above the "Japanese line", that demarcates the steepest watershed area of Kosrae as watershed, is now inhabited in areas, and there are plans to release lands within this watershed to private owners. It is not known whether the Land Use Plan will place restrictions on the release and/or use of these lands. If not, the release of these critical watershed areas for unrestricted use is a major threat to Kosrae's watershed.

Values, benefits, and services: Watersheds integrate natural habitats from ridge to reef and greatly affect the quality of downstream habitats, including the *ka* forest. Watershed management is also critical to the protection of Kosrae's water supply and a fledgling bottled water industry with potential to bring in much needed revenue to the island.

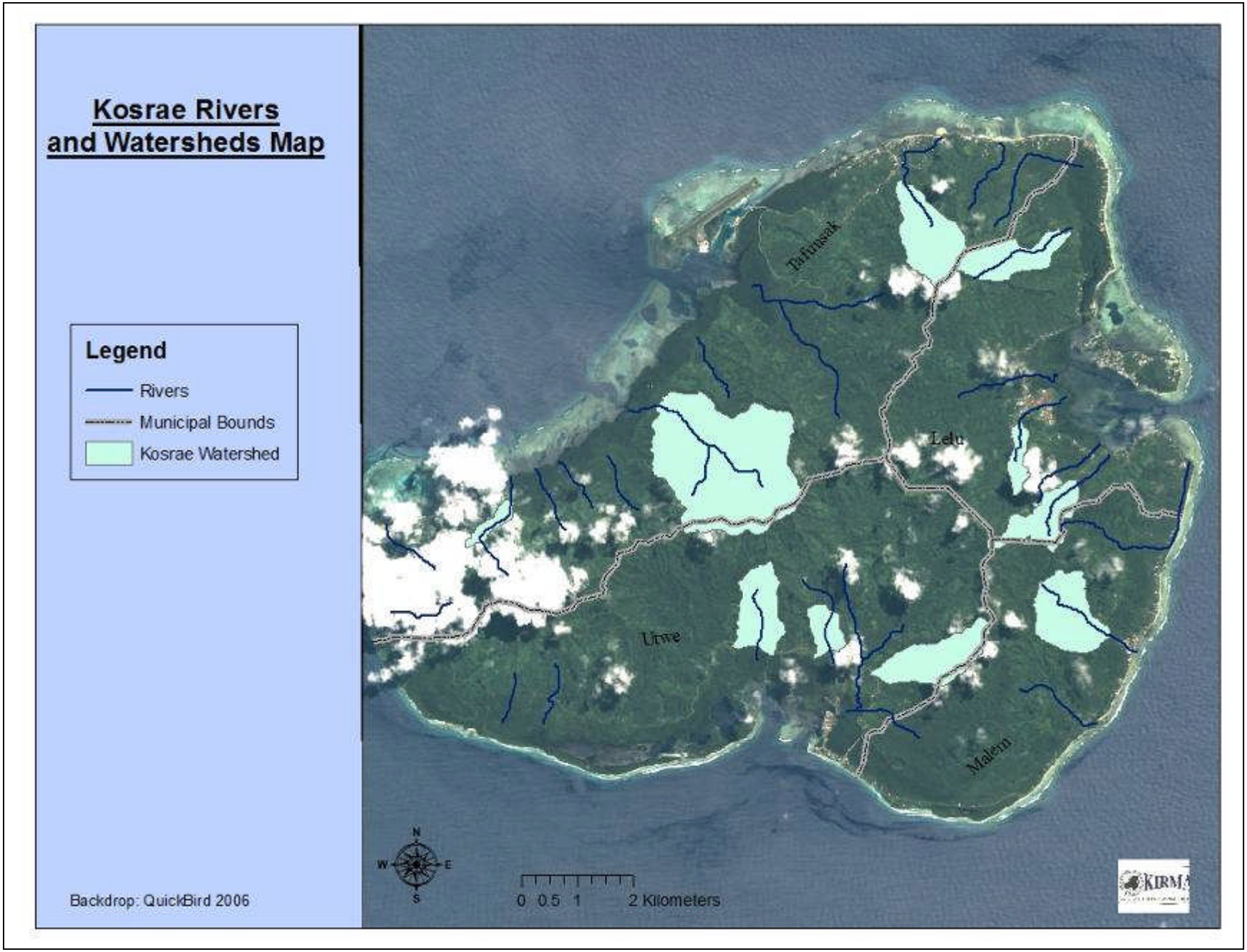
Threats: Threats to Kosrae's *ka* forest include road building activities, the possible development of a sawmill, and recent agricultural clearing by foreign business interests.

Opportunities: KIRMA has been successful in obtaining a competitive grant for work in watersheds up to 2011. The world-class beauty of the *ka* (*Terminalia carolinensis*) forest has raised concern for its protection. An ongoing project funded under the USFS competitive grant program is raising awareness of the importance of watersheds, and the recent eligibility of Kosrae for the Forest Legacy program may help protect these biodiversity rich watersheds and the unique *ka* forest.

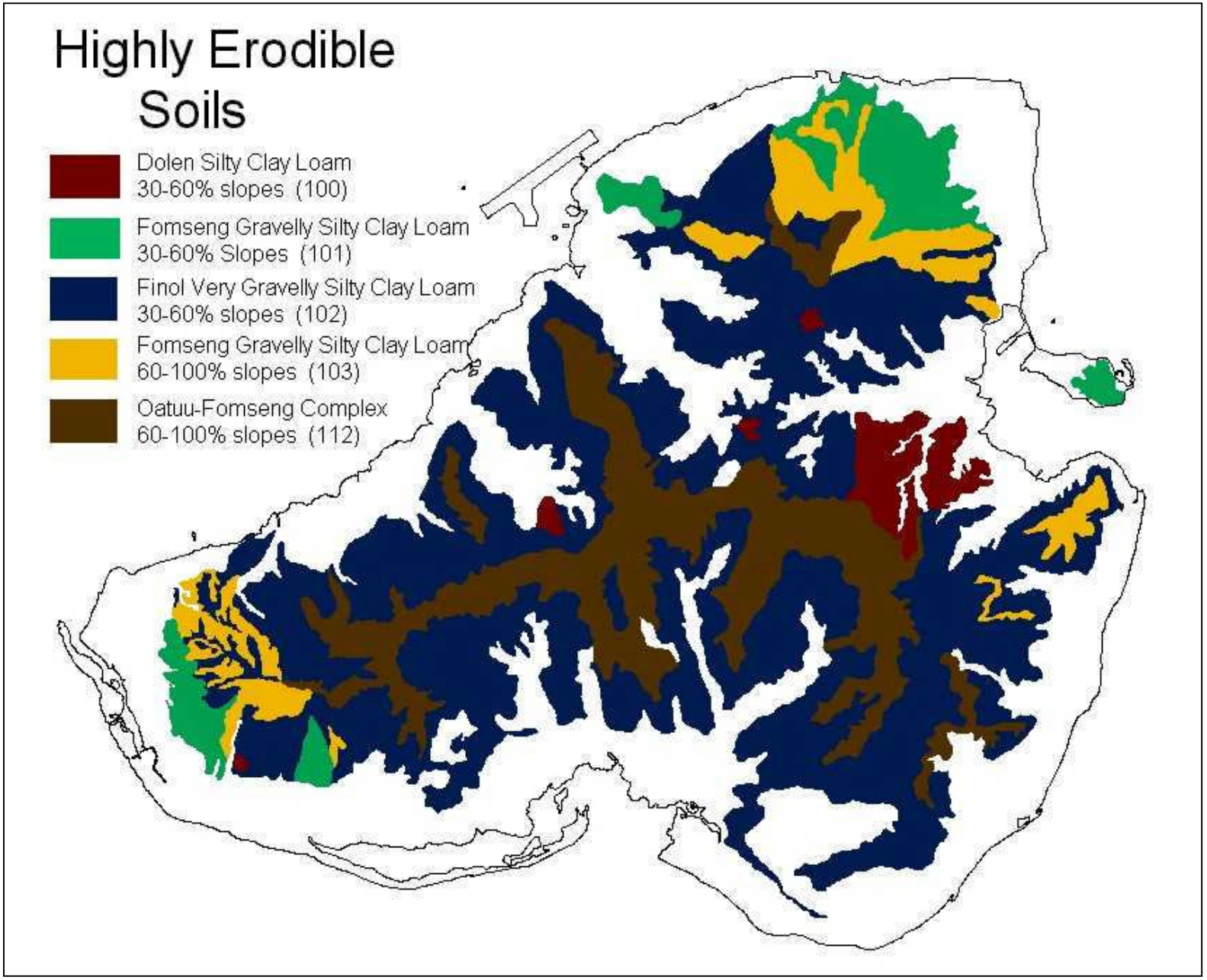
Priority forest landscape areas for outreach and activity to address issue: Map K-7 shows a digital elevation model (DEM) of some of Kosrae's most important watersheds. KIRMA is developing an Analysis of Need (AON) for the Forest Legacy Program to protect the upland forests and watersheds of Kosrae, including the ka forests. Map K-8 shows major watersheds and rivers. Map K-9 shows highly erodible soils of Kosrae. It is essential that these areas be protected within a watershed reserve.



Map K-7: Digital Elevation Model with Important Watersheds of Kosrae



Map K-8: Important watersheds and rivers of Kosrae



Map K-9: Highly erodible soils of Kosrae showing soil types from SCS soil survey with slope. Based on slope, the yellow and olive brown areas are most highly erodible soils

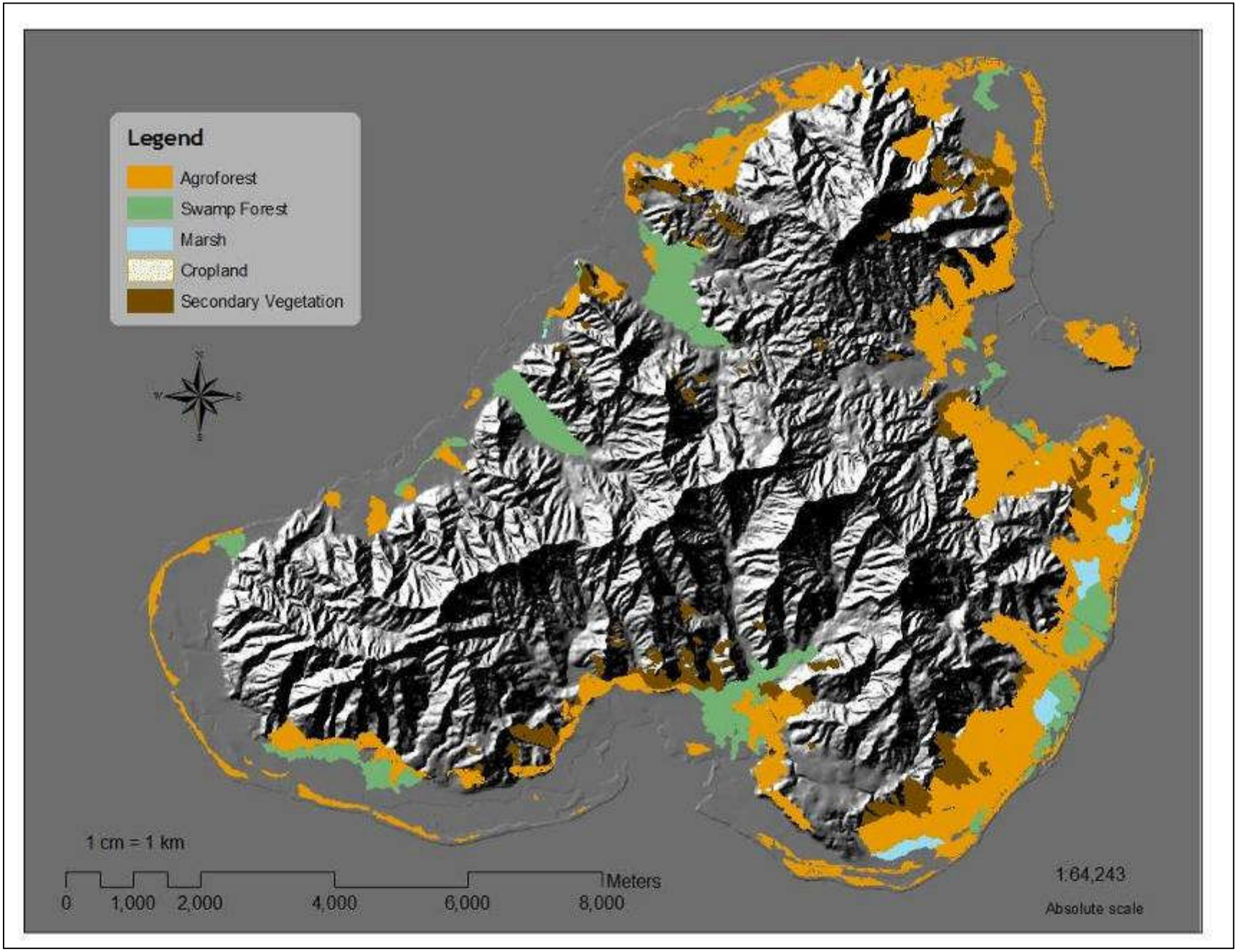
D. Food Security

Climate Change and sea level rise are great threats to Kosrae's food security. Most of Kosrae's agricultural lands are low lying areas of the coast vulnerable to sea level rise and storm surge as well as to changes in hydrology that could result in the oxidation of peat soils and their subsidence and subsequent inundation by salt water. Sensitive engineering is needed in order to construct climate-proofed roads while also protecting these critical agricultural lands and managing fluxes in the freshwater/ saltwater interface. Methods of food production such as taro patch culture that do not require the drainage of peat soils in low lying areas, and agroforestry practices that do not result in the removal of forest canopy on slopes is critical. The traditional taro patch and agroforestry food production systems are high in species, and varietal diversity. The maintenance of this agrobiodiversity is critical to the resilience of Kosrae's agricultural system and to food security in the face of climate change. LIDAR imagery is needed to define areas suited for taro patch production and to manage water flow through agroforest areas. Several subtypes of agroforest are mapped in Whitesell et al (1086). Map K-1 shows vegetation zones of Kosrae and Map K-10 provides a spatial analysis of food productive areas.

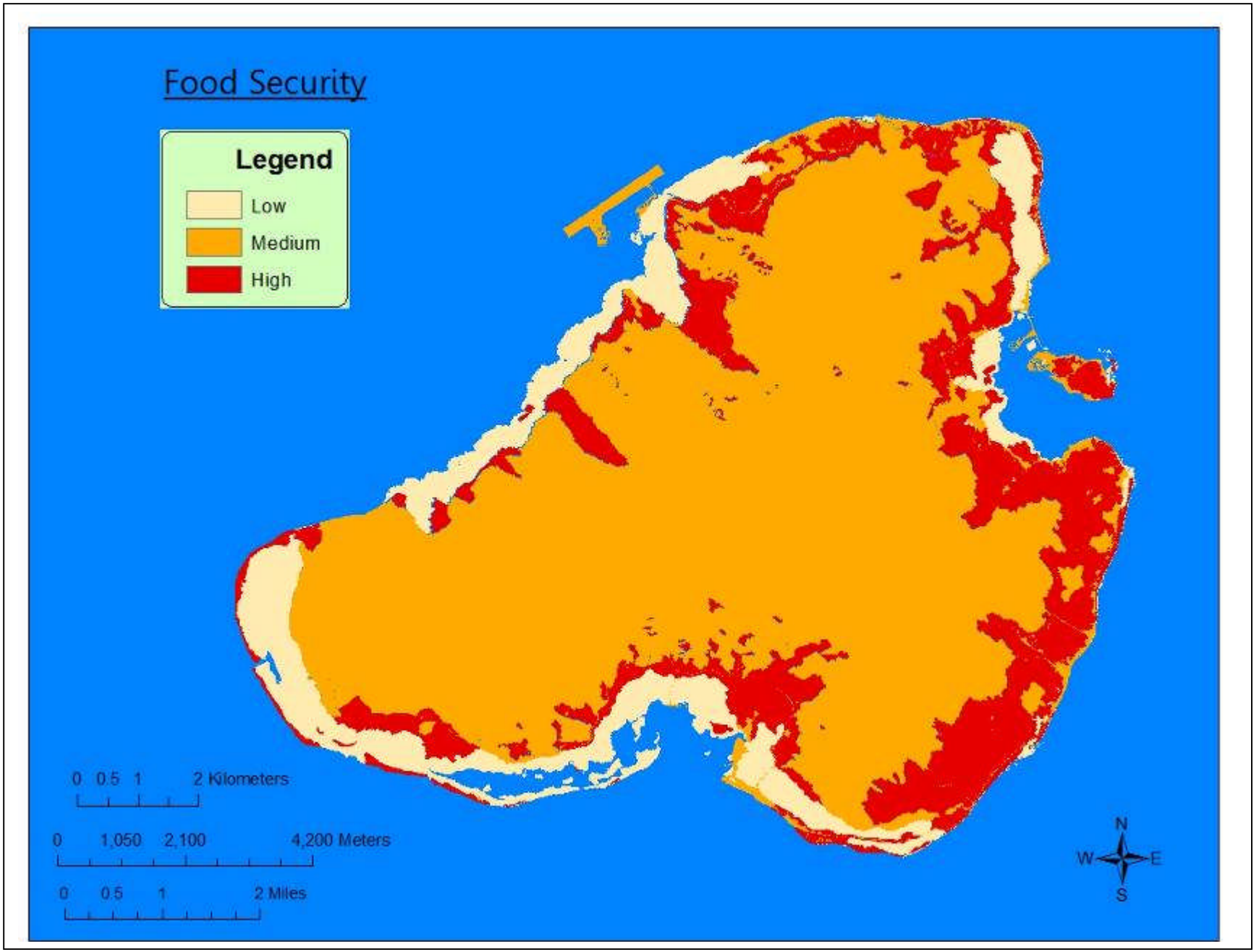
Agroforests serve as food production areas, sources of fiber and medicines while providing the ecosystem services of forests. Threats including climate change and sea level rise, invasive species and diseases, are a great threat to agroforests and taro patch systems. With rising costs of imported food people may need to turn to traditional food production. Current programs encouraging the growing and use of local foods to combat dietary related health problems may also contribute to an increase in local food production. If food production in the priority areas could be enhanced, it could also reduce pressure on natural forests.

Invasive species, insects, and plant diseases also pose a high threat to Kosrae's food security. The main food crops such as banana, breadfruit, and taro can be easily damaged by invasive species, insects, or plant diseases, as evident by the 'citrus canker' breakout a few years ago. With insufficient resources to combat these threats, development and implementation of programs to manage and control invasive species, insects, or plant diseases is crucial to safeguard the productivity of Kosrae's agroforests, and the availability of food crops.

Priority Landscapes: Map K-10 shows areas of agroforest, low-lying agricultural land, and secondary vegetation. Secondary vegetation, being already disturbed, are priority areas for enhancement of food production as well as other sustainable production (issue E.). The use of areas of secondary vegetation in this way would spare more biodiverse forest from conversion. Map K-10 shows priority areas for developing food security.



Map K-10: Kosrae Agroforest and areas used or potentially useable for food production, with swamp forest



Map K-10b: Priority areas for food security

E. Production and Sustainable Harvesting

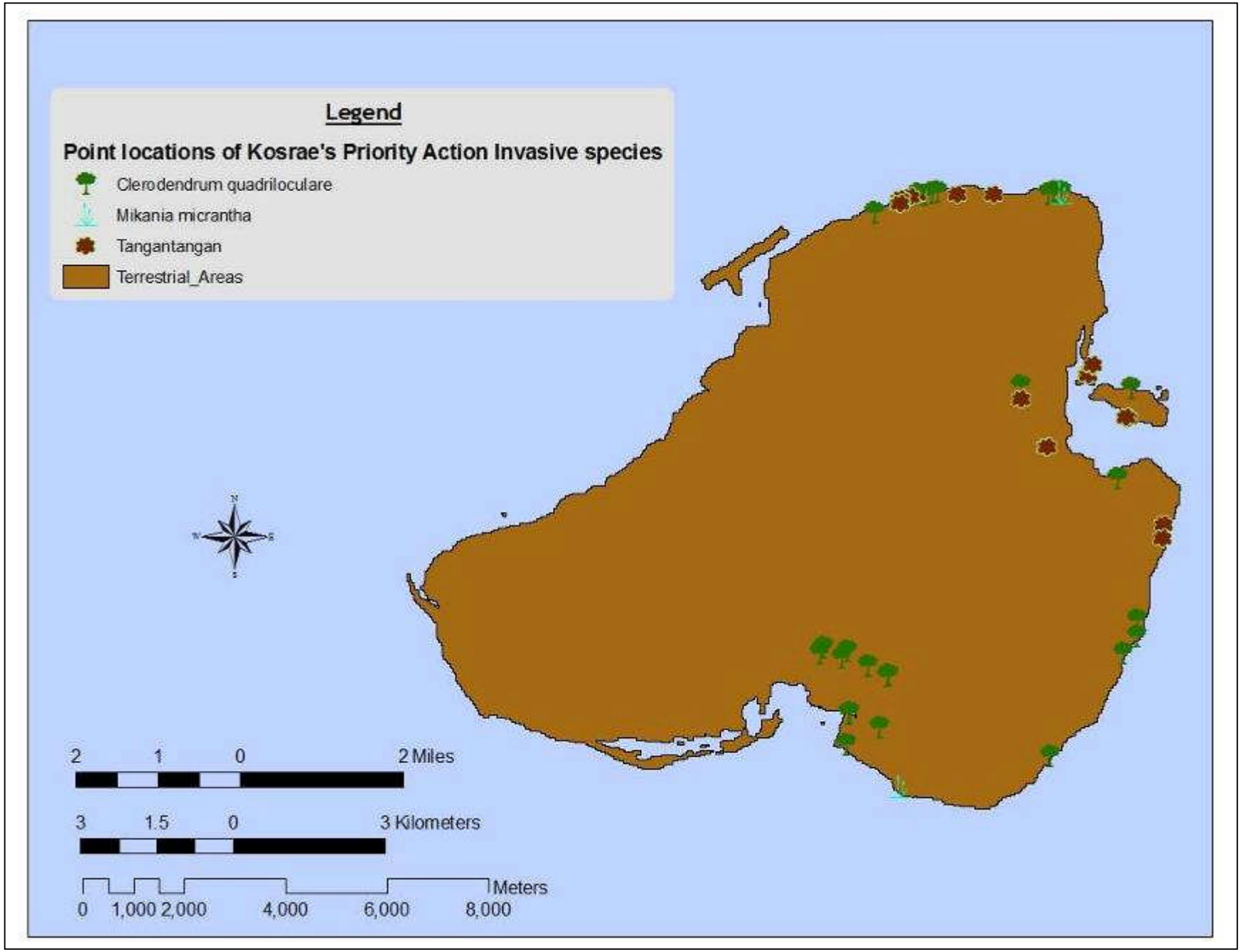
Powerful machinery helps people to make big changes faster and easier in order to make conditions more comfortable for people, and to enable economic development. Often, however, the link between a healthy environment and a healthy economy is not yet realized, and heavy machinery may be used in a way that damages the ecosystem upon which people's livelihoods depend.

Trends: Natural resources appear to be exploited unsustainably but there is no system to monitor their status. A second iteration of the FIA survey should yield data on change in areas surveyed and give some idea of the sustainability of activities affecting these areas. The USFS PSW Station, Institute of Pacific Islands Forestry is also conducting a study of the impact of clearing for *sakau* on stream and water quality.

Threats: Threats to forest resources include road-building, land clearing for open canopy agricultural plots, unsustainable timber and firewood harvest, sea level rise and loss of habitat for birds and fruit bats that spread seeds of forest trees. Mangroves are exploited for firewood, especially for use in the Kosraean specialty of cooking in underground ovens. The favored mangrove trees for firewood, *Rhizophora*, do not coppice when cut and when cut too heavily they die. Overexploitation of forests threatens the very survival of mangrove forests; threatens the biodiversity value of intact upland native forests; and reduces the woody component and watershed value of agroforests.

Opportunities: Since the government manages most funding for large projects, the government could do a lot to prevent damage to forest resources. In addition, Kosrae has the most advanced system of environmental impact assessment in the FSM in the form of the Development Review Process overseen by KIRMA. Other opportunities include linking production and sustainable harvesting activities with ecotourism.

Priority landscapes to address issue: Map K-11 shows priority areas for sustainable harvest. This area includes most of Kosrae's mangrove areas. See also, Map K-14 that shows areas of mangrove reforestation, urban forestry tree planting and timber planting.



Map K-11: Incidence of 3 targeted invasive species

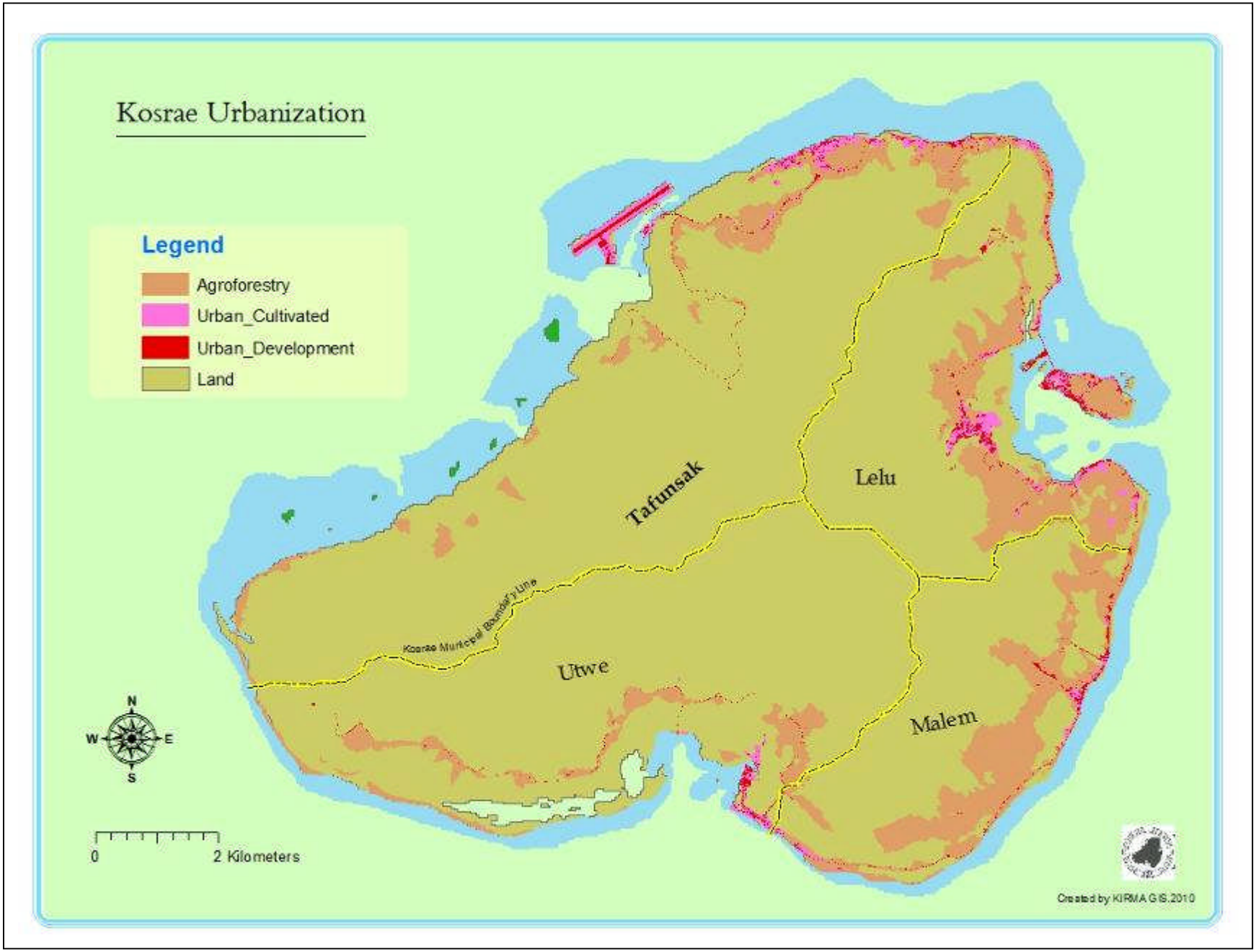
Critical Information gaps: Expert input on sustainable levels of timber harvest is needed. Such information could form the basis of a program to certify timber as sustainably harvested and subsequent legislation to make the sale of unsustainably harvested timber illegal. The PSW (1988) timber survey and the forest inventory assessment (FIA 2009/10) could be used as background data for such assistance. A sawmill is currently being established on Kosrae, and while not yet permitted, the issue of timber extraction will emerge and it would be well to have expert input on the sustainability or lack of sustainability of timber harvest in Kosrae before this issue becomes urgent.

F. Urban Forestry

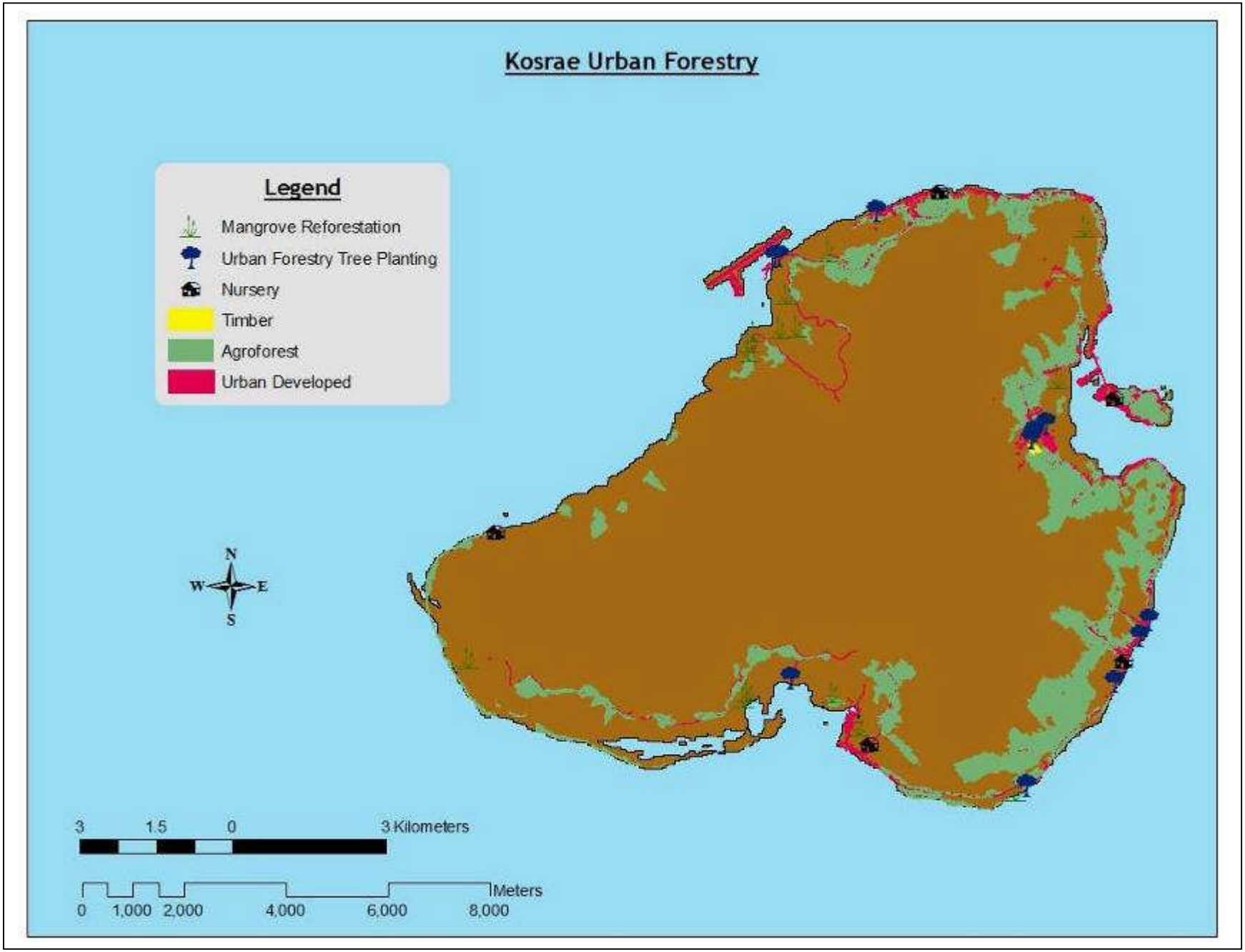
Community forests include trees, forests, secondary forest, agroforests, mangrove forests, watersheds and associated animal life and other natural resources in the areas where we live, work and play. Community Forestry is the management of this resource. There is need to foster an improved environment for all people in Kosrae by organizing and encouraging the planting and maintenance of trees so that communities will be cooler, have cleaner air and water, quieter streets and paths, more peaceful neighborhoods, improved nutrition, sources of materials for artisans as well as building materials and medicines; stronger village economies and more pleasant surroundings in the places where people live, work and play.

Trends: Trees growing in urbanized areas are often cleared for new constructions and some trees present a hazard to safety, in urban and residential settings if not properly pruned. Tall trees near and under power and telephone lines threaten utilities. Development activities in urban areas are also very likely to potentially impact the viability and productivity of the mangrove forests that tend to occur adjacent to coastal urban areas. To increase availability of land for urban development, conversion of freshwater and mangrove swamp areas into landfills have gradually increased over the years. Implementation of sustainable land management plans continues to be highlighted as a crucial key to prevent degradation of these mangrove and freshwater swamp forests. A need for tree-trimming and removal services is developing. The training of Kosraeans in proper maintenance of urban trees would benefit Kosrae by making it possible to prune rather than remove trees in many areas. It could also provide an opportunity to develop a private-sector workforce, providing employment on Kosrae, as well as skills and potential employment to Kosraeans who emigrate to Guam, Hawaii, and other locations.

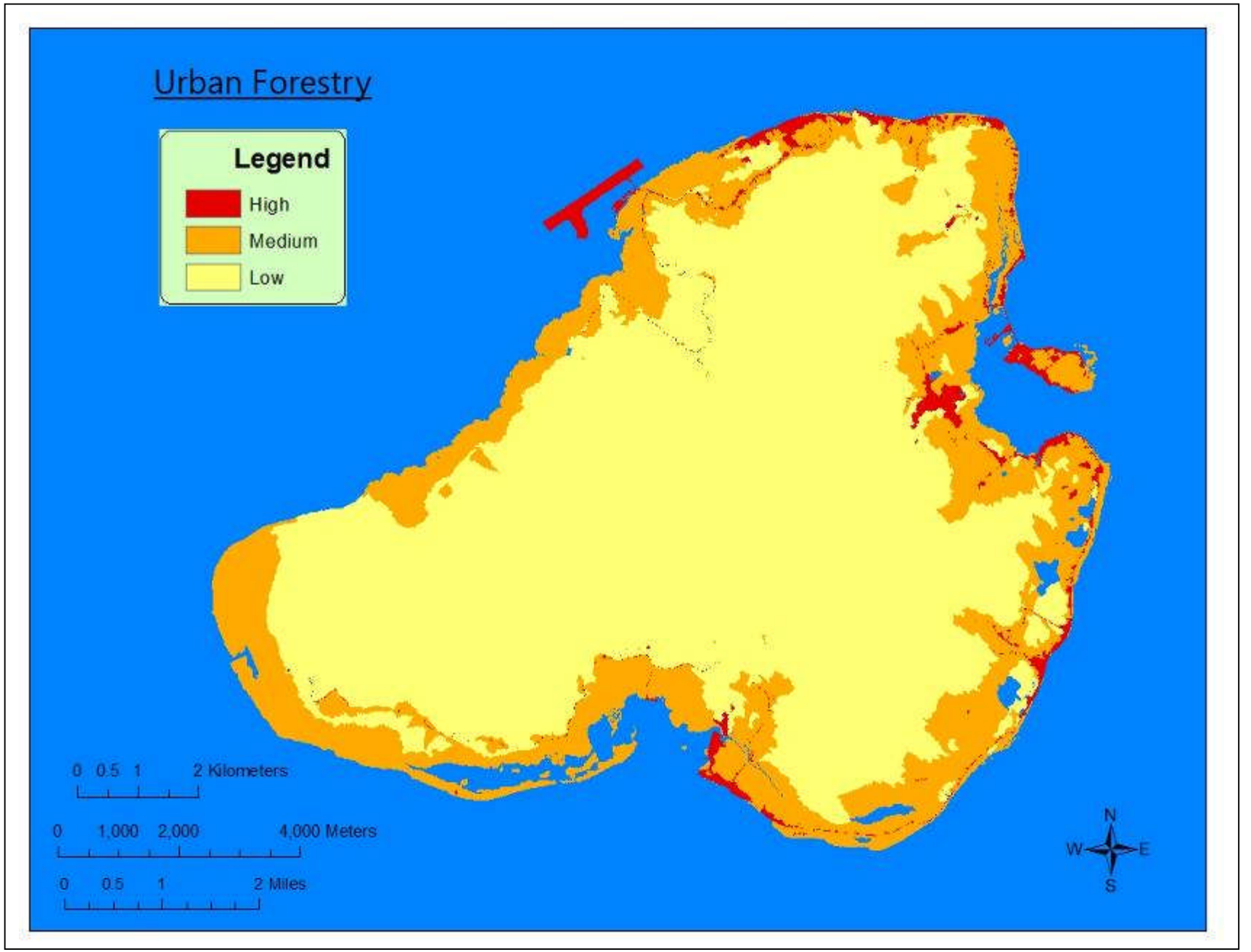
Priority forest landscapes to address issue: Map K-1 shows urban areas in grey. Map K-12 shows urban areas of Kosrae, including areas of urban development, agroforestry, and urban cultivation. Map K-14 shows areas of urban development along with agroforest and sites of mangrove reforestation, urban forestry tree planting, timber planting and nurseries.



Map K-12: Areas of urban development, agroforestry, and urban cultivation



Map K-13: Urban and agroforest areas and sites of mangrove reforestation, urban forestry tree planting, timber planting and nurseries



Map K-14: High, medium, and low priority areas for urban forestry

G. Capacity Building

Two types of capacity development are considered here: 1) of capacity of Forestry staff, and 2) the capacity of communities and the Public.

Building capacity of Forestry Staff: The numbers of forestry staff are low. Table 2 shows the proportion of Kosrae Forestry staff to cooperators. Kosrae currently has 4 full-time forestry staff and 2 part-time staff supported by USFS State & Forestry grants. The S&P program also supports overtime work by forestry staff. Such overtime work is often necessary to accommodate the schedules of visiting advisors and researchers.

Trends: A number of young people are being trained in natural resource areas and if pledged funding from TNC and Conservation International should come through, there may be support for them to work in natural resource areas. The work of KIRMA is also complemented by the Kosrae Conservation Society, an NGO.

Values, benefits, and services: The local forestry staff is needed to provide expertise in forestry to communities who are now eligible to obtain funding through the Micronesian Conservation Trust (MCT) UNDP small grants program (SGP).

Threats: Threats include declines in funding and many demands on the time of the limited staff. The FSM government currently operates on a performance-based budget system. The ability of local forestry staff to achieve budgeted work is often limited by other demands on their time such as attendance at unanticipated workshops, off-island training or assisting visiting members of outside agencies and groups. This limits their time to provide guidance to communities and could have telescoping impacts on the ability of communities to obtain assistance through the SGP.

Opportunities: The TNC and CI have pledged 12 Million U.S. dollars (six million dollars each), to support the Micronesia Challenge. Should some of this support become available to local forestry agencies it could help maintain and perhaps increase forestry staff. Communities are eligible for funding for environmental projects under the UNDP Small Grants Program. This provides a more motivated clientele for forestry staff, and provides leveraging opportunities to greatly expand the impact of S&P funding. In addition, UNDP has made ‘scholarship funding opportunities’ available through a FSM Sustainable Land Management (SLM) Project to enhance FSM’s local capacity in carrying out sustainable land management needs by awarding scholarships to potential college students pursuing degrees in environmental science or natural resource management.

Outside agencies could adapt their programs to the needs of local forestry staff and schedule workshops and trips well enough in advance that they could be fit into the year’s performance objectives. In addition, it would be helpful if workshops result in certification of attendees in needed skills that would contribute to Individual Development Plans.

Building Capacity of the Public and Communities: KIRMA and Kosrae Forestry are well organized to serve communities. Each municipality has Resource Management Committees and women’s organizations, and there is increasing support for communities to undertake environmental projects with assistance from the Small Grants Program. The local forestry staff is needed to assist communities to develop and implement good environmental projects.

II. Resource Strategy

Long-term Desired Conditions

It is anticipated that local communities will be able to develop community forest resource management plans and monitor forest conditions and adapt their strategies and activities as needed. State government would continue its mandates but the community/ municipality would do monitoring of their specific needs & areas. A growing number of Kosraeans will be engaged and employed in forest resource stewardship.

By the year 2020, locally produced food will be more readily available. A Forest Legacy Assessment of Need and a Forest Legacy program will have been developed. At least 20% native upland forest will be protected under the Micronesia Challenge and the rest will be under effective stewardship. By the year 2048, there will be enough timber and good soil to meet each generations needs; streams will run clear, representatives of all natural communities will be present, intact and made up of native and non-invasive species.

Resources

Human resources and sources of funding for addressing this SWARS are summarized in Table K-2. The first column shows the number of Kosrae's forestry staff, column 2 lists on-island cooperators, and column 3 lists off-island agencies and groups whose funding and/or mandates include assistance to the FSM. Row 2 shows sources of financial support for Kosrae's forestry activities. A comparison of the resources in line 1 (people and advisory groups), and line 2 (sources of financial support), shows that Kosrae Forestry has access to much technical and other advice but limited financial support. Given this situation success in obtaining assistance from the baseline S&P grant program as well as the competitive grant program and the Forest Legacy program are critical.

Table K-2: Resources

<table>
<tr><th colspan="3">Human Resources</th></tr>
<tr><th>Kosrae Island Resource Management Authority (KIRMA) Forestry Staff</th><th>On-Island Cooperators</th><th>Off-Island Advisory Agencies & Groups</th></tr>
<tr><td>4 full-time forestry positions & 1 part-time GIS specialist paid by Kosrae Government, Environment Sector Grants</td><td rowspan="2">Dept. of Resources & Economic Affairs, Attorney General's Office, Kosrae Conservation & Safety Organization, Yela Environmental Landowners Authority, College of Micronesia-Federated States of Micronesia Land Grant Program (Kosrae), Kosrae Women's Association , Tafunsak Municipal Government, Lelu Town Government, Malem Municipal Government, Utwe Municipal Government, Department of Transportation & Infrastructure, Department of Education , Kosrae Invasive Species Taskforce, 4 Municipal Resource Management Committees, Kosrae Visitors Bureau, Kosrae Broadcast Authority. Kosrae Girl Scouts…</td><td rowspan="2">Secretariat of the pacific Community (SPC) and their in-country representatives including areas of invasive species and forestry, South Pacific Regional Environment Program (SPREP), SOPAC, The Nature Conservancy (TNC), The Regional Invasive Species Council (RISC), PILN Invasive species group, Pacific Islands Invasive Species Network (PIIN), Pacific Island Ecosystems at Risk (PIER) and other invasive species advisory groups; NOAA, FAO, Micronesian Conservation Trust (MCT), UNDP Small Grants Program (SDP), European Union Conservation and Environmental Education and Protection Program (EUCEEP), Venezuela Gov't., JICA, USFS-PSW (former IPIF), Natural Resources Conservation Service (NRCS), NY Botanical Garden, National Botanical Garden and many others</td></tr>
<tr><td>One full-time & 1 part-time position paid by S&P</td></tr>
<tr><th colspan="3">Financial Resources</th></tr>
<tr><td>Kosrae State Government</td><td>Kosrae and FSM Government funding</td><td>State & Private grants
MCT SGP for communities</td></tr>
</table>

Strategy for investing USFS State and Private grants and other resources in priority areas

As can be seen in Table K-2, the USFS S&P program is one of the few sources of funding available to local forestry agencies, but there are many agencies and groups available to provide technical and other advice. There is thus much opportunity to leverage USFS S&P funding.

Table K-3 lists Strategies by FSM Issues, along with Funding, Cooperators, and Performance Measures and shows how S&P funding will leverage additional funding and actions.

Table K-3: Issues, strategies, S&P funding and leveraging, main cooperators and performance Measures

KOSRAE ISSUES	Strategies & activities for 5-yr SWARS Plan	Resources / Funding:		Main Cooperators	Performance Measures
		S&PF	Others		
A) Food Security	A.1. Establish comprehensive, intensive agro-forestry program that will promote sustainable development and utilization of agro-biodiversity or agro-forestry. A.2. Establish and implement a sustainable 'Invasive Control Program' to prevent degradation of working forests (for food production) .A.3. Improve and strengthen Bio-Security quarantine protocols.	CFHP, CFHP-IP, FRM/ FSP, CE, Western Competitive Grants…	FAO, SPC, UNDP, JICA, Venezuela Gov't.	Dept. of Resources & Economic Affairs, FSM Div. of Agriculture, COM-FSM Land Grant Program, Kosrae Farmers Association…	A.1. Establishment of a permanent 'agro-forestry' program. A.2. Establishment of a permanent 'Invasive Control Program'. A.3. Increase in bio-security quarantine officers; and decrease in bio-security quarantine non-compliance incidents.
B) Coastal Stabilization	B.1. Enhance vegetation of coastal beach strands through re-planting. B.2. Promote Kosrae Climate Proofing Road Development Project (Pacific Adaptation to Climate Change Project) to protect and maintain natural landscapes and ecosystems. B.3. Establish and enact 'Mangrove & Watershed Protection Bill'. B.4. Adopt and implement 'Draft Mangrove & Watershed Management Plan'. B.5. Establish and enact 'Draft Kosrae Shoreline Management Plan'. B.6. Revise and adopt 'Kosrae State	U&CF, FRM/FSP, CE	SOPAC, UNDP (PACC), SPC, TNC, Chinese Govt	Local Municipal Governments, Resources Management Committees, Dept. of Transportation & Infrastructure, Office of the Attorney General, Dept. of Resources & Economic Affairs.	B.1. Increase in coastal vegetation. B.2. Existence of a sustainably developed climate-proofed road. Existence of a 'Mangrove & Watershed Protection Law in place. B.4. Mangrove & Watershed Management Plan adopted and implemented. B.5. Kosrae Shoreline Management Plan adopted and implemented. B.6. Existence of a revised/ updated version of the 'Kosrae State Land Use Plan'.

	Land Use Plan'.				
C) Biodiversity	C.1. Establish and monitor protected forest areas. C.2. Establish and monitor Forest Legacy Areas. C.3. Establish and implement a comprehensive Invasive Management Program. C.4. Request research on Meremia peltata, and other aggressive vines. C.5. Improve/ strengthen bio-security quarantine protocols. C.6. Support implementation of the Kosrae Invasive Species Taskforce (KIST) Strategic Action Plan.(see summary below) C.7. Monitor Wildfire conditions. C.8. Develop a Wildfire Plan and program, including Community wildfire Protection Plans C.9. Establish terrestrial invasive species control program.	FRM/ FSP, Forest Legacy, CFHP, CFHP-IP, Cooperative Fire, CE, Western Competitive Grants	PILN, KIST, SPC, NOAA, TNC, SLM,	Dept. of Resources & Economic Affairs, FSM Div. of Agriculture, FSM National Weather Station, KCSO, YELA…	C.1. Existence and enactment of 'Protected Forest Areas' C.2. Existence and enactment of 'Forest Legacy Areas'. C.3. Establishment of a permanent 'Invasive Management Program'. C.4. Availability of data/ information on Meremia peltata, and/ or other aggressive vines. C.5. Increase in bio-security quarantine officers; and decrease in bio-security quarantine non-compliance incidents. C.6. Decrease in number of KIST incomplete strategic actions/ activities. C.7. Establishment of a wildfire condition or weather forecast recording system. C.8. Existence of a contingency wildfire program developed and adopted. C.9. Existence of a permanent invasive species control program.
D) Watershed	D.1. Establish and enact 'Mangrove & Watershed Protection Bill'. D.2. Adopt/ implement Mangrove & Watershed Management Plan.	FRM/ FSP, U&CF, CE, Forest Legacy, CFHP,	TNC, SLM, JICA, Wallace Research	Dept. of Resources & Economic Affairs, Dept. of	D.1. Existence of a Mangrove & Watershed Protection Law in place. D.2. Adoption of management

	D.3. Effectively manage and maintain native forest cover in watershed areas. D.4. Establish and manage 'Kosrae Protected Watershed Areas'.	Western Competitive Grants…	Foundation,	Transportation & Infrastructure, Office of the Attorney General, Dept. of Health Services-Sanitation Unit, Local Municipal Governments, KCSO, YELA…	plan and development of management regulations. D.3. Increase in native forest cover in watershed areas; improvement in water quality. D.4. Existence of legally declared 'Protected Watershed Areas'.
E) Production & Sustainable Harvesting	E.1. Promote alternative means for wood fuel to alleviate pressure on mangrove harvesting. Repeat Hauff ( ) survey of mangrove harvesting to determine trends in mangrove exploitation. E.2. Continue implementation of Community Reforestation Projects/ Tree Planting Projects.	FRM/ FSP, CE, U&CF, Western Competitive Grants…	MCT, SLM, SPC, Venezuela Govt	Dept. of Resources & Economic Affairs, Resource Management Committees, YELA, KCSO, COM-FSM Land Grant Program…	E.1. Decrease in mangrove gaps. E.2. Decrease in mangrove gaps.
F) Urban Forestry	F.1. Develop and implement community forest stewardship plans. F.2. Establish/ expand public and private Nurseries. F.3. Establish and observe 'ARBOR DAY' F.4. Continue to implement outreach activities during Earth Day, Environment Day, Biodiversity Day, etc…	U&CF, FRM/ FSP, CE…	SPC, SLM, Venezuela Govt	Local Municipal Governments, RMCs, Kosrae Women's Association, Kosrae Girl Scouts, KCSO, YELA,	F.1. Existence of adopted forest stewardship plans. F.2. Existence of private nurseries; increase in seedling production and distribution. F.3. Adoption and observance of a state 'Arbor Day'. F.4. Evident observation of environmental awareness-raising events.
G) Capacity - Building	G1. ICS Training & Certification G2. Tree Worker Training & Certification G3. Arborist Training & Certification	Cooperative Fire, U&CF, CE, CFHP, 'Western	SPC, JICA, TNC	Office of the Attorney General, Local Municipal Governments,	G.1. Development of ICS Training Program and existence of ICS Certified personnel

	G4. Develop 'Staff Development Plans' G5. Develop 'Forest Conservation Capacity-Building Network' that will serve as a vehicle for announcing or obtaining information on funding or training opportunities. G6. Environmental Impact Assessment implementation G7. Assist Communities with development of natural resources stewardship plans. G8. GIS Training and equipment for remote sensing, spatial imagery, geo-database development, and converting old aerial photos to maps G9. Obtain training for wildfire prevention and suppression and the development of Community Wildfire Protection Plans and obtain equipment needed for fire suppression	Competitive Grants'…		Resource Management Committees, Kosrae Utilities Corporation, COM	G.2. Development of a Tree-Worker Training Program and existence of certified tree workers. G.3. Development of a Arboriculture Training Program and existence of certified arborists. G.4. Development of 'staff development plans'. G.5. Improved dissemination of information on training or funding opportunities; increase in the number of training opportunities participated in; increase in funds received through grants. G.6. Development of EIA Training Program; Application of EIA Training in Development Projects. G.7. Development and existence of stewardship plans. G.8. Increase in availability of comprehensive GIS Maps

The Kosrae Invasive Species Plan

The Kosrae Invasive Species Taskforce (KIST) identified 6 thematic areas of concern for invasive species management in Kosrae State: Funding, Public awareness, Commitment, Capacity building, Coordination, and Policy and Legislation. Longer-term strategic goals and objectives have been established for each thematic area.

KIST identified three species of terrestrial plants for immediate priority action in the current and next financial years, *Mikania micrantha* mile-a-minute vine (Mah Tepat), *Leuceana leucocephala* tree (Tangantangan) and *Ischaemum* sp. grass (Mah Sacnsrihk). Marine invasive species are recognized as important and flagged for future action.

The KIST Strategic Action Plan (SAP) establishes goals, objectives, activities, collaborators, timeframe, funding sources and estimated costs for control of these three species. Work plans have been developed to address these terrestrial plants, linked to the KIST mission, and carry through to the end of 2008. For more details, see Appendix.

Program Integration

Kosrae is well organized to integrate S&P programs within Forestry and to integrate Forestry projects with other efforts for holistic resource management. The Kosrae Island Resource Management Agency (KIRMA) is a semi-governmental organization governed by a Board of Directors. It houses the functions of Environmental Protection (EPA), Environmental Education, Forestry and Wildlife, Marine Conservation and Historic Preservation under one roof. Associated with KIRMA are Resource Management Committees (RMCs) in each of the islands 4 municipalities. An Urban & Community Forestry Council oversees the functions of the RMCs and serves as an advisory body to the S&PF programs coordinated through KIRMA. The work of KIRMA is further complemented by the islands main conservation NGO, the Kosrae Conservation and Safety Organization (KCSO). The existence of KIRMA satisfies the requirement for a management agency for the Forest Legacy Program and Kosrae is the pioneer State in the FSM for the development of a Forest Legacy Program that is the subject of the next chapter.

Long-term monitoring of outcomes of activities in priority landscapes and how actions will be revised when needed.

This SWARS is a living document that will be updated as warranted. GIS capacity will continue to be developed and resultant maps will be utilized in future updates. Should updated aerial photography become available, new vegetation maps for Kosrae will be developed and an assessment of current conditions and trends of forest resources will be conducted. Aerial imagery will also be made available to community groups developing community stewardship plans. The availability of LIDAR imagery would enable the development of elevation profiles that are critical to planning for adaptation to sea level rise. Priority landscape areas for specific issues will be monitored and strategic actions will be revised as needed.

List of Kosrae Maps

K-1: Generalized vegetation map of Kosrae
K-2: Kosrae "areas of biodiversity significance"
K-3: Kosrae "areas of biodiversity significance" and protected/ managed areas with color-coded vegetation
K-4: Kosrae Forest Legacy Map
K-5: Kosrae coastal forests and marshlands
K-6: Kosrae coastal hazard zones
K-7: Major watersheds DEM map
K-8: Major watersheds & rivers map
K-9: Highly erodible soils
K-10: Coastal vegetation types utilized or potentially usable for food production, and swamp forest
K-11: Incidence of 3 targeted invasive species
K-12: Urban areas
K-13: Urban and agroforest areas and sites of mangrove reforestation, urban forestry tree planting, timber planting and nurseries
K-14: Urban and agroforest areas and sites of mangrove reforestation, urban forestry tree planting, timber planting and nurseries

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Appendices for Kosrae State

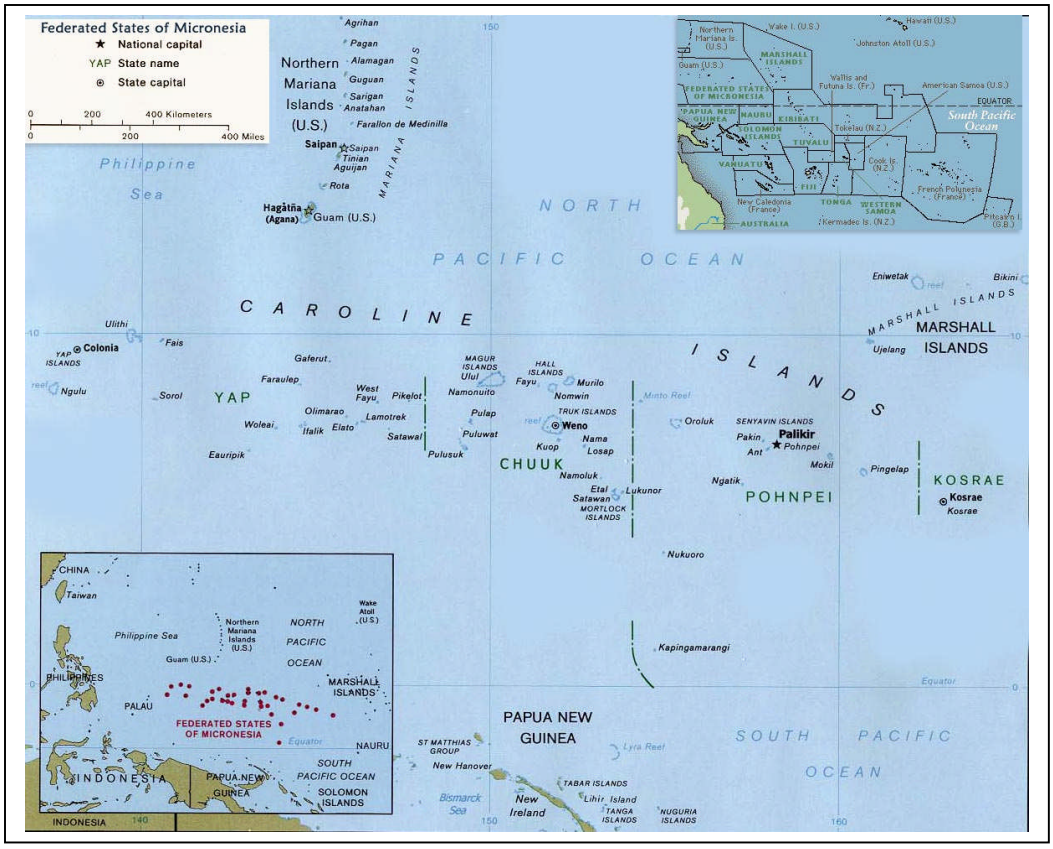
Kosrae Invasive Species Taskforce (KIST) Strategic Action Plan

VI. FOREST LEGACY – ASSESSMENT OF NEED

Introduction

The Federated States of Micronesia (FSM) is a young independent nation. FSM was a United Nations Trust Territory of the Pacific Islands (TTPI) administered by the United States of America until the two nations signed a Compact of Free Association in 1986 leading to the trusteeship termination by the United Nations in 1991. The Compact treaty established a special relationship with the United States and provides economic support to FSM.

FSM is the largest and most diverse part of the greater Micronesian region, and is comprised of four States, which include from west to east: Yap, Chuuk, Pohnpei and Kosrae. All but Kosrae State includes more than one island, and each state has considerable autonomy within the Federation, particularly with respect to land tenure and land management. The total landmass of the FSM is 438 square miles (702 km2) with a declared Exclusive Economic Zone (EEZ) covering over 1 million square miles (1.6 million km2). FSM comprises 607 islands with land elevation ranging from sea level to about 2,500 feet (760 m). The archipelago lies in a broad east-west swath across 1.6 million square kilometers of the western Pacific Ocean above the equator between 1.0-9.90 N and 138.2-162.60 E (see Figure 1). The northeast trade wind belt heavily influences the tropical climate of FSM. Trade winds prevail from December through April and periods of weaker winds and doldrums occur from May through November.



Map AON-1: Map of Federated States of Micronesia

Seasonally May to November the rainfall is extremely high on the volcanic islands of Kosrae, Pohnpei and Chuuk, and can exceed 400 inches (1,016 cm) a year (SPREP, 1993 and Lindsay and Edward, 2000). The region is affected by storms and typhoons (hurricanes) that are generally more severe in the western islands, and by periods of drought and excessive rainfall associated with "El Nino". The droughts of 1982-1983 and 1997-1998 were especially severe on terrestrial habitats, further increasing localized threats to biodiversity. Groundwater sources were taxed, agricultural systems damaged and problems associated with wildfires and invasive species were greatly aggravated. High mean water temperatures especially associated with low water spring tides caused coral bleaching and damage to inshore marine ecosystems (Falanruw, 2001).

The indigenous population is Micronesian with most of the people residing on the main islands of the State capitals. The 2000 FSM Census preliminary count of the population was 107,000. FSM National Census counts and reports are done in 10-year periods. Hence, the 2010 FSM Census count is currently in its initiation phase. Traditional, social and cultural institutions are still very strong in Micronesia. Micronesian society is based on the extended family, which is responsible for the family welfare, especially in relation to customary family land. Ownership of land and aquatic areas varies between States. In Kosrae and Pohnpei, land is both State and privately owned, while aquatic areas are managed by the State as public trusts. In Chuuk, most land and aquatic areas are privately owned and acquired through inheritance, gift or recently by purchase. In Yap, almost all land and aquatic areas are owned or managed by individual private estates and usage is subject to traditional control. In all States, land cannot be sold to non-citizens of FSM (Falanruw, 2001 and URS, 2001). These land and aquatic ownership patterns greatly influence the strategies and actions required to sustainably manage the biodiversity of the nation.

The economy of FSM is largely dependent on aid provided through the Compact of Free Association with the United States of America (SPREP, 1993). The majority of economic activities are government services, wholesale and retail, and subsistence farming and fishing. The government services sector dominates the economy at 42 percent. The commercial tuna fishery (international and domestic) is the nation's second highest revenue earner with annual revenues between US$13–20 million dollars (FSM Government Report, 1999). Fifty thousand tourists entered FSM in 2000, (Kosrae 12%, Pohnpei 37 %, Chuuk 36 %, Yap 15 %), contributing small revenue earnings to the economy of the country (SPREP, 1993). Real GDP per capita for 2001 is US$2030 (personal communications with FSM Economic Affairs).

The national constitution of the FSM is the basis for all legal authority and decision making for the nation. The legislation and institutional framework of the Federated States of Micronesia includes, both National and individual State constitutions with each of the four States functioning as semi-autonomous governments. This structure makes allows each State to enact their own legislation in line with their powers as mentioned in the FSM Constitution to address all issues relating to the conservation of biodiversity.

Individual State environmental and biodiversity regulations are in different stages of development and are being amended as new issues arise. The responsibility for environmental issues is shared between the FSM National Government and the individual FSM State governments. This sharing of responsibility has at times resulted in legislation that appears duplicated at the State and National levels. It has also resulted in gaps in legislation and areas in

which the location of responsibility between the State and National Governments has been less than clear. The States takes the lead role in ensuring that development is avoided in vulnerable areas as well as ensuring that critical natural systems are protected. Each State has made efforts to control development and manage natural resources through the creation of land use plans, coastal zone plans, legislation and regulations. The National Government provides guidance and technical assistance to the States when needed and requested on matters related to planning, economic development, natural resources, fisheries, and the environment.

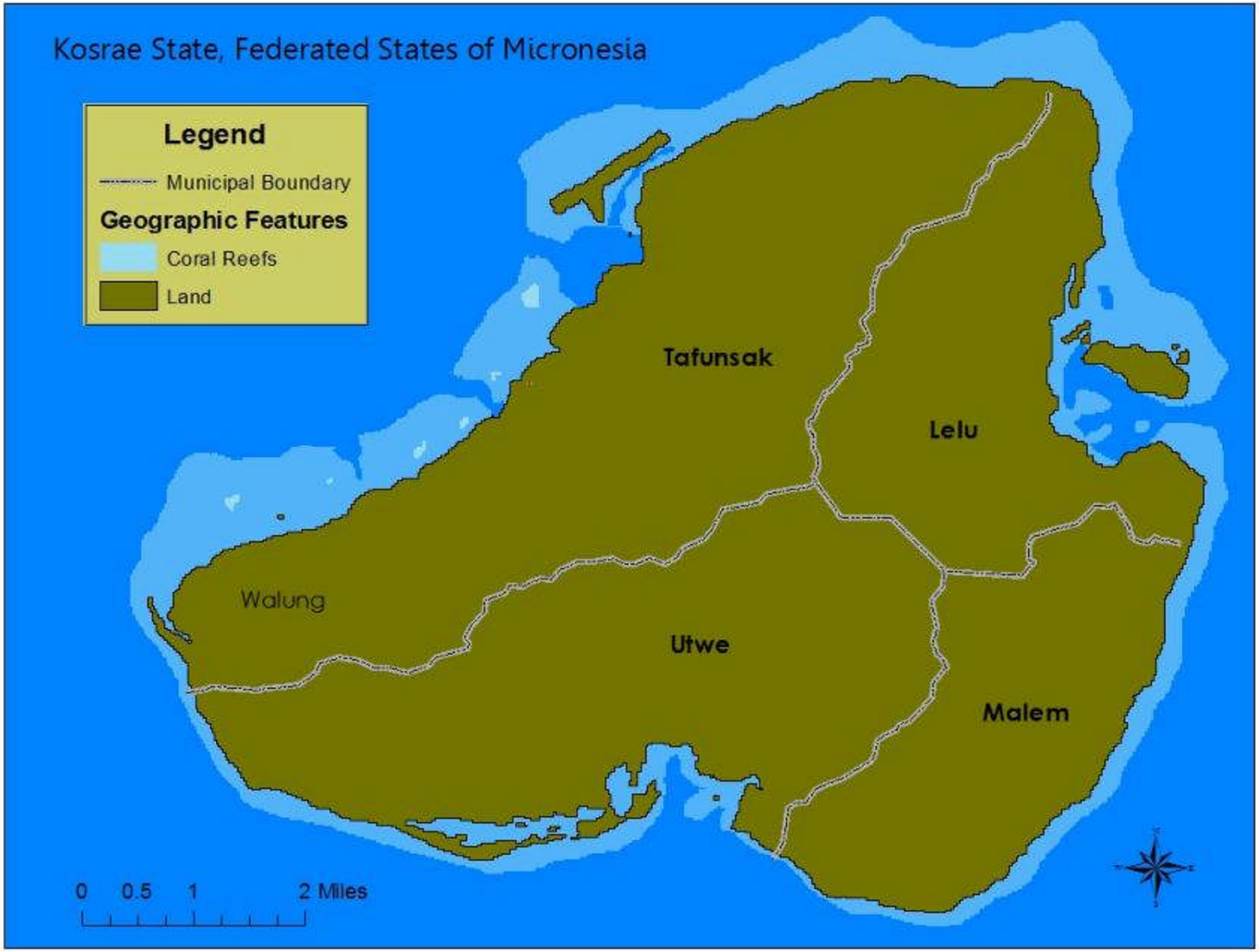
I. Kosrae State

The small volcanic island of Kosrae rises from the Pacific Ocean 2,200 miles southeast of the Philippines and 5° above the equator. The island was settled by at least the first millennium A.D. The first European whaling ships arrived in 1820s, followed by traders, missionaries, copra planters, and after World War II (WWII), Japanese occupation. Following WWII, Kosrae became a United Nations Trust Territory administered by the United States as a unit of the Pohnpei District. Since 1977, it has been part of the Federated States of Micronesia, a nation joined to the United States through the Compact of Free Association.

Kosrae is a remnant peak of an ancient volcano 1.2-2.6 million years old. Its 43 square miles form a triangular patch of land that rises steeply in the center with two peaks over 2,000 feet high. Deep wet valleys tie the basaltic up lands to a wide alluvial plain along the island's perimeter. Most of the island's 7,686 inhabitants live along this perimeter. About 50 percent of these inhabitants are under the age of 16.

Kosrae has four municipalities (Figure 2), each with a municipal office, a school for grades 1-9, and a church. Lelu, the traditional capital and largest municipality (with a population of 2,591) has most of the government offices, a power plant, post office, hospital, a high school, and a number of shops, hotels and restaurants. The other municipalities are Malem, with a population of 1,571; Utwe, with a population 1,067; and Tafunsak at a population of 2,459. Tafunsak is notable for the village of Walung, which is remotely situated at the northwestern end of the island with a population of only 230 residents that are geographically isolated from the other main communities. With the incomplete circumferential road and the difficult access to this remote area, Walung is notable for not having much development, and still sustaining a traditional community lifestyle. Walung operates its own primary school and church.

Kosraean industries include construction, gravel quarries, sand mining, a small petroleum/oil/lubricants storage tank farm, a power plant, an airport, a seaport, and an aquaculture facility. The majority of the labor work force is the public sector, just as in the other Federated States, but many still depend on the land and sea for food. As the population grows and demand for western lifestyle increases, there will be more pressure on island resources. These resources will need sustainable management & regulations.



Map AON-2: Kosrae Municipalities Boundaries

The Kosrae Visitor's Bureau (KVB) estimates that the island receives approximately 2,100 visitors annually, about half are business travelers and the remaining are ecotourists. The island's biggest attractions are the fringing reef, mangroves, waterfalls, lagoons, the Yela Terminalia Forest, and the trails on Mt. Olum, Mt. Poro, and to the steep peaks of Mt. Finkol, Mt. Oma, and Mt. Mutunte. Many tourists also visit Lelu and Menka Ruins. Tourism's busy seasons are December and June through September. There are three hotels that operate on the island.

Kosrae State Statistics

- Location: 163 degrees east, 5 degrees north
- Population: 7686
- Percentage of total FSM Population: 7.2%
- Population Density (per sq.mi.): 179
- Relevant Areas Land Area: 43 sq. miles, 27,420 acres
- Land Area for Agriculture: 4 sq. miles
- Forest Area: 25 sq. miles
- Ocean Area: 560 sq. miles
- GDP (1966): 15.6 million
- GDP per Capita: 2.414% (2003)
- Share of Services in GDP: 6.9 million
- Share of Industry in GDP: 0.05 million
- Share of Agriculture in GDP: 1.3 million
- Percentage Exports of Imports: 22.9
- Main Exports: Banana, Taro, Kava
- Average Rainfall: 240" per year

II. Existing Conditions and Trends

A. Government

State Government

The State Government of Kosrae is similar in structure to the FSM National Government with three branches and a Constitution similar to that of the United States. Most State operations are administered by an elected Governor who heads the Executive Branch that is assisted by cabinet members assigned to primary departments and agencies, and guided by Boards of Directors. The Legislative Branch is comprised of elected representatives for each municipality, and headed by an elected Speaker and Vice Speaker. The Judicial Branch is presided by an appointed Chief Justice and an Associate Justice.

Municipal Governments

Each of the four municipalities also have their own government, headed by an elected Mayor and Council, which oversee and address community issues, needs, and priorities through its standing committees (such as the Ways & Means Committee, Health, Education & Social Affairs Committee, and the Resources & Development Committee). The local government runs their operations primarily on funds appropriated from the FSM National Congress as well as from local revenue generation.

Environmental Protection and Natural Resource Management Authority
Kosrae Island Resource Management Authority (KIRMA) is a semi-autonomous government agency mandated by state law to oversee the wise use and protection of Kosrae's natural resources. The agency houses the following divisions and units: Forestry & Wildlife, Marine Conservation & Surveillance, Historic & Preservation, GIS, Environmental Education, Permitting (which reviews development projects to attempt to minimize environmental impact) and an administrative division.

Other Government Departments and Agencies
Other government departments and agencies, which also have some involvement in natural resource management, include the Department of Resources & Economic Affairs (DREA), Kosrae Visitors Bureau (KVB), and the Kosrae State Land Court, and the Department of Health Services-Environmental Health Division.

B. Non-Government Entities

Local environmental Non-Government Organizations (NGOs) and educational institutions that also support natural resource management and conservation efforts include the Kosrae Conservation & Safety Organization (KCSO), Yela Environmental Landowners Authority (YELA), and the College of Micronesia-FSM/ Kosrae Campus Land Grant Program.

At the municipal level, Resource Management Committees (RMCs) have been established in each of the 5 main communities (Lelu, Malem, Utwe, Tafunsak, and Walung), which are legitimately recognized by municipal charters, and play a participatory role in both local and state natural resource management needs and issues. The RMCs are comprised of volunteers from the local communities that assist in the conservation and sustainable use of island resources. State-level resource management and conservation efforts have become favorably transitioned down to the community-based and community-driven conservation initiatives that are managed by local community groups or private landowners.

C. Social & Cultural Values

Kosrae's traditional culture was highly influenced in the mid 19th century by American missionaries. Today, religion remains a strong influence on Kosraeans. Religion also plays an influential role in encouraging islanders to utilize the environment and the resources it provides with a sense of appreciation and stewardship.

Kosraean families have over many generations lived with extended families, in which food and household needs are a shared responsibility. These large-numbered families acquire their needs usually through subsistence farming and fishing. Traditional fishing and farming practices and techniques have been used and passed on from one generation to another. Over the past two decades, extended families have transitioned into nuclear or immediate families, where the size of the families are much smaller, but with a high tendency to rely on imported western goods.

Natural ecological and geological features, such as the mountains, freshwater swamps, waterfalls, rivers, streams, mangroves, and beaches provides scenic views for both tourists and locals as well as benefits the people socially, financially, and economically. Ancient ruins from the pre-missionary era and World War II are also registered and marked as they are important to the history and culture of Kosrae.

Kosraean is the native and primary language spoken here. English is widely spoken and used, but is only secondary.

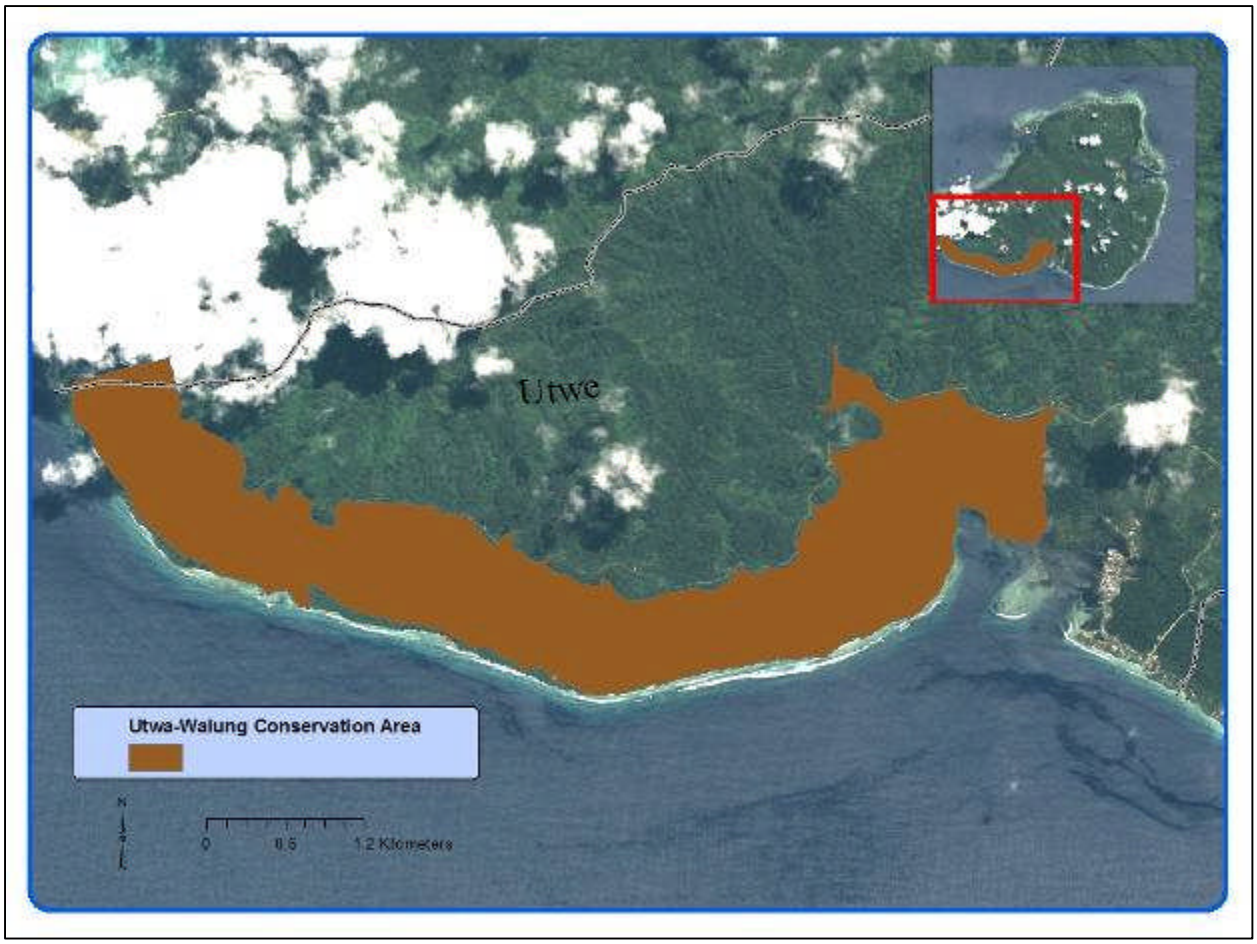
D. Marine Environment

The marine environment of Kosrae is typical of tropical volcanic islands. Habitats include channels, passes, fringing reefs, shallow reef flats, terraces, submerged reefs, slopes, reef holes, embayment, quasi estuaries, sea grass beds, mangroves, and mud and sand flats. Four main harbors nestle along the mostly mangrove-ringed shoreline, alternating with occasional sandy beaches and facing the fringing reef. The reef flats that surround Kosrae are considered to be among the most pristine in the world (KIRMA, 2003).

Kosrae's territorial waters, beginning from the high water mark out to twelve miles, are managed under the jurisdiction of the state government. Beyond the territorial waters the FSM National Government owns a 200 mile Exclusive Economic Zone (EEZ). Although the State owns all marine areas within twelve miles of the reef crest, residents are permitted to harvest freely within the area, except in the Utwe-Walung Marine Park and Trochus sanctuaries (Figure 3 and 4).

The Trochus Sanctuary is located on the reef in the Okat area and extends protection to other species of marine life as identified in the Shoreline and Reef Management Strategy. The Utwe-Walung Marine Park Sanctuary spans a large portion of the mangrove and reef area on the southern side of the island, and covers 727.63 hectares. The park is bordered by Molsron Tukunsru to the west, Infal Yesron on the east, the ten meter elevation contour to the north and the in-shore corals to the south.

Map AON-3: Trochus Sanctuary



Map AON-4: Utwe-Walung Marine Park Sanctuary

According to the 2006 Kosrae Rapid Ecological Assessment (REA), the island's in-shore marine environment hosts over 500 species of reef, estuarine, mangrove and freshwater fishes, 250 of which are considered food fish; 222 species of coral (200 stony coral, and 22 soft coral); 71 species of mollusks; 38 species of algae; 3 species of sea grass; and 40 species of sea cucumbers have been identified and recorded. Eight of Kosrae's marine species are endangered and protected by law: turtles, lobsters, trochus, sea cucumbers, mangrove crabs, corals, bump-head parrot fish, and giant clams. Other declining fish species include mullet fish, rabbit fish, napoleon wrasse, and unicorn fish.

As identified in the 2003 Kosrae State Land Use Plan, mangrove areas are considered part of the island's marine environment. These mangrove areas include mangrove forest and swamps that are situated at the boundary between the near-shore marine and terrestrial environment, also known as the intertidal zone. The mangroves function as essential habitats for a number of important mangrove tree, shrub, fern, and palm species that are adapted to live in and tolerate the daily influence of high and low tides. The mangrove swamps also serve as habitat, spawning, and feeding areas for numerous fish species, mangrove crabs, eels, and some aquatic invertebrates.

E. Terrestrial Environment

The terrestrial environment consists mostly of steep, uninhabitable upland tropical rainforests and lower agro-forest. Together, these two ecosystems account for about 70% of the island's total land area, so virtually all of the population lives in the five coastal villages. Several sandy beaches break through the mangrove shoreline to provide easy access to the narrow surrounding lagoon. The mangrove swamps cover 14% of the island.

Native endemic species include the dusky white eye (*Horsfeldia nunu*) and the only remaining stand of Ka trees *(Terminalia carolinensis)* in the world, known today as the Yela Terminalia Forest, which are identified as an Area of Biological Significance in the FSM Eco-regional Plan, also called the 'Blueprint for Conserving the Biodiversity of the FSM'.

Some of the common domestic animals include pigs, dogs, cats, and chickens. Invasive animal species include the African snail, white flies, frogs, rats, and monitor lizard.

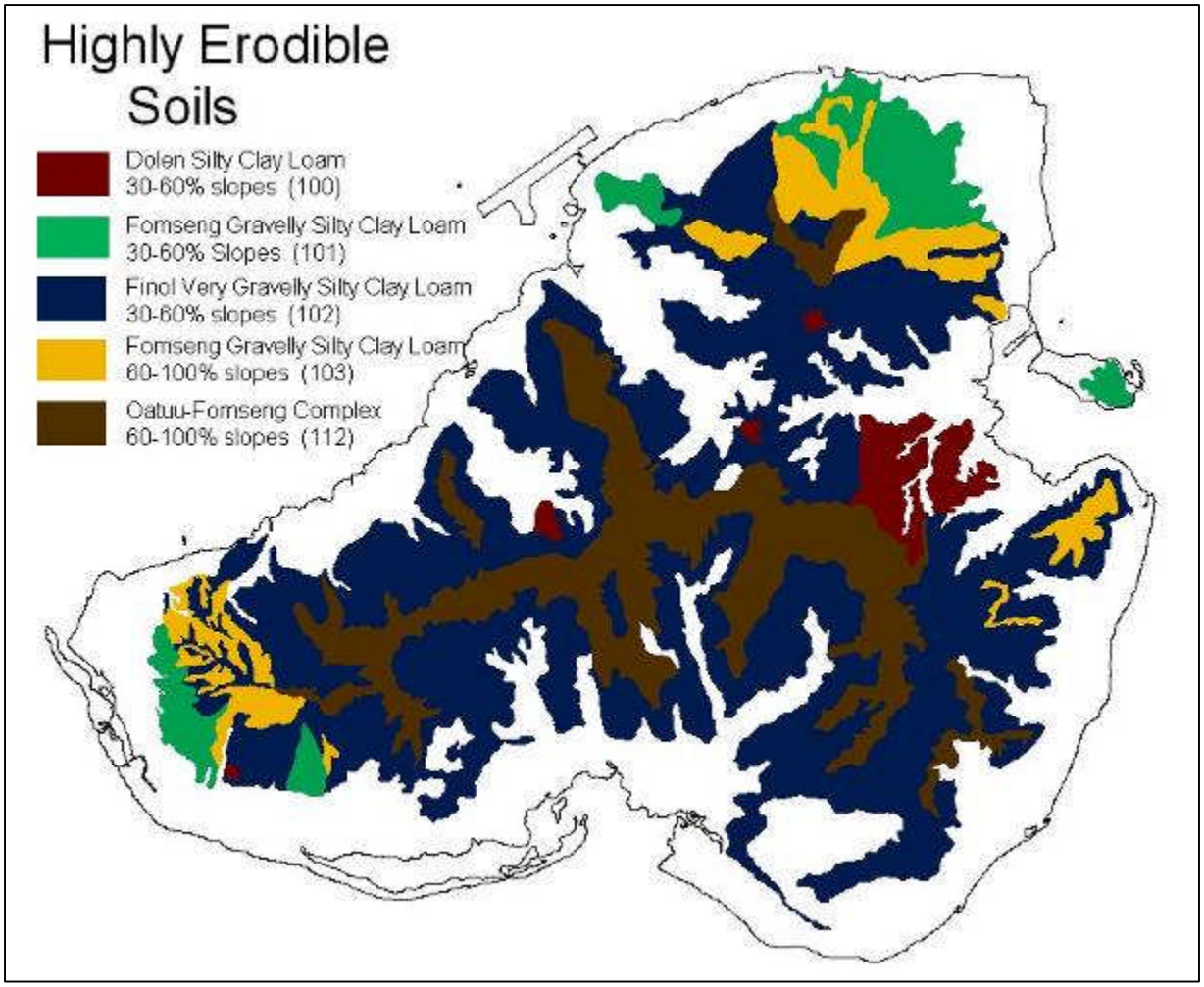
Kosrae exports citrus, banana, and taro to neighboring islands harvested from its agricultural and agroforest areas. Citrus, palm trees, banana, breadfruit trees, and taro plants have always been precious to the people of Kosrae; other plants provide medicine and are used to build shelter and canoes. There are at least 45 species of food crop plants which include fruits, vegetables, aroids, and tubers. Today, planting and shipping of Sakau (*Piper methysticum)* to Kosrae's neighboring island of Pohnpei has also become a major export.

F. Soils

Certain soils on Kosrae are classified as "highly erodible" or "very highly erodible" in the Soil Survey of the Island of Kosrae, Federated States of Micronesia (USDA Soil Conservation Service, 1983). To avoid erosion, vegetation on these soils should not be disturbed. Vegetated stream-sides serve as filter strips and buffers can mitigate erosion generated from other lands.

Table AON-1: Kosrae Soil Classification

Soil #	Soil Name	Erosive
100	Dolen Silty Clay Loam, 30 to 60 percent slopes	High
101	Fomseng Gravelly Silty Clay Loam, 30 to 60 percent slopes	High
102	Finol Very Gravelly Silty Clay Loam, 30 to 60 percent slopes	High
103	Fomseng Gravelly Silty Clay Loam, 60 to 100 percent slopes	Very high
112	Oatuu-Fomseng Complex, 60 to 100 percent slopes.	Very high



Map AON-5: Highly Erodible Soils of Kosrae

Because sediment carried by streams to the shoreline can damage mangroves, seagrasses, coral reefs and other ecosystems; several areas with highly erosive soil have been identified in the Land Use Plan as Areas of Particular Concern. Additional erosive soils and stream banks throughout the island deserve special consideration.

To date, no assessment on the productivity of Kosrae's soil types have been conducted. However, the people of Kosrae tend to do their farming and agricultural work in the agroforest and freshwater swamp areas as they find these areas more suitable and productive for their agricultural activities.

G. Mineral Resources

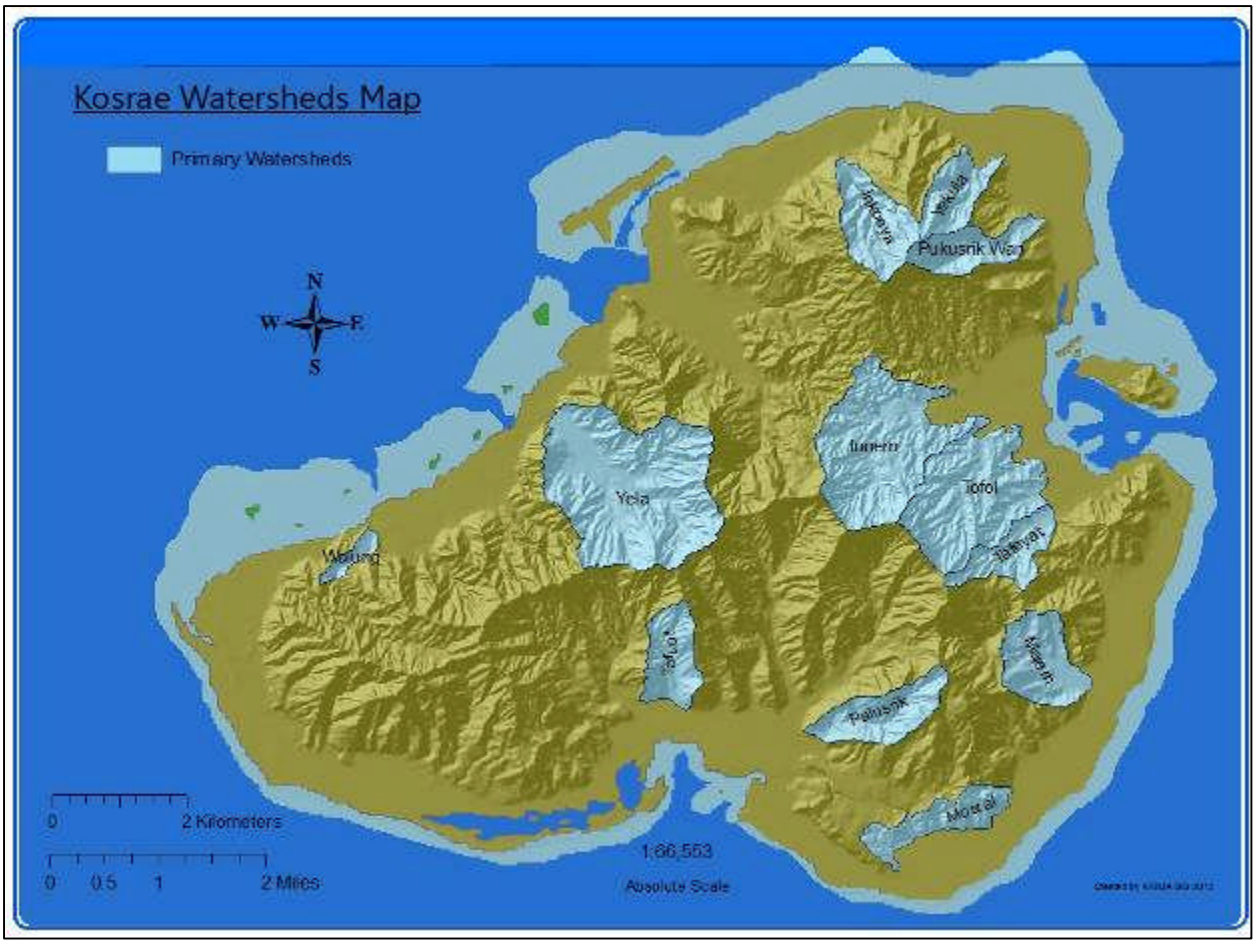
The volcanic island of Kosrae is formed entirely from basalt, and has no known mineral deposits. Limestone dredged from the coral reefs is the only useful material available and used particularly for road construction and landfills, which material cannot be found in forest areas. Therefore, mineral resource potential is not a consideration in any Forest Management Plan.

H. Water Resources

There are six sources of fresh water on Kosrae: wells and springs (groundwater), streams, dams, swamps, and rainwater catchments attached to tin roof buildings or structures. All take advantage of the Island's abundant rainfall, which averages 200 inches near the coast and 240 inches in the mountainous interior. In some parts of the beach strand, wells tap a shallow layer or lens of freshwater underlain by saltwater. However, these wells only rarely provide drinking water because their water quality is poor. There are few upland wells and springs on Kosrae as well. The U.S. Army Corps of Engineers recognizes 22 perennial streams on the island. Most flow into the three harbors of Utwe, Okat, and Lelu. Rainwater catchments are common on Kosrae. Rainwater collected from the roofs of buildings is stored in large cement or plastic catchments for household use and drinking water.

The Kosrae Land Use Plan proposes a Central Watershed Reserve, to be generally located in the central part of the island, on steep mountain slopes. By encompassing the steepest land, the most erosive soils, and the upper elevations with the highest rainfall, the reserve would protect the most sensitive parts of the island's watersheds. The Kosrae Land Use Plan also recognizes eleven primary watersheds draining into dams that supply water to the villages:

1. Mutunte River Basin
2. Yekula River Basin
3. Pukusruk River Basin
4. Innem River Basin
5. Tofol River Basin
6. Tafuyat River Basin
7. Malem River Basin
8. Mosral River Basin
9. Palusrik River Basin
10. Tafuot River Basin
11. Walung River Basin



Map AON-6: Kosrae Watershed Map

I. Biodiversity

Kosrae's significant biodiversity is the foundation of the island's long-term economic self-sufficiency. The island has at least 511 vascular plant species, of which 261 are indigenous, including 31 endemic species (found nowhere else on earth besides Kosrae). Its oceans are home to over 500 species of fish and 222 species of coral.

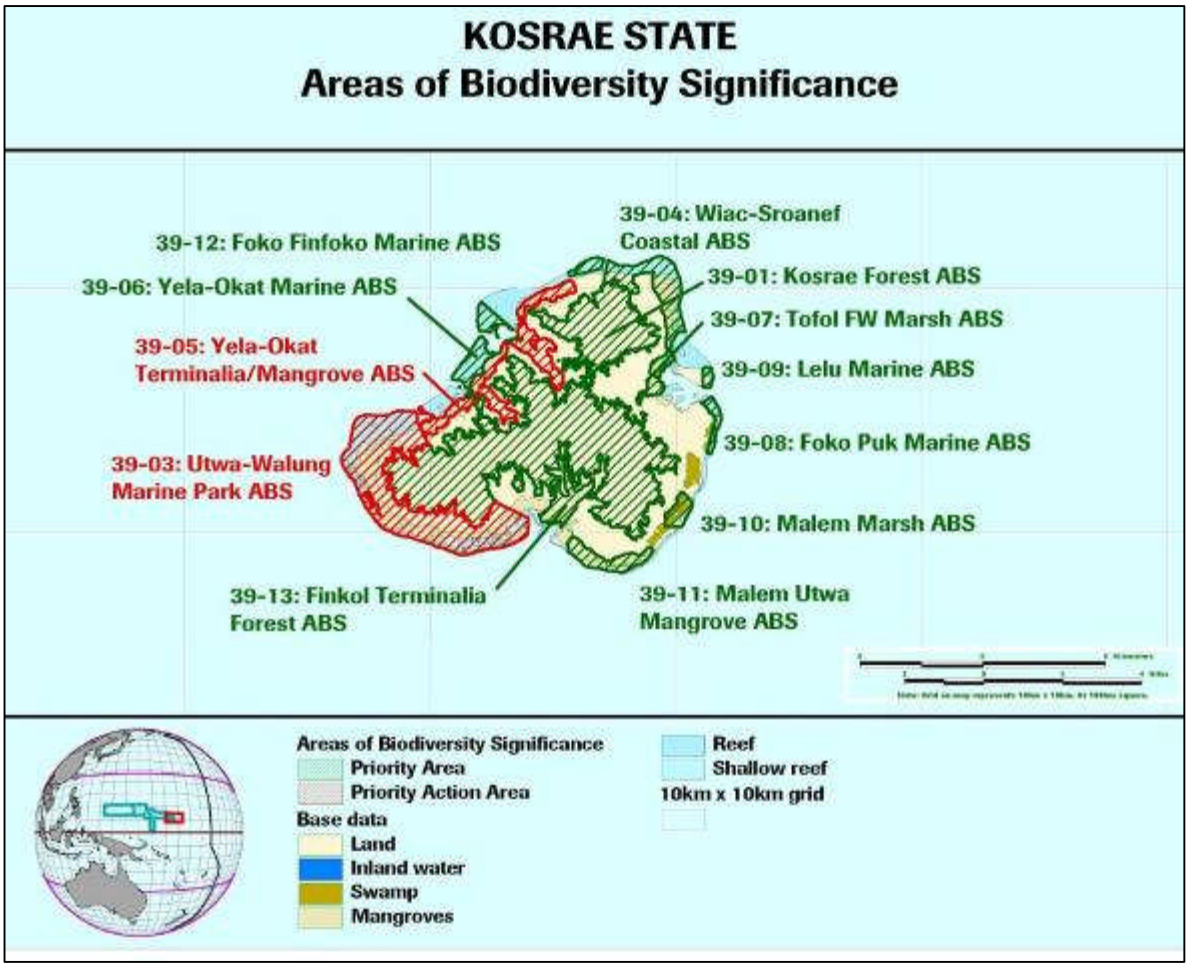
The FSM Conservation Blueprint was produced to identify species, natural communities, and ecological systems that represent the biodiversity of FSM; to record the best remaining examples of where these species, natural communities, and ecological systems occur; and to define, delineate, and prioritize "Areas of Biological Significance" or clusters of high quality examples of species, natural communities, and ecological systems. Among the 130 Areas of Biological Significance (ABS) identified nation-wide, 12 are located in the island state of Kosrae (see Table 2 below).

Table AON-2: Areas of Biological Significance

ABS Site Type	Number of ABS Sites	Area Size (hectares)	Area (acres)
Terrestrial Sites	2	4,835	11,948
Marine Only Sites	1	55	135
Coastal Marine Sites	5	1,466	3,624
Coastal Freshwater Sites	4	1,905	4,707
TOTAL	12	8,261	20,412

The identified and delineated ABS sites in Kosrae encompass conservation targets that include ecosystems, natural communities, or individual species either highly significant in biological value or threatened, such as the Kosrae flying fox, Micronesia pigeon, Caroline Islands swiftlet, Terminalia/ Nypa swamp forest, Grouper spawning aggregation sites, coastal freshwater marsh, coconut crab, high-island nearshore marine, fern-sedge savanna, mixed broadleaf forest, montane cloud forest, Napolean wrasse, bump-head parrot fish, turtle nesting beaches, estuaries, mangrove forest, atoll forest-beach strand complex, and seabird nesting areas. Following are the Kosrae ABS sites as identified and coded in the FSM Conservation Blueprint:

- 39-01: Kosrae Forest ABS
- 39-03: Utwe-Walung Marine Park ABS
- 39-04: Wiyaa-Sroanef Coastal ABS
- 39-05: Yela-Okat Terminalia Forest ABS
- 39-06: Yela-Okat Marine ABS
- 39-07: Tofol Freshwater Marcsh ABS
- 39-08: Foko Puk Marine ABS
- 39-09: Lelu Marine ABS
- 39-10: Malem Marsh ABS
- 39-11: Utwe Mangrove ABS
- 39-12: Foko Finfoko Marine ABS
- 39-13: Finkol Terminalia Forest ABS



Map AON-7: Areas of Biological Significance

J. Forests

The forests of Kosrae can be divided into several different types, which are included in the list of vegetation types on Kosrae shown in map below (Figure 8). The most basic difference between these forests is the elevation. The lowest elevation forests are the Mangroves, which are found along the coast, while the highest elevation forests are the Native Upland Forests and Dwarf Forests. In between these forest types are Agroforests and Swamp Forests. Most of the population of Kosrae can be found around the coastal areas of the island. Hence, the main areas that are cultivated for growing food trees and crops such as coconut palms, breadfruits, bananas, papayas, sour sops, mangoes, pandanus, as well as various garden crops are also located within the coastal areas.

1. Mangrove Forests

Mangrove forests found in the intertidal zone are very ecologically and socially important. Both inner and outer mangroves trap sediment and silt runoff, which protects

coral reefs from the most destructive effects of sedimentation. The forests also provide fuel wood and timber. Many marine species particularly crabs and fish, but also birds and lizards depend on the mangrove for the sheltered habitat it provides.

The outer edges of the mangroves protect the shoreline from erosion by tidal currents, common waves, and any storm waves that are not stopped by the fringing reef. Low seaside areas can wash away if there are no mangroves to protect them. Filling in mangroves not only reduces these ecological contributions but also increases flooding during heavy rains due to the mangroves' impaired ability to drain the area.

Mangroves on Kosrae are characterized by the presence of nine tree species. The unique Suhkasrihk (*Rhizophora*) mangrove trees include three species and one hybrid: Suhkasrik fwel (*Rhizophora apiculata*), Suhkasrik loes (*Rhizophora mucronata*), Suhkasrik fototo (*Rhizophora stylosa*), and Suhkasrik lolacp (*Rhizophora x lamarckii*). Also present are the Sroal (*Bruguiera gymnorhiza*), Fulofohl (*Sonneratia alba*), Tuhi (*Xylocarpus granatum*), and the increasingly rare Oi (*Lumnitzera littoralis*). Fahsuc (*Nypa fruiticane*) is also common, and Kwacngi (*Pemphis acidula*) is found mostly along the western side of the island. Some of the largest and oldest mangrove trees in the Pacific are found on Kosrae reaching approximately 30m in height with trunk diameters up to 1.5m wide (Merlin, et al 1993). However due to increasing pressure to over harvest, this forest type has decreased in size over the years.

2. Native Upland Forests and Dwarf Forests

The interior of Kosrae consists of steep mountain ridges, peaks, and valleys. Almost 70 percent of the island is mountainous, and many slopes have gradients greater than 60 percent. Dense vegetation covers much of the uplands, with plant types and species changing with elevation. The undisturbed upland forests of Kosrae are good examples of tropical rain forest vegetation. Further, many species of rare plants and animals live in the rain forests and on crested slopes. Dwarf or moss forests occur at lower elevations in Kosrae than in other parts of the world in the wet cloud zone of mountain peaks and ridges. These forests are characterized by stunted trees and epiphytic bryophytes, ferns, fern allies and orchids. The principal forest genera here include *Horsfieldia, Neubergia, Psychotria, Syzgium, Campnosperma, Macaranga, Cyathea, Dendrocnide, Boehmeria*, and *Ficus*, and the only indigenous palm, *Ptychosperma ledermanniana*. Species diversity is high and many different species of ferns, both terrestrial and epiphytic, are present (Zicus, in Press WWF).

Kosrae's upland forest has high value for both watershed protection and conservation of biodiversity, including endemic species. Forests are important water sources that nourish freshwater streams and groundwater of Kosrae. Their cover also helps prevent the erosion that occurs when steep slopes are cleared. Erosion forfeits valuable topsoil as well as pollutes water by adding silt and sediment to streams, swamps, mangroves, and coastal waters. Guidelines and recommendations for managing forests for watershed protection are found in the "Highly Erodible Soils and Stream Sides" Special

Consideration District and in the "Rivers and Water Resources" Area of Particular Concern.

3. Swamp Forests

Swamp forests occur in freshwater wetlands frequently just inland and upstream of mangroves, but also can be found on inland habitats where drainage is impeded. Swamp forest values in Kosrae include aesthetics and biodiversity, as native swamp forests are typically dominated by the endemic tree *Horsfeldia nunu* and the towering buttressed *Terminalia carolinensis* that is endemic to Kosrae and Pohnpei. Swamp forests are also valued for their canoe logs, timber, wildlife products and as a habitat for modified wetland agroforest that provides freshwater taro and other food crops. Additionally, Swamp forests provide ecological services typical of many wetlands: flood control and settling basins for sediment.

4. Agroforests

Agroforests occur primarily on the lower slopes of Kosrae and are characterized by a spatial and temporal mix of introduced and native trees and other species with economic and cultural value. Small patches and clearings are interspersed with older, structurally complex forests of mixed species. The agroforest system has high "agroethnobotany" value, as it encompasses both indigenous cultural practices and varieties and species of traditional plants. More recently introduced species are incorporated into the system to provide additional products. Though agroforests are a human disturbance of native forests, they do provide moderate to good watershed protection, especially relative to Western agricultural practices and urban land uses (see Section IV.B.1 for more details).

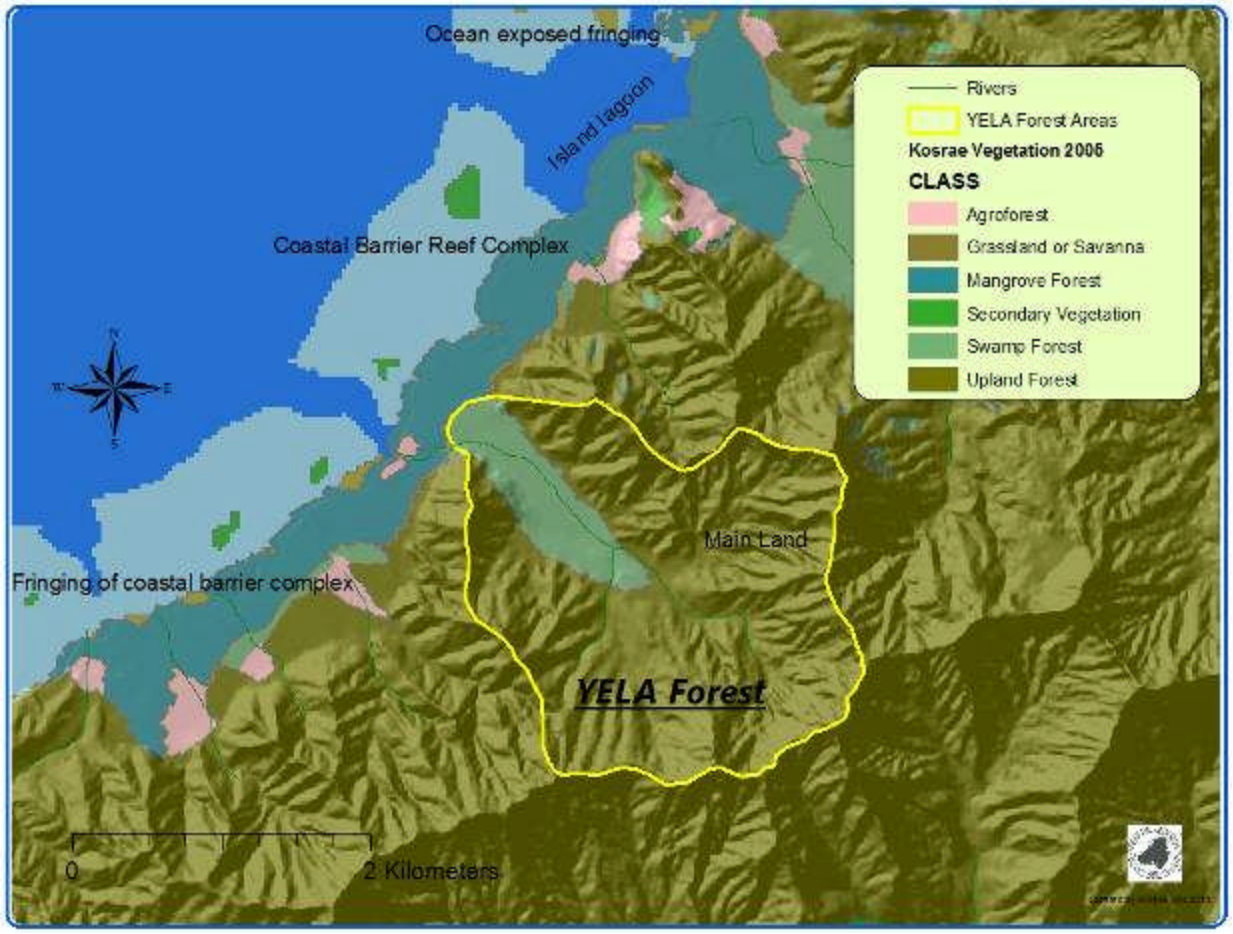
5. Littoral Plant Communities

A variety of plants can be found in coastal areas which are characterized by the community they occur within as well as the range from low-growing herbs and vines to large trees. Vines and grass are not as common here due to intolerance to shade and salt spray. These communities and some of the uses for these plants are:

a) *Herbaceous Strand* - contains non-woody plants that live above the high-tide water mark on sandy or rocky shores. On Kosrae the most extensive herbaceous plants are found on the south and southwestern sides. Plants include *Ipomea pes-caprae* and *Vigna marina*. Some of these plants growth entangles, which are used to form mats or helo to trap and build up nutrients in the soil.
b) *Littoral Shrubland* - is found on windy coastal ridges and slopes, or on the seaward edges of coastal forest strands. Plants found in the littoral shrublands in Kosrae include the *Scaevola taccada*.

c) *Pandanus Scrub* - is dominated by the pandanus plant and can be found usually on rocky, often exposed, windswept shores. Pandanus is hardy short stature trees that are salt resistant with cropped roots. This tree can produce edible fruits.

d) *Littoral Forest* - is the most common vegetation found on tropical shores. Common trees are *Barringtonia asiatica, Hernandia sonora,* and *Calophylum inophyllum,* which serve as habitat and feeding areas for birds. Other plants are are *Vitex trifolia, Pemphis acidula, Scaevola tacada, Ipomea* spp., *Tournefortia argenta, Guettarda speciosa, and Terminalia* spp.



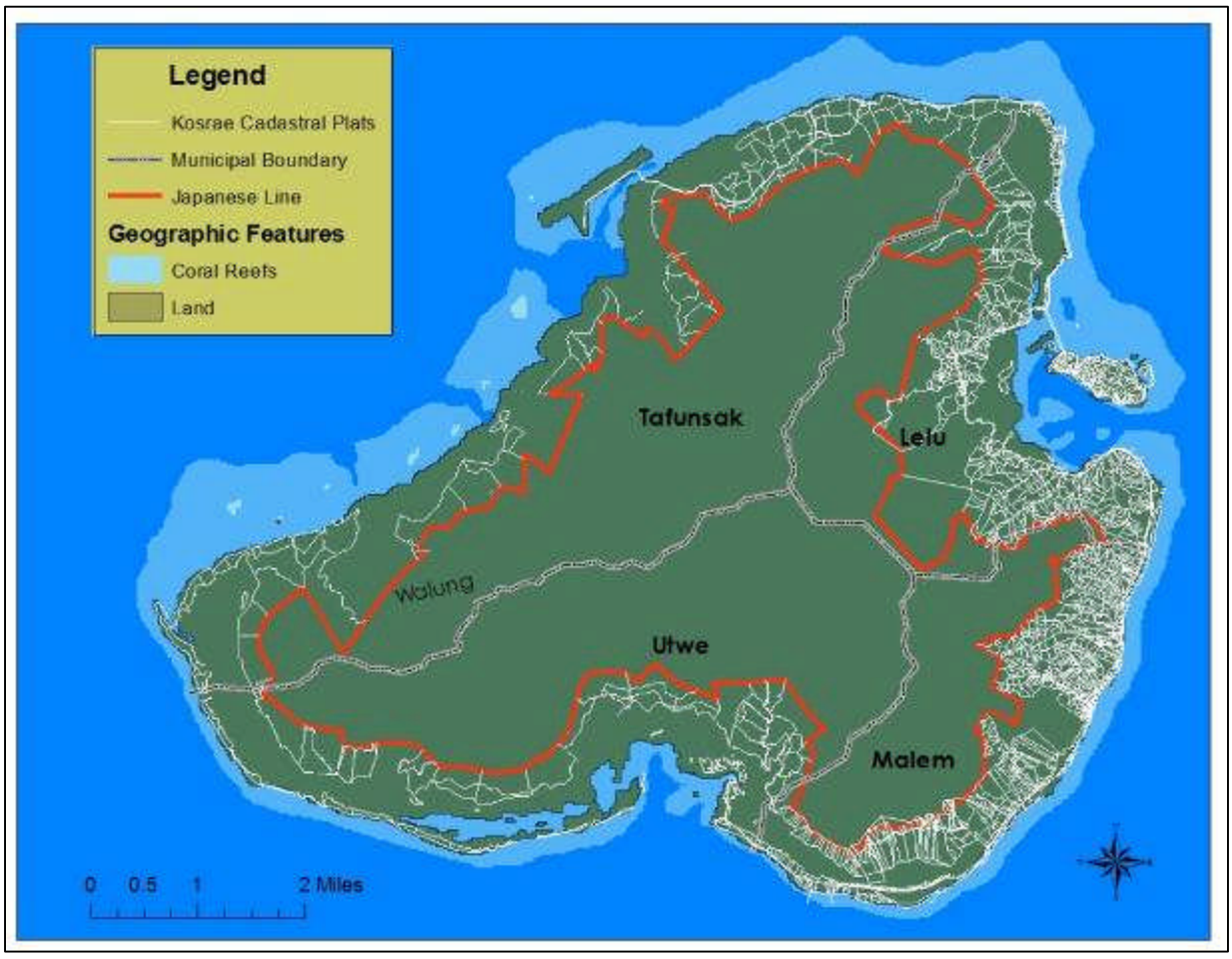
Map AON-8: The Yela Forests on Kosrae

K. Public & Private Land Boundaries

Land ownership on Kosrae is probably more important today than ever before because of the world recession, high prices of imported energy and food, and the need to provide homesteads for newly formed families in a society that is still primarily dependent on subsistence farming.

In addition, the commercial and residential areas of Lelu, Tafunsak, Malem and Utwe contain numerous households but there is little space for expansion of agriculture activities, or for construction of additional family dwellings. The low, flat land and accessible areas with associated utilities are just now becoming economically valuable to landowners where private investment is expanding into marine and tourism industries.

During the Japanese occupation of Kosrae (from 1930 to 1945), public lands were expanded to include the shoreline below the mean high water mark (including all mangrove forests), and the upland forests above the "Japanese line", a line that was arbitrarily placed by the Japanese administration to restrict access to the upland areas as well as to manage the development or utilization of these upland forests (Figure 9). Through this demarcation, authority of all land above the Japanese line were taken away from the rightful landowners and declared as 'community forests'.



Map AON- 9: Kosrae Japanese Line and Public and Private Boundaries

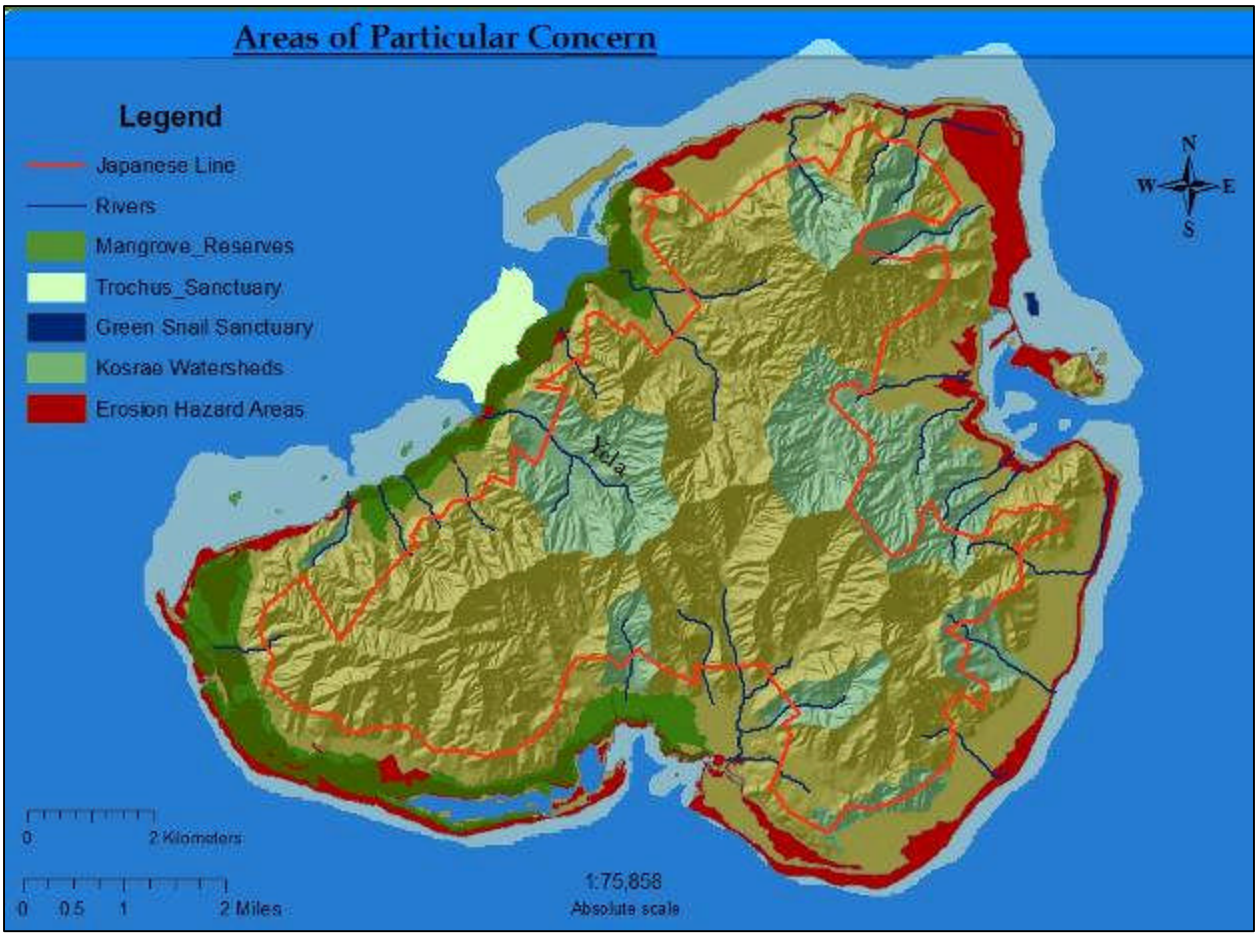
According to the Kosrae State Land Use Plan (KIRMA 2003), the land above the Japanese line includes approximately 67 percent of the total land area of Kosrae, and most of this land is still under the control of the Kosrae State Government. As much as 50 percent of this area is too steep for development and should be maintained as forests for watershed protection. However, Amendment 19 of the 1995 Kosrae State Constitutional Convention now allows reclamation of

land above the Japanese line by the original landowners or their descendants. Land will be awarded by issuing a Certificate of Title in 'fee simple' to an individual or a representative of the heirs; allowing for restoration, utilization, or occupation of the land. Note**:** In becoming private lands again, all upland forests above the Japanese line will be included in proposed Forest Legacy Areas for Kosrae.

The land tenure system in Kosrae is based on individual property rights. Land may be owned by both males and females and is usually divided among siblings upon the death of the parents. Land ownership is important because subsistence farming provides local families with a significant portion of their food supply. Almost all families on Kosrae own land, but land sales are increasing. The long-range impact of land sales may result in a scenario in which certain families come to own a majority of the land on the island. Land may be sold at the discretion of the landowner, but not to non-citizens of FSM (Article XI, Section 7 of the State Constitution, and Article XIII, Section 4 of the FSM Constitution) or to FSM citizens who are not of Kosraean descent (Amen. 17; 1995). Under the Kosraean Constitution and the Land Code, there are no provisions for leasing.

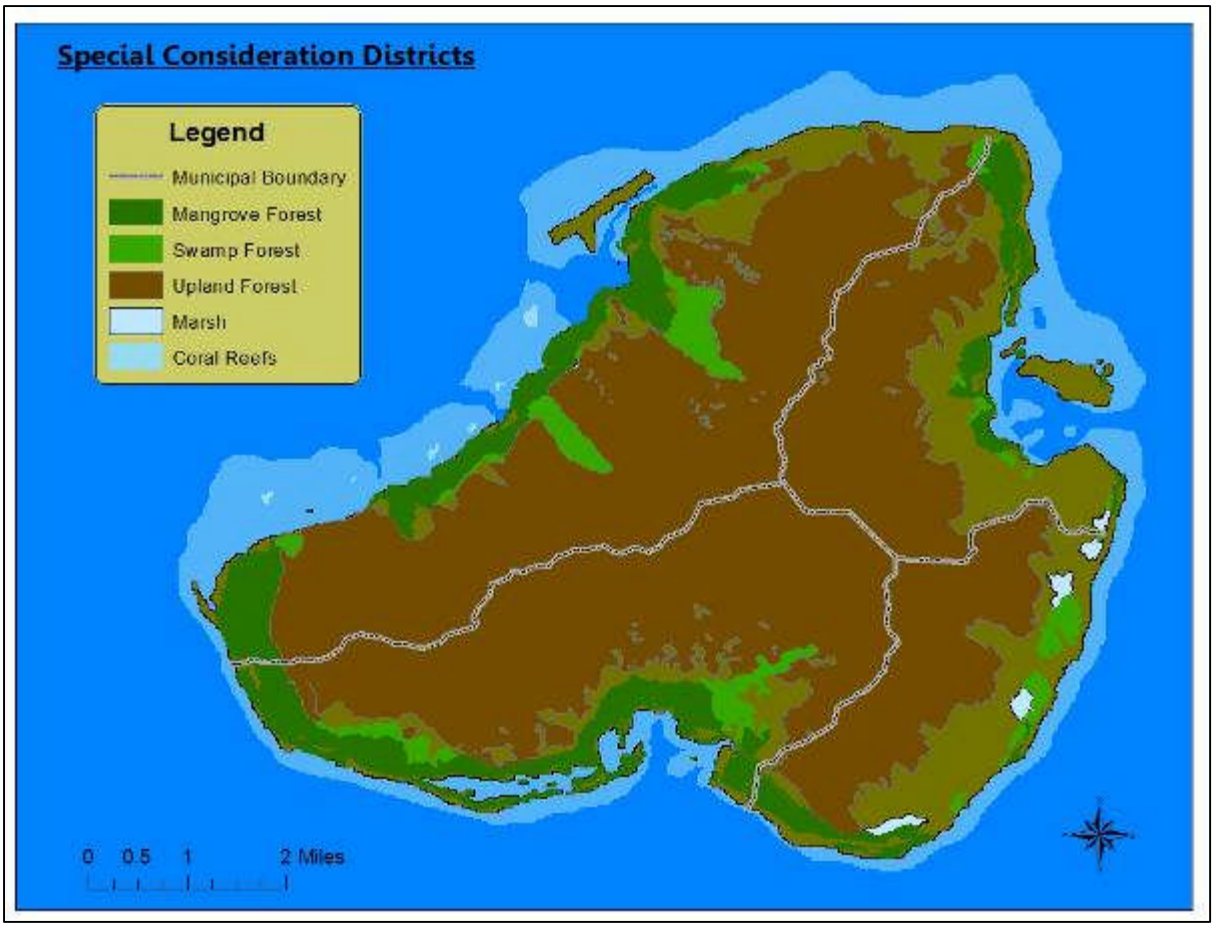
The Division of Survey and Mapping is in the process of surveying all private property boundary lines. Currently, 94 percent of the total area of private property boundary lines has been finalized: 96% in Lelu, 87% in Malem, 94% in Tafunsak and 100% in Utwa Municipalities (not including land above the Japanese line). Boundary disputes have slowed the project considerably, and the courts decide irreconcilable boundary disputes. The mangrove wetland areas in Kosrae are public land and provide local residents with valuable resources and services. Any activities that would alter these areas, such as filling in mangroves, require permission in the form of government-issued land use rights. It is customary, however, for landowners to exercise a sense of ownership over adjacent or abutting wetland areas. The second Kosrae State Constitutional Convention passed an amendment granting rights to Municipalities and community members requiring that they are notified and consulted prior to any development activity in public wetland areas in addition to the acquisition of government issued land use rights (KIRMA, 2003)

The Kosrae State Land Use Plan also identified and delineated 'Areas of Particular Concern' and 'Special Consideration Districts' to help guide the development of management and conservation strategies covering the following areas: Forests, Shoreline and Reef, Waste Management, Utwe-Walung Marine Park, and Historical Site Preservation. Areas of Particular Concern include Mangrove Reserves, Shoreline Erosion Hazard Areas, Rivers and Water Resources, Mouths of Rivers, the Trochus Sanctuary, the Green Snail Sanctuary, Cultural & Historical Sites, and areas identified in the FSM Conservation Blueprint as Areas of Biological Significance. These areas are identified as Areas of Particular Concern because of their sensitive ecological, cultural, and social requirements.



Map AON-10: Kosrae Areas of Particular Concern

The Special Consideration Districts includes Mangroves, Freshwater Wetlands, Upland Forests, Ocean Waters from the reef crest to twelve miles out, the Shoreline and Reef, and Highly Erodible Soils and Streambanks. These ecosystems are designated Special Consideration Districts because of their important ecological value to the sustained life of the island as well as they also require special review when being considered for development.



Map AON-11: Special Consideration District

III. The Need for a Forest Legacy Plan

The Kosrae Assessment of Need will serve as the Forest Legacy Plan. This Plan will be more fully developed over time as elements of existing critical environmental protection plans (Nationwide Environmental Management Strategies, National Biodiversity Strategy and Action Plan and Federated States of Micronesia National Biodiversity Strategy and Action Plan) are incorporated. Additionally, it is hoped that legislation focusing on the protection of forested areas, extraction regulations, and Best Management Practices will be brought into law and enforced. Clearly the Forest Legacy Plan will incorporate these actions if they are ever formalized. The primary elements of Kosrae's Forest Legacy Plan can be found below.

A. The Importance of Forest Resources

1. Timber

There is currently no timber industry in Kosrae, nor are there any significant tree plantations on the island. The rugged, high steeped landscape of the island is not suitable for timber plantations. The main use for local timber is for traditional uses such as: canoe building, house posts, fencing, and household furniture.

2. Protection of Carbon Storage and Sequestration Potential

It has been suggested that the active management and sustainable use of carbon, much of which can be found in trees and root systems, can help reduce the harmful effects of carbon dioxide in our atmosphere. A number of studies suggest that carbon storage and sequestration play very important roles in climate change by removing harmful carbon dioxide (CO^2) from the atmosphere via photosynthesis in plant matter (Asner 2009). The development of carbon markets is also occurring globally to incentivize 'smart' growth and 'green' living. While it is not known the role, if any, small island nations may have in the global carbon market (volunteer based or otherwise), it is important to stay abreast of possible future financial incentives that could be associated with carbon. This issue may become important to consider when developing conservation easement language in the future.

3. Traditional Non-Timber Materials

The people of Kosrae use the forest for a wide variety of needs and purposes. Fuel-wood, handicrafts, wood crafts, canoes, local medicine, local lotions and fragrances, leis, and stems, tubers, fruits and nuts are some of the products obtained from the forest resources. Kosrae has a conservative system of local healers who use plants and/or parts of plants to treat patients. Since it is difficult to reach the native forest, most of the non-timber products produced in Kosrae today are usually obtained from the secondary forests and agroforests.

4. Eco-tourism

As mentioned earlier, The Kosrae Visitor's Bureau (KVB) estimates that the island receives approximately 2,100 visitors annually. About half are business travelers, and the rest are ecotourists. The island's biggest attractions are the fringing reef, mangroves, waterfalls, lagoons, the Yela Terminalia Forest, and the trails up Mt. Olum, Mt. Poro, and to the steep peaks of Mt. Finkol, Mt. Oma, and Mt. Mutunte. Many tourists also visit Lelu and Menka Ruins.

5. Wildlife Habitat

With the island's interior being mostly of steep slopes, the upland forest is relatively inaccessible and undisturbed from development, hence being able to provide a healthy habitat for wildlife. Native and endemic bird, animal, and plant species use the forest for their survival, including species that are rare, threatened and/or endangered.

6. Subsistence Livelihood

The people of Kosrae still rely greatly on its forest resources for subsistence living. People utilize both plant and animal resources from all forest types for food supply, wood-fuel, medicinal needs, and for non-timber products and materials which can be a source of income.

7. Water Resources & Water Quality

One of the most important functions of the forests in Kosrae is the protection of watersheds. The rugged mountains and steep slopes on the island's interior are covered with native forests that protect highly erodible soils and fragile streambanks from erosion

caused by heavy rainfall. The intact upland forests also retain some of the rainwater in the soil where it slowly seeps through the ground, or into streams during the dry seasons providing for a more even stream flow during the year. The presence of intact forests also helps sustain the quality of the island's water resources. In addition, the quality of both the surface and ground water affects the viability of all its associated ecosystems.

8. Research & Education

The single, volcanic island of Kosrae has all its natural ecosystems uniquely, yet meticulously interconnected, with a wide array of natural ecosystems and wildlife species. Some research has been conducted on the marine and terrestrial environments, such Forest Inventory Assessments, Vegetation Surveys, Mangrove Forest Gap Assessments, etc. However, more research studies and assessments still need to be done to better understand the nature of Kosrae's forest ecosystems.

The outdoor environment can also serve as outdoor classrooms for students, youth, and college students, which are often encouraged by the local schools, environmental NGOs, and resource management agencies.

B. Threats & Constraints on Kosrae's Biodiversity

Generally, the people of Kosrae consider anthropogenic threats to forest integrity to be of utmost concern. Together with increased population rates, recognized threats to Kosrae's forests include over-harvesting or overexploiting resources; using inappropriate/destructive harvesting methods; pollution; habitat modification and destruction; climate change; and introduction of alien invasive species.

For the marine sector sedimentation, net fishing and use of chemicals are causing the majority of problems, but there is concern that new technologies used for fishing may be even more destructive. Also of concern is the health of some commercialized or exported species such as mangrove crabs, giant clams, and sea cucumbers. Coral dredging, landfill in the mangrove forest areas and boat anchorage are causing marine habitat modification while oil spills, littering, and land-based sources of pollution, including waste dumps in mangrove areas, are the main pollution concerns.

For terrestrial areas, harvesting mangrove trees for fuel and hunting of significant species are of utmost concern for biological resources. For instance, people use mangrove wood fuel almost every day for cooking, *um* (pit ovens), traditional occasions like funeral meals, and other commercial purposes. This creates a large demand for mangrove wood. Other problems include the pollution of rivers and habitats by littering, chemical and oil spills, pigpens, pesticides and fertilizers, and scattered dumpsites. A significant number of households in the State of Kosrae have their own pigpens, but often do not have septic tanks or pits to catch the waste, and so contribute to runoff pollution in habitats and rivers. Freshwater swamp forests are threatened by either fill or drainage, and potentially by overharvesting. Infrastructure development and general construction, landfills, land clearing, gravel quarrying, burning, and diverting rivers and streams have all modified the terrestrial environment. The circumferential road and farm roads into the inner part of the island modify the island by allowing access to new areas, and landfills and road

construction damage plant and animal habitats. The constraints in addressing these problems are similar to those of other States, including funding, lack of awareness, coordination, and overall capacity.

1. Agriculture & Food Security

The production of food in Kosrae is very important and subsistence agriculture is one of the primary activities among island residents. Along with fishing, agriculture provides most of the basic food for Kosraeans. Coconut, breadfruit, taro, bananas, cucumber, and unique citrus fruit provide for much of the food crops. Between 1975 and 1983, agricultural land increased from 16 percent to 23 percent of the total area of Kosrae. In the past twenty years, the amount of land used for agriculture has continued to increase. Because of Kosrae's rapidly increasing population, more forestland may need for agricultural uses.

Most of Kosrae's agricultural land is farmed with a traditional cropping system called "agroforestry" that combines food crops (annuals) with tree crops (perennials) at the same space and time. This type of farming typically does not exhaust the soil fertility and continues to provide food and other crops such as timber, fiber and medicine. However because of projected population increases and possible soil infertility from over-cultivation, Kosrae's traditional cropping system may be threatened. Changes in farming practices could decrease the values provided by traditional farming systems in nutrition, cultural preservation, ecological balance, and rural economic stability as almost all food production (subsistence, local market and export crops) occurs on traditional family-owned farms (KIRMA, 2003). Agriculture production is the primary livelihood for most Kosraean citizens, and is also one of the main activities contributing to the loss of biodiversity. Social and economical benefits sought after through agricultural production, particularly mono-cropping that involves a significant amount of land clearing activities, threatens the natural forest coverage of the island.

With respect to the Forest Legacy program, conversion of native forest to agroforest is a threat to native biodiversity and may be a degradation of watershed function, but agroforest has its own values and is a form of "working forest" allowable in Forest Legacy. Conversion of forest to non-forest agriculture is a threat to all forest values including biodiversity, watershed and agro-ethnobotanical/cultural values.

2. Roads & Other Infrastructure

The main road extends from Okat past the villages of Tafunsak, Malem, and Utwe, and includes Lelu Island. Currently, nearly 70 kilometers of road have been completed on Kosrae and 37 kilometers are paved. To date there are four road segments that have been completed, namely, RS-1, RS-2a, RS-2b, and RS-3. The RS-4 and RS-5 segments are under construction and comprise the remaining 10 kilometers of the circumferential road. The segments shown with dashed lines in the map below are not yet physically under construction (Figure 12). Completion of these road segments will connect the road from Okat to Utwe Village. Construction of a cross-island road was proposed in 1986 along with the circumferential road. Plans for the cross-island road have been designed and construction is waiting for the availability of funds.

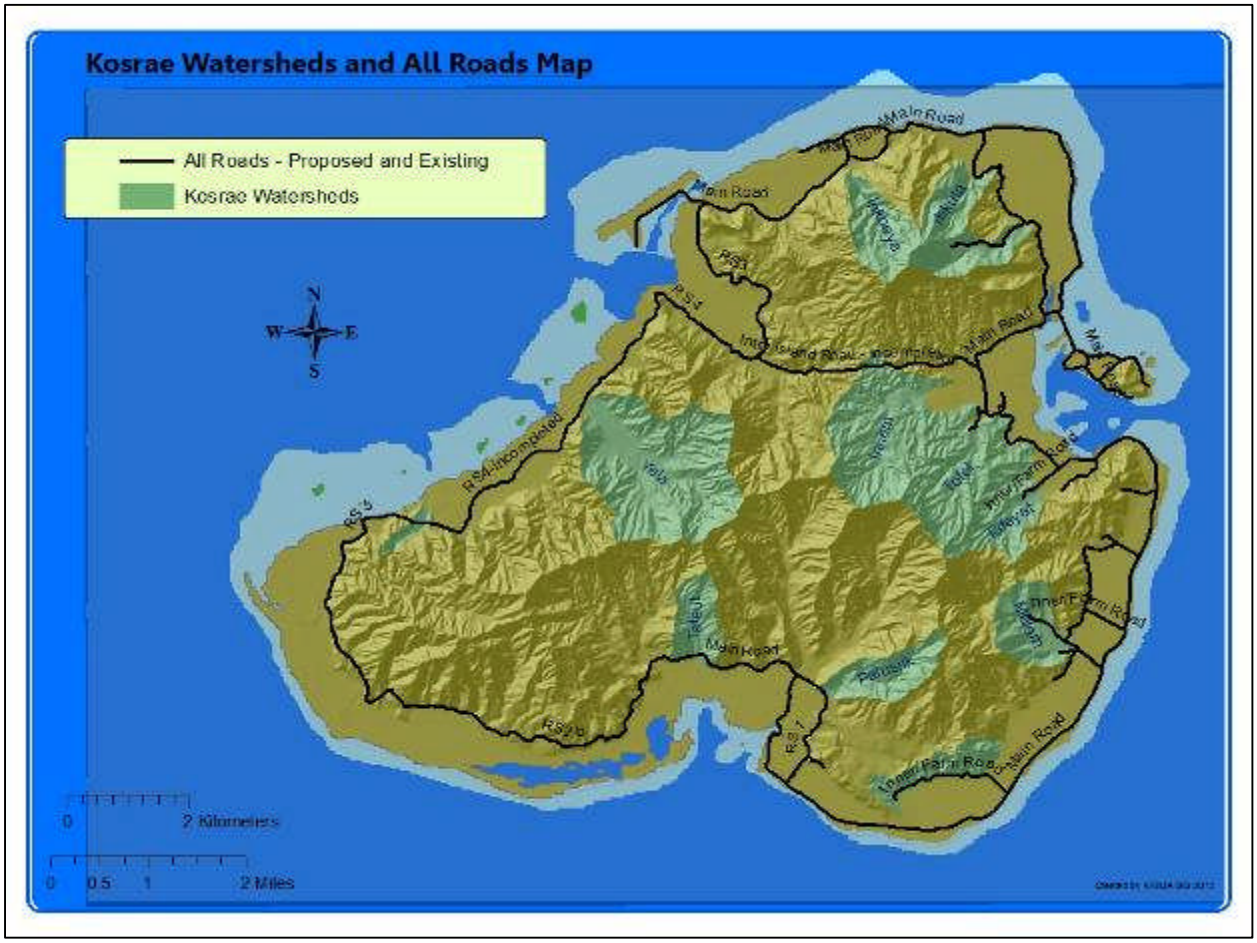
State and municipal roads not only provide direct access to forests but also extend the reach of secondary and private roads. Roads pose direct threats to forests not only by their "footprint" (clearing for a new road) but also by impounding water, diverting freshwater flows, and can even lead to the conversion freshwater and mangrove wetland forests to non-forest types. Roads pose indirect threats to forest values as they open land to agriculture and development, as well as threaten interconnected ecosystems and contribute to erosion and sedimentation.

Map AON-12: Kosrae Roads

There are potential threats associated with socio-economic needs such as: public school facility improvements and services, airport operations, hospital facility and services, etc. More corporate investments opportunities are being sought through large grants from foreign governments/countries, or foundations. These large grants for large-scale projects usually require large areas for development, as well as need resources for clearing, quarrying, and sand mining which generally impact intact forest areas of the island.

The watersheds are threatened primarily by erosion and sedimentation, mostly due to the construction of the circumferential road and smaller farm and village roads. The "Kosrae Watershed Assessment Draft" (McKean 1994) discusses road erosion issues and suggests

several matters that must be addressed in order to appropriately manage watershed areas in the face of future development. Streamside management will also be critical to watershed preservation.



Map AON-13: Kosrae Watershed and Overlay with Roads

3. Land Ownership Changes

The Kosrae State Land Use Plan designates and delineates all lands above the Japanese Line, as 'Special Consideration Districts' and also designated it as 'community forests' during the Japanese administration. Although the Land Use Plan document provides management and conservation guidelines, there are no accompanying legislation or regulations set in place for the protection of these upland forests. Without appropriate forest protection legislation in place, the greatest threats to forests in Kosrae is related to changes in land tenure and the potential claiming and clearing of forest above the Japanese line that converts native forest to agroforest, housing or agriculture.

4. Invasive Plant and Animal Species

One of the greatest threats to the long-term survival of native biodiversity in small and fragile island environments such as FSM is the spread of both intentionally and inadvertently introduced alien species. Invasive plant and animal species pose a serious

threat to Kosrae's native forests. Many invasive species invade disturbed areas, where they sometimes establish non-native secondary vegetation that may not allow the reestablishment of native species. Shade-tolerant invasive species may move into areas of native forest that have not been disturbed at all and may, by their shade tolerance, prevent the re-growth of young native trees. Invasive species introduced to one part of the island may be spread all over the island by birds, water ways, wind, humans, and other vectors.

About 50 percent of plant species found on Kosrae are introduced; some of these introduced species have become invasive pests that have widely established themselves. According to a "Invasive Plant and Weed Species of Kosrae Survey" conducted by the USDA Forest Service in 2000, over 40 invasive plant/ weed species have been found to be present in Kosrae, in which ten have been identified as the Top 10 Invasive Plants/ Weeds for Priority Action under the Kosrae Invasive Species Taskforce (KIST) Strategic Action Plan:

- Siam Weed *(Chromolaena ordata)*
- Bronze-leaved Clerodendrum *(Clerodendrum quadriloculare)*
- Wedelia *(Sphagneticola trilobata)*
- Giant Bramble *(Rubus molucannus)*
- Commelina *(Commelina diffusa)*
- Bottle Gourd *(Luffa sp.)*
- Mile-A-Minute *(Mikania micrantha)*
- American Joint Vetch *(Aeschynomene Americana)*
- Creeping Vine *(Clerodedrum sp.)*
- Ischaemum *(Ischaemum sp.)*

Comprehensive lists of aquatic invasive organisms, marine invasive species, and terrestrial invasive animals (e.g. African land snail, cane toad, Crown of Thorn, feral pig, monitor lizard, etc) have not been developed to date. The identification, assessment, control and/or eradication of all invasive species have been highlighted as a priority for the nation.

The spread of alien invasive species is a continual threat due to increased movement of people and machinery between the islands, and across political and biological/geographical barriers. These movements need to be carefully monitored and controlled to prevent further spread of invasive species. Further development and agriculture provide vectors for the spread of invasive species as equipment and people may introduce new species and spread species across the landscape. Increased control measures that evaluate organisms transferred between and within islands of FSM need to be addressed, as current legislation and enforcement is minimal. The implementation of rigorous programs, associated facilities and well trained personnel are required to minimize the potential of possible negative impacts of alien species on native biodiversity.

5. Climate Change and Sea Level Rise

Unlike the other FSM States (Pohnpei, Chuuk, and Yap), Kosrae does not experience a high frequency of typhoons/hurricanes. Most of Kosrae's agricultural lands are low lying

near the coast, thus are vulnerable to sea level rise, storm surges, salt water infiltration, and salt spray impacts on vegetation. The Agroforests and Swamp Forests are also vulnerable to changes in precipitation and hydrological regimes such as flooding from the upland areas. Climate change and sea level rise is anticipated to impact the natural landscapes and ecosystems of Kosrae by degrading biodiversity, causing increased flooding and associated coral reef deterioration, forcing agriculture activities to move in and upland and consequently impacting Kosrae's food security. It is crucially important to develop climate change and sea level rise adaptation strategies and measures. Protection and enhancement of Kosrae's forests will help sustain the services and products received through the island's biodiversity. Protecting the island's mangrove and swamp forest could also play a critical role in keeping the inland human and animal populations from catastrophic storm events (Figure 14).

Map AON-14: Mangrove and Swamp forests in the Yela area on Kosrae.

6. Forest Related Legislation

There is currently no existing forest legislation. The Kosrae State Code encompasses all of the general environmental protection legislative provisions; however, there is no legislation specifically designed for the protection of forests. The Kosrae State Land Use Plan only provides guidelines and recommendations for forest management and conservation measures. The Development Review Permitting Process administered by

KIRMA, can stipulate project development conditions where forests are impacted, but it does not have any full prohibition of unsustainable activities on any forests. Hence, specific legislation and regulations must be established for the effective protection of forests and forest resources.

C. Goals and Objectives of the Assessment of Need

The principal goal of the Forest Legacy Program in Kosrae State is to aid in the protection and management of high priority native forests that are currently in private ownership or will be transferred to private ownership in the future. Essential to achieving this protection is to reduce the threat of converting forests to non-forest uses. This will be achieved by implementing the following objectives:

- Protect and manage private lands encompassing native forests critical for:
  - Watershed protection, ensuring water quality and quantity
  - Sustainable supplies of forest products including but not limited to food, shelter materials, medicines, hand craft materials, etc.
- Sustainable management of private traditional agroforest areas.
- Protect wildlife habitat, rare plants, and biodiversity.
- Maintain habitat connectivity/corridors and related values.
- Protect riparian areas and other key forest types.
- Maintain and restore natural ecosystem functions.

The Forest Legacy Program attains these goals by purchasing land or development rights from willing private landowners. The principal goal of the Kosrae State Assessment of Need (AON) is to define how the program will be implemented to reach the program goals.

The AON defines a Forest Legacy Area (FLA) as a large area within Kosrae which has forests of high value facing significant risks. The FLA in Kosrae includes private land, land above the Japanese line that may be released to private ownership in the future, and some public land. The FLA designation does not impose any restrictions or change land rights in any way; it only identifies the area which is eligible for the Forest Legacy program. Privately owned parcels of land that lie within or partially within the Forest Legacy Area, will be eligible for voluntary participation in the program. When a landowner or set of landowners in one area apply to the Forest Legacy program to sell their land or a conservation easement, this is called a Forest Legacy Project. Any grant funding will be awarded by the USDA Forest Service to the FSM National Government – Department of Resources & Development, and then fully or partially sub-allotted to the Kosrae Island Resource Management Authority. Any ownership or conservation easements purchased will belong to the Kosrae State Government.

D. Criteria, Eligibility, FLA Selection & Program Amendments

The criteria required for determining priorities for forest protection has been developed as part of the Blueprint for Conserving the Biodiversity of the Federated States of Micronesia and the National Biodiversity Strategy and Action Plan (TNC, 2003). This "Blueprint" lists "Areas of Biological Significance" and/or the areas that capture the most and best examples of the

conservation targets in order to attain conservation goals. This list essentially became Kosrae's Potential Conservation Areas in the FSM National Biodiversity Strategic Action Plan. Appendix 3 provides the list of potential conservation areas for the nation, including Kosrae State, based on this process. The Forest Legacy Area will include all lands within the Kosrae terrestrial Areas of Biological Significance including the Kosrae Forest Conservation Area, Yela-Okat Terminalia/Mangrove Conservation Area, Finkol Terminalia Forest Conservation Area, forested portion of Utwa-Walung Marine Park, Utwa Mangrove Conservation Area. Marine and mangrove areas are not included in the Forest Legacy Area because they are categorically not private lands. The Kosrae Forest Conservation Area boundary roughly encompasses the same general area as the forested lands above the Japanese Line, which are currently under government control, but will be included in the Forest Legacy Area because they may be returned to the historic private owners as described in the section on Land Ownership.

The Forest Legacy Area, thus defined, includes portions of privately owned lands (below the Japanese line but within the Kosrae Forest Conservation Area) in several of Kosrae's valleys. It thus makes entire parcels of private land in those valleys eligible for the program. The exact boundary of the Kosrae Forest Conservation Area is therefore not a concern, since adjacent land, which often also contains good-quality native forest, is eligible if it is part of the same parcel. Nearly every valley around the island has good-quality native forest on its upper slopes, traditional agroforest and canoe logs in its lower slopes, water resources, and many have significant archaeological and historic sites. While the distribution process for land above the Japanese line is resolved, management plans and possibly conservation easements on adjacent privately owned lands will help to encourage protection of forest above the Japanese line.

Any requested amendments to any aspect of the FSM Forest Legacy Program (FLP) Assessment of Need (AON) will be proposed through the USDA Forest Service Region 5 Offices. As needed over time, the FSM FLP AON may need to be amended, to expand or change the program implementation area (beyond Kosrae State), eligibility criteria, project selection criteria or other aspects of this Program. Amendments to this Program shall be done in accordance with the Forest Legacy Program Implementation Guidelines (USDA, 2003 or any future additions), and shall include a full AON review, outline any changes, follow a public review process, and include all official signatures.

Map AON-15: Kosrae Forest Legacy Areas

Identification & Selection of Forest Legacy Areas

Generally, the determination of Forest Legacy Areas is based on the set goals and priorities for the Forest Legacy Program, and involves the following eligibility criteria for a proposed area:

1. It must be a tract of land that is at a minimum five acres in size and is privately owned; has a willing seller; and must be within or partially overlap with the Kosrae Forest Legacy Area.
2. It must be predominately covered with forest. Proposed areas must have at least 75 percent forest coverage or vegetation.
3. It must be threatened by conversion to non-forest vegetation. These threats may include, but not are not limited to the following:
    a) Current development trends in the area, proximity to roads (which open an area to possible development).
    b) Proposed housing, industrial, commercial, or public recreational development.
    c) Fragmentation of land ownerships into smaller, less manageable parcels.
4. It must contain one or more of the following important public values:
    a) Watershed values, including water resources.
        - Contribute to public or private water supply, including underground sources.

- Important to erosion and sediment control.
- Important to maintain and protect quality of water resources.
- Contain river/stream, water body, or a recharge area for major underground water resources.

b) High biodiversity values, including endemic, rare, threatened, and/or endangered species.
   - Within Areas of Biological Significance (ABS) identified under the FSM Conservation Blueprint.
   - Have unique plant communities.
   - Have unique geological features.
   - Have a unique or exceptional mix of ecological systems and communities.
   - Shelter colonies or communities of endemic or threatened and/or endangered species.

c) Wildlife habitat.
   - Contain an outstanding habitat for one or more important conservation species or ecosystem target.
   - Contain nesting or recruitment sites for migratory birds or sea birds.
   - Contain significant wildlife populations.

d) Social and traditional values, including culture.
   - The area may contain resources that provide for a sustainable subsistence for the people, particularly non-timber products and services.
   - Have archeological or religious sites that are important to Kosraean culture.

e) Ecotourism, including aesthetic and scenic value.
   - Have registered U.S. National Preservation sites.
   - Have important scenic plains or panoramic views.
   - The area may have existing or potential natural resources based recreation, such as nature camp grounds or hiking trails.

f) Education & Research value.
   - The area may be suitable for establishing nature or interpretative trails.
   - The area may be suitable for accommodating outdoor conservation education programs.
   - The area may contain ecosystems, natural communities, or species that may be appropriate for research purposes.

5. Promote the preservation of the forest landscape in order to protect large blocks of contiguous forest lands to yield greater ecological benefits, as well as to create a simplified management protocol of other protected areas.

E. Administration of Forest Legacy Areas

1. State of Kosrae Law Concerning Land

The State of Kosrae has the legal right to own and manage real property. The State also has the right to acquire real property for public purpose, as stated in the Kosrae State Constitution. The Kosrae State Constitution states under Article XI, Land and the Environment, Section 3, “The use of real property shall in the public interest be regulated by law to ensure public health, community well-being, the orderly and economical use of

land, preservation of places of cultural or historic value, and island beauty." Section 5 further states, "The State Government may acquire interest in private land for public purpose without the consent of the interested parties. The acquisition may occur upon payment of fair compensation and the state government's showing that the land and the interest are highly suited to their intended use, that it has made a good faith effort to gain the consent of the interested parties, and that it has made every reasonable effort to avoid substantial hardship to the interested parties in consideration of their personal circumstances. Procedures for the acquisition shall be prescribed by law and shall include the payment by State Government to the interested parties of the attorney costs and reasonable attorney's fees incurred in connection with the acquisition proceedings."

The State has the right to transfer management responsibility for real property or interest in real property to various government agencies of the state. Consequently, the Constitution permits the State to purchase real property (anticipated via the Forest Legacy Program) and transfer management responsibility to KIRMA. In a recent written opinion of the Kosrae State Attorney General, the State of Kosrae can acquire conservation easements from private land owners. "It is the opinion of this office [office of the Attorney General] that easements, created for lawful purpose, are and will be enforceable in the Court of the State of Kosrae. This would include the creation of a 'conservation easement'."

2. Project Development, Evaluation & Prioritization Process

a) Principles of Kosrae program outreach, include that program authorities must be clearly explained to the public (including the fact that the purchase of lands or conservation easements is permanent). The competitive nature of the program (funding subject to national ranking) must also be clarified to avoid raising unrealistic expectations; agencies and landowners throughout the FSM have expressed the preference to see how a pilot Forest Legacy project (likely Yela Forest Watershed) fares in national scoring before commencing their own projects. Boundaries of the Forest Legacy Area and project selection criteria will be publicized to clarify that all viable projects are eligible to apply, not just certain landowners.

b) Initial application will require landowners to fill out a Kosraean-language application form providing essentially the same information required under the national Forest Legacy Program. KIRMA, KCSO, and other groups may assist the landowner by explaining the information requested and helping to identify the landowner's forest values and threats. KIRMA and the Kosrae Forest Stewardship Committee will review the application and determine whether it is viable (has any chance of success under the Forest Legacy program). If viable, KIRMA will assist by translating the application into English, and again sharing the application with the FSM Forest Stewardship Committee for advice and to solicit technical assistance and potential financial matching. The Kosrae State Forest Stewardship Coordinating Committee, consisting of key technical staff from departments, organizations, or programs involved in natural resource management and

environmental conservation (namely, the Dept. of Resources & Economic Affairs, Kosrae Visitors Bureau, COM-FSM Kosrae Campus Land Grant Program, Kosrae Conservation & Safety Organization, Yela Environmental Landowners Authority, Office of Community Affairs, and the municipal governments and resource management committees) and the lead agency, KIRMA, are to develop procedures for reviewing, ranking and selection of projects applicants. Each application must be reviewed by this Committee which will provide recommendations to the State Forester.

c) Most if not all landowners will require external assistance to proceed with project preparation and achieve a high "readiness" score. The decision to provide such assistance to any given project will depend upon the internal decision-making process of any organization that may be willing to provide that assistance.

d) The landowner, with assistance from KIRMA, will submit a revised and improved English application to the FSM Forest Stewardship Committee. Each year, the State Forest Stewardship Coordinating Committee (Appendix II) will review all applications received by August 1st, and advise the FSM "state" foresters or lead agencies concerning the recommended ranking by September 1st. The FSM State Forester will submit project information to the USDA Forest Service by October.

e) A Forest Stewardship Program management/Resource 'Plan' will be developed prior to project closing. This Plan will outline the general resource management goals needed to maintain or improve the resources within this project. The Plan will also detail the methods used to accomplish these goals.

3. Acquisition and Due Diligence Processes

a) If project is funded, a series of due diligence procedure will ensue (depending on the type of acquisition and local laws) including but not limited to a 'Yellow Book' appraisal, Federal review of appraisal, survey of property boundaries, title report, Baseline Report, Conservation Easement language development & negotiation with landowner and various local and federal legal interactions (USDA, 2003).

b) Forest Legacy Program funds are reimbursable; therefore it is important for the State to work closely with the federal government on the transfer of funding. It is recommended that the aid of a Land Trust or credible non-profit entity be considered during this phase of the project, if not earlier.

4. Project Monitoring and Reporting

a) For Conservation Easements (CE), annual monitoring of the project site will take place. The exact monitoring method will comply with any federal standards, but will be left up to local authorities. All monitoring will utilize the Baseline Report, generated during the CE terms development process, and will document any

changes to the biota, new structures/roads, or other activities that may or may not have an impact on the define project area and conditions of the forest within. An assessment of the status of the project site will be conducted. The outcome must comply with the general Kosrae and National Forest Legacy Program Standards. Any serious deviation from these standards will trigger a remediation, as detailed in (USDA, 2003).

b) Monitoring reports will be produced regularly (1 to 3 yr intervals). An agreement can be made with a local Land Trust or Non-Profit to assist with reporting. For Fee Title acquisitions, the overall integrity of the project will be monitored on a regular basis and included in general Forest Legacy Program Administration annual reports.

F. Recommended Forest Legacy Areas

A highly recommended Forest Legacy Area is the Yela Forest Watershed (Appendix I) which is privately owned and identified as an Area of Biological Significance in the FSM Conservation Blueprint. This area meets all of the FLA Selection Process "Criteria and Eligibility Factors" and it is believed that the acquisition of this area will have serious positive impacts on Kosrae's biodiversity, hydrologic functions, coral reef protection, food security and ultimately protect human lives. It is anticipated that more sites, particularly within interior and upland areas of the island, will be identified in the future as potential Forest Legacy Projects as more assessments on other potential sites will be conducted to private ownership and made available for acquisition.

IV. Public Involvement in the Assessment Phase

The requirements of the USFS Forest Legacy Program pertaining to the Assessment of Need (AON) for Kosrae State were outlined and discussed among FSM leadership and staff on October 15 and 16, 2009. The participants at these meetings included Robert H. Jackson, Director of KIRMA; Erick Waguk, State Forester; Betty Sigrah, U&CF Coordinator of KIRMA; Blair Charley, GIS Specialist of KIRMA; Larson Livae, Administrative Officer of KIRMA; Joyminda George, Community Liaison Officer of KIRMA; William K. William, Program Manager of YELA; and Fanston Marcus, Terrestrial Program Coordinator of Kosrae Conservation and Safety Organization. The Forest Legacy Program AON was outlined and discussed at length along with an update on Kosrae's State Wide Assessment and Resource Strategy. All comments were collected and will be incorporated appropriately.

Many of the issues and components of the AON and the Yela Forest Watershed project are similar to those identified and addressed in the Kosrae State Biodiversity Strategic Action Plan and the Kosrae State Land Use Plan, the Kosrae AON development team avoided conducting unnecessary duplicate consultations, but rather utilized public input on sets of issues already documented in these plans. The public was consulted regarding both the AON and the Yela Project specifically, in open meetings on various occasions in 2009 and 2010. These public meetings included discussion pertaining to the draft Kosrae Forest Legacy Program AON.

Additionally, the draft Forest Legacy Program AON was placed on the KIRMA public website (June 9-14, 2010) as well as the Research and Development website (June 9-14, 2010) for review. A draft of this document was also place in a public library on Kosrae and Pohnpei from June 9-14, 2010. All comments and suggestions will be considered and/or incorporated appropriately. As of submission of this document, no formal letters were received regarding this document. Any future public input that is received, will be kept on file at KIRMA and considered for incorporation in any future amendments to this document.

List of Kosrae AON Maps

AON-1: Map of Federated States of Micronesia
AON-2: Kosrae Municipalities Boundaries
AON-3: Trochus Sanctuary
AON-4: Utwe-Walung Marine Park Sanctuary
AON-5: Highly Erodible Soils of Kosrae
AON-6: Kosrae Watershed Map
AON-7: Areas of Biological Significance
AON-8: The Yela Forests on Kosrae
AON- 9: Kosrae Japanese Line and Public and Private Boundaries
AON-10: Kosrae Areas of Particular Concern
AON-11: Special Consideration District
AON-12: Kosrae Roads
AON-13: Kosrae Watershed and Overlay with Roads
AON-14: Mangrove and Swamp forests in the Yela area on Kosrae
AON-15: Kosrae Forest Legacy Areas

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Appendix I: Draft Application/Project Brief - Yela Forest Watershed

Forest Legacy Project

Yela Forest Watershed, Tafunsak (Kosrae County), Federated States of Micronesia

PROVISIONAL

FUNDING HISTORY

Forest Legacy Program FY 2011 Funding	*$ 500,000*
FY 2011 Non-Federal Cost Share	*$ 166,667*
FY 2011 Project Costs	*$ 530,000*
FY 2011 Project Acres	*87*
Forest Legacy Funding to Date	*$ 0*
Total Project Costs	*$ 1,030,000*
Total Project Acres	*1,283*

Tract Name	Size (acres)	Tract Cost	FLP Funding	Non-Fed Cost Share	Status
Alik Lower Parcel	87	$ 530,000	$ 500,000	$ 166,667	Provisional 2011
Alik Upper Parcel	550	$ 50,000	$ 50,000	$ 16,667	Provisional 2012
Wesley Lower Parcel	96	$ 400,000	$ 400,000	$ 133,334	Provisional 2013
Wesley Upper Parcel	550	$ 50,000	$ 50,000	$ 16,667	Provisional 2014
Total	1,283	$ 1,030,000	$ 1,000,000	$ 333,335	

General Description – Yela valley, ridge to reef, is one of the least disturbed wetland-dominated watersheds left in the Pacific. The freshwater swamp in the valley bottom is the world's largest forest of towering, buttressed "ka" (Terminalia carolinensis) trees, a species endemic to Kosrae and Pohnpei. The Yela forest project is a protection effort that involves placing approximately four conservation easements over the nearly 1,300 acre Yela River watershed. Two extended families, named Alik and Wesley, own the two sides of the watershed. The first transaction is ready to move forward with the Alik family (organized as the Yela Environmental Land Authority, Y.E.L.A.) with acquisition of a conservation easement over an 87 acre tract at the lower end of the valley. This will be the first conservation easement in all of Micronesia.

PROJECT FEATURES

Important:

- A. The valley includes the largest (200-acre) and least disturbed ka (Terminalia carolinensis) forest in the world. Ka is endemic to Kosrae and Pohnpei; most stands have been drained or converted to agroforestry.
- B. Yela is one of the most intact wetland-dominated watersheds left in Southeast Asia and the Pacific, where freshwater wetland forests have typically been converted to taro or rice paddies and mangroves have been filled or converted to prawn ponds.
- C. The valley has over 99 plant species, nearly all (82) native. The forest is extraordinary in the tropical Pacific Islands for its near-total absence of invasive plant species.
- D. Five valley species are endemic to Kosrae alone: the nunu (Horsfieldia nunu) tree of the swamp forest; Nes (Eugenia stelechanthoides) tree of the upland forest; a vine (Antidesma kusaiense) and herbs (Astronidium kusaianum and Selaginella kanehirae).
- E. Native wildlife in the valley includes the endangered Micronesian Imperial Pigeon, freshwater eel, freshwater goby species, and swiftlets in a cave.
- F. The watershed provides natural flows of water with natural levels of sediment and nutrients to maintain adjacent, publicly owned mangrove swamps and reefs of the "Yela-Okat Marine Conservation Area."
- G. The valley has been studied by the USDA Forest Service as a natural reference site for hydrological connections between freshwater and marine systems, responses to ENSO climate disturbances, and tropical wetland carbon storage.
- H. Adjacent mangrove forests are among the most productive on the island for timber and fuelwood. Harvesting levels are currently within sustainable rates. While mangrove forests are public, adjacent private landowners strongly influence their use.
- I. Nearshore mangroves and reefs serve as habitat for many marine species on which the islanders depend on for food and income.
- J. Yela's owners have formed a non-profit conservation organization known as Yela Environment Landowners Authority (YELA) focused on the protection of the forest and its native wildlife.
- K. YELA and partners have secured grants for an educational program and boardwalk for boat/pedestrian access for

residents, Micronesians, ecotourists and international visitors.

- L. The forest has an ancestral burial site (noted by piles of stones over the deceased) and an ancestral cave on one of the slopes.
- M. The tract's ka forest is productive, with large straight trees.
- N. The easement will allow hunting of non-native pigs and gathering of non-native fruits and plant materials, typically the "canoe plants" brought to Kosrae by its first settlers for subsistence and cultural use.

Threatened:

- A. The Yela forest is threatened by proposed construction of a road. The island's existing circumferential road ends near the villages at either end of the roadless coast along which Yela is one valley.
- B. Proposed routes for the road would skirt or pass through the freshwater swamp forest, disrupting water flows, likely causing ponding or drainage affecting the forest and downstream ecosystems, as well as perpetual maintenance problems.
- C. Completion of the road through Yela has been included in development packages under discussion from foreign donors. In the meantime, local bulldozers without engineers have extended the circumferential road at either end.
- D. The Kosraean government requested the landowners, YELA, to grant an easement to permit construction of the road. YELA rejected the request stating that the road was incompatible with pending negotiations for a conservation easement.
- E. While the Yela conservation effort has support from the current administration under Governor Weilbacher, without a conservation easement in place, the road threat will continue.
- F. If the road is constructed, clearing the forest along the entire coast is will surely follow, within Yela valley, adjacent valleys, and adjacent mangrove forests, as has taken place along existing roads on Kosrae and many Micronesian islands.
- G. Road access enables fill of adjacent freshwater swamp and mangrove swamp for permanent conversion to urban uses. Roads also facilitate access and conversion of forest to agriculture and agroforest.
- H. Tracts at the upper end of the valley are lands that have been held in trust by the government and are now slated, by the state constitution, to be returned to private landowners with ancestral claims.
- I. Release of lands from trust to private ownership carries a threat of clearing for agriculture and agroforestry. Conservation easements on these lands would protect the forest from conversion.
- J. While the extended family of landowners has agreed and organized to pursue the "conservation option," individual family members have said that without eventual financial payment for an easement, they will reassert their rights to clear the land.

Strategic:

- A. Completion of the conservation easement on the first 87-acre tract will demonstrate the viability of the program to other landowners in Yela.

- B. Easements for the tracts in the upper valley as they are released to private ownership will set a precedent for forests on the trust lands (up to 15,000 acres) to be protected as the lands are released.

- C. This easement would pilot the easement tool throughout Micronesia. Easements are more culturally acceptable than acquisition on many islands where there is a desire to keep lands in traditional ownership.

- D. The 87-acre tract includes parts of the "Yela-Okat Terminalia/Mangrove Conservation Area" and the "Kosrae Forest Conservation Area," two of the five Conservation Areas designated in forest in Kosrae to protect native forest types and the pigeon.

- E. These "Conservation Areas" are proposed for protection in the National Biodiversity Strategy and Action Plan submitted by the FSM to fulfill obligations under the international Convention on Biological Diversity.

- F. Yela is recognized as a priority area for conservation in FSM's national Sustainable Development Plan.

- G. Yela is an "Area of Particular Concern" (for conservation) in the Kosrae Land Use Plan.

- H. The transaction will significantly advance Kosrae's contribution towards its implementation of the Micronesia Challenge, a commitment by the Micronesian nations and territories to preserve 20% of the forests and 30% of the reefs in Micronesia by 2020.

- I. Yela will likely be added to UNESCO's Bioreserve acreage for the island, building on the island's 4,300 acre Utwe-Walung Marine Park Bioreserve.

Ready:

- A. YELA has agreed to the terms of a draft conservation easement.

- B. A yellow book standard appraisal was completed in May of 2009 on the 87 acre tract that valued the easement at $530,000 and the landowners have agreed to that purchase price.

- C. A Memorandum of Understanding between the Kosrae Island Resource Management Authority, Kosrae Conservation and Safety Organization, and YELA has been signed in which all three parties agree to the terms of a draft easement and management for Yela.

- D. An uncertified Phase 1 Hazardous materials report was completed with a finding of "no recognized environmental conditions."

- E. Title work is complete on the initial 87-acre tract.

- F. The draft easement is expected to be finalized in the next several months followed by an Option agreement. Closing on the 87 acre tract will be ready to occur in 2010.

- Supporting parties include: Kosrae Conservation and Safety Organization , Kosrae Island Resource Management Authority, Kosrae State, Governor Weilbacher's office, Micronesia Conservation Trust, Secretariat of the Pacific Community, The Nature Conservancy and USDA Forest Service, PSW Research Station, Institute of Pacific Islands Forestry

For more information on the Forest Legacy Program, contact:

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Appendix II: State Forest Stewardship Coordinating Committee

Interest or agency required by law "if feasible"	**Name, title, affiliation**
Forest Service	Kathleen Friday, USFS
NRCS	NRCS Pohnpei Field Office
Farm Service Agency	Not in the FSM
Cooperative Extension Service	Jim Currie, Vice President, COM-FSM Cooperative Research and Extension
Local Government	Maheta Kilafwasru, Chairman, Council of Mayors, Kosrae State Pintas Kenneth, Mayor Rep, Chuuk State (Intend to add local government representatives from Pohnpei Municipal Government and Yap Traditional Leadership Focal Points)
Soil and Water Conservation District	(To be added when and if a Pohnpei or other S&WCD is established by USDA NRCS)
Consulting foresters	Francis Ruegorong, Waab Land & Wildlife Coordinator, Yap State Erick Waguk, State Forester, Kosrae State Basiente Atan, UCF Coordinator, Chuuk State (Intend to add Pohnpei State forester)
Forest products industry	Dr. Tholman F. Alik, Yela Environmental Landowners Authority, Kosrae State (Intend to add Yap, Chuuk, Pohnpei and Kosrae Farmers associations[16] and ecotourism representatives)
Private Forest landowners	Mr. Barton Musrasrik, Kosrae Farmers Representative (Intend to add Chuuk, Pohnpei and Yap Farmers representatives)
Land-trust organizations	Mr. Robinson H. Timothy, Principal Judge, Kosrae Land Court Kaster Sisam, Division of Land Management, Chuuk State (Intend to add Pohnpei and Yap State Land Commission Focal Points when designated)
State lead agency for Forest Legacy	Mr. Gibson Susumu, State Forester
Environmental/ Conservation organizations	Mr. Marston Luckymis, Acting Executive Director, Kosrae Conservation Safety Organization Bradford Mori, GIS Specialist, Chuuk EPA Curtis Graham, Chuuk Conservation Society Patterson Shed, Executive Director, CSP
State fish & wildlife agency	Robert Jackson, Director, Kosrae Island Resource Management Authority Romeo Osiena, Director, Department of Marine Resources, Chuuk State Yap State Department of Resources and Development [already represented by Francis Ruegorong, Waab Land & Wildlife

[16] Local farmers associations mostly practice agroforestry methods

	Coordinator, above, and Michael Gaan, Director, below] (Intend to add Pohnpei State Department of Land and Natural Resources Director)
Tribal representatives (chiefs)	Henry Nedlic, Traditional Chief, Chuuk State (Intend to add representatives from: Yap Council of Pilung and Tamol Chuuk Mayors Council Pohnpei Paramount Chiefs Council Kosrae Mayors Council)
Other (Departments of Agriculture)	Innocente Penno, Director Department of Agriculture, Chuuk State Julian Sivas, Chief of Forestry, Chuuk State Steven L. George, Director, DREA, Kosrae State Michael Gaan, Director, DLN&R, Yap State (intend to add Pohnpei Division of Agriculture)
Other	Furasi Bonochou, Department of Public Safety, Chuuk State

Appendix III: List of Areas of Biological Significance for the Nation

ABS Site Type	Number of ABS sites	Area (Hectares)	Area (Sq. Miles)
TERRESTRIAL SITES			
Yap	3	651.94	2.52
Chuuk	9	4,328.06	16.71
Pohnpei	9	12,833.28	49.53
Kosrae	2	4,835.04	18.66
TOTAL TERRESTRIAL	**23**	**22,648.32**	**87.42**
MARINE ONLY SITES			
Yap	6	49,471.10	190.95
Chuuk	10	20,683.29	79.83
Pohnpei	5	12,480.50	48.17
Kosrae	1	54.52	0.21
TOTAL MARINE	**22**	**82,689.39**	**319.17**
COASTAL MARINE SITES			
Yap	21	24,007.43	92.66
Chuuk	20	77,089.91	297.55
Pohnpei	18	75,695.26	292.17
Kosrae	5	1,466.07	5.66
TOTAL COASTAL MARINE	**64**	**178,258.67**	**688.04**
COASTAL FRESHWATER SITES			
Yap	2	31.76	0.12
Chuuk	11	936.66	3.62
Pohnpei	3	5,283.09	20.39
Kosrae	4	1,904.89	7.35
TOTAL COASTAL FRESHWATER	**20**	**8,156.39**	**31.48**
OVERALL TOTAL	**130**	**291,752.77**	**1,126.11**