
FEDERATED STATES OF MICRONESIA
FOREST ACTION PLAN
2020-2030
FSM Department of Resources and Development
12-31-2020

ACKNOWLEDGEMENTS

The Federated States of Micronesia Department of Resources and Development (FSM R&D) is indebted to the efforts of all those who contributed to the development of the nation's revised Forest Action Plan 2020-2030.

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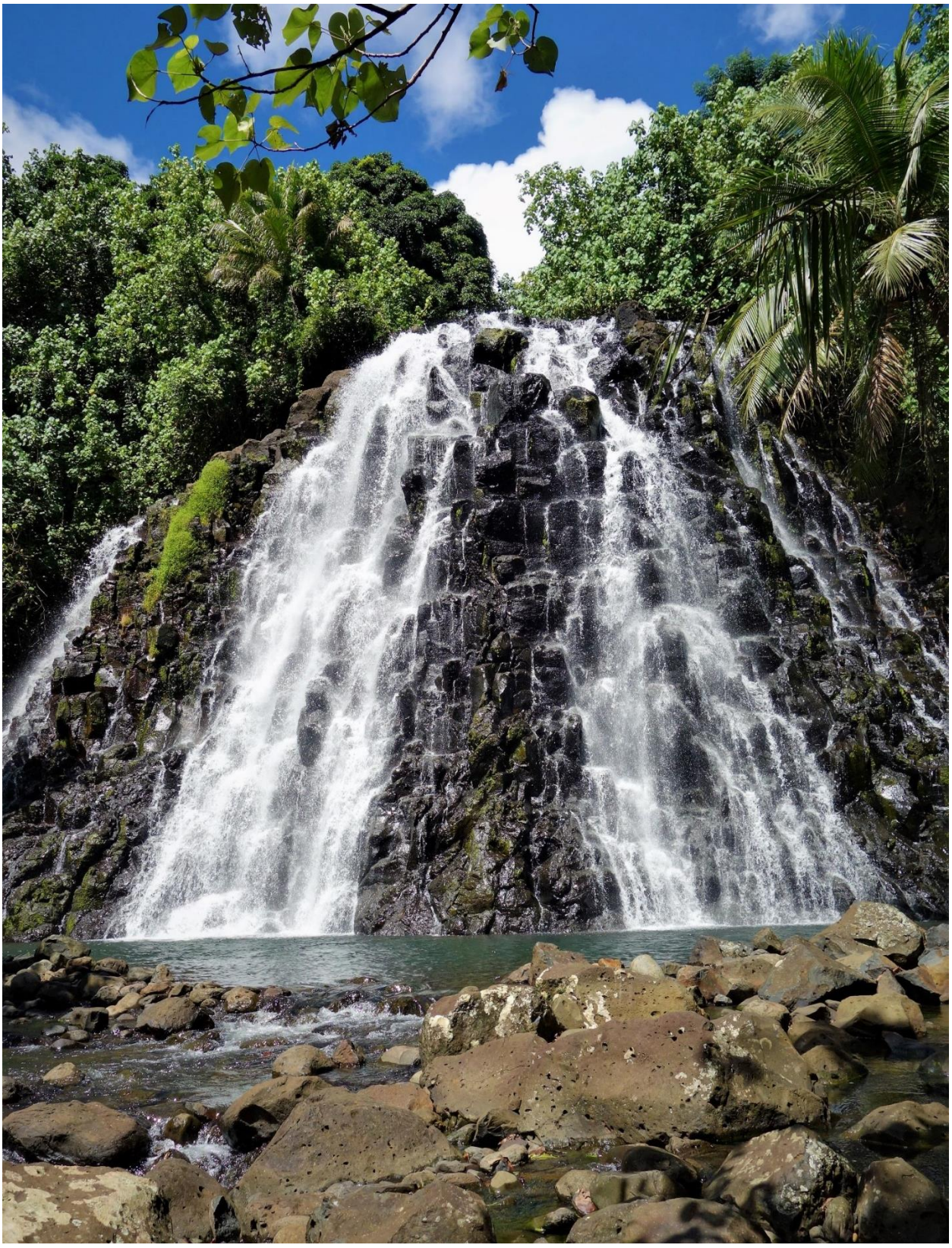
JANUARY 2021 DOCUMENT LAYOUT AND PHOTOS BY RACHAEL NASH UNLESS OTHERWISE CREDITED

CONTENTS

ACRONYMS

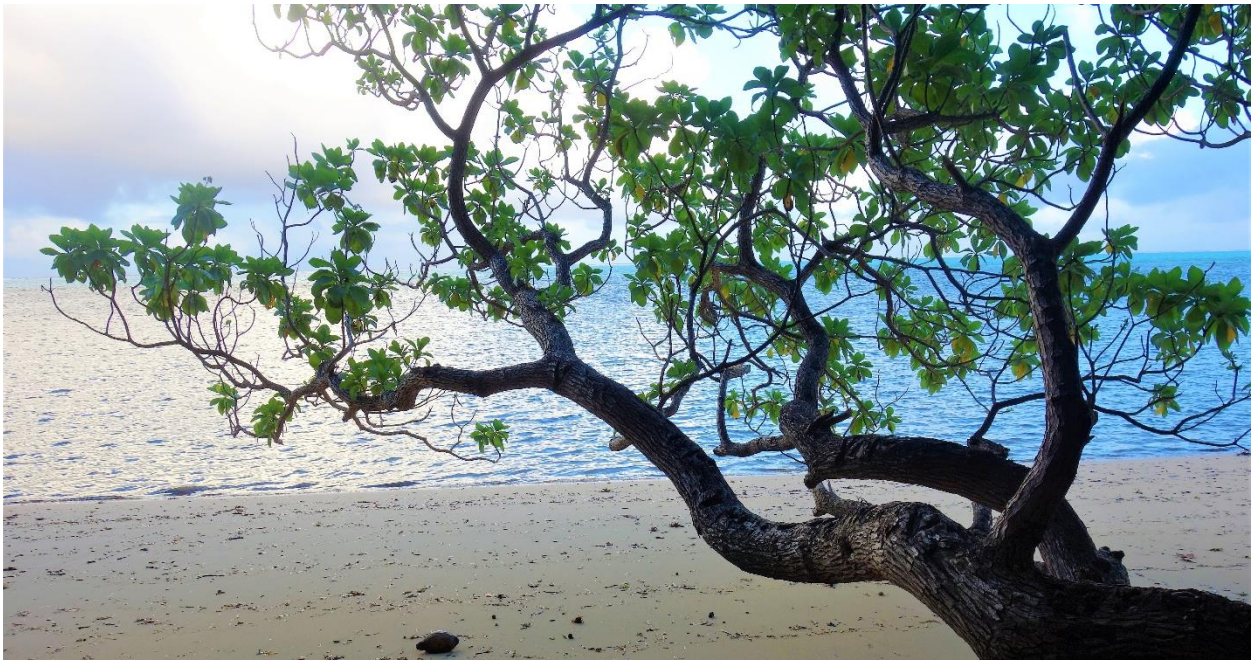
AON	Forest Legacy Assessment of Need
BSAP	Biodiversity Strategic Action Plan
CE	Conservation Education (authorities within FSP, U&CF and FH)
CFAA	Cooperative Forestry Assistance Act
CFOS	Community Forests and Open Space program (for acquisition of land)
COM-FSM	College of Micronesia - FSM
COM-FSM CRE	College of Micronesia – FSM, Cooperative Research & Extension
CWPP	Community Wildfire Protection Plans
DLNR	Department of Lands and Natural Resources (Pohnpei)
FSM R&D	FSM Department of Resources and Development
R&D	Department of Resources and Development (Yap)
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, Cooperative Fire (USFS program)
FAP	Forest Action Plan (formerly SWARS)
FH	Cooperative Forest Health (USFS program)
FLP	Forest Legacy Program
FRM	Forest Resource Management (authorities within FSP)
FS	USDA Forest Service
FSM	Federated States of Micronesia
FSP	Forest Stewardship Program (USFS program)
GIS	Geographic Information System
IFRA	Important Forest Resource Area – GIS layer used in FSP reporting system
IPIF	USFS Institute of Pacific Islands Forestry (research)
LSR	Landscape Scale Restoration (USFS program awarded via “Western Competitive Grants”)
NRCS	USDA Natural Resources Conservation Service

PIPTIEM	Professional Internships in Pacific Terrestrial Island Ecosystem Management (project funded by USFS grants)
R5	USFS Region 5
RNGR	FSP Reforestation, Nurseries & Genetic Resources (authorities within FSP)
S&PF	State & Private Forestry (branch of USFS)
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 (USFS program)
USDA	United States Department of Agriculture
USFS	United States (Department of Agriculture) Forest Service
USGS	United States Geological Survey



KEPIRHOI WATERFALL, POHNPEI

I. FSM NATIONAL GOVERNMENT



Introduction

This Forest Action Plan identifies the Federated States of Micronesia (FSM)'s highest priorities for forest resource management, and assistance needs from the United States Department of Agriculture Forest Service (USFS). State assessments and resource strategies are integral to USFS' 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" was required to complete a State-Wide Assessment and Resource Strategy (SWARS) within two years after enactment of the 2008 Farm Bill (June 18, 2008) to receive funds under CFAA. FSM met this requirement with its 2010 SWARS. Ten years later, an update of the SWARS was required, resulting in this document now known as the FSM 2020 Forest Action Plan (FAP).

The FSM 2020 FAP includes two components of the assessment and planning required by S&PF to identify priority forest landscape areas and highlight work needed to address national (US), regional, and 'state' (referring to the FSM in this document) forest management priorities:

> **Statewide Forest Resource Assessment** —provides an analysis of forest conditions and trends in the state and delineates priority rural and urban forest landscape areas.
>
> **Statewide 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 FSM 2020 FAP summarizes information from other existing assessments and strategic plans: details may be found in those existing documents, which are hyperlinked within the document or attached as appendices.

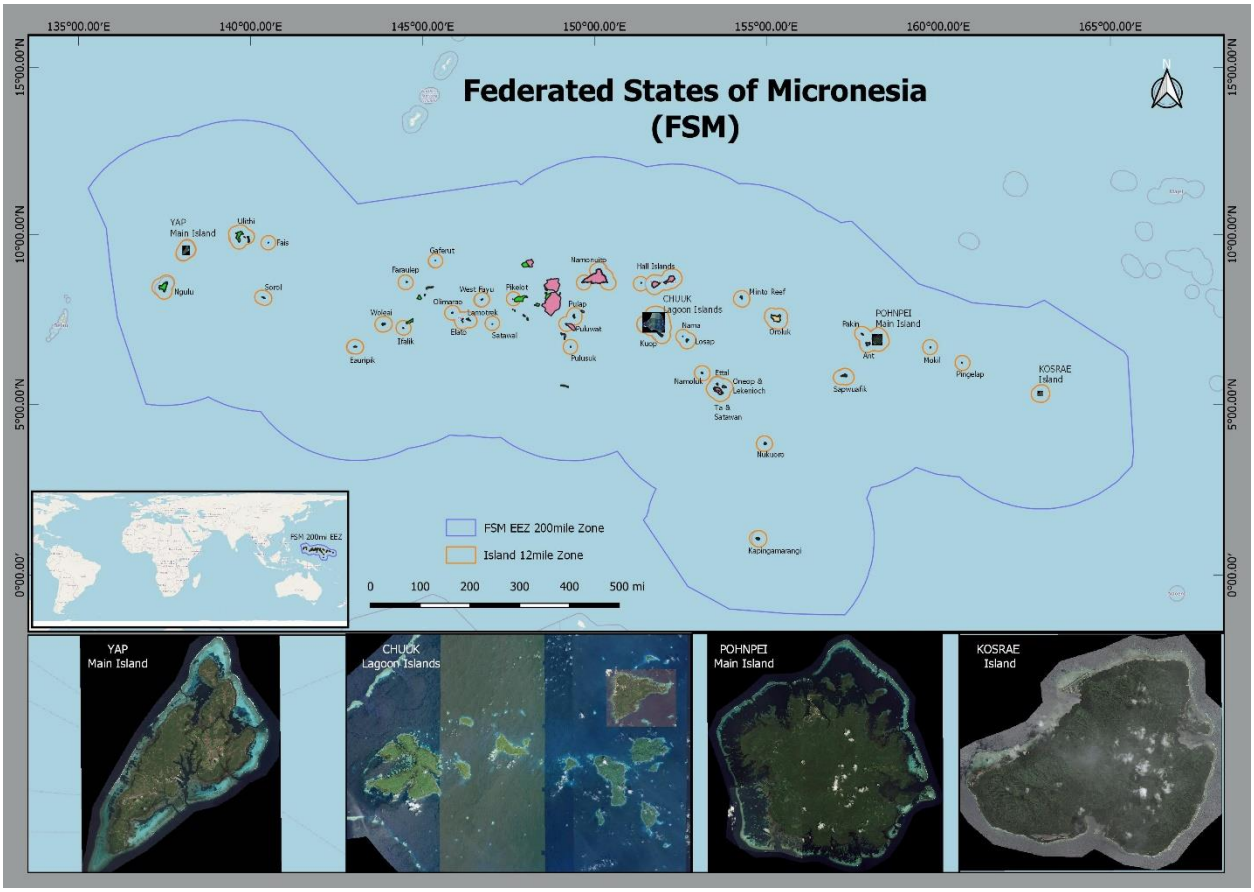
The FAP provides a basis for subsequent annual grant proposals, as authorized under several CFAA programs. The redesign deemphasized program-by-program planning and emphasized program integration to meet island priorities. The original 2010 FSM SWARS was thus organized around Micronesia's own priority issues with respect to forests.

These issues, shown in **Table 1**, were revisited, reviewed, and revised for the 2020 update of FSM's Forest Action Plan by relevant **stakeholder groups** through a process that involved a desktop review, in person workshops, and individual consultations in person or virtually over calls and emails. The FSM retained six of the original seven 'issues': Food Security, Biodiversity, Watersheds, Coastal Stabilization, Production & Sustainable Harvest, and Capacity Building, the latter which addresses non-spatial needs that pertain to the proceeding issues that have identified priority landscape areas. 'Urban and Community Forestry' was listed as an issue in the original plan, but was removed as it is better described as a program that helps to address strategies for each of the 6 issues. An additional change was to highlight three major threats (invasive alien species (IAS), wildfires, and climate change) that were previously discussed only in the context of biodiversity or a few issues. They have been shown as cross-cutting threats to all issues.

The FSM forest resource assessment and forest resource strategies in this document will be addressed in the context of these identified issues and cross-cutting threats, both at the FSM National and state levels.

TABLE N 1 US NATIONAL THEMES, FSM ISSUES AND THREATS, AND FSM SDP SECTOR GOALS

U.S. National Themes	FSM Priority Issues	Relevant FSM SDP Sector Goals
1. Conserve Working Forest Landscapes	**Cross-cutting threats (Invasive species, wildfires, and climate change) affect all issues**	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	**1. Food security (agroforest)**	
2. Protect Forests from Harm		
2.1. Restore fire-adapted lands and reduce risk of wildfire impacts	**2. Coastal stabilization (strand forest and mangrove forest)**	
2.2. Identify, manage, and reduce threats to forest and ecosystem health		
3. Enhance Public Benefits from Trees and Forests	**3. Biodiversity conservation (relates to Forest Legacy, protected areas management, gap analysis, etc.)**	
3.1. Protect and enhance water quality and quantity		
3.2. Improve air quality and conserve energy	**4. Watersheds (high islands)**	
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	**5. Production and sustainable harvesting of 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	**6. Capacity-building (coordination, technology and resources, training, and recruiting new generation of natural resource managers)**	
3.7. Manage and restore trees and forests to mitigate and adapt to global climate change		



MAP N1 FEDERATED STATES OF MICRONESIA (FSM)

Conditions and Trends

The Federated States of Micronesia (FSM) (Map N1) 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) (2018) and subsequently its Strategic Development Plan 2004-2023 (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. It has been estimated that FSM's biodiversity contributes 8% of house household income in Pohnpei, 9% in Kosrae, 26% in Chuuk and 29% in Yap (NBSAP, 2018). Further inventory and monitoring of the FSM terrestrial and marine biodiversity 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.

Forest Resource Monitoring

The US Forest Service Forest Inventory and Analysis (FIA) is the primary long-term methodology for assessing forest resources in the FSM. As the FIA program conducts monitoring across Micronesia every 10 years, it was selected as the method to measure the progress of terrestrial protected areas across the region. Additional, intensified plots compatible with FIA data, located in Protected Areas, are part of this methodology if funding allows, and are a priority strategy for the FSM as a whole. The 2006 FIA report summarized that the 'program collected, analyzed, and summarized field data on 73 forested field plots on the islands of Kosrae, Chuuk, Pohnpei, and Yap in the Federated States of Micronesia (FSM). Estimates of forest area, tree stem volume and biomass, the numbers of trees, tree damages, and the distribution of tree sizes were summarized for this statistical sample. Detailed tables and graphical highlights provide a summary of FSM's forest resources and a comparison to prior vegetation mapping and inventory work' (Donnegan et al, 2011). (With the generous technical and grant support from the USFS, the

program expanded, adding protected area monitoring plots in the FSM in 2016. This project leverages the existing USFS FIA program, making adjustments as needed. In order to adequately monitor conservation and biologically significant terrestrial landscapes, it was necessary to install additional plots at greater intensity.

TABLE N 2 NUMBER OF BASE FIA AND MICRONESIA CHALLENGE MONITORING PLOTS 2016

	Base FIA Inventory	Micronesia Challenge
Yap	14	38
Chuuk	10	5
Pohnpei	41	14
Kosrae	13	14

In 2016, the Micronesia Challenge (MC) terrestrial measures core group established the terrestrial resource monitoring protocol. A companion Terrestrial Measures Scorecard was also developed identifying priority forest resources for monitoring and established indicators to measure the progress. These indicators include forest, mangrove, water and birds. Information on the MC monitoring and data summaries can be viewed on a terrestrial web-viewer.

The FIA data is available at https://www.fs.fed.us/pnw/rma/fia-topics/inventory-data/index.php. Supplemental summaries were created from the FIA Pacific Island database using data from base plots from the first and most recent inventories and the change between them, as well as newly established Micronesia Challenge plots. The information was gathered to support the update of this FAP, especially priority areas of coastal stabilization, food security, and species biodiversity. The category of forest community used by the FIA was useful for organizing these priority areas, since strand and mangrove forests are both critical for coastal stabilization, agroforest is important for food security, and lowland and montane rainforest both shelter many native and endemic plant species. As such the summaries were focused on the trends and characteristics of forest communities, since the formal FIA reports generally provide a broad overview of all forests per jurisdiction and were unpublished and unavailable to reference at the time of writing. This supplemental information is attached to this FAP (Appendix 1).

FSM State Conditions and Trends

Further conditions and trends have been described for each state in subsequent sections, with information broken down by six priority FSM issues linked to US National Themes shown in **Table N 1.**

Cross-cutting Threats

Threats to forest resources in the Federated States of Micronesia are also broken down by FSM State and Priority Issue. The major cross-cutting threats identified for the FSM are invasive alien species, climate change and wildfires.

Invasive species

Invasive alien species are recognized globally as one of the main drivers of major biodiversity loss and ecosystem disturbance on islands worldwide. Islands are particularly vulnerable to biological invasions. Invasive alien species can outcompete and replace native and endemic species and lessen the health and productivity of ecosystems while changing the flow of its services. Throughout the world, invasive species have directly or indirectly caused or contributed to the decline and extinction of many birds, reptiles,

mammals and plants, including agricultural products and marine resources leading to declining food security and unsustainable livelihood.

The islands of the FSM are home to numerous native and endemic species including more than 1000 plant species, over 100 bird species and more than 20 reptile species (NISSAP, 2015). Regrettably, the Global Register of Introduced and Invasive Species, initiated by the IUCN and developed by the Invasive Species Specialist Group contains 592 entries for the FSM. Verified records suggest that 526 invasive alien species are plant species, 62 are animal and one is fungal, with a small number of bacteria and virus species (NBSAP, 2018). As growing numbers of invasive plant and animal species have been witnessed across all states, it has never been more important to focus on eradication efforts across the islands.

The FSM National overarching goals for invasive alien species as outlined in the Federated States of Micronesia Invasive Species Strategy and Action Plan 2016-2021 (NISSAP, 2015) prioritize the following to "establish biosecurity (border control, quarantine, eradication and/or management) programs to effectively protect the FSM's biodiversity, livelihoods, sustainable development and resilience to climate change from the impacts of invasive species."

Climate change

Shifting weather patterns are already significantly affecting the health of the environment and food and water security in the FSM. The tropical west Pacific is the site of pronounced ENSO conditions. El Niño conditions are characterized by a general decrease in the intensity of the trade winds; in the FSM, this is already causing a decrease in net precipitation, which is leading to persistent drought, especially during strong events such as those that occurred in 1997- 1998 and a 2015-2016 event that caused severe drought and storms across Micronesia. La Niña conditions are characterized by intensification of the trade winds, driving a rise in sea level and precipitation. Rising sea level generates coastal erosion, dangerous marine inundation, and salt contamination of soil, food, and water sources. As described in the FSM's Second National Communication to the United Nations Framework Convention on Climate Change (2015), major climate and weather-related

events include droughts, forest fires, typhoons, storm surges and sea level rise. All events are trending increases and pose significant threats, adding stress to the already vulnerable ecosystems in the FSM.

The growing body of research about the relationship between climate change and ecosystem health in the FSM confirms anecdotal observations that healthy, functional ecosystems are crucial to the success of climate change adaptation strategies. The services provided by the ecosystems are critical for the maintenance of the FSM's population, as the majority of its just over 100,000 people depend on the country's ecosystems for their livelihoods, both for subsistence and as sources of income. Watersheds, fisheries, freshwater lenses, and agroforests provide the population with food, raw materials, water, and medicines. In addition to these provisioning services, the islands' ecosystems also provide critical protection against storm surges, king tides, typhoons, and other natural disasters and contribute to mitigating erosion and buffering wind and waves during storms, storage and processing of soil nutrients, natural waste management, pollution control and detoxification, habitats for resident and transient birds and animals and the provisioning of pollinators for the reproduction of plant populations.

It is therefore imperative to include climate change as an important cross-cutting threat to forest and terrestrial resources and planning throughout the FSM. While each state may have differing specific impacts, all resource managers, agencies, NGOs, and community representatives overwhelmingly shared climate change impacts as an overarching threat to the continued ability of humans to depend on the ecosystems services they need to thrive.

Wildfires

Wildfires are a threat to all of FSM's priority issues, but as the four FSM states are not equally impacted, additional details are discussed in in subsequent sessions and chapters.

Priority Areas

Priority areas are broken down by FSM State and Theme, with a narrative description and visual maps.

Spatial Information and Information Sharing:

Since the original SWARS, all levels of government in the FSM, statutory organizations and the private sector have invested in the development of spatial information. The largest investment has been by the national government, with a wide range of government departments, agencies and offices creating large datasets for spatial information. This has enabled the various sectors of government to improve their efficiency and develop new processes and outputs. While the initial drive to create spatial datasets was to improve operational efficiency at the department and sector levels, it has become increasingly apparent that the best value from spatial information comes when there is integration between a range of different datasets. By creating spatial information from a combination of different yet interrelated datasets, a more comprehensive understanding of a problem can be produced with better responses and solutions to the problem generated.

The spatial sector in the FSM is a relatively new sector focusing on the creation and centralization of spatial information. The national government remains the largest contributor to this sector primarily through the development of various activities through the Department of Lands work to survey and develop cadastral and topographic maps. Spatial information is also widely used in the natural resources sector (environment, agriculture, forestry, marine, fishery) and to a lesser degree in some of the administrative sectors (town planning, census and statistics). The utilities and infrastructure sector also use and

contribute through the national infrastructure organizations (utilities corporations, telecommunications, roads, etc.).

Until recently this spatial information had been developed and used independently. The need to develop a National Spatial Strategy and Framework was identified and such document is currently in the final stage of review and endorsement. To assist in the implementation and coordination of the Strategy's goals, objectives and activities, a GIS program office is now housed at the FSM Department of Environment, Climate Change and Emergency Management (DECEM). The GIS office at DECEM assists the national and state departments, agencies and offices with spatial information and processes requests including providing basic mapping and GIS capacity trainings. In the states, there are designated GIS practitioners, however with limited GIS resources, there is a need to increase their capacity. While progress has been made, the need to advance and detail spatial analyses using new technologies still exists both at national and state levels.

Additionally, in this new digital environment and age, a variety of opportunities now exist that could potentially enhance the effectiveness of spatial information in the FSM. This would add value to national development planning, resource management and monitoring, emergency planning and response and public engagement and awareness. This also includes opportunities to improve spatial data resources and acquisition, increase ICT capacity, and enhance awareness and demand from the public and external stakeholders. Recently, the demand for the acquisition and subsequent use of LIDAR data has come from the states. LIDAR imagery would enable natural resource planners to evaluate threats such as sea level rise and storm surge and to plan for adaptation actions. Aerial photography and LIDAR imagery from which elevation and hydrological profiles can be developed, are an especially critical need for both the high Main Islands and the low-lying Outer Islands in all of the FSM

The FSM national government currently has several data portals for archiving and centralizing its environmental datasets, reports, documents and other environmental information online and housed at FSM DECEM. This includes the Inform Data Portal for FSM's environmental data (https://fsm-data.sprep.org/), Climate Change Data Portal for FSM's climate change data (https://iclim.decem.gov.fm/), and FSM Digital Atlas of Micronesia for FSM's geospatial datasets (http://islandatlas.org/#/). These data portals are managed and monitored by the GIS and IT office at DECEM and are available for public use.

STATEWIDE (FSM-WIDE) FOREST RESOURCE STRATEGY

Strategies are detailed for each FSM State by issue, with links to the US National Themes, performance measures, and contributing programs and resources. Several major strategies, programs, and resources are FSM wide, and described below. These appear as “programs that contribute” and/or “cooperators” for many of the strategies listed in the state chapters. Additional FSM wide priority strategies are continued long-term monitoring (including the Micronesia Challenge plots), and capacity building: improving information sharing and spatial imagery as described above, ensuring adequate trained staff, improved coordination, and increased awareness and conservation education.

Programs that contribute

USFS programs

The USFS has provided long term technical and funding support to the FSM. The FSM National government and three of the four FSM state governments are eligible for USFS grants (consolidated and competitive) as per guidance from USFS. Chuuk state has been unable to receive funds for several years, but hopes to take steps to become eligible. The FSM primarily utilizes three major programs: Forest Stewardship, Urban & Community Forestry, and Forest Health. It also benefits from additional programs described here: spf-authorities-final.pdf (usda.gov)

Micronesia Challenge

The Micronesia Challenge (MC) is a shared commitment made by the FSM, Guam, Palau, CNMI, and the RMI originally launched in 2006 to effectively conserve 30% of marine resources and 20% of terrestrial resources by 2020. During the 24th Micronesia Island Forum in 2019, the Leaders recognized the success of the first 15 years of the Micronesia Challenge and endorsed the new Micronesia Challenge 2030 goals to effectively manage 50% of marine resources, including the exclusive economic zone (EEZ), and 30% of terrestrial resources by 2030. The goal now also includes a larger voice for fisheries management, reducing invasive species, restoring habitats, increasing livelihood opportunities and reducing risks to communities from climate impact in Micronesia. As was mentioned under the Forest Resource Monitoring section above, with USFS support, a long-term terrestrial monitoring program was established to track progress towards these goals, and data made available on a Terrestrial Web-viewer accessible online. Continuation of these efforts are a priority for the FSM as a whole.

FSM Protected Area Network

In 2015 the FSM Department of Resources and Development and each of the State Governments adopted the Protected Areas Network Policy Framework, establishing a nationwide Protected Areas Network (PAN). The PAN is designed to facilitate the national government in assisting states in the protection of significant areas of biodiversity, key habitats, and other valuable resources that are important to the future stability and health of the FSM. The PAN Policy establishes procedures for the Management Units of protected area sites to apply to join the PAN and outlines the benefits of membership in the Protected Areas Network, including access to technical and financial assistance. The FSM's PAN augments efforts at the state, municipal, and community levels throughout the country to achieve conservation goals, which broadly reflect the country's participation in the Micronesia Challenge and the United Nations Convention on Biological Diversity. Monitoring and management of terrestrial protected areas across the FSM is a priority strategy for this Forest Action Plan.

Global Environmental Fund (GEF) 5th Replenishment (Ridge to Reef):

The Ridge to Reef program was launched across the Pacific in 2016 under the Global Environment Facility. This program, adopted by the FSM, seeks to ensure biodiversity protection and conservation is undertaken in a way that is integrated with sustainable land use and management. The 'ridge to reef' concept reflects the intrinsic links between the health of terrestrial and marine ecosystems, and the need to maintain essential ecosystem services to sustain livelihoods. The program supports the growing number of designated protected areas across the FSM.

Global Environmental Fund (GEF) 6th Replenishment (Invasive Species):

The FSM National Government passed a resolution to accept the next iteration of funding from UNDP in October 2020. GEF-6is the "Safeguarding Biodiversity From Invasive Alien Species in the Federated States of Micronesia". The project aims to safeguard biodiversity in terrestrial and marine ecosystems and in agricultural and fisheries production systems from the impacts of invasive alien species in the Federated States of Micronesia. The main project outcomes include: strengthening of the national biosecurity governance framework, institutionalized and aligned with relevant Pacific initiatives, Awareness of IAS impacts and importance of biosecurity, strengthening of the capacity to safeguard biodiversity from IAS impacts, enhancement of IAS inspection and enforcement, capacity building on IAS management, creation and management of an IAS information system.

Global Environment Fund (GEF) 7th Replenishment (Sustainable Land Management)

At the time this FAP was submitted, a concept note was being prepared for the next GEF replenishment from UNDP, with the working title 'Securing global environmental benefits in FSM through climate-resilient sustainable land management and progress towards land degradation neutrality' as of December 2020. The draft concept note focused on terrestrial projects, and included improving information, capacity, and knowledge management, and climate-smart sustainable management including rehabilitation projects. While the final project might change, there should be potential for it to closely align or address issues and strategies identified in this FAP.

Coconut for Life (C4L) Project

C4L is an FSM Vital initiative to resurrect the coconut industry in the FSM through enhancing the capacity to buy, sell, export, manufacture, process, and distribute copra and other products from coconut trees in the FSM. New community-based revenue streams are created for the people as opportunities become available for farmers to market coconuts. MCT leads the community component and carries out awareness meetings in communities, supports interested communities to register at the FSM registrar office, form their group to become a Participatory Guarantee System (PGS), provide business support service (BSS) trainings and support these established PGS groups by building their own capacity to run their own PGS groups by the end of project. This project is to boost livelihoods of communities by providing a sustainable alternative source of income on a monthly basis.

Green Climate Fund

The Green Climate Fund (GCF) is a fund established within the framework of the United Nations Framework Convention on Climate Change (UNFCCC) as an operating entity of the Financial Mechanism to assist developing countries in adaptation and mitigation practices to counter climate change. The National Designated Authority (NDA) for the GCF for the Federated States of Micronesia is at the FSM Department of Finance and Administration. The Micronesia Conservation Trust (MCT) Is an Accredited Entity to the GCF.

STAKEHOLDER GROUPS COORDINATED WITH FOR THE FSM FOREST ACTION PLAN

FSM FAP Development and Coordination Process

This 2020 FSM Forest Action Plan is an update of the original FSM 2010 FAP (formerly SWARS), which has been carefully reviewed and revised as appropriate. Much of the information in the original version remained relevant in 2020, and was retained. Thus, the development process for both the original and revised document is described below.

2010 FSM FAP (SWARS)

The FSM first identified specific issues that address the three U.S. National themes (Conserve, Protect, Enhance) in consultation with each FSM state's forestry agencies and their stakeholders. Through coordination by FSM R&D with the FSM states, several consultation processes and trainings were done to develop the assessment component of the 2010 SWARS. Several agencies and other key partners, including conservation NGOs, communities and natural resource related entities were also consulted. Several data gaps were identified which were provided by the FSM GIS team.

The 2010 FSM SWARS included a chapter for the Forest Legacy Program (FLP) Assessment of Need (AON) (Appendix 2) with a Forest Legacy eligibility area in Kosrae State. The AON focused on one project (Yela Valley) for which one easement had been put in place (Alik parcel) and two more potential easements were under development at the time.

2020 FSM FAP

The 2020 FSM FAP's development was been a collaborative effort and iterative consultation process from September 2019 to December 2020. The update was led by the FSM 'State' Forester at FSM Department of Resources and Development (FSM R&D) in cooperation with the Chuuk, Kosrae, Pohnpei and Yap State Forestry agencies and their key cooperators and stakeholders, also represented on the FSM State Forest Stewardship Coordinating Committee (SFSCC). Assistance in coordinating consultations, and revising and writing the document was provided by the Micronesia Conservation Trust (MCT) staff (Tamara Greenstone-Alefaio and Roseo Marquez), and their consultants (Rachael Nash and Julian Dendy). The USFS, provided crucial technical support, funding assistance, review of the draft FAP, and overall guidance and support. Special thanks are extended to USFS staff Kathleen Friday, Miranda Hutten, Rich MacKenzie and Ashley Lehman.

After an initial desktop review in September and October 2019, the team, together with Snyther Biza with FSM Department of Energy, Climate Change and Emergency Management (DECEM) GIS unit held 3-day workshops in the four states of the FSM (Chuuk, Pohnpei, Yap and Kosrae). The workshops were held in Chuuk (October 28th – 31st, 2019), Yap (November 25th -27th, 2019), Kosrae (December 10th – 13th, 2019) and Pohnpei (January 8-10, 2020), with a total of 89 participants including 21 female and 68 male participants. For each workshop, FSM R&D worked with the relevant FSM state forestry agencies to invite forestry staff and relevant stakeholders. Prior to and during the workshops, each state reviewed their representatives to the SFSCC to ensure that there would be appropriate representation throughout the FAP process. During the workshops, the team reviewed the original 2010 SWARS with participants and reconfirmed or adjusted FSM's issues. For each issue, they conducted a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis to serve as information needed to describe the current conditions and trends and threats. The group then discussed priority landscape areas for each issue, and the DECEM GIS specialist reviewed maps prepared for feedback. Following the workshops, MCT, the consultant, and GIS specialist collected additional information during follow up meetings, which was then compiled to update the FAP narrative.

A follow up validation workshop with key stakeholders was originally planned to take place to review drafts. However, the FSM began to take precautions to address the growing global pandemic due to COVID-19, enacting a declaration of emergency, and closed its borders to incoming arrivals in March 2020. As the islands are spread out and rely on one US commercial airline, this prevented travel between the FSM states. Several FSM states took additional measures, including closing government offices, requiring agency staff to participate in COVID-19 task force meetings, and initiating social distancing guidelines that included limiting meetings.

During the workshops, FSM R&D and the Nature Conservancy (TNC) provided comprehensive information regarding the FLP as a resource conservation tool and framework for program implementation. TNC began consultations to assist FSM R&D with updating Kosrae's chapter of FSM's AON to extend eligibility for the FLP, and to develop chapters in the AON for Pohnpei and Yap. Several potential forest legacy projects in each state 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. When completed, the updated AON will be submitted as an amendment of this 2020 FAP.

A full list of organizations that contributed to this FAP, along with workshop agendas and participants, is included in Appendix 3.

State Forest Stewardship Coordinating Committee

Forest Stewardship Coordinating Committee (SFSCC) members were updated by the FSM State Forester with input from FSM state local forestry agencies and partners. FSM national, state, NGO, private and individual representatives are included within the committee. The FSC members were invited to be a part of the consultation process described above, and either attended the in-person workshops or meetings, sent representatives, or provided information and feedback remotely. As previously noted, FSM-wide COVID-19 precautions prohibited extensive in person meetings, so the draft FAP was primarily shared via email for review.

TABLE N 3 FSM FOREST STEWARDSHIP COORDINATING COMMITTEE

Federated States of Micronesia (FSM) State Forest Stewardship Coordinating Committee (SFSCC)	
Interest or agency required by law "if feasible"	**Name*, Title, Affiliation** *(all italicized names were directly involved in the FSM FAP review process, through in person workshops or consultations, or virtually. Additional names were submitted as important to the FAP implementation in the FSM and will be consulted as appropriate)*
Forest Service	*Kathleen Friday, USFS*
U.S. NRCS	*NRCS Pohnpei Field Office David Komorowski, District Conservationist (sent draft via email as unable to travel to FSM due to COVID-19 as of December 31st, 2020)*
Farm Service Agency	N/A (not in the FSM)
Cooperative Extension Service	*Steven Young, Director COM-FSM Cooperative Research and Extension*
Local (FSM State) Government	Jackson Albert, Chairman, Council of Mayors, Kosrae State Leon Fred, Chairman of the Chuuk Council of Mayors *Mayor Smithy Clark of Pingelap, Chairman, Pohnpei Council of local Chief Executives* Yap State Council of Tamol and Pilung Representative
(USDA) Soil & Water Conservation District	To be discussed when NRCS representative arrives in the FSM (see NRCS comment above)
Consulting FSM state foresters	*Francis Ruegorong, Waab Land & Wildlife Coordinator* *Maxson Nithan, State Forester, Kosrae State* *Basiente Atan, Chief of Forestry, Chuuk State* *Eugene Eperiam, State Forester, Pohnpei State*
Forest products industry	*Dr. Tholman F. Alik, Yela Environmental Landowners Authority, Kosrae* *Nelbert Perez, Chairman, Pohnpei Farmers Association* *Peter Garamfel, Chairman, Yap Farmers Association* *Peter Aten, Chief for Commerce and Industries, Office of Commerce and Industries, Chuuk State*
Private Forest landowners	*Dr. Tholman F. Alik, Yela Environmental Landowners Authority, Kosrae* *William Hawley (Rohsa), Chairman Nahnpei Estates*

	Fabro Andrew, UFO Conservation Society
Land-trust organizations (no direct FSM equivalent. Local offices related to land issues are shown)	Robinson H. Timothy, Principal Judge, Kosrae Land Court Maneichy Sonis, Senior Land Commissioner, Division of Land Management, Chuuk State Peter Lohn, Director of Land, Pohnpei State John Waayan, Chief of Division of Land Resources (R&D)
Lead agency for Forest Legacy	*Marlyter Silbanuz, FSM State Forester* *Blair Charley, Director, Kosrae Island Resource Management Authority*
Environmental/Conservation Organizations	*Andy George, Executive Director, Kosrae Conservation and Safety Organization* *Bradford Mori, Deputy Director, Chuuk EPA* *Marcellus Akapito, Chuuk Conservation Society* *Senator Wisney Nakayama, Chair Chuuk Women Council* *Eugene Joseph, Executive Director, Conservation Society of Pohnpei* *Henry Susaia, Director, Pohnpei EPA* *Sabino Sauchomal, Director, Yap Community Action Program*
State (FSM) fish & wildlife agency or equivalent	*Blair Charley, Director, Kosrae Island Resource Management Authority* *Curtis Graham, 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 Arlynne Chugen, Director, below] Hubert Yamada, Director, R&D, Pohnpei
Tribal representatives (chiefs)	Henry Nedlic, Traditional Chief, Chuuk State Yap State Council of Tamol and Pilung Representative Hon. Salvador Iriarte, Chairman, Council of Traditional Leaders (Mwoalen Wahu of Pohnpei) Council of Mayors of Chuuk and Kosrae State (represented above)
Other (FSM State Departments of Agriculture)	*Kantito Kanas, Director Dept of Agriculture, Chuuk State* *Basiente Atan, Chief of Forestry, Chuuk State* Gerson Jackson, Director, Dept of Resource and Economic Affairs, Kosrae Arlynne Chugen, Director, Yap Dept of Resources and Development *Saimon Lihpahi, Chief, Forestry and Natural Resources Management Division, Pohnpei* *Mark Kostka, Chief, PNI Division of Agriculture/Chairman of local S&WCD board*
Other	Kerson Rizal, Dept of Public Safety, Chuuk State Angelino Rosokow, Chief Public Affairs, Chuuk State *Wisney Nakayama, Senator Chuuk State Legislature* *Adelino Lorens, Technical Expert*

State Technical Committee

The Farm Bill expects consultation with the USDA NRCS convened State Technical Committee, which would normally represent interests within the "state", but is a regional body in the Pacific. The State Forester for the Pacific Island Region, Mathew Cocking, is based in Hawaii. Meetings typically cover topics of relevance to the domestic islands only, and the interests that would normally be represented by a State Technical Committee are largely the same as the interests represented in the Forest Stewardship Committee. While there is an NRCS office in Pohnpei FSM, the District Conservationist, David Komorowski, was unable to take up his post in the FSM due to COVID-19 travel restrictions before this FAP was completed. Therefore, this requirement was addressed by providing the draft updated FSM Forest Action Plan was to NRCS (Mr. Komorowski and Mr. Cocking) on November 3rd, 2020. The final revised will also be shared.

State Wildlife Agency

Responsibility for terrestrial and marine wildlife rests with the Chuuk State Departments of Marine Resources and Agriculture; Kosrae Island Resource Management Authority and Kosrae Department of Resource and Economic Affairs; Pohnpei State Department of Resources and Development; and Yap State Department of Resources and Development. Representatives for these agencies were involved in updating the 2020 FSM FAP, and are also included in the SFSCC.

Lead agency for the Forest Legacy Program

Currently, only Kosrae State is utilizing the FLP after becoming eligible through the AON prepared in 2010 (Appendix 2), and the Kosrae Island Resource Management Authority (KIRMA) is the lead agency for that state.

The AON is in the process of being revised as described above, with updated information for Kosrae, and chapters for Pohnpei and Yap State. It will be submitted as an amendment to this FAP when complete.

The FSM Department of Resources and Development, Division of Resource Management and Development, Agriculture Program house the FSM 'State' Forester, and will act as the lead agency for the FLP for the FSM as a whole.

Applicable Federal land management agencies and military installations

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

OTHER PLANS INCORPORATED IN THE FSM FOREST ACTION PLAN

Community Wildfire Protection Plans

Lying at the western end of the FSM where wildfires are a greater problem due to climatic conditions, Yap State has the most comprehensive wildfire management program, with the Yap Division of Agriculture and Forestry (DAF) working with the Yap Division of Public Safety (DPS) and assisting communities with planning and prevention. The Yap State Community Wildfire Protection Plan (CWPP) was developed in 2011. Yap has since continued to engage communities in activities to prevent and mitigate wildfires, further described in the Yap chapter of this Forest Action Plan. Other FSM states also rely on support from

their respective public safety agencies, and some have identified development of wildfire plans as strategies.

State (FSM) 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 reviewed for the development of the original SWARS and this updated FAP, and are listed below under 'Other'.

Other

The following documents were heavily drawn from to prepare this Forest Action Plan, and can be referred to for additional details regarding forest resources and priority strategies within the FSM. Additional documents and plans are shown in the reference section for the National and State Chapters.

TNC 2003. A Blueprint for Conserving the Biodiversity of the FSM, 103pp.

The Federated States of Micronesia National Biodiversity Strategy and Action Plan: (FSM 2004, updated in 2018) and the state-level BSAP

FSM Protected Areas Network Policy Framework

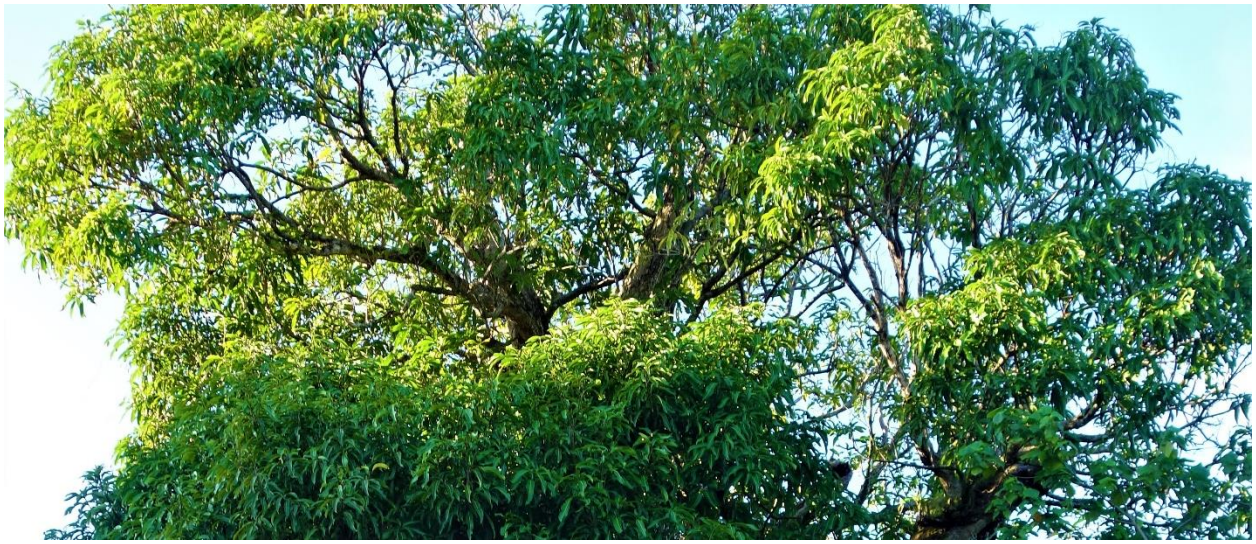
FSM Agriculture Policy 2012-2016

National Invasive Species Strategy and Action Plan 2016-2021(NISSAP, 2015)

FSM Strategic Development Plan 2004-2023

FSM National Environment Management Strategy 2019-2023

Forestry agencies in the FSM, the US Forest Service, and many partners and programs have supported the development of Forest Stewardship Plans, terrestrial protected area management plans, watershed plans, and more. As the majority of land in the FSM is privately owned and management by communities, those plans will not be linked in this FAP, but parties interested in learning more about them can reach out to the FSM State Forester to be connected to the appropriate contact.



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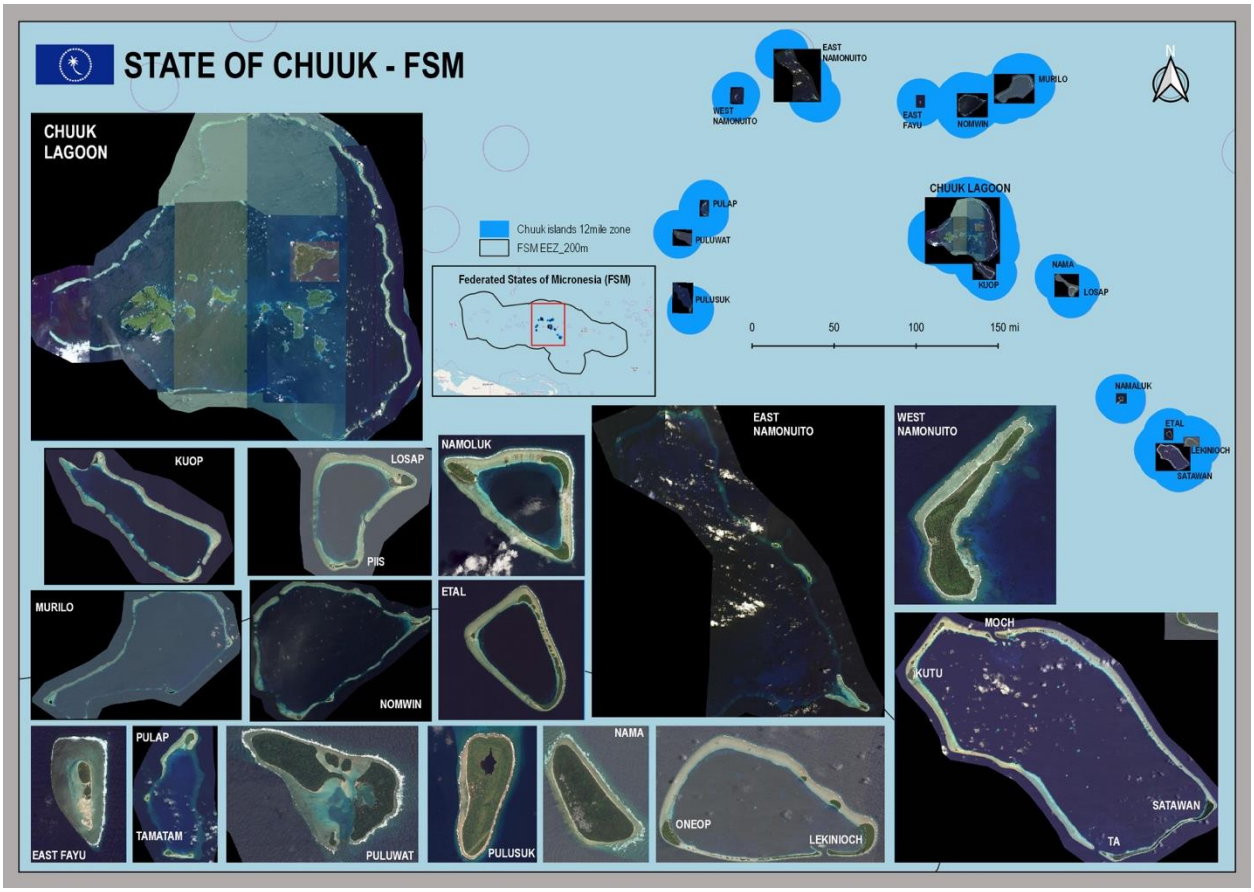
VIEW FROM NEFO FOREST, CHUUK STATE. PHOTO CREDIT: CHUUK WOMEN'S COUNCIL

II. CHUUK STATE



Map C1 - Chuuk State

This map shows the locations of Chuuk's lagoon islands and its neighboring outer islands within the FSM EEZ, using the 2016 WorldView-3 satellite imagery as the background for each island.

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 numerous 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.

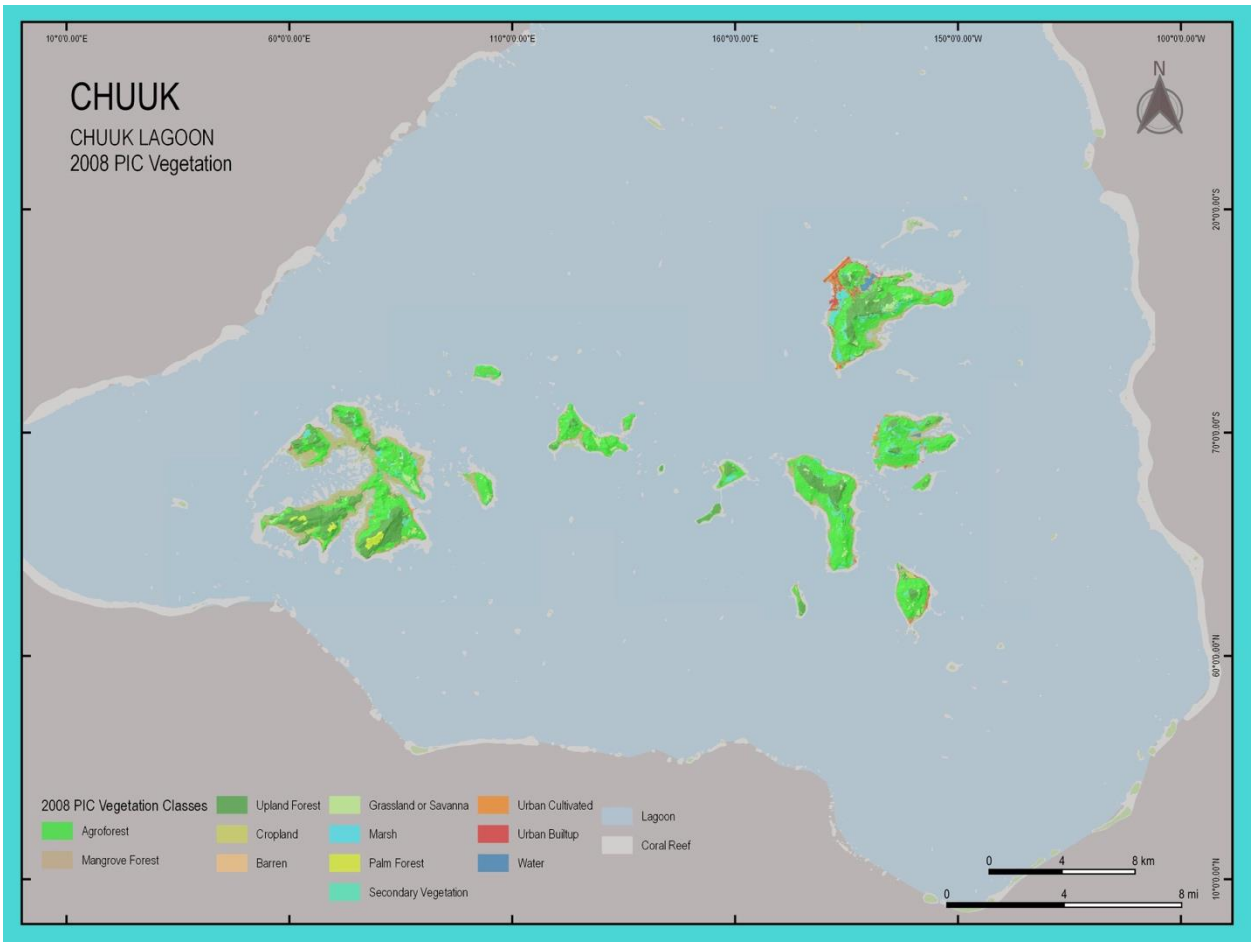
Chuuk is the most populated state in the Federated States of Micronesia (FSM). The State is made up of the Chuuk Lagoon and the Outer island regions of Nomwunweito, Halls, Patti, and Mortlocks. Chuuk Lagoon has a land area of 49 square miles. Chuuk is the most populous of the four states of the FSM with the highest overall population and highest population density in the FSM of 993 people per square mile,

rising to 1,000 per square mile on the outer islands of Chuuk (CBSAP, 2018). Chuuk's high population has led to an increase in environmental threats facing the islands. These threats range from conversion and degradation of habitat and ecosystems, invasive organisms and pests, to over-exploitation and unsustainable harvesting of resources (NBSAP 2018). Given the low-lying nature of many of the islands in Chuuk, climate change also poses environmental and existential threats to Chuuk's islands and ecosystems.

CHUUK STATE FOREST RESOURCE ASSESSMENT

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.

Chuuk Lagoon islands' 12 vegetation and land cover classes include: upland forest, agroforest, mangrove, swamp, marsh, cropland, grassland/savanna, barren, urban built-up, urban cultivated, and water.



MAP C2: Chuuk lagoon islands: 2008 Vegetation layers map

This map shows the vegetation classes of Chuuk lagoon in 2008. The data set was developed from 2007 QuickBird satellite imagery by Digital Globe through land cover classification carried out by U.S. Forest Service (2007).

Conditions and Trends

PHOTO CREDIT: TAMARA GREENSTONE-ALEFAIO

Chuuk 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 FAP can be found in these references.

Chuuk was once a much bigger island than it is today. 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 geologic time, the island sank, leaving just the mountain peaks surrounded by a barrier reef consisting of the islands of the Chuuk Lagoon as we know them today. When people began to populate the islands, they mainly utilized the lower lying lands, and the unique native forests were left relatively untouched. These areas are some of the most unique and endangered forests in Micronesia. The rest of Chuuk state consists of low-lying atolls lying precariously close to sea level, with vulnerable water resources stored in freshwater lenses.

In Chuuk, much upland native forest was cleared during WWII and has not significantly recovered due to being converted to agroforestry areas or having become overgrown by invasive species (SOE, 2018). 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), Dendy (2020) It is estimated that a little over 28 sq. miles of Chuuk is forested, equating to almost 60% of land (et al, 2011). Of this, upland forest covers 6.5 square miles, palm forest covers 0.3 sq. miles and agroforest cover 16.6 sq. miles (Donnegan et al, 2011).

In the original SWARS, it was reported that observations of forest trends over the years indicated a decline of native forest and good quality agroforest and an increase in areas covered by aggressive vines and invasive species. The decline has continued and remains a major issue at this time. 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. The situation has not improved substantially although there is an emphasis on promoting sustainable use of mangroves and a Mangrove Protection Act (2019) has been drafted and remains with Chuuk Legislature to be endorsed.

Issues

PHOTO CREDIT: CHUUK WOMEN'S COUNCIL

The numerous islands of Chuuk state are small, and with closely linked ecosystems in a small area, there is little leeway for ecological missteps. Once ecosystems are disrupted, they are difficult to re-establish. Therefore, cross cutting threats identified for Chuuk states terrestrial biodiversity include invasive alien species and climate change and to a lesser extent wildfire. It is also 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 as it relates to climate change, and the health of the island's ecosystem. The Integrity of biodiversity is also identified as a high priority issue for Chuuk in terms of the necessity of protection both for its own sake and the link between ecosystem and human health. The increasingly higher tides due to sea-level rise and increased development have resulted in a high priority being placed on coastal stabilization. Also of importance to Chuuk is the watershed approach that is not only ecologically sound but clearly delineates the relationships between ecological landscapes and the connection between ecological integrity (biodiversity), food production and the need for sustainable production and harvesting. Therefore,

matters to do with the production and sustainable harvest of terrestrial resources are urgent. Last, only because it is non spatial in nature, is the significant need for local capacity development and increased education and training opportunities. This is urgently needed both for terrestrial resource managers, government employees and in the development of public and community awareness and capacity.

Table C-1 below summarizes FSM Cross-cutting issues and their Priority Landscapes in relation to USFS Primary National Themes. Maps of primary priority areas are indicated in this table and inserted with their respective issues. Additional maps are either referred to and provided at the end of this chapter or simply provided for further analysis and might apply to multiple issues.

TABLE C 1 CHUUK ISSUES, PRIORITY AREAS, NATIONAL THEMES

FSM National Issues	Priority Landscape Areas	U.S. National Themes
Cross-Cutting Threats	Cross-cutting threats (Invasive species, wildfires, and climate change) affect all issues	3 Enhance, 1 Conserve, 2 Protect
A. Food Security	Strong emphasis on both agroforestry and upland and mangrove areas (Map C3)	3 Enhance, 2 Protect
B. Coastal Stabilization	Primarily mangrove, developed areas along the shoreline, and the projected sea level rise (SLR) hazard zones (Map C8) from the shoreline (Map C4)	1 Conserve, 3 Enhance
C. Biodiversity Conservation	Upland agroforestry, protected areas (Map C10), Areas of Biological Significance (ABS) (Maps C9A and C9B) (Map C5)	3 Enhance, 1 Conserve, 2 Protect
D. Watershed	Priorities are upland, agroforestry marsh, and 100ft buffer of rivers/streams (Map C6)	3 Enhance, 1 Conserve, 2 Protect
E. Production & sustainable harvesting	Priorities are upland, agroforest, secondary vegetation, palm forest. (Map C7)	3 Enhance, 1 Conserve
F. Capacity-building	(non-spatial)	3 Enhance

Cross-cutting Threats

Invasive species

The identified cross-cutting threats for Chuuk are invasive alien species, climate change and to a lesser extent, wildfires. These threats have been identified as cross-cutting due to their overwhelming effects

on terrestrial resources and must be addressed in the context of all of the FSM National Issues. All three threats have the potential to destroy endemic biodiversity, overtake land for food production and cause significant devastation.

Chuuk is home to numerous endemic species including the Chuuk Monarch (*Metabolis rubensis*), Chuuk Fruit Bat (*Pteropus insularis*), Mortlocks Fruit Bat (*Pteropus pelagicus*), Paawan Tree (*Semecarpus kraemeri*), Chuuk Giant Milipede or Siichón *(Acladocricus setigerus*) and Truk Greater White-eye or Nimeséwúnúpwún (*Rukia ruki*) (NISSAP, 2015). Other Endemic Species of note include "Uruse" Schefflera kraemeri; "Kiniaw" Clinostigma carolinensis; "Nifach" Freycinetia comensii). Chuuk State overarching goal for invasive species as outlined in the Federated States of Micronesia Invasive Species Strategy and Action Plan 2016-2021 (NISSAP, 2015). Invasive alien species have increased in Chuuks upland and savannah zones threatening strategies to establish agroforests to increase food security and protect biodiversity. Moreover, the 2015 NISSAP outlines the following overall goal for Chuuk state, prioritizing the following under invasive alien species "Establish biosecurity (border control, quarantine, eradication and/or management) programs to effectively protect the Chuuk's biodiversity, livelihoods, sustainable development and resilience to climate change from the impacts of invasive species". Invasive alien species actions are found throughout the FSM National Issues as identified below a well as within the Chuuk State Strategy Table.

Climate change

The Chuuk Joint State Action Plan for Disaster Risk Management and Climate Change (JSAP) identifies drought, typhoons, storm waves, flooding, sea level rise and landslides as the main threats to Chuuk due to the increasing effects of climate change in the islands (2017). Direct impacts from climate change on terrestrial resources include threats to traditional agroforestry systems through saltwater intrusion, droughts and typhoons (SOE, 2018). Climate change is identified as a major threat to all FSM National Issues and is exasperating the negative impacts of numerous other issues such as loss of land for agroforestry, decrease in coastal stabilization, increase in invasive alien species, fragility of biodiversity and ecosystem health, and human impacts such overharvesting of terrestrial resources and development projects.

Wildfires

While not as significant as in Yap state, for instance, extensive wildfires associated with severe El Niño-Southern Oscillation (ENSO), impacts forests in Chuuk. During times of drought, wildfires burn unchecked destroying grasslands, eroding forest edges and preventing weedy areas from reforesting by killing tree seedlings. The problem is exasperated by the invasive alien species *Pennesetum* grass that makes open areas more susceptible to wildfires. There is also a continued practice of slash and burn agriculture and arson contributing to wildfire risks in Chuuk.

A. Food Security

Conditions and Trends

Most locally produced food in Chuuk continues to be produced through traditional agroforestry and taro patch systems. Chuuk has the most extensive area of land classified as agroforest in the FSM at 61% and is dominated by breadfruit (Dendy, 2020). Chuuk state's agroforests also include the most breadfruit,

pandanus, coconut and mango tress among the four states (Dendy, 2020). The vegetation maps produced in 1987 (Falanruw et al) indicate that some 57% of the four islands surveyed consisted of coconut/ breadfruit agroforest. (Subsequent vegetation type mapping has not distinguished forest from 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 is 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 road-side market stalls, and locally grown and processed food is still exported to Guam where there is a large Chuukese population. Comparative analyses between the 2006 FIA and the 2016 FIA, the number and volume of coconut trees has significantly decreased in every state but was the species with most significant loss of volume in Chuuk (Dendy, 2020). Climate Change continues to impact food security and agroforestry production through increased periods of drought, heavier than normal rainy periods and storms. In 2015, for instance, Typhoon Maysak significantly impacted agroforestry systems in Chuuk (SOE, 2018). Importantly for Chuukese, there are also several traditional methods for sustainable agroforestry. As breadfruit is the most culturally significant stable crop in Chuuk, there are two bread fruit customs of *Mwemei* and *Omwuumei*, both involving ceremonies to celebrate the harvest of the season (SOE, 2018).

Traditional agroforests, dominated by woody species, are good watershed cover. Continued 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 may have destabilized steep slopes, contributing 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. The thinning of freshwater lenses, desiccating winds and drought also threaten agroforests on Outer Islands. The significant impacts of climate change including higher temperatures, prolonged drought and sea level rise will result in the eventual collapse of freshwater 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 was an especially high priority of the initial SWARS and remains as such for this FAP.

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. Damage to agroforest trees from vines is the largest damage type overall and in Chuuk (Dendy, 2020). 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.

Strengths:

- **Traditional agroforestry**: is immensely important to Chuukese culture and livelihoods, and still being practiced, along with traditional preservation methods especially the preservation of breadfruit called *maar* or *opwot.* With costs of imported foods continuing to increase, continued agroforestry practice contributes to providing low-cost food security to families/communities.

- **Success of coconut and breadfruit rehabilitation projects:** success includes tree planting initiatives (breadfruit and coconut) funded by the GEF5 Ridge to Reef (R2R) project, the completion of a conference on tree planting, and the declaration of September 2nd as Coconut Day in the FSM by President Mori in 2009.
- **Artificial taro patches in place in the outer islands:** the completion of taro patch assessments on Chuuk's outer islands by the Chuuk State Department of Agriculture (DOA) and Chuuk College of Micronesian Cooperative Research and Extension (COM-FSM CRE) while taro rehabilitation has been the top priority for DOA over the years.
- **Agroforestry Nursery Project:** the establishment of community and home gardens and companion school curriculum on the main islands of Weno by the Chuuk Women's Council (CWC) funded by the USAID Pacific-American Climate Fund (PACAM) project.
- **Nursery Improvements in Outer Islands:** The Catholic Relief Services built 9 nurseries on 9 islands in the Chuuk lagoon in partnership with the International Office of Migration (IOM) USAID Disaster Preparedness program.
- **Increased Awareness and Education:** there was a significant increase of awareness activities in communities and schools focused on small scale farming and nurseries with the goal of imparting skills for sustainability them by Chuuk COM-FSM CRE.
- **Increased Availability of Produce:** while still not organized into a central and uniform system, local produce availability has increased and is brought to the main island of Weno from the lagoon islands and sold in market stalls and at the wharf.
- **Increased Livelihood from Sale of Produce:** per point above, the increase in local produce being brought to the main island of Weno has also increased the livelihood of local farmers/women selling their produce and food items.
- **Expanding Export of Food:** there has been a significant increase in food being shipped to Guam and to other Micronesian jurisdictions that is seen as a positive for livelihood opportunities.
- **FSM Integrated Agriculture Census 2016:** the FSM National government undertook an agriculture census in 2016 that provides detailed baseline information and was released in 2018.
- **Increase in Management Plans and Nursery Projects:** a significant project was the development of the Sapo, Oror, Ununo (UFO) Fefen Forest Stewardship Plan by the Conservation Society of Chuuk (CCS) and the SOU Community. This also included the implementation of initial actions such as a coconut census and delineation of the area. Moreover, the CCS completed the Oneisomw island nursery project and CWC carried out a rehabilitation project in the Nefo Forest with communities as well as a tree planting and awareness campaign. Both projects include planning to support farmers as well as village and settled areas and home gardens and replanting initiatives.

Weaknesses

- **Increase of Invasive Alien Species (IAS)**: the invasive species coverage increased since last the SWARS and is increasingly difficult to manage as it is so widespread. 15 species in Chuuk are

classified as 'invasive' based on evidence of impact or record of aggressive spread in the natural environment (SOE, 2018). There is a significant increase in IAS especially in the upland mountains. Invasive weeds are damaging crops and decreasing the availability of land for future growing of agroforestry plots.

- **The Chuuk Invasive Species Taskforce (CIST) is currently inactive**: while agencies and NGO's in Chuuk continue to work to manage and eradicate invasive species, there lacks a coordinated effort that CIST could lead.
- **Agriculture as Low Leadership Priority:** there has been a decrease in prioritization of agriculture investments at the national and state levels which is also stated in the Chuuk Joint State Action Plan for Disaster Risk Management of 2017.
- **Overharvesting of Taro:** traditionally during breadfruit season, family heads and village chiefs require that families do not harvest taro and rely more on the breadfruit harvest and preserving breadfruit is a common task so that during off-season, there would be "maar" or "opwot" to go along with Taro and banana. More recently, some families prefer to sell taro during breadfruit season to make more money which has led to decrease in taro crops in some areas.
- **Lack of Management or Control of Resource Management:** this is exemplified by the over harvesting of taro example above. Whereas there used to be cultural norms and ways to manage resources, some of these mechanisms are no longer in practice. There is also concern that there are not enough laws and regulations around this.

Opportunities

- **Availability of Capacity Development:** COM-FSM CRE programs are available in Chuuk and do not require travel off island to access many.
- **Outside Donors Prioritizing Food Security:** examples include (but are not limited to) the GEF5 R2R program that is supporting rehabilitation and replanting projects, the GEF6 Invasive Species Project (housed at the FSM Department of Resources and Development) to begin in 2021 will support rehabilitation in the context of invasive species, the FSM National Government Food Security Proposal to the Green Climate Fund (by GCF accredited entity the Micronesia Conservation Trust) that if funded, will support famers, agroforestry, nurseries, and a more cohesive marketing plan for the sale of produce within and outside of the FSM.
- **Crop Assessments for Climate Change Resiliency:** with more funding focused on food security, there is an opportunity to further investigate specific crops that will be resilient to climate change and saltwater inundation that could be grown in Chuuk.
- **New Technologies:** there is an opportunity to pilot and establish best practices for technologies to increase agroforestry and food production in Chuuk.
- **Reconvene the Chuuk Invasive Species Taskforce (CIST):** with the GEF6 Invasive Species Project beginning at the national level, the opportunity to reconvene CIST is timely.

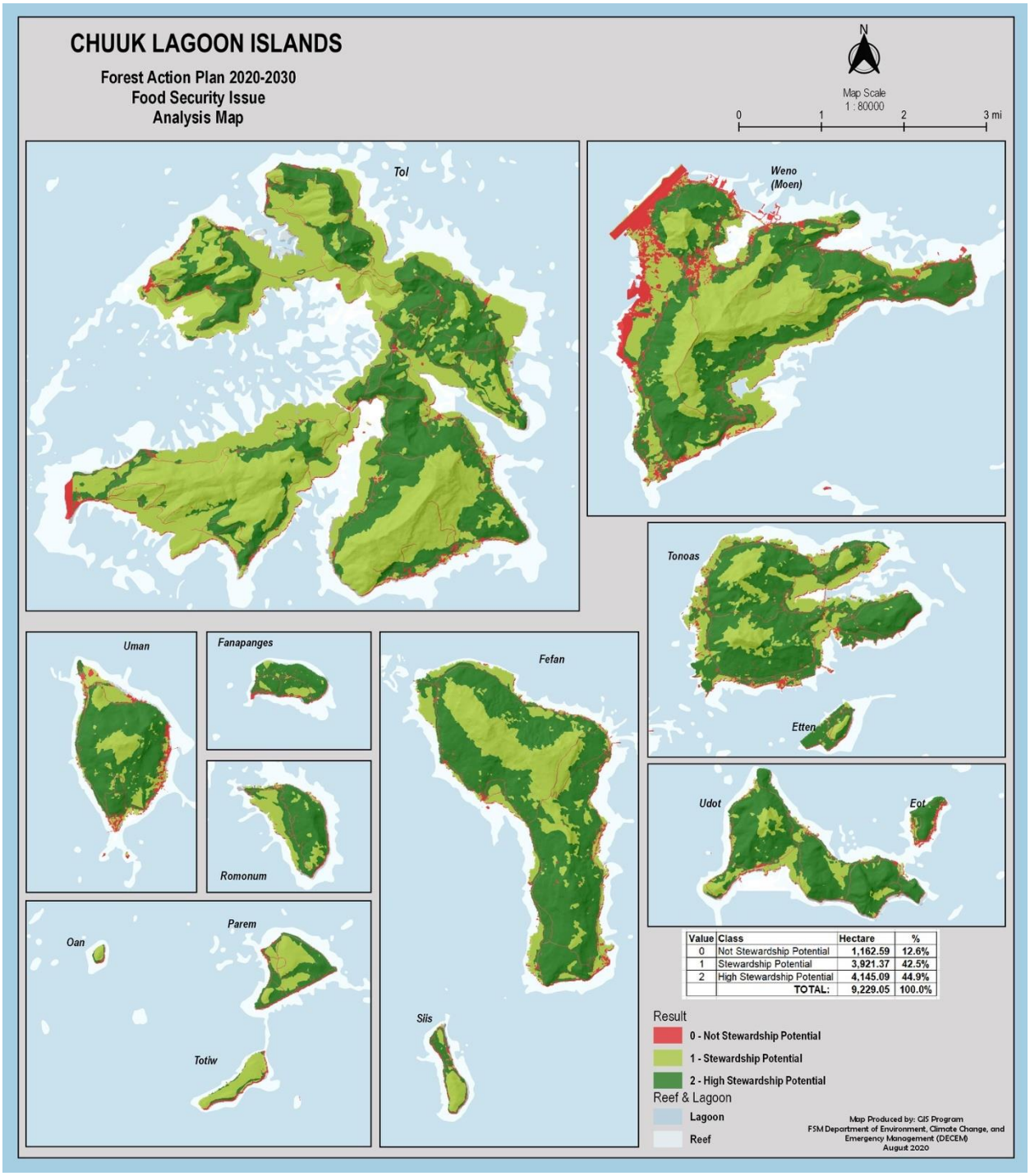
- **Further Develop Community Training Programs for Invasive Alien Species:** while some NGO and community projects have addressed invasive alien species over the years, there is an opportunity to develop programs, with CIST, for community members to learn to combat their own IAS issues.
- **Increase Participation in the Regional Invasive Species Council (RISC):** with the reconvening of CIST, there is potential for Chuuk to be more involved in RISC going forward.

Threats

- **Lack of Capacity and Resources to Respond to Natural Disasters:** after Chuuk experienced Typhoon Maysak in 2015, there is widespread concern about the state and nations capacity to respond to future natural disasters especially in relation to damage or destruction of food crops. This is seen as the greatest threat to food security in Chuuk.
- **Unpredictable Weather Patterns Due to Climate Change**: there are concerns about the noticeable increase in periods of drought and unpredictable rain seasons as well as the increasing unpredictability of seasons.
- **Invasive Alien Species:** there are significant concerns that invasive alien species are destroying food crops, limiting agroforest species and overtaking potential areas for converting to food and agroforestry land. New invasive species, such as the coconut rhinoceros beetle, could destroy important trees and crops if they reach the island.
- **Government Priorities:** while food security is a current target priority of the state and national governments, a change in leadership could force a change in political will and cause a shift in priorities.

Priority Areas for Food Security:

Agroforest vegetation is first priority while areas of upland, secondary vegetation and palm are second priority as they represent land that has already disturbed and could be converted to more agroforest areas without sacrificing native forests. Mangrove areas are also second priority due to their 'nursery' status for fish and crab while developed areas are not priority for food security due to their already developed status.



MAP C3: Chuuk lagoon islands: Food Security analysis map

This map shows the result of the reclassification and overlay analysis of Chuuk lagoon islands spatial layers including vegetation, developed areas, and protected areas (MAP C10) into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the food security issue for Chuuk. Dark green areas (44.9%) are the high potential areas (agroforest), light green areas (42.5%) are the potential areas (upland, mangrove, secondary vegetation, palm), and the red

areas (12.6%) are the not potential areas (developed areas) for food security issue in Chuuk. The analysis was done only for the Chuuk lagoon islands because there is no data layer available for the outer islands.

B. Coastal Stabilization

Conditions and Trends

Reports of the International Panel on Climate Change and other groups acknowledge climate change and predict more severe ENSO events and storms, rises in sea level and sea surges are resulting in erosion and inundation of coastal areas of Chuuk, especially in the low-lying outer islands (SOE, 2018). Impacts are exacerbated by damage to coastal ecosystems such as mangroves, through road building, landfills and dredging operations. Moreover, residents of high islands are increasingly moving inward as a result of coastal erosion and shifting weather patterns. These movements are contributing to habitat fragmentation and degradation due to the increasing demand for housing and infrastructure (FSM, 2014). The Chuuk Joint State Action Plan for Disaster Risk Management and Climate Change (JSAP) targets coastal hazards and erosion as a priority action (2017).

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.

Strengths

- **Coastal Management is a priority of Community-Based Management Strategies:** Through planning tools such as the Locally Managed Marine Area (LMMA), the Local Early Action Planning tool (LEAP), Forest Stewardship planning and other planning processes, community-based plans include coastal management with ecosystem-based adaptation actions such as planting projects for mangroves and strand forests. The sustainable use of mangroves is also prioritized in these planning processes.
- **Successful Revival of Mangrove Sites:** There has been focus on mangrove rehabilitation and planting that has led to the successful revival of seven sites in the state so far. This includes the replanting of 23,000 mangrove seedlings in 2017 and 2018 by the Chuuk Red Cross alone.
- **Policy in place for Disaster Risk and Adaptation:** JSAP was developed in 2017.
- **More Data Available:** there is increased availability of GIS layers to determine potential coastal hazard areas.

- **Development of Mangrove Protection Act (2019):** a draft act was developed and submitted to Legislature for review.
- **Red Cross Green Belt Project:** this project was spear-headed by the Red Cross and has installed mangrove nurseries, conducted trainings for community and completed mangrove planting around Chuuk.

Weaknesses

- **Lack of Coastal Zone Plan and Legislation:** this is also outlined as an issue in the JSAP of 2017.
- **Local attitudes Towards Roles and Funding:** there is concern that many believe outside organizations local NGO's should be paying for and leading replanting efforts along the coastline. Individuals feel that this work is not their role and behavior and attitude shifts are needed.
- **Lack of Awareness on Benefits of Coastal Protection:** there is a need for more awareness of the importance of planting and maintaining existing mangroves and other coastal vegetation and how they impact coastal community safety during storms, storm surge and sea level rise. This will also help with the point above about attitudes.
- **Lack of Capacity:** There are not enough engineers and technical professionals in Chuuk who can properly assess and identify suitable solutions to help coastal communities build resilience of their coastlines.
- **Lack of Data on Low Lying Atolls:** More information is needed to understand the needs of outer island communities in Chuuk.

Opportunities

- **Increases Awareness:** while a lack of willingness and attitudes are pointed out as a weakness, there is an opportunity to increase awareness and education activities for communities and especially focusing on youth to implement more coastal planting projects.
- **Funding Opportunities:** a number of funding opportunities were identified for eco-system based coastal rehabilitation projects such as the United Nations Development Program Small Grants Program (SGP), Red Cross and future funding from larger opportunities like the Green Climate Fund and the Adaptation Fund.
- **Livelihood Opportunities:** with funding and awareness, there is an opportunity to create more alternative livelihood opportunities to shift the reliance on selling mangrove wood as firewood in markets to other more sustainable practices.
- **More Programs Targeting Coastal Stabilization:** there is a need to develop more government and community-based programs that address this issue. This should include increasing state funding towards replanting and ecosystem-based projects and awareness raising programs for policy makers and communities alike.

- **Stronger Emphasis on Coastal Protection:** there is a need to shift behavior and attitudes among communities and also government officials to prioritize the protection of Chuuk's coastlines in practice, in policy and in funding.
- **Revisit Policies and Improve them:** need to revisit existing dredging and earth moving policies to address ecological loss.
- **Use New Science and Technical Support:** identify engineers and technical professionals to properly assess and identify suitable solutions to help coastal communities build the resilience of their coastlines.
- **Determine Needed Information and Gather it**: to better be able to plan, more information and data is required. This is most important for outer islands communities in Chuuk where data gaps are preventing the development of a plan to best plan for the future.

Threats

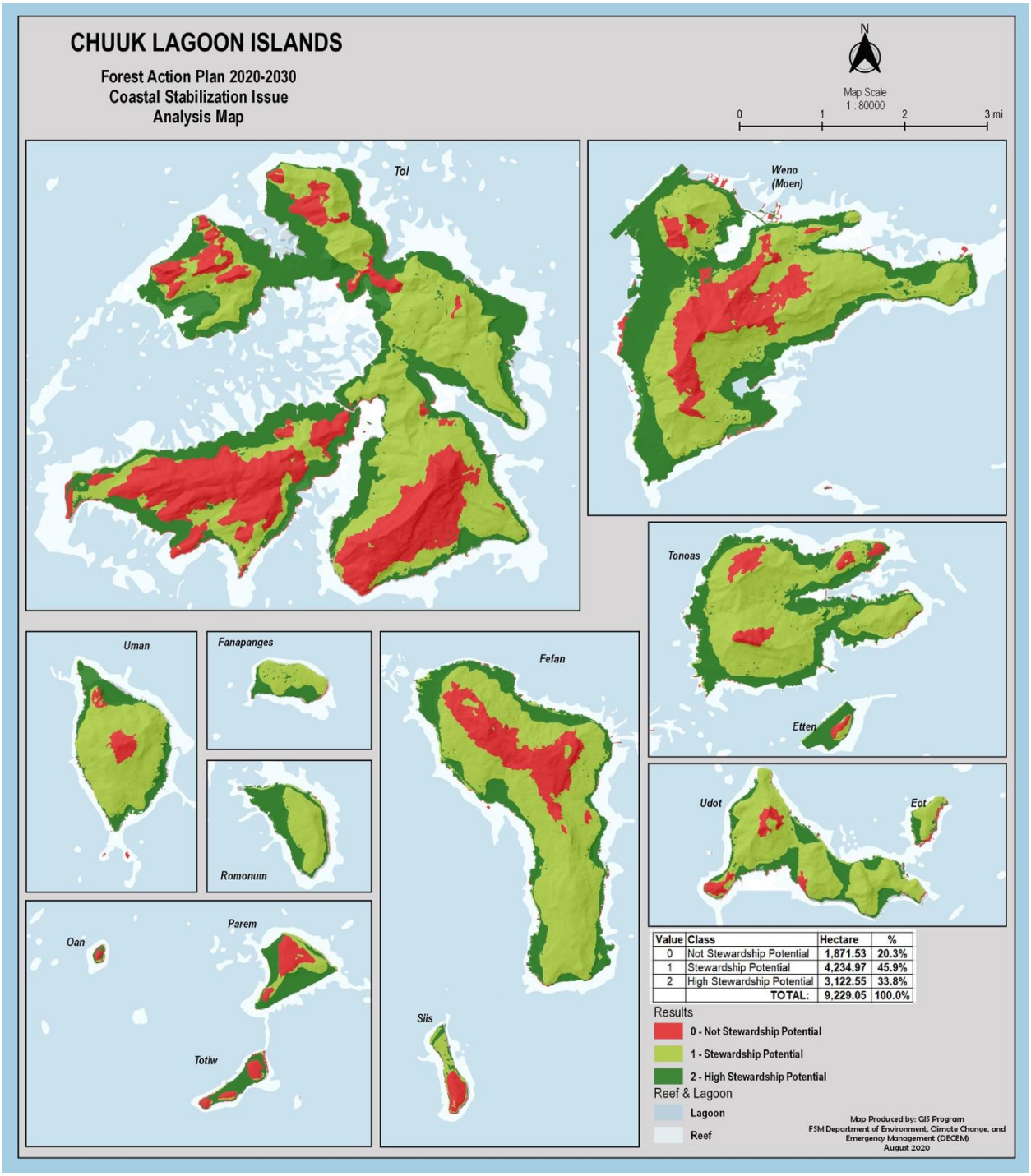
- **Development Along Coastlines:** roads, shipping docks, buildings and even farms and agriculture spaces are necessary infrastructure that is often built along the coastlines of Chuuk. The need to continue to provide development opportunities will remain, especially with increased movement of outer islanders to main islands like Weno.
- **Illegal dumping:** trash is often thrown into the ocean or along the coast. As well, some use trash as landfills along the coast without proper barriers.
- **Continued Harvesting of Mangroves:** a preference remains for mangrove wood for fires and cooking. An updated assessment of the status of mangrove forests and the passage of the Mangrove Protection Act are still needed as is a need to revisit dredging and earth moving policies. 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. Lack of clarity and a need to update dredging policies was an issue consistently identified. This is made more difficult in Chuuk where mangroves are privately owned.
- **Dredging:** development of infrastructure requires the raw materials to build including sand and coral that is dredged from coastal areas. This is impacting coastal stabilization and existing policies are not sufficient to prevent ecological degradation from these practices.
- **Preference for Artificial Seawalls:** seawalls built with cement or other products are preferred over ecosystem-based solutions even while they are more expensive and can cause further damage. This is because many in Chuuk think that and ecosystem-based solutions such as planting do not always have the same coastline protection impact.
- **Intensified Effects of Climate Change:** climate change mitigation is slow, and adaptation takes a lot of funding while impacts on coastal communities will continue to increase.
- **Severe Destruction of Coastlines:** the current status of many of the coastlines in many areas of Chuuk are already degraded so much that many may not be able to be rehabilitated.

- **Isolation and Inaccessibility of Outer Islands:** Chuuk's outer islands are isolated from the main island while the entire archipelago of Chuuk state is isolated from other regions of the FSM and other countries. This causes complex capacity, travel, design and implementation issues across the islands.

Priority Areas for Coastal Stabilization:

PHOTO CREDIT: TAMARA GREENSTONE-ALEFAIO

The first priorities for coastal stabilization are the areas most affected by erosion, development and sea level rise (SLR) including mangrove areas, developed areas along the shoreline, and the projected SLR hazard zones (MAP C8) from the shoreline. Second priority are agroforestry areas and upland, secondary vegetation and palm forest areas are not of priority for coastal stabilization.



MAP C4: Chuuk lagoon islands – Coastal Stabilization analysis map

This map shows the result of the reclassification and overlay analysis of Chuuk lagoon islands spatial layers including vegetation, developed areas, protected areas (MAP C10) and hazard layers (MAP C8) into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the coastal stabilization issue for Chuuk. Dark green areas (33.8%) are the high

potential areas (primarily mangrove, developed areas along the shoreline, and the projected SLR hazard zone from the shoreline), light green areas (45.9%) are the potential areas (agroforest), and the red areas (20.3%) are the not potential areas (upland, secondary vegetation palm forest) for the coastal stabilization issue in Chuuk. The analysis was done only for the Chuuk lagoon islands because there is no data layer available for the outer islands.

C. Biodiversity Conservation

Conditions and Trends

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.) Forests and trees contribute to biodiversity, protection and maintenance of ecosystem services in the FSM and Chuuk. They also play a significant role in mitigating the impacts of climate change. Unfortunately, despite their essential role in sustainable development, these valuable resources are under continuous threat from destructive human activities associated with agricultural clearing, firewood collecting and logging (SOE 2018). The removal of native forest and habitat fragmentation has direct impact on biodiversity, affecting vulnerable species and facilitating expansion of invasive plants. Degradation by activities such as bulldozing, unsustainable timber harvests, conversion to other uses and wildfires is resulting in deforestation and erosion diminishing soil fertility and water quality (FSM Fifth National Report to the Convention on Biological Diversity, 2014). Biodiversity across the FSM and Chuuk is incredibly rich. The FSM and its states are recognized part of the globally important Polynesia-Micronesia biodiversity hotspot (CEPF, 2007). Chuuk hosts high levels of species endemism being home to sixteen endemic plant species and three endemic bird species (IUCN, 2018).

In 2002, numerous sites were identified as Areas of Biological Significance (ABS) in the FSM through the Nature Conservancy blueprint process (see MAPs C9a and C9b for Chuuk State ABS). In 2006, in support of the importance of conservation of biodiversity across the region, the Micronesia Challenge (MC) was launched. This commitment from the leaders of the FSM, the Republic of the Marshall Islands (RMI), the Republic of Palau (ROP), Guam, and the Commonwealth of the Northern Mariana Islands (CNMI) committed to effectively conserving 30% of near-shore resources and at least 20% of forest resources across Micronesia by 2020 (Micronesia Challenge). In July 2019, the Chief Executives reaffirmed their commitment to the MC with a renewed challenge raising the conservation targets to effectively conserving 50% of marine resources and 30% of terrestrial resources by 2030, respectively.

Chuuk's terrestrial biodiversity is significant. 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. Several sites have been designated by US National Park Service as National Historic Sites through the Chuuk Office of Historic Preservation. There are opportunities to combine priority forest sites with historic sites, as identified by stakeholders.

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 all continue to threaten Chuuk's biodiversity. 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 may have contributed to landslides during storms and periods of especially heavy rainfall. Invasive species and aggressive vines threaten native forests.

Mangroves are threatened by fill & conversion; they are cut for firewood, and to open boat channels to individuals' land. Other threats include oil spills and dredging operations. Mangroves may be threatened, or their composition changed by sea level rise. 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.

Per the most recent CBSAP update: "it is clear from the revised Chuuk BSAP that extensive work has been achieved to date to conserve Chuuk's biodiversity and support its sustainable management. Yet, there remains much to be done." (2018). Protected areas plan, Forest Stewardship plans, policies and development of community capacity have all improved some aspects of biodiversity conservation and some terrestrial and forest regeneration n in Chuuk. An example of forest regeneration can be seen in the Nefo watershed that is being replanted with native tree species (FSM Sixth National Report to the Convention on Biodiversity, 2020). The same can be said for the previous SWARS and into this new FAP. The CBSAP and the Forest Action Plan are most importantly, plans of action that provide a pathway for the people of Chuuk to continue to conserve their vital terrestrial resources for future generations. An important recognition of the CBSAP is that conservation and sustainable management of the biodiversity in Chuuk are vital, and with most land and near-shore marine areas being privately owned in Chuuk, people and traditional governance are central to all matters of the environment and natural resources (CBSAP, 2018). 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 in Chuuk. 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.

Strengths

- **State Terrestrial Conservation and Biodiversity Plans Established:** Chuuk State PAN Law (2017), FSM National (and States) Biodiversity Strategy and Action Plan (2018), JSAP (2017), Chuuk State Strategic Development Plan (2018)
- **Increase in Terrestrial Protected Area Plans:** through the FSM and Chuuk State Protected Area Network (PAN) and the development of the Chuuk State PAN law, there has been a significant increase in plans led by communities focusing on the protection of biodiversity.
- **Increase in Protected Areas Maps and Datasets:** since 2006, work to establish terrestrial protected areas has increased, maps have been produced and baseline data is being collected (See MAP C10).

- **Regional Funding and Technical support:** there has been an increase in funding and expertise offered to the state and nation from regional and international partners to support communities, governments and private landowners to establish plans and implement actions.
- **Forest Inventory and Analysis (FIA**): the FIA in 2006 provided a baseline understanding of the status of the forests and terrestrial resources. The re-measurement in 2016 provided an opportunity to gauge success of efforts and develop management interventions based on a data to management loop.
- **Establishment of the Micronesia Challenge Endowment:** on behalf of the Micronesia Challenge, the Micronesia Conservation Trust was selected to host a regional endowment to provide long-term, sustainable funding for biodiversity conservation. Once a jurisdiction has met the milestones necessary (which include PAN Laws, an endorsed National PAN Framework, and a PAN funds distribution mechanism), it can begin to withdraw its dividends from the MC Endowment. This funding will be accessible by communities with management plans across the FSM.
- **Regional Invasive Species Council (RISC)**: the establishment of RISC provides invasive species management technical support and capacity building opportunities. Chuuk state is a member and has attended RISC regional meetings.
- **Visual Representation of Data:** a significant development to support the visualization of findings and needs for conservation efforts to be shared with communities and policy makers alike. Two examples of this are the Digital Atlas of Micronesia and the Micronesia Challenge Terrestrial Webviewer.

Weaknesses

- **Biosecurity System Insufficient:** there are overall concerns with the biosecurity system including customs (air and boat travel, and between the main island and outer islands in particular), a lack of enforcement (items not checked and coolers not opened), and a concern that Congress is not supportive of increasing enforcement efforts.
- **Lack of Enforcement of Existing Policy:** policies and regulations already in place suffer from lack of enforcement due to lack of resources, political will and technical capacity.
- **Lack of Collaboration:** while there are many governments entities, NGO's, communities, and landowners developing and implementing plans, they are not coordinated and often entities are not aware of the activities of other departments, even between government entities.
- **Lack of Capacity and Resources to Respond to Natural Disasters:** after Chuuk experienced Typhoon Maysak in 2015, there is widespread concern about the state and nations capacity to respond to future natural disasters especially in relation to damage or destruction of food crops. This is seen as the greatest threat to food security in Chuuk.
- **Reliance on External Technical support (FSM National and from other states):** while funding and technical support from the national government, other states and other countries is seen as a strength, there is also concern that the dependence is so great the people of Chuuk are not building enough capacity to tackle the issues without the external support.

- **Funding to Support Staff for Biodiversity Efforts**: there is not enough funding to support new staff at government offices and those who are employed do not receive raises.
- **Increased Occurrence of Invasive Alien Species:** 15 species in Chuuk are classified as 'invasive' based on evidence of impact or record of aggressive spread in the natural environment (SOE, 2018). There is a significant increase in IAS especially in the upland mountains. There is also not enough equipment or capacity to eradicate IAS such as pesticide applicator certification and safety.
- **Increase of Invasive Alien Species, Pests and Diseases**: the invasive species coverage increased since last the SWARS and is increasingly difficult to manage as it is so widespread. 15 species in Chuuk are classified as 'invasive' based on evidence of impact or record of aggressive spread in the natural environment (SOE, 2018). There is a significant increase in IAS especially in the upland mountains. Invasive weeds are damaging crops and decreasing the availability of land for future growing of agroforestry plots.
- **Limited Knowledge and Awareness on Biodiversity Conservation:** there is still a need to increase awareness raising for communities and policy makers on the importance of biodiversity conservation.
- **Continued Practice of Slash and Burn Agriculture:** there is increased fire risk due to prolonged drought, causing fires that can become out of control (there is also a problem of arson).

Opportunities

- **Collective Action Could Lead to Better Management and Planning:** there is a call for better coordination and groups have been formed that are working to coordinate funding, projects and implementation. This coordinated effort will empower stakeholders to be able to better dictate priorities to policy makers and donors alike.
- **Increase in Collective Interest in Protecting Natural Resources:** many people in Chuuk are beginning to deeply understand and care about the importance of protecting biodiversity.
- **Capturing Traditional Knowledge:** with increased interest in biodiversity conservation and traditional ways of knowing, there is an opportunity to capture traditional knowledge to share with current and future generations.
- **Other Funding Opportunities:** a number of funding opportunities were identified for eco-system based coastal rehabilitation projects such as the United Nations Development Program Small Grants Program (SGP), Red Cross, grants from the Micronesia Conservation Trust, FSM PAN Network and future funding from larger opportunities like the Green Climate Fund and the Adaptation Fund.
- **Increased Number of NGO's Working on Biodiversity:** examples include: the Chuuk Conservation Society (CCS), the Chuuk Women's Council (CWC), UFO Conservation Society, Island Pride, Brothers and Sisters of Parem, the ONEI Resource Management Committee

- **Increased Donor Responsiveness to Needs:** many donor organizations in the region are adapting their funding opportunities to the needs of jurisdictions especially as it relates to climate change and biodiversity.
- **Increased Collaboration for Policy Development**: Leadership (national and state) are working more closely with communities, resource managers and NGO's on policy development. This is leading to higher levels of confidence and communities are increasingly realizing benefits deriving from conservation initiatives i.e., livelihood opportunities.
- **More students returning to work in the field:** With increasing numbers of Micronesian students attending post-secondary education, there is an opportunity to support their studies to focus on biodiversity and conservation and support their return to Chuuk to contribute to their home islands. The BRMC is an opportunity under this umbrella.
- **Micronesia Challenge Young Champions Program (MCYC):** this program was seen as a catalyst opportunity for younger, college level students, to complete internships at home in Chuuk, inspiring them to pursue further studies in this area.

Threats

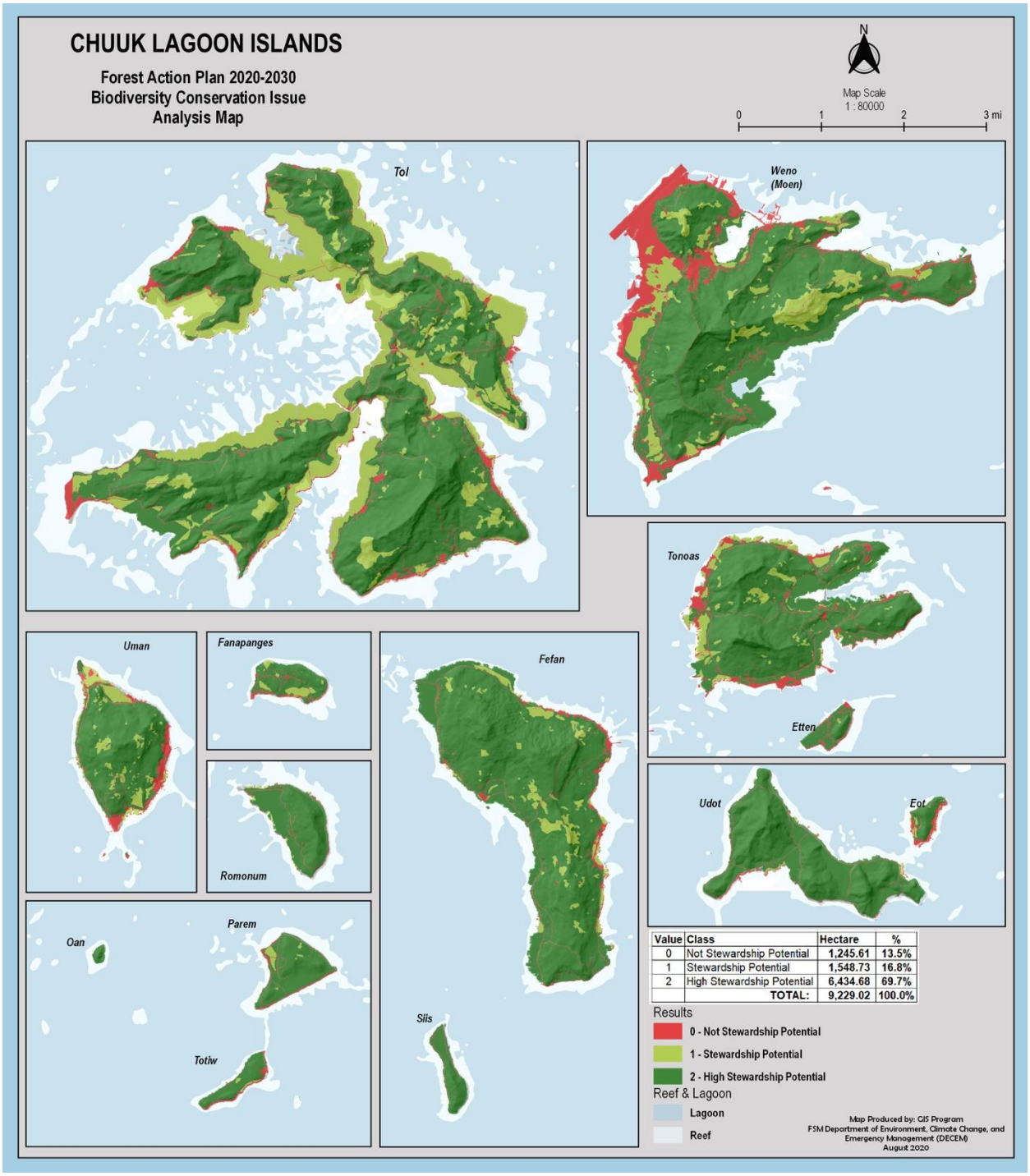
- **Risk of Loss of Traditional Knowledge (TK)** there is significant concern that TK is at risk due to increased outmigration and changes in technology. There is a need to strengthen and support traditional management practices for the conservation and sustainable use of biodiversity (BSAP, 2018).
- **Increased Mobility:** increasingly, more Chuukese are traveling within Chuuk and between the FSM and internationally (to Guam and the US Mainland). There has also been an increase in tourism and trade. There are more ships and more materials arriving in Chuuk from out of state. These activities are all seen as a threat to overall biodiversity paired with lack of border enforcement.
- **Increased Development:** upland forests are threatened by bulldozing for: roads, agricultural areas and house sites. Moreover, there is an increase in agricultural burning for development that is not likely to cease.
- **Threshold Might Be Beyond Survival:** the current status of some species is endangered putting the biodiversity and ecosystem health in some areas of Chuuk at such high risk that they may not be rehabilitatable.
- **Intensified Effects of Climate Change:** climate change mitigation is slow, and adaptation takes a lot of funding while impacts on coastal communities will continue to increase.
- **Government Priorities:** priorities can change with new leadership. If leaders prioritize economic opportunities over sustainable use of resources and when administrations change, projects and policies and funding can refocus and decrease for biodiversity conservation. A change in leadership could also force a change in political will and cause a shift in priorities.

- **Local Attitudes Towards Roles and Funding:** there is concern that many believe outside organizations local NGO's should be paying for and leading adaptation projects. Individuals feel that this work is not their role and behavior and attitude shifts are needed. Moreover, there is also a belief that the problem 'will just go away'.
- **Donor Issues**: while many donors are more responsive to priorities, it can be difficult to get funding support in a timely manner or based on the requested needs vs the requirements of donors' own priorities. Moreover, some formerly reliable donors are withdrawing from the region.
- **Economic Impacts and Volatility:** Chuuk's capacity to conserve its biodiversity depends in part on funding and the economies of outside donor agencies and are subject to the global economy that is often in flux.
- **Capacity Loss and Turnover:** capacity takes time to develop, when someone leaves a job or passes on, often the knowledge needed to continue the work is lost as well. Moreover, there is concern about outmigration away from Chuuk and the FSM when some are seeking better pay than is available at home.

Priority areas

MONITORING IN NEFO FOREST, CHUUK. PHOTO CREDIT: CHUUK WOMEN'S COUNCIL

The highest priority areas for biodiversity conservation are upland agroforest areas, protected areas (see MAP C10), and all Areas of Biological Significance (ABS) (see MAPs C9a and C9b for Chuuk State ABS). This is due to their high biodiversity concentrations and already established and identified significance. Of secondary priority are mangrove and secondary vegetation while developed areas are not priority at all due to their already extremely disturbed status.



MAP C5: Chuuk lagoon islands – Biodiversity Conservation analysis map

This map shows the result of the reclassification and overlay analysis of Chuuk lagoon islands spatial layers including vegetation, developed areas, protected areas (MAP C10) and ABS layers (MAPs C9a and C9b) into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the biodiversity conservation issue for Chuuk. Dark green areas (69.7%) are the high potential areas (upland, agroforestry, and all land ABS areas), light green areas (16.8%) are the

potential areas (mangrove, secondary vegetation), and the red areas (13.5%) are not potential areas (developed areas) for biodiversity conservation issue in Chuuk. The analysis was done only for the Chuuk lagoon islands because there is no data layer available for the outer islands.

D. Watersheds

Conditions and Trends

Watersheds integrate natural habitats from ridge to reef and greatly affect the quality of downstream habitats. Watersheds provide important ecosystem services that include access to abundant clean freshwater. Several issues for water quality are associated with the degradation of watersheds on the main islands including development of infrastructure, deforestation, invasive species, droughts, wildfires and storms (SOE, 2018). Negative impacts of degraded watersheds are accelerated erosion, poor water quality, landslides, siltation of rivers and nearshore marine, and increased flooding downstream. 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 renovation and paving of the road in Weno have affected patterns of runoff and water flow. Per the recent State of the Environment report, management of watersheds is priority issue for the protection of inland and coastal waters in the FSM (2018).

Due to the land tenure system in Chuuk, most of the surface freshwater sources are found on private land. Access to these vital resources is granted by landowners and can be the source of issues of conservation, distribution and enforcement of efforts to protect the 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.

Strengths

- **Increased Collaboration with Communities and Schools:** there has been an increase in awareness activities and planting activities with communities and schools funded by the GEF5 R2R program and other donors that is resulting in behavior and attitude changes and a deeper understanding of the connection between the health of watersheds to biodiversity, forest health, food security and human health.
- **Increased # of Watersheds Supplying Water to Communities:** through traditional knowledge, work has begun to identify upland water sources that were known to remain available through drought historical periods of drought.
- **Increased Donor Priority for Watersheds:** examples include funding to support watershed protection and rehabilitation from GEF R2R, the Micronesia Conservation Trust, and the Secretariat of the Pacific Regional Environment Programme (SPREP) and National Government Adaptation Fund project.

- **State and Municipal Terrestrial Conservation Plans Inclusive of Watershed Planning Established:** FSM National (and States) Biodiversity Strategy and Action Plan (2018), JSAP (2017), Chuuk State Strategic Development Plan (2018), Oneisomw Watershed Management Plan.
- **Watersheds Delineation:** watersheds have mostly been delineated.

Weaknesses

- **Existing Policies are Not Enforced:** Chuuk has policies in place to protect the watersheds, but there is a lack of will and resources to enforce the rules. There is therefore a need to work with high level state leadership to develop legislation and increase will for enforcement.
- **Human Practices and Attitudes:** many landowners rely on pig pens for subsistence and practice deforestation to clear land for homes and infrastructure and are not aware of or are not as concerned about the impacts on the watershed ecosystems from these practices.
- **Deep Wells:** there is concern that there are numerous deep wells in Chuuk that may be affecting the wellbeing of the water lenses.
- **Lack of Management or Control of Resource Management:** this is exemplified by the examples of human practices and deep wells above. Whereas there used to be cultural norms and ways to manage resources, some of these mechanisms are no longer in practice. There is also concern that there are not enough laws and regulations.
- **Lack of Collaboration:** while there are many governments entities, NGO's, communities, and landowners developing and implementing plans, they are not coordinated and often entities are not aware of the activities of other departments, even between government entities.

Opportunities

- **Other Funding Opportunities:** a number of funding opportunities were identified for eco-system based biodiversity and watershed projects such as the United Nations Development Program Small Grants Program (SGP), grants from the Micronesia Conservation Trust, FSM PAN Network and future funding from larger opportunities like the Green Climate Fund and the Adaptation Fund.
- **Increases Awareness:** there is an opportunity to increase awareness and education activities for communities and especially focusing on youth to participate in and implement more watershed protection projects including replanting and education.
- **Use of Traditional Knowledge to Increase Water Supply:** as was pointed out above as a strength, through traditional knowledge, work has begun to identify upland water sources that were known to remain available through drought historical periods of drought. Resources should be secured to map all sites and to maintain these traditional water sources that communities have always depended on as some have been neglected over the years or have been forgotten.

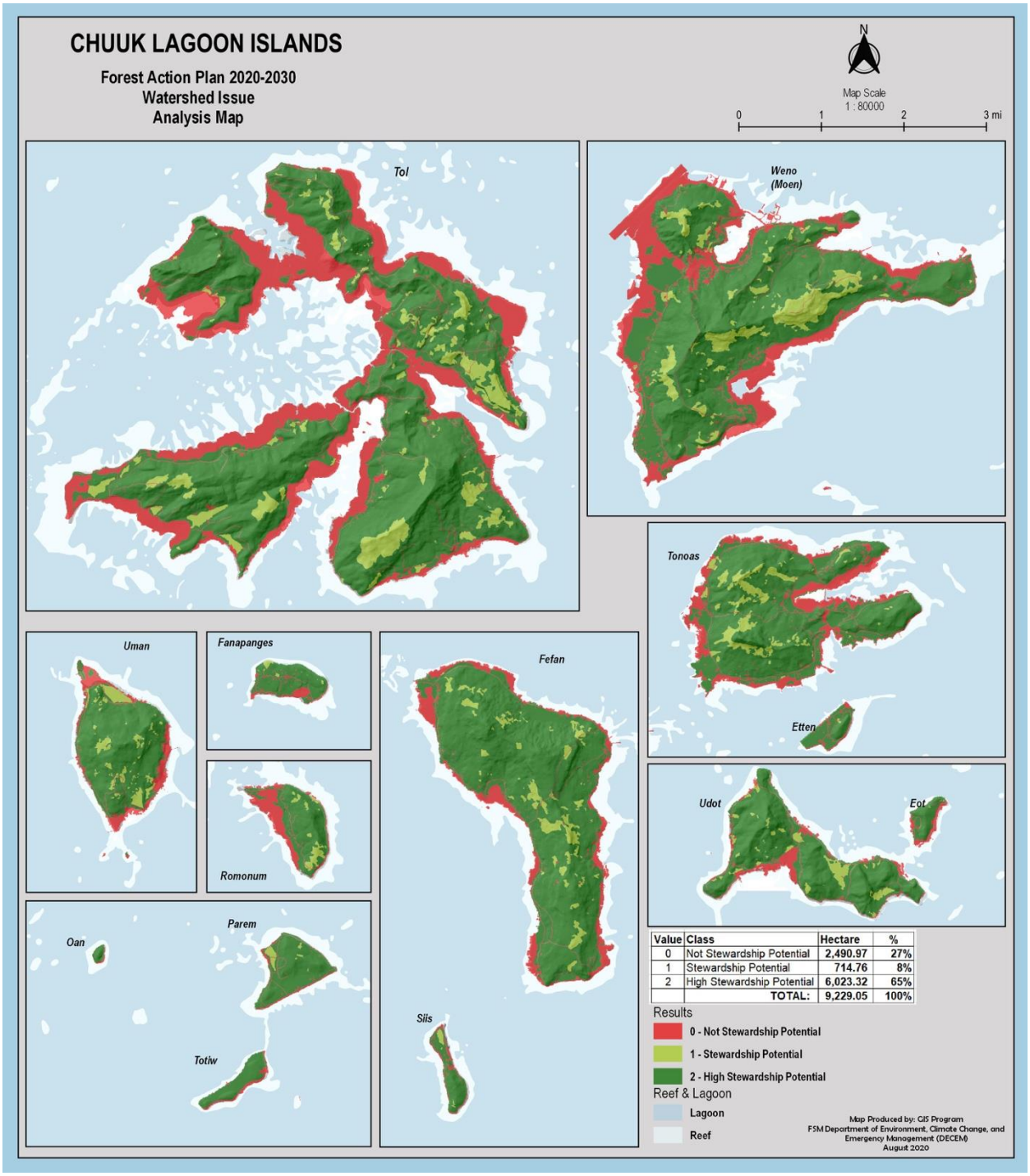
Threats

- **Intensified Effects of Climate Change:** climate change mitigation is slow, and adaptation takes a lot of funding while impacts on coastal communities will continue to increase.
- **Private Landownership:** the fact that most of Chuuk's land is privately owned means that it is more difficult to have control over landowners' individual use of their land.
- **Increased Development:** upland forests are threatened by bulldozing for: roads, agricultural areas and house sites. Moreover, there is an increase in agricultural burning for development that is not likely to cease.
- **Threshold Might Be Beyond Survival:** the current status of some species is endangered putting the biodiversity and watershed health in some areas of Chuuk at such high risk that they may not be rehabilitatable.
- **Forest Fires:** there is the potential, especially with increased drought due to climate change, for there to be more destructive fires in the watershed areas.
- **Invasive Alien Species:** there are concerns that invasive alien species are destroying forested areas, limiting agroforest species and overtaking land. New invasive species, such as the coconut rhinoceros beetle, could destroy important trees and cause detrimental effects on water sources.

Priority Areas

Overwhelmingly high priority areas for watersheds are upland, agroforest, marsh, and a 100 ft buffer of rivers/streams while second priority is secondary vegetation. Developed, barren and mangrove areas are not at all priority.

RESTORATION IN NEFO FOREST, CHUUK. PHOTO CREDIT: CHUUK WOMEN'S COUNCIL



MAP C6- Chuuk lagoon islands: Watershed analysis map

This map shows the result of the reclassification and overlay analysis of Chuuk lagoon islands spatial layers including vegetation, developed areas, protected areas (MAP C10) and hazard layers (MAP C8) into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the watershed issue for Chuuk. Dark green areas (65%) are the high potential areas (upland, agroforest, marsh, and 100ft buffer of rivers/streams), light green areas (8%) are the potential areas (secondary vegetation), and the red areas (27%) are the not potential areas (developed

areas, barren and mangrove) for watershed issue in Chuuk. Streams and rivers are found mostly in the upland forests, agroforests and marsh areas, thus considered as high potential for watershed issue.

E. Production & Sustainable Harvesting

Conditions and Trends

The integrity of Chuuk's culture is ultimately dependent on its natural resource base. Local forests, particularly mangroves, provide needed fuel wood and poles for posts and rafters. Local non-native mahogany plantings, while not fast growing, could provide some timber for local use. Efforts are being made to conduct mangrove assessments in certain regions of the lagoon to better understand mangrove management measures that need to be taken. In addition, a draft Mangrove Protection Act was introduced at the Chuuk State Legislature but is still being reviewed (SOE, 2018).

Beyond climate change and storm impacts, the most major factors contributing to a loss of mangroves in all four states includes human impacts from new developments, as well as harvesting and removal (through girdling or ringbarking) for wood products and open channels for boat transportation (SOE, 2018).

Strengths

- **Development of Mangrove Protection Act (2019):** a draft act was developed and submitted to Legislature for review.
- **Regulation on Commercialization of Terrestrial Resources:** there is a total ban on the sale of mangrove wood for commercial harvesting.
- **Earth Moving and Permitting Processes:** while harvesting still exists, there has been a decrease unsustainable harvesting of terrestrial resources. There has also been action taken towards companies that do not follow the rules such as one case of an outside company caught and prevented from illegally harvesting mangrove wood.
- **Landowner Contributions:** the number of landowners who are willing to turn their savannah forests into agroforest areas is increasing.
- **State Terrestrial Conservation and Biodiversity Plans Established:** Chuuk State PAN Law (2017), FSM National (and States) Biodiversity Strategy and Action Plan (2018), JSAP (2017), Chuuk State Strategic Development Plan (2018)
- **Increase in Terrestrial Protected Area Plans:** through the FSM and Chuuk State Protected Area Network (PAN) and the development of the Chuuk State PAN law, there has been a significant increase in plans led by communities focusing on the protection of biodiversity and the unsustainable use of resources.
- **Livelihoods Programs Increasing:** more new community-based revenue streams are created for and by communities as opportunities become available for farmers to market coconuts and other sustainably harvested resources. An example is the Coconuts for Life (CFL) project. This project is an initiative of FSM Petrocorp and the Micronesia Consecration Trust to resurrect the coconut industry in the FSM (so far Pohnpei and Chuuk) through enhancing the capacity to buy, sell, export, manufacture, process, and distribute copra and other products from coconut trees.

Weaknesses

- **Unsustainable Harvesting:** despite a decrease in unsustainable harvesting of terrestrial resources (mangroves in particular), they are still being removed to support livelihoods and food security among communities.
- **Inconsistence Regulations and Ordinances:** not all municipalities have accompanying regulations for the Mangrove Protection Act (2019).
- **Decrease in Upland Forest Health:** upland forests are affected by invasive alien species and are especially susceptible to destruction from natural disasters (such as typhoons).

Opportunities

- **Support Development of Regulations or Ordinances for all Municipalities:** there are currently regulations or ordinances in some municipalities but not all. There are therefore models to follow for the rest of the municipalities and the will of communities to establish them.
- **Establish More Mangrove Reserves:** continue to assist communities and landowners to establish no-take and limited take mangrove areas.
- **Undertake Exchange Programs:** as mangrove management and sustainable harvesting is working in Pohnpei, there could be learning exchange opportunities for Chuukese policy makers, community members and landowners to learn about Pohnpei's mechanisms and accomplishments.
- **Ecotourism Activities:** as tourists prefer to visit pristine spaces, especially in tropical and isolated islands, Chuuk could promote ecotourism sites where mangrove removal is banned, beaches are clean, and reefs are alive. These areas can provide livelihoods and serve as models for communities to promote behavior and attitude shifts. Beaches, mangroves and bird watching areas are all possible ecotourism activities.
- **Investigate and Catalogue Alternative Resources:** conduct a survey to catalogue which trees are currently unsustainability used and plan to plant alternative and/or more of the most important trees that can be used for firewood and/or handicraft use.
- **Manage Upland Invasive Alien Species:** conduct a survey of the IAS in the uplands and develop a plan to manage, control and eradicate requesting technical expertise where needed.

Threats

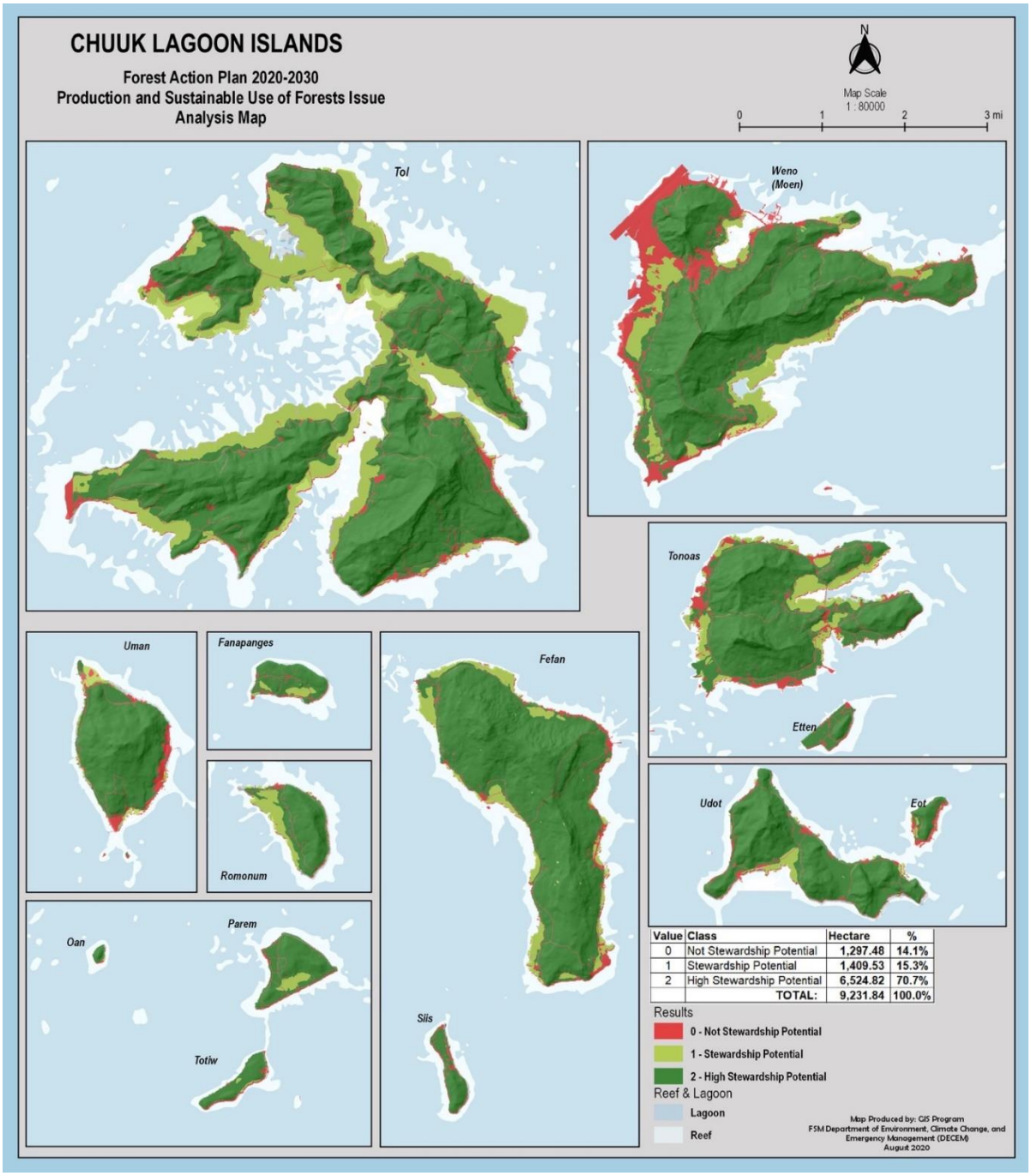
- **Livelihoods at Risk:** peoples incomes depend heavily on the sale of firewood in Chuuk. A decrease in harvesting without an alternative source of income will lead to hardship. People will find it hard to stop harvesting.
- **External Markets for Mangrove Harvesting:** in relation to the point above about livelihoods, there are markets promoted by foreign businesses that depend on the illegal harvesting of mangroves and exports outside of Chuuk. While it is an illegal practice, there are concerns that it will continue, especially if the payments are significant for harvesters.

- **Increase in Handicraft Trade:** while it has been slow to provide livelihoods for people in Chuuk, an increase in the wooden handicraft market could threaten the sustainability of the resources if specific areas are not set aside and/or those who are using the resource are not educated on how to best harvest the raw materials sustainability.
- **Government Priorities:** priorities can change with new leadership. If leaders prioritize economic opportunities over sustainable use of resources and when administrations change, projects and policies and funding can refocus and decrease for biodiversity conservation. A change in leadership could also force a change in political will and cause a shift in priorities.
- **Private Landownership:** the fact that most of Chuuk's land is privately owned means that it is more difficult to have control over landowners' individual use of their land.
- **Increased Development:** upland forests are threatened by bulldozing for: roads, agricultural areas and house sites. Moreover, there is an increase in agricultural burning for development that is not likely to cease.

Deforestation was confirmed to be the greatest threat to harvest and production. It also makes resources more vulnerable to the added threats of invasive species and climate change. Political will could change conditions: if a bill passes that allows foreign investment including lumber harvest, it could threaten limited tree resources. Sawmills weren't seen as a current threat but were noted to be a potential threat through both increased cutting and reduced cost of labor lowering the overall value of the product.

Priority Areas for Production and Sustainable Harvesting

Upland, agroforest, secondary vegetation, and palm forest are overwhelming first priority areas for production and sustainable harvesting while mangrove areas are a far second with developed areas as non-priority. The priority away from mangrove areas reflects the need to expand planting and harvesting activities for production to commodities other than mangrove trees.



MAP C7: Chuuk lagoon islands – Production & Sustainable Use of Forest analysis map

This map shows the result of the reclassification and overlay analysis of Chuuk lagoon islands spatial layers including vegetation, developed areas, protected areas (MAP C10) and hazard layers (MAP C8) into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the issue of production and sustainable use of forest for Chuuk. Dark green areas (70.7%) are the high potential areas (upland, agroforest, secondary vegetation, palm forest), light green areas (15.3%) are the potential areas (mangrove), and the red areas (14.1%) are the not potential areas (developed areas) for the issue of production and sustainable use of forest in Chuuk. The analysis was done only for the Chuuk lagoon islands because there is no data layer available for the outer islands.

F. Capacity-building

Conditions and Trends

With funding declining under the Compact of Free Association (COFA), Compact Sector Grants, additional funding of forestry positions is not likely. In addition to ongoing programs, the local forestry staff is needed to provide expertise in forestry to communities to obtain grants for forestry projects. The potential leverage capacity of S&PF grants is therefore quite high.

Strengths

- **Awareness through Monthly Farmers Fairs:** once a month, vendors sell agricultural products in Weno. NGO's and government entities also take advantage of this space for awareness campaigns to promote farming, tree planting, careers in agriculture and forestry.
- **Forestry Conservation Connected to Food Security**: it is acknowledged that the promotion of forest conservation is also promoting food security. NGO's such as CWC and CCS offer awareness around this correlation to enhance community understanding of the important of biodiversity conservation to food security and livelihoods.
- **Increase in Independent Farmers:** there has been an increase in farmers who take care of their land and bring their goods to Weno's market areas.
- **Increase in Education and Awareness Activities:** specifically geared towards students, there have been field trips to nurseries (by CWC an COM-CRE), also there is an annual career fair with the Chuuk State Department of Education (DOE).
- **The Caroline College & Pastoral Institute (CCPI) Partnership:** established in 2010, this institute partners with Chaminade University of Honolulu to provide a bachelor's degree program for the purpose of strengthening the teachers presently employed, or seeking employment, at the Chuuk Department of Education. This opportunity is seen as a vital link for forestry, agroforestry and conservation in Chuuk as the more educated the teachers, the better educated the students.
- **The Federated States of Micronesia Environmental Data Portal:** mechanism for centralizing data across the FSM is in place.

Weaknesses

- **Funding Decreases: access/capacity to write grants/decreasing availability**: there has been an increase in obstacles in acquiring funding for this sector, difficulties in acquiring Compact Sector Funds, USFS funds and a reliance on state and national budgets that do not prioritize this sector.
- **Communication and Awareness:** while there has been an increase in awareness over the years in Chuuk about the importance of the forestry sector, especially as it relates to food security and costal stabilization, more needs to be done. Many people, communities and landowners still do not prioritize this area

- **Dependency on external funding support/technical capacity:** there are not enough funding streams within Chuuk or the FSM to support the work and the technical capacity to implement is still in need of growth.
- **Sector is less attractive:** many students are not pursuing forestry, agriculture or terrestrial conservation preferring to study marine conservation, fisheries and policy. Not enough skilled/educated local people pursuing careers in this field.
- **Recruitment of students**: based on the last point, students are either not returning after studies abroad or those who do return are not applying for jobs in this field

Opportunities

- **Build Capacity to Access Funding and Capacity**: there is an opportunity to increase access to training and funding opportunities. One way would be to hire a dedicated staff member inside the Department of Agriculture to write and manage grants including accessing the more increasingly difficult to acquire Compact sector funding (for the Environment), USFS grants and others. A position could also be created a position for a technical expert with a Geographic Information System (GIS) Skill set.
- **Increase Promotion of Forestry and Agriculture as Careers:** support community resource owners and DOA staff to promote the importance of the work as both a livelihood and as a mechanism for the survival of culture that would allow Chuukese to remain in Chuuk and on their own land even in the face of the adverse effects of climate change and other threats.
- **Targeted Outreach, Awareness and Recruitment:** need better outreach to students to understand the kinds of skills and jobs available in this area. Need to promote forestry and agriculture within elementary and high school, improve the messaging around this field. DOA staff and others should be visiting elementary and especially high schools to identify specific people who have interest in pursuing forestry, agriculture, terrestrial conservation as a career and support their chosen path.
- **More Funding for Community Initiatives:** not only will more funding lead to more positive action but youth who are part of management processes within their communities as they grow up are more likely to pursue professional careers in this field.
- **Increase Capacity Opportunities Inside Chuuk:** more current staff and potential resource managers would be able to access training and skills building if more opportunities were offered on island instead of in the other states of the FSM or internationally. Capacity for existing staff or those who are not able to go off island for training could be better coordinated with COM-FSM CRE Chuuk Campus.

Threats

- **External Researchers and Data Teams Not Sharing Information:** there is significant concern that many teams come to Chuuk (and the FSM) to do research that is important to the work on the ground however the teams do not always collaborate with those in Chuuk. This is a concern

because of the loss of opportunity to capacitate local teams and because of the importance of understanding local knowledge and mores. Moreover, there is also concern that because of the lack of collaboration, information that is gathered is not relayed back to communities, resource managers or policy makers. There is therefore a loss of opportunity to ensure that this information is part of the ongoing science to management loop necessary to continue to improve management initiatives.

- **Donor Dictating Priorities and Controlling Access:** there is concern that some donor funding is tied to specific priorities that are not in line with Chuuk's or FSM's priorities. There is also concern regarding access to funding and a feeling that some donors make it very difficult to acquire funds to support Chuuk states priorities.
- **Government Priorities:** priorities can change with new leadership. If leaders prioritize economic opportunities over sustainable use of resources and when administrations change, projects and policies and funding can refocus and decrease for biodiversity conservation. A change in leadership could also force a change in political will and cause a shift in priorities.
- **Behavior and Mentality as a Barrier:** there still exists both a high degree of dependence on outside funding and outside technical support (dependence mentality) mixed with attitudes that the problem is not too large, it will just go away.
- **Demands on the Time of the Limited Staff:** funding for staff at DOA is limited. 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. There is a need to partner with and leverage more support for and with non-profit organizations to both receive funding and implement projects on behalf of and in partnership with government entities.

CHUUK STATE FOREST RESOURCE STRATEGY

Table C3 "Chuuk State Strategies" below summarizes strategies for addressing the Cross-cutting Threats and each of the FSM Issues. FSM Issues are shown in priority order for Chuuk State. The table also includes primary USFS and other programs that contribute resources and technical support and the main cooperators for each strategy. Successful implementation of these strategies will require technical and funding support from multiple partners and donors. While key existing and potential partners are listed within the table, it is anticipated, that over time, other partners are able to identify potential contributions in assistance of this plan.

Table C2 "Resources Required: USFS, Other Partners, Funding Sources and Cooperators for Chuuk State" lists those referred to in Table C3 "Chuuk State Strategies".

TABLE C2: RESOURCES REQUIRED: USFS, OTHER PARTNERS, FUNDING SOURCES AND COOPERATORS FOR CHUUK STATE

Resources Required: USFS, Other Partners, Funding Sources and Cooperators for Chuuk State			
USFS/US	**International & Regional**	**National**	**State**
Forest Health (FH) Urban & Community Forestry (U&CF) Forest Stewardship (FSP) Western Competitive Grants (WCP) Fire and Aviation Management (F&AM) USFS Institute of Pacific Islands Forestry (IPIF) USDA Natural Resources Conservation Service (NRCS) United States Geological Survey (USGS) US Department of Interior (DOI) National Oceanic and Atmospheric Administration (NOAA) USDA Rural Development (USDARD)	The Nature Conservancy (TNC) Micronesia Conservation Trust (MCT) Secretariat of the Pacific Regional Environmental Programme (SPREP) Secretariat of the Pacific Community (SPC) Green Climate Fund (GCF) Adaptation Fund (AF) United Nations Development Program Small Grants Program (SGP) Water and Environmental Research Institute of the Western Pacific (WERI) Food and Agriculture Organization of the United Nations (FAO) Pacific Islands Managed and Protected Area Community (PIMPAC) Red Cross International Union for Conservation of Nature (IUCN)	UNDP GEF-5 FSM Ridge to Reef UNDP GEF-6 FSM Invasive Species College of Micronesia – Federated States of Micronesia, Cooperative Research and Extension (COM-FSM CRE) FSM Department of Resources and Development (FSM R&D) FSM Department of Transportation, Communications & Infrastructure (FSM TC&I)	Chuuk State Department of Agriculture (DOA) Chuuk Women's Council (CWC) Chuuk Conservation Society (CCS) Chuuk Invasive Species Taskforce (CIST) Chuuk Environmental Protection Agency (EPA) Chuuk Department of Marine Resources (DMR) Chuuk Office of Historic Preservation Chuuk State Department of Education (DOE) Farmers Associations

TABLE C3: CHUUK STATE STRATEGIES

FSM Issue	Strategy	Resources Required		Main Cooperators	US National Objective	Performance Measures
		USFS	Other Partners and Funding Sources			
Cross Cutting Threats	Protect and maintain natural landscapes and ecosystems by incorporating new science and climate proofing projects	FH, U&CF	USGS, IPIF, NRCS, SPREP, SPC	DOA, COM-FSM CRE, CCS, TNC, DMR, EPA, MCT,	1 Conserve, 2 Protect, 3 Enhance	Development/utilization of guidelines for climate-proof projects (including infrastructure) to ensure ecosystem integrity
	Update Chuuk Invasive Species Taskforce (CIST) Strategic Action Plan and implement priority actions	FH, U&CF	DOI, NRCS, GEF6, SGP	CIST, DOA, COM-FSM CRE, EPA, MCT, CCS,	1 Conserve, 2 Protect	Reestablished state invasive species task force operationalized and implementing activities based on SAP
	Improve invasive species management/control/eradication	FH, U&CF	DOI, NRCS, GEF6	CIST, DOA, COM-FSM CRE, EPA, MCT, CCS, CWC	1 Conserve, 2 Protect	Increased capacity in invasive species management
	Evaluate forest & agroforest resources with respect to climate change & Sea Level Rise (SLR) for both Chuuk Lagoon and Outer Islands (OI)	FH, U&CF	USGS, IPIF, NRCS	DOA, COM-FSM CRE, EPA, TNC, MCT, CCS	1 Conserve, 2 Protect, 3 Enhance	Site specific management plans with completed surveys and actions identified through community-driven processes
	Develop a Chuuk State wildfire plan and program with contingency plan for years of extreme drought	F&AM, FH	IPIF, USDARD	DOA, COM-FSM CRE, EPA	1 Conserve, 2 Protect	Develop a Chuuk State wildfire plan and program with contingency plan for years of extreme drought and obtain fire

	and obtain fire suppression equipment and conduct training					suppression equipment and conduct training
A) Food Security	A.1. Select priority crop varieties for further propagation to enhance and expand agroforestry/food security systems taking into account climate resistant crops A.2. Work with landowners to investigate and pilot new technologies and methodologies for food security to enhance agroforestry and food production for climate adaptation and disaster planning A.3. Enhance extension to communities on relationship between agroforestry, watershed/water lens health, restoration and waste management in relation to food security A.4 Enhance existing state nursery capacity and establish more community nurseries	FH, FSP, WCP, U&CF	GEF-5, GEF-6, IPIF, SGP, MCT, TNC, WERI, GCF, AF, FAO, NRCS, SPREP, SPC	DOA, COM-FSM, EPA, DMR, CCS, CWC, DOE, FSM R&D, PREL, PIMPAC, USDA-NRCS, Farmers Associations	2 Protect, 3 Enhance	A.1. List of priority crop varieties to enhance and expand existing propagation and distribution programs A.2. New technologies piloted, established best practices recorded and ready for duplication and scaling up A3. Enhanced understanding of both climate and human induced effects on food security A4. Existing nurseries improved; new nurseries established with increased capacity to adapt to climate induced food insecurity
B) Coastal Stabilization	B.1. Revisit existing dredging and earth moving policies to address ecological loss due to destructive dredging activities	U&CF, FSP	USGS, GCF, GEF-5, SGP, GCF, AF, IPIF, MCT, TNC, NOAA, SPREP, SPC	EPA, DOA, COM-FSM, DMR, CCS, CWC, Red Cross, FSM TC&I	1 Conserve, 3 Enhance	B.1. Revised policies for increased protection of mangroves and coastal areas

	B.2 Identify alternative excavation sites for sand (construction needs) through impact analysis surveys B.3. Conduct state-wide surveys and cost benefit analysis to identify site specific, ecosystem based best practices. B.4. Expand community-based mangrove replanting initiatives and education					B.2 # of designated excavation sites identified based on least impact B.3 Improved coastal stabilization with implementation of best practices B.4. # of hectares of coastal protection increased through expansion of mangroves habitats and awareness
C) Biodiversity Conservation	C.1. Develop and integrate a biodiversity conservation curriculum in both public and private elementary schools across Chuuk C.2. Increase government funding for conservation to include biodiversity conservation in their planned activities C.3. Identify, establish and monitor Forest Legacy Areas. C.4. Evaluate, strengthen, and monitor the efficiency of Chuuk State PAN Law and develop regulations and criteria for implementation C.5. Catalogue traditional knowledge on biodiversity and use of terrestrial resources/ecosystem	U&CF, FSP, WCP, FH, F&AM	USGS, GCF, AF, GEF-5, GEF6, SGP, MCT, TNC, GGF, NOAA, SPREP, SPC	DOA, COM-FSM, EPA, DMR, CCS, CWC, DOE, PIMPAC, HPO, All Chuuk State Government Departments, traditional leaders, Council of Mayors communities	1 Conserve, 2 Protect, 3 Enhance	C.1. Integrated biodiversity curriculum in use in elementary schools, pre- and post-survey in schools to determine effectiveness C.2. # of biodiversity conservation activities integrated into regular government activities C.3. Existence and enactment of 'Forest Legacy Areas'. C.4. Review of PAN law and establishment of endorsed PAN regulations and criteria C.5. Traditional knowledge documented and shared

	C.6 Continue to access technical assistance and capacity building opportunities for terrestrial biodiversity conservation activities					C.6 # of capacity opportunities completed by resource managers, forestry staff and communities to protect terrestrial biodiversity in Chuuk
D) Watershed	D.1. Improve watershed health through increased tree planting in riparian zones and uplands D.2. Develop new Forest Stewardship Plans with private upland landowners and implementation actions in both new and already endorsed plans D.3. Establish tree planting program in elementary schools D.4. Revitalizing environmental clubs/programs (i.e. Earth Council) D. 5. Draft watershed protection legislation	U&CF, FSP, WCP, FH	GCF, SGP, GEF-5, MCT, TNC, GGF, NRCS	DOA, COM-FSM, EPA, CCS, CWC, DOE, PIMPAC, HPO, All Chuuk State Government Departments, community associations, USDA-NRCS, NGO partners, traditional leaders, Council of Mayors communities	1 Conserve, 2 Protect, 3 Enhance	D.1. # of trees planted, # of trees survived, decrease in sedimentation D.2. # of new plans, # of actions implemented D.3. # of trees planted by students, increased knowledge of importance of trees to water quality D.4. # of environmental clubs/programs D.5. Existence of draft watershed protection legislation
E) Production & Sustainable Harvesting	E.1 Draft regulations on commercialization of terrestrial resources including review of business licensing	FSP, WCP,	USGS, IPIF, GCF, AF, IPIF, SGP, GEF-5, GEF-6, MCT, TNC, GGF, NRCS	DOA, COM-FSM, EPA, CCS, CWC, DMR, NGO Partners, HPO, Red Cross, HPO	3 Enhance	E.1. Existence of draft regulations, permit review amended where necessary

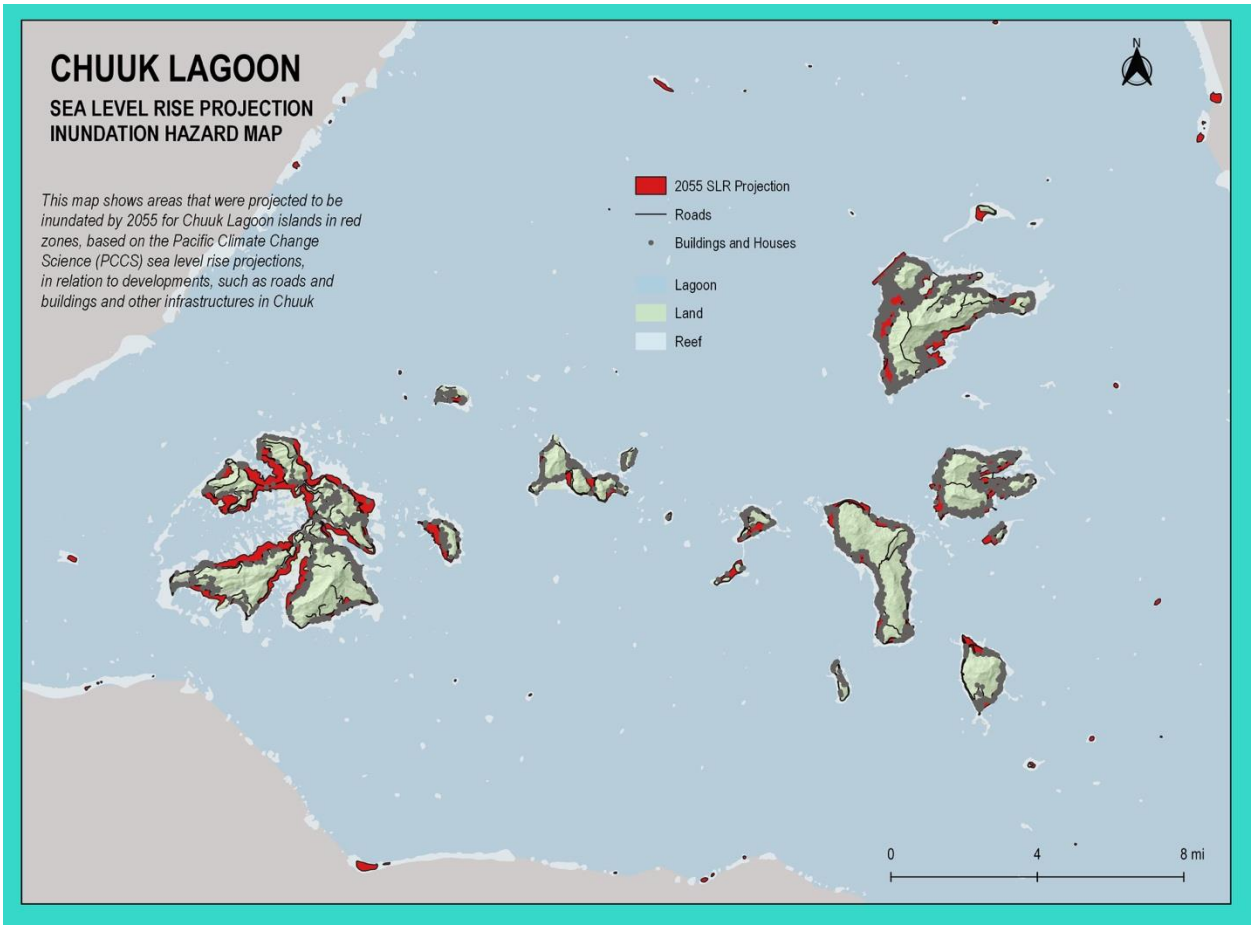
	E.2. Conduct a mangrove assessment as follow up from 2008 activity E.3 Identify and catalogue alternate firewood availability i.e. tangatangan, kerosene tree, African tulip, breadfruit E.4 Plant woody species as future resource for lumber (high value and for firewood) E.5. Assess potential savannah sites for revegetation pilot project E.6. Establish new mangrove reserves/protected areas to protect fish habitats/nurseries E.7 Promote eco-tourism sites					E.2. Comparison assessment report completed, and recommendations made E.3 Info Sheet produced including top 10 alternatives placed in markets and public places E.4 # of trees planted, and hectares increased E.5. Assessment completed and pilot site(s) identified E.6. # of reserves/PAs established E.7 # of Eco tourism sites identified and developed
F) Capacity Building (Non-Spatial)	F.1. GIS/Safety Training & Certification (information communication) F.2. Arborist Training & Certification (ISA) F.3 Attend Pacific Islands Forestry Committee (PIFC) meetings annually F.4. Coordinate services of outside and local agencies so that they contribute to budgeted performance objectives or development of local capacity.	U&CF, FSP, WCP, FH, F&AM	GCF, SGP, GEF-5, GEF-6, MCT, TNC, GGF, SPREP, SPC, FAO, NRCS	DOA, COM-FSM, EPA, CCS, CWC, DOE, PIMPAC, HPO, All Chuuk State Government Departments, community associations, USDA-NRCS, NGO partners, traditional leaders, Council of Mayors communities	1 Conserve, 2 Protect, 3 Enhance	F.1. Access to GIS/Safety Training Program and existence of GIS/Safety Certified personnel F.2. Development of an Arboriculture Training Program and existence of certified arborists. F.3. Forestry Staff attend PIFC F.4. Improved dissemination of information on training or funding opportunities; increase in the number of training opportunities participated in; increase in funds received through grants, better local

						focus & initiative & performance for performance-based budget
	F.5. Assist Communities with development of natural resources forest stewardship plans and PA management plans					F.5. New stewardship and PA plans exist with more private landowners and communities engaged and stewarding their resources
	F.6 Pesticide application training					F.6 Staff/resource managers with pesticide application certification
	F.7. Conduct cross-site visits and learning exchanges to showcase successes and share lessons learned and best practices					F.7 Pesticide application certification
	F.8. Hire at least two trained technical staff, 1 grant writer and 1 GIS specialist					F.8 Increased capacity for DOA to conduct work
	F.9 Work to increase capacity to access USFS and other funding opportunities					F.9 Receive USFS and other funding opportunities
	F.10 Continue to obtain up to date aerial photos for remaining Chuuk State sites, carry out surveys and produce updated maps to determine trends.					F.10 Updated aerial photos and baseline images for resource assessments of previously unsurvey islands. Images and analysis available to share with communities for developing plans and measuring progress towards resource stewardship, updated vegetation maps, updated analysis of forest trends in Chuuk
	F.11 Develop elevation and habitat profiles for low lying outer islands					F.11 Profiles of low-lying atolls to aid in site specific and statewide planning processes

	F.12 Awareness raising through celebrating of Environment and Forestry focused international/regional days through clean ups and tree planting activities annually					F. 12 Public is aware of natural resource issues and makes wise decisions for their sustainable use, all activities documented and used for further awareness activities (i.e. social media)

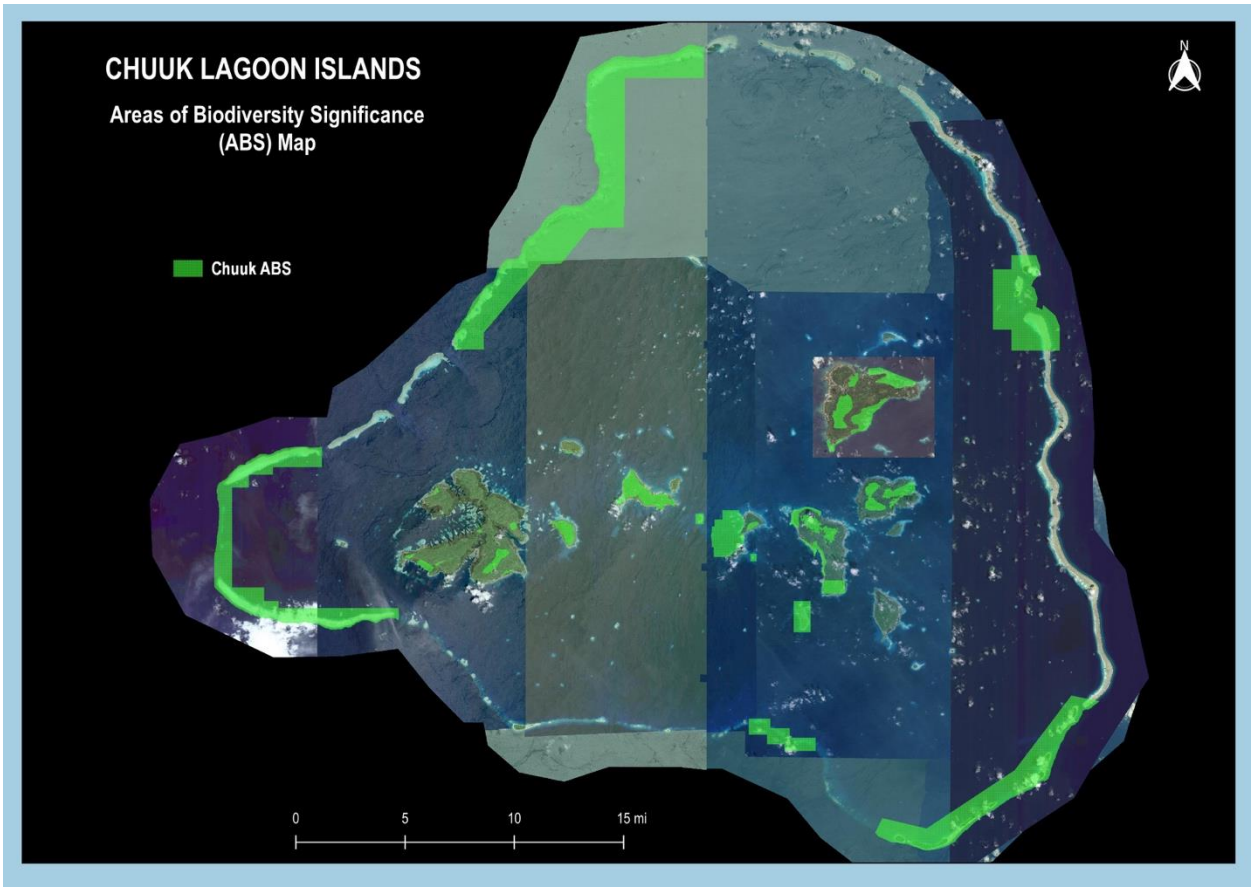
All Other Mapped Priority Areas

Chuuk FAP – Maps codes and descriptions

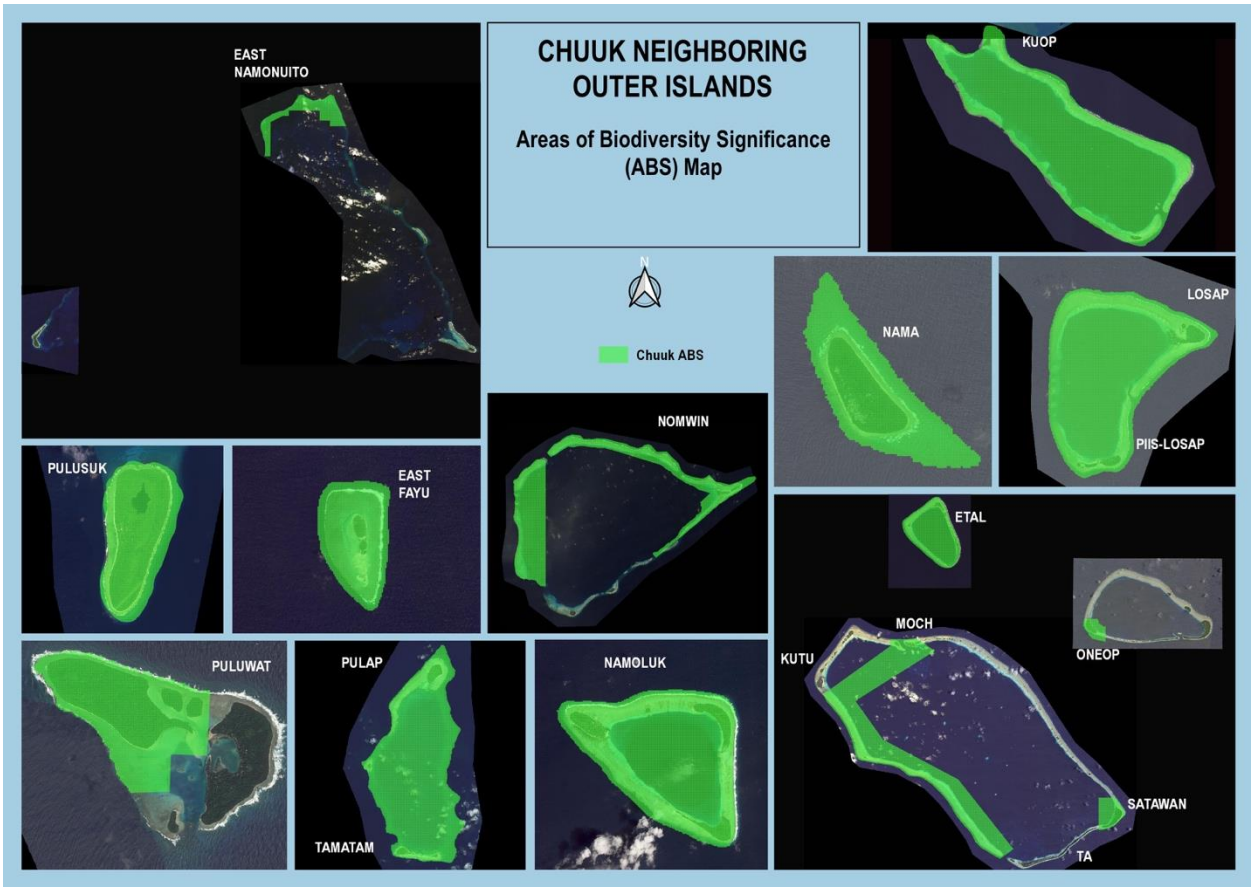


MAP C8 – Chuuk lagoon islands: Sea-Level Rise and Inundation hazard map

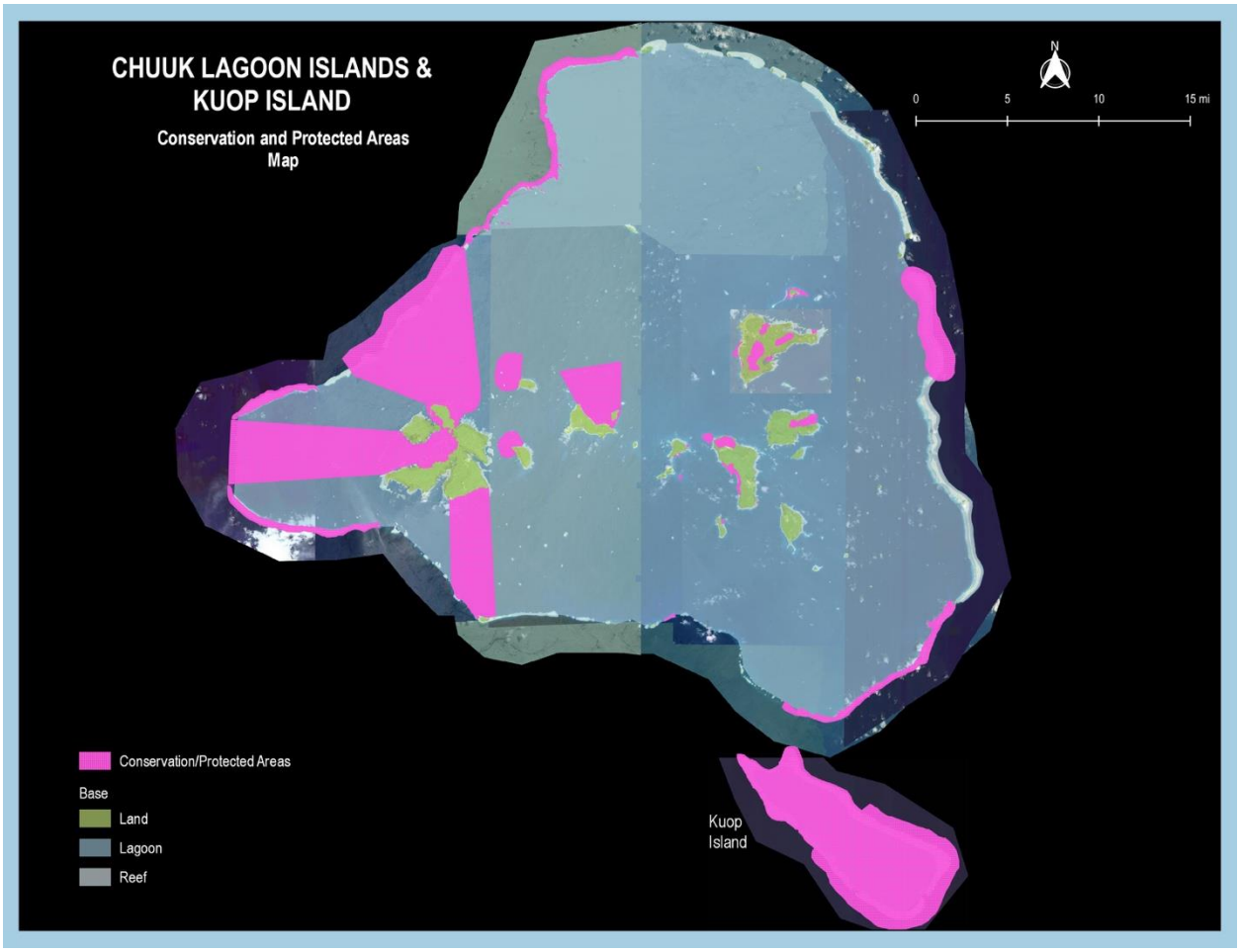
This map was generated from the Sea Level Rise (SLR) projection modeling project in collaboration of FSM OEEM office, SPC and COM-FSM back in 2013 showing areas projected as inundation hazard by 2055 in red color, along the coastline of Chuuk lagoon islands. All areas that were projected to be at inundation risk by 2055, based on the SLR model, were considered as the highest priority for the coastal stabilization issue in Chuuk. The modeling project was only done for the high islands for the elevation data for the low-lying neighboring islands do not exist. All land in the low-lying atolls can be assumed to be at risk of destructive inundation events by 2055.



MAP C9A – Chuuk lagoon islands: Areas of Biodiversity Significance (ABS) (Map 1)
This map shows the Areas of Biodiversity Significance (ABS) of Chuuk lagoon islands overlaid on the Chuuk 2016 WorldView-3 high-resolution satellite image.

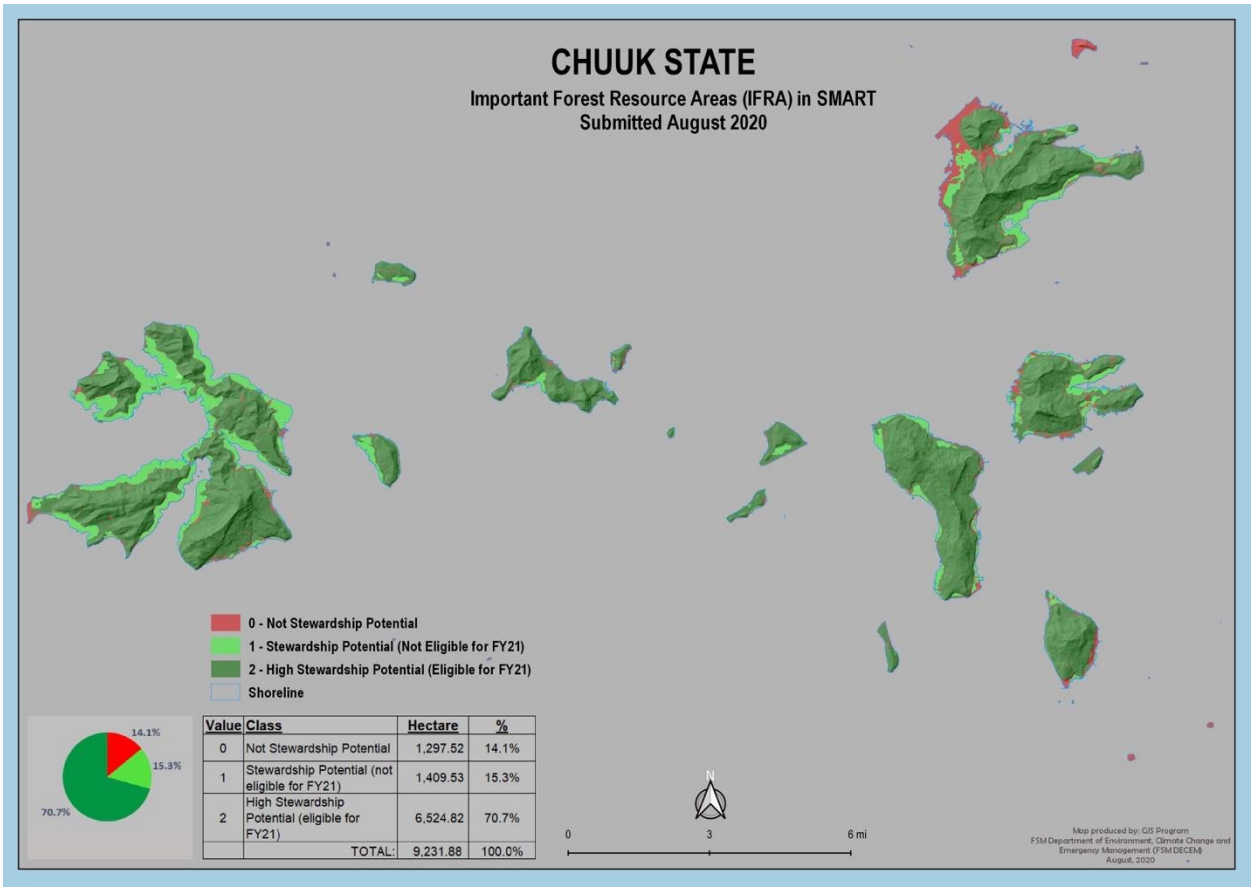


MAP C9B – Chuuk outer islands: Areas of Biodiversity Significance (ABS) (Map 2)
This map shows the Areas of Biodiversity Significance (ABS) of Chuuk's outer islands overlaid with the 2016 WorldView-3 high-resolution satellite image of each island.



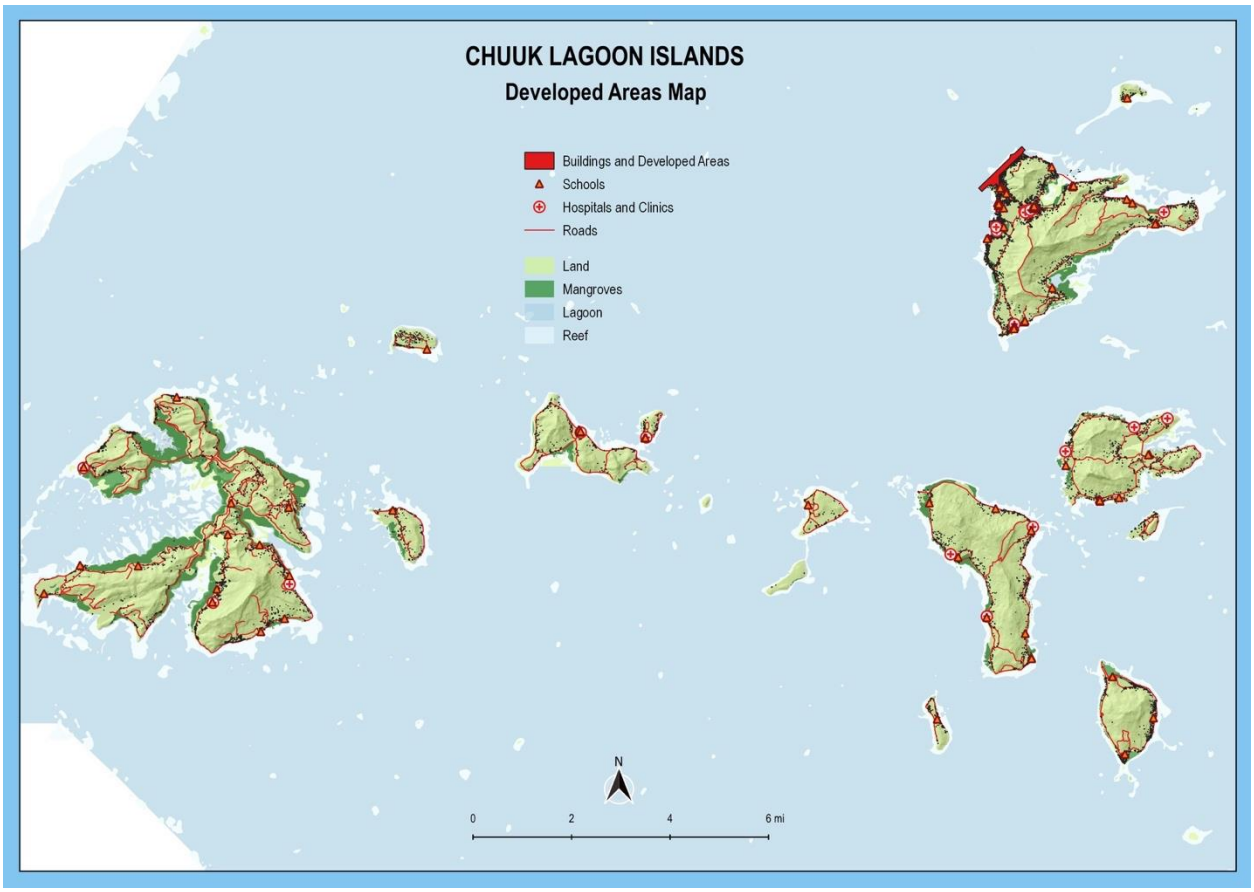
MAP C10 – Chuuk lagoon islands and Kuop island: Conservation & Protected areas map

This map shows the designated Protected Areas sites on and around the Chuuk lagoon islands and Kuop island. Orange color polygons represent the active and designated PA sites, and blue color polygons represents the proposed PA sites. The PA sites data used in this map was updated in 2019. The sites as identified are community driven with support from many partners and programs and are continually being reviewed. As work continues to operationalize the Chuuk State Protected Areas Network (PAN) through the drafting of regulations to accompany the PAN Law and the drafting of the FSM National Operations Manual, among other activities, the sites will be further delineated, and sites will be officially endorsed.



MAP C11 – Chuuk lagoon islands: Important Forest Resource Areas (IFRA) map

This map was generated in 2020 as an update for Chuuk's important forest resource areas (IFRA) to reflect new program guidance in the "Modernized" Forest Stewardship program. This map reflects long-term prioritization for Chuuk's 2020 IFRA, and subsequent annual IFRA updates may be found in the Stewardship Mapping and Reporting Tool (SMART) for program administration purposes.



MAP C12 – Chuuk lagoon islands: Developed and urban areas, and infrastructures map

This map shows the developed and urban areas and infrastructures of Chuuk lagoon islands including buildings, roads, and port areas.

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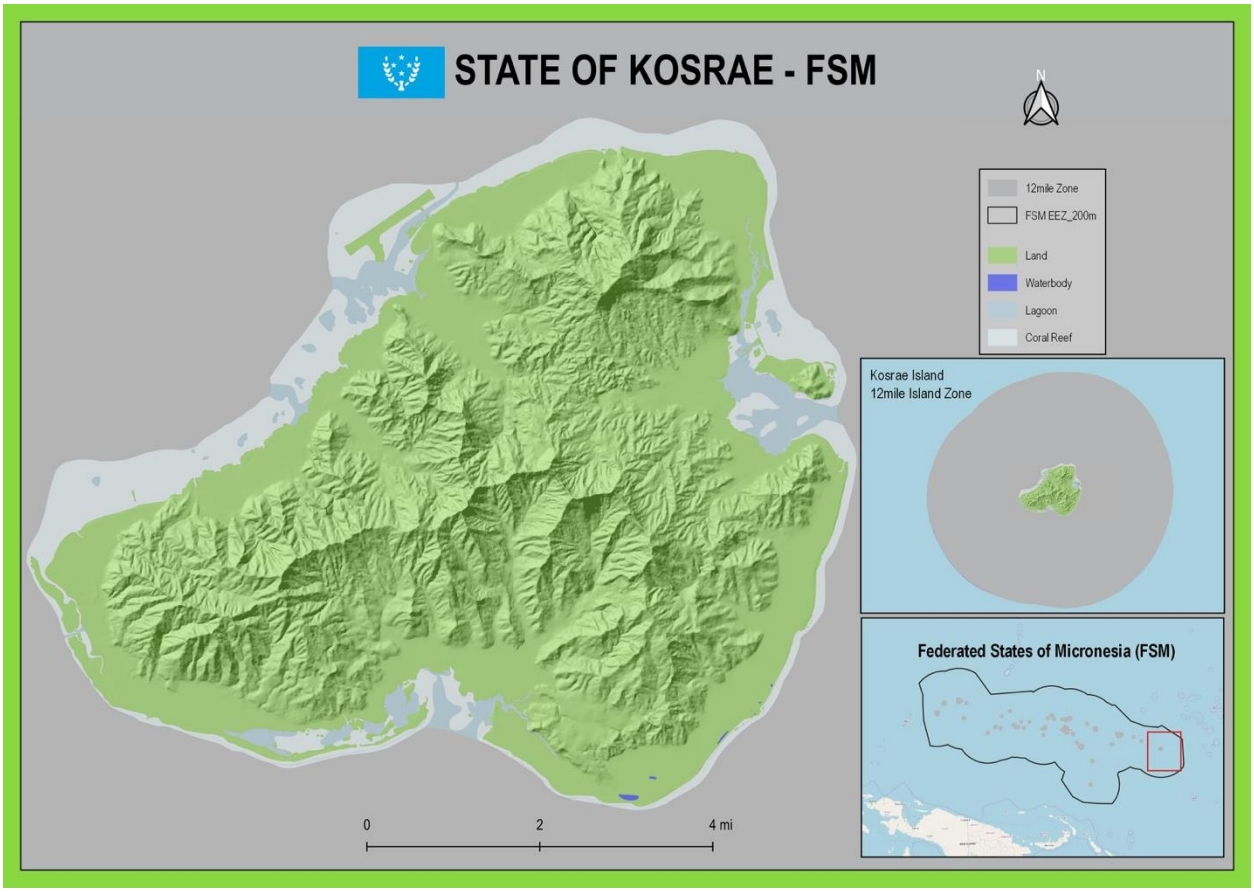
VIEW FROM MT. OMAN, KOSRAE STATE

III. KOSRAE STATE



MAP K1: State of Kosrae

This map shows the location of Kosrae island within the FSM EEZ.

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 43 sq. miles/27,520 acres (Kosrae Biodiversity Strategy and Action Plan, KBSAP 2018). The 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. In Pohnpei and Kosrae, the land is under a mix of private and State ownership, and the majority of near-shore marine areas are under State control and held as public trusts (NBSAP, 2018).

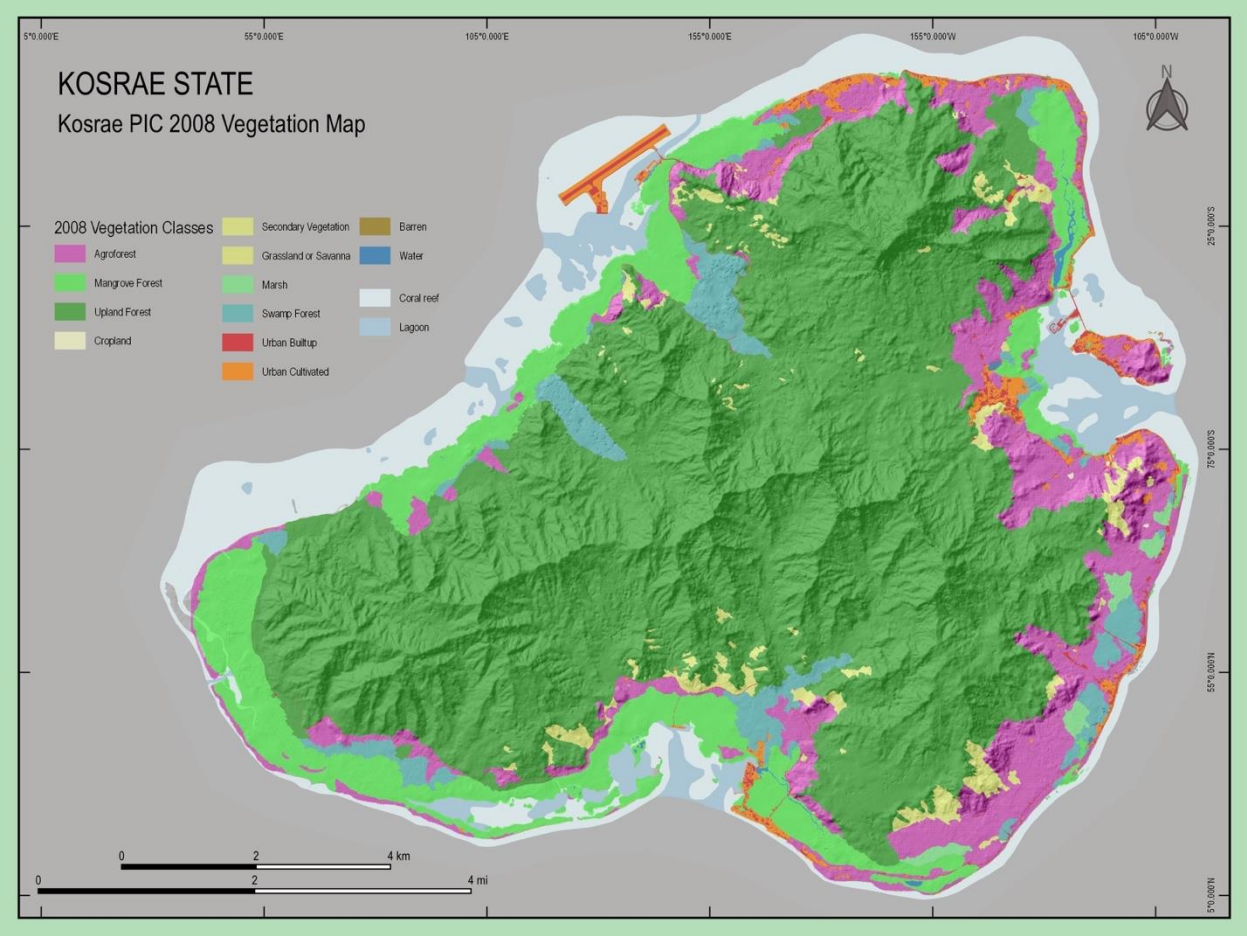
Kosrae is the least populous state, with a population of just over 6,000, and has the lowest population density at 156 per square mile (KBSAP, 2018). Kosrae is made of one high island with no outer islands. Migration is therefore to and from the state, not within it. Land in Kosrae is under a mix of private and State ownership. Most of Kosrae consists of steep mountains that are more difficult to live on or cultivate. The uninhabitable slopes of Kosrae account for approximately 70% of the land area (Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change JSAP, 2016), resulting in a relatively small amount of inhabited land. There is therefore a less rigid land tenure system with fewer rules and regulations, and fewer difficulties of ownership conflict and dispute settlement (SOE, 2018). In Kosrae, land and terrestrial resources can be privately owned while the marine system is all public (SOE, 2018).

The biggest threats to Kosrae's terrestrial biodiversity, forests and overall ecosystems are increasing with the effects of climate change. Kosrae's risk of the following impacts are high: landslides, higher than normal high tides, large sea swells, increased impact of storm surges and flooding as a result of sea level rise, drought, tropical storms and typhoons (SOE, 2018). Human induced impacts include sand and coral removal and land reclamation, beach mining, road development, invasive pests, unsustainable harvesting of coastal resources, coastal construction (seawalls) and some stream outlet repositioning and changes in drainage patterns (JSAP, 2016). Since the last original SWARS was developed in 2010, an increase in the overall efforts to conserve and protect Kosrae's forest resources has occurred. This has come from community and local government and NGO efforts and especially through the establishment of the Makontowe Conservation Area that guarantees the protection of a large area of Kosrae's uplands from future development.

KOSRAE STATE FOREST RESOURCE 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.

Kosrae Island has 12 vegetation and land cover classes include: agroforest, mangrove forest, upland forest, cropland, secondary vegetation, grassland/savanna, marsh, swamp forest, barren, urban built-up, urban cultivate d, and water.



MAP K2: Kosrae – 2008 Vegetation layers map

This map shows the vegetation classes of Kosrae in 2008. The data set was developed from 2007 QuickBird satellite imagery by Digital Globe through land cover classification carried out by U.S. Forest Service (2008).

Conditions and Trends

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 FAP can be found in these references.

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 non-forest. Notably, the first conservation easement in the region was established in Kosrae in 2014. The easement, a system whereby landowners surrender certain development rights in return for annual payments from an easement fund, was implemented to protect the Yela Ka Forest, the

largest stand of *Terminalia carolinensis* trees in the world. This enables traditional ownership of the forest, and sustainable traditional harvest of forest and medicinal resources, to continue while preventing future development of the land. The easement also allows for some eco-tourism activities (KBSAP, 2018). Upland forests provide habitat for biodiversity including a number of endemic species. They are also an important source of clean water for drinking, agriculture and for several species of fish and aquatic invertebrates. Mangrove forests have multiple values that include 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. Mangroves can also help maintain the elevation of coastal areas, making them more resilient to sea level rise (Krauss et al. 2010). Recent studies in Yap and Kosrae (Donato et al. 2011) have shown that mangroves sequester large amounts of carbon from the atmosphere that is stored in both tree biomass and in deep mangrove mud. If left undisturbed, the carbon can be stored for thousands of years. Mangroves are thus extremely important for reducing the release of greenhouse gasses into the atmosphere. 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.

While the 2010 SWARS reported anecdotal accounts of damage to Kosrae's upland forest, the recent State of the Environment Report for the FSM reports that because Kosrae is characterized by a steep topography with limited the access to the upper watershed, a dense upland rainforest still persists (2018). 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. This led to a slight decrease in overall mangrove cover of 2% during this time. Since then, studies have shown that Kosrae's mangrove forest is considered to be largely intact with many trees of exceptionally large sizes and is considered some of the most productive mangrove forests in the world (Twilley et al., 2017), although changes to coastal areas, pollution and harvesting have caused irreversible damages in some areas (SOE, 2018).

Issues

Kosrae, being one island composed of many different ecosystems that depend on one another from the ridge to the reef must protect all of its natural environment equally. As they are all so dependent on one another, if one system suffers, they will all quickly follow suit. While Kosrae State has prioritized their 6 Major Issues per the FSM overall Issues, they have also identified invasive alien species, climate change and to a lesser extent, wildfire, as important cross cutting issues. The Integrity of biodiversity is identified as first high priority issue for Kosrae in terms of the necessity of protection both for its own sake and the link between ecosystems, human health, livelihoods, and food security. The increasingly higher tides due to sea-level rise and increased development have resulted in a high priority being placed on coastal stabilization. Also, of importance to Kosrae is the watershed approach that is not only ecologically sound but clearly delineates the relationships between ecological landscapes and the connection between ecological integrity (biodiversity), food production and the need for sustainable production and harvesting. For Kosrae, it is also important to link the

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 as it relates to climate change, and the health of the island's ecosystem. Therefore, matters to do with the production and sustainable harvest of terrestrial resources are urgent. Last, only because it is non spatial in nature, is the significant need for local capacity development and increased education and training opportunities. This is urgently needed both for terrestrial resource managers, government employees and in the development of public and community awareness and capacity.

Table K-1 below summarizes FSM Cross-cutting issues and their Priority Landscapes in relation to USFS Primary National Themes. Maps of primary priority areas are indicated in this table and inserted with their respective issues. Additional maps are either referred to and provided at the end of this chapter or simply provided for further analysis and might apply to multiple issues. An overall listing is provided in the Reference Section.

TABLE K 2 KOSRAE ISSUES, PRIORITY AREAS, NATIONAL THEMES

FSM National Issues	Priority Landscape Areas	U.S. National Themes
Cross-Cutting Threats	Cross-cutting threats (Invasive species, wildfires, and climate change) affect all issues	3 Enhance, 1 Conserve, 2 Protect
A. Biodiversity Conservation	Priority is native forests and wetlands, protected areas (PAs) (MAP10) and the areas of biodiversity significance (ABS) (MAP K9) (MAP K3)	3 Enhance, 1 Conserve, 2 Protect
B. Coastal Stabilization	Priority is mangrove, agroforest and developed areas along the coastline and the projected sea level rise (SLR) hazard zones (Map K12) from the shoreline (Map K4)	1 Conserve, 3 Enhance
C. Watershed	Priorities are upland forest, watersheds and streams (MAP K12) (MAP K5)	3 Enhance, 1 Conserve, 2 Protect
D. Food Security	Primarily agroforest, secondary vegetation, and cropland (MAP K6)	3 Enhance, 2 Protect

E. Production & sustainable harvesting	Priority for upland forests, secondary and agroforest (MAP K7)	3 Enhance, 1 Conserve
F. Capacity-building	(non-spatial)	3 Enhance

Cross-cutting Threats

The identified cross-cutting threats for Kosrae are invasive alien species, climate change and to a lesser extent, wildfires. These threats have been identified as cross-cutting due to their overwhelming effects on terrestrial resources and must be addressed in the context of all of the FSM National Issues. All three threats have the potential to destroy endemic biodiversity, overtake land for food production and cause significant devastation.

Invasive species

Invasive alien species in Kosrae have already caused havoc on citrus plants (food security) and have the potential to destroy important trees and terrestrial resources that support the islands biodiversity, ecosystem health and to a certain extent the livelihoods of Kosreans. Invasive alien species are found under all themes of this FAP and are a priority concern for Kosrae. The 2015 NISSAP outlines the following overall goal for Kosrae state, prioritizing the following under invasive alien species "Establish biosecurity (border control, quarantine, eradication and/or management) programs to effectively protect the Kosrae's biodiversity, livelihoods, sustainable development and resilience to climate change from the impacts of invasive species.". Invasive alien species actions are found throughout the FSM National Issues as identified below a well as within the Kosrae State Strategy Table. Also, see MAP K13 for a visual representation for Kosrae.

Climate change

The Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change (2016) identifies coastal erosion from sea level rise and storm swells, flooding, rain induced landslides, typhoons and drought and extreme heat as the main threats to Kosrae due to the increasing effects of climate change (2016). Direct impacts from climate change on terrestrial resources include threats to traditional agroforestry systems through saltwater intrusion, droughts, landslides and typhoons (SOE, 2018). Climate change is identified as a major threat to all FSM National Issues and is exasperating the negative impacts of numerous other issues such as loss of land for agroforestry, decrease in coastal stabilization, increase in invasive alien species, fragility of biodiversity and ecosystem health, and human impacts such overharvesting of terrestrial resources and development projects.

Wildfires

While wildfire is not common on Kosrae given the high rainfall, fire can occur during periods of drought in more flammable savanna areas may erode away forest edges and cause long-term damage. In addition, while clearly a bigger problem for Pohnpei, in Kosrae, there has been minimal, yet gradually increasing, burning of forest to clear land for growing the local commodity *sakau (Piper methysticum)*. There is therefore risk that a 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 as a strategy in this updated FAP.

A. Biodiversity Conservation

Conditions and Trends

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 (CBD Technical Series No. 43, 2009). Forests and trees contribute critically to biodiversity, protection and maintenance of ecosystem services in the FSM and Kosrae. They also play a significant role in mitigating the impacts of climate change. Unfortunately, despite their essential role in sustainable development these valuable resources are under continuous threat from destructive human activities associated with agricultural clearing, firewood collecting and logging (SOE 2018). Biodiversity across the FSM and Kosrae is incredibly rich. The FSM and its states are recognized part of the globally important Polynesia-Micronesia biodiversity hotspot (Critical Ecosystem Partnership Fund, 2007). Kosrae is home to variety of endemic species including *Cyrtandra kusaimontana*, *Medinilla diversifolia*, Mweng Finol (*Pandanas kusicolus*), *Phretia kusaiensis*, *Polyscias subcapitata* and the Kosrae White-eye. Kosrae is also home to a number of important endangered species, including the Kosrae Flying Fox *teropus ualanus* and the Micronesian pigeon *Ducula oceanica*. Moreover, the only remaining intact, significant stand of *Terminalia carolinensis* trees in the world, locally known as Ka, is found in Kosrae (KBSAP, 2018).

In 2006, in support of the importance of conservation of biodiversity across the region, the Micronesia Challenge was launched. This commitment from the leaders of the FSM, the Republic of the Marshall Islands, the Republic of Palau, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI)committed to effectively conserving 30% of near-shore resources and at least 20% of forest resources across Micronesia by 2020 (Micronesia Challenge, n.d.). Significant progress has been made within the Kosrae Protected Areas Network (PAN) that will result in at least 20% of marine area and 19% of terrestrial area protected if the currently proposed protected areas are designated (the Nature Conservancy, Spatial Analysis in Support of Development of the Kosrae Protected Area Network, 2019). A number of terrestrial and marine reserves are in place, including the Yela Ka Forest Conservation Easement, the Utwe Biosphere Reserve and the Tafunsak Marine Reserve. The Walung, Malem and Lelu Marine Protected Area is in the process of being designated, while the Trochus Sanctuary established in

1986 has been consistently maintained and managed. The establishment of the Makontowe Conservation Area in 2018 has also increased hectares and efforts by guaranteeing the protection of a large area of Kosrae's upland forests from future development.

Forests in Kosrae like the other states are threatened by road building, clearing for agricultural projects and house sites, 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 overharvesting 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.

Kosrae's agroforests and mangrove forests are susceptible to plant diseases. The root pathogen *Phellinus noxius* is common in Kosrae (Cannon et al, 2014). 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 their natural resources. Since the 2010 SWARS was written, an invasive species program has been established in Kosrae.

PHELLINUS NOXIUS ON A KA TREE, KOSRAE

Per the updated KBSAP, "significant developments toward comprehensive biodiversity conservation in Kosrae and throughout the FSM have been undertaken". Still, there remains a lot of work to do. The same can be said for the previous SWARS and into this new FAP. The KBSAP and the Forest Action Plan are most importantly, plans of action that provide a pathway for the people of Kosrae to continue to conserve their vital terrestrial resources for future generations. Per the 2018 KBSAP "the significance of nurturing the biodiversity of Kosrae State through maintaining its habitats and ecosystems is vital to ongoing social, economic and cultural development, and to sustaining its rich traditions."

Strengths

- **Establishment of the Kosrae Protected Area Network (PAN):** Kosrae State passed a Protected Areas Act in 2010 and subsequent terrestrial PA's including the Mahkontohwe Conservation Area and Utwe Biosphere Reserve (Municipal Management Plans) have been approved.

- **Establishment of the Micronesia Challenge Endowment:** on behalf of the Micronesia Challenge, the Micronesia Conservation Trust was selected to host a regional endowment to provide long-term, sustainable funding for biodiversity conservation. Once a jurisdiction has met the milestones necessary (which include PAN Laws, an endorsed National Framework, and a PAN

funds distribution mechanism), it can begin to withdraw its dividends from the MC Endowment. This funding will be accessible by communities with management plans across the FSM.

- **State Terrestrial Conservation and Biodiversity Plans Established:** Updated National and Kosrae State BSAP (2018), Kosrae Joint State Action Plan for Disaster Risk Management (2017), Kosrae State Strategic Development Plan (2014), Kosrae State Protected Area Act of 2010.

- **Increased Number of NGO's Working on Biodiversity:** Yela Environmenta Landowners Authority, Kosrae Conservation and Safety Organization (KCSO), Women in Farming Kosrae, Kosrae Resource Management Committee, the Micronesia Red Cross-Kosrae Chapter, Civil Society of Kosrae,

- **Forest Inventory and Analysis (FIA):** the FIA in 2006 provided a baseline understanding of the status of the forests and terrestrial resources. The re-measurement in 2016 provided an opportunity to gauge success of efforts and develop management interventions based on a data to management loop.

- **Kosrae Invasive Species Taskforce (KIST)/Micronesia Regional Invasive Species Council (RISC):** Seen as a highlight, the KIST SAP for 2013-15 outlined actions for invasive species activities and KIST was re-activated in February 2020 including a draft updated SAP to replace their previous one from 2015. The establishment of RISC provides invasive species management technical support and capacity building. There has been significant Kosrae membership and attendance at RISC meetings. This has also ensured ongoing work to combat invasive plants in Kosrae.

- **GEF-5 Ridge-to-Reef Project:** The GEF replenishment focusing on the protected areas and conservation is seen as an important strength for biodiversity and has contributed significantly to efforts in biodiversity in Kosrae.

- **Successful Development of Permit System/Land Use Plan:** there is an established process for requesting and registering development and land use work with the state that then leads to a full review process and then if all is approved, a permit to complete the project. This process is seen as successful in Kosrae.

Weaknesses

- **Lack of Enforcement and Awareness of Existing Policies and Regulations:** there is a general consensus that lack of resources, low political will and technical capacity along with communication gaps to communities, individuals and government officials has led to lack of understanding, knowledge and therefore enforcement of existing policies and regulations to protect biodiversity.

- **Lack of Collaboration:** while there are many governments entities, NGO's, communities, and landowners developing and implementing plans, they are not coordinated and often entities are not aware of the activities of other departments, even between government entities.

- **Insufficient Control of Invasive Alien Species:** while an identified strength includes the reactivation of the Kosrae Invasive Species Taskforce (KIST) and the active membership in RISC, more still needs to be done including further capacity building of staff, resource managers and community members to eradicate and manage IAS.

- **Limited Knowledge and Awareness on Biodiversity Conservation:** there is still a need to increase awareness raising for communities and policy makers on the importance of biodiversity conservation.

- **Lack of Funding to Support Science and Outreach:** there is a need for more funding to support research of biodiversity and gather data specific to Kosrae and then to support outreach and awareness of results for communities, students and policy makers.

- **Biosecurity System Insufficient:** there are overall concerns with the biosecurity system including customs (air and boat travel, and between the main island and outer islands in particular), a lack of enforcement (items not checked and coolers not opened), and a concern that Congress is not supportive of increasing enforcement efforts.

- **Government Priorities:** priorities can change with new leadership. If leaders prioritize economic opportunities over sustainable use of resources and when administrations change, projects and policies and funding can refocus and decrease for biodiversity conservation. A change in leadership could also force a change in political will and cause a shift in priorities.

- **Local Attitudes Towards Roles and Funding:** there is concern that many believe outside organizations local NGO's should be paying for and leading adaptation projects. Individuals feel that this work is not their role and behavior and attitude shifts are needed. Moreover, there is also a belief that the problem 'will just go away'.

Opportunities

- **Increase in Collective Interest in Protecting Natural Resources:** many people in Kosrae are beginning to understand the importance of protecting biodiversity. There is a feeling that this is the right time to take advantage of this changing attitude with increased awareness and opportunities for community members to be involved in the work.

- **Establish More Protected Areas:** with an increased understanding and interest growing, there is an opportunity to continue the efforts under the Kosrae PAN to establish more terrestrial protected areas including tying them to historical areas .

- **Other Funding Opportunities:** a number of funding opportunities were identified for biodiversity projects such as the United Nations Development Program Small Grants Program (SGP), funding through the GEF-5 (Ridge to Reef) and GEF-6 (Invasive Species) funding to FSM National Government from the United Nations Development Program, grants from the Micronesia Conservation Trust, FSM PAN Network and future funding from larger opportunities like the Green Climate Fund and the Adaptation Fund.

- **Land Use Plan Update 2020:** With support from the GEF-5 Ridge to Reef Program, an intensive Strategic Environmental Assessment (SEA) was carried out to inform the update of Kosrae's Land Use Plan. The LUP will be revised based on the SEA recommendations and is slated to be completed in 2021.

- **Increased Number of NGO's Working on Biodiversity Resulting in Opportunity for More:** as was mentioned under strengths above, there are increasingly more local organizations working in biodiversity. There is an opportunity for these organizations to implement more projects and for more organizations to be established to support this work.

- **Kosrae Conservation Enforcement Taskforce**: there is an opportunity to work more closely with this group to enhance their motivation, capacity and funding.

- **Coconuts for Life (CFL) Project:** the C4L project is an initiative of FSM Petrocorp and the Micronesia Consecration Trust to resurrect the coconut industry in the FSM (so far Pohnpei and Chuuk) through enhancing the capacity to buy, sell, export, manufacture, process, and distribute copra and other products from coconut trees. Stakeholders see an opportunity to expand this program to Kosrae.

- **Micronesia Challenge Young Champions Program (MCYC):** this program was seen as a catalyst opportunity for younger, college level students, to complete internships at home in Kosrae, inspiring them to pursue further studies in this area.

- **Japan International Cooperation Agency (JICA):** there is a continued opportunity to increase capacity development for biodiversity conservation, specifically terrestrial resource conservation with JICA.

- **College of Micronesia – Federated States of Micronesia Cooperative Research and Extension Program (COM-FSM CRE):** increased opportunity for local capacity training and support for rehabilitation/re-planting, dry litter piggery support, seedling production and distribution.

- **Work With Community Groups for Invasive Alien Species:** while some NGO and community projects have addressed invasive alien species over the years, there is an opportunity to develop programs, with CIST, for community members to learn to combat their own IAS issues.

Threats

- **Change of Lifestyle:** there is concern that the way of life of the islands is changing quickly with a preference for imported food and newer technologies that are leading to less reliance on the health of the island's biodiversity. This in turn is causing a disconnect between people's lives and their physical environment leading to a lack of concern for biodiversity and ecosystem well-being.

- **Increased Outmigration:** Kosrae has seen significant outmigration that increases annually. As there is limited employment at wages that do not fulfill people's needs, many are leaving for better jobs and many students are not returning after completing their educations aboard. This is leading to a severe lack of capacity and skilled people in positions that are vital to conserving the islands biodiversity.

- **Increased Travel and Mobility:** increasingly, more Kosrean's are traveling between the states of the FSM and internationally (to Guam and the US Mainland). There has also been an increase in tourism and trade. There are more ships and more materials arriving in Kosrae from out of state. These activities are all seen as a threat to overall biodiversity paired with lack of border enforcement.

- **Intensified Effects of Climate Change:** climate change mitigation is slow, and adaptation takes a lot of funding while impacts on coastal communities will continue to increase.

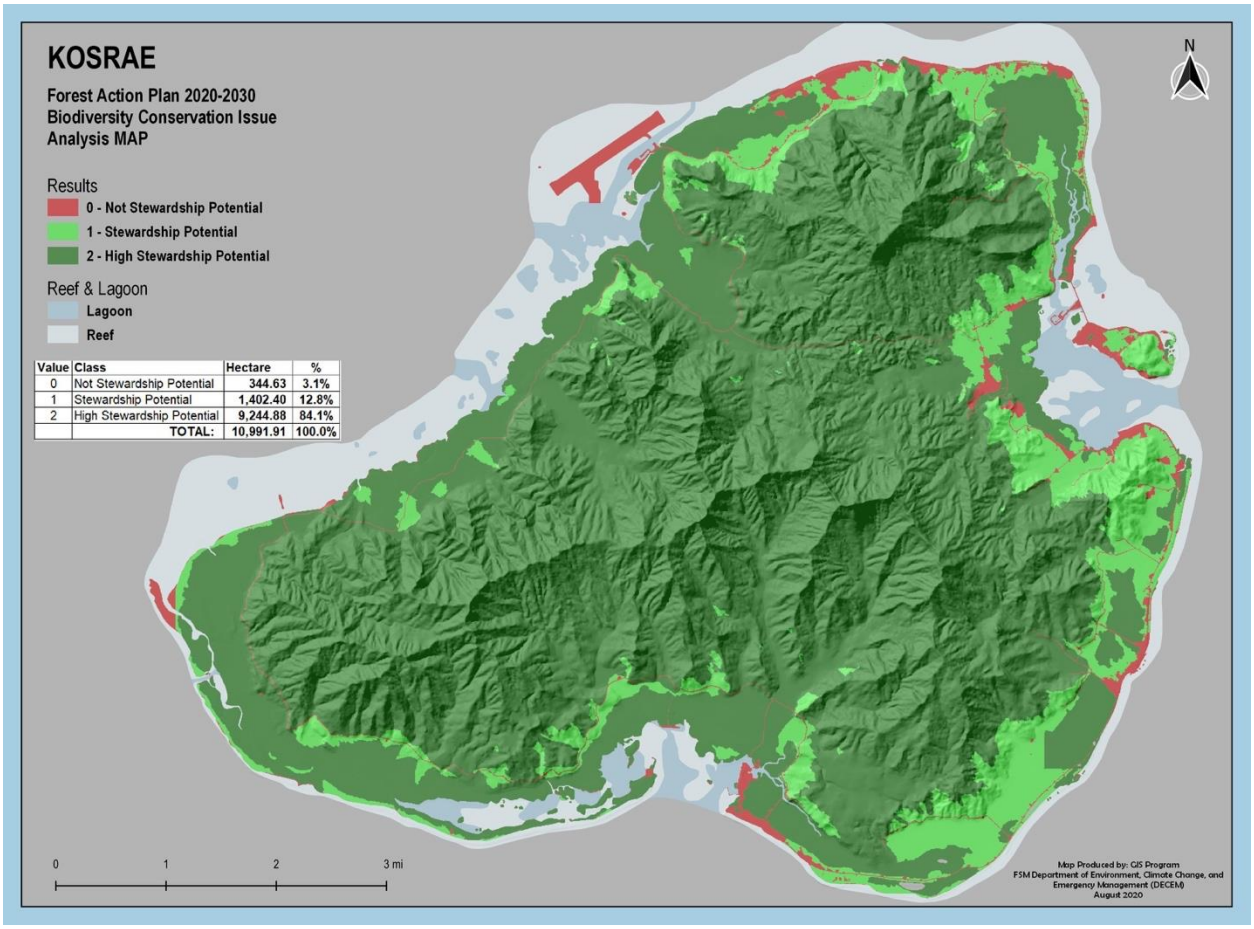
- **Threshold Might be Beyond Survival:** the current status of many of the coastlines in many areas of Kosrae are already degraded so much that many may not be rehabilitative

- **Changing of Leadership and Political Will:** there is concern that when leaderships changes, so to do priorities. Moreover, there is risk when administrations change, projects and policies and funding can refocus and decrease for biodiversity conservation.

- **Insubordination of Conservation:** there is concern that the need for development versus the importance of biodiversity conservation can easily favor development at all levels including within communities, governance and traditional leadership. This can lead to neglect of the important of conservation through behavior, attitudes and funding.

Priority Areas

Highest priorities for biodiversity conservation are native forests, protected areas (see MAP K10), and all Areas of Biological Significance (ABS) (see MAPK9). This is due to their high biodiversity concentrations and already established and identified significance. Of secondary priority are agroforest and secondary vegetation while developed areas are not priority at all due to their already extremely disturbed status.



MAP K3: Kosrae Biodiversity Conservation Analysis Map

This map shows the result of the reclassification and overlay analysis of Kosrae's spatial layers including vegetation, developed areas, protected areas, areas of biodiversity significance and hazard layers into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the biodiversity conservation issue for Kosrae. The High Potential areas in dark green (84.1%) include the native forests and wetlands, protected areas (PAs) and the areas of biodiversity significance (ABS); the Potential areas in light green (12.8%) include the agroforest and secondary vegetation; and the Not Potential areas in red (3.1%) include the developed areas in Kosrae.

B. Coastal Stabilization

Conditions and Trends

For many years, Kosrae has experienced 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 forests and especially mangroves help reduce coastal erosion but are threatened by construction activities. Coastal

erosion has removed areas of beach strand and caused the loss of coastal trees and damage to coastal areas used for dwellings and agriculture. It is assumed that coastal erosion, driven by the combined effects of sea-level rise and development practices, will continue to threaten coastal infrastructure in Kosrae (JSAP, 2016). In Kosrae, mangroves provide a level of natural resilience through direct coastal protection to around 22% of Kosrae's coastline. (JSAP,2016). While harvesting is a threat, overall, a study found that between 1976 and 2006, Kosrae's mangrove cover was reduced by only 2%. This trend while accelerating somewhat, continues to be slow and overall, the mangroves of Kosrae are considered to be relatively intact (SOE, 2018).

Strengths

- **Legislation and Regulations in Place to Protect Coastlines:** mangrove harvesting permitting process, coastal management plan in place called the Protected Areas (Forest Management) Regulation of 2014 and the Kosrae Shoreline Management Plan also in 2014.

- **Successful Development of Permit System/Land Use Plan:** there is an established process for requesting and registering development and land use work with the state that then leads to a full review process and then if all is approved, a permit to complete the project. This process is seen as successful in Kosrae.

- **Enforcement of Mangrove Harvesting:** the mangrove harvesting permit process through Kosrae Island Resource Management Authority (KIRMA) has also increased enforcement for those who harvest illegally and without a permit.

- **Green Belt Project:** this project was spear-headed by the Red Cross and has conducted trainings for community and completed mangrove planting around Kosrae along with the Ridge to Reef International Waters lemon grass replanting project.

- **Agroforestry Seedlings/Nurseries/Replanting projects:** there is an increase in availability of mangrove and agroforestry seedlings, nursery supplies and projects for replanting.

- **Establishment of the Kosrae Protected Area Network (PAN):** Kosrae State passed a Protected Areas Act in 2010 including among others, terrestrial protected areas including the Mahkontohwe Conservation Area and Utwe Biosphere Reserve.

- **Long Term Mangrove Monitoring Plots:** permanent plots that were established in the 1990s through a partnership between the US Forest Service, the US Geological Survey and what was the Kosrae Development Review Commission (DRC) and is now KIRMA,) have been updated while forest structure and response to sea level rise have continue to be monitored through this partnership.

Weaknesses

- **Lack of Capacity:** There are not enough engineers and technical professionals in Kosrae who can properly assess and identify suitable solutions to help coastal communities build resilience of their coastlines.

- **Lack of Awareness on Benefits of Coastal Protection:** there is a need for more awareness of the importance of planting and maintaining existing mangroves and other coastal vegetation and how they impact coastal community safety during storms, storm surge and sea level rise.

- **Enforcement Still Needs Improvement:** while increased enforcement is seen as a strength because it has improved significantly, it is also seen as a weakness at the institutional level with needed improvement for enforcement officer motivation, capacity development, collaboration and supplies.

Opportunities

- **Funding Opportunities:** a number of funding opportunities were identified for eco-system based coastal rehabilitation projects such as the United Nations Development Program Small Grants Program (SGP), GEF-5 Ridge to Reef Program, the Micronesia Red Cross-Kosrae Chapter and future funding from larger opportunities like the Green Climate Fund and the Adaptation Fund.

- **Mangrove Assessment:** it is timely for Kosrae to complete a full island terrestrial assessment that will include mangrove areas for management purposes and establish a situation report on the full status of updated health of mangrove forests.

- **Increase Capacity:** with an increase in funding and technical support for coastal rehabilitation, Kosrae seeks to take more advantage of projects and support and focus trainings on areas of importance for coastal stabilization such as such as planting and green belt projects.

- **Kosrae Shoreline Management Plan:** this 2014 plan identifies moving populations further upland and there is opportunity already underway to implement this plan through projects such as the FSM National Government Adaptation Fund project that will move the main roads in Malem and Utwe.

- **LIDAR:** for Kosrae, following the 2010 SWARS, LiDAR is still a priority to develop storm surge and inundation modeling, shoreline mapping and coastal vulnerability maps. It is also seen as important to better establish sensitive road engineering projects to protect both coastal mangroves and low-lying agricultural lands.

Threats

- **Human Activities:** while there is a lot of effort and a lot of good work being done, dredging for sand and construction supplies and harvesting of mangroves and coastal forests is still ongoing. Seawalls are still being built and eco-based solutions are not as widespread or popular.

Development priorities versus environment protection are still prioritized and there is still active deforestation.

- **Development Priorities:** as is mentioned in the point above, continued human induced land degradation prioritization development is a threat to the coastlines. This includes the need for roads, farms, docks, and buildings that are all necessary infrastructure and often built along the coastlines of Kosrae.

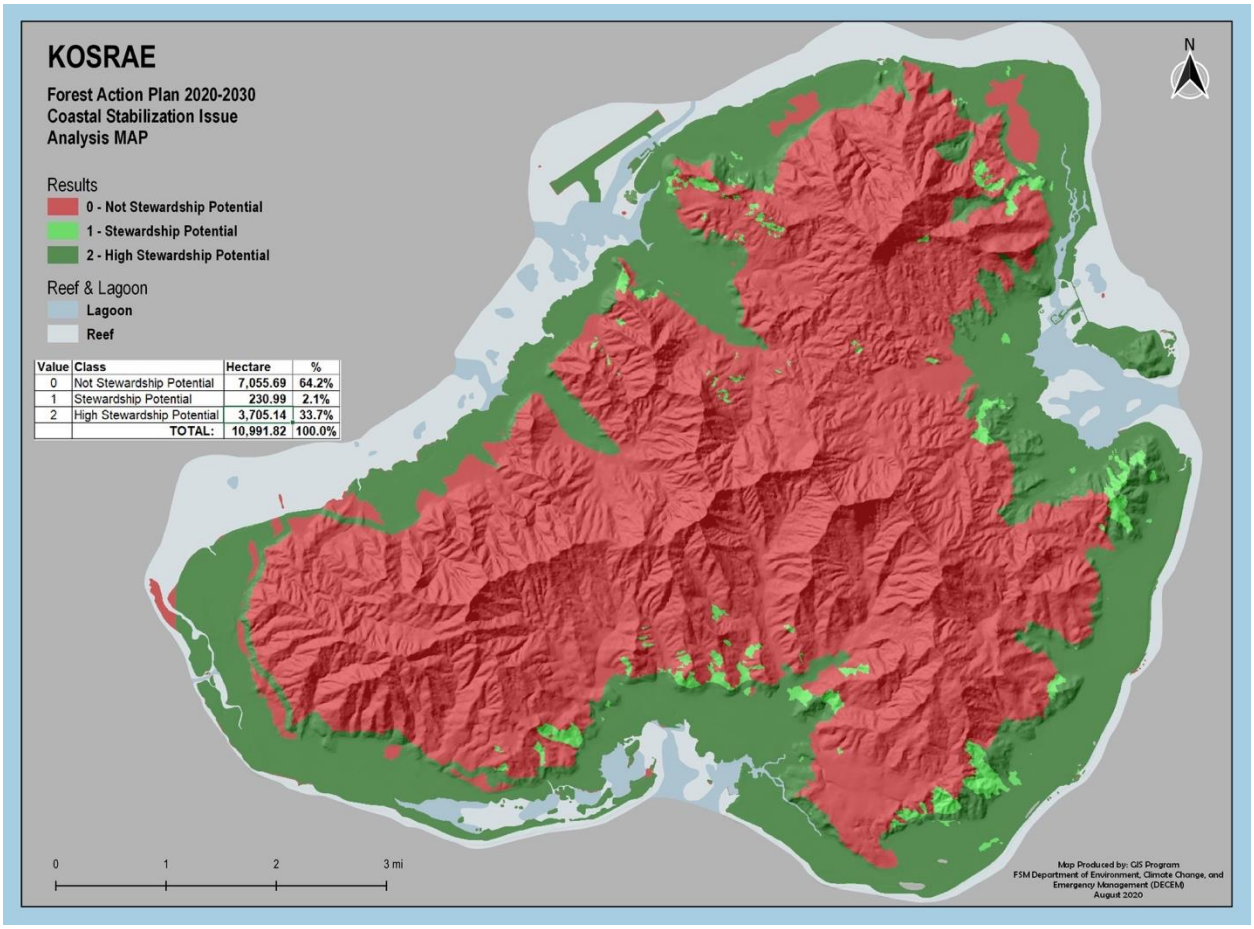
- **Funding:** because eco system-based coastline rehabilitation projects are less popular, funding is more difficult to acquire versus gray coastline projects.

- **Intensified Effects of Climate Change:** climate change mitigation is slow, and adaptation takes a lot of funding while impacts on coastal communities will continue to increase and likely to increase including coastal erosion and saltwater intrusion of taro patches

- **Continued Harvesting of Mangroves:** there is still a preference and dependence on mangrove wood for fires and cooking and changing attitudes and understanding is a long process.

Priority Areas

The first priority for coastal stabilization are the areas most affected by erosion, development and sea level rise (SLR – MAP K8) including mangrove areas, agroforest and developed areas along the coastline. Second priority, albeit very low compared to the first priority areas, is cropland and some secondary vegetation. As Kosrae is a high island, the area that is not priority for coastal stabilization is also a significantly large amount of the island due to it being the higher elevations of Kosrae.



MAP K4: Kosrae – Coastal Stabilization analysis map

This map shows the result of the reclassification and overlay analysis of Kosrae's spatial layers including vegetation, developed areas, protected areas, areas of biodiversity significance and hazard layers into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the coastal stabilization issue for Kosrae. The High Potential areas in dark green (33.7%) include primarily mangroves and the developed areas and agroforest along the coastline; the Potential areas in light green (2.1%) include cropland and some secondary vegetation; and the Not Potential areas in red (64.2%) include all in higher elevations in Kosrae.

C. Watersheds

Conditions and Trends

Watersheds provide important ecosystem services that include access to abundant clean freshwater. Several issues for water quality are associated with the degradation of watersheds on the main islands including development of infrastructure, deforestation, invasive species, droughts, wildfires and storms (SOE, 2018). Negative impacts of degraded watersheds are accelerated erosion, poor water quality,

landslides, siltation of rivers and nearshore marine, and increased flooding downstream. 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. 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.

Being a mountainous island with some of the highest rainfall in the world, watershed management is very important in Kosrae. Fortunately, access to the upland watershed areas of Kosrae are steep and difficult to access making them less at risk from human induced impacts (SOE, 2018). The Japanese Line demarcates the upland watershed, which is public land and a recent law returned some of this land to

people who demonstrated that it once belonged to their family. Although there is no formal enforcement or management of this area but Kosraean's consider the area managed mostly due to it being so inaccessible (SOE, 2018). Kosrae has several protected watersheds including the Mahkontowe Conservation Area, a terrestrial upland/watershed protected area and the Yela *Kaa* swamp forest with the remaining relatively undisturbed forests of the endemic *Terminalia carolinensis* Kaneh. (*ka*) in the world. The Forest Legacy program already has completed one easement and has funding to protect more of these world-class forests and their watershed.

Strengths

- **Development of the Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change (JSAP):** the development of this plan and its focus on conservation plans is seen as an important step.

- **Establishment of the Kosrae Protected Area Network (PAN):** Kosrae State passed a Protected Areas Act in 2010 including among others, terrestrial protected areas including the Mahkontohwe Conservation Area and Utwe Biosphere Reserve.

- **Long Term Mangrove Monitoring Plots:** permanent plots that were established in the 1990s through a partnership between the US Forest Service, the US Geological Survey and what was the Kosrae Development Review Commission (DRC) and is now KIRMA,) have been updated while forest structure and response to sea level rise have continue to be monitored through this partnership.

- **Increased Donor Responsiveness to Watershed Projects:** many donor organizations in the region are adapting their funding opportunities to the needs of jurisdictions. For Kosrae, increased funding is available for watershed protection such as the GEF-5 Ridge to Reef Project, the Ridge to Reef International Waters and grants from the Micronesia Conservation Trust and the Nature Conservancy (through German Government funding for projects in Malem), are some examples.

- **GEF-5 Ridge-to-Reef Project:** the GEF replenishment focusing on the protected areas and conservation is seen as an important strength for watershed conservation having established one each in these watersheds in Kosrae: Tofol to Mutunneneah,malem and Tafunsak

- **Re- Establishment of the Kosrae Invasive Species Taskforce:** the reconvening of this taskforce in 2020 will prioritize the eradication of invasive alien species in watershed areas.

- **National and Regional Biosecurity Plans:** established in 2015, both the Regional Biosecurity Plan for Micronesia and Hawaii and the FSM National Invasive Species Strategy and Action Plan (NISSAP) seek to manage the border control of IAS and collaboratively tackle IAS challenges and issues.

Weaknesses

- **Policies Not Enforced:** policies exist to protect the watershed, but they are not enforced. This is partly due to lack of awareness and political will and partly because the policies are not robust enough.

- **Insufficient Control of Invasive Alien Species:** while strengths include the reestablishment of KIST and Kosrae's active membership in RISC, more needs to be done to deal with the increasing invasive alien species problem that continues to destroy Kosrae's terrestrial resources.

- **Insufficient Funding for Management of Watersheds:** while an outlined strength is that there are more watersheds under management, there is still insufficient funding available to implement all the actions under management plans in the watershed areas.

- **Behavior and Attitudes:** unfortunately, while most Kosrean's understand the importance of watersheds as their direct source of fresh water, behaviors reflect a different understanding. There are issues with littering and the building of pig pens near rivers.

- **Stronger Watershed Protections:** other than those watersheds under management plans, there is a need to have statewide watershed protection legislation.

- **Lack of Technical Expertise:** while capacity is growing to manage watershed areas, there is still a lack of specific technical expertise available on island.

Opportunities

- **Available Funding Opportunities:** a number of funding opportunities were identified that could support watershed protection such as GEF-5 Ridge to Reef Project, the Ridge to Reef International Waters and grants from the Micronesia Conservation Trust**,** the Micronesia Challenge Endowment and international opportunities such as the Green Climate Fund and the Adaptation Fund.

- **Island Wide Watershed Assessment**: with funding and technical support, there is an opportunity to conduct this assessment to understand the relative health of the watersheds, the biggest threats and develop recommendations and policy to further protect them.

- **Kosrae Invasive Species Taskforce (KIST):** the reformation of KIST is seen as a significant opportunity to continue the work to protect Kosrae's watersheds. Watersheds could be prioritized in an updated KIST SAP as could invasive species related assessments to determine invasive related needs and support mechanisms.

- **Municipal Resource Management Committees:** the establishment of these communities provides an opportunity to work with community groups on all aspects of watershed protections.

- **Green Belt Project:** this project was spear-headed by the Red Cross and has conducted trainings for community and completed mangrove planting around Kosrae and continues through the Ridge to Reef International Waters to plant lemon grass around watershed areas.

- **Water and Environmental Research Institute of the Western Pacific (WERI) at the University of Guam**: the relationship with WERI is seen as an opportunity to further develop technical expertise and conduct research on the watershed ecosystems of Kosrae.

- **COM-FSM CRE Kosrae Campus:** the extension program can provide seedlings for crops, crops, tissue cultures and a nursery to support replanting projects for the watershed areas.

- **Establishing More Dry Litter Piggeries:** the process of converting and re-locating piggeries along riverbeds has already begun through the Ridge to Reef International Water Program. This work should continue to decrease toxins released into Kosrae's water supplies.

Threats

- **Intensified Effects of Climate Change:** climate change mitigation is slow, and adaptation takes a lot of funding while impacts on coastal communities will continue to increase and likely to increase including coastal erosion and saltwater intrusion of taro patches**.** Kosrae is especially concerned with natural disasters and sea level rise.

- **Risk of Loss of Traditional Knowledge (TK)** there is significant concern that TK is at risk due to increased outmigration and changes in technology and a real concern that traditional knowledge is already decreasing.

- **Private Landownership:** as most of the land is privately owned, it is difficulty to have control over landowners' use of their land for farming and other practices that can harm the well-being of the land and watersheds. Some also chose to ignore policies and regulations.

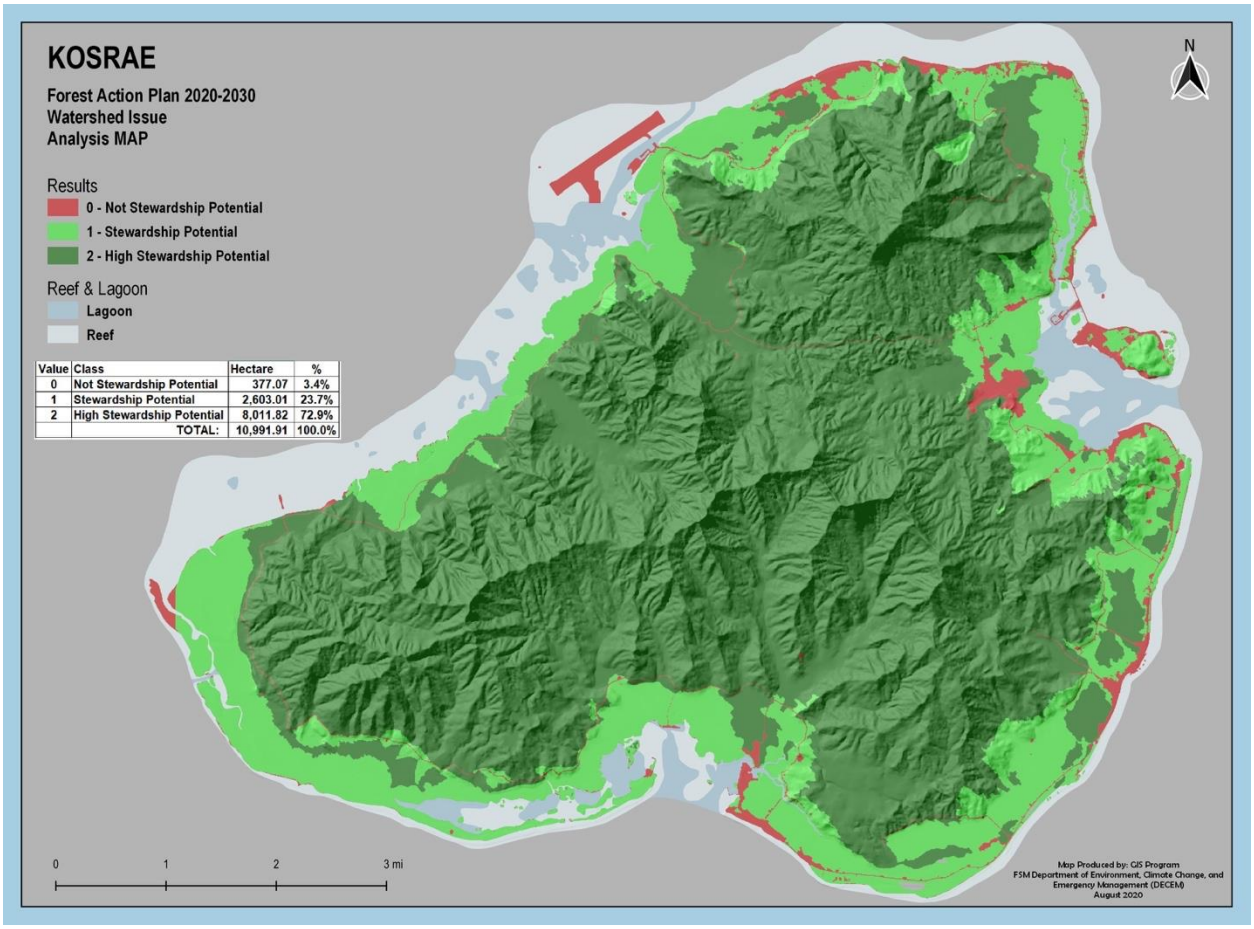
- **Funding Decreases:** there has been an increase in obstacles in acquiring funding for this sector, difficulties in acquiring Compact Sector Funds.

- **Changing of Leadership and Political Will:** there is concern that when leaderships changes, so to do priorities. Moreover, there is risk when administrations change, projects and policies and funding can refocus and decrease for watershed conservation and wellbeing.
- **Continued Encroachment of Invasive Alien Species (IAS):** priority IAS including *Merremia peltata* and *Phellinus noxious* are continuing to spread in the watershed areas.

- **Development Within Watershed Areas:** the impacts of development are threatening water quality and quantity.

Priority areas

The highest priority areas for watersheds include upland forest and streams (see MAP K12), with secondary priority of mangroves and agroforestry areas. Non priority areas include all developed areas.



MAP K5 Kosrae – Watershed analysis map

This map shows the result of the reclassification and overlay analysis of Kosrae's spatial layers including vegetation, developed areas, protected areas, areas of biodiversity significance, watersheds and streams, and the hazard layers into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the watershed issue for Kosrae. The High Potential areas in dark green (72.9%) include upland forest, watersheds and streams; the Potential areas in light green (23.7%) include mangrove forest and agroforest, and the Not Potential areas in red (3.4%) include developed areas in Kosrae.

D. Food Security

Conditions and Trends

Agroforests in Kosrae serve as food production areas, sources of fiber and medicines while providing the ecosystem services of forests. Threats, like in the other states of the FSM, include 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 although imported food is still often preferred. Programs encouraging the growing and use of local foods to combat dietary related health problems have contributed to an increase in local food production with women farmers groups increasingly promoting planting and harvesting programs.

Climate Change and sea level rise continue to be major 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. It is still important to be requiring engineering for the construction of climate-proofed roads to protect critical agricultural lands and manage 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 remain high in species, and varietal diversity. The maintenance of this agro-biodiversity is critical to the resilience of Kosrae's agricultural system and to food security in the face of climate change.

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. For example, the citrus canker, a pest that impacts citrus and was introduced to Kosrae in the late 1990's, has seriously impacted citrus production in Kosrae. Citrus is relied on for substance, health and livelihoods. Outbreaks of the white fly have impacted agriculture production and the black sock fungal disease (*Phellinus noxius*) has been reported affecting native forest trees and agroforestry (SOE, 2018).

Strengths

- **Increased Number of NGO's focused on Agroforestry and Food Security:** Women in Farming Kosrae, Kosrae Women Association (KWA), Kosrae Conservation and Safety Organization (KCSO), Lelu Farmers Association, the Micronesia Red Cross-Kosrae Chapter.
-
- **Increased Establishment of Home Gardens:** likely due to the point above, there is a steady increase in family/home gardens across the island.

- **Increased Number of Local Farmers:** there are more Kosraean's farming now than before.

- **FSM Agriculture Policy (2012-2016):** The development and existence of this national policy is seen as an important recognition of food security issues across the country.

- **Establishment of the Kosrae Protected Area Network (PAN):** The establishment of the PAN has placed more agroforest land under protection.

- **Agroforest Areas Still Abundant**: banana, breadfruit and citrus trees abound. In Kosrae, as the population grows, more areas will remain agroforest areas as Kosraens prioritize these crops. If development moves upland, agroforest plots will also.

- **National and Regional Biosecurity Plans:** established in 2015, both the Regional Biosecurity Plan for Micronesia and Hawaii and the FSM National Invasive Species Strategy and Action Plan (NISSAP) seek to manage the border control of IAS and collaboratively tackle IAS challenges and issues.

- **Nurseries for Agroforestry:** Kosrae Island Resource Management Authority (KIRMA) and the Kosrae Department of Resource an Economic Affairs (DREA) both grow native and climate resilient seedings that are available to the general public.

- **Mangrove Areas for Food Security:** mangrove areas are vital to the food security of Kosrae serving as "nursery" areas for crabs and fish. The harvesting of fish, crabs, and clams from mangroves and the continued work to protect mangroves along the coastline is increasing the islands capacity for food security.

- **Sakau Farming is Decreasing:** there is less monocropping for sakau and in turn a decrease in deforestation to plant sakau than there was before.

- **Control and Suppression Projects for Invasive Plants:** Kosrae has continued to focus efforts on controlling and eradicating invasive plants that can destroy agroforest areas. There has been ongoing monitoring of *Neotermesrainbowi* termite infestations and surveys for *Phellinus noxious* including in agroforestry crops such as bread fruit.

Weaknesses

- **Reliance on External Technical support (FSM National and from other states):** while funding and technical support from the national government, other states and other countries is seen as a strength, there is also concern that the dependence is so great the people of Kosrae are not building enough capacity to tackle the issues without the external support.

- **Behavior and Mentality:** there is a preference for imported food and newer technologies that are leading to less reliance on the health of the island's biodiversity and food security. This in turn is causing a disconnect between people's lives and their physical environment leading to a lack of concern for food security and ecosystem well-being.

- **Means of Export:** farmers who make a living from agroforestry and food crops find it difficult to export products and therefore have to rely on local consumers only, limiting their livelihood potential.

- **Limited Farmland:** while there are still a lot of agroforest and farming areas, the consensus is that there are still not enough. The biggest issue is the inaccessibility of land is not easily accessible as roads and infrastructure does not exist to access the areas.

- **Insufficient Quarantine Management:** lack of capacity to control invasive alien species from entering Kosrae and the FSM in general with no law for the Environmental Protection Agency (EPA) or KIRMA to board vessels.

- **Lack of Pest Management Program:** there is no comprehensive pest management program in Kosrae.

Opportunities

- **Farming/Agroforestry Focused Projects:** farming projects have increased over the last few years as have attitudes and interests of community and government. There is an opportunity to take advantage of the shifting priorities to advocate for funding to implement food and agroforestry related projects going forward.

- **Outside Donors Prioritizing Food Security:** examples include (but are not limited to) the GEF5 R2R program that is supporting rehabilitation and replanting projects, the GEF6 Invasive Species Project (housed at the FSM Department of Resources and Development) to begin in 2021 will support rehabilitation in the context of invasive species, the FSM National Government Food Security Proposal to the Green Climate Fund (by GCF accredited entity the Micronesia Conservation Trust) that if funded, will support famers, agroforestry, nurseries, and a more cohesive marketing plan for the sale of produce within and outside of the FSM.

- **Continue Forest Inventory and Analysis (FIA):** with the FIA completed in 2006 and 2016 in the FSM, baseline data and comparative data is now available. This will provide information that can be used to understand the state of agroforestry in Kosrae and if continued, will provide continued insight and a solid science to management loop in the FSM as a whole.

- **Develop Export Market/Economy Improvement:** providing increased livelihood opportunities for farmers is incentive for communities to want to grow more local foods. The export of produce and agroforest products is seen as an opportunity to increase incomes and that will in turn be an incentive for more people to farm in Kosrae leading to more access and availability on island as well.

- **Health Improvement Program:** tying the important of protecting agroforest ecosystems to the health of Kosraean's is an important link that needs to be better established through partnerships with the education and health sectors in the state.

- **Promotion of Traditional and Contemporary Food Preservation Methods:** there is a need and an opportunity to document and teach traditional farming and food preparation methods in schools and communities.

- **COM-FSM Extension Program:** there exists more opportunities to provide funding and technical expertise to enhance agroforestry programs

Threats

- **Lifestyle Change:** There continues to be a preference for imported foods and more modern technologies, especially among the younger generation. With increased outmigration and ongoing changes in technology, there is a real concern that traditional knowledge is already decreasing. Agroforestry and farming are not seen as viable livelihood opportunities and students are not learning enough in schools or from their families.

- **Increased Outmigration:** Kosrae has seen significant outmigration that increases annually. As there is limited employment at wages that do not fulfill people's needs, many are leaving for better jobs and many students are not returning after completing their educations aboard. This is leading to a severe lack of capacity and skilled people in positions that are vital to conserving the islands biodiversity and increasing capacity for food security.

- **Intensified Effects of Climate Change:** climate change mitigation is slow, and adaptation takes a lot of funding while impacts on coastal communities will continue to increase. Kosrae is especially concerned with natural disasters and sea level rise.

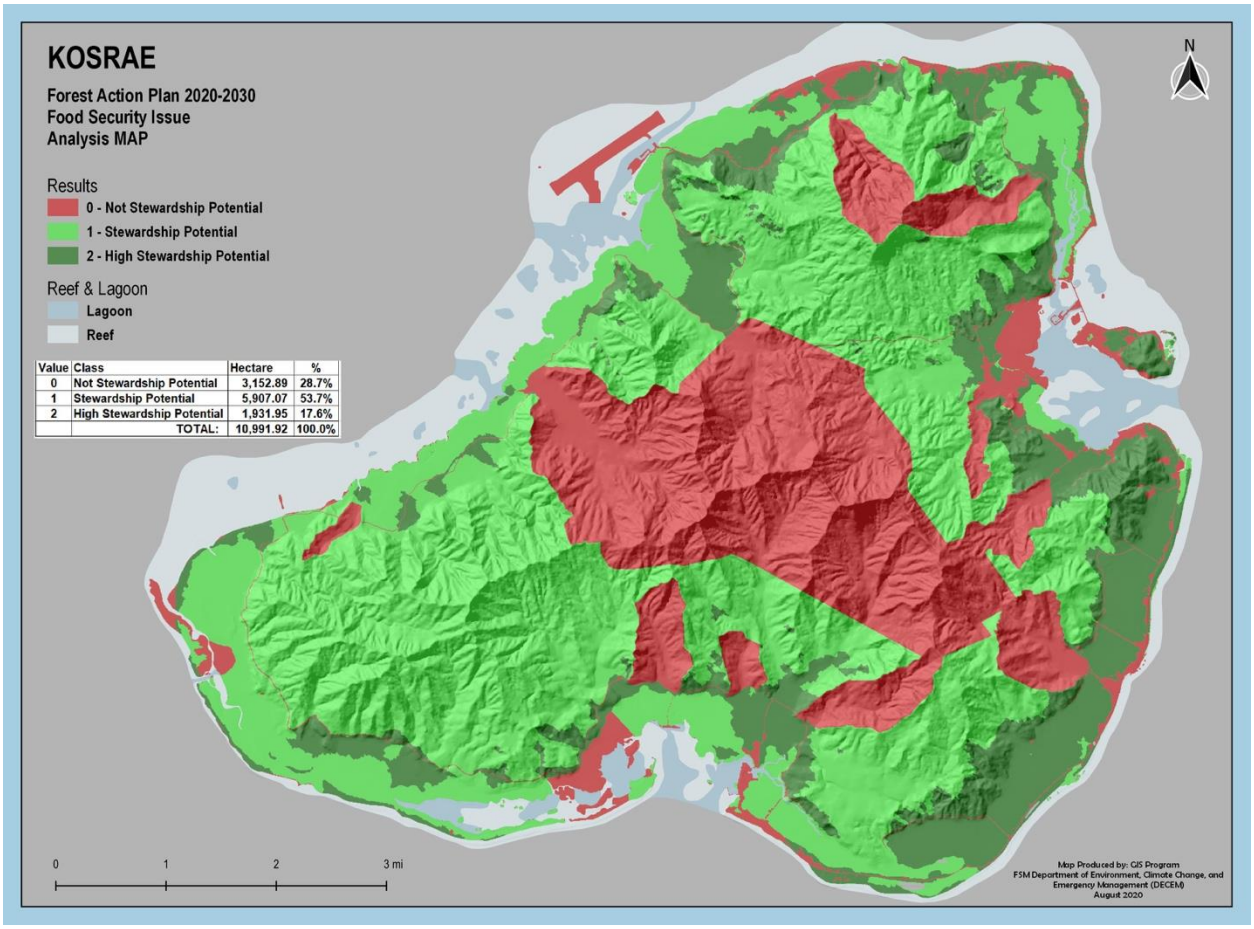
- **Increased Development:** coastal forests in Kosrae are threatened by bulldozing for: roads, agricultural areas and house sites.

- **Invasive Alien Species:** Concerns that IAS are destroying food crops, agroforest species and overtaking potential areas for converting to food. This risk is exasperated by concerns of IAS arriving in Kosrae through transshipments. Concerns are related to risk of introduction of invasive species, capacity of quarantine and border control, and frequent oil spillage. Furthermore, there are concerns about the encroachment of *Merremia peltata* and *Phellinus noxious* on the island.

- **More Land Under Protection, Less Land to Farm:** there is a concern that while the protected areas network is ensuring more land is protected and conserved, it will also lead to less land to use for agroforest and farming purposes.

Priority Areas

High potential areas include primarily agroforest, secondary vegetation, and cropland although this constitutes only a small percentage of the land available in Kosrae. Second priority is mangrove (due to their 'nursery' status for fish and crab) and upland forests that are *not* considered as protected area or official watershed and non-priority are already designated protected areas and watersheds along with already developed areas.



MAP K6: Kosrae – Food Security analysis map

This map shows the result of the reclassification and overlay analysis of Kosrae's spatial layers including vegetation, developed areas, protected areas, watersheds, and hazard layers into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the food security issue for Kosrae. The High Potential areas in dark green (17.6%) include primarily agroforest, secondary vegetation, and cropland; the Potential areas in light green (53.7%) include mangrove and upland forests that are not considered as protected area and watershed; and the Not Potential areas in red (28.7%) include all designated protected areas, watersheds, and developed areas for food security in Kosrae.

E. Production & Sustainable Harvesting

Conditions and Trends

Beyond climate change and storm impacts, the most major factors contributing to a loss of mangroves in all four states includes human impacts from new developments, as well as harvesting and removal (through girdling or ringbarking) for wood products and open channels for boat transportation (SOE, 2018).

Threats to forest resources in Kosrae include roadbuilding, 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 as well as, for house building. 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.

Expert input on sustainable levels of timber harvest or how to selectively cut to preserve the integrity of the overall tree, 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.

Strengths

- **Green Belt Project:** this project was spear-headed by the Red Cross and has conducted trainings for community and completed mangrove planting around Kosrae along with the Ridge to Reef International Waters lemon grass replanting project.

- **Agroforestry Seedlings/Nurseries/Replanting Projects:** there is an increase in availability of mangrove and agroforestry seedlings, nursery supplies and projects for replanting.

- **Legislation and Regulations in Place to Protect Coastlines:** mangrove harvesting permitting process, coastal management plan in place called the Protected Areas (Forest Management) Regulation of 2014 and the Kosrae Shoreline Management Plan also in 2014.

- **Enforcement of Mangrove Harvesting:** the mangrove harvesting permit process through Kosrae Island Resource Management Authority (KIRMA) has also increased enforcement for those who harvest illegally and without a permit.

- **Monitoring of Harvesting Gaps**: there is a focus on monitoring the gaps in mangrove harvesting for replanting purposes.

- **Legislative Champions:** there are number of state senators who support these initiatives and who have pledged to be Champions at the policy level.

Weaknesses

- **Enforcement Still Needs Improvement:** while increased enforcement is seen as a strength because it has improved significantly, it is also seen as a weakness at the institutional level with needed improvement for enforcement officer motivation, capacity development, collaboration and supplies.

- **Loss of Traditional Knowledge**: there is an increasing concern about the loss of knowledge for planting such as the knowledge of the certain times to plant and harvest based on the moon phase calendar.

- **Equipment to Support Projects:** there is not enough equipment due to lack in funding to support all the projects that are required**.**

- **Lack of Capacity:** There are not enough engineers and technical professionals in Kosrae who can properly assess and identify suitable solutions to help coastal communities build resilience of their coastlines.

Opportunities

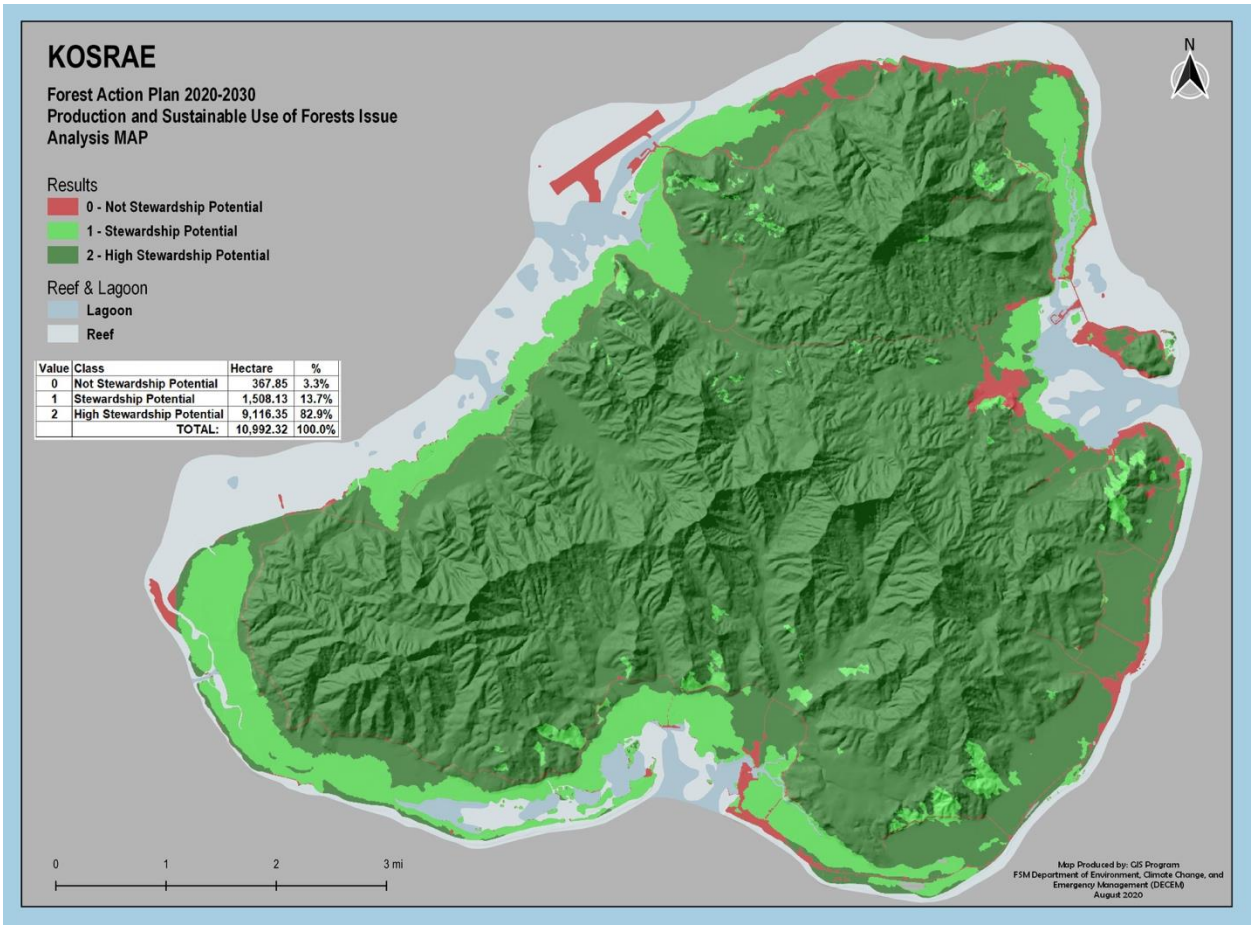
- **The Forest Action Plan (FAP):** there is interest in using this document to garner more funding and support for this work.
- **Funding Opportunities:** a number of funding opportunities were identified for eco-system based coastal rehabilitation projects such as the United Nations Development Program Small Grants Program (SGP), GEF-5 Ridge to Reef Pprogram, the Micronesia Red Cross-Kosrae Chapter and future funding from larger opportunities like the Green Climate Fund and the Adaptation Fund.
- **Ecotourism Activities:** as tourists prefer pristine spaces, especially in tropical and isolated islands, sites could be promoted as ecotourism sites where mangrove removal is banned, beaches are clean, and reefs are alive. These areas can provide livelihoods for local communities and serve as models to promote behavior and attitude shifts. Beaches, mangroves and bird watching areas are all possible ecotourism sites.
- **Awareness programs:** there needs to be more widespread awareness of the impacts of mangrove harvesting

Threats

- **Human Activities:** while there is a lot of effort and a lot of good work being done, dredging for sand and construction supplies and harvesting of mangroves and coastal forests is still ongoing. Seawalls are still being built and eco-based solutions are not as widespread or popular. Development priorities versus environment protection are still prioritized and there is still active deforestation.
- **Intensified Effects of Climate Change:** climate change mitigation is slow, and adaptation takes a lot of funding while impacts on coastal communities will continue to increase and likely to increase including coastal erosion and saltwater intrusion of taro patches. Kosrae is especially concerned with natural disasters and sea level rise.
- **Financial/Livelihoods:** many local incomes depend on the sale of firewood. A decrease in harvesting without an alternative source of income will lead to hardship. People will find it hard to stop harvesting.
- **Development Priorities:** continued human induced land degradation prioritization development is a threat to the coastlines. This includes the need for roads, farms, docks, and buildings that are all necessary infrastructure and often built along the coastlines of Kosrae.
- **Community Buy-In**: there is a need for much more awareness because the success of any project lies at the community level: if community is not in support of an initiative, then it will not be successful.
- **Increase of Invasive Alien Species and Pests:** invasive species have caused havoc on agroforest crops in Kosrae and there is risk that others will invade mangrove and coastal areas.

Priority Areas

Upland forests, secondary and agroforest are overwhelming first priority areas for production and sustainable harvesting while mangrove areas are a far second with developed areas as non-priority. The priority away from mangrove areas reflects the need to expand planting and harvesting activities for production to commodities other than mangrove trees.



MAP K7: Kosrae – Production & Sustainable Use of Forest analysis map

This map shows the result of the reclassification and overlay analysis of Kosrae's spatial layers including vegetation, developed areas, protected areas and hazard layers into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the production and sustainable use of forest issue for Kosrae. The High Potential areas in dark green (82.9%) include upland forests, secondary and agroforest; the Potential areas in light green (13.7%) include the mangrove forest; and the Not Potential areas in red (3.3%) include the developed areas in Kosrae.

F. Capacity-building

Conditions and Trends

With funding declining under the Compact of Free Association, Compact Sector Grants, additional Kosrae State 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. A need to increase the capacity of Forestry staff, communities and to provide awareness of employment opportunities in this field are all prioritized by Kosrae.

Strengths

- **Training/Scholarships Availability:** through different sources such as COM-FSM CRE, the USFS Internships in Pacific Terrestrial Island Ecosystem Management (PIPTIEM) Program, the Micronesia Conservation Trust (MCT), Bill Raynor Micronesia Challenge (BRMC) Scholarship, the Secretariat of the Pacific (SPC), Secretariat of the Pacific Regional Environment Programme (SPREP), the Nature Conservancy (TNC) and other offer training, internships and funding for capacity building in forestry and terrestrial related fields.

- **Traditional Knowledge (TK) for Skills Training:** the continued passing down of traditional knowledge regarding agroforestry, traditional harvesting and the like, are seen as an important and continued strength in the capacity of Kosrean's to manage their terrestrial resources.

- **Learning Exchanges (LE):** Kosrae sees LE's as a very good means to learn technical and forestry/planting support. An example was the Women's Farmers Association LE to Pohnpei and another LE to Samoa to learn about dry litter piggeries.

Weaknesses

- **Appropriate Training Participants:** often times people assigned to attend trainings and workshops are not the appropriate people based on their job descriptions or their capacity to share the knowledge back to those who did not attend.
- **Dependency on external funding support/technical capacity:** there are not enough funding streams within Kosrae or the FSM to support the work and the technical capacity to implement is still in need of growth.
- **Custom and Tradition:** sometimes, the strict gender roles in Kosrae can prevent the acquisition of skills through training for some. For example, for grant writing or education in general the belief/tradition is that girls should be limited in their participation of decision-making further limits the capacity of women and perpetuates gender inequality.
- **Outmigration of Resource People:** Kosrae continues to suffer high outmigration to Guam and the U.S. Some who leave are those with the knowledge and capacity and replacing them is difficult and takes time.
- **Recruitment of Students**: based on the last point, students are either not returning after studies abroad or those who do return are not applying for jobs in this field.
- **Caliber of Education:** there is concern that the education system for elementary and high school students is not sufficient enough to entice or prepare Kosreans for further studies in forestry/environmental related careers.
- **Limited Staff Trained:** not enough staff trained across the themes of this FAP.
- **Funding Decreases: access/capacity to write grants/decreasing availability**: there has been an increase in obstacles in acquiring funding for this sector, difficulties in acquiring Compact Sector Funds, USFS funds and a reliance on state and national budgets that do not prioritize this sector.
- **Awareness Activities Not Prioritized:** in Kosrae, family and Church are the most important and everything else, including community meetings for anything other than these purposes, comes second. There is a need to better communicate environmental protection of resources and how this will also protect families.

Opportunities

- **Increase Awareness Programs:** there needs to be more awareness programs for all themes of the FAP.
- **Increase Promotion of Forestry and Agriculture as Careers:** support community resource owners and KIRMA staff to promote the importance of the work as both a livelihood and as a mechanism for the survival of culture that would allow Kosrean's to remain in Kosrae and on their own land even in the face of the adverse effects of climate change and other threats.

- **Implement More Pilot Projects:** projects such as dry litter piggeries funded by the Ridge to Reef International Waters Project garner the interest of community and governments and can result in further funding and increased capacity to implement restorative projects across the island.

- **Kosrae Historic Preservation Office (KPRO)/KIRMA Digitization Project:** historical files including images, videos and documents are being converted into electronic format. Need to continue efforts.
- **Forest Inventory and Analysis (FIA):** the FIA in 2006 provided a baseline understanding of the status of the forests and terrestrial resources. The re-measurement in 2016 provided an opportunity to gauge success of efforts and develop management interventions based on a data to management loop.

- **Build Capacity to Access Funding and Capacity**: there is an opportunity to increase access to training and funding opportunities. One way would be to hire a dedicated staff member inside the Department of Agriculture to write and manage grants including accessing the more increasingly difficult to acquire Compact sector funding (for the Environment), USFS grants and others.

- **KIRMA Educational Program:** it is important to continue the KIRMA education program. The KIRMA awareness programs focus on sharing environmental best practices for conservation, solid waste management and other subjects to do with protection and sustainable use of ecosystems and their services. This program includes annual celebrations of world environmentally recognized days such as: water day, environment day and forest day. Outreach also includes about laws and regulations pertaining to environmental conservation and management. Programs are implemented at all schools and also include community visits.
- **Raise Minimum Wage:** the low wages in Kosrae, especially those wages earned by the state government employees, are leading to outmigration to find better jobs and causing Kosrean graduates to seek work elsewhere and not return home.

Threats

- **Low Salaries:** as is pointed out above, the low salaries available for government employees and resource managers in Kosrae leads to outmigration and lack of motivation to come home to work.
- **Traditional Norms and Beliefs:** as was pointed out above under weaknesses, the strict gender roles of Kosrean society prevent women from aspiring to some positions in government and resource management. This has been pointed out as a weakness and a continued threat as western lifestyle practices undermine customary/ traditional norms and beliefs.
- **Behavior and Mentality as a Barrier:** there still exists both a high degree of dependence on outside funding and outside technical support (dependence mentality) mixed with attitudes that the problem is not too large, it will just go away.

- **Continued Loss of Resource People:** this is ongoing either due to death or out migration.
- **Limited Resources:** there are limited financial resources for capacity and resource management.
- **Lack of Collaboration:** while there are many governments entities, NGO's, communities, and landowners developing and implementing plans, they are not coordinated and often entities are not aware of the activities of other departments, even between government entities. There are also sometimes issues of competition due to the limited funding available to implement projects.
- **Communication and awareness:** while there has been an increase over the years about the importance of the forestry sector, especially as it relates to food security and costal stabilization, more needs to be done. Many people, communities and landowners still do not prioritize this area.
- **Demands on the time of the limited staff:** insufficient funding to support enough staff at KIRMA and other agencies stretches everyone too thin. 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.
- **Decrease in Compact Funding:** access and existence of compact funding is decreasing and will continue. Environmental Sector funds are crucial to this work in Kosrae with not enough external sources of funding.

KOSRAE STATE FOREST RESOURCE STRATEGY

Table K3 "Kosrae State Strategies" below summarizes strategies for addressing the Cross Cutting Threats and each of the FSM Issues. FSM Issues are shown in priority order for Kosrae State. The table also includes primary USFS and other programs that contribute resources and technical support and the main cooperators for each strategy. Successful implementation of these strategies will require technical and funding support from multiple partners and donors. While key existing and potential partners are listed within the table, it is anticipated, that over time, other partners are able to identify potential contributions in assistance of this plan. Table K2 "Resources Required: USFS, Other Partners, Funding Sources and Cooperators for Chuuk State" lists those referred to in Table K3 "Kosrae State Strategies".

TABLE K2: RESOURCES REQUIRED: USFS, OTHER PARTNERS, FUNDING SOURCES AND COOPERATORS FOR KOSRAE STATE

Resources Required: USFS, Other Partners, Funding Sources and Cooperators for Kosrae State			
USFS/US	**International & Regional**	**National**	**State**
Forest Health (FH) (USFS program) Urban & Community Forestry (U&CF) (USFS program) Forest Stewardship (FSP) Western Competitive Grants (WCP) Fire and Aviation Management (F&AM) USFS Institute of Pacific Islands Forestry (IPIF) USDA Natural Resources Conservation Service (NRCS) United States Geological Survey (USGS) US Department of Interior (DOI) National Oceanic and Atmospheric Administration (NOAA) USDA Rural Development (USDARD)	The Nature Conservancy (TNC) Micronesia Conservation Trust (MCT) Secretariat of the Pacific Regional Environmental Programme (SPREP) Secretariat of the Pacific Community (SPC) Green Climate Fund (GCF) Adaptation Fund (AF) United Nations Development Program Small Grants Program (SGP) Food and Agriculture Organization of the United Nations (FAO) Pacific Islands Managed and Protected Area Community (PIMPAC) Japan International Cooperation Agency (JICA)	UNDP GEF-5 FSM Ridge to Reef UNDP GEF-6 FSM Invasive Species College of Micronesia – Federated States of Micronesia, Cooperative Research and Extension (COM-FSM CRE) FSM Department of Resources and Development (FSM R&D) FSM Department of Environment, Climate Change and Emergency Management (DECEM)	Kosrae Island Resource Management Authority (KIRMA) Kosrae Department of Resource an Economic Affairs (DREA) Kosrae Conservation and Safety Organization (KCSO) Kosrae Invasive Species Taskforce (KIST) Kosrae State Department of Health (DOH) Kosrae Department of Education (DOE) Yela Landowners Association (Yela) Kosrae Historic Preservation Office (HPO)

TABLE K3: KOSRAE STATE STRATEGIES

FSM Issue	Strategy	Resources Required		Main Cooperators	US National Objective	Performance Measures
		USFS	Other Partners and Funding Sources			
Cross Cutting Threats	Continue to implement IAS Management plan	FH, U&CF	GEF-6, DOI, NRCS, GEF6, SGP	KIRMA, DREA, KCSO, KIST, COM-FSM CRE, MCT, Municipal Governments, Farmers Groups	1 Conserve, 2 Protect	Decrease in invasive species #'s and hectares of coverage
	Update Kosrae Invasive Species Taskforce SAP and implement priority actions	FH, U&CF	GEF-6, DOI, NRCS, GEF6, SGP	KIST, KIRMA, DREA, KCSO, COM-FSM CRE, MCT	1 Conserve, 2 Protect	State invasive species task force operational and implementing activities based on SAP
	Request research on invasive vines such as Meremia peltata and increase eradication efforts	FH, U&CF	GEF-6, IPIF, NRCS, SPREP, SPC	KIST, KIRMA, DREA, KCSO, COM-FSM CRE, MCT	1 Conserve, 2 Protect	Better management of most aggressive invasive vines
	Continue to implement and sustain an 'Invasive Control Program' to prevent degradation of working forests (for food production)	FH, U&CF	GEF-6, IPIF, NRCS, SPREP, SPC	KIRMA, DREA, KCSO, KIST, COM-FSM CRE, MCT, Municipal Governments, Farmers Groups	1 Conserve, 2 Protect	Working Invasive Control Program protecting Kosrae's agroforests and food crops
	Complete climate proof road development project through Adaptation Fund/National Govt and adapt best practices for future projects	FH, U&CF	AF, USGS, IPIF, NRCS, SPREP, SPC	DECEM, KIRMA, DREA, KCSO, KIST, COM-FSM CRE, Municipal Governments	1 Conserve, 2 Protect, 3 Enhance	Completed climate resilience road and lessons learned documented for future road projects

	Develop a Kosrae State wildfire plan and program with contingency plan for years of extreme drought and Community Disaster Risk Management Plans and capacity building opportunities	F&AM, FH	IPIF, USDARD	KIRMA, KCSO, COM-FSM CRE	1 Conserve, 2 Protect, 3 Enhance	Existence of a wildfire plan and program with annual reports on wildfires, available equipment, completed training and contingency plan for years with severe drought and community driven DRR plans and receiving funding for fire program
A) Biodiversity	A.1. Establish more terrestrial protected areas including establishing more historical areas as PA's, enhance monitoring and enforcement of PA's and monitor for forest and biological health (MC indicators) A.2. Identify, establish and monitor Forest Legacy Areas. A.3 Continue to implement, update and enforce the Protected Areas Act of 2010 A.4. Increased funding access to NGO's, CSO's, Women's Groups, faith based, and other community groups to support project funding and implementation of terrestrial conservation efforts A.5 Increase enforcement trainings for police, conservation officers and communities A.6. Further engage government leaders (State, Municipal and Community) with knowledge and	U&CF, FSP, WCP, FH, F&AM	USGS, GCF, AF, GEF-5, GEF6, SGP, MCT, TNC, GGF, IPIF, NOAA, SPREP, SPC, JICA	KIRMA, DREA, COM-FSM, KCSO, Yela, PIMPAC, HPO, traditional leaders, Municipal Governments, State Legislators	1 Conserve, 2 Protect, 3 Enhance	A.1. # of new plans, # of actions implemented, # of infringements processed, updating forest health indicators for Kosrae A.2. Existence and enactment of 'Forest Legacy Areas'. A .3. Continued adherence to PA law # of new official terrestrial PA sites A.4. More funding and more entities engaged in terrestrial conservation efforts, # of projects and amount of funds A.5 # of trainings, # of people trained A.6 # of Government leaders advocating at each level for environmental resource

	training to be Environmental Resource Champions A.7. Further engage community groups towards best management practices in environmental resource management and terrestrial areas designation and establishment					conservation management as priority effort, increase in funding A.7. # of community individuals and groups engaged, increase in funding
B) Coastal Stabilization	B.1. Enhance vegetation of coastal beach strands through seedling production, nurseries and replanting program B.2. Facilitate stakeholder and government leader review and develop zoning to accompany the Protected Areas Act of 2010 and the Protected Areas (Forest Mangement) Regulation of 2014 identifying harvesting sites in all communities B.3.Review and update Kosrae Shoreline Management Plan (2014) to expand to ridge to reef approach and continue to implement B.4. Revise and adopt 'Kosrae State Land Use Plan' B.5 Develop and pass specific sand mining legislation	U&CF, FSP	USGS, GCF, AF, GEF-5, GEF6, SGP, MCT, TNC, GGF, IPIF, NOAA, SPREP, SPC	KIRMA, DREA, COM-FSM, KCSO, traditional leaders, Municipal Governments, Attorney General	1 Conserve, 3 Enhance	B.1. # of trees planted, increase in coastal protection B.2 Stakeholder input, completed zoning regulations identifying legal harvesting sites B.3. Updated Plan expanded beyond shoreline to also include ridge to reef concerns and actions being completed under plan B.4. Existence of a revised/ updated version of the 'Kosrae State Land Use Plan' B.6 Existence and enforcement of sand mining law

C)Watershed	C.1.Review and update Kosrae Shoreline Management Plan (2014) to expand to ridge to reef approach and continue to implement C.2. Effectively manage and maintain native forest cover and water quality in watershed areas. C.3. Facilitate stakeholder and government leader review of Watershed Forest Law (19-807) for possible update C.4. Expand the implementation of dry-litter piggery projects C. 5. Draft watershed protection legislation	U&CF, FSP, WCP, FH	GCF, SGP, GEF-5, MCT, TNC, GGF, NRCS	KIRMA, DREA, COM-FSM, KCSO, Yela, DOH, PIMPAC, HPO, traditional leaders, Municipal Governments, Attorney General	1 Conserve, 2 Protect, 3 Enhance	C.1. Updated Plan expanded beyond shoreline to also include ridge to reef concerns including watersheds and actions being completed under plan C.2. Increased hectares of native forest in watershed areas C.3. Law reviewed, stakeholders input received, updates made C.4. # of pig pens converted to dry- litter mechanism C. 5. Draft watershed protection legislation
D) Food Security	D.1. Develop Kosrae State Action Plan under National Agriculture Policy D.2. Upgrade and maintain local Gene Bank by increasing staff and rehabilitant the site D.3.Continue to promote sustainable agriculture (agroforestry)	FH, FSP, WCP, U&CF	GEF-5, GEF-6, IPIF, SGP, MCT, TNC, GCF, AF, FAO, NRCS, SPREP, SPC	KIRMA, DREA, COM-FSM, KCSO, Yela, PIMPAC, DOE, DOH, HPO, FSM R&D, traditional leaders, Municipal Governments, State Legislators	2 Protect, 3 Enhance	D.1 Kosrae specific plan for Agriculture is endorsed and being implemented D.2. Functioning Gene Bank for Kosrae State D.3. Increase in agroforestry sites producing for food security
	E.1 Promote use of and planting for alternative means for wood fuel, handicrafts, building supplies to	FSP, WCP	USGS, IPIF, GCF, AF, IPIF, SGP, GEF-5, GEF-6,	KIRMA, DREA, COM-FSM, KCSO, HPO, DOE, Yela, DOE, PIMPAC,	3 Enhance	E.1. Increased availability of alternative means for production, awareness of impact

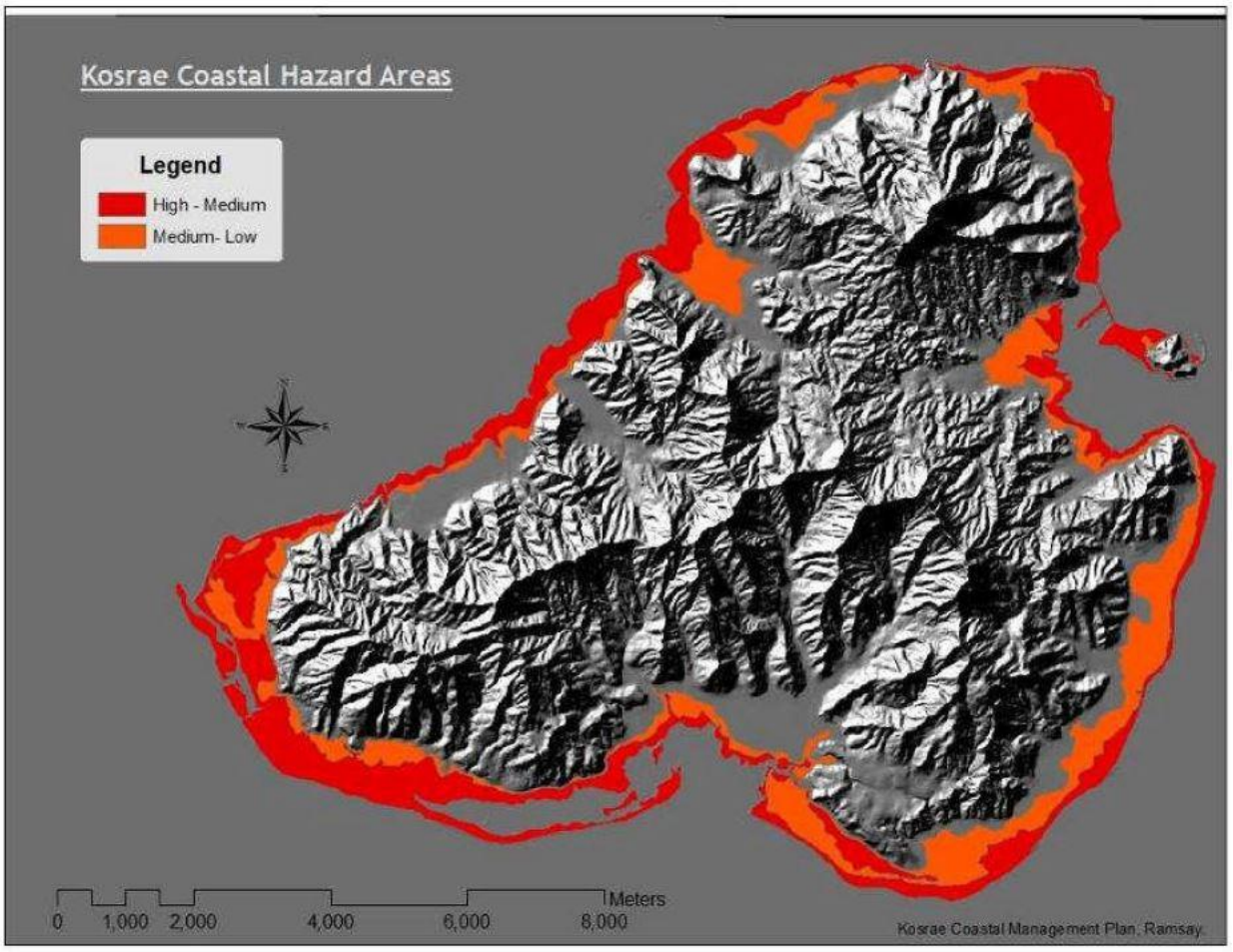
E) Production & Sustainable Harvesting	alleviate pressure on mangrove and upland forest harvesting. E.2. Conduct full island assessment of mangrove and upland forest resources for management purposes through analysis/data collection/survey project E.3 Implement Island Wide Mangrove Assessment and WARMER Model of Kosrae (following the Pohnpei Pilot Project) E.4 Continue to support mangrove and upland forest rehabilitation projects E.5. Develop zoning to accompany the Protected Areas Act of 2010 and the Protected Areas (Forest Management) Regulation of 2014 identifying harvesting sites in all communities E.6. Facilitate stakeholder and government leader review and develop zoning to accompany the Protected Areas Act of 2010 and the Protected Areas (Forest Management) Regulation of 2014 identifying harvesting sites in all communities		MCT, TNC, GGF, NRCS	Municipal Governments, Attorney General		of use of mangroves, decrease in mangrove harvesting and gaps E.2 Baseline data of mangrove and upland forest resources report complete and shared with policy makers and communities to determine use of resource policies and regulations E.3 Implement Island Wide Mangrove Assessment and WARMER Model of Kosrae (following the Pohnpei Pilot Project) E.4 # of trees planted, and hectares increased E.5. Completed zoning regulations identifying legal harvesting sites E.6. Stakeholder input, completed zoning regulations identifying legal harvesting sites

	E.7 Promote eco-tourism sites					E.7 # of Eco tourism sites identified and developed
F) Capacity Building (Non-Spatial)	F.1. GIS Training and equipment for utilization of old and new aerial photos, remote sensing, spatial imagery, geo-database development F.2. Continue to participate in Arborist Training & Certification (ISA) F.3. Develop "Staff Development Plans" ensuring targeted capacity building opportunities F.4 Attend Pacific Islands Forestry Committee (PIFC) meetings annually F.5. Develop a 'Kosrae Island Terrestrial Resource Management Working Group" that will coordinate activities related to terrestrial resource management among government, NGO and communities including capacity building opportunities. F.6. Assist Communities with development of natural resources forest stewardship plans and PA management plans	U&CF, FSP, WCP, FH, F&AM	GCF, SGP, GEF-5, GEF-6, MCT, TNC, GGF, SPREP, SPC, FAO, NRCS, JICA	KIRMA, DREA, COM-FSM, FSM R&D, KCSO, Yela, DOE, PIMPAC, HPO, Municipal Governments	1 Conserve, 2 Protect, 3 Enhance	F.1. Increase in availability and practical use of GIS Maps. F.2. Completed Arboriculture Training Program and existence of certified arborists. F.3. Staff Development Plans exist for all state forestry and agriculture staff F.4. Forestry Staff attend PIFC F.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, better local focus & initiative & performance for performance-based budget F.6. New stewardship and PA plans exist with more private landowners and communities engaged and stewarding their resources

	F.7 Ensure that all outside technical consultants, advisors and researchers offer capacity building opportunities to local government, NGO and community groups (as appropriate) as part of their projects/engagement					F.7 Increased capacity of local NGO, government, resource managers, # of trainings, # of participants
	F.8. Conduct cross-site visits and learning exchanges to showcase successes and share lessons learned and best practices					F.8 Increased capacity of local NGO, government, resource managers, # of trainings, # of participants
	F.9 Conduct integrated awareness and education on resource management in communities and schools including celebrating Earth Day, Environment Day, Biodiversity Day, International Day of Forests, Kosrae Invasive Species Day (March 10th) (KIRMA education program)					F.9 Expanded awareness program
	F.10 Promote and practice traditional knowledge in all aspects of terrestrial resource management activities ensuring that knowledge is passed between generations					F.10 # of activities ensuring traditional knowledge is reflected in resource management and community involvement
	F.11 Ensure Proper Monitoring and assessment of projects and programs					F.11 # of project and programs established, and levels of strategic program goals achieved towards US national and FSM state-wide goals

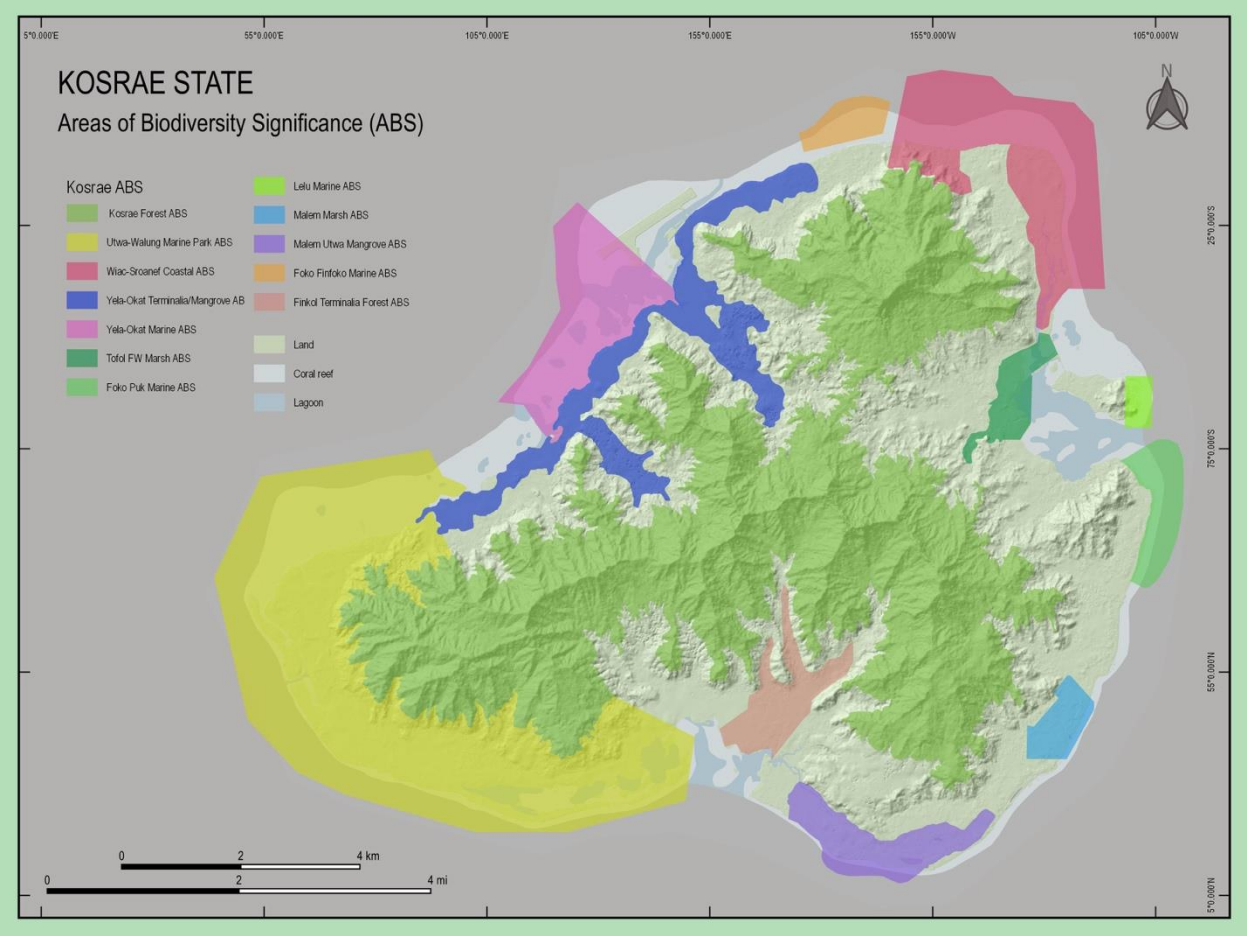
All Other Mapped Priority Areas

Kosrae FAP – Maps codes and descriptions



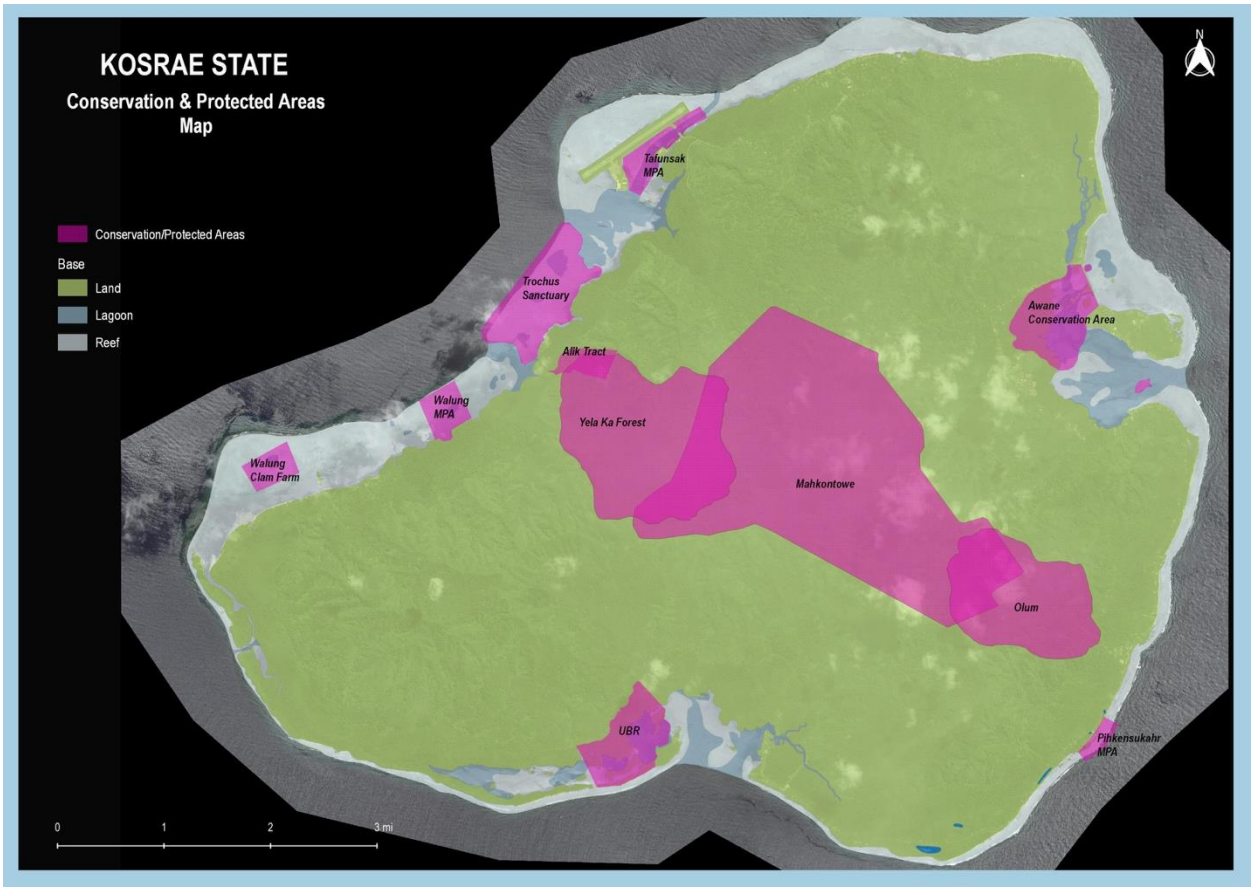
MAP K8: Kosrae – Coastal hazard map

This map shows areas along the coastline of Kosrae that are considered high to low hazard for inundation.



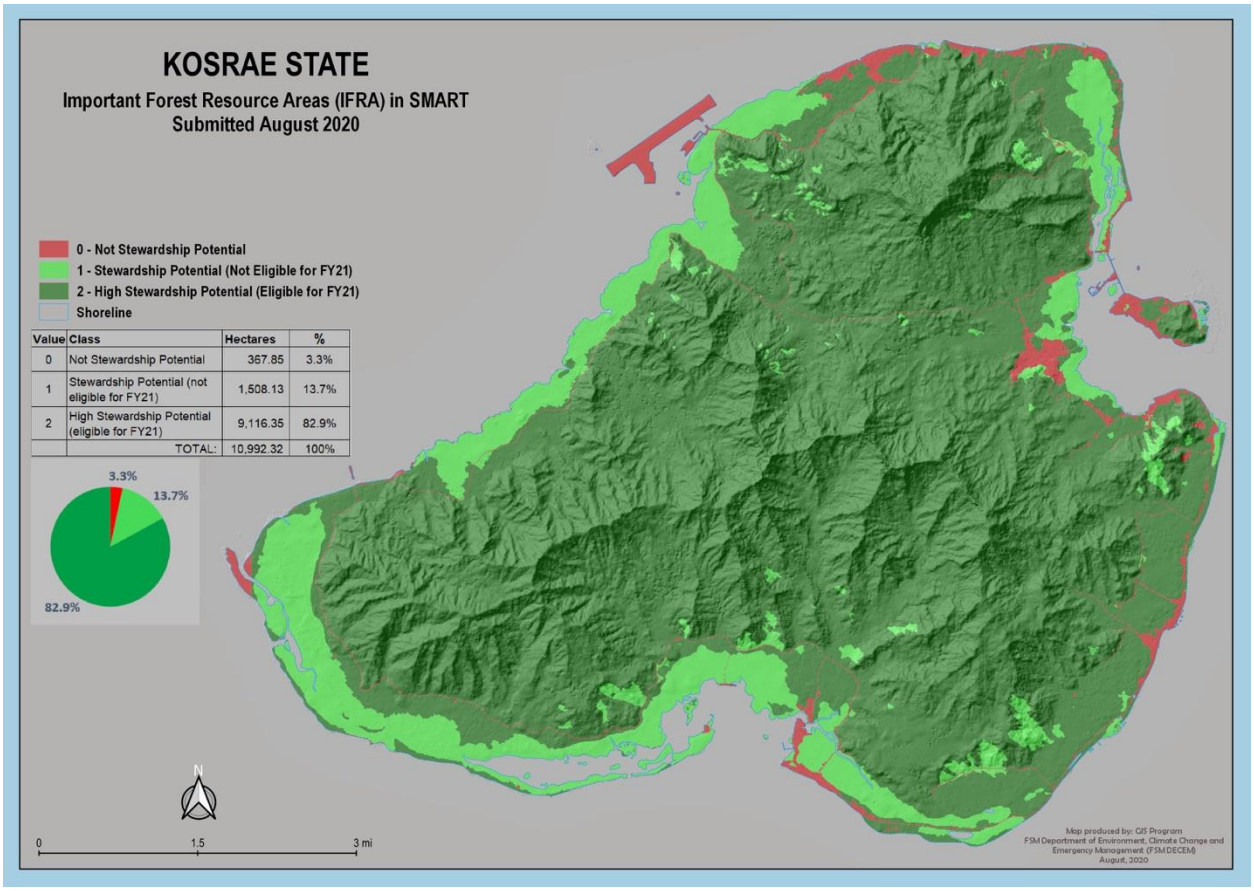
MAPK9 – Kosrae – Areas of Biodiversity Significance (ABS) map

This map shows the Areas of Biodiversity Significance (ABS) of Kosrae.



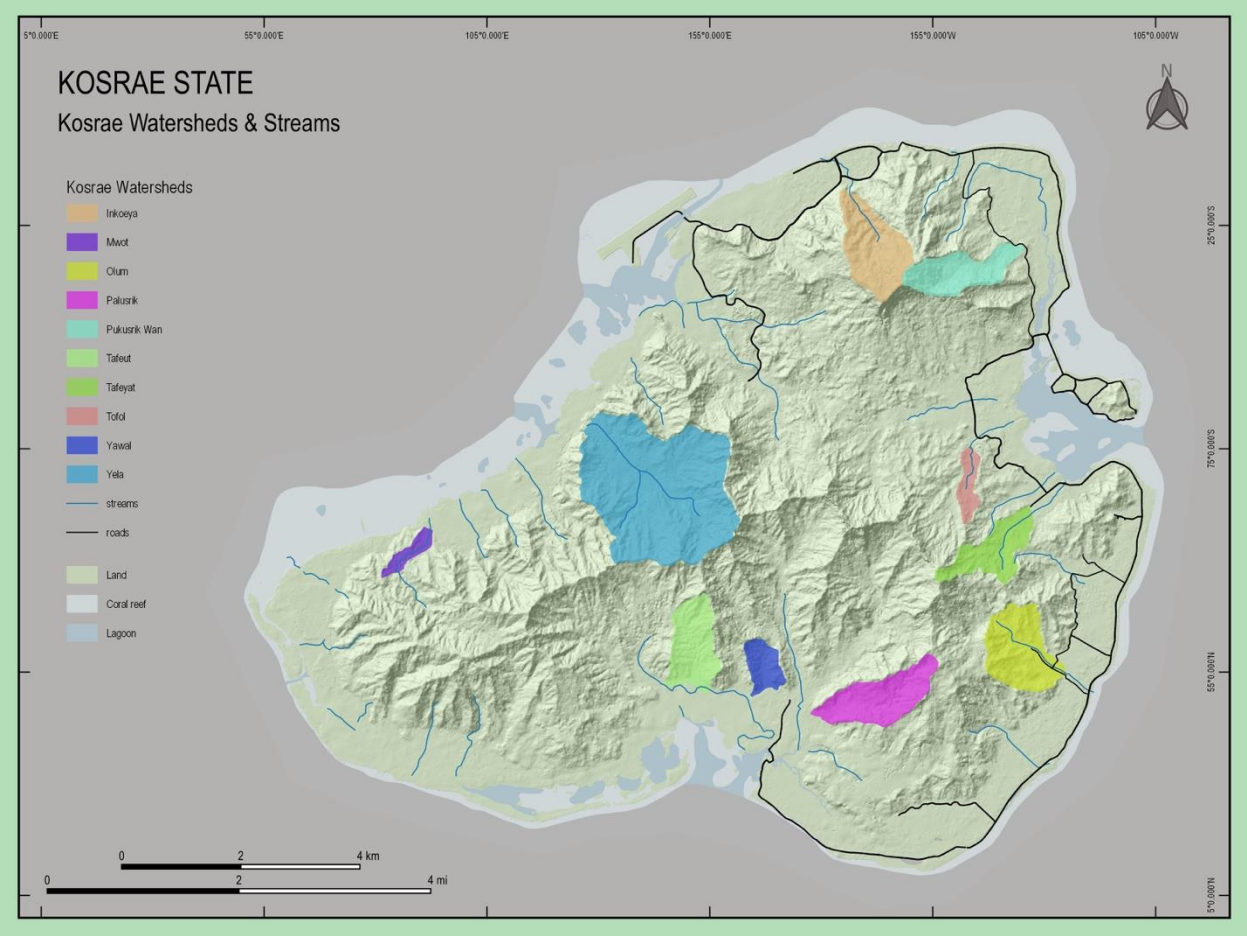
MAP K10 – Kosrae – Conservation & Protected areas map

This map shows the protected areas (PAs) on and around the island of Kosrae. Orange color polygons represent the marine protected areas (MPAs), and green color polygons represents the land protected areas. The sites as identified are community driven with support from many partners and programs and are continually being reviewed. As work continues to officialize the Kosrae State Protected Areas Network (PAN) through the drafting of regulations to accompany the PAN Law and the drafting of the FSM National Operations Manual, among other activities, the sites will be further delineated, and sites will be officially endorsed.



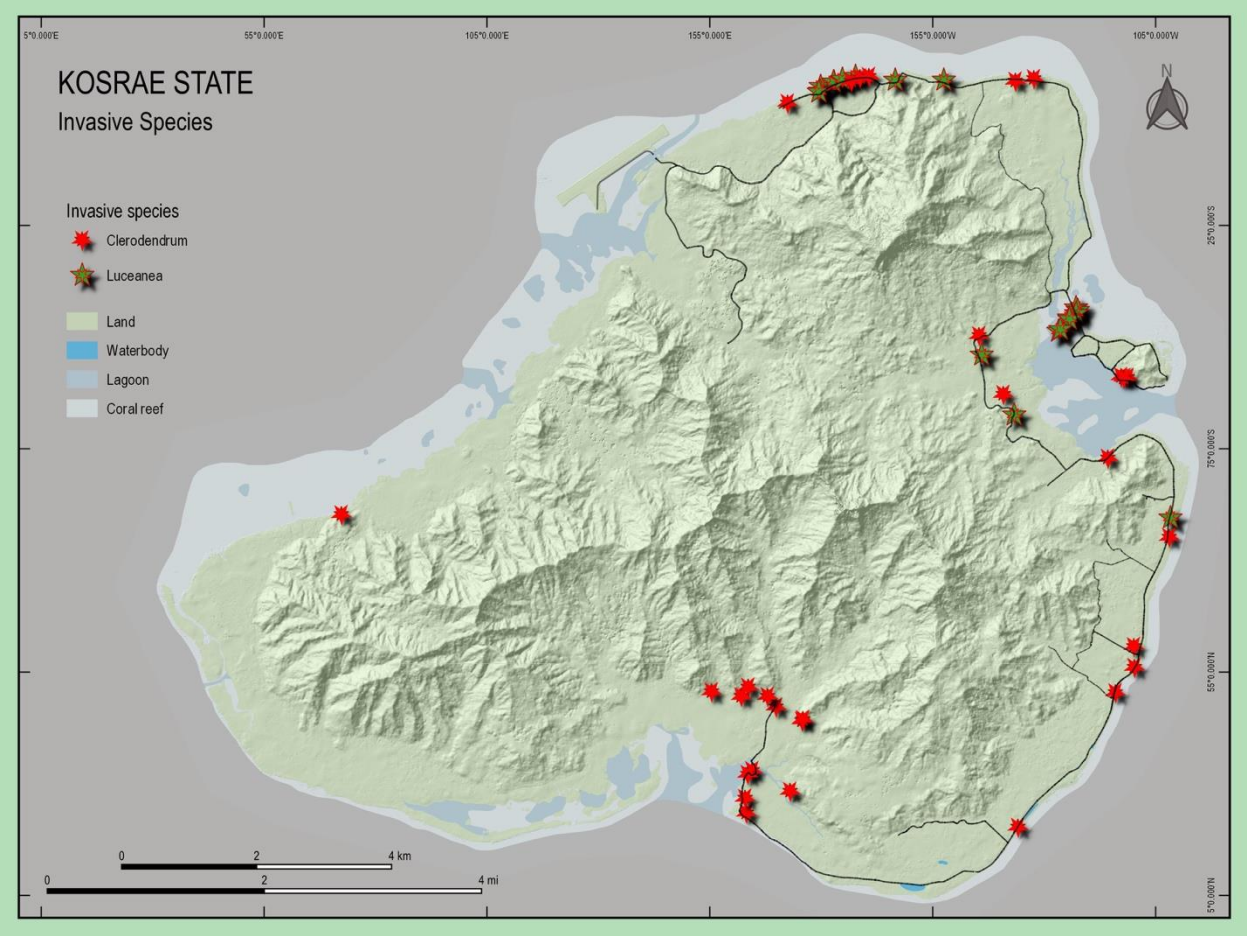
MAP K11 – Kosrae – Important Forest Resource Areas (IFRA) map

The IFRA was updated August 2020 to reflect new program guidance in the "Modernized" Forest Stewardship program and may be updated annually for use with the Stewardship Mapping and Reporting Tool (SMART) for program administration purposes. The new Kosrae IFRA differs significantly from the earlier IFRA, because the new IFRA places a high priority on both private (mostly agroforest) lands and the higher-elevation lands that are eligible for the program whether or not there is private title to the land. Also, the new IFRA shows mangroves as eligible (under Rural Forestry Assistance authorities for state forest lands) but lower priority because their close connection to coastal communities make them suitable for support from the Urban & Community Forestry Program.



MAPK12: Kosrae – Watersheds and Streams map

This map shows the watersheds that feed into drinking water intake points and streams on and around the island of Kosrae.



MAPK13: Kosrae – Invasive species map

This is the invasive species map of Kosrae

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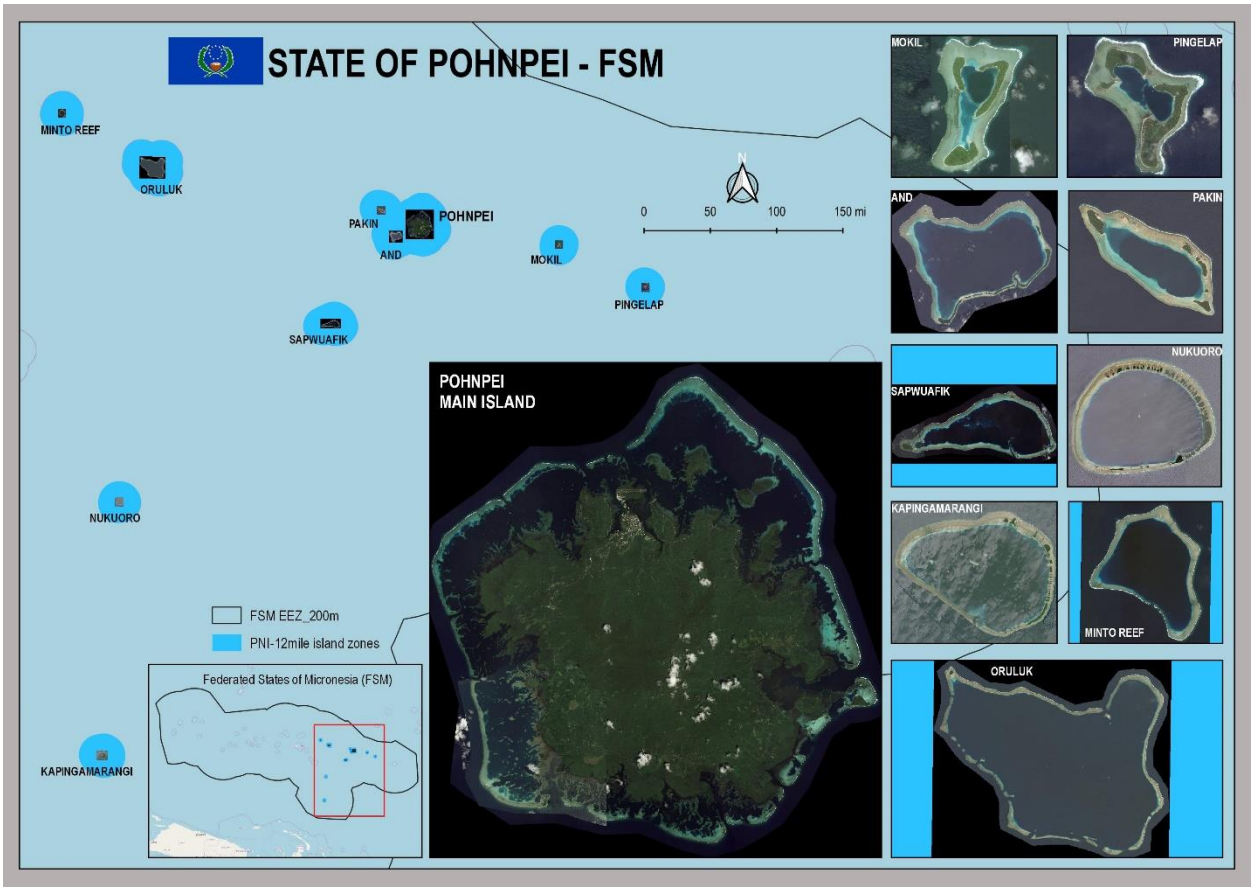
VIEW OF SOKEHS ROCK, POHNPEI STATE. PHOTO CREDIT: CHRIS KNIGHT

IV. POHNPEI STATE



Map P 1 shows the locations of Pohnpei's main island and its neighboring outer islands within the FSM EEZ using the 2016 WorldView-3 satellite imagery as the background for each island.

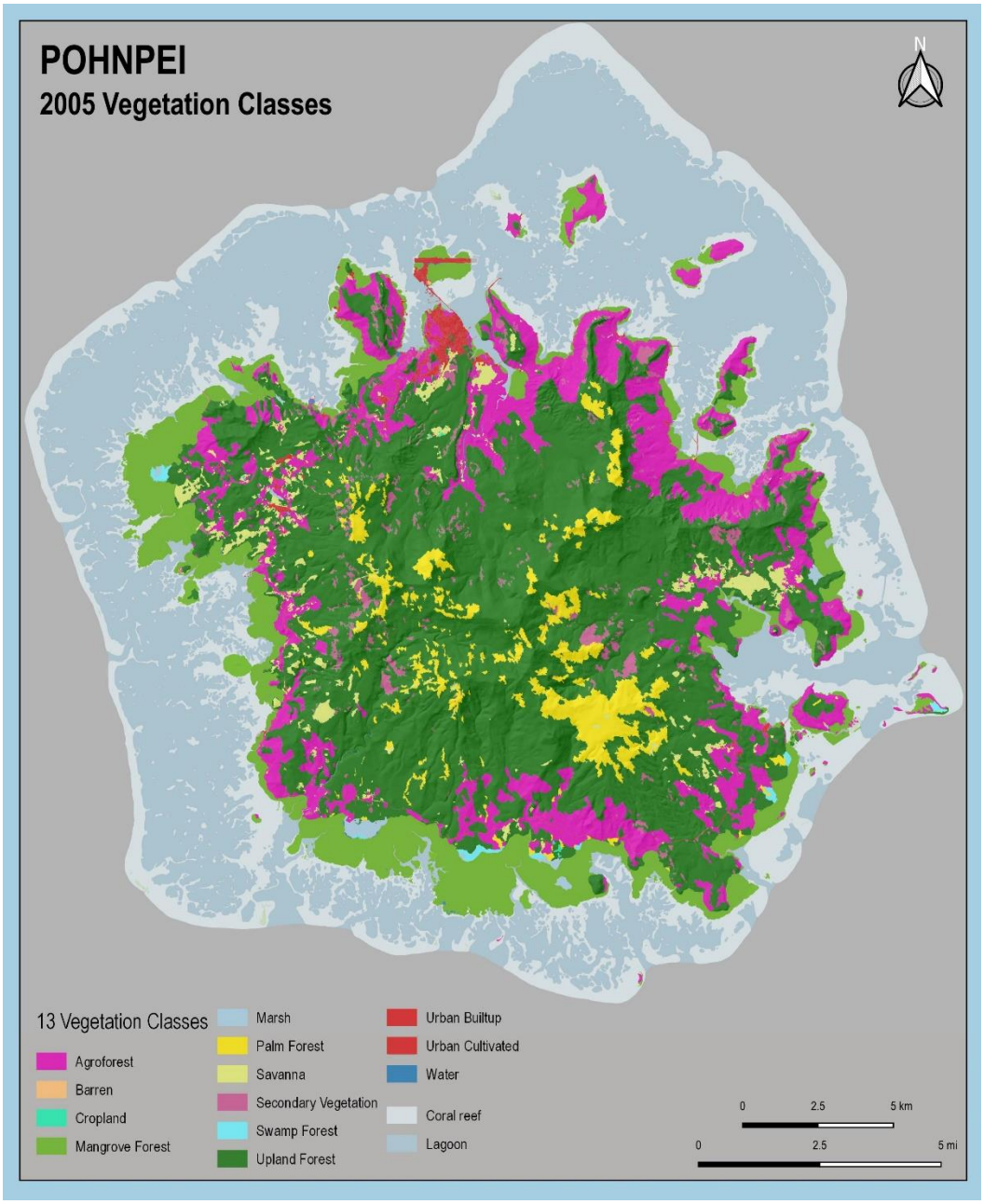
Introduction

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 five 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, while Nukuoro, Kapingamarangi and Mwokil atolls have mayors that are re-elected every four years.

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.

POHNPEI STATE FOREST RESOURCE 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.



P2 – Pohnpei main island – 2005 Vegetation layers map

This map shows the vegetation classes of Pohnpei in 2005. The data set was developed from 2005 QuickBird satellite imagery by Digital Globe through land cover classification carried out by U.S. Forest

Service (2007). The dataset was slightly modified by Island Research & Education Initiative (iREi) (2017) to better match 2016 WorldView-3 satellite imagery.

Conditions and Trends

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. Additional details on topics included in this FAP can be found in these references.

Pohnpei is the only FSM state for which there is data on the status of native forest. (Maps P-20-22: 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. Updated high resolution imagery is needed to determine change from 2002 to present.

A detailed 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. Forest Inventory Analysis (FIA) surveys conducted in 2006 and 2016 provide additional data on the species composition and condition of measured plots (Dendy, 2020). 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.

Upland forests provide habitat for biodiversity including a number of endemic species. They are also an important source of clean water for drinking, agriculture, and several species of native fish and aquatic invertebrates. Mangrove forests have multiple values that include 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. Mangroves can also help maintain the elevation of coastal areas, making them more resilient to sea level rise (Krauss et al. 2010). Studies (Donato et al. 2011) have shown that mangroves sequester large amounts of carbon from the atmosphere that is stored in both tree biomass and in deep mangrove mud. If left undisturbed, mangrove soil carbon can be stored for thousands of years. 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.

There is limited published information regarding forests and resources on Pohnpei's Outer Islands. 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 (within the past 15

years) 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 not previously recorded in an earlier description (Buden 1996).

All native forests of Pohnpei are threatened by many factors (NBSAP/PBSAP 2018), especially land moving operations such as clearing, road building and dredging and deforestation for agricultural use, including *sakau* (*Piper methysticum*), a high value crop that has resulted in the loss of nearly 70% of Pohnpei's native cloud forest.

Table P 1 below summarizes FSM Cross-cutting issues and their Priority Landscapes in relation to USFS Primary National Themes. Maps of primary priority areas are indicated in this table and inserted with their respective issues. Additional priority and informative maps can be found at the end of this chapter.

TABLE P 1 POHNPEI ISSUES, PRIORITY AREAS, NATIONAL THEMES

Issue	Priority areas	Primary National Themes
Cross-cutting Threats	Areas with targeted invasive species (Map P15) Areas most vulnerable to wildfires, especially those adjacent to forests of high natural integrity and areas being restored (Map P14)	1 Conserve, 2 Protect, 3 Enhance
A. Food Security (agroforests)	Strong emphasis on atolls. For Pohnpei's main island, priority landscape areas are agroforests (Map P3)	3 Enhance, 2 Protect
B. Biodiversity	Native forest, protected areas, Areas of Biological Significance (ABS) (Map P4, P12a-c, Map 13a-b)	1 Conserve, 2 Protect
C. Coastal Stabilization	Eroding shorelines and mangroves, with priority placed on those areas overlap with Areas of Biological Significance. All areas of Pohnpei Outer Islands are highest priority. (Map P5)	1 Conserve, 3 Enhance
E. Watershed	Pohnpei Watershed Reserve (Map P6)	3 Enhance, 1 Conserve, 2 Protect
F. Production & sustainable harvesting	Mangrove forests (Map P7)	3 Enhance, 1 Conserve
G. Capacity-building	(non-spatial)	3 Enhance

Cross-cutting threats

The identified cross-cutting threats for Pohnpei are invasive alien species, climate change and to a lesser extent, wildfires. These threats have been identified as cross-cutting due to their overwhelming effects on terrestrial resources and must be addressed in the context of all of the FSM National Issues. All three threats have the potential to destroy endemic biodiversity, overtake land for food production and cause significant devastation.

Invasive species

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 limited capacity to detect, monitor and control invasive plants and animals and pests early on, and need capacity building in this area. They work closely with the Consevation Society of Pohnpei (CSP) and the Invasive Species Taskforce of Pohnpei (iSTOP), which as identified 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 also considered. The coconut rhinoceros beetle (CRB) has the potential to wreak havoc on coconut trees, which Pohnpeians depend on for food and products such as coconut oil: Pohnpei has an emergency response plan for CRB in place.

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 iSTOP Strategic Action Plan (SAP) establishes goals, objectives, activities, collaborators, timeframe, funding sources and estimated costs for control of specific species. FSM wide, there is the National Invasive Species Strategy and Action Plan 2016-2021 (NISSAP, 2015). Representatives from Pohnpei are also involved in the Regional Invasive Species Council (RISC).

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. The Department of Public Safety has a wildfire plan, but there are currently non at the community level.

Climate Change

Direct impacts from climate change on terrestrial resources include threats to traditional agroforestry systems through saltwater intrusion, droughts and typhoons (SOE, 2018). Climate change is identified as a major threat to all FSM National Issues and is exasperating the negative impacts of numerous other issues such as loss of land for agroforestry, decrease in coastal stabilization, increase in invasive alien species, fragility of biodiversity and ecosystem health, and human impacts such overharvesting of terrestrial resources and development projects. The Pohnpei Joint State Action Plan (JSAP) for Disaster Risk Management and Climate Change provides additional details regarding climate change projections for Pohnpei, and approaches to risk reduction.

A. Food Security

Conditions and Trends

Traditional Pohnpeian 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).

Actual data on trends of agroforests in mainland Pohnpei is limited. Though traditional crops remain important, especially for cultural events, 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.

Diseases and pests can impact local food crops: fruit fly (breadfruit), papaya mealybug (papaya), whitefly (pepper, sakau, lime, soursop), and coconut scale (coconut scale). One of the main crops important for consumption and cultural events, *Dioscorea* yams, has been heavily impacted by yam rust disease in recent decades.

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, and pests. 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.

Strengths:

Traditional agroforestry is immensely important to Pohnpeian culture and livelihoods, and still being practiced, along with traditional preservation methods. The landscape of the high island is considered ideal, with fertile soil and abundant year-round rainfall, and crop biodiversity is high.

Of FSM's FAP themes, food security was held as the highest priority during stakeholder consultations in January 2020. This is supported by progress made and current trends. The FSM National government undertook an agriculture census in 2018 that provides a detailed baseline, with results released in June 2020. Agriculture policies, new staff, agriculture fairs and awareness campaigns in the government have contributed to local food being more readily available in the markets. The Urban and Community Forestry program in Pohnpei has recently supported 6 communities, including coconut rehabilitation on Pingelap and Pakin, and food security projects in Sapwaufik.

Agroforestry has additional support from non-government entities, such as local NGOs, farmers' associations, and the Island Food Community of Pohnpei. There's been a demand for new technology, with COM-CRE researching crop production, and a request to expand nurseries.

Weaknesses

Many of the current weaknesses identified relate to shifting attitudes and practices, with a general loss of knowledge of traditional agroforestry techniques and preservation methods. Outmigration for better opportunities among youth is an issue, and the remaining younger generation isn't as interested in farming. There's less prestige in it compared to other vocations, and a preference for imported food such as rice due to change in taste and convenience. Sakau is increasingly grown for market rather than ceremonial use, and the high demand has locals turning to destructive mono cropping methods compared to traditional planting. The outer islands have additional challenges: limited fresh water (both in quantity

and quality) and poor soil limit the types of crops that can be grown, and residents have fewer access to training and capacity building opportunities.

Opportunities

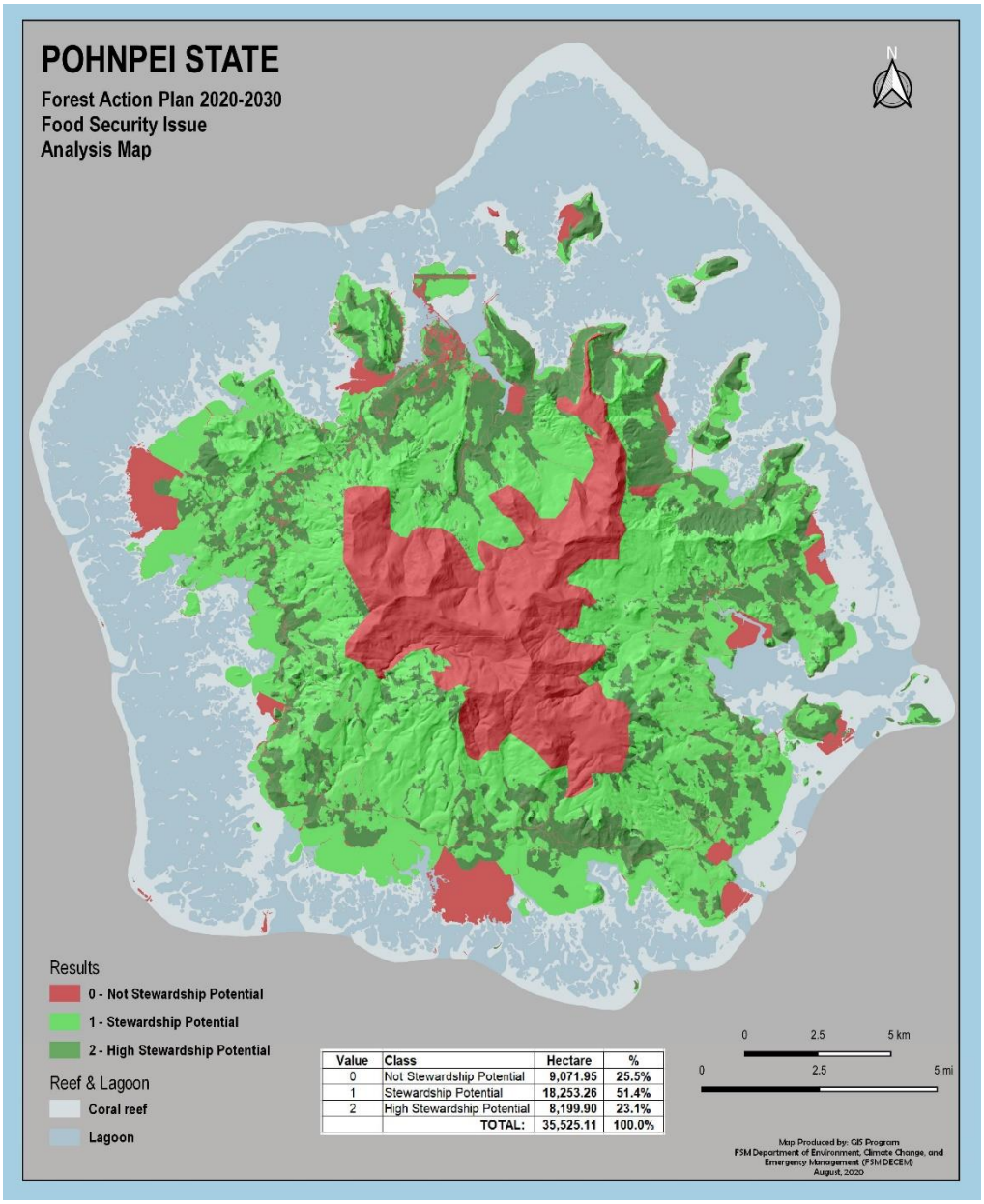
Adaptation strategies to mitigate the impact of climate change are increasing in Pohnpei and the FSM. There's a new emphasis on promoting traditional agroforestry practices. New technology can be expanded to increase food production and improve methods to preserve crops such as breadfruit and coconuts. The College of Micronesia could recruit more agriculture students and keep them in Pohnpei. Outside donors are becoming more interested in supporting food security and livelihood initiatives, and both government agencies and NGOs are engaging with funding and technical partners to attract support. USFS and University of Guam have provided in person and virtual training opportunities.

Threats

Climate change is seen as the greatest threat to food security, with drought, sea level rise, floods and landslides having the potential to cause severe impacts on agroforestry. If youth are not interested in agriculture, and recruitment opportunities to the sector aren't created, traditional knowledge could be lost. New invasive species, such as the coconut rhinoceros beetle and little fire ant, could destroy important trees and crops, or prevent the harvesting of crops, if they reach the island. While food security is a current target of the government, change in political will could cause a shift in priorities.

Priority Areas

Agroforest vegetation on the high island and atolls is first priority. 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.



P3 – Pohnpei main island – Food Security analysis map

This map shows the result of the reclassification and overlay analysis of Pohnpei's spatial layers including vegetation, protected areas, ABS, developed areas, and hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the food security issue of Pohnpei main island. The analysis was done only for the main island because there is no available spatial data and layer for the outer islands. The High Potential areas in dark green (23.1%) include agroforest, secondary vegetation, cropland, cultivated areas and savanna; the Potential areas in light green (51.4%) include upland and mangrove forests; and the Not Potential areas in red (25.5%) include the developed areas, PAs and conservation areas in Pohnpei.

B. Biodiversity Conservation

Conditions and Trends

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. Much of this change is attributed to forest clearing for growing *sakau*, *Piper methysticum,* 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. The serious decline in intact native forest 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 Micronesia Challenge calls for the effective conservation of 20% of terrestrial resources by 2020, and 30% by 2030. The Blueprint for Conservation in Micronesia (TNC 2003) indicates a number of "areas of biodiversity significance" (ABS). The Nature Conservancy conducted an analysis to identify conservation gaps and recommend priority sites and targets (TNC 2015).

Pohnpei is in the process of building its Protected Area Network (PAN) with a state PAN coordinator and updating its legislation. The FSM PAN Framework lays out requirements for protected areas to be included in the National PAN. Several programs support PA development (i.e. FSM R2R), and tools have been created to guide communities (LEAP) and measure management effectiveness (MPAME, METT).

Pohnpei State Forestry is committed to working with partners and stakeholders to develop terrestrial Forest Stewardship plans, Protect Area management plans, and Conservation Action Plans. Pohnpei has

several plans at varying stages of management, including Kitti, Madolenihmw, Nanwelin Rohi, Peide mangrove plan, and others.

Ant Atoll is an established Biosphere Reserve (FSM PR 031110). 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 forest-dependent wildlife such as the protection of the rare Pohnpei owl, fruit bats (by virtue of International and U.S. Endangered species laws), and the protection of mangrove crabs in mangrove forest sanctuaries. Mangroves also provide critical habitat for juvenile marine species.

Strengths

Stakeholders recognized that building and strengthening the Protected Area Network (PAN) has been the strongest approach toward conserving terrestrial biodiversity. There are more protected areas in place, with improved management, local early action, and forest stewardship plans. A PAN Framework is in place for all of FSM, Pohnpei has a dedicated PAN office and coordinator at the state government. Awareness programs are increasing, and residents are able to see results first hand. Community capacity is building, and efforts are bottom up instead of top down. More people are working in conservation, and there is a new focus on terrestrial resources. The Micronesia Challenge helped to develop standardized monitoring, attract donors and technical support, and inspire others. Collaboration between NGOs, government, and communities has improved. Data collection is increasing, and the results more accessible. Socioeconomic monitoring has allowed tracking of how efforts impact communities. Government and traditional leadership have supported efforts, and new policies and laws are in place including development permitting.

The invasive species program scaled up its efforts through iSTOP, in expansion of awareness and currently increasing community involvement in the awareness, management and eradication of invasive species. Pohnpei is represented in the Regional Invasive Species Council (RISC), which allows for collaboration between islands

Weaknesses

Lack of enforcement of existing policies and regulations was a considerable weakness. Only the Fish and Wildlife office is able to carry out enforcement, and doesn't have enough staff to dedicate. The process is unclear and time consuming to get through, and fines and penalties are not usually enacted. The development permitting process is also insufficient. Small projects don't require an EIA, and larger ones don't have follow up after. Awareness programs of the importance of biodiversity are increasing but not enough. Educated individuals can still sometimes disregard rules due to a lack of alternative livelihoods. Local government funding is limited, and acquisition of compact environment sector funds has decreased. Overall, there are not enough resources and manpower. Additional data is needed, especially in the outer islands and regarding invasive species. Technical and funding assistance is sought as part of the strategies for this FAP. With loss of biodiversity comes loss of trees and plants that important for traditional and medicinal use, and there is little data to track. Traditional knowledge is also being lost with outmigration.

Opportunities

Enhancing nursery resources was a key selected opportunity to combat loss of biodiversity. Growing and distributing more native plants through central and community-based nurseries is a targeted strategy. Planting local food and medicinal crops contributes to food security and traditional knowledge. Creating

alternative livelihoods and income generating activities alleviates the need to harvest or clear unsustainably. There is minimal ecotourism on Pohnpei that generates income, but room to greatly increase. Continuing expansion and effective management of protected areas is crucial, and there are opportunities to integrate with historical and culturally significant sites that have biodiversity. Revising the earth moving permitting process and EIA could lend toward more sustainable development, something reiterated by a Strategic Environment Assessment (SEA) conducted for Pohnpei state with the support of the FSM Ridge to Reef program to develop an Integrated Environmental Management Plan (IEMP). The SEA report and IEMP drafts were still being reviewed at the end of 2021. Additional biological and socioeconomic data is needed to help inform decisions and adaptive management.

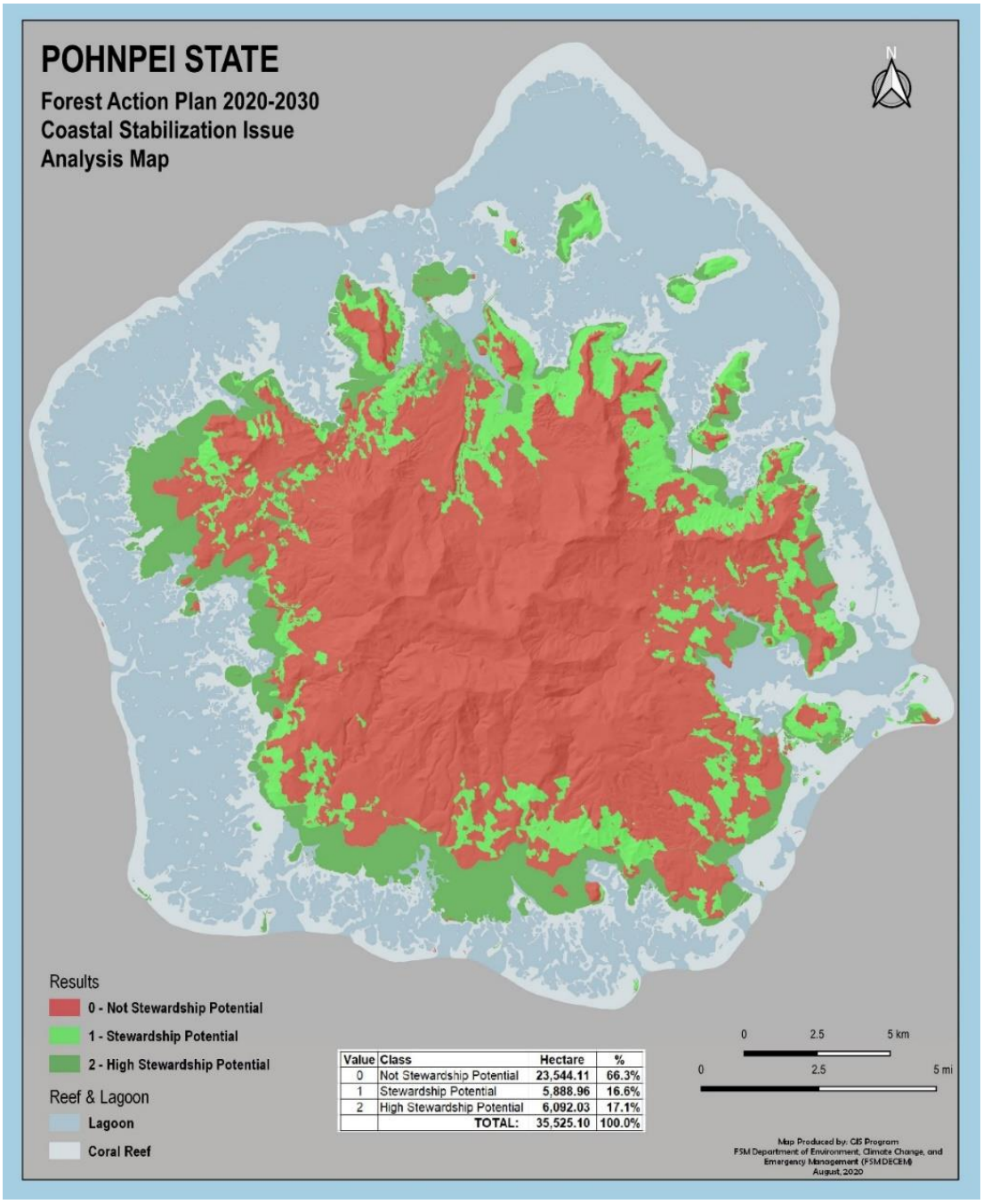
The Forest Legacy Program is another opportunity that will be elaborated upon in a later Assessment of Need, and the Forest Health program could be further utilized for IAS, agroforestry pests and early detection.

Threats

Political will and changing administrations could shift priorities away from conserving biodiversity. Migration and mobility are increasing, opening up the potential for new invasive species to come in. Traditional consumption of sakau has long been part of Pohnpei's culture, but commercial sale has resulted in unprecedented clearing and deforestation. This leads to further loss of biodiversity through vulnerability to climate change and invasive species. Climate change could heighten the effects of seasonal ENSO, resulting in drought and subsequent wildfires.

Priority areas

All areas within any of the following categories, with higher priority for lands where more categories overlap: native forest (mangrove forest, upland forest, and palm forest), protected areas (PAs), and Terrestrial Areas of Biodiversity Significance (Pohnpei main island or atolls)



P4 – Pohnpei main island – Biodiversity Conservation analysis map

This map shows the result of the reclassification and overlay analysis of Pohnpei's spatial layers including vegetation, protected areas, ABS, developed areas, invasive species, and hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the issue of biodiversity conservation of Pohnpei main island. The reclassification analysis was only done for the main island. Dark green areas (79.3%) are the high potential areas (native forests-upland, wetlands, palm, ABS and PAs), light green areas (16.3%) are the potential areas (agroforest and secondary veg), and the red areas (4.5%) are the not potential areas (developed areas) for the biodiversity conservation issue in Pohnpei.

C. Coastal Stabilization

Conditions and Trends

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.

Strengths

Establishing mangrove protected areas was acknowledged as a strength for Pohnpei. Multiple stakeholders and agencies support effective management of mangrove areas through development of management plans and policies. Pohnpei State's Urban & Community Forestry program, the FSM Ridge to Reef Program, and NGO partners all have coastal rehabilitation activities. Data collection is improving, with Japan exploring below ground carbon storage, USFS/USGS collaboration that has been monitoring long term mangrove plots response to sea level rise since the 1990s, and a more recent USFWS/USFS/USGS/MCT collaboration modelling the resilience of mangroves to sea level rise over the next 100 years.

Weaknesses

Increased development has resulted in a number of weaknesses. Lack of clear and dredging regulations and insufficient enforcement was an issue consistently identified, leading to unsustainable dredging impacting Pohnpei's coastal resources. This is tied to political will, as there is inconsistence among government agencies in addressing the matter. While Pohnpei has a mangrove harvesting permit, it's poorly enforced. There are gaps in planning and development, with coastal projects not requiring climate proofing, and a lack of a state-wide coastal management plan. Dependence on foreign aid can limit addressing problems as thoroughly or as timely as needed. There's an additional break down of knowledge of traditional waterway and coastal management. The outer islands have the most vulnerable coastal resources and experience the greatest threats to coastal stabilization, and but have the least amount of available data and support.

Opportunities

Mangrove rehabilitation through planting and restoration of dredging sites was key for stakeholders, and opportunities through Pohnpei's Urban & Community Forestry program, FSM Ridge to Reef, and other projects should continue. There's the potential for new data to inform adaptive management, and technology such as LIDAR could greatly complete the picture. Creating a state-wide coastal management

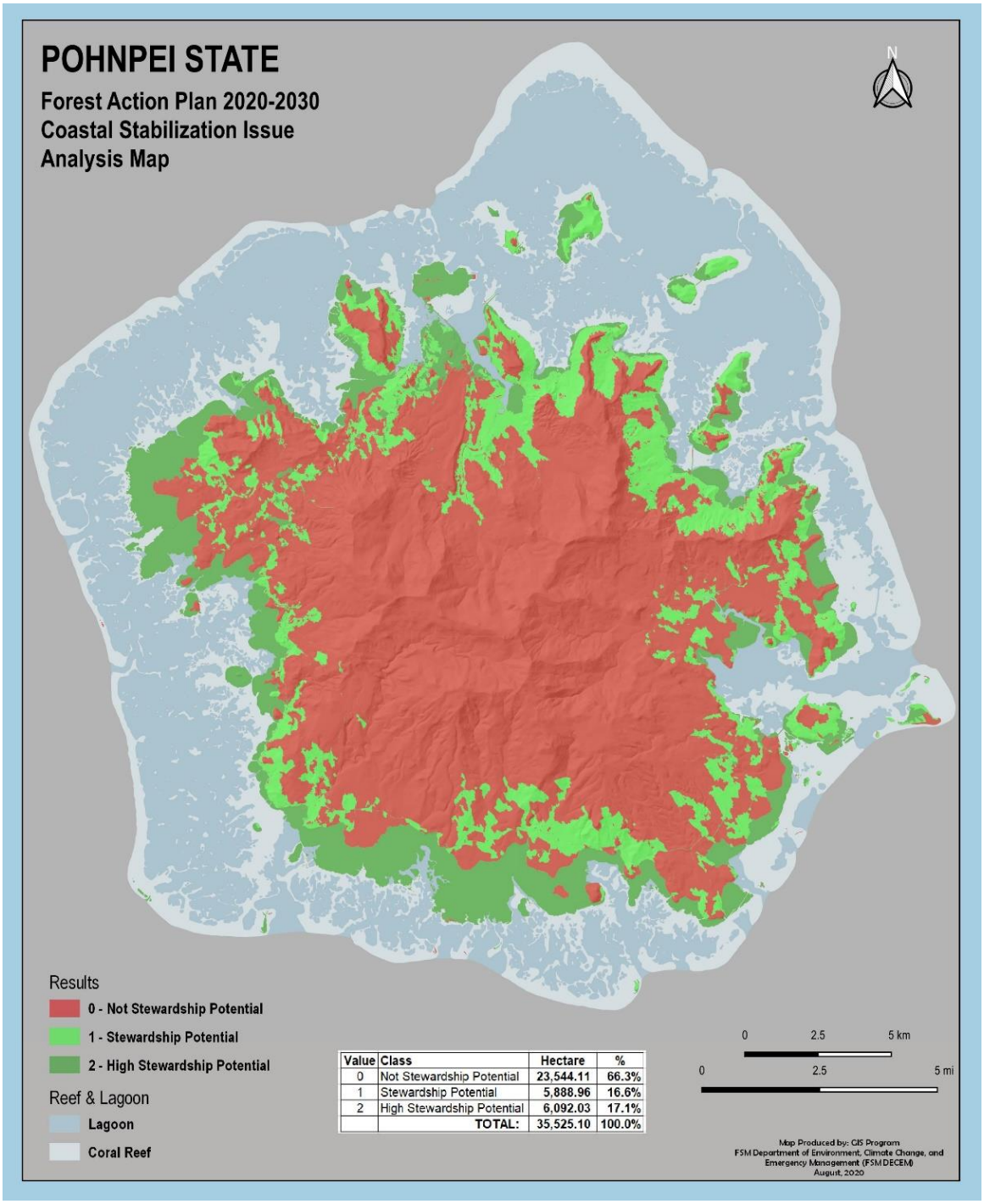
plan that includes the outer islands would improve development and give direction to requests for foreign aid. Reviving traditional management practices would give communities immediate tools for resiliency.

Threats

Political will and changing administrations were the greatest threats noted by stakeholders, as coastal stabilization is greatly impacted by government priorities and policies. Dredging, illegal landfills, and piggeries degrade coastal resources. These practices make resources even more vulnerable to sea level rise and salt water inundation. Loss of traditional knowledge and management will continue unless addressed.

Priority areas

The highest priority are coastal areas of the high islands and all Outer Islands of Pohnpei. 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. Pohnpei also has a unique low lying a unique archaeological site, Nan Madol, along the coast, with site conservation efforts having some overlap with other terrestrial measures.



P5 – Pohnpei main island – Coastal Stabilization analysis map

This map shows the result of the reclassification and overlay analysis of Pohnpei's spatial layers including vegetation, protected areas, ABS, developed areas, and hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the issue of coastal stabilization of Pohnpei main island. The High Potential areas in dark green (17.1%) include primarily mangrove and developed areas along the shoreline; the Potential areas in light green (16.6%) include agroforest; and the Not Potential areas in red (66.3%) include all in higher elevations for the coastal stabilization issue in Pohnpei.

D. Watersheds

The word "Watershed" in Pohnpei locally 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. The complete "watershed" which drains into streams, onto reefs and into the lagoon includes all areas below the reserve. *Sakau* farming, road construction, squatting, wastes from small homestead piggeries, invasive species, and landslides impact this larger watershed and even the Reserve.

Conditions and trends

Pohnpei has a watershed and mangrove protection act of 1987 that proposed a Pohnpei Watershed Reserve. Efforts to establish the reserve began in late 1989 & early 1990, but there was resistance to the initial surveys among the communities, especially in Nett Municipality, which has the largest watershed, due to misunderstanding. Pohnpei forestry launched a robust public awareness campaign to address this, and in 1991, the Pohnpei Watershed Steering Committee was created to help implement it and advise efforts. The committee has continued, and follows an action plan recently updated and housed by the Conservation Society of Pohnpei.

Madolenihm, U, Sokehs and Kitti municipalities have now completed demarcation of their respective watershed boundaries, with efforts spanning several decades to present (2020) through the support of the Municipal governments, traditional leaders, and many partners.

Strengths

Management of the Watershed Reserve has improved over the past decade, with increased delineation and plans to further demarcate Pohnpei. Leadership has been supportive, with watershed summits, a law in place that coordinates watershed activities, and an active watershed steering committee and watershed basin committee. Monitoring of the watershed has increased from both Pohnpei forestry and NGOs, and additional data from the Forest Inventory Analysis. Forest regenerates quickly in Pohnpei, and planting activities have been successful in U, with additional restoration and rehabilitation work upcoming through the FSM R2R program. Conversion to dry litter piggeries in Awak has been successful and improves water quality, as it reduces runoff of pig waste into streams.

Weaknesses

The law is in place, but a management plan is still needed along with a process for law enforcement. Lack of enforcement was identified as major weakness. Pohnpei Forestry and Conservation Society of Pohnpei monitor the area and record any issues, but there is no system in place for reporting violations such as illegal sakau clearings, and insufficient funds. Zoning laws were started but never completed for Pohnpei state. The vegetation map is outdated and the full impact of clearings in the area is unknown. Behavior is changing with residents desiring to move into the watershed. There is good water quality and quantity in the upper watershed, but it gets degraded when it reaches downstream piggeries.

Opportunities

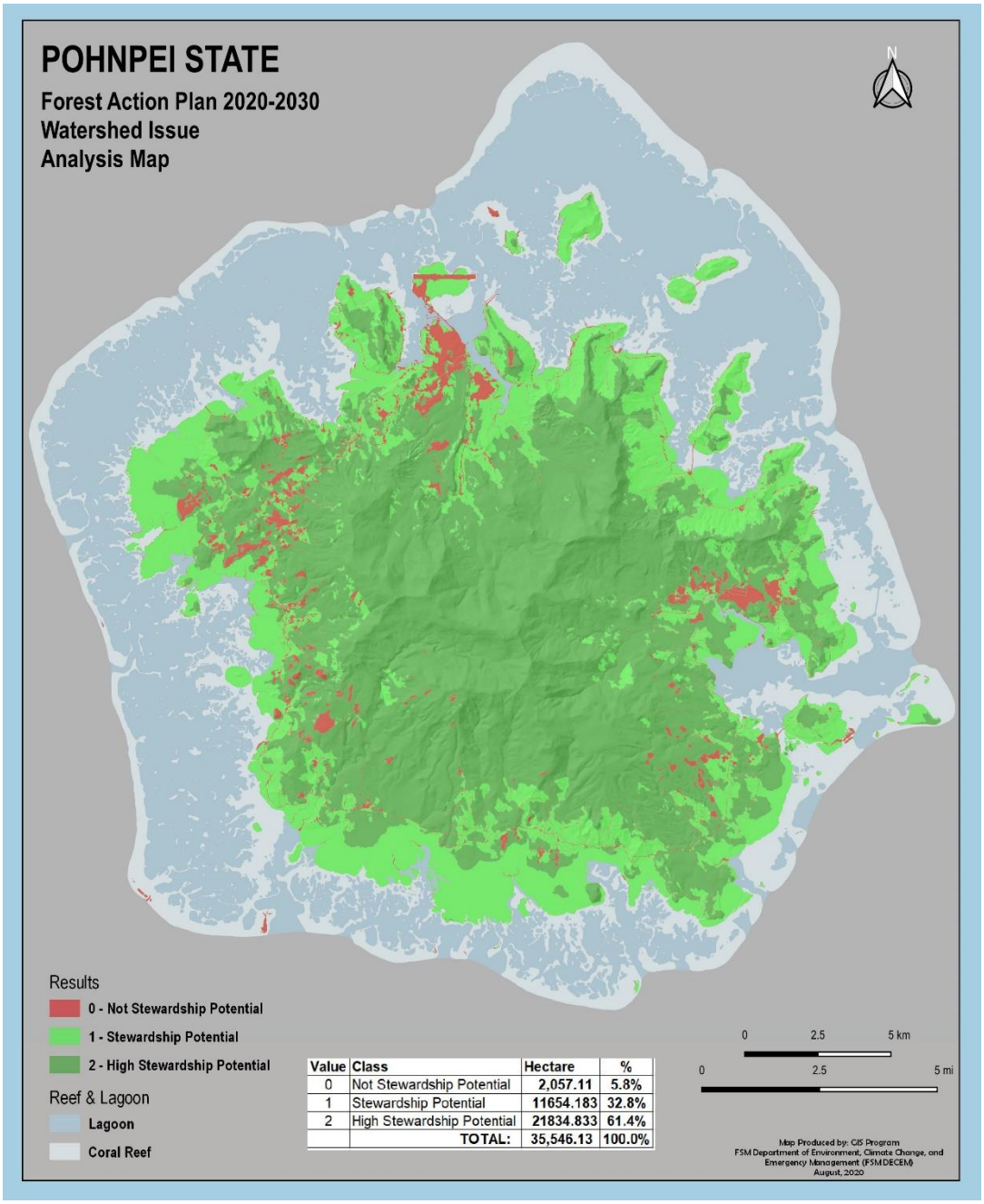
Additional data collection is needed to help inform decision making. Updating the vegetation map with support from S&PF would provide insight into the current status of watershed resources. Completing delineation and developing a management plan and zoning laws would help provide grounds for enforcement. Leadership meetings are an opportunity to provide awareness. The leaders might also benefit from a more hands-on learning exchange to see the destruction resulting from clearing. Creating jobs to manage the watershed, alternative livelihoods and incentives are other approaches. Awareness programs for youth can be increased, and promoting the 'Grow Low' campaign continued. There are additional partnerships that can be created and grants available. Restoration efforts have been successful, with more in the pipeline.

Threats

Sakau is an integral part of Pohnpeian culture, and planting for traditional use within a mixed-cropping agroforest has long been part of agroforestry practices on island. Unfortunately, planting massive amounts for commercial sale has led to the greatest threat to the watershed reserve. This destructive clearing causes deforestation, and makes the area vulnerable to invasive species moving in. Having intact forests also increases resiliency to the impacts of climate change, such as drought, erosion and landslides. Whatever happens in the watershed effects the island from ridge to reef. Controversy over laws and between land owners is increasing, and without clear delineation, many residents are moving up. Traditional use and government will set the direction for the watershed.

Priority area

The Pohnpei Watershed Reserve and other watershed areas are priority landscapes.



P6 – Pohnpei main island – Watershed analysis map

This map shows the result of the reclassification and overlay analysis of Pohnpei's spatial layers including vegetation, protected areas, ABS, developed areas, invasive species, and hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the issue of watershed of Pohnpei main island. Dark green areas (61.4%) are the high potential areas, light green areas (32.8%) are the potential areas, and the red areas (5.8%) are the not potential areas for the watershed stewardship in Pohnpei.

E. Production & sustainable harvesting

Conditions and Trends

Current information on the conditions related to production and sustainable harvest is limited. A timber survey was conducted (MacLean et al 1988) in the past, but is now outdated, and none has taken place in recent years. Commercial timber harvest is considered unsustainable, though future studies confirming that may be useful. Devoe classified areas of mangroves on the basis of their conservation and productivity values and Metz (1996) followed up with a proposed Mangrove Management Plan for government harvest permit systems. There is a harvest permit requirement in place, but the system needs to be revisited and improved. The current system lacks monitoring of harvested mangrove. Current mangrove studies suggest that there is no such thing as sustainable harvesting of mangrove trees for Pohnpei. Pohnpei recently held a Mangrove Conference in November 2020, and established a Mangrove Working Group. This group is tasked to improve/enhance the mangrove permitting system as well as mangrove dredging.

Strengths

Strategies are already in place to both protect resources and enhance production. Terrestrial and mangrove protected areas are increasing and improving in effective management. Nurseries are active and providing seedlings, and there are plans for expansion. Sustainable livelihood programs are in place, such as the Coconuts for Life project, handicrafts in Kapingamari, and utilizing senile coconut trees on Pingelap. Replanting projects are supported by multiple agencies. Lumber harvest is controlled through municipal permitting systems, and isn't commercialized for export. There are some sawmills, but mostly contained on private land.

Weaknesses

Enforcement of existing protections is an issue, and lack of funding contributes to that. More awareness is needed regarding ecosystem services so that residents don't harvest important rare and native species.

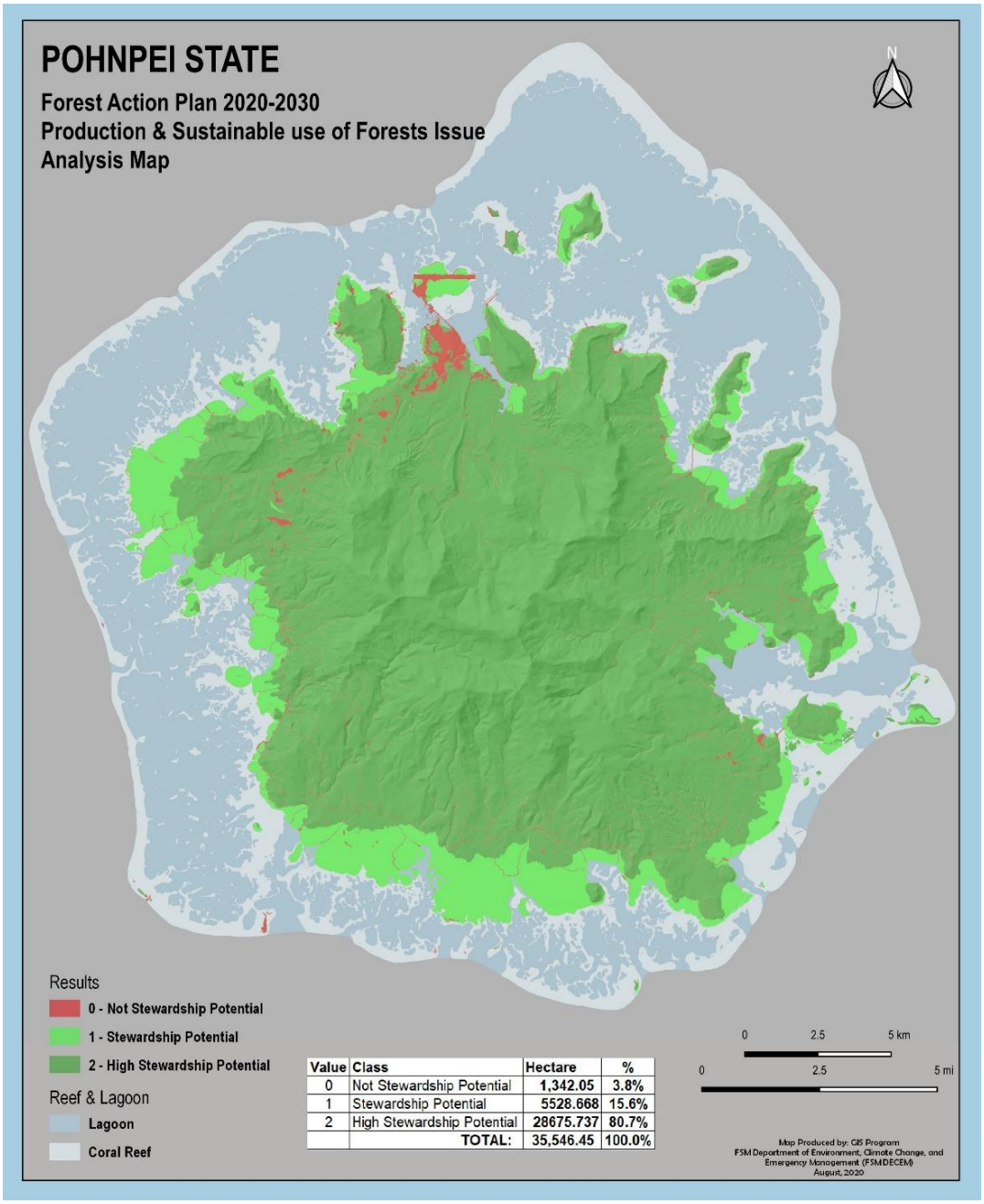
Opportunities

Creating alternative sources of income was seen as the most promising opportunity. These could include expanding on existing projects shown to be successful, such as the Pingelap lumber project, or investing in new ideas. Coconut oil is in high demand. There a potential to plant trees for future harvest, and mahogany planted in the past could soon be ready. Awareness programs could teach which trees are important to the ecosystem, and which invasive species to harvest and use instead, information which could be put together with assistance from the Forest Health Program.

Threats

Deforestation was confirmed to be the greatest threat to harvest and production. It also makes resources more vulnerable to the added threats of invasive species and climate change. Political will could change conditions: if a bill passes that allows foreign investment including lumber harvest, it could threaten limited tree resources. Sawmills weren't seen as a current threat, but were noted to be a potential threat through both increased cutting and reduced cost of labor lowering the overall value of the product. While dredging isn't directly related to harvest, it greatly threatens mangroves, and decreases their availability to be used sustainably.

Priority Areas



P7 – Pohnpei main island – Production & Sustainable Use of Forest analysis map

This map shows the result of the reclassification and overlay analysis of Pohnpei's spatial layers and data including vegetation, protected areas, ABS, developed areas, and invasive and hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the issue of production and sustainable use of forest of Pohnpei main island. The analysis was done only for the main island. Dark green areas (80.7%) are the high potential areas (upland, agroforest, secondary veg, savanna, and palm), light green areas (15.6%) are the potential areas (mangrove), and the red areas (3.8%) are the not potential areas (developed areas) for the production and sustainable use of forests issue in Pohnpei.

F. Capacity-building

Conditions and Trends

Pohnpei benefits from 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 shown in the Strategy tables.

Strengths

Pohnpei has a wealth of local expertise and institutional knowledge, through state government agencies, local NGOs, COM-CRE, and US and foreign agencies on island. Additional support and training opportunities are available through networks such as the Pacific Island Managed and Protected Areas Community (PIMPAC). Efforts are being made to recruit more agriculture students, and the Urban & Community forestry program has supported interns. Internet access and technology continues to improve and provide access to information. The Micronesia Challenge has an ongoing internship program for undergrads, and the MC Bill Raynor scholarship program, which is for graduate students focused on conservation in the region. FSM DECEM has created a new data portal to compile reports and publications from across the FSM for easy utilization, and the Micronesia Challenge terrestrial web-viewer showcases results from the Forest Inventory Analysis.

Weaknesses

More high-level support from government and traditional leaders is needed. Outside expertise is often still preferred for many initiatives, and there can be a disconnect between researchers and foreign experts and local managers. There have been a few attempts to inventory available local expertise and capacity building needs, but usually for individual groups or projects. Communication is insufficient, and coordination between agencies is lacking. While there are many training opportunities, the target audience is limited. Often, they are provided to the same government and NGO staff, who are already spread too thin. Capacity building within communities isn't as prevalent, nor is hands on activities that are more effective at that level. The outer islands are difficult to reach and often left out.

Opportunities

Revitalizing the Pohnpei Resource Management Committee (PRMC), a group made up of key environmental organization representatives and cross-sector ones, recognized as the most efficient way to address many needs. This would greatly improve communication and coordination between agencies, and provide a centralized group for outside researchers and donors to go to, as well as share back products and publications.

The FSM DECEM data portal is expanding and should continue to be an accessible source of information. A terrestrial resource managers groups was formed and continues to meet.

Individuals can take advantage of the previously mentioned internships and scholarships, along with others including the GI Bill. Micronesia Conservation Trust is reestablishing its capacity building program and co-leads PIMPAC. MCT is also developing an Island Ecology Course with University of Guam and support from the USFS. Virtual trainings can allow access to numerous topics. The USFS offers the online i-Tree Academy, which was utilized in 2020 in Pohnpei, and iSTOP members attended virtual training supported by the University of Guam and the USFS on IAS, including LFAs and CRBs.

For communities, there are a number of tools that have been developed to help improve management of natural resources, such as the Local Early Action Planning (LEAP) toolkit, and Managed and Protected Area Management Effectiveness (MPAME) tool. For organizations, there are additional support groups and a standard capacity assessment tool.

Threats

Though there are many capacity building and scholarship opportunities, there are still a limited number of youths obtaining higher education and remaining on island. There's a lack of initial access, and then follow through at the university level. Outmigration of students is high, and there aren't enough skilled and educated individuals remaining. Many opportunities for Pohnpeians exist due to the Compact of Free Association, and it's uncertain what that agreement will look like come 2023.

POHNPEI STATE FOREST RESOURCE STRATEGY

Table P-2 below shows current and potential sources (funding, technical assistance, and capacity building) of the resources required to carry out Pohnpei's Forest Action Plan strategies. The list is neither all-inclusive or limited to these entities and programs, but it shows the most frequent supporters.

Table P-3 summarizes strategies for addressing the Cross-cutting Threats and each of the FSM Issues. The table also includes the primary USFS and other programs that contribute resources and technical support and the main cooperators for each strategy. Resources and capacity are limited in the FSM, and successful implementation of these strategies will require technical and funding support from multiple partners and donors. While key existing and potential partners are listed within the table, it is anticipated that there will be additional opportunities..

TABLE P 3: RESOURCES REQUIRED FOR POHNPEI STATE STRATEGIES

Resources Required: USFS, Other Partners, Funding Sources and Cooperators for Pohnpei State			
USFS/US	**International & Regional**	**National**	**State**
Forest Health (FH)	The Nature Conservancy (TNC)	UNDP GEF-5 FSM Ridge to Reef	Pohnpei State Government
Urban & Community Forestry (U&CF)	Micronesia Conservation Trust (MCT)	UNDP GEF-6 FSM Invasive Species	Pohnpei Office of the Attorney General (OAG)
Forest Stewardship (FSP)	Secretariat of the Pacific Regional Environmental Programme (SPREP)	College of Micronesia – Federated States of Micronesia, Cooperative Research and Extension (COM-FSM CRE)	Pohnpei Division of Agriculture (DOA)
Western Competitive Grants (WCP)	The Pacific Community (SPC)	FSM Department of Resources and Development (FSM R&D)	Pohnpei Department of Land (DOL)
Fire and Aviation Management (F&AM)	Green Climate Fund (GCF)	FSM Department of Transportation, Communications & Infrastructure (FSM TC&I)	Pohnpei Division of Fish and Wildlife (DFW)
USFS Institute of Pacific Islands Forestry (IPIF)	Adaptation Fund (AF)	FSM Department of Education	Pohnpei Public Safety Division of Fire and Emergency Services (DPS Fire)
USDA Natural Resources Conservation Service (NRCS)	United Nations Development Program (UNDP)		Pohnpei Environmental Protection Agency (EPA)
United States Geological Survey (USGS)	Global Environment Facility (GEF) and GEF Small Grants Program (SGP)		invasive Species Taskforce of Pohnpei (iSTOP)
US Department of Interior (DOI)	Water and Environmental Research Institute of the Western Pacific (WERI)		Conservation Society of Pohnpei (CSP)
National Oceanic and Atmospheric Administration (NOAA)	Food and Agriculture Organization of the United Nations (FAO)		Island Food Community of Pohnpei (IFCP)
USDA Rural Development (USDARD)	Pacific Islands Managed and Protected Area Community (PIMPAC)		Pohnpei Farmers' Assoc
	Red Cross		Local Municipal govt, traditional leaders, communities
	International Union for Conservation of Nature (IUCN)		
	Catholic Relief Services (CRS)		
	Japan International Cooperation Agency (JICA)		

TABLE P 4: POHNPEI STATE STRATEGIES, RESOURCES REQUIRED, US NATIONAL THEMES AND PERFORMANCE MEASURES

FSM Issue	Strategy	Resources Required		Main Cooperators	US National Objective	Performance Measures
		USFS	Other			
Cross-cutting threats	Improve and strengthen Bio-Security quarantine protocols.	FH, U&CF, F&AM	GEF-6, AF, MCT, TNC, NRCS, DOI	iSTOP, DOA, DPS-Fire	2 Protect, 3 Enhance	Increase in capacity of bio-security quarantine officers; and decrease in bio-security quarantine non-compliance incidents.
	Support implementation of the Invasive Species Taskforce of Pohnpei (iSTOP) Strategic Action Plan to prevent degradation of forests/agroforests. Request assistance with control/eradication for invasive species that are more difficult to control					Establishment of a permanent 'Invasive Control Program'. Availability of data/ information on control of especially aggressive vines and invasive species
	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)					Existence of a wildfire plan and program with annual reports on wildfires and contingency plan for years with severe drought.
A) Food Security	A.1. Establish comprehensive, intensive agro-forestry program that will promote, utilize and sustain agro-biodiversity	FH, U&CF, FSP, WCP, USFS research	SGP, MCT, TNC, WERI, GCF, AF, FAO, NRCS, SPREP, SPC, JICA, NRCS, DOI	FSM R&D, COM-FSM CRE, Pohnpei Farmers Associations, SPC, IFCP	1 Conserve, 3 Enhance	A.1. Enhancement and expansion of existing agro-forestry systems.
	A.2. Maintain traditional knowledge and practices, and integrate new technology where appropriate, in atolls and coastal areas affected by salt water intrusion and climate change					A.2. On-site trials conducted
	A.3. Update inventory of traditional crops and varieties, conduct analysis of nutritional value					A3. Inventory of traditional crops conducted with nutritional information
	A.4. Establish Gene banks					A4. Gene banks established

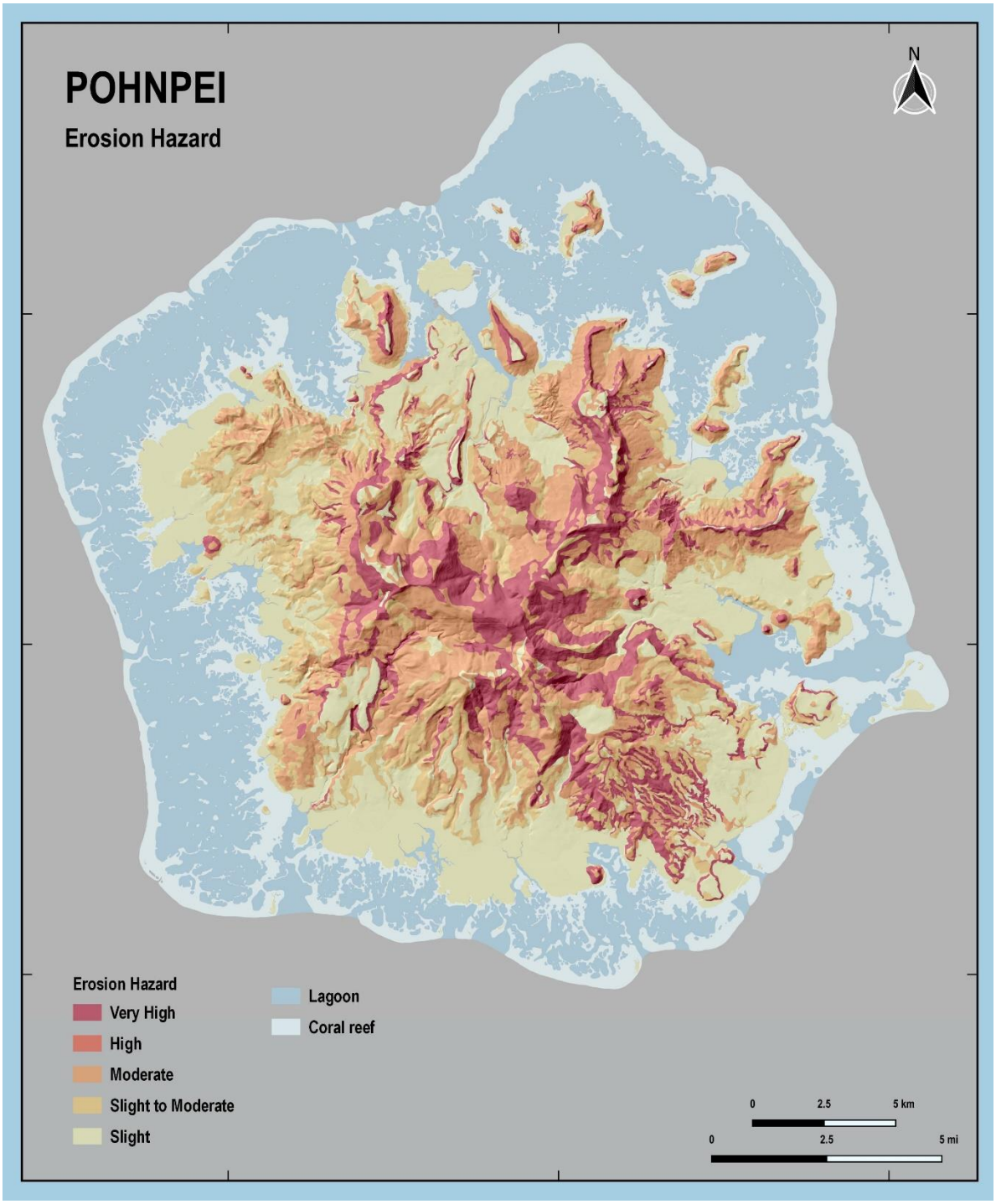
	A.5. Establish/expand/improve public/private nurseries, centralized and in communities (nurseries will also benefit additional issues such as biodiversity and production & sustainable harvest)					A.5. Development/expansion of public and private nurseries; increase in seedling production and distribution
	A.6. Identify most appropriate practices for sustainable food production (include increasing production, preservation, consumption, and marketing)					A.6. Guidelines on best practices developed
B) Biodiversity	B.1. Establish and monitor conservation easements	FH, U&CF, FSP, WCP, Forest Legacy Program (FLP), Community Forestry and Open Space (CFOS), USFS research	USGS, GCF, AF, GEF-5, GEF6, SGP, MCT, TNC, NOAA, SPREP, SPC	TNC, Local Municipal Governments, RMCs, OAG, Pohnpei EPA, SPC, DL&NR, DOA, FSM R&D	1 Conserve, 2 Protect, 3 Enhance	B.1. Easements established
	B.2. Establish, manage and monitor terrestrial protected areas and forest stewardship areas (forest and mangrove) (utilize FIA, rSET, other available methodology)					B.2. Terrestrial protected and forest stewardship areas established. % land area protected under Micronesian Challenge
	B.3. Assist Communities with development of natural resources forest stewardship plans and PA management plans					B.3. Development and existence of stewardship and PA plans.
	B.3. Establish and monitor Forest Legacy Areas.					B.3. Existence and enactment of 'Forest Legacy Areas'.
	B.7. Establish and monitor historic and cultural sites					B.7. Historic and cultural sites established and maintained
	B.8. Preservation of biodiversity (through herbariums, planting, Pohnpei training nursery etc)					B.8. Utilize nurseries and herbariums to preserve biodiversity
C) Coastal Stabilization	C.1. Enhance coastal vegetation, especially mangroves to reduce coastal erosion	U&CF, FSP	TNC, SPREP, USGS, DOI, F&WS, USAID, GCF, GEF-5	TNC, FSM R&D, DOA, CSP, MCT, SPC	1 Conserve, 2 Protect, 3 Enhance	C.1. Increase in coastal vegetation, reduce coastal erosion
	C.2. Utilize traditional measures for coastal management (non veg)					C.2. Traditional measures documented and implemented
	C.3. Enhance the capacity to conduct EIA for dredging sites (include restoration/dyke removal, permits, etc)					C.2. EIA process improved, EIA training conducted, EIAs implemented
	C.4. Support enforcement and awareness					C.4. Enforcement and awareness raising in all municipalities

	C.5. Protect and maintain natural landscapes and ecosystems as projects are climate-proofed					C.5. Development/utilization of guidelines for climate-proof projects (including infrastructure) to ensure ecosystem integrity
D) Watersheds	D.1. Establish and manage 'Pohnpei Protected Watershed Areas' (include enforcement and rehabilitation/reforestation programs).	U&CF, FSP, WCP, USFS research	TNC, JICA, GEF-5, GEF-7	TC&I, OAG, Local Municipal Governments, CSP, MCT, TNC	1 Conserve, 3 Enhance	D.1. Existence of legally declared 'Protected Watershed Areas'.
	D.2. Adopt and Develop Mangrove & Watershed Management Programs and plans					D.2. Adoption of management plan and development of management regulations.
	D.3. Develop guidelines and approach to demarcating and monitoring watershed areas, including the use of GIS. Utilize existing methods with Survey and Mapping					D.3. Guidelines developed
	D.4. Delineation and demarcation of watershed boundaries					D.4. Watershed boundaries delineated
	D.5. Effectively manage and maintain native forest cover in watershed areas, zoning law					D.5. Increase in native forest cover in watershed areas; improvement in water quality and quantity
	D.6. Erosion and sedimentation monitoring					D.6. Watershed sedimentation assessments
	D.7. Conduct atoll water assessment and develop management plans					D.7. Atolls assessed and plans developed
E) Production & Sustainable Harvesting	E.1. Determine amount of sustainable harvest outside of watershed reserve, and mangrove harvest (no harvest specific guidelines, only clearing guidelines)	U&CF, FSP, WCP	MCT, FAO, Vital, Coconuts for Life (C4L)	Resource Management Committies, CSP, SPC, FAO, COM-FSM Land Grant Program	3 Enhance	E.1. Upland/Mangrove harvest determined and program in place to limit unsustainable harvest
	E.2. Continue implementation of Community Reforestation Projects/ Tree Planting Projects. (usually individual landowners/link to native tree planting?)					E.2. Decrease in upland forest and mangrove gaps.
	E.3 Promote coconut production (food, oil, lumber)					E.3 Increase in coconut production and use, coconut planting
	E.4. Create timber lot guidelines, and assist communities with establishing timber lots					E.4. Timber lots developed

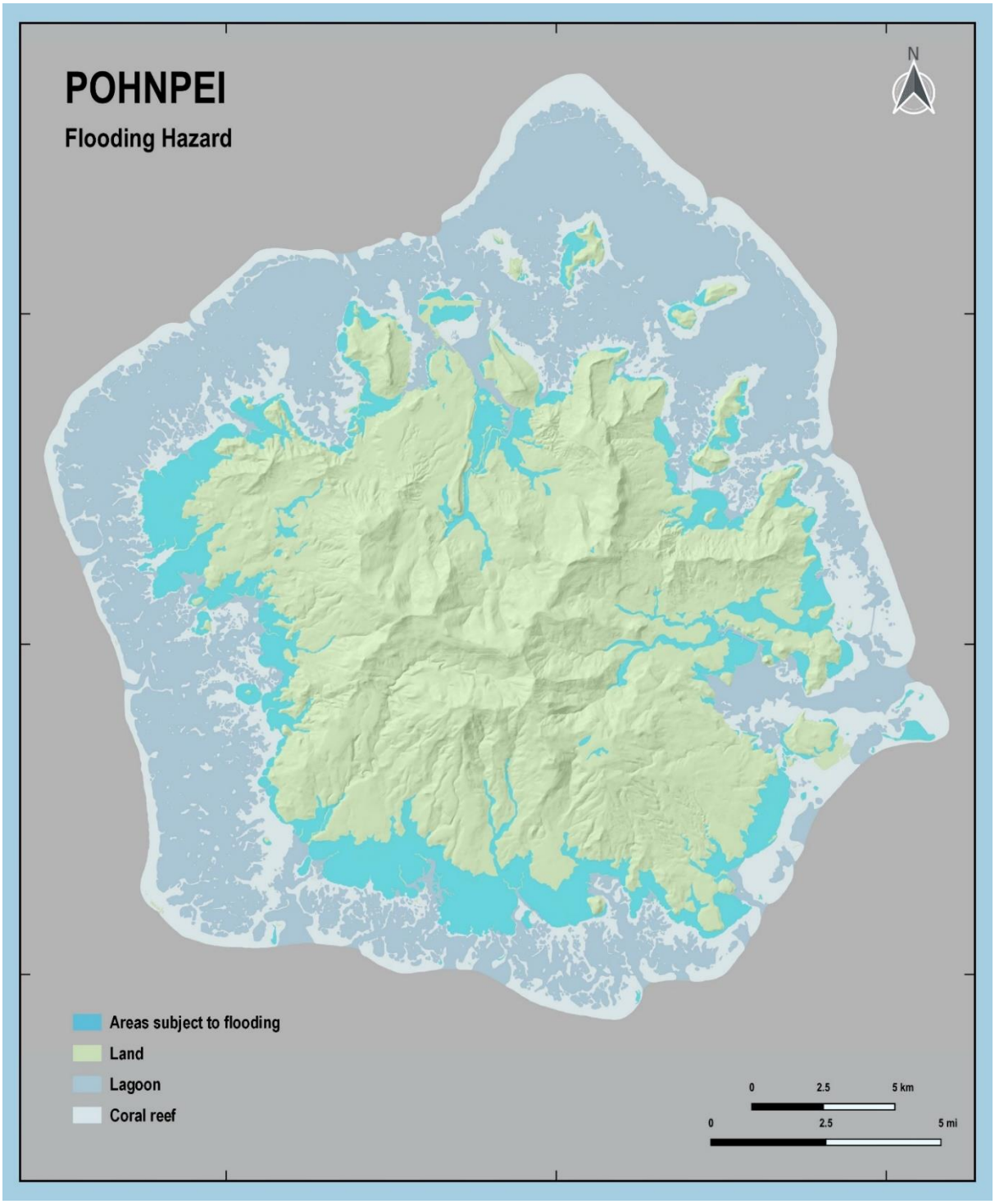
F) Capacity Building	F.1. Awareness and Conservation Education (Outreach activities during Earth Day, Environment Day, Biodiversity Day, Sept 9 Micronesia cleanup day etc…) (Observe 'Arbor Day', 'World Forest Day' etc), Utilize partner awareness programs and plans (MC, Water Policy, R2R plans, RARE)	U&CF, FH, F&AM, FSP, WCP	MCT, TNC, GEF-5, GEF-6, Vital, DOI, SPC, FAO, SPREP, Rare, JICA	CSP, DOE, DOL, Municipal Governments, Communities, Traditional leaders, CSP, MCT, TNC, Rare	1 Conserve, 2 Protect, 3 Enhance	F.1. Public is aware of natural resource issues and makes wise decisions for their sustainable use
	F.2. Obtain up to date spatial imagery for all of Pohnpei State, especially of Pohnpei Outer Islands in order to monitor, detect change, and inform planning					F.2. Updated imagery main island (i.e., vegetation maps, forest trends), and baseline images for resource assessments of Outer Islands. Info available to partners and communities for planning
	F.3. GIS Training and equipment for utilization of old and new aerial photos, remote sensing, spatial imagery, geo-database development					F.3. Increase in availability and practical use of GIS Maps.
	F.4. Establish GIS Office for Pohnpei					F.4. GIS office for Pohnpei established
	F.5. Improve State/NGO/community collaboration, coordination and networking (through PRMC, technical committees, and working groups)					F.5.Active PRMC and working groups
	F.6. Develop 'Forest Conservation Capacity-Building Network' and utilize existing networks (i.e. PIMPAC, MIC, MFAN) that will serve as a vehicle for announcing or obtaining information on funding or training opportunities					F.6. Improved dissemination of information on training or funding opportunities; increase in the number of training opportunities participated in; increase in funds received through grants.
	F.7. Improve data access and research sharing through centralization (new Inform portal, MC terrestrial web-viewer, other)					F.7. Data accessible and shared with stakeholders, agencies and communities for adaptive management
	F.8. Ensure relevant Pohnpei State plans (SDP, etc) address terrestrial conservation					F.8. Relevant plans support terrestrial conservation
	F.9. ICS Training & Certification (information communication)					F.9. Development of ICS Training Program and existence of ICS Certified personnel

	F.10. Arborist Training & Certification (ISA)					F.10. Development of an Arboriculture Training Program and existence of certified arborists.
	F.11. Develop 'Staff Development Plans'					F.11. Staff development plans in place.
	F.12. Develop and conduct EIA training program; utilize EIA for development projects					F.12. Development of EIA Training Program; Application of EIA Training in Development Projects.
	F.13 Grant writing and project management training					F.13. Enhanced capacity in grant writing and management
	F.14. Promote careers in natural resources management (i.e. internships, trainings, courses etc) to recruit new staff working in field					F.14. Increased number of staff working in natural resource stewardship fields
	F.15. Pesticide application training					F.15. Pesticide application certification
	F.16. Conduct cross-site visits and learning exchanges to showcase successes and share lessons-learned and best practices					F.16. Cross-site visits held
	F.17. Improve invasive species management/control/eradication					F.17. Increased capacity in invasive species management

All Other Mapped Priority Areas

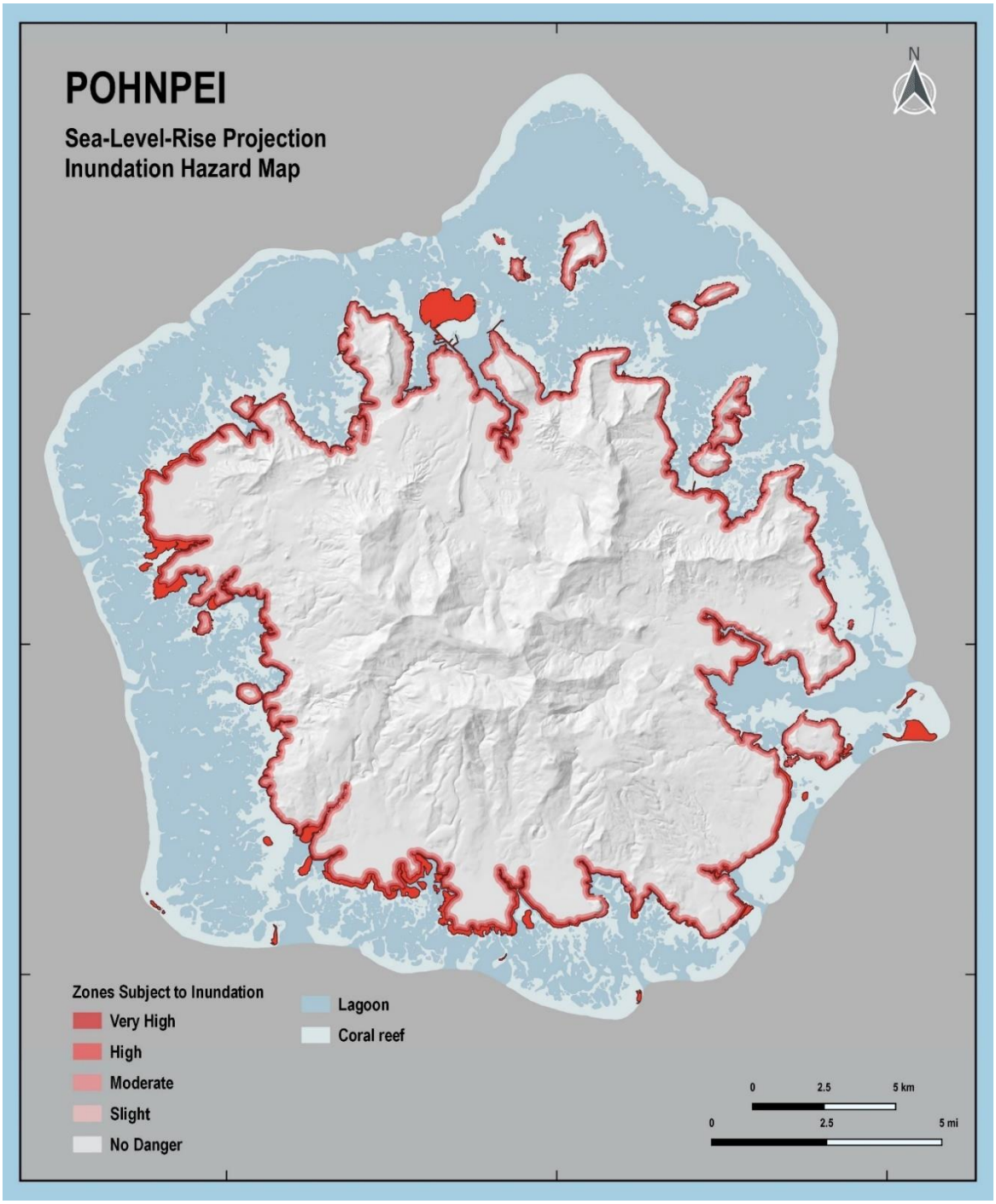


P8 – Pohnpei main island – Erosion hazard map
This map was derived from the NRCS soil map of Pohnpei main island showing the soil erosion hazard areas, which include severe areas, very high areas, moderate areas, and slight areas of erosion hazard.



P9 – Pohnpei main island – Flooding hazard map

This map was also derived from the NRCS soil map of Pohnpei Main Island showing the flooding hazard areas, which include areas that frequently get flooded, areas occasionally get flooded and areas rarely get flooded from rivers.

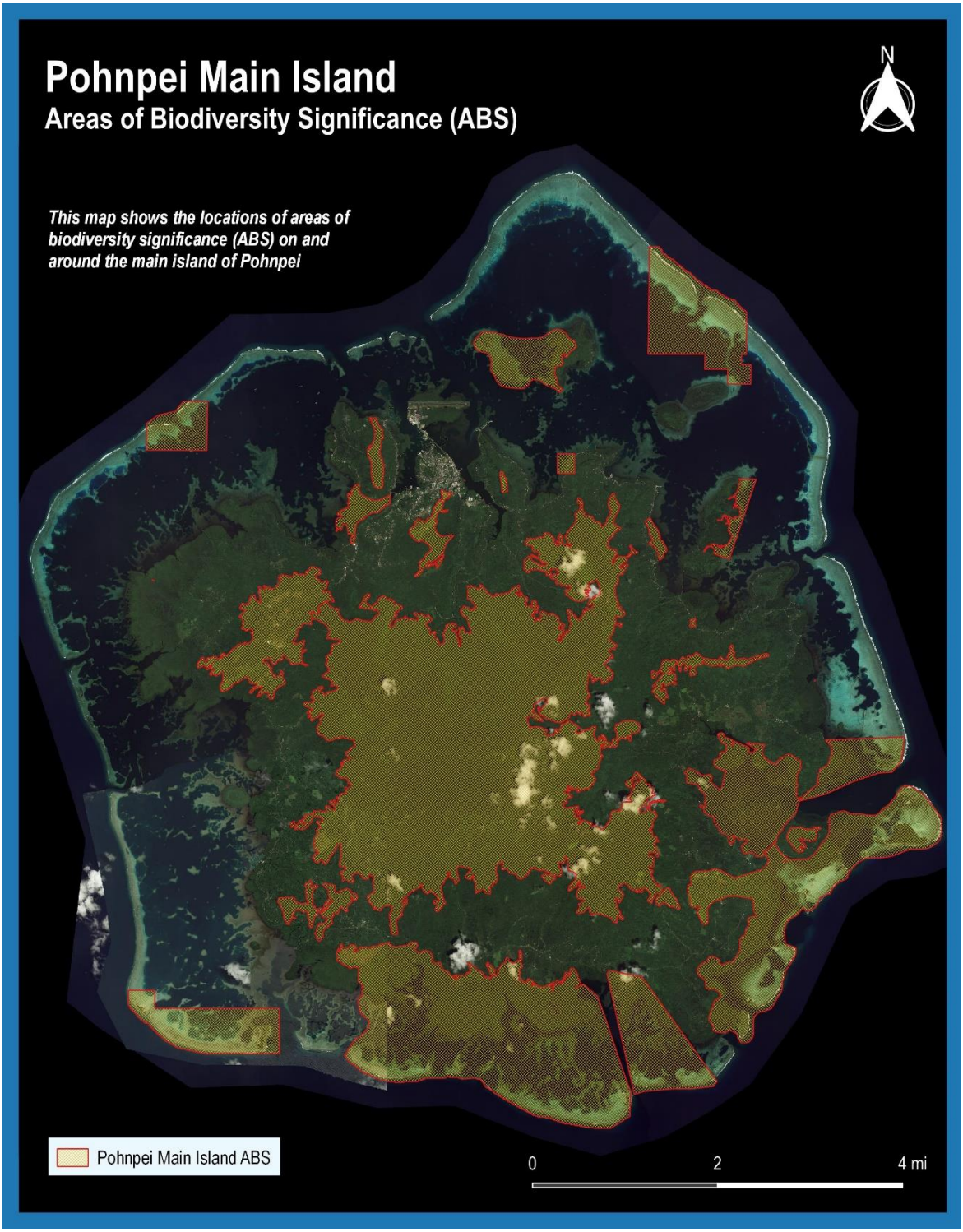


P10 – Pohnpei main island – Sea-Level Rise and Inundation hazard map

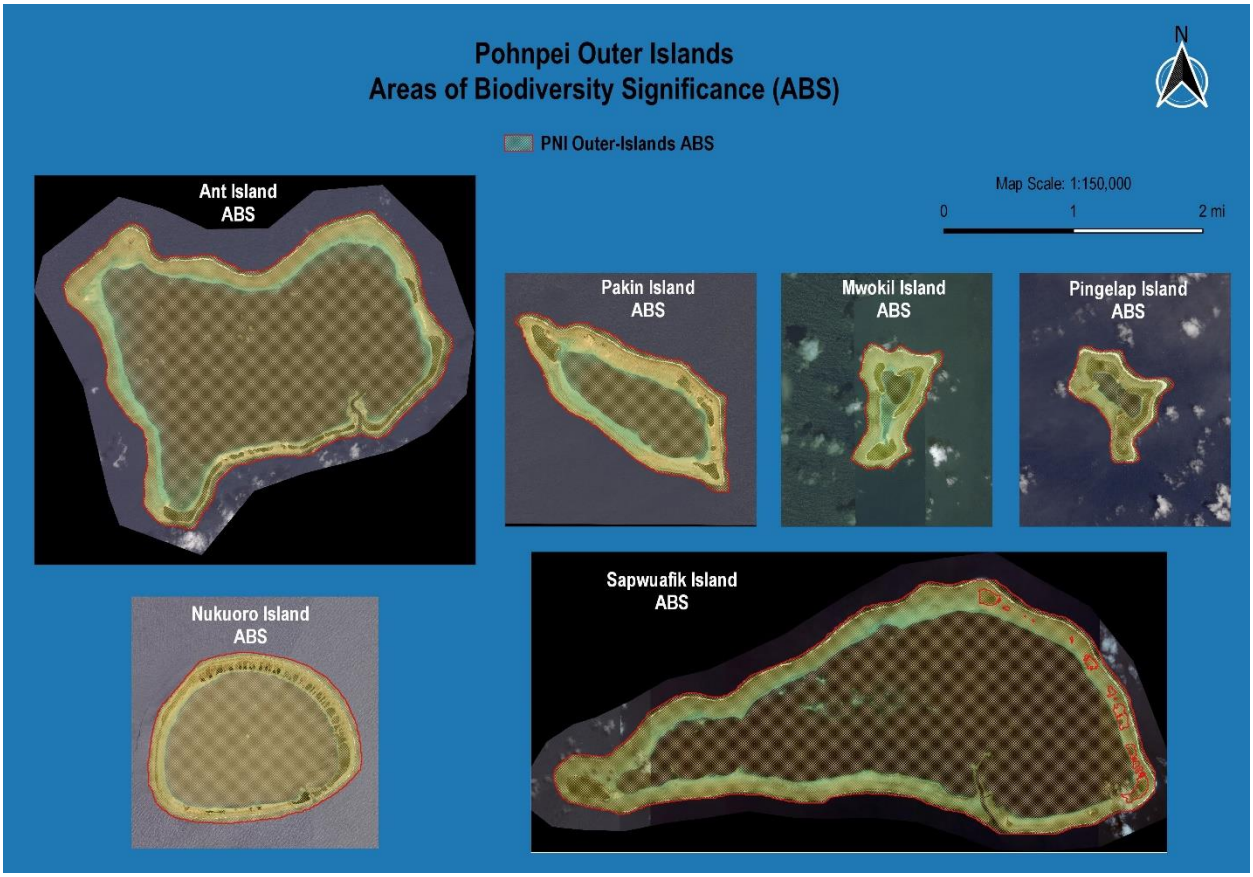
This map was generated from the Sea Level Rise projection modeling project in collaboration of FSM OEEM office, SPC and COM-FSM back in 2013 showing areas likely to be inundated by 2055 in red color, with high hazard zone areas for inundation, which is 100m buffer from the projected areas to be inundated, along the coastline of Pohnpei main island. The modeling project was only done for the high islands for the elevation data for the low-lying neighboring islands that do not exist.

P11 – Pohnpei main island – General soil type map

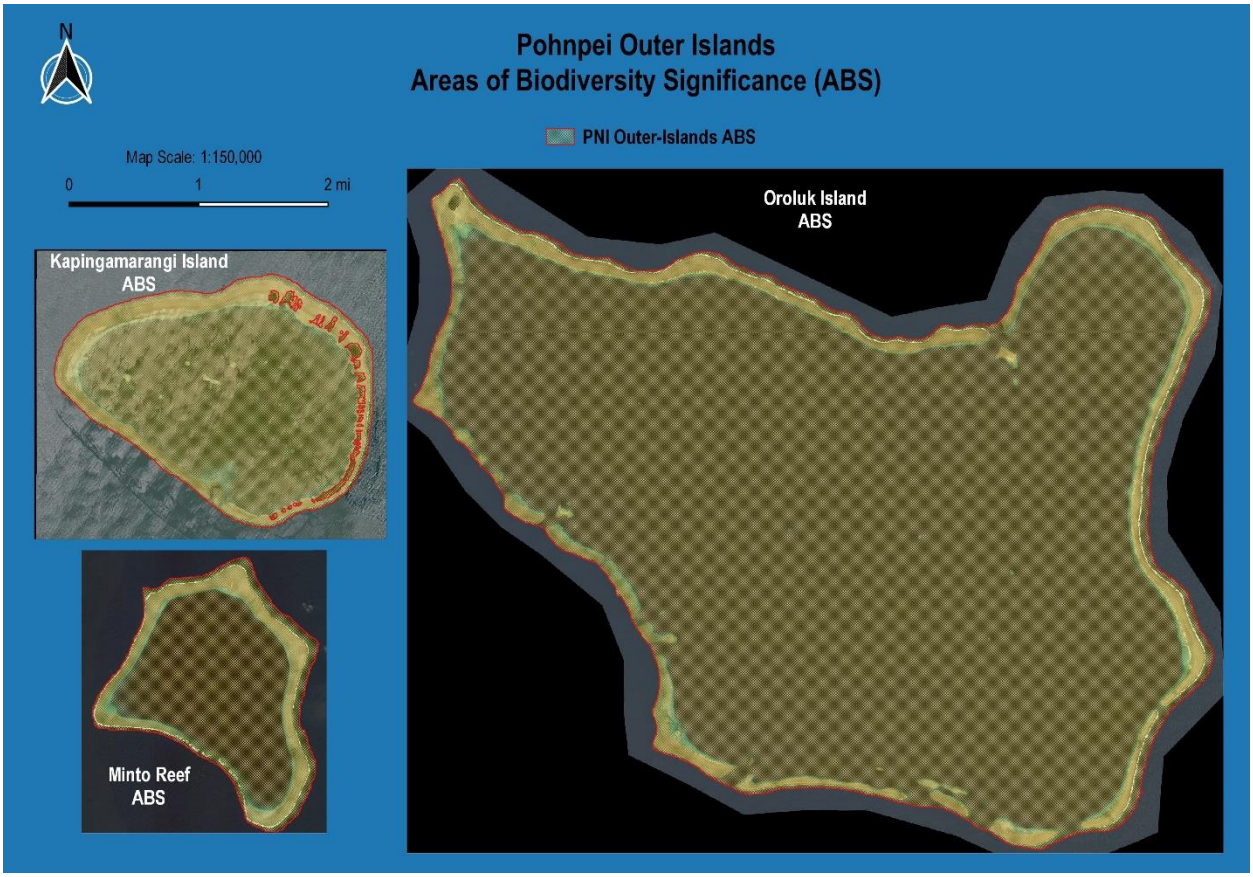
This map shows the basic soil types of Pohnpei main island. The original data set was created by the U.S. Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS) (1982) as part of the soil survey of the Island of Ponape, Federated States of Micronesia at 1:10,000 scale. Soil map unit delineations were confirmed as accurate during a subsequent evaluation (1999). In addition to soil names and classification, the data set contains information on terrain, erosion hazard, flooding hazard, and soil suitability for specific crops.



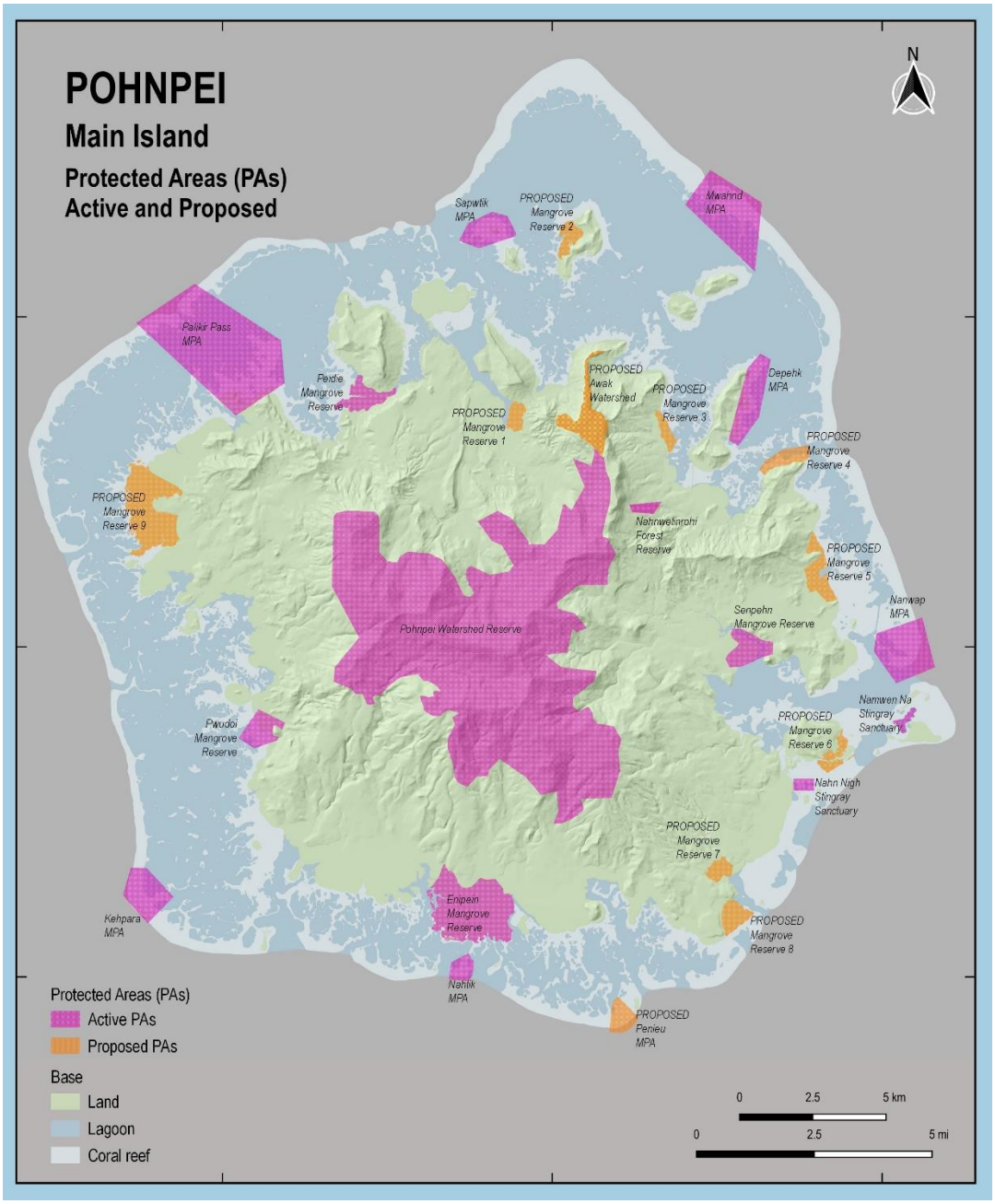
P12a – Pohnpei main island – Areas of Biodiversity Significance (ABS) map1
This map shows the Areas of Biodiversity Significance (ABS) of Pohnpei's main island overlaid on the Pohnpei 2016 WorldView-3 high-resolution satellite image.



P12b – Pohnpei outer islands – Areas of Biodiversity Significance (ABS) map2
This map shows the Areas of Biodiversity Significance (ABS) of Pohnpei's outer islands including Pingelap, Mokil, Pakin, Ant, Sapwuafik and Nukuoro islands overlaid with the 2016 WorldView-3 high-resolution satellite image of each of the islands.

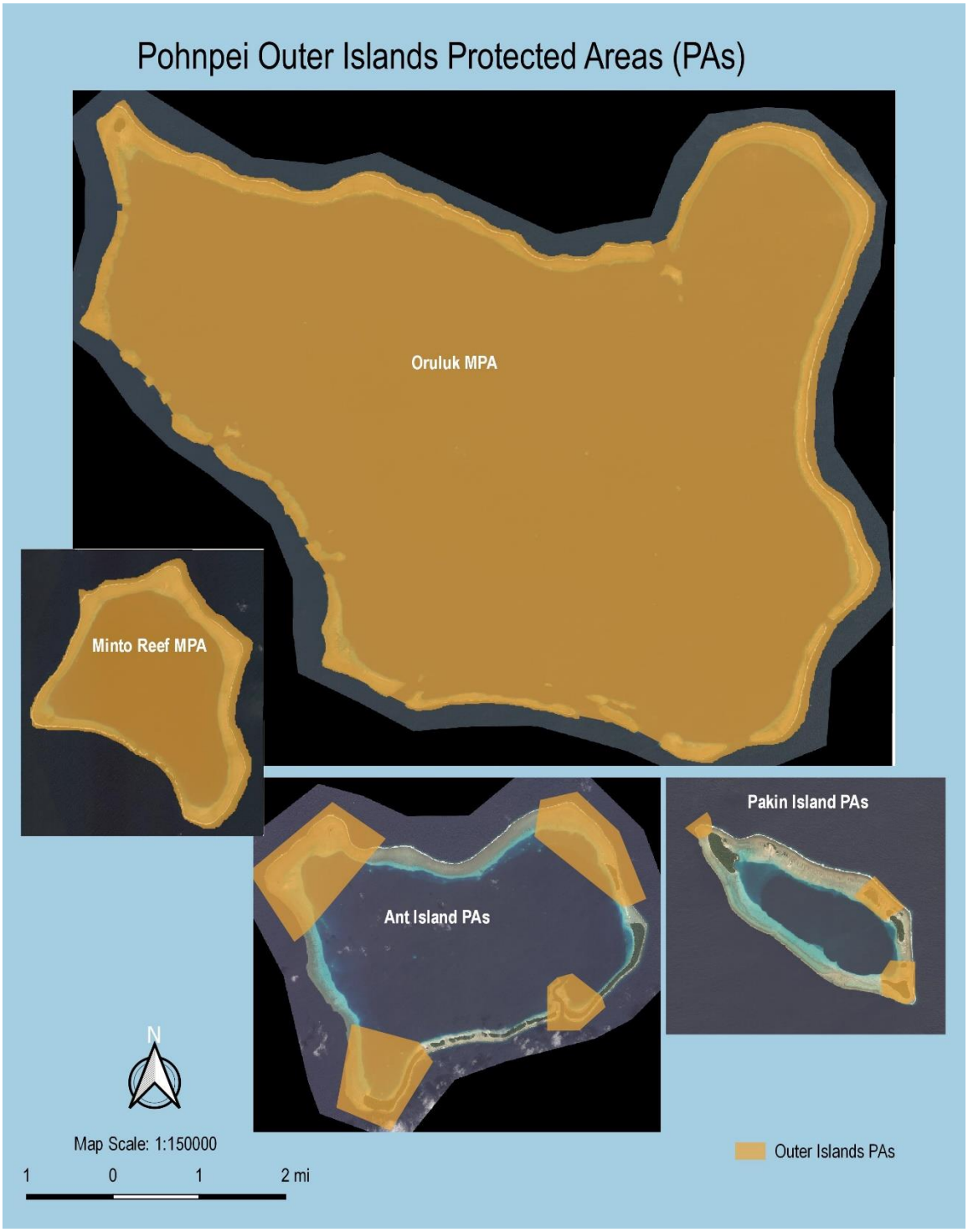


P12c – Pohnpei outer islands – Areas of Biodiversity Significance (ABS) map3
This map shows the Areas of Biodiversity Significance (ABS) of Yap neighboring islands including Oroluk and Kapingamarangi islands, and Minto reef overlaid with the 2016 WorldView-3 high-resolution satellite image of each of the islands.

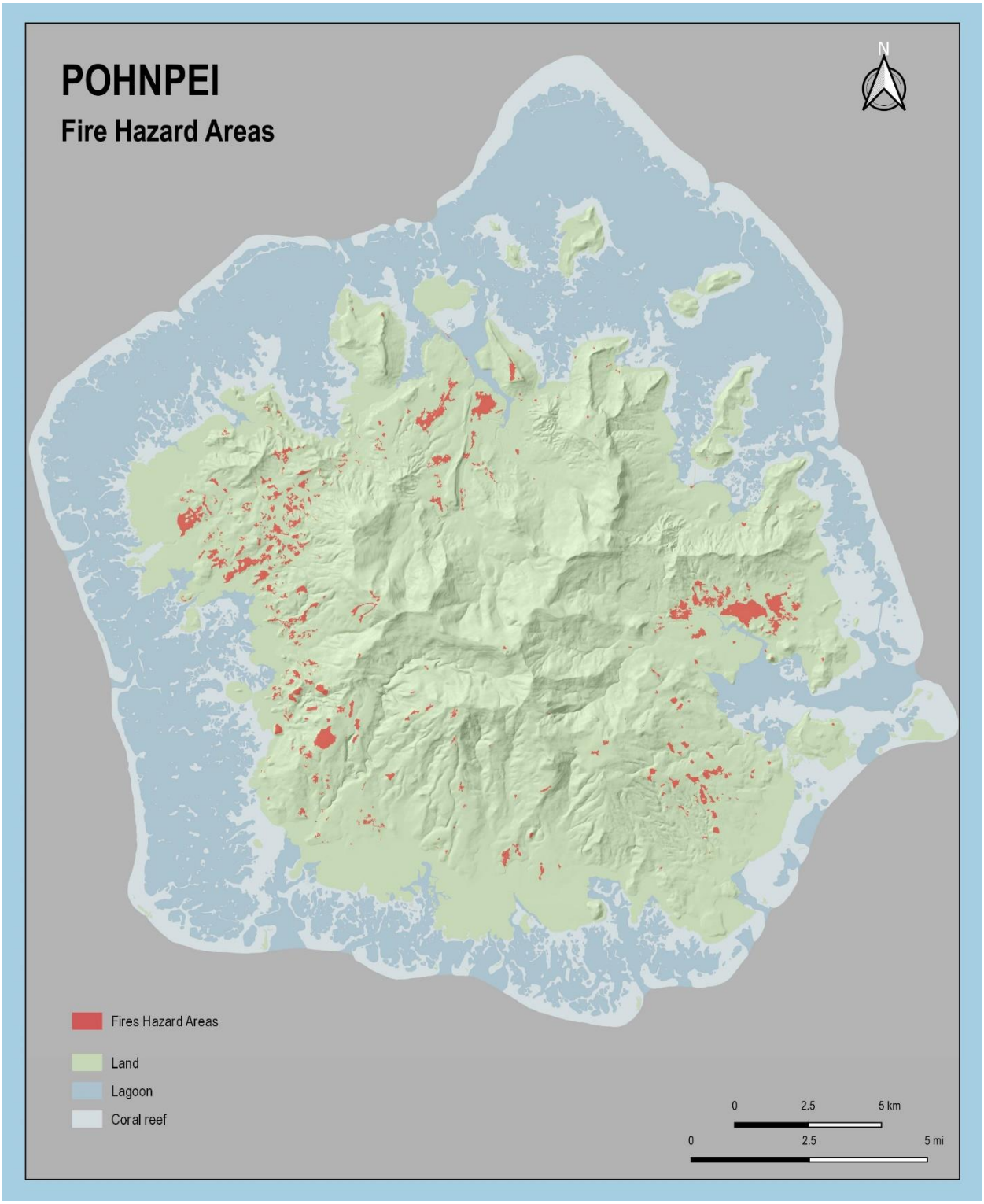


P13a – Pohnpei main island – Conservation & Protected areas map1

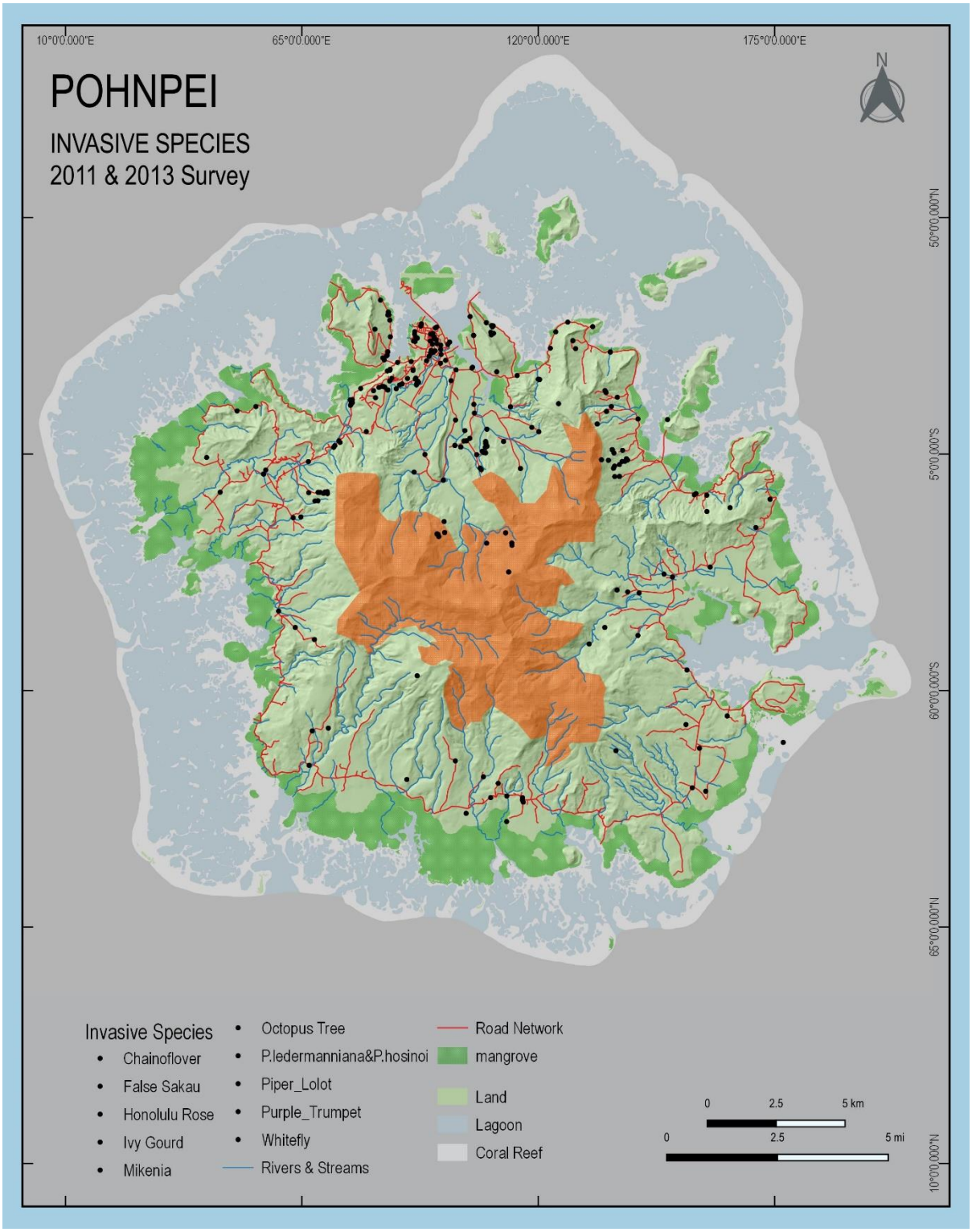
This map shows the designated and proposed PA sites on and around the Pohnpei main island including the mangrove forest areas. Orange color polygons represent the active and designated PA sites, and blue color polygons represents the proposed PA sites. The PA sites data used in this map was updated 2019. The sites as identified are community driven with support from many partners and programs and are continually being reviewed. Partners continue to operationalize the Pohnpei State Protected Areas Network (PAN) through the update of Pohnpei's PAN Law and drafting of accompanying regulations, development of the National PAN Operations Manual, and support for protected area management plans. Throughout these efforts, sites will continue to be reviewed and confirmed.



P13b – Pohnpei outer islands – Conservation & Protected areas map2
This map shows the PA sites on some of the outer islands of Pohnpei state, including the Ant island PAs, Pakin island PAs, Oruluk MPA and Minto Reef MPA.

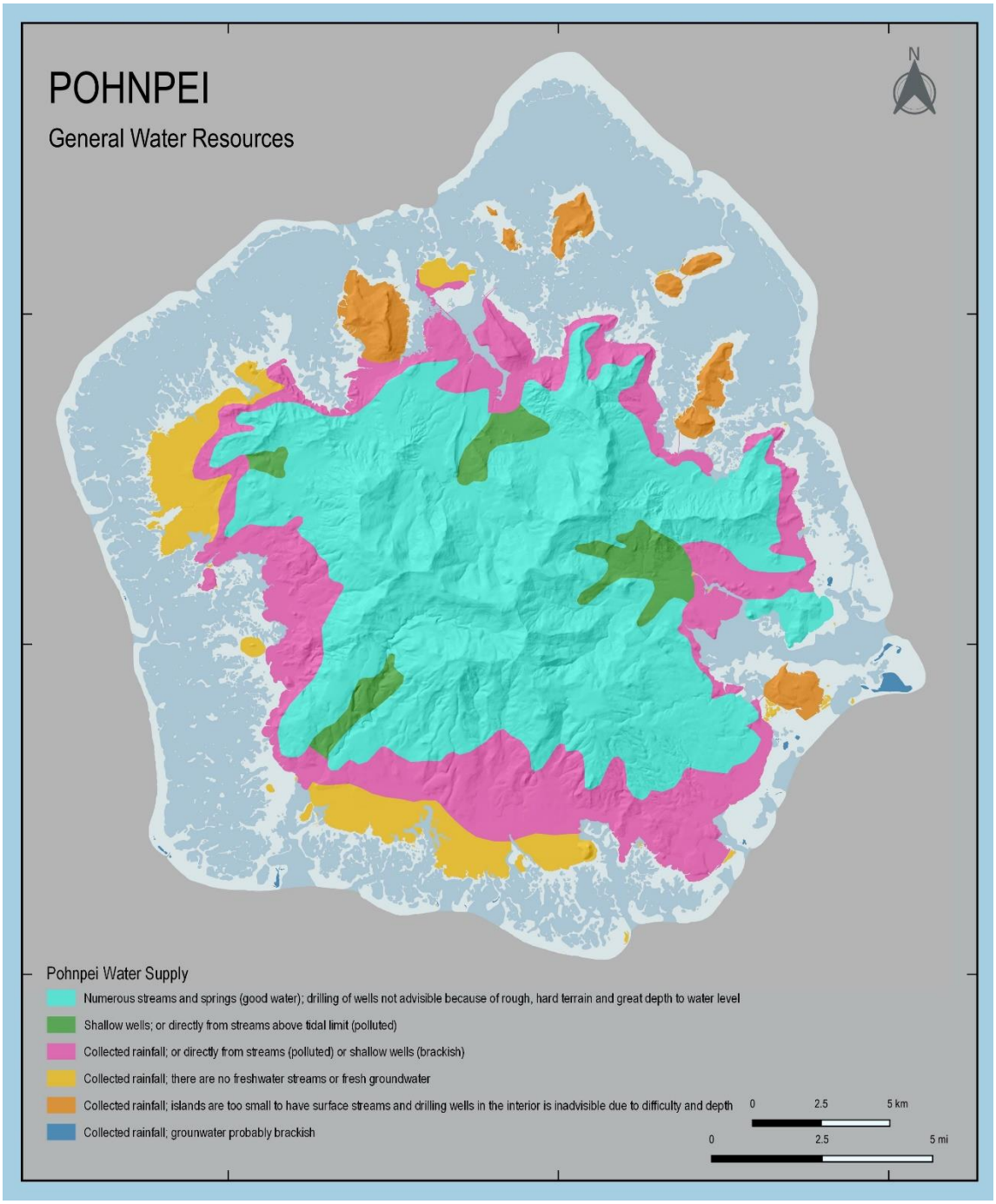


P14 – Pohnpei main island – Fire hazard map
This map shows areas that are fire prone on and around Pohnpei main island.



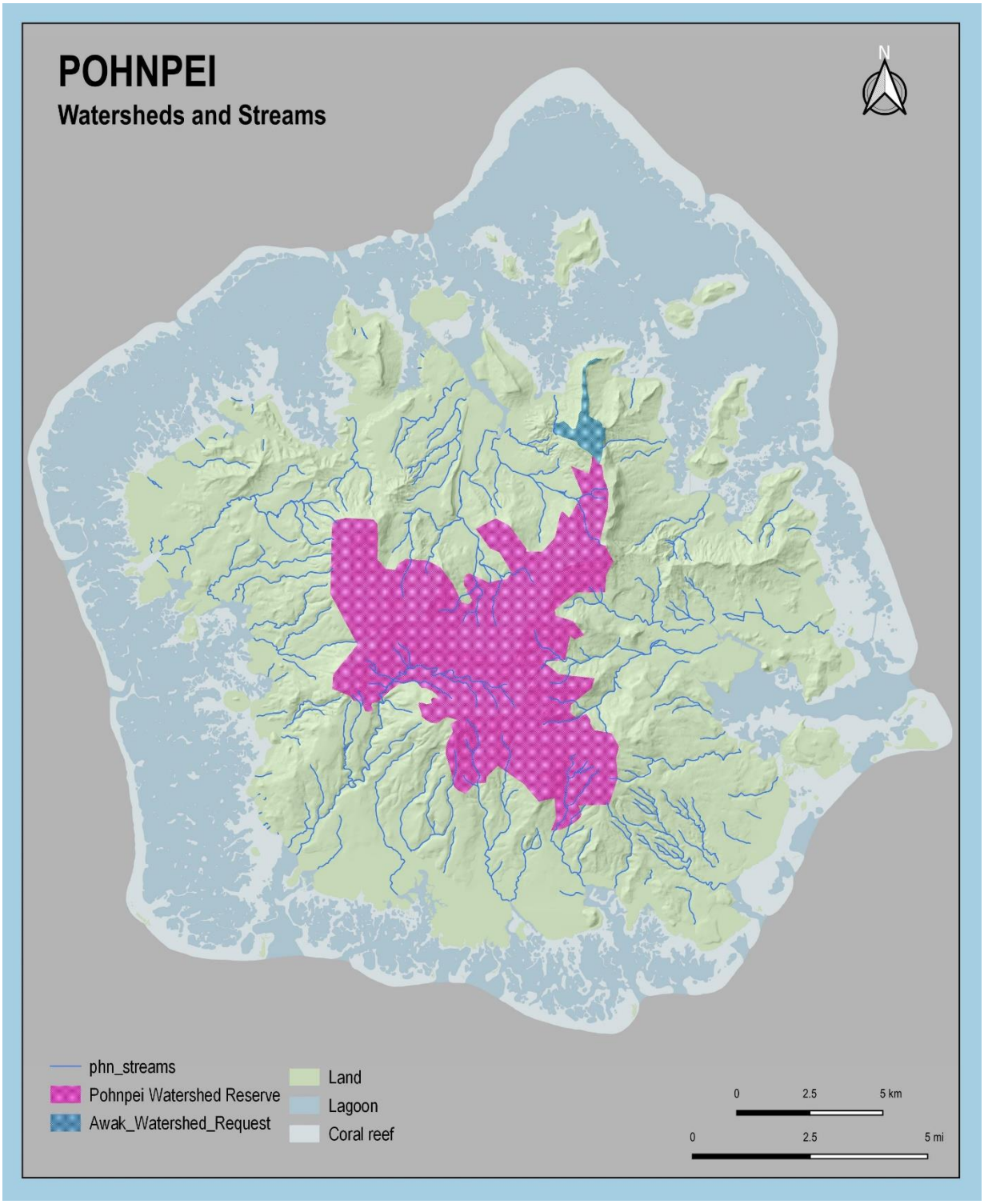
P15 – Pohnpei main island – Invasive Species map

This map shows locations of invasive species surveyed in 2011 – 2013 on Pohnpei main island, in relation to rivers, roads and the Pohnpei watershed reserve.



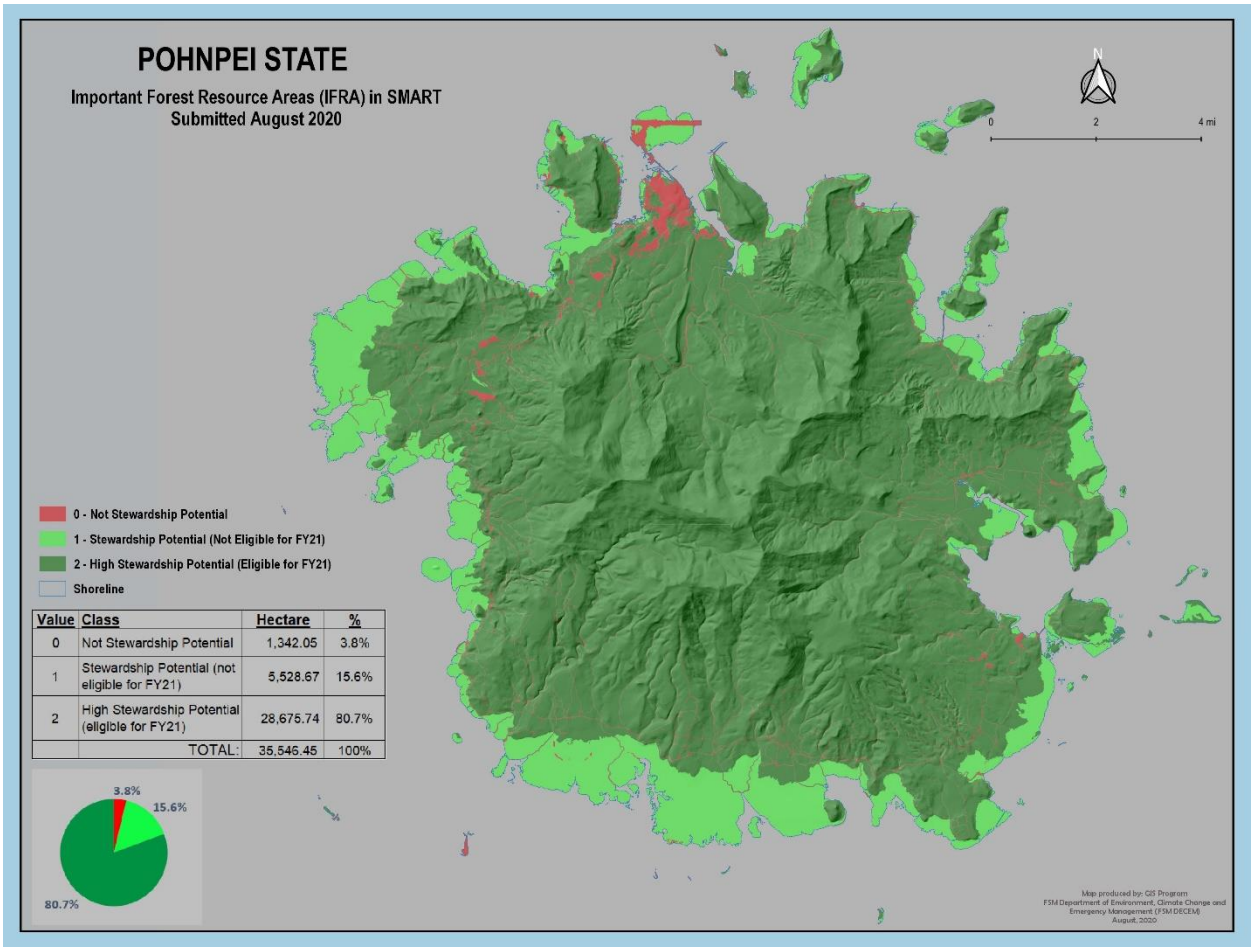
P16 – Pohnpei general water resources map

This map shows the general distribution of freshwater resources on Pohnpei. The data layer was created by Island Research & Education Initiative (iREi) (2017) by scanning, georeferencing, and digitizing a very general paper map prepared by the U.S. Geological Survey (1944) for the Chief of Engineers, U.S. Army as part of the Strategic Engineering Study No. 109 titled Ponape including Pakin and Ant Islands (Carolines) Terrain Intelligence. The map was found in the library collection at the national campus of the College of Micronesia (COM).



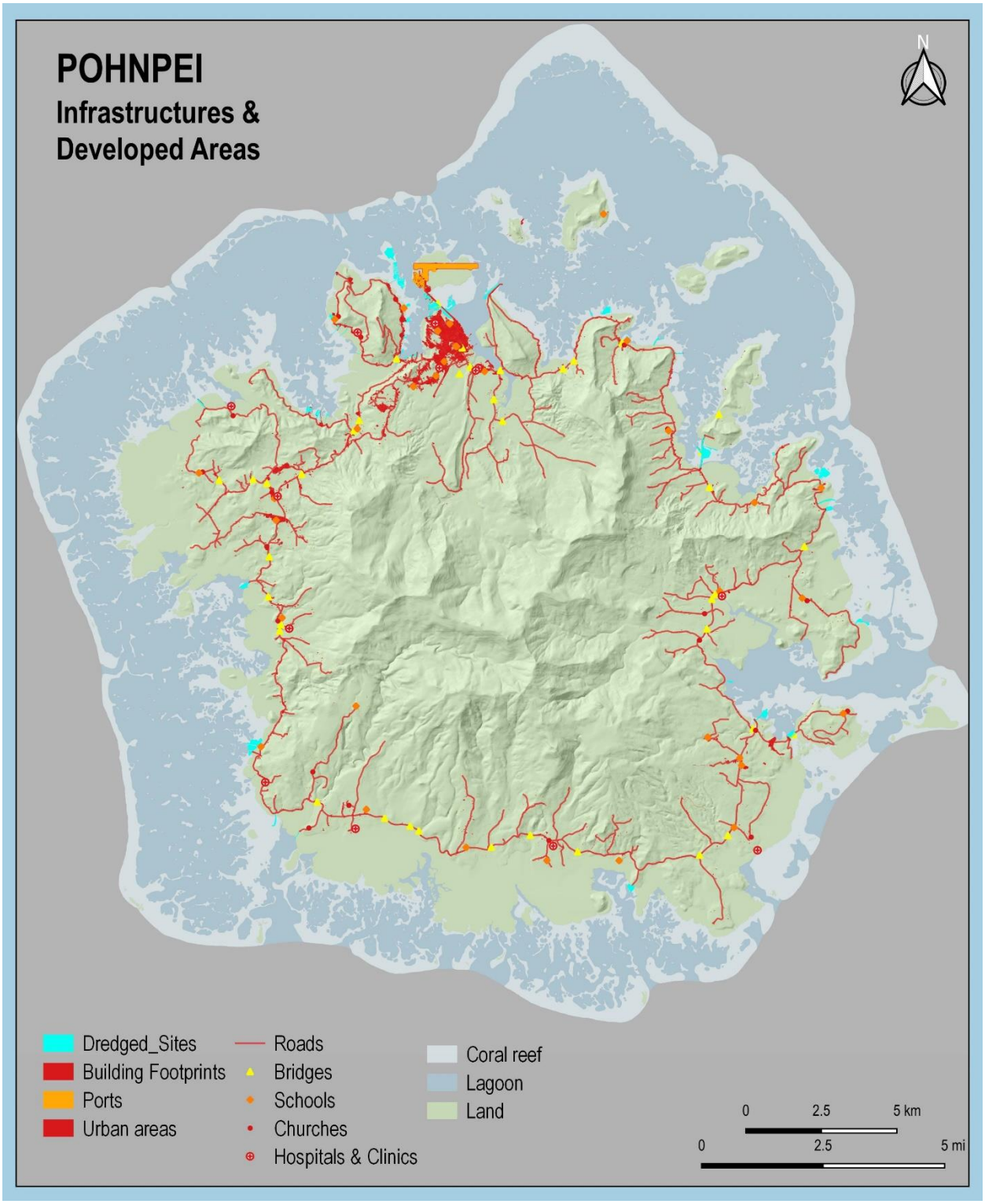
P17 – Pohnpei watershed reserve and streams & rivers map

This map shows the watershed reserve and the general distribution of freshwater streams and rivers of Pohnpei main island.

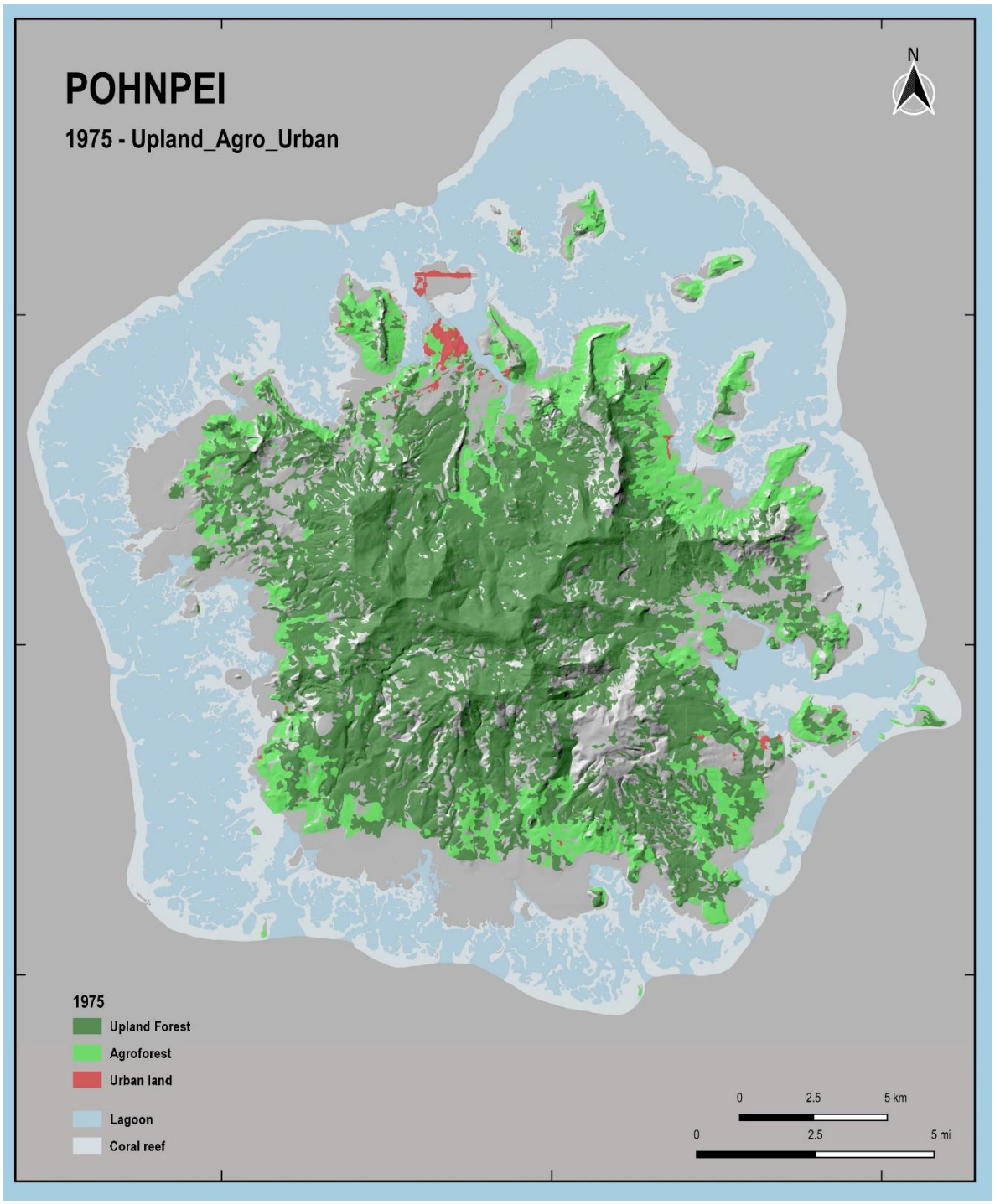


P18 – Pohnpei main island – Important Forest Resource Areas (IFRA) map

The IFRA was updated August 2020 to reflect new program guidance in the "Modernized" Forest Stewardship program, and may be updated annually for use with the Stewardship Mapping and Reporting Tool (SMART) for program administration purposes. The new Pohnpei IFRA differs significantly from the earlier IFRA, because the new IFRA places a high priority on both private (mostly agroforest) lands and the Pohnpei Watershed Reserve. Also the new IFRA shows mangroves as eligible (under Rural Forestry Assistance authorities for state forest lands) but lower priority because their close connection to coastal communities make them suitable for support from the Urban & Community Forestry Program.

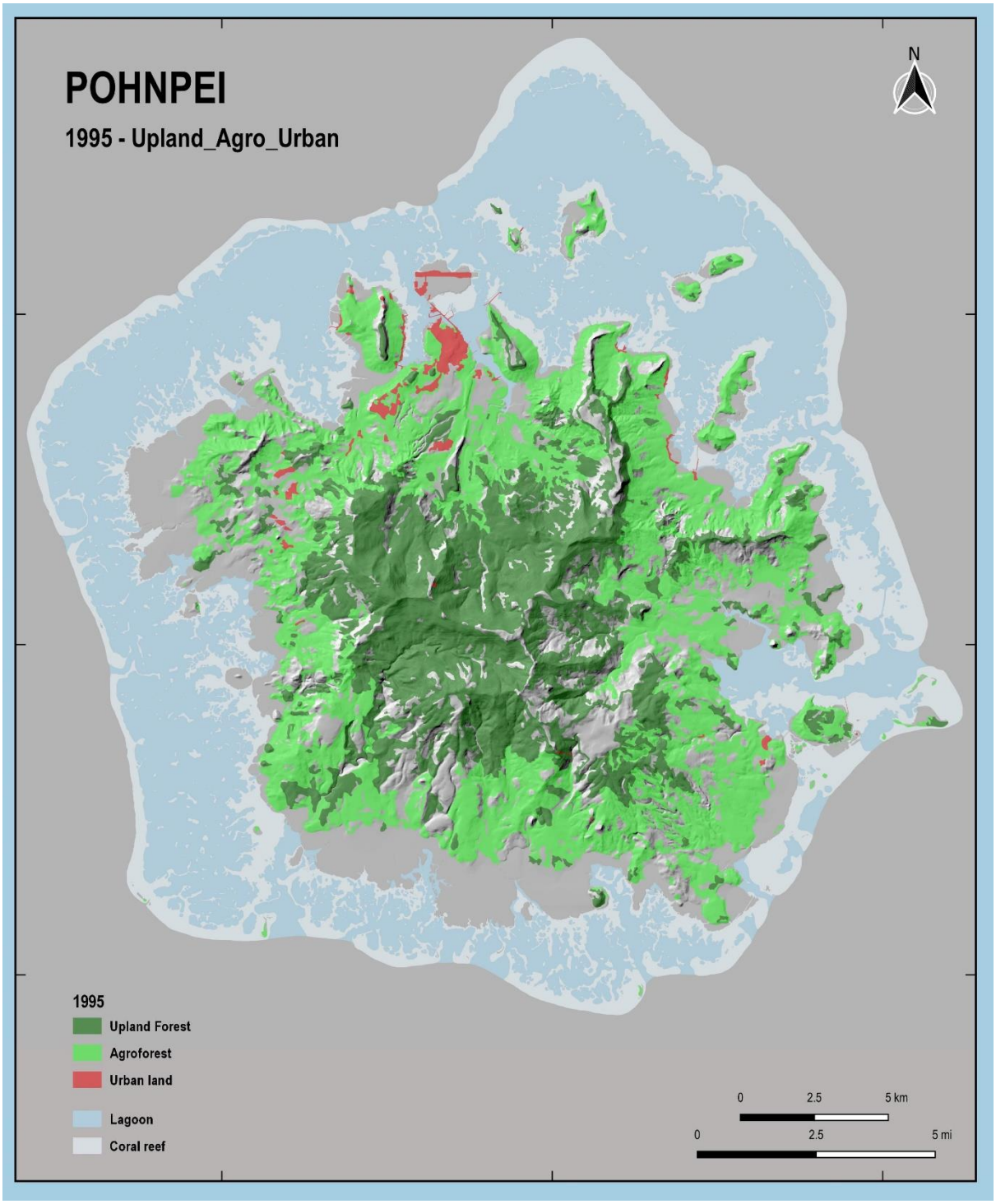


P19 – Pohnpei main island – Developed and urban areas, and infrastructures map
This map shows the developed areas and infrastructures of Pohnpei main island including roads, buildings, bridges, dredged sites, and etc.



P20 – P22 – Pohnpei main island – Changes in Upland forest, Agroforest, and Urban from aerial imageries of 1975, 1995, and 2002

These maps show visual trend (decline in upland forest and increase in developments/urban areas) from 1975, 1995, and 2002 aerial imageries. The datasets used in producing these maps were provided courtesy of The Nature Conservancy (TNC).



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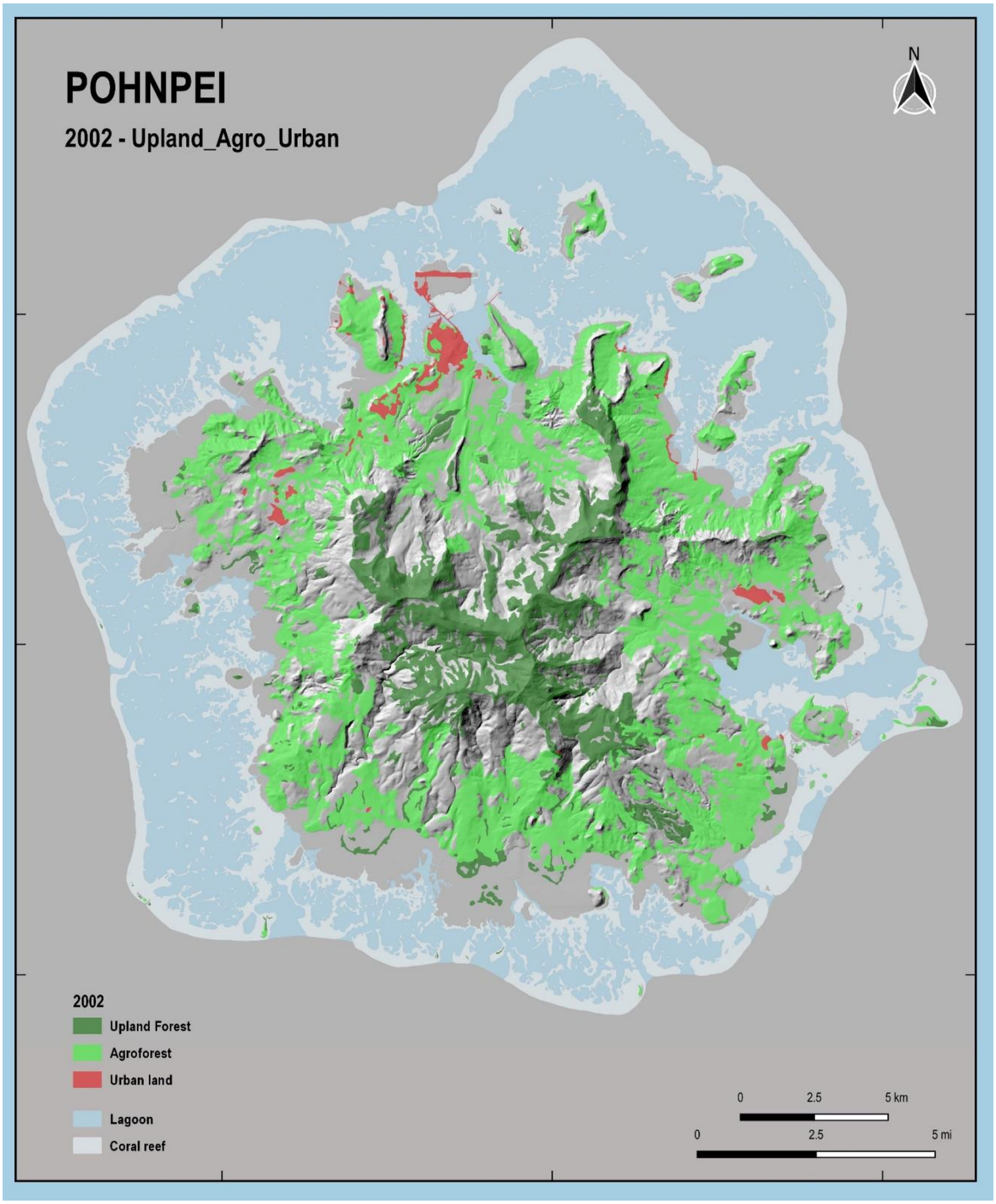

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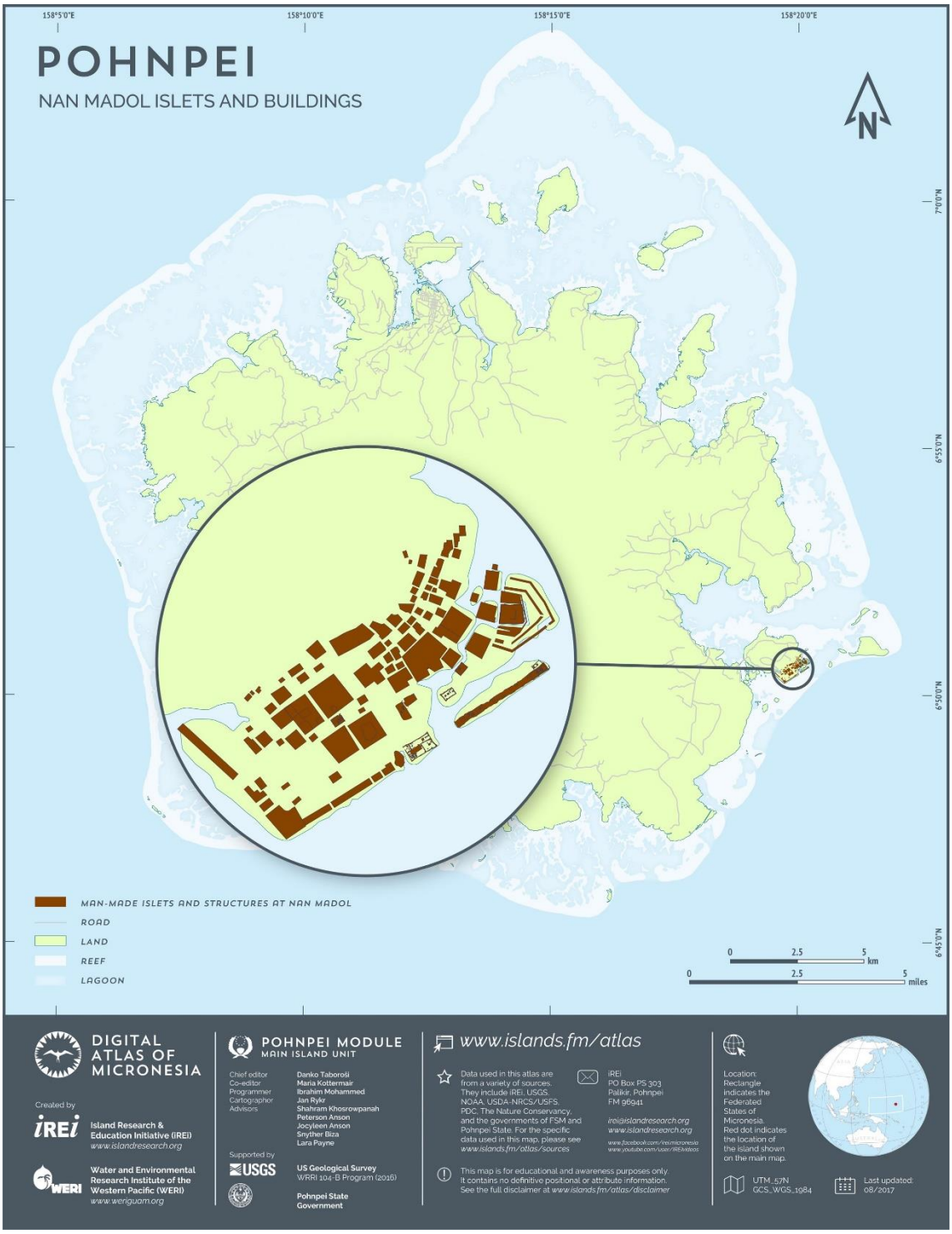

P23 – Pohnpei Nan Madol Islets and Buildings map

This map shows the islets and buildings at Pohnpei's premier prehistoric site, the ancient Saudeleur capital at Nan Madol. The data layer was formatted for GIS by Island Research & Education Initiative (iREi) (2017), using exclusively KML files created by Alex Zuccarelli for Pohnpei Eco-Adventure Map Guide Series (2013), and is available on the Digital Atlas of Micronesia (https://islandatlas.org/pohnpei)

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Pohnpei: Invasive Species Taskforce Of Pohnpei (iSTOP) Strategic Action Plan 2018 - 2022

Pohnpei: Joint State Action Plan (JSAP) for Disaster Risk Management and Climate Change

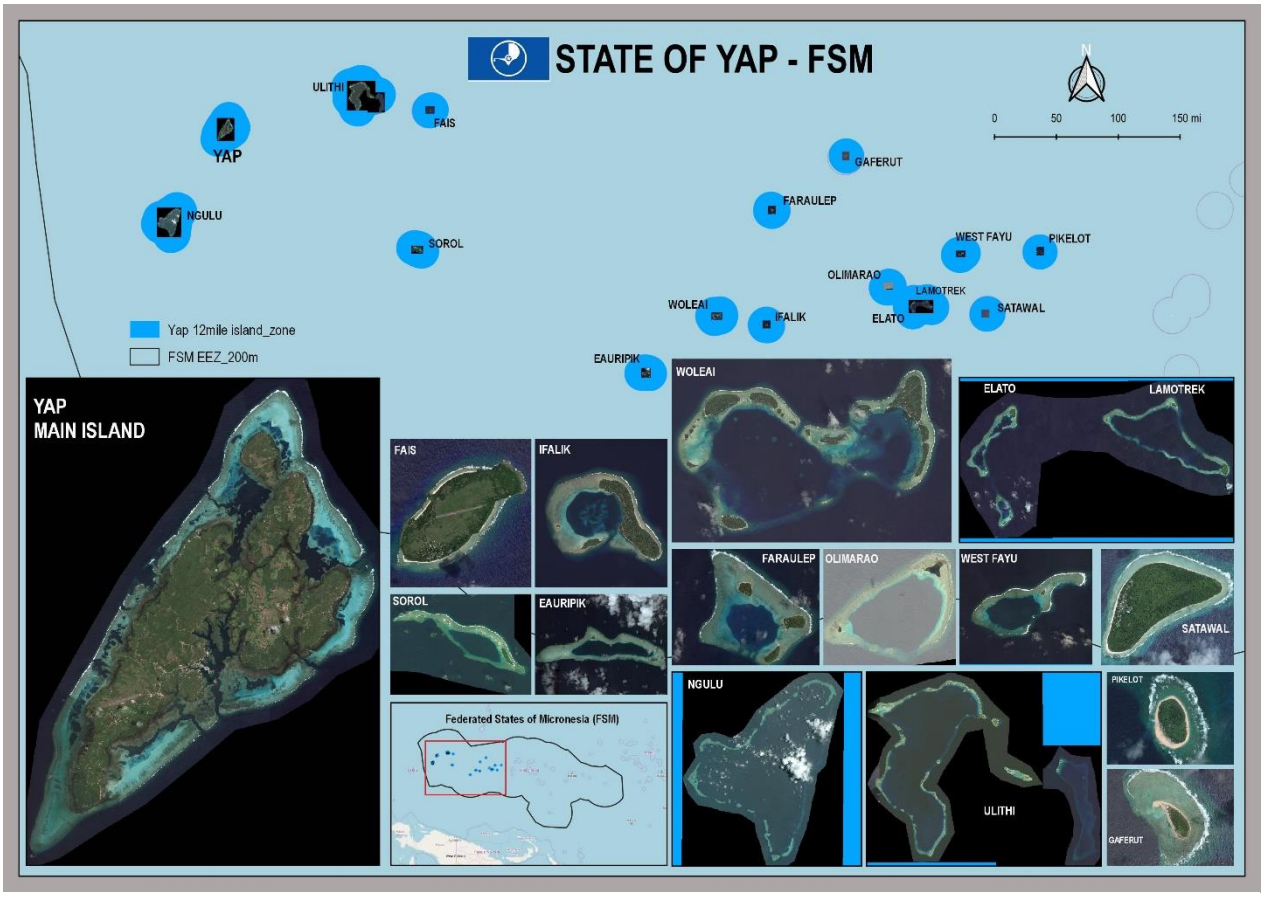
FSM: Federated States of Micronesia (2015). FSM National Invasive Species Strategy and Action Plan 2016-2021.

FSM: Federated States of Micronesia (2014). Fifth National Report to the Convention on Biological Diversity.

FSM: Federated States of Micronesia (2018). State of Environment Report.

View From Rumung, Yap State. Photo Credit: Ryan Talken

V. YAP STATE



MAP Y- 1 YAP STATE ISLANDS

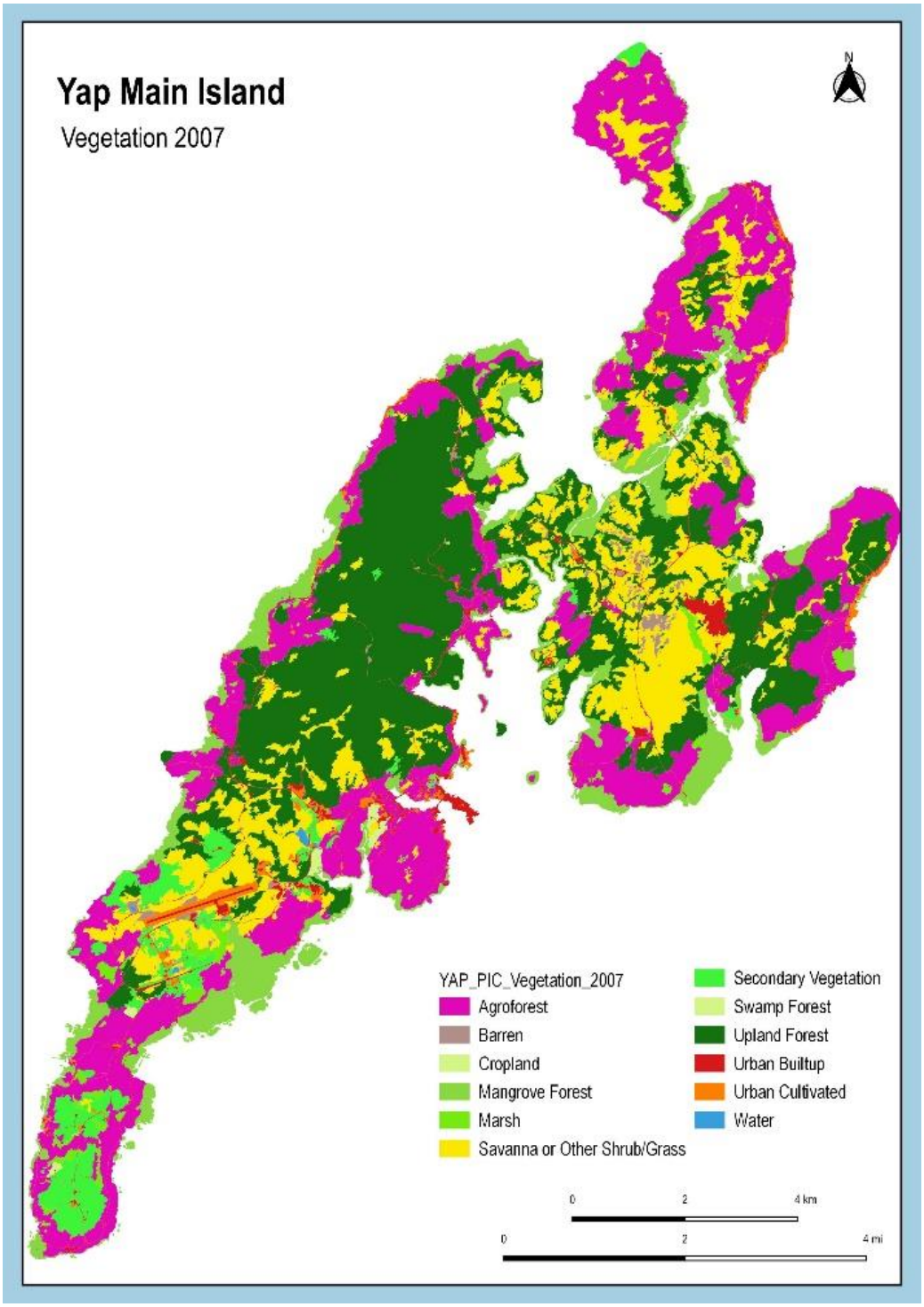
Introduction

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. It is affected by low rainfall, sometimes exacerbated by El Niño resulting in reduced rainfall and periods of drought (Yap JSAP, 2015). 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 shows the locations of Yap's main island and its neighboring islands within the FSM EEZ using the 2016 WorldView-3 satellite imagery as the background for each island.

YAP STATE FOREST RESOURCE ASSESSMENT

This section provides a qualitative, quantitative and geospatial assessment of Yap's forest resources and major issues of forest stewardship referenced to USFS themes. It includes conditions and trends of priority landscapes, values of these forest resources, threats and opportunities.



Y2 Yap main island – 2007 Vegetation layers map

This map shows the vegetation classes of Yap main island from 2007. The data set was developed from 2007 QuickBird satellite imagery by Digital Globe through land cover classification carried out by U.S. Forest Service (2007). The dataset was slightly modified by Island Research & Education Initiative (iREi) (2017) to better match 2016 WorldView-3 satellite imagery.

Conditions and Trends

The general forest types of 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 /YBSAP 2018). 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. Studies of carbon stocks (Donato et al 2011) 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. Their conservation is thus important for mitigation of climate change as immense amounts of carbon are stored in mangrove peat soils. 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. Trees of Yap: A Field Guide is a thorough and informative resource on Yap's tree species, written by Dr. Marjorie Falanruw, a long-time Yap resident and technology transfer specialist for USFS Institute of Pacific Islands Forestry.

There is limited published information regarding forests and resources on Yap's Outer Islands. 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. Native atoll forest trees provide roosting and nesting sites that are critical to the survival of sea birds that aid fishermen in finding fish. In addition uninhabited islets are refuges for native biodiversity such as sea turtles and sea birds, and even recently (within the past 15 years) 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 (Wynn et al, 2012).

Issues

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. Yap has 6 priority issues: Food Security, Biodiversity, Watersheds, Coastal Stabilization, Production & Sustainable Harvest, and Capacity Building (Table Y 1 that follows), all which are closely connected. Yapese still depend on agroforestry for subsistence, and Food Security is a primary concern for stakeholders. Biodiversity relates to the protection of ecosystem integrity, and Yap has highlighted it as a priority in several ways: through its updated 2018 Biodiversity Strategic Action Plan (YBSAP 2018), in support Forest Stewardship Plans and the development of a Protected Area Network (PAN), and in committing to the regional goals of the Micronesia Challenge. 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. 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. In the 2010 SWARS, Urban & Community Forestry was listed as an issue, but it is better described as a program that helps to address the above issues and threats, especially when communities are involved. In Yap, nearly all land is privately owned, and most activities require

community engagement, aside from a few developed urban centers requiring government or collaborative stewardship. Invasive species, climate change, and wildfires were previously discussed under Biodiversity, but have been highlighted as Cross-cutting Threats as they impact each of the issues.

Table Y 1 below summarizes Yap's Issues and Cross-cutting Threats in relation to their Priority Landscapes and the USFS Primary National Themes. Maps of some of the primary priority areas are indicated in this table and inserted in the narrative with their respective issues. Additional priority area and information maps can be found at the end of this chapter.

TABLE Y 1 FSM ISSUES AND YAP STATE PRIORITY LANDSCAPE AREAS

FSM National Issues	Priority Landscape Areas	3 U.S. National Themes
Cross-cutting Threats	Areas with targeted invasive species Areas most vulnerable to wildfires, especially those adjacent to forests of high natural integrity and areas being restored Map Y15	1 Conserve 2 Protect 3 Enhance
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 Map Y3, Food Security Analysis	1 Conserve 2 Protect 3 Enhance
B. Biodiversity (Ecosystem integrity, protected areas, forest legacy)	Areas of forest with highest intact natural forests and areas that can be restored or revert to intact forest, roosting & nesting sites of wildlife, flight paths of fruit bats. Protected Areas and Areas of Biological Significance (Map Y 4, Biodiversity Analysis. Maps Y8a-8d, Map Y9)	1 Conserve 2 Protect 3 Enhance
C. Watershed	Watersheds, rivers, riverine buffer zones and wetlands. Map Y 4, Watershed Analysis. MayY10	3 Enhance
D. Production & sustainable harvesting	Areas suitable for reforestation, timber and fuel production Map Y 5, Production and Sustainable Use Analysis	3 Enhance
E. Coastal stabilization,	All Mangroves and coastal areas within 1, 2 & 5-meter zones Map Y 6, Coastal Stabilization Analysis. Map Y13. Map Y14.	3 Enhance
F. Capacity building	Non-spatial	3 Enhance

Cross-cutting threats

Invasive Species

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 UNDP GEF-6 support to the FSM will focus on invasive species.

The FSM National Invasive Species Strategy and Action Plan states that Yap's goal is to 'Keep Yap uniquely beautiful and safe by managing invasive species effectively' (NISSAP 2016).

The first Yap Biodiversity Strategic Action Plan (YBSAP) in 2004 highlighted invasive species and other threats to biodiversity, which were also addressed when the plan was updated in 2018 (YBSAP 2018), and highlight invasive species and other threats to biodiversity. To address YBSAP recommendations, Yap created a position for an Invasive Species Coordinator, organized a Yap Invasive Species Task Force (YIST), and completed a YIST Strategic Action Plan (SAP) in 2008, with the most recent version found here: YIST SAP 2018-2023. The plan identifies priority species and actions.

A considerable achievement of this program is the near eradication of one of the world's most invasive grasses, *Imperata cylindrica*. This acreage declined dramatically between 2001 and 2004, until Typhoon Sudal struck and temporarily suspended efforts, and acreage had increased by the time it resumed. This demonstrates the importance of a continued monitoring. Chain-of-Love or Sagraraw, *Antigonon leptopus,* has also been provisionally eradicated.

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*. Coconut rhinoceros beetles (CRB) are a grave concern due to close proximity with infested islands, and would wreak havoc on Yap, as the population depends on coconuts for consumption and products. Yap has detection programs in place. Little Fire Ants (LFA) are new to the island, and intensive efforts are underway to control and eradicate them. LFA and CRB are priority species in the YIST, and awareness posters can be found posted throughout the island. A root rot pathogen, *Phellinus noxius*, was found to be infrequent in Yap in 2013, but is prevalent in Pohnpei and Kosrae and should be monitored (Cannon et al, 2014).

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 40 years, at least 22% of Yap has been burnt during drought periods.

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 official response system now used by Yap State.

In 2002, Region 5 Fire and Aviation Management (F&AM) 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). In 2004, Yap State began mapping areas burnt by wildfires as part of the Yap State/Queen's University GIS program. 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 the past decade, the program has had many highlights. Yap DAF works closely with the Division of Public safety, and the fire section has increased its capacity with needed fire engine parts, field equipment for fire suppression, and GPS assistance in mapping burned areas, fire hydrant locations, access roads and water lines.

Yap DAF is involved in several wildfire awareness initiatives. It conducts yearly programs to at least ten

BURNED AREA IN RUMUNG, YAP. PHOTO CREDIT: RYAN TALKEN

elementary schools and ten communities, and distributes awareness materials such as fire safety coloring booklets, posters, t-shirts, hand towels and backpacks to the students and community members. Yap has an annual cycle of eco-events (i.e., Yap Day, Earth Day, Tree Planting Day), and additional awareness materials are shared, including brochures, posters, fire safety booklets, Smokey bat T- shirts, cinch backpacks & hand towels, are distributed to participants during Yap's annual cycle of eco-events (Yap Day, Earth Day, Tree Planting Day). A new (2020) Yap Wildfire Awareness Curriculum was developed with USFS support and Yap DAF assistance.

Capacity building is ongoing. Yap DAF has hired nine college level students as interns, creating incentive for students to receive degrees in fire science, forestry or further training in wildfire management. One Yap DAF staff member and five community members from Tomil Municipality traveled to Orlando, Florida to receive training on wildfire prevention, mitigation and education and wildfire suppression management systems used in the United States.

Humans cause many of the wildfires on Yap are human, due to activities such as burning to clear garden areas that grows out of control. Yap State EPA developed regulations for the management of fire permits and burning, and sends out notice of fire risk in times of drought.

Yap DAF works with communities to improve their capacity to prevent and respond to wildfires. One highlight was a community wildfire suppression workshop with experts from the USFS, and collaboration between F&AM, Yap DAF, and Yap DPS. Basic techniques were demonstrated. Over 37 community members from Tomil joined the training. Community “Captains” were chosen to ensure that the training is an ongoing activity, and tools used in the workshop were donated to the community.

DAF also involves communities in decreasing the size and extent of *teid* (savannah) through reforestation and natural regeneration, working in four municipalities to establish low fuel zones and shaded fuel breaks. This reduces the contiguous area of highly flammable vegetation to limit the size of areas burnt by wildfires. Over 23,000 trees were planted to establish the shaded fuel breaks, covering approximately 52 acres of savannah.

Additional information on wildfires Yap and strategies to address them can be found in the Yap State Wildfire Plan (Yap 2009), and the Yap State Community Wildfire Protection Plan (CWPP) developed in 2011. The CWPP was a collaborative effort between USFS, Yap DAF, and Yap Division of Public Safety. It is currently the only such plan in the FSM, and can serve as a model for additional plans.

Climate Change

Direct impacts from climate change on terrestrial resources include threats to traditional agroforestry systems through saltwater intrusion, droughts and typhoons (SOE, 2018). Climate change is identified as a major threat to all FSM National Issues and is exasperating the negative impacts of numerous other issues such as loss of land for agroforestry, decrease in coastal stabilization, increase in invasive alien species, fragility of biodiversity and ecosystem health, and human impacts such overharvesting of terrestrial resources and development projects. The Yap Joint State Action Plan for Disaster Risk Management and Climate Change provides additional details regarding climate change projections for Yap, and approaches to risk reduction, including several projects in recent years. It noted that current farming systems are insufficient in addressing climate change impact, and low-lying areas are at risk of inundation and erosion (Yap JSAP, 2015). Strategies in this FAP should be considered with a climate lens for planning and implementation. The Pacific Islands Managed and Protected Area Community (PIMPAC) has a Local Early Action Planning (LEAP) toolkit for climate change that can be utilized with communities.

A. Food Security

A vegetation survey reported that about 26% of Yap island was used for agroforestry, with agroforests, 5 categories of agroforests (Falanruw et al 1987). Agroforests serve as food production areas, sources of fiber and medicines while providing the ecosystem services of forests. On the main island, Yapese have long practiced indigenous management of fallow through taro patch and tree garden agroforest systems (Falanruw 2002). 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 and climate-smart agroforestry strategies 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 continued for the past decade, increasing pressure on forest resources of Yap in new ways, though many of the settlements that have expanded in the past decade have done so in already degraded areas, and are supported by COM-FSM CRE, Yap government, and other partners.

Conditions and Trends

Observations and market data suggest that the traditional food production system of mainland Yap has been reduced in extent and productivity. 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. Information on current conditions and trends are continuously being collected, most notably through the 2016 FSM wide Agriculture Census (FSM 2019).

Strengths:

Agroforestry is still very important to Yapese culture. Community focused projects supported by Yap DAF, COM-FSM CRE, and USFS competitive grants are seen as Yap's greatest food security strength. On Yap main island, this includes programs to plant fruit trees on private land, providing seeds and seedlings to the public from an established seedbank and nursery. Coconut rhino beetle (CRB) surveys are conducted and traps set at entry ports and commercial areas to protect coconuts, and little fire ant (LFA) control is ongoing, with over 55 acres treated including agroforest areas. Residents are encouraged to plant crops where invasive species such as chain of love and *Imperata* were eradicated. With shifting attitudes over time, it's no longer a stigma for Yapese women to buy traditional crops, resulting in more purchases from local markets. Agroforestry projects have support from a variety of organizations and agencies, including the Yap Women's Association and traditional councils. Yap DAF and partners provide information and awareness during regular events such as Yap Day and the Agriculture Fair. In the Outer Islands, food security through climate change adaptation is a focus, with artificial taro patches installed to mitigate the effects of sea level rise on crops. Additionally, the *Melai Mai* (breadfruit garden) project aims to rehabilitate breadfruit.

Weakness:

While traditional crops remain important, increased consumption of imported food was a top weakness. Information gaps include economic valuation of agroforestry crops, especially coconuts, and a study to assess why taro patches are being abandoned. Research and capacity building are needed, but there are

only so many available staff. Yap has had to turn down opportunities to collaborate with visiting researchers due to not having available staff to work with them.

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.

Assessment of crops resilient to climate change is key. In general, more training and capacity building is an ongoing opportunity. Current and upcoming projects and funding sources such as UNDP GEF 5&6 will help implement strategies identified later in this document. One example under the GEF 5 Ridge to Reef (R2R) Project is conducting an economic valuation of agroforestry resources, a request that DAF has long identified as a priority.

Threats

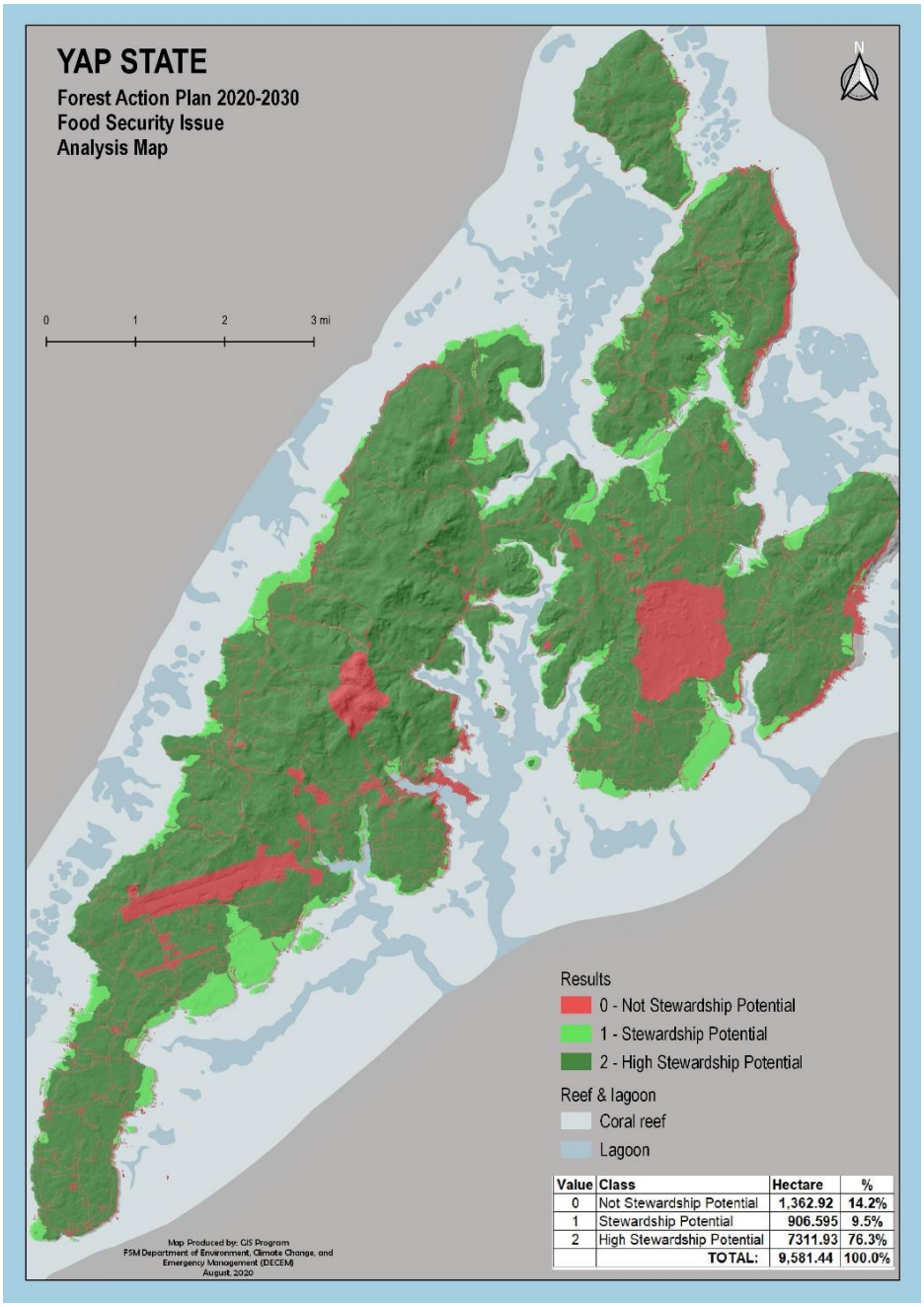
Population growth and people's desire to be able to drive up to their houses and to have power and water have resulted in the settlement of families away from their traditional agroforestry estates or bulldozing of agroforest areas. Water management systems have not been maintained as well as in the 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. Preference for imports could also result in a loss of traditional agroforestry practices.

Climate change remains a top threat, in particular to taro patches with salt water inundations. Invasive species presence continues to increase and threaten local crops, with the newest threat from Little Fire Ants (LFAs) recently come to the island, and the fear that coconut rhino beetles might reach the island. Two new infestations were found in Daboch and Meeruru villages. Pests that threaten Yap's trees include white flies, aphids, breadfruit borers, and mango fruit flies, the latter of which Yap DAF set up traps to combat.

Priority areas

Traditional tree garden/ taro patch agroforests and lands that can be reconditioned into agroforest production systems are key. For the high islands, agroforest and secondary forest are target areas, with higher priority on fertile soils and lower priority on low elevations. On atolls, all arable land is priority since it is limited.



Value	Class	Hectare	%
0	Not Stewardship Potential	1,362.92	14.2%
1	Stewardship Potential	906.595	9.5%
2	High Stewardship Potential	7311.93	76.3%
	TOTAL:	9,581.44	100.0%

Y3 – Yap main island – Food Security analysis map

This map shows the result of the reclassification and overlay analysis of Yap's spatial layers including the 2007 PIC vegetation, 2019 protected and conservation areas, ABS, developed areas, and hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the food security issue for Yap main island. The analysis was done only for the main island because there is no available spatial data and layer for the neighboring islands. Dark green areas represent the high potential areas, which include agroforest, secondary, and upland forest (76.3%), light green areas represent the potential areas, which include the wetlands (9.5%), and the red areas represent the not potential areas, which include developed areas and conservation areas (14.2%) for the food security issue in Yap.

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 2004-2023 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" (FSM 2004).

Conservation of Biodiversity is shown to be a priority for Yap, from the international to community level. The FSM 2019-2023 National Environmental Strategy provides a five-year framework for environmental strategies. It Includes Theme 2, Terrestrial Resources, and Theme 4, Conservation of Biodiversity. These two themes help track Yap's progress toward the global Aichi targets, and Sustainable Development Goal (SDG) 15: Life on Land (NEMS 2019). The Micronesia Challenge initiative had an initial goal to effectively conserve 20% of terrestrial resources by 2020, which was increased to 30% by 2030 in 2019 with endorsement from Yap's Governor (24th MIF Communique). The Yap State Biodiversity and Strategic Action Plan (Yap 2018) identifies many strategies that align with this FAP. The UNDP GEF FSM Ridge to Reef Program has a goal of no net loss of intact forests through its time span, and also supports Protected Area Network (PAN) development. It is thus important to Yap to conserve a significant percent all of Yap's intact forests types, including additional area of mangroves that are also important to coastal stabilization.

Conditions and Trends

Strengths:

Increased opportunities for funding was a top identified strength, including the sustainable financing that the Micronesia Challenge Endowment will offer. Yap State gained more direct access and decision-making ability when utilizing funding channeled through National Government. Partner support within and outside of Yap increased, along with local environmental organizations and individuals working in terrestrial conservation. Capacity building opportunities also increased.

There was improved documentation of terrestrial resources over the past decade: watershed mapping with support from Dr. Perkins and Queens University, the aforementioned Yap tree identification guide by Dr. Marjorie Falanruw, and the 2016 Forest Inventory Analysis that was expanded to include additional sampling for the Micronesia Challenge (Appendix 1).

The FSM launched a Protected Area Network (PAN) Framework in 2018, and resources and guidelines to support effective management of protected areas were developed. The Nature Conservancy developed a spatial analysis report to help inform PAN development. Yap established new community driven terrestrial protected areas with Forest Stewardship and management plans (i.e., the Weloy Forest Stewardship area, fruit bat sanctuary). These and additional terrestrial activities are replicable and have the potential to serve as models for future projects, and are supported by many partners and stakeholders such as the FSM Ridge to Reef program, Yap Locally Managed Area Network (LMAN).

Efforts to combat invasive species are ongoing, with targeted treatment of African tulip and lantana. Two strengths are the successful eradication of chain-of-love and *Imperata* in Yap, and involvement in the

Regional Invasive Species Council, which allows for collaboration across Micronesia. Planning, implementation, and funding of wildfire prevention projects increased. Overall, awareness of conservation issues and stewardship of resources has increased in Yap.

Weaknesses:

The primary weakness in addressing biodiversity conservation identified in Yap is the amount of work needed to be done without enough skilled individuals to do it. There are few dedicated staff for terrestrial resources, and are often stretched too thin with multiple duties. Coordination of existing conservation efforts, particularly toward the MC goals, could be improved.

Limited funding was seen as an issue overall along with sustainability, with the majority of funding coming from USFS and other outside sources. This is an additional challenge for invasive species, when the state is responsible for eradication but no local funds are available. The time it takes to apply for funds can delay efforts on the ground resulting in the spread of invasive species. There isn't yet an internal mitigation plan for IAS, and minimal awareness among the public, with new ornamental plants being brought to Yap and residents unsure how to address IAS already on island.

The concept of 'taking care of Yap' and stewardship is part of Yap's culture, but traditional knowledge isn't always passed down, and youth aren't always interested or seeking it. While modern research and documentation has improved, the results of studies don't always get back to communities or even partner organizations.

Opportunities:

The Micronesia Challenge provides the potential for immediate technical support and coordination as an enabling mechanism, an incentive to advance progress toward the MC goals, and has the potential to provide access to sustainable financing through the Endowment. A strategy identified for Yap in 2010 was to hire a Micronesia Challenge Coordinator at the Division of Agriculture and Forestry (DAF 2009). This was temporarily fulfilled in 2020 with the establishment of a Yap PAN Coordinator, but institutionalization and long-term funding is still needed. The USFS Forest Legacy Program (FLP) is an opportunity for another kind of protected area, and an "Assessment of Need" was under preparation as of 2020, to be added to this Forest Action Plan at a later date. Combining the protection of priority forest sites with historic preservation sites should be considered in partnership with the Yap State Historic Preservation Office (YSHPO).

Improved mapping of traditional resources is still highly desired, with LIDAR a priority to capture vegetation types, traditional land use systems, and more. Continued commitment to achieving the Micronesia Challenge goals opens up increased opportunities to tap into resources and collaborate with neighboring islands. Yap has many replicable successful terrestrial projects that can be expanded and serve as models.

The possibilities to improve information sharing and coordination are many; one potential step is to expand research permits. Establishing a cross sector group, or revitalizing the Environmental Stewardship Consortium, could allow for effective coordination, and cross sector efforts such as disaster planning create additional opportunities to bring in a conservation and biodiversity lens.

Yap hopes to continue its momentum in managing and eradicating IAS by updating biosecurity laws and regulations and increasing awareness. An overarching opportunity is community willingness to improve and effect change.

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 the more recent trend of moving away from the coast to more upland areas, resulting in the deforestation of some of the few remaining intact forests.

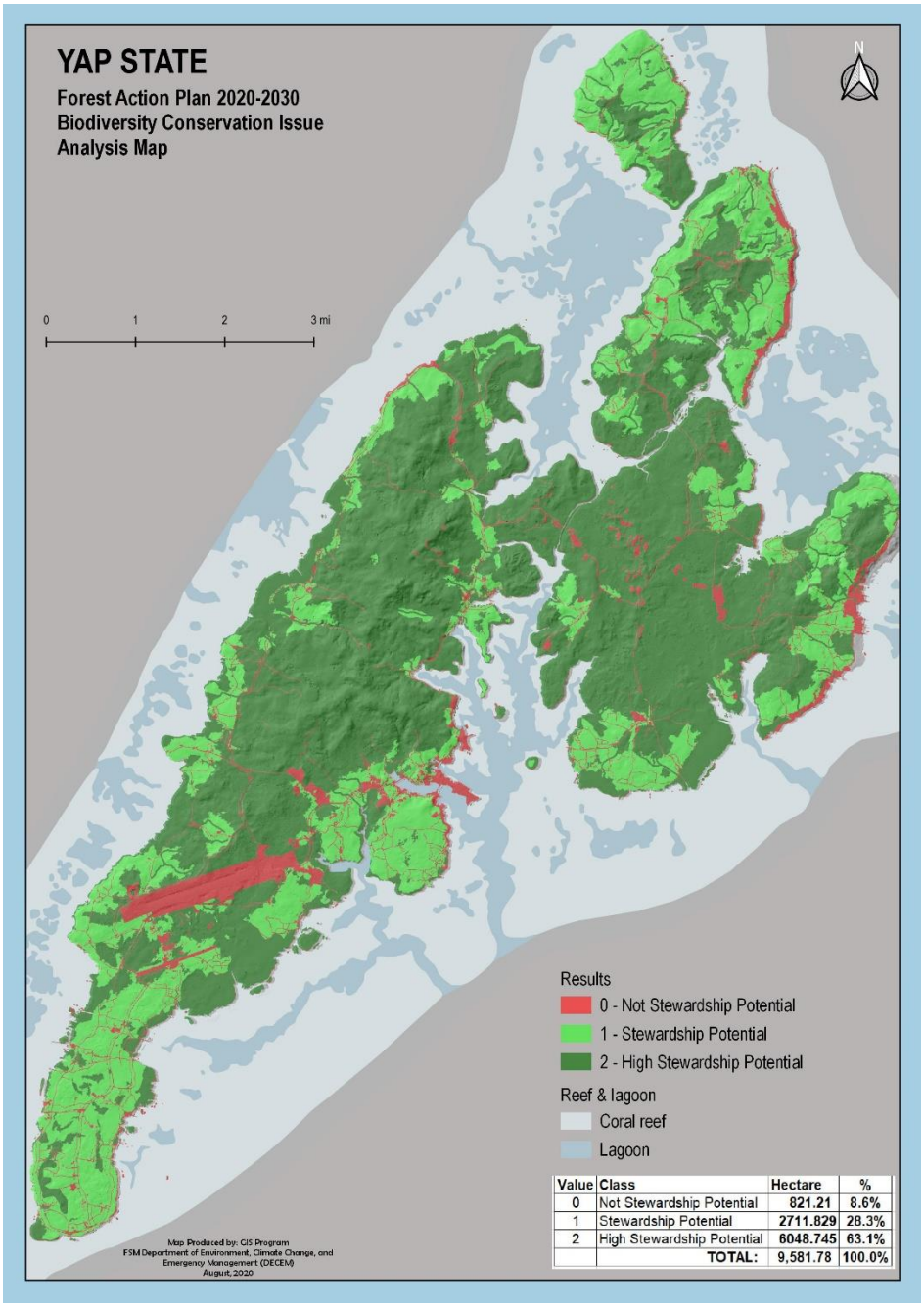
Mangroves are threatened by roads, fill, and conversion. Roads are an especially urgent threat as when roads are made between mangroves and marshes without sufficient and properly located culverts, water circulation between the systems is interrupted to the detriment of both mangroves and marshes. This 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 fully recovered over a decade later. 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 Yap 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 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.

The greatest identified potential threat is political will, as any change in government priorities can affect everything on the ground. Climate change will continue to have an array of impacts, including the potential for increased natural disasters, erosion, wildfires, etc. Outmigration and the shift to 'modern' jobs can result in fewer people to fulfill community roles and locally manage resources. Increased travel and mobility can also result in new IAS arriving. Poorly planned development and limited land use regulations could negatively impact resources in Yap.

Priority areas

Priority landscapes for biodiversity are areas with the highest intact natural forests, areas that can be restored or revert to intact forest, roosting & nesting sites of wildlife, and flight paths of fruit bats. All Protected Areas and Areas of Biological Significance (ABS) are priority sites. Additionally, areas most vulnerable to wildfires, especially those adjacent to forests of high natural integrity and areas being restored, and areas with targeted invasive species are high priority.



Y4 – Yap main island – Biodiversity Conservation analysis map

This map shows the result of the reclassification and overlay analysis of Yap's spatial layers including the 2007 vegetation, 2019 protected and conservation areas, ABS, developed areas, invasive species, and hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the biodiversity conservation issue for Yap main island. The reclassification analysis was only done for the main island. Dark green areas represent the high potential areas, which include upland forests, wetlands and the conservation areas (63.1%), light green areas represent the potential areas, which include agroforest and secondary vegetation (28.3%), and the red areas represent the not potential areas, which include developed areas (8.6%) for biodiversity conservation issue in Yap.

C. Watersheds

Conditions and trends

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.

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.

The watershed monitoring project, prioritized in the previous 2010-202 FAP and successfully implemented, came about to provide a way to assess resources in Yap without having to describe village boundaries and thus avoid any controversy. The proposal Yap submitted to USFS was ranked highest in the Western Region competition, and received the full amount requested. The project resulted in detailed watershed mapping and GIS layers, available for public use at Yap State Division of Land Resources. Some streams still require mapping, and not all areas were considered watershed, but the information allows communities to better understand resources and aid in effective planning and management. Results are described in a 'Watershed-Based Approach to Food Security and Sustaining Biodiversity on Yap', a report prepared for USFS grant 12-1G-11052021-223 (Ruegerong et al).

Strengths:

The project mapped all watersheds in Yap by type and vegetation and provided public access to the information, which was a great strength and led to additional actions. Taro patch types were mapped, and community surveys conducted to record any salt water intrusion with additional ground truthing to verify results. Yap DAF is involved in ongoing restoration of terrestrial resources, rehabilitation of taro patch and stream banks, and planting of wildfire breaks. TNC is working with women with a focus on erosion and storm water management, and the FSM Ridge to Reef project is supporting restoration and land use planning. Yap EPA has established earth moving regulations. Within communities, traditional knowledge of watershed management and erosion through stone paths and ditch beds has been preserved.

Weaknesses:

Inadequate funding is the primary ongoing weakness. As in other areas, the amount of hard work exceeds the number of people with the capacity to carry it out. While watershed areas are now mapped out, development in adjacent properties could have negative impacts, and the Yap's regulations for environmental impact assessments might not capture all potential issues. Overall watershed management is difficult as streams run through many private landowner properties within municipalities.

Opportunities:

Technical and financial support from the USFS is a key opportunity. Additional partners and the potential for more can be considered. Yap state recognizes the need to manage natural resources at the watershed level, or from ridge to reef. Along with biological monitoring, continuing socio-economic surveys that capture community perception of the watershed and sharing outcomes with partners could better inform efforts.

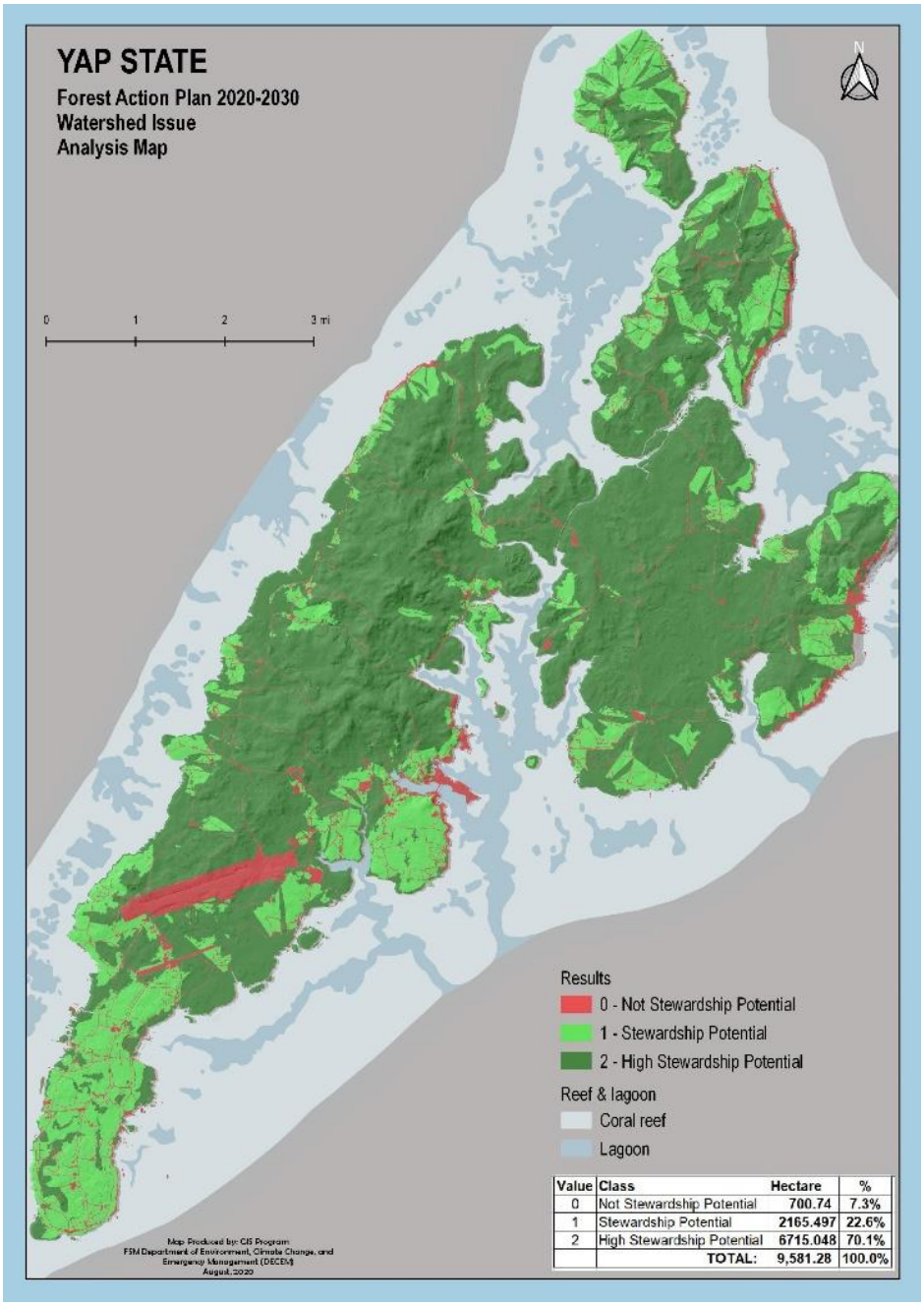
Threats

Poor development was seen as the number one threat to Yap watersheds. Other prominent threats are unpaved roads causing erosion, wildfires, invasive species and impact of climate change. 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. Sawmills are increasing on Yap. Mismanagement of watersheds can also lead to indirect issues such as dengue fever and leptospirosis.

Priority areas

Watersheds, rivers, riverine buffer zones and wetlands.

PHOTO CREDIT: RYAN TALKEN



Value	Class	Hectare	%
0	Not Stewardship Potential	700.74	7.3%
1	Stewardship Potential	2165.497	22.6%
2	High Stewardship Potential	6715.048	70.1%
	TOTAL:	9,581.28	100.0%

Y5 – Yap main island – Watershed analysis map

This map shows the result of the reclassification and overlay analysis of Yap's spatial layers including the 2007 vegetation, 2019 protected and conservation areas, ABS, developed areas, watersheds and streams, and hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the watershed issue for Yap main island. Dark green areas represent the high potential areas, which include upland forest, wetlands and the watersheds (70.1%), light green areas represent the potential areas, which include agroforest and secondary vegetation (22.6%), and the red areas represent the not potential areas, which include developed areas (7.3%) for watershed issue in Yap.

D. Production & sustainable harvesting

Conditions and Trends

Yapese traditionally managed the exploitation of natural resources through a hierarchical system of estates. This cultural allocation 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 earth-moving machinery has resulted in environmental impacts that were not previously possible. Use of personal sawmills on island has continued, resulting in unsustainable felling of large trees, and an increase in access roads to reach them.

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. Natural resources appear to be deteriorating, but there is no system to monitor environmental indicators to determine status. There is some attempt through the Micronesia Challenge terrestrial scorecard.

Betelnut and coconut oil are the most common commercial forest products, along with local lumber. Yap considers ecotourism and landscaping/beautification projects as part of production and sustainable harvest.

Strengths

Reforestation projects are seen as Yap's strongest approach toward production, and a big part of the Urban and Community Forestry Program, Forest Stewardship Program and Fire & Aviation Management Program. The Yap State Registration Program provides for protection of historic sites, which in turn can offer protection for natural resources in the area. Once a site is registered, it can't be altered (i.e. have modern buildings) as a requirement from the National Park Service through Yap State Historic Preservation Office. The Yap DAF nursery is active and continues to provide plants and trees, and community nurseries are increasing. Betelnut export is a significant livelihood in Yap. Traditionally prepared and 'virgin' coconut oil are products. Interest in ecotourism is growing: there is one trail (Tamilyog) that is accessible to the public that has a brochure for a self-guided hike, and some of the hotels take visitors on kayak tours through mangroves. Yap has

'beautification' programs to plant local flowering and ornamental trees and shrubs in urban areas and along roadsides.

Weaknesses

Capacity to implement projects was the greatest identified weakness, followed similarly by poor development planning. The increase in number and use of sawmills was a continued concern, but difficult to address as sawmills and resources are privately owned. Local trees are preferred for building materials and handicrafts, as they are better quality, last longer in the tropical environment, and are significantly cheaper than imported lumber, which is also limited in supply.

FSM as a country 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. It might be possible to derive some information from the 1988 timber survey (MacLean et al 1988) and the Forest Inventory & Analysis results (2005 and 2016). There is an urgent associated need for information on the *in-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. Due to the small size of Yap island, it is unlikely that any type of timber industry would be feasible or sustainable. Since most resources are private, and use is therefore up to the landowners, it would be helpful for them to have information needed to make informed decisions. Yap has prioritized conducting an economic valuation of forest resources as part of its Food Security strategies, but this could be extended to species with additional value.

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. Protection and production and sustainable harvesting efforts could be tied in with ecotourism.

Funding and additional personnel to implement projects was the top priority for 2020. There are many opportunities for awareness and outreach activities to continue, especially related to wildfires. There are ongoing activities to assist communities with management and conservation planning, and it's a continued strategy identified in this FAP. There's the potential for the government to better oversee plans from residents to relocate inland as a result of climate change and mitigate impact.

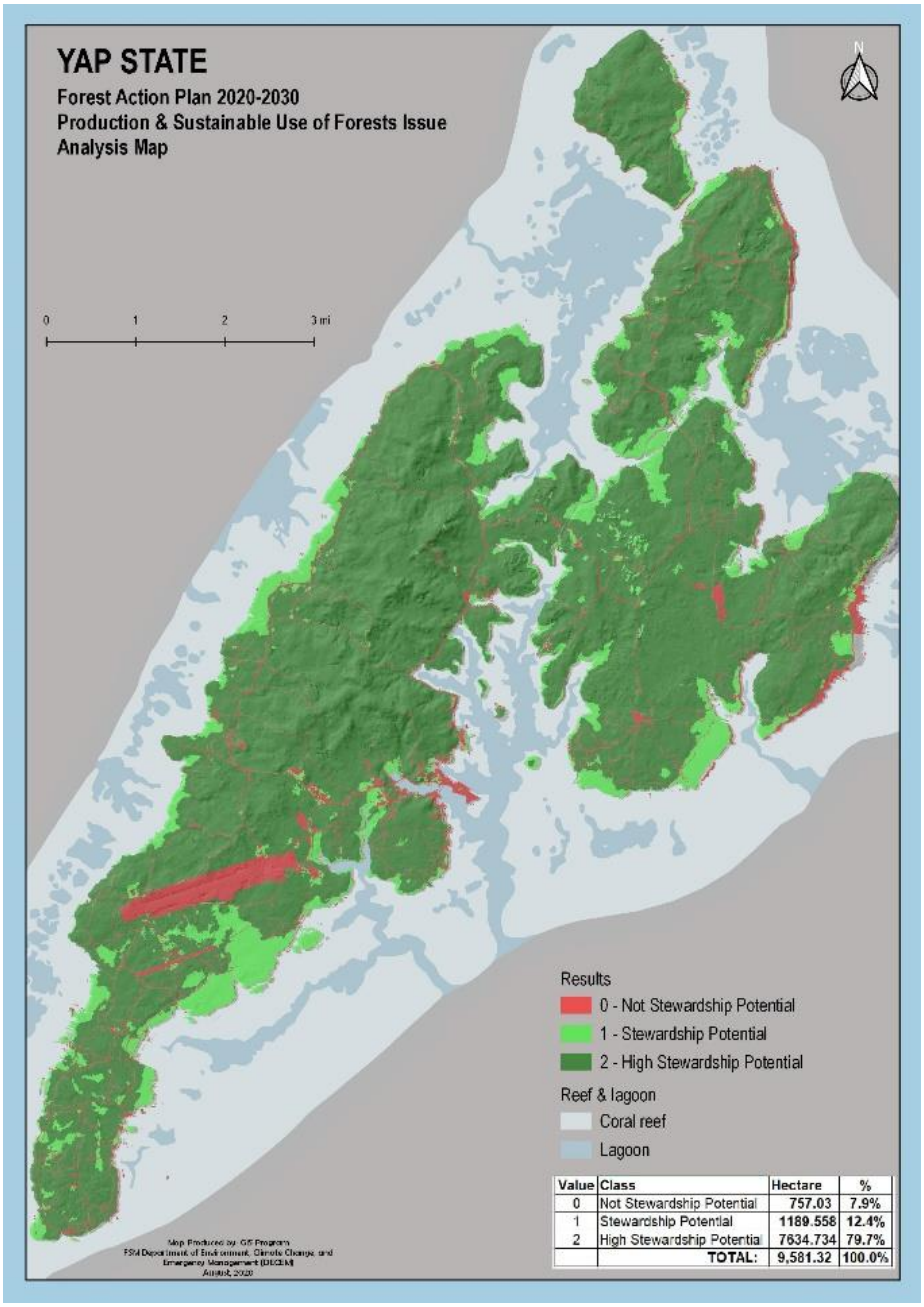
Threats

Climate change impact resulting in communities moving inland and clearing/using resources to build was the greatest threat. Related human activities (earthmoving, slash/burn gardening, resulting erosion, additional development) all impact forest areas.

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.

Priority areas

Areas suitable for reforestation, timber and fuel production, coconut production.



Y6 – Yap main island – Production & Sustainable Use of Forest analysis map

This map shows the result of the reclassification and overlay analysis of Yap's spatial layers and data including the 2007 vegetation, 2019 protected and conservation areas, ABS, developed areas, and invasive and hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for the issue of production and sustainable use of forest of Yap main island. The analysis was done only for the main island. Dark green areas represent the high potential areas, which include upland forest, secondary vegetation, and savanna (79.7%), light green areas represent the potential areas, which include wetlands and agroforest (12.4%), and the red areas represent the not potential areas, which include the developed areas (7.9%) for the issue of production and sustainable use of forests in Yap.

E. Coastal stabilization

Conditions and Trends

Coastal forests and especially mangroves help reduce coastal erosion, and protect inland areas from storms. Mangroves provide important habitat and nursery sites for wildlife. 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 15 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, in April 2004, greatly damaged areas where dieback had already begun (original dieback cause unknown), and have still not recovered (Cannon et al, 2014). Coastal erosion in the Outer Islands has removed areas of beach strand and even caused the loss of coconut trees and atoll forest trees.

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.

Strengths:

Yap has established mangrove reserves and rehabilitated damaged areas to improve coastline protection through mangrove and nipa planting. Harvesting of coastal resources (i.e. cutting mangroves to cook lime) is improving. Traditional management of waterways is being revived, and community and organization capacity to manage coastlines is improving.

Weaknesses:

Monitoring and enforcement were the described as crucial weaknesses during consultations. It's difficult to track if existing regulations regarding coastal activities are being followed, and how to address the issue when they aren't. Coastal dredging, sand mining and seawalls all negatively impact coastal areas. Erosion from activities in the watershed followed by increased rainfall leads to sedimentation along the coast. The capacity to effectively address coastline resource degradation is limited.

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.

Opportunities

LIDAR to adequately evaluate coastal resources was previously identified as a priority and was reiterated as an important opportunity.

Improved monitoring is needed that includes sediment traps, as aerial photos have indicated runoff from erosion, especially near roads. This could be part of a larger SEA assessment similar to what's been conducted for Pohnpei and Kosrae under the FSM R2R Project to develop and update their respective land use plans. The SEA should review alternative livelihoods to any identified destructive practices. The SEA could provide the opportunity to develop a coastal management plan that also includes protecting ABS sites.

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.

Yap DAF can continue rehabilitation of coastal and inland areas. With limited time and funds, a potential strategy would be to train communities to do the implementation, similar to current activities under R2R for Yap. Yap Marine Resources and Management Division should be a close partner in plans and activities involving the coastline.

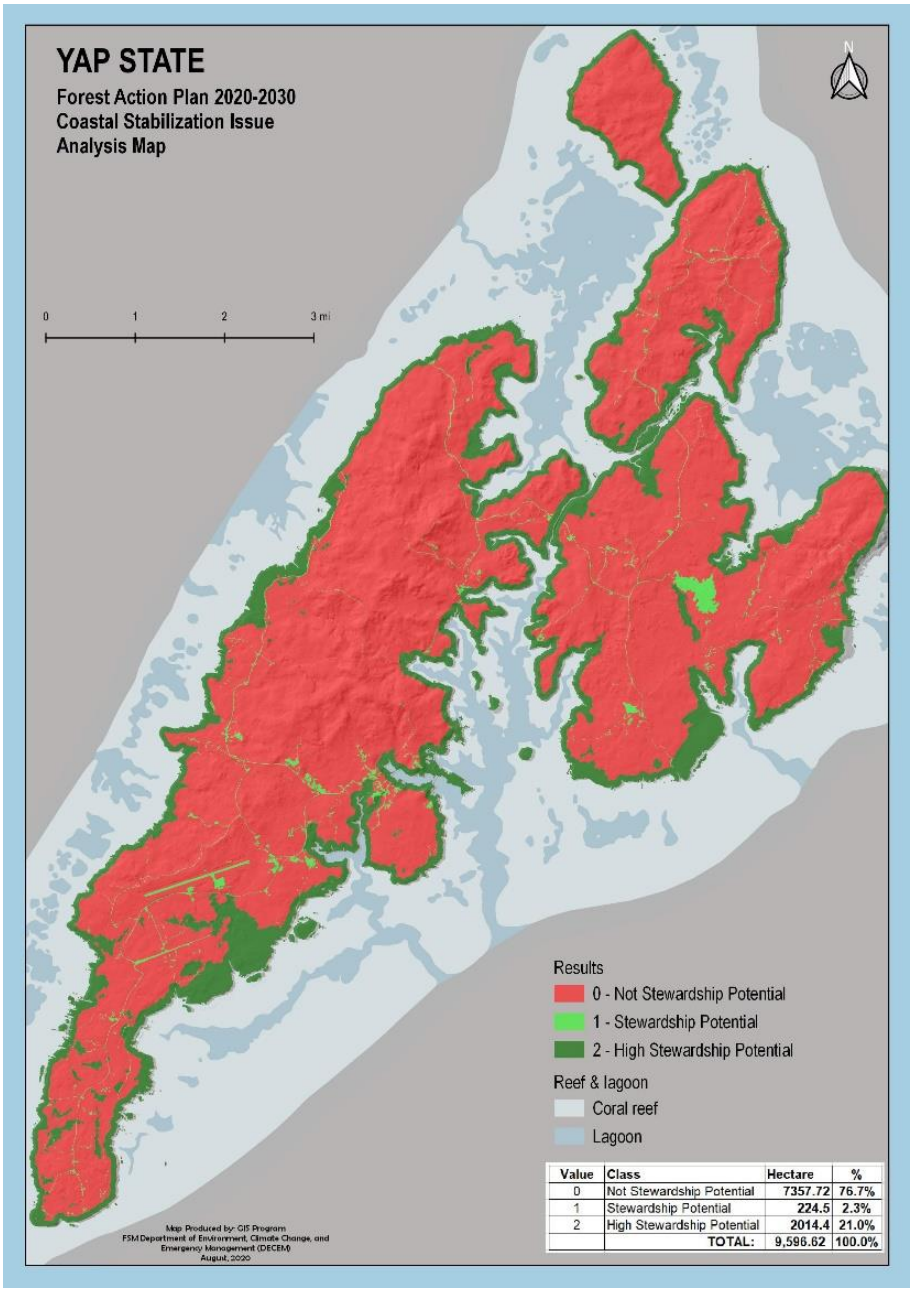
People's concern over recent high waters may result in less damage to mangroves and coastal forest, and possible willingness to plant trees for coastal protection. Recent data on the high levels of carbon sequestration by mangroves and the potential for income for "carbon credits" may induce coastal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

Threats

Unplanned and poorly planned development is the greatest threat for coastal areas. Dredging operations (replacement material from off island would be costly), 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.

Priority areas

The priority areas for consideration includes all mangroves and coastal areas lower than 5 meters elevation. 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 affected by sea level rise and storm surge.



Value	Class	Hectare	%
0	Not Stewardship Potential	7357.72	76.7%
1	Stewardship Potential	224.5	2.3%
2	High Stewardship Potential	2014.4	21.0%
	TOTAL:	9,596.62	100.0%

Y7 – Yap main island – Coastal Stabilization analysis map

This map shows the result of the reclassification and overlay analysis of Yap's spatial layers including the 2007 vegetation, 2019 protected and conservation areas, ABS, developed areas, and inundation and flooding hazard data into 3 classes showing areas that are considered high stewardship potential, stewardship potential and not stewardship potential for coastal stabilization issue for Yap main island. The analysis was done only for the main island. Dark green areas represent the high potential areas, which include mostly mangroves and the 100m inundation hazard zone from the shoreline (21.0%), light green areas are the potential areas (2.3%), and the red areas represent the not potential areas (76,7%) for coastal stabilization issue in Yap.

F. Capacity-building

Conditions and trends

Local forestry staff are needed for ongoing programs and to provide expertise to communities as they plan and implement resource management projects. 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 funding.

Strengths

The College of Micronesia-FSM Yap campus has an agriculture certificate program that DAF supports, along with an intern program for college and high school students. DAF regularly provides conservation education and awareness to school students through the forestry outreach program, and awareness and training to communities on key issues such as wildfires, invasive species, and agroforestry. This has expanded in recent years with support from the U&CF program. New wildfire curriculum was launched in 2020 with support from USFS. Support is available to individual landowners as well through Forest Stewardship, and DAF has a number of forestry outreach clients.

Weaknesses

Not enough staff with too many ‘hats’/responsibilities was emphasized in 2020 as the number one weakness. There are increasing expectations and demands on the time of Yap Forestry staff as a result of a number of initiatives such as the Micronesia Challenge. 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. In addition, some staff are headed toward retirement, and there are few younger staff, and low interest from the younger generation in forestry in general. For some projects, lack of specialized capacity can be a constraint. Sometimes a trained forester/certified arborist is necessary. Due to logistics of providing support to remote areas, there is limited support for and access to Rumung and the Outer Islands: extension agents to Outer Island communities have been reassigned to work with Outer Island settlements on Yap main island.

USFS Region 5 State & Private Forestry (S&P) grants are the only reliable ongoing source of support to enable Yap Forestry to respond to growing needs, and it is crucial to maintain a base level of funding to retain Yap DAF staff.

Opportunities:

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

Yap government could improve communications with outside agencies and donors to ensure that visits, workshops and trainings align with Yap’s priorities and schedule, and produce relevant results (i.e. needed certification, plans, etc.)

The Institute of Pacific Islands Forestry (IPIF) offers an intern program to develop capacity of local staff, as well as many training and technical support opportunities.

There are several supportive local and regional networks. The Pacific Islands Managed and Protected Area Community (PIMPAC) focuses on capacity building of resource managers, the Yap Locally Managed Area Network shares information between community managers, the Micronesians in Finance and Administration Network (MFAN) promotes administrative skills, and the Micronesians in Conservation (MIC) network targets building emerging leaders.

For college students, internships are available through the Micronesia Challenge Young Champion program, and graduate students can apply for fully funded Bill Raynor Micronesia Challenge scholarships in natural resource related concentrations.

Technology continues to improve, along with opportunities for online training and certifications, which was noted as having the greatest potential in 2020.

Threats

The younger generation moving off island or not being interested in agriculture and forestry is viewed as the primary threat, followed by the possibility of the compact sector funds ending in 2023.

Priority areas

Capacity building is non-spatial, and therefore does not have a priority landscape area. However, it is perhaps one of the most important issues for Yap, as building capacity will assist with addressing the other 5 priority issues and cross-cutting threats. The capacity building section in Yap's strategies below is the largest, and includes actions related to mapping/obtaining up to date imagery, coordination, information sharing, awareness and conservation education.

YAP STATE FOREST RESOURCE STRATEGY

Table Y-2 below shows current and potential sources (funding, technical assistance, and capacity building) of the resources required to carry out Pohnpei's Forest Action Plan strategies. The list is neither all-inclusive or limited to these entities and programs, but it shows the most frequent supporters.

Table Y-3 summarizes strategies for addressing the Cross-cutting Threats and each of the FSM Issues. The table also includes the primary USFS and other programs that contribute resources and technical support and the main cooperators for each strategy. Resources and capacity are limited in the FSM, and successful implementation of these strategies will require technical and funding support from multiple partners and donors. While key existing and potential partners are listed within the table, it is anticipated that there will be additional opportunities.

TABLE Y 2 YAP STATE RESOURCES REQUIRED

Resources Required: USFS, Other Partners, Funding Sources and Co-operators for Yap State			
USFS/US	**International & Regional**	**National**	**State**
Forest Health (FH)	The Nature Conservancy (TNC)	UNDP GEF-5 FSM Ridge to Reef	Yap State Government
Urban & Community Forestry (U&CF)	Micronesia Conservation Trust (MCT)	UNDP GEF-6 FSM Invasive Species	Department of Youth and Civic Affairs (DYCA), Yap Dept of Education (DOE)
Forest Stewardship (FSP) Fire and Aviation Management (F&AM)	Secretariat of the Pacific Regional Environmental Programme (SPREP) The Pacific Community (SPC)	UNDP GEF-7 FSM Sustainable Land Management	Department of Resources & Development (Yap R&D) Division of Agriculture and Forestry (DAF)
Western Competitive Grants* (WCP) *includes Landscape Scale Restoration (LSR)	Green Climate Fund (GCF) Adaptation Fund (AF)	College of Micronesia – Federated States of Micronesia, Cooperative Research and Extension (COM-FSM CRE)	Yap Court, Yap Office of the Attorney General (OAG) Yap Division of Public Safety (DPS)
Forest Legacy Program (FLP) Community Forestry and Open Space Program (CFOS)	United Nations Development Program (UNDP) Global Environment Facility (GEF) and Small Grants Program (SGP)	FSM Department of Resources and Development (FSM R&D)	Yap Division of Land Resources (DLR) Yap Environmental Protection Agency (EPA)
USFS Institute of Pacific Islands Forestry (IPIF)	Water and Environmental Research Institute of the Western Pacific (WERI)	FSM Department of Environment, Climate Change & Emergency Management (DECEM)	Yap Community Action Program (YapCAP), Yap Protected Area Network (PAN) Yap Environmental Stewardship Consortium (ESC)
USDA Natural Resources Conservation Service (NRCS) USDA Rural Development (USDARD)	Food and Agriculture Organization of the United Nations (FAO) Japan International Cooperation Agency (JICA), Australia Agency for International Development (AusAID)	FSM Department of Transportation, Communications & Infrastructure (FSM TC&I)	Tamil Resources Conservation Trust (TRCT), Kaday Community and Cultural Development Organization (KCDO)
United States Geological Survey (USGS)	Pacific Islands Managed and Protected Area Community (PIMPAC)	FSM Department of Education (FSM DOE)	Yap Invasive Species Taskforce (YIST) Yap Locally Managed Area Network (YLMAN)
US Department of Interior (DOI)	Red Cross International Union for Conservation of Nature (IUCN)	FSM Supreme Court	Yap Farmer's Association (YFA) Yap Women's Association (YWA) Council of Pilung (COP), Council of Tamol (COT) Traditional leaders, communities

National Oceanic and Atmospheric Administration (NOAA)	Catholic Relief Services (CRS)		

TABLE Y 3 YAP STATE FOREST ACTION PLAN STRATEGIES

FSM Issues	Strategies*	Resources Required		Main Co-operators (DAF for all)	US National Themes	Performance Measures
	***priority strategies for Yap are highlighted in yellow**	**US Forest Service**	**Other**			
Cross-cutting	Update wildfire vulnerability maps and prioritize community eligibility for development of wildfire plans, training & equipment	F&AM, U&CF, FH	FSM R&D, DAF, DLR, MCT, GEF-5, GEF-6, GEF-7, RISC, DECEM	DPS, YIST (refer to SAP), LR, NGOs, communities	1 Conserve, 2 Protect, 2 Enhance	Up to date maps, communities prioritized and capacity enhanced for CWPP
	Determine most effective system of fire breaks to break up large flammable areas, train communities, establish fire breaks					Establishment of fire breaks, CWPP
	Prevent, manage and eradicate invasive species (Implement YIST plan and update as needed, work with RISC, follow FSM biosecurity plan)					# species managed, # and location of acres treated & # and location of acres surveyed or inventoried
A. Food Security	A.1. Evaluate agroforestry resources with respect to climate change & Sea Level Rise (SLR) (both mainland Yap (WAAB) and Outer Islands (OI)	FSP, U&CF, WCP, USFS research	FAO, SPC, MCT, COM-CRE, TNC, DECEM, WERI, CRS, FSM R&D, SPC, SPREP, GEF-5, GEF-7, GEF-SGP, AF, GCF	LR, COM-CRE, TRCT, KCDO, YWA, YFA, COP, COT, NGOs, communities	1 Conserve, 2 Protect, 2 Enhance	A.1. Resource information, Maps showing agroforest that are susceptible to sea-level rise
	A.2. Develop profiles of elevation and habitats of OI					A.2. Elevation and habitat profiles of the O.I.
	A.3. 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					A.3. Establishment of watershed/hydrology extension program, environmental literacy

	A.4. Work with communities to develop best practices for enhancing & expanding agroforestry & other food production systems adapted to SLR					A.4. Agroforest enhancement and expansion plan
	A.5. Survey genetic resources & select priority varieties for propagation & distribution to enhance & expand agroforestry systems					A.5. Propagation and distribution of priority plant/tree species
	A.6. Enhance and expand DAF and community nurseries					A.6. # of nurseries, communities supported
	A.7. Work with communities to develop proposals and projects that enhance & expand agroforests & other adaptive food production systems					A.7. # proposals/projects, #communites/people, #acres managed. Forestry/Agroforestry community driven instead of government driven
	A.8. Conduct economic valuation of agroforestry resources on Yap (main island and O.I.)					A.8. Economic valuation study available to inform agencies and land owners
B. Biodiversity	B.1 Conduct surveys and inventory species, support FIA and MC monitoring. Develop additional monitoring methods and establish indicators	FSP, U&CF, F&AM, WCP, FLP, CFOS, USFS research	FSM R&D, DECEM, Yap govt., DAF, MCT, TNC, PAN, GEF 5 R2R, GEF SGP, COM-CRE	Yap PAN, Yap LMAN, Yap govt, COM-CRE, TRCT, KCDO, NGOs, COP, COT, communities	1 Conserve, 2 Protect, 2 Enhance	B.1. Up to date inventory and monitoring results
	B.2. Develop and support rehabilitation, restoration and reforestation programs with communities of degraded (due to wildfire, etc) sites					B.2. Savanna reforestation program, # acres restored

	B.3. Support the Micronesia Challenge (MC) and FSM/Yap Protected Area Network (PAN). Develop information base and capacity to assist communities/private landowners with developing terrestrial protected/managed areas plans (i.e., Forest Stewardship, management plans). Ensure areas and plan incorporate relevant information (ABS sites, TNC gap analysis, FIA data, LEAP/MPAME/METT tools)					B.3. establish information base for development of plans (FIA, etc) # Community/private landowners forest stewardship and management plans, # acres managed
	B.4 Evaluate opportunities for conservation easements and similar programs					B.4. Assessment of Need complete, Forest Legacy Areas or other easements established
C. Watersheds	C.1. Evaluate and prioritize watersheds & develop best practice guides for watersheds, forests, agroforest & mangroves (i.e., opportunities to use SEM to guide)	FSP, U&CF, WCP, USFS research	FSM R&D, DECEM, DAF, MCT, TNC, GEF-5, GEF-7, GEF SGP, COM-CRE	LR, YapCAP, YWA, COP, COM-CRE, TRCT, KCDO, NGOs, communities	1 Conserve, 3 Enhance	C.1. Development/implementation of watershed plan
	C.2. Provide extension to communities to enable them to evaluate their watersheds, make use of GIS database and develop plans and proposals for projects (i.e., tree planting, erosion, sediment control)					C.2. Development and implementation of watershed management plans and projects
	C.3. Implement best practices for enhancement of watersheds (i.e., restoration and rehabilitation)					C.3. Develop and implementation of watershed management plans and projects
D. Coastal Stabilization	D.1. Conduct surveys & work with partners & communities to identify and develop best coastal stabilization practices	FSP, U&CF, WCP, USFS research	FSM R&D, DECEM, DAF, TNC,	LR, EPA, Yap Public Works, COM-	1 Conserve,	D.1. Coastal stabilization guidelines/plan developed

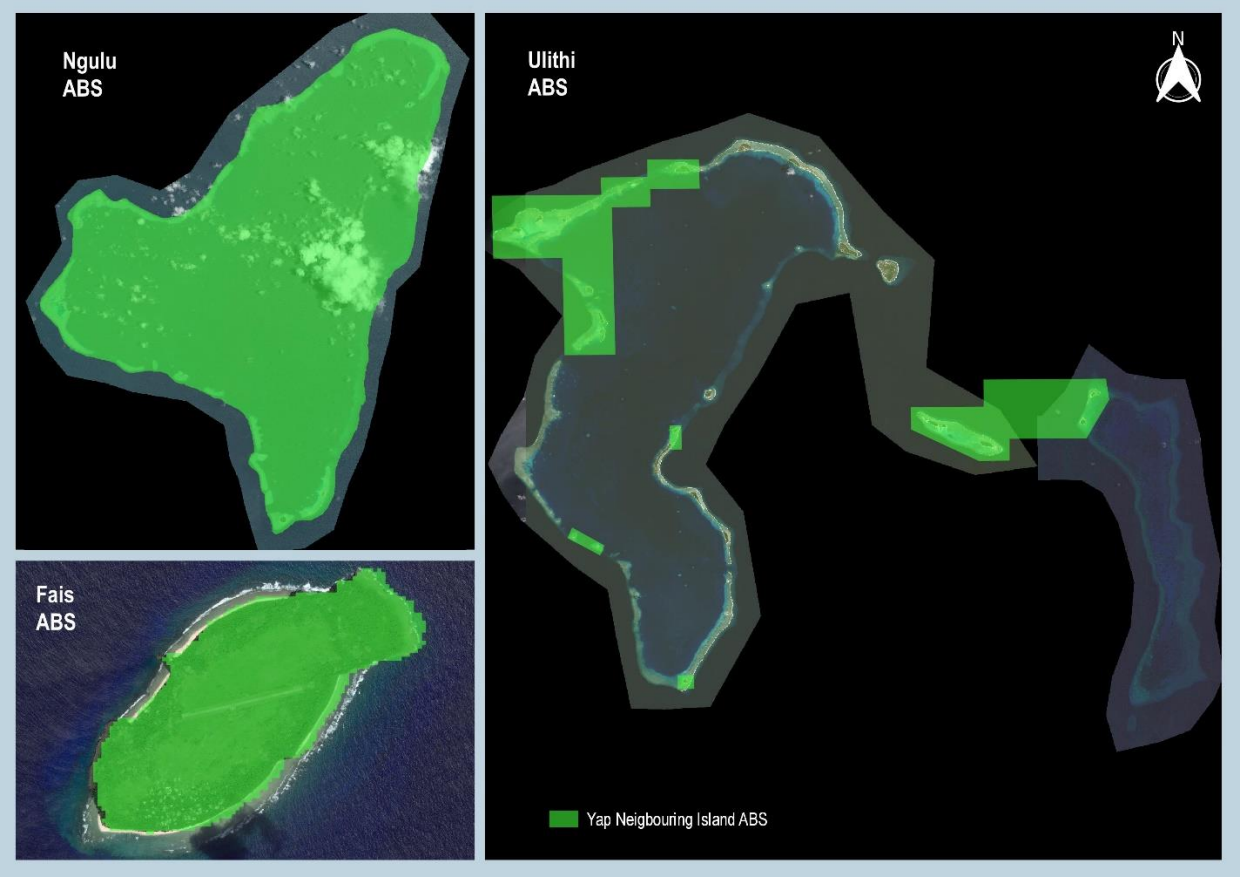
	D.2. Work with partners & communities to implement best coastal stabilization practices		MCT, GEF-5, GEF-7, SPC, SPREP, AF, GCF	CRE, TRCT, KCDO, communities	2 Protect, 2 Enhance	D.2. #coastal stabilization practices implemented, #communities, #acres managed
	D.3. Monitor mangroves, evaluate mangrove dieback and develop methods for restoration					D.3. mangrove surveys, mangrove restoration plan developed
	D.4. Work with communities to conduct mangrove restoration & coastal stabilization projects					D.4. Restoration of mangrove dieback and stabilization of the coastline, #acres
	D.5 Determine value of mangroves, ecosystem services					D.5. mangrove valuation information
E. Production and Sustainable Harvest	E.1. Obtain assistance to evaluate production value, determine sustainable timber and non timber harvest (and develop and implement priority actions based on assessment) (i.e., coconuts)	FSP, FH, F&AM, U&CF, WCP, USFS research	FSM R&D, MCT, TNC, GEF-7, Vital, Coconuts 4 Life (C4L), SPC, SPREP	YapCAP, COM-CRE, Yap govt, TRCT, KCDO, DPS, NGOs, communities	1 Conserve, 3 Enhance	E.1. Resource valuation, Establishment of timber annual sustainable cut
	E.2. Develop trails and other ecotourism projects (note: trails can serve as firebreaks)					E.2. Development of ecotourism project and trail, # ecotourism sites
	E.3. Convert some savanna lands to timber and non timber production					E.3. Conversion of Savanna into timber land
	E.4. Convert some savanna lands to croplands with enhanced fallow					E.4. Conversion of savanna into cropland
	E.5. Assist with landscaping/beautification projects					E.5. Acreage & # communities/private landowners assisted
F. Capacity Building	F.1. Ensure adequate number of Yap DAF forestry staff	FSP, FH, F&AM, U&CF, WCP	FSM R&D, DECEM, MCT, TNC, GEF-5, GEF-6, GEF-7, PIPTIEM, University of Guam, SPC, SPREP,	YapCAP, COM-CRE, Yap govt, TRCT, KCDO, DPS, NGOs, Yap PAN, Yap LMAN, EPA, OAG, LR, communities,	1 Conserve, 2 Protect, 2 Enhance	F.1. Adequate staff
	F.2. Provide relevant forestry training, with emphasis on capacity development that confers certification as forestry professional (such as the arborist certification offered by ISA)					F.2. Qualify/certified forestry staff, ISA

	F.3 Improve conservation education (CE) and increase awareness through Annual Cycle of Eco-events, School Outreach, and Community Outreach. Utilize existing communication strategies (MC, R2R) or develop/improve where needed		DYCA, DOE, DPS	Yap DOE, ESC, Yap Historic Preservation Office, Public Works		F.3. # and type of outreach programs
	F.4 Improve coordination by revitalizing and utilizing the Yap Environmental Stewardship Consortium, U&CF, and other technical committees and networks (LMAN, etc)					F.4. Active committees and networks
	F.5 Improve data collection, storage, and access to information					F.5. Inform portal, MC web viewer
	F.6 Improve GIS/mapping capacity, and obtain current high-resolution imagery, carry out surveys & produce updated maps (i.e., vegetation, wildfire, etc) to determine trends					F.6. Updated vegetation & resource maps & analyses
	F.7 Support and improve student and intern capacity programs (PIPTIEM, COM interns, COM ag certificate, MCYC, Bill Raynor)					F.7. # students, interns
	F.8 Develop “utility training” for chainsaw safety and ISA certification of tree workers and arborists, and chainsaw safety					F.8. # trainings
	F.9 Increase capacity of DAF, DPS, and communities to manage wildfires (Yap-US cross training, community fire break training, etc.)					F.9. Yap-California cross training program, community training

	F.10 Establish a permitting/review system for visiting researchers, and a coordinated project review process so that research and projects are appropriate, information is shared, and capacity is built with local partners					F.10. Permitting system in place for researchers, review process in place for projects
	F.11 U&CF/Forest Stewardship Board training/workshop					F.11. # training/workshop
	F.12 Identify and utilize relevant online training opportunities					F.12. # training opportunities identified and utilized

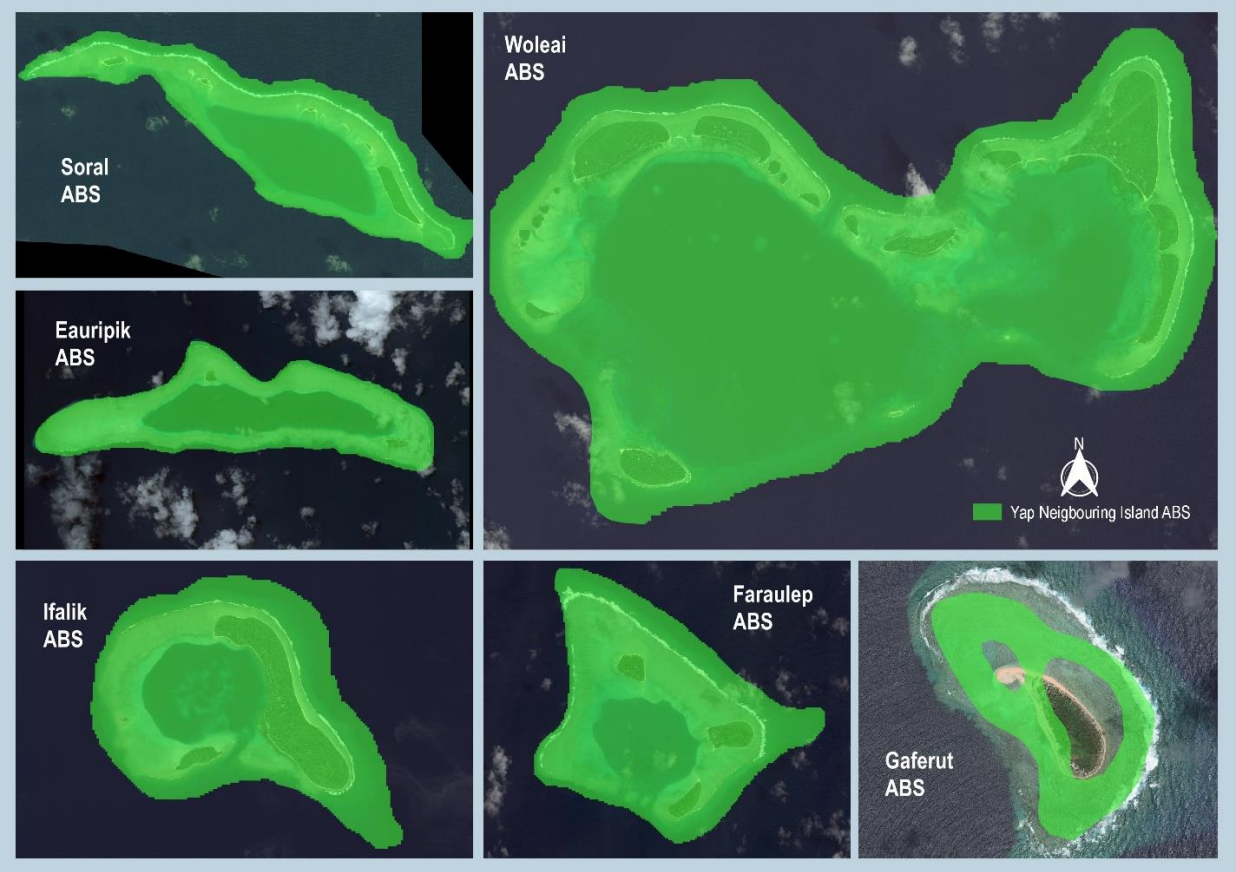
All other mapped priority areas

Y8a – Yap main island – Areas of Biodiversity Significance (ABS) map
This map shows the Areas of Biodiversity Significance (ABS) of Yap's main island overlaid on the Yap 2016 WorldView-3 high-resolution satellite image.



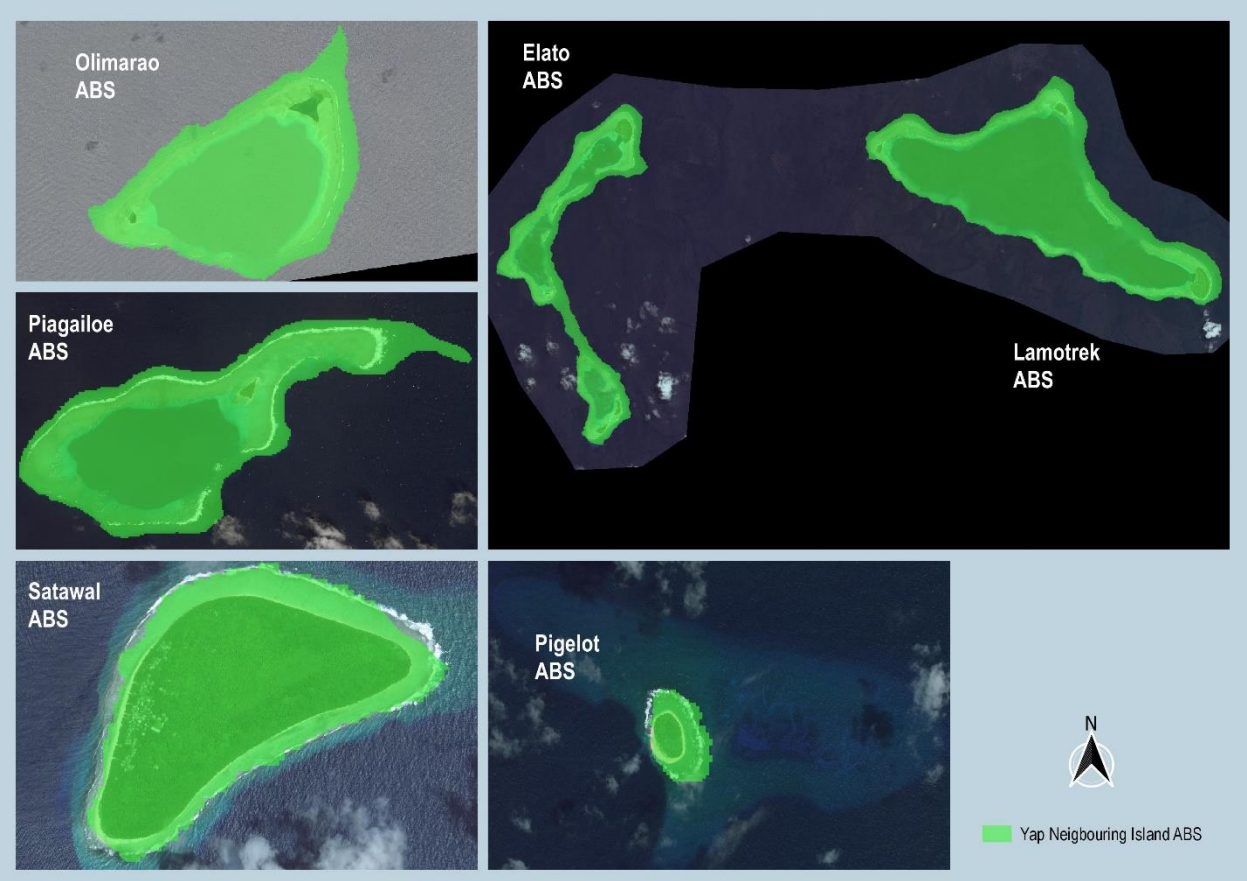
Y8b – Yap neighboring islands – Areas of Biodiversity Significance (ABS) map1

This map shows the Areas of Biodiversity Significance (ABS) of Yap's neighboring islands including Ngulu ABS, Ulithi ABS, and Fais ABS overlaid with the 2016 WorldView-3 high-resolution satellite image of each of the islands.

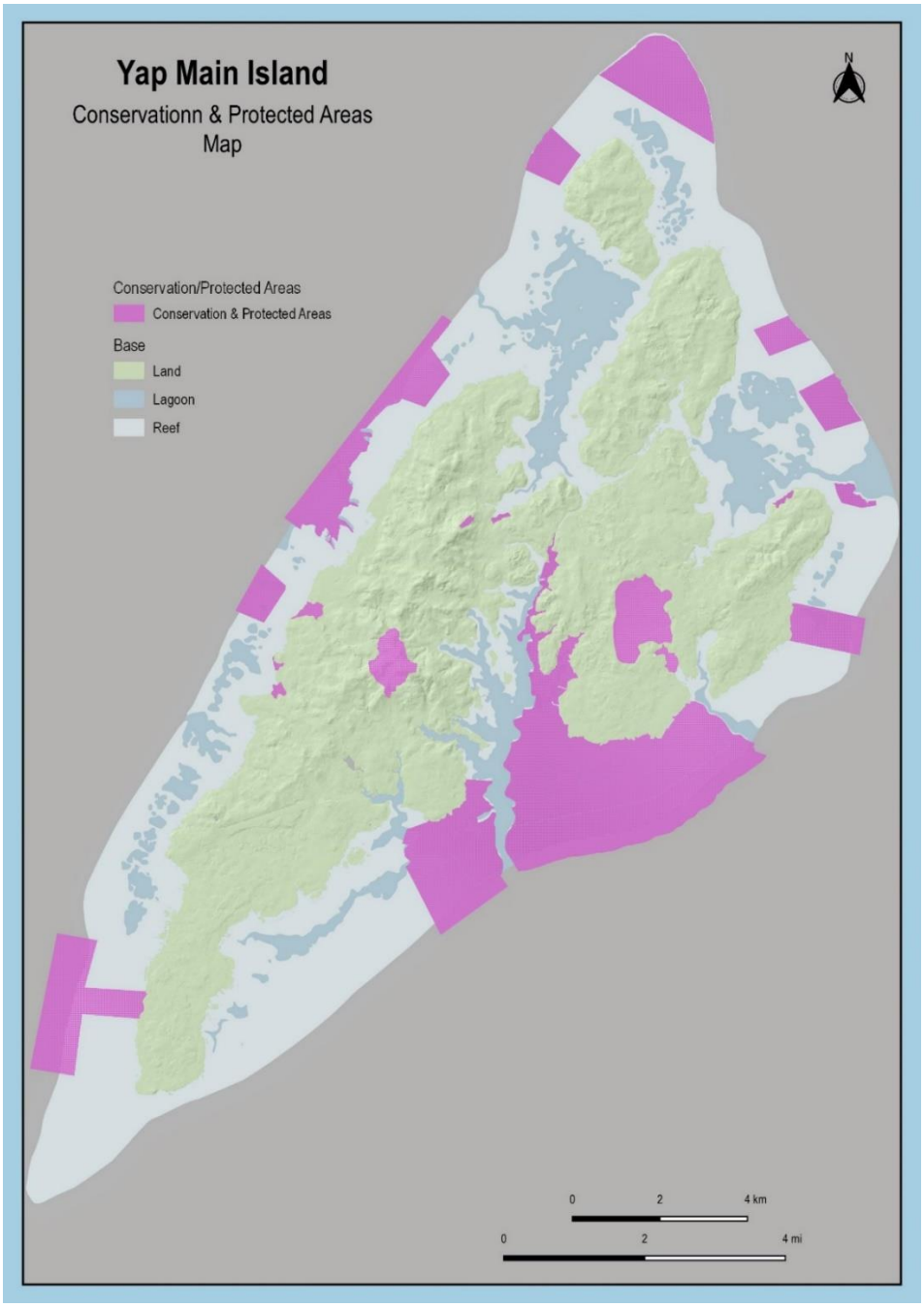


Y8c – Yap neighboring islands – Areas of Biodiversity Significance (ABS) map2

This map shows the Areas of Biodiversity Significance (ABS) of Yap neighboring islands including Soral, Eauripik, Ifalik, Woleai, Faraulep, and Gaferut overlaid with the 2016 WorldView-3 high-resolution satellite image of each of the islands.

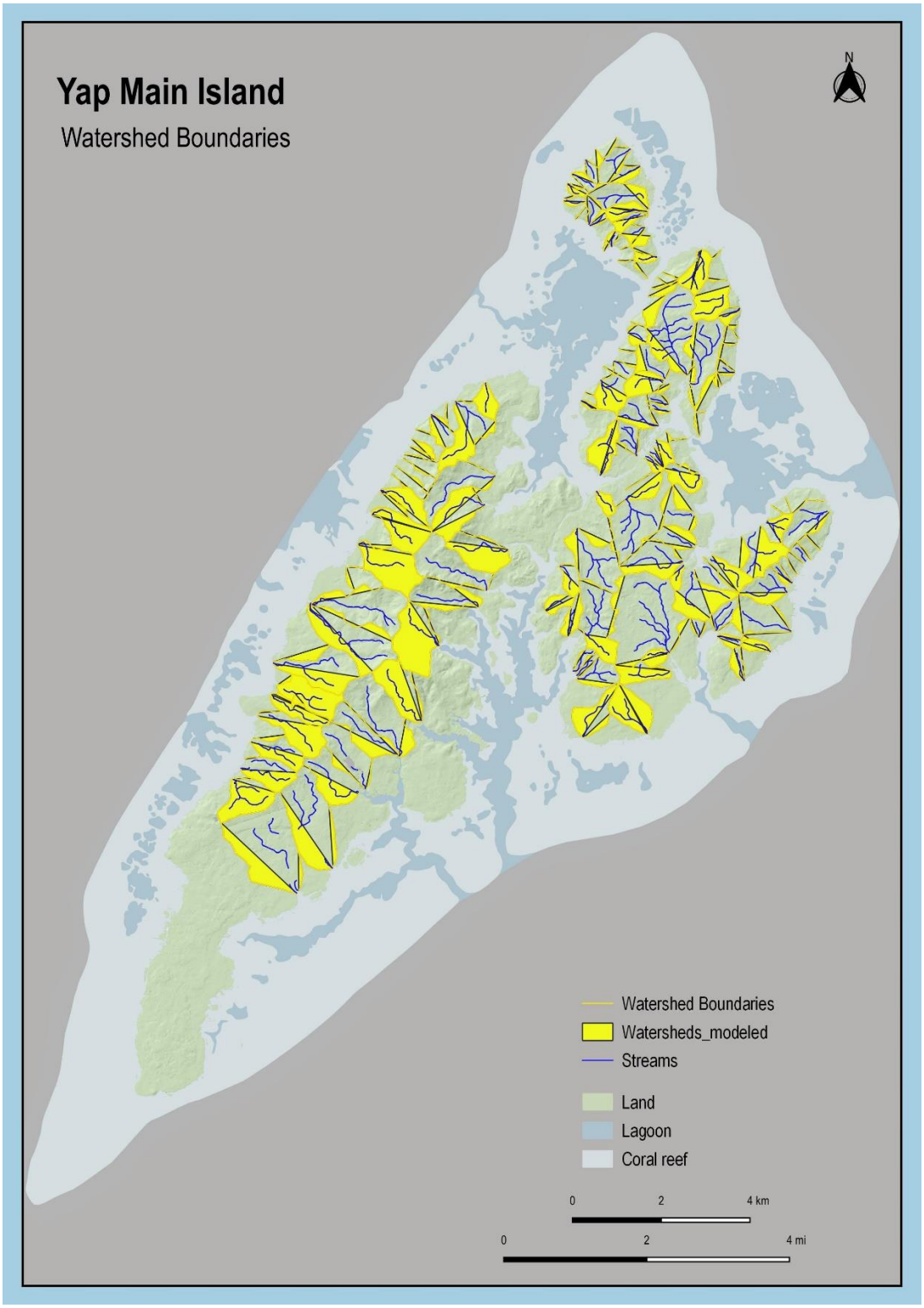


Y8d – Yap neighboring islands – Areas of Biodiversity Significance (ABS) map3
This map shows the Areas of Biodiversity Significance (ABS) of Yap neighboring islands including Olimarao, Piagailoe, Satawal, Pigelot, Elato, and Lamotrek overlaid with the 2016 WorldView-3 high-resolution satellite image of each of the islands.



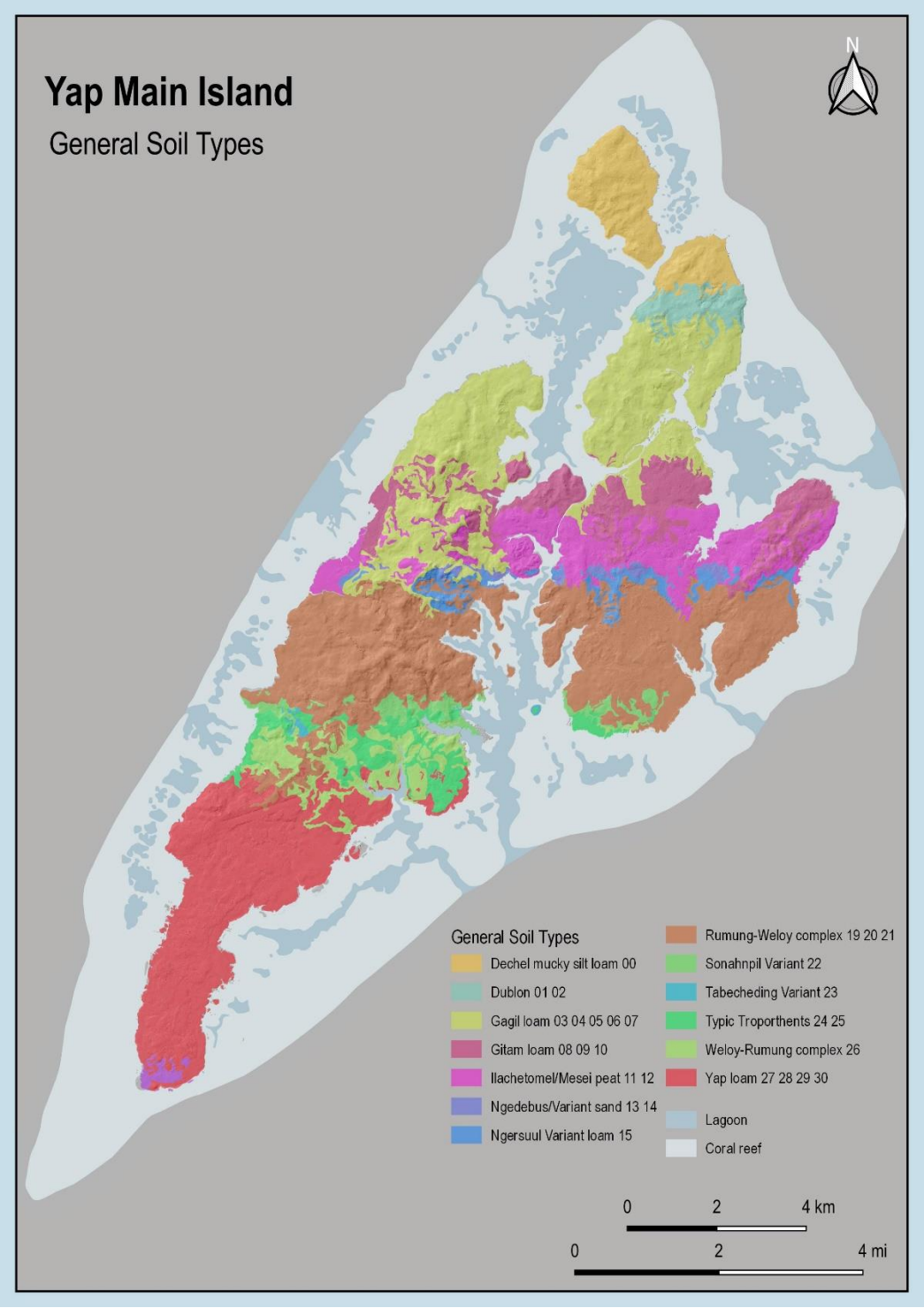
Y9 – Yap main island – Conservation & Protected Areas map

This map shows the protected and conservation sites on and around the Yap main island including the terrestrial and marine sites. The PA sites data used in this map were updated 2019. The sites as identified are community driven with support from many partners and programs, and are continually being reviewed. Partners continue to operationalize the Yap State Protected Areas Network (PAN) through the establishment of a state PAN Coordinator, office and criteria, development of the National PAN Operations Manual, and support for protected area management plans. As part of these efforts, sites will continue to be reviewed and confirmed.



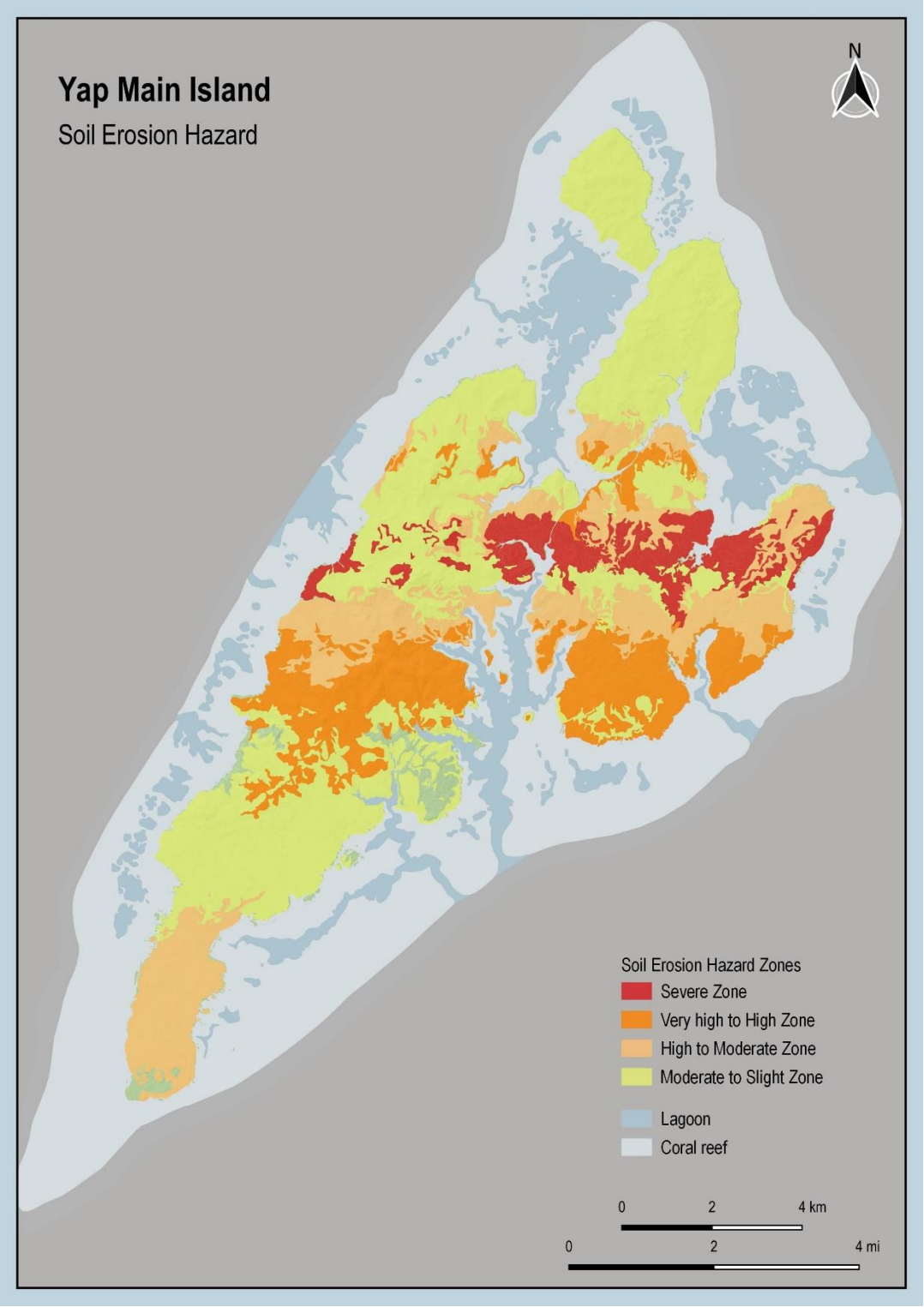
Y10 – Yap main island – Watersheds and streams map

This map shows the watershed boundaries with some of the watershed polygons modeled from the watershed boundaries and the general distribution of freshwater streams in Yap main island.



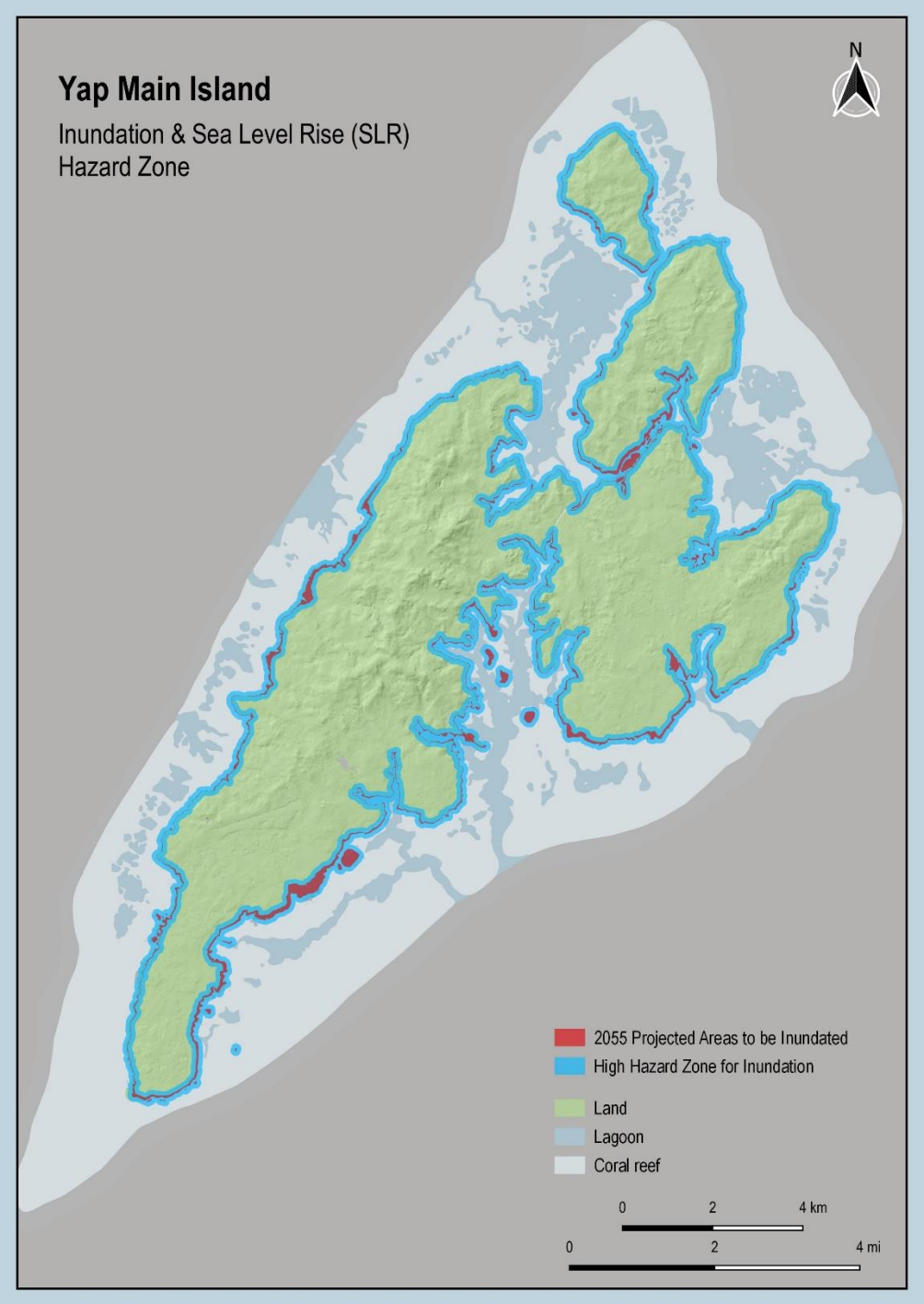
Y11 – Yap main island – General soil types map

This map shows the basic soil types of Yap main island. The original data set was created by the U.S. Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS) (1982) as part of the soil survey of the Island of Yap, Federated States of Micronesia at 1:10,000 scale. In addition to soil names and classification, the data set contains information on terrain, erosion hazard and flooding hazards.



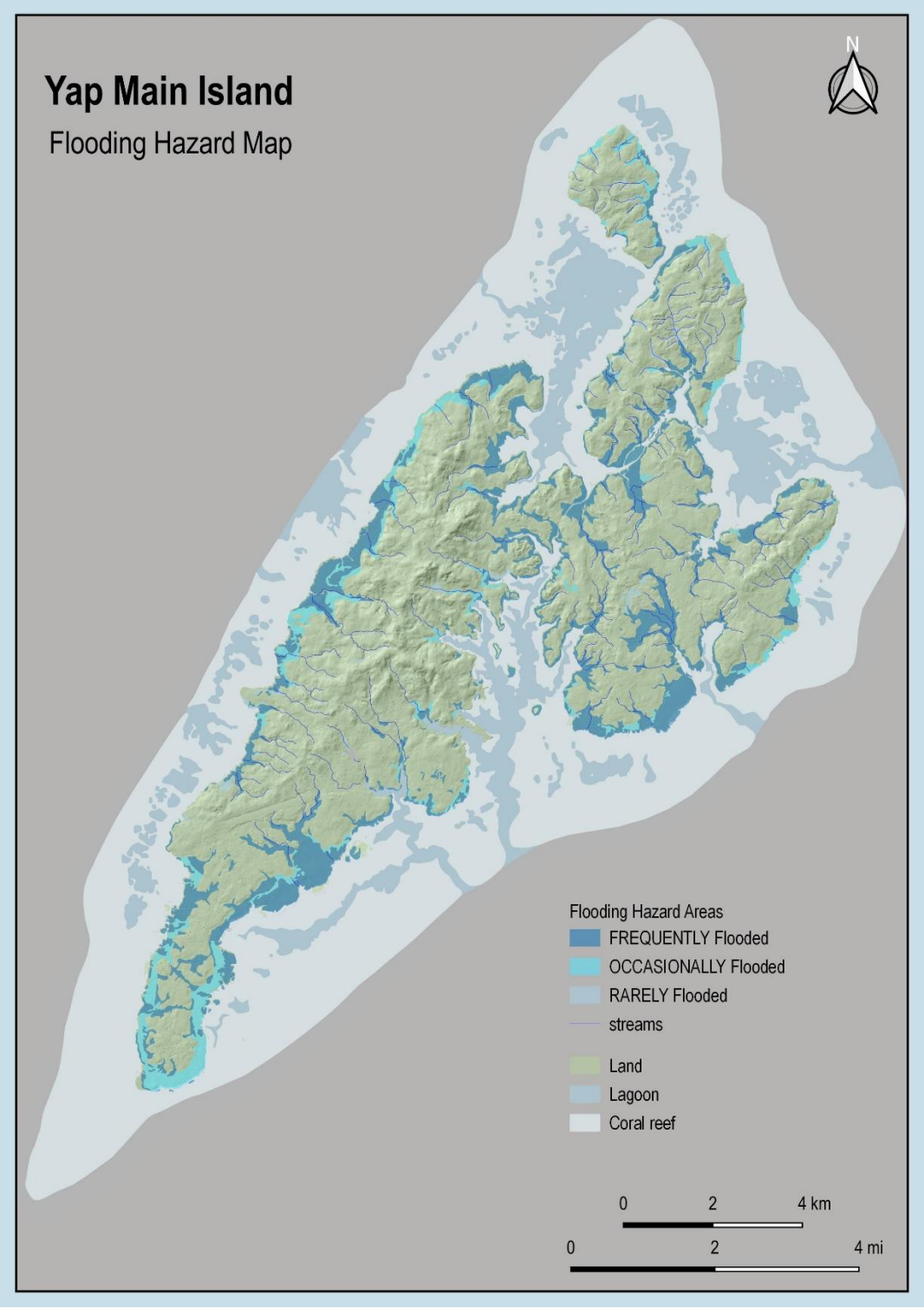
Y12 – Yap main island – Soil Erosion hazard map

This map was derived from the NRCS soil map of Yap main island showing the soil erosion hazard areas, which include severe areas, very high areas, moderate areas, and slight areas of erosion hazard.



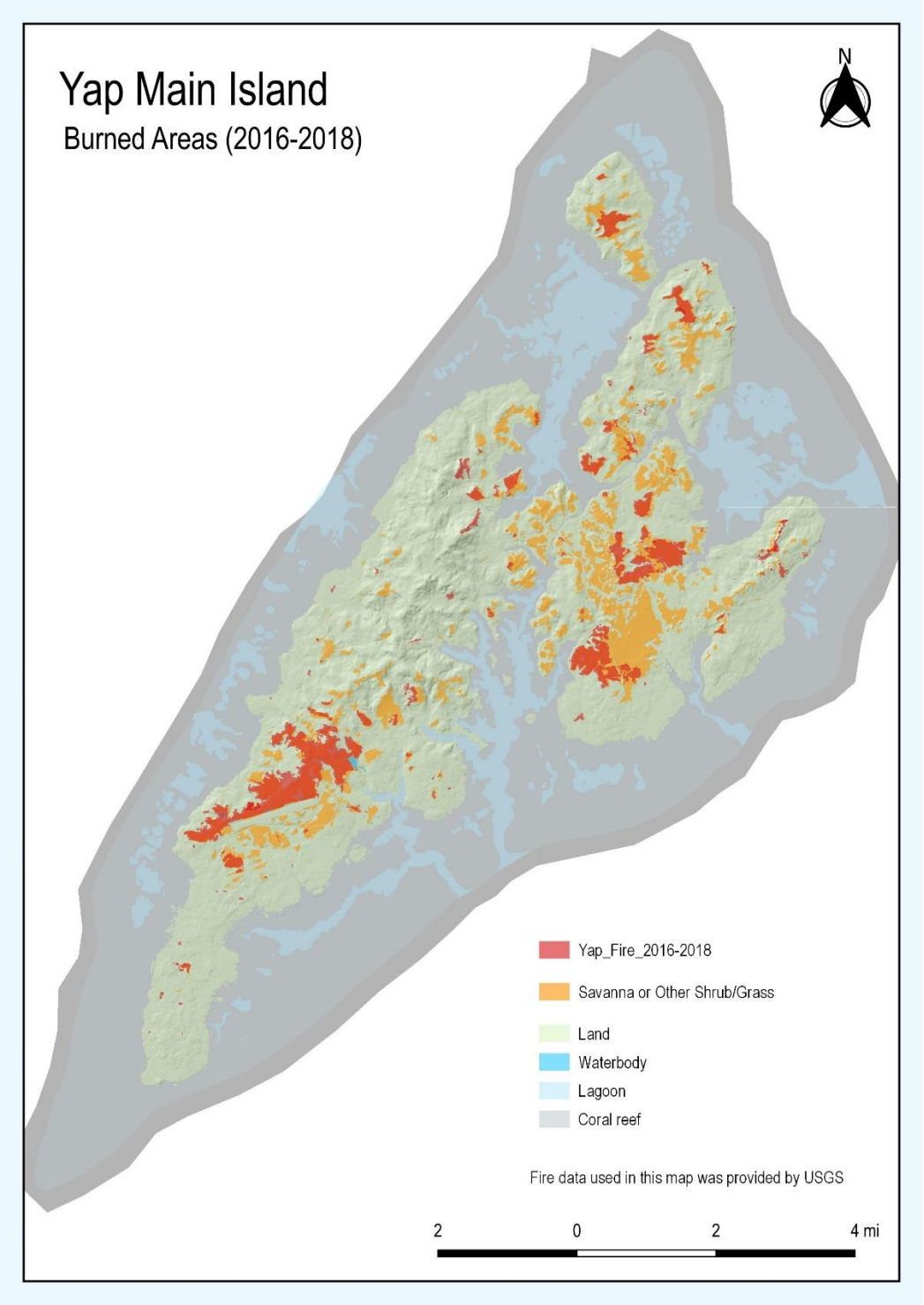
Y13 – Yap main island – Sea-Level Rise and Inundation hazard map

This map was generated from the Sea Level Rise projection modeling project in collaboration of FSM OEEM office, SPC and COM-FSM in 2013 showing areas likely to be inundated by 2055 in red color, with high hazard zones for inundation, which is 50m buffer from the projected areas to be inundated, along the coastline of Yap main island. The modeling project was only done for the high islands for the elevation data for the low-lying neighboring islands that do not exist.



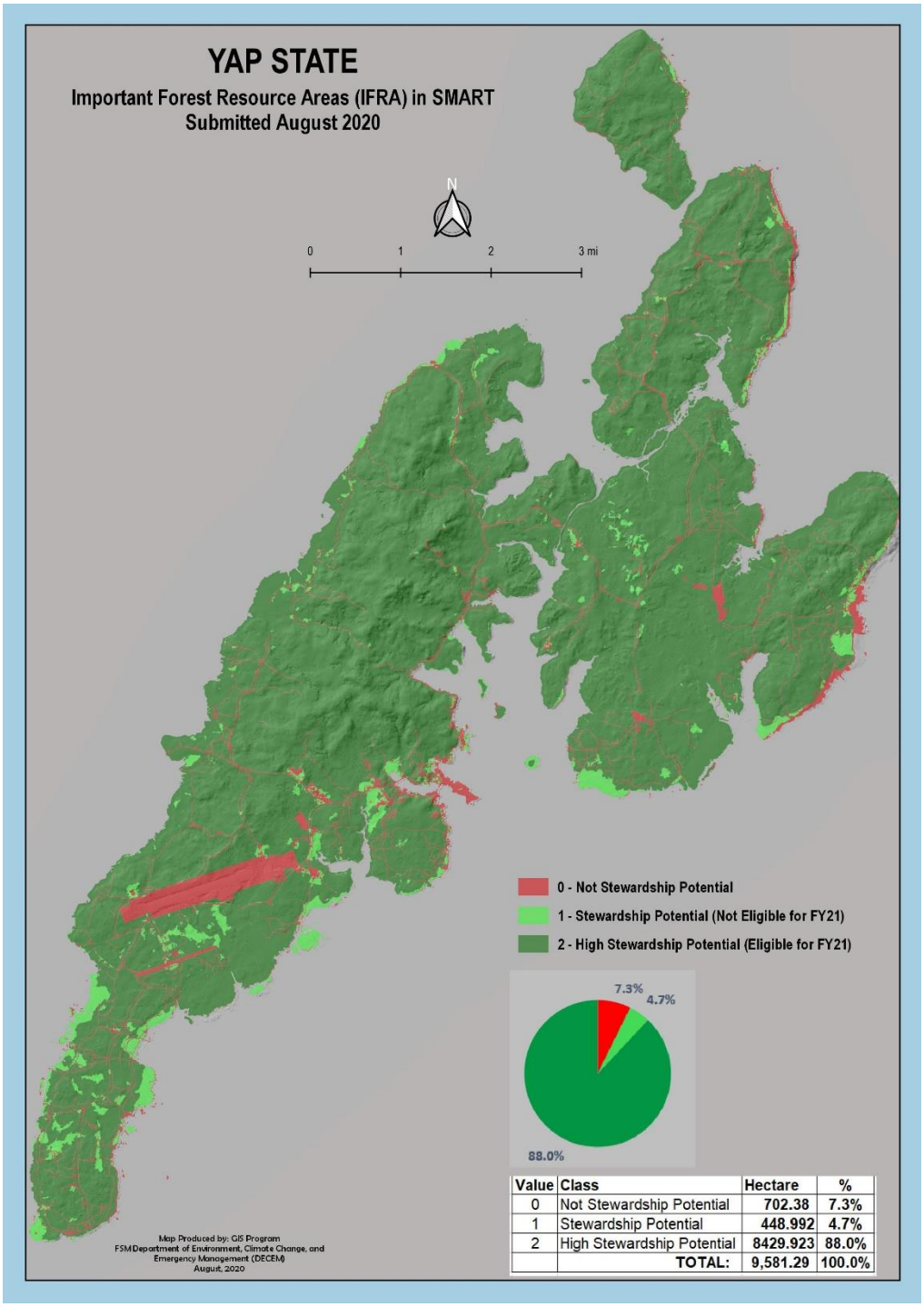
Y14 – Yap main island – Flooding hazard map

This map was derived from the NRCS soil map of Yap Main Island showing the flooding hazard areas, which include areas that frequently get flooded, areas occasionally get flooded and areas rarely get flooded from streams.



Y15 – Yap main island – Burned areas (2016-2018) map

This map shows the areas that were burned based on the USGS survey and data from 2016 to 2018 including the highly vulnerable areas for burning (savanna and grassland) on Yap main island.



Value	Class	Hectare	%
0	Not Stewardship Potential	702.38	7.3%
1	Stewardship Potential	448.992	4.7%
2	High Stewardship Potential	8429.923	88.0%
	TOTAL:	9,581.29	100.0%

Y16 – Yap main island – Important Forest Resource Areas (IFRA) 2020 map

This map was generated in 2020 for the update for Yap main island important forest resource areas (IFRA) for forest stewardship, showing areas that are high stewardship potential, stewardship potential, and not stewardship potential.

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V.I. APPENDICES

APPENDIX 1

FSM FAP Supplemental Information

FSM FAP Supplementary Information from FIA Summary Data

Prepared by Julian Dendy, May 2020

This information was generated from the FIA database containing both base plot and MC plot data for the FSM from 2005 (for comparisons over time and growth, removals and mortality) and 2016. Most of the possible comparisons of MC terrestrial measures were made in the FSM MC measures report, so most of the additional information contained in this document is focused at the FSM state level and/or forest community level. This information was summarized with the intention to inform the FSM forest action plan, especially priority areas of coastal stabilization, food security, and species biodiversity. The forest communities used by the FIA seem useful for organizing these priority areas, since strand and mangrove forests are both critical for coastal stabilization, agroforest is important for food security, and lowland and montane rainforest both shelter many native and endemic plant species. The document is divided into sections based on forest community, and there is a short discussion at the beginning of each to highlight trends in priority areas.

In addition to average (or mean) values which are presented in tables and figures throughout, there are sample error (SE) values which provide an estimate of how reliable the average values are. The larger the sample size (and lower SE), the more reliable the average estimate will be, and the smaller the sample size (and larger SE), the less reliable the average will be. As such, the reader is encouraged to always compare the SE to the average estimate before making any conclusions. Unfortunately, the sample sizes are small for many categories, including at the total state level (Chuuk), national level (montane rainforest), and management level. Additionally, the variation within forest communities (especially lowland rainforest) and among FSM states is high, which also contributes to high SE values. It is therefore difficult to make definitive statements about the direction of trends of indicators in all the priority areas, and if SE values are larger than average estimates, the direction and size of trends should be used with this understanding in mind.

Before the forest community sections there are a half dozen tables and figures summarizing the number of plots by state, forest community, or base/MC, as well as summaries of forest communities by disturbance type and canopy cover, which are presented as a reference to the reader to check on sample sizes and general trends among forest communities across FSM. Some important considerations based on these summaries are: montane rainforest was only sampled in 4 plots in Pohnpei; strand forest was mostly sampled in outer islands of Yap, with no strand forest sampled in Chuuk and sample size of 2 in Kosrae; Chuuk had sample sizes smaller than 5 for mangrove and lowland rainforest, and only 5 MC plots; Yap only had 5 mangrove plots and Kosrae only had 4 agroforest plots.

Human disturbance was the largest disturbance type overall, which affected agroforest the most, but lowland rainforest was the most disturbed forest community by area (and the community with largest sample size). Lowland rainforest and mangrove had the highest live canopy cover, with essentially no forest area with less than 40% cover and more than 50% of forest area with greater than 80% cover. Both strand and agroforest had no plots sampled with canopy cover higher than 90%, and agroforest had the most forest area covered with less than 40% canopy cover (~20% of agroforest area).

Total number of base FIA forest plots and MC forest plots and by forest community

	Base FIA Inventory	Micronesia Challenge
Total Forest Plots in 2016	78	71
Strand Forest Plots	1	25
Montane Rainforest Plots	4	0
Mangrove Plots	15	21
Agroforest Plots	15	13
Lowland Rainforest Plots	49	18

Number of base FIA forest plots and MC forest plots by state.

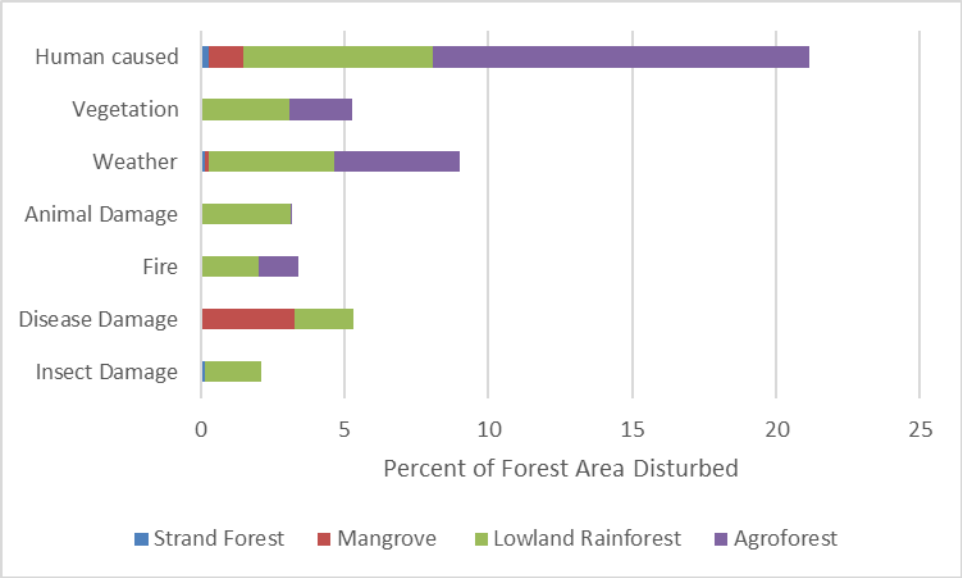
	Base FIA Inventory	Micronesia Challenge
Yap	14	38
Chuuk	10	5
Pohnpei	41	14
Kosrae	13	14

Total number of all forest plots and MC forest plots and by forest community by FSM state. Number of base plots is equal to total number minus MC number.

	Yap	YapMC	Chuuk	ChuukMC	Pohnpei	PohnpeiMC	Kosrae	KosraeMC
Total Forest Plots in 2016	52	38	15	5	55	14	27	14
Strand Forest Plots	18	18	0	0	6	5	2	2
Montane Rainforest Plots	0	0	0	0	4	0	0	0
Mangrove Plots	5	2	4	3	16	7	11	9
Agroforest Plots	11	9	7	1	6	2	4	1
Lowland Rainforest Plots	25	12	4	1	28	1	15	4

Percent of forest area disturbed by type and forest community in FSM.

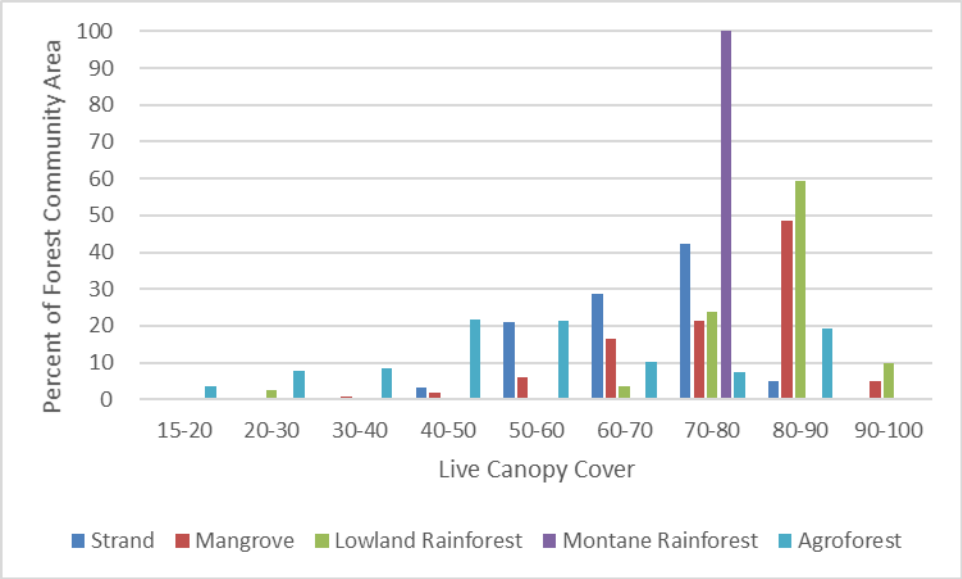
	Strand		Mangrove		Lowland		Agroforest		Total	
Disturbance Type	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Insect Damage	0.1	0.1	--	--	2.0	1.4	--	--	2.1	1.5
Disease Damage	--	--	3.3	1.9	2.0	1.4	--	--	5.3	2.4
Fire	--	--	--	--	2.0	1.5	1.4	1.0	3.4	1.7
Animal Damage	--	--	--	--	3.1	1.8	--	--	3.2	1.8
Weather	0.1	0.1	0.1	0.1	4.4	2.2	4.4	2.1	9.0	2.7
Vegetation	--	--	--	--	3.1	2.0	2.2	1.5	5.3	2.4
Human caused	0.3	0.6	1.2	1.1	6.6	2.6	13.1	3.3	21.2	3.9
Any Disturbance	0.4	0.7	4.6	2.2	19.3	4.2	15.3	3.4	39.6	4.7
Undisturbed	2.4	1.4	12.5	3.4	38.3	4.9	2.6	1.6	60.4	4.7
Total	2.8	1.4	17.1	3.8	57.5	4.9	17.9	3.7	100.0	0.0



Percent of forest area disturbed by disturbance type and forest community in FSM. There were no disturbances observed in montane rainforest in Pohnpei.

Percent of forest community area by live canopy cover class in FSM

	Strand		Mangrove		Lowland		Montane		Agroforest	
Live Canopy Cover	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
15-20	--	--	--	--	--	--	--	--	3.7	3.7
20-30	--	--	--	--	2.4	1.9	--	--	7.8	6.5
30-40	--	--	0.8	0.8	--	--	--	--	8.4	7.5
40-50	3.2	3.2	1.7	4.5	0.4	1.3	--	--	21.6	10.5
50-60	21.0	26.1	6.1	6.1	0.4	1.3	--	--	21.5	10.1
60-70	28.8	28.2	16.5	10.0	3.7	2.9	--	--	10.3	7.7
70-80	42.2	30.9	21.3	11.3	23.9	6.0	100.0	--	7.5	5.9
80-90	4.9	4.9	48.6	12.3	59.4	6.8	--	--	19.1	9.9
90-100	--	--	4.9	4.1	9.7	4.2	--	--	--	--



Percent of forest community area by live canopy cover in FSM

Mangroves

Mangroves are important across the global tropics for the various ecosystem services they offer, including coastal stabilization and buffering, carbon storage, juvenile fish nursery, and provision of food and building materials. Various threats to mangroves in FSM were described in the original FAP. Studies of mangroves in the region have highlighted the high carbon storage of mangrove soils in Yap and the relatively large size of mangrove trees in Pohnpei and particularly Kosrae. Coastal stabilization is difficult to quantify with the FIA data, so measurements like stem density, disturbance, tree removals, and missing canopy cover can give some initial indication of the integrity of mangroves across FSM. Dr. Rich MacKenzie has provided some ideas for focused studies on sea level rise and response of mangroves. Measures like proportion of mangrove trees by species, relative dominance, percent of forest area by dominant species, average diameter, average height, volume, biomass, and stem density allow for detailed comparisons of mangrove forests among FSM states.

The mangrove FIA inventory results mostly agree with the mangrove studies that have been conducted in FSM. Mangrove trees were larger (taller and larger DBH) in Pohnpei and Kosrae than in Chuuk in Yap, which is probably a consequence of less frequent typhoons (Cole et al, 1999). The difference in size is large, with both average diameter and height in Pohnpei and Kosrae being about twice that in Chuuk and Yap. Kosrae had significantly larger mangrove trees than Pohnpei in average diameter, but not average height.

Unlike in Cole et al 1999: *Bruguiera gymnorrhiza* was the most abundant species overall, not *Sonneratia alba*; *Lumnitzera littorea* had the least volume per acre, not *Rhizophora mucronata*; *Rhizophora apiculata* trees were not taller and larger volume in Kosrae than everywhere else. These differences are likely due to the grid-based random sampling of FIA and unequal sampling in Pohnpei and Kosrae (ie more plots there than elsewhere) in Cole et al 1999.

Kosrae had a bi-modal mangrove size distribution, with many trees in the smallest and largest size classes, which seems to result from the size distribution of *Sonneratia alba*. Pohnpei showed a somewhat less dramatic bi-modal distribution, but also had a larger sample size of mangrove plots. Other than *S. alba*, Pohnpei had the largest average size trees of all the other main mangrove tree species, and by far the most mangrove trees in FSM (including *S. alba*).

The authors of Cole et al 1999 speculate that the bi-modal distribution of trees and larger size of *Sonneratia alba* in Kosrae compared to Pohnpei may be a result of major typhoon damage in Pohnpei in 1905, which did not affect Kosrae as severely, but still damaged some mangrove resulting in some areas with smaller trees and some with larger trees. This seems reasonable, as *S. alba* trees were found to be capable of commonly re-sprouting from a snapped stem after a typhoon in Yap and had the highest survivorship, whereas *B. gymnorrhiza* and *Rhizophora* species were not commonly observed re-sprouting, and had snapped main stems less often but were thrown by wind more often (Kaufman & Cole, 2010).

There was one mangrove plot in Yap which was disturbed by wind and was estimated to be missing 10% of canopy, which seems likely to be due to typhoon damage from 2015. There was also one plot each in Chuuk and Kosrae missing canopy in mangroves, with human disturbance recorded, and overall, 7.8 % (SE=6.6) of mangrove forest area was missing canopy in FSM. Weather had disturbed about 7.1% (SE=7.1) of mangrove forest area in the 2005 inventory with about 9.4% (SE=8.1) total disturbed

mangrove area. Human disturbance appears to have declined in mangroves from about 2 to 1 %, and overall mangrove disturbance declined by half to about 4.6% (SE=2.2), but the sample size of mangrove plots was tripled in 2016 and SE values are high (especially for 2005) so we can't say for sure if the decline in mangrove disturbance was real. Tree disease was the largest disturbance type in mangroves in 2016, and disease in tree seedlings and saplings was observed in two Pohnpei mangrove plots in 2016.

Mangroves often have a zonation pattern of tree species occurrence from the seaward to landward edge, with one species being dominant in each zone, but there are also situations with species co-dominance. As described in Yap by Kaufman & Cole (2010), there can also be differences from locality to locality, and from windward to leeward side. There are also surprisingly large differences from state to state, with *B. gymnorrhiza* being by far the most dominant species in Yap, *S. alba* by far the most dominant in Kosrae and Pohnpei, and potentially three or four co-dominant species including *Xylocarpus granatum, L. littorea*, and one or two species of *Rhizophora* in Chuuk.

Generally, mangrove trees get larger as they occur closer to the landward edge, and the soil depth and carbon stocks also increases towards land. Kaufman et al (2011) found extremely high carbon saturation values in mangrove soils in Palau and Yap and estimated that 67 and 77% respectively of total ecosystem carbon stocks were contained in mangrove soils. While it is unknown what will happen in mangroves as sea level rises, they point out that soils in seagrass beds adjacent to mangrove only contain 7% of ecosystem carbon stocks, so losing mangroves could present a drastic loss of carbon storage from FSM. It appears that soil carbon in mangroves in Chuuk, Pohnpei and Kosrae remains unstudied, but given that average aboveground biomass per acre is so high, especially for *S. alba*, it would be reasonable to assume there are also very large carbon stocks in Pohnpei and Kosrae mangrove soils.

Mangroves have extraordinary root systems which are thought to be adaptations to growing in loose muddy soils and can have very high root: shoot ratios so a fairly high proportion of mangrove tree volume is contained in their roots compared to normal trees. Komiyama et al (2008) estimate that 15 to 17 % of a tree's total above ground biomass is contained in its mangrove prop roots (*Rhizophora* species), which is nearly equal to what is contained in its branches. The FIA inventory incorporated several new measurements in the last cycle to attempt to describe mangrove roots (height by length, type of root system), but subsequently has decided that it is not possible to analyze them in a statistically valid manner, so these won't be measured in the next inventory. Apparently allometric equations have not been developed for *B. gymnorrhiza* knee roots or *S. alba* pneumatophores, but Dr. Olaf Kuegler is potentially working on incorporating equations that estimate biomass for *Rhizophora* prop roots, and branches, stems and leaves of all species.

Across FSM, mangrove trees are sometimes harvested for building materials, particularly poles, and sometimes *Nypa fruticans* is planted near the landward edge, whose fronds can serve as roof thatch. *Nypa fruticans* showed up as a dominant tree species in Kosrae mangrove, and despite the forest area estimate being unreliable due to high SE, it does indicate *Nypa* has been planted in or near Kosrae mangrove forest. There were no observed mangrove trees removed between inventories in Pohnpei and Yap, but in Chuuk and Kosrae there were an estimated 13,169 (SE=13,634) and 14,696 (SE=14,090) mangrove trees removed respectively, for a total in FSM of 27,866 (SE=19,607) mangrove trees removed between 2005 and 2016. Only one mangrove tree inventoried was coded as removed from mangrove forest, which was a *Rhizophora apiculata* tree in Kosrae, removed for silvicultural or land clearing

activity. Cole et al (1999) estimated up to 40% of gross mangrove stem volume had rotten wood or poor form, and 88% of *S. alba*, *R. mucronata* and *X. granatum* trees > 30 cm DBH had stem rot or poor form, which suggests that while mangroves may be suitable for periodic, small scale harvesting of a select few trees for local needs, larger scale timber harvesting, even of the impressively large *S. alba* on Kosrae, is unlikely to be profitable.

The FIA inventory estimated 38.7% of all mangrove trees were damaged in FSM, with more than half of trees damaged in Yap and Chuuk (with high sample error). However, most of the damaged trees can be attributed to stem decay, which was recorded when there was any visible evidence, so it seems likely that tree damage was overestimated. In the 2005 inventory, which used the older methodology for damage estimation, only 5 % (SE=0.9) of tree were damaged in FSM, and tree disease was not recorded, but conks or fruiting bodies (which would classify as stem decay in the new methodology, but had a 20% stem circumference coverage threshold) was the largest damage type overall (1.8% of trees, SE=0.8).

15.7 % (SE=3.0) of mangrove trees in Yap had open wounds, which probably resulted from typhoon damage. Mangrove trees damaged by human activities were only observed in Chuuk, and the root disease *Phellinous noxious* was observed in Pohnpei mangroves (0.6% of trees, SE=0.6), but there were no invasive plant species recorded in FSM mangroves. There were significant differences by damage type among mangrove tree species across FSM, with stem decay again likely overestimated as it was the largest damage type in all species except *Rhizophora apiculata*. Other than stem decay, *Rhizophora stylosa* seems to be affected by root disease, and *Sonneratia alba* and *Xylocarpus granatum* had relatively high rates of broken or dead tops.

For FSM overall, there was an estimated increase of 2,489,933 (SE=2,236,596) mangrove trees between 2005 to 2016, accounting for 3,742,175 (SE=2,223,702) new mangrove trees and 1,224,377 (SE=891,971) mangrove trees that died. By wood volume, FSM mangroves gained 11,198,289 (SE=8,106,491) net cubic feet through growth and lost 7,964,514 (SE= 6,240,514) cubic feet through mortality, but SE values for removals and net change were larger than estimates. In Pohnpei, 9,379,766 (SE=7,992,061) cubic feet of wood was gained through growth, 7,949,729 (SE=6,240,491) was lost through mortality, and 21,533,235 (SE=19,900,224) was lost through removals, but net change SE values were higher than the estimate.

The total mortality rate of mangrove trees in FSM for the time period was 4.6% (SE=1.6), which varied from 1.1 % (SE=1.1) in Chuuk, 1.3 % (SE=2.2) in Kosrae, 4.9% (SE=2.3) in Pohnpei and 6.6% (SE=0.7) in Yap. It seems likely that typhoon effects explain the higher mortality rate in Yap mangroves. *S. alba* had the highest mortality rate by species, at 2 % (SE=1.5), which was more than twice that of the species with the next highest rate, *B. gymnorrhiza* at 0.4% (SE=0.3).

Overall, it appears that mangroves (in 2016) in FSM were in good condition, with high overall canopy cover, relatively low missing canopy, and the highest proportion of plots (61%) with full forest among forest communities. There was low disturbance except for tree disease, some of which may be due to a low threshold of field measurement protocol. Some missing canopy indicated human activity in Chuuk and Kosrae, and mangrove tree removals. The total volume in Pohnpei appears to have declined (insignificantly), which could be of concern since it has the largest area of mangrove forests in FSM with the most abundant and largest trees (other than *S. alba* in Kosrae).

Number of mangrove tree species in base FIA forest plots, MC forest plots and all forest plots by FSM state

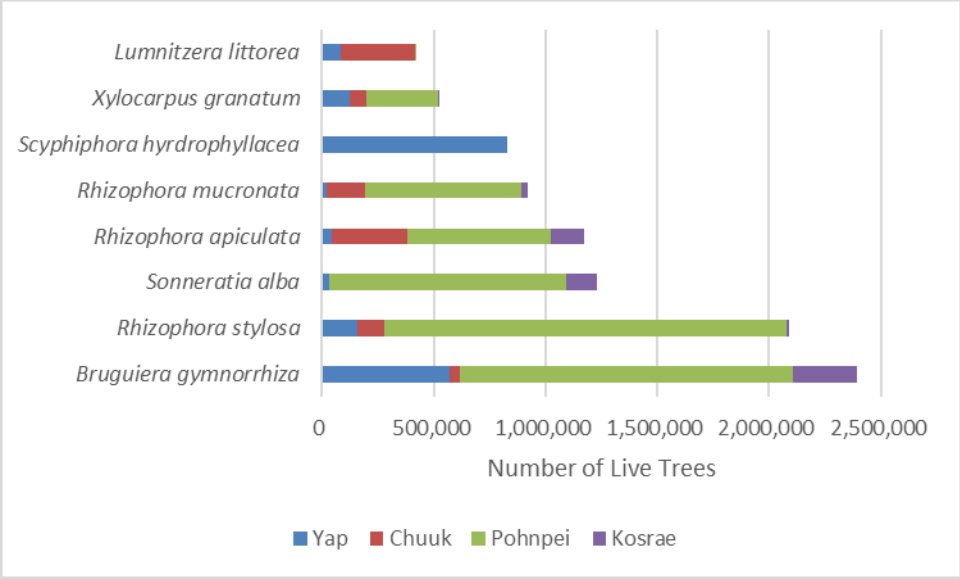
	Species in Base Plots	Species in MC plots	Total Species
Yap	7	4	9
Chuuk	7	4	8
Pohnpei	7	8	9
Kosrae	3	10	10

Tree species in mangrove forest plots (base FIA, MC, or both) in FSM states, with mangrove species highlighted in gray, and strand species in blue.

Mangrove Tree Species	Yap	Chuuk	Pohnpei	Kosrae
Bruguiera gymnorrhiza	Base	Both	Both	Both
Heritiera littoralis		Base	Base	
Lumnitzera littorea	Base	Base	MC	
Rhizophora apiculata	Both	MC	Both	Both
Rhizophora lamarckii		Both	MC	MC
Rhizophora mucronata	MC	Both	Both	MC
Rhizophora		Base		
Rhizophora stylosa	Base	Base	Both	MC
Scyphiphora hydrophyllacea	Base			
Sonneratia alba	MC		Both	Both
Xylocarpus granatum	Base		Both	MC
Barringtonia racemosa				MC
Calophyllum inophyllum	Base			MC
Pandanus dilatatus				MC
Pemphis acidula				MC
Thespesia populnea		Base		

Number of mangrove trees (live trees>1-inch DBH) by species in FSM states and overall

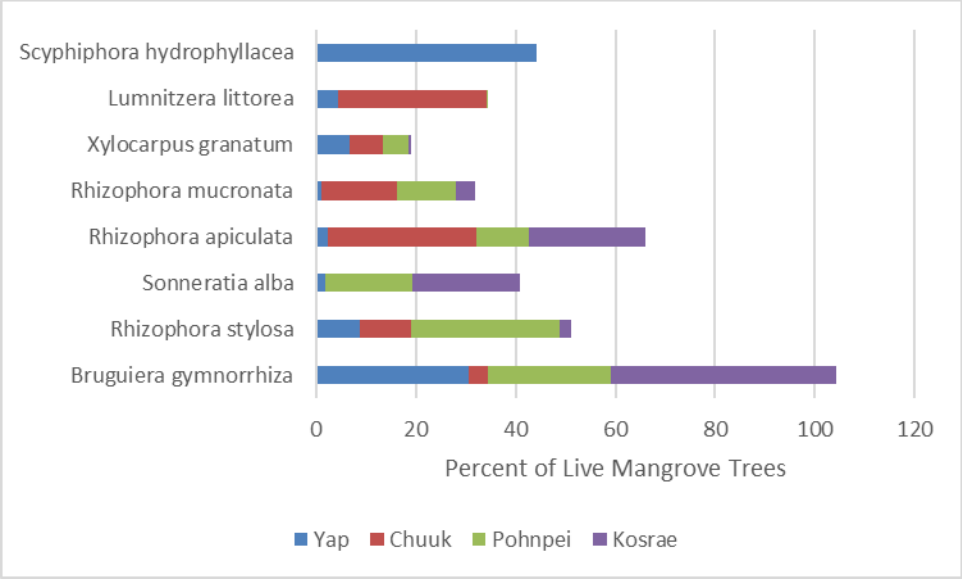
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Mangrove Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Bruguiera gymnorrhiza	574,100	535,493	43,443	94,999	1,487,627	754,779	286,987	426,643	2,392,157	1,023,471
Rhizophora stylosa	161,532	146,131	117,532	254,879	1,797,555	1,512,744	15,398	54,572	2,092,018	1,541,976
Sonneratia alba	31,015	69,979	--	--	1,059,653	529,077	137,005	99,029	1,227,673	542,795
Rhizophora apiculata	41,267	42,284	338,433	1,094,667	645,986	405,798	147,233	217,808	1,172,919	1,188,359
Rhizophora mucronata	18,609	46,209	173,567	249,393	702,092	401,625	24,051	64,538	918,319	479,374
Xylocarpus granatum	123,894	132,570	75,039	69,587	319,507	170,116	3,708	13,143	522,148	227,001
Lumnitzera littorea	82,861	88,664	336,593	312,136	5,305	20,027	--	--	424,759	325,102
Scyphiphora hyrdrophyllacea	830,430	888,585	--	--	--	--	--	--	830,430	888,535
Total	1,872,916	1,686,561	1,134,620	1,394,186	6,032,004	2,061,473	633,489	631,425	9,673,040	3,071,907



Number of mangrove trees (live trees >1 inch-DBH) by species in FSM states.

Percent of mangrove trees (live trees > 1 inch-DBH) by species in FSM states and overall.

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Mangrove Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Bruguiera gymnorrhiza	30.7	3.5	3.8	9.6	24.7	10.0	45.3	33.1	24.7	8.0
Rhizophora stylosa	8.6	8.6	10.4	25.2	29.8	19.5	2.4	2.4	21.6	14.1
Sonneratia alba	1.7	3.8	-	-	17.6	8.6	21.6	15.4	12.7	5.9
Rhizophora apiculata	2.2	2.0	29.8	66.9	10.7	5.9	23.2	25.7	12.1	10.8
Rhizophora mucronata	1.0	2.5	15.3	5.7	11.6	6.8	3.8	9.7	9.5	4.7
Xylocarpus granatum	6.6	6.6	6.6	6.6	5.3	2.9	0.6	0.6	5.4	2.1
Lumnitzera littorea	4.4	4.4	29.7	29.7	0.1	0.1	-	-	4.4	3.2
Scyphiphora hydrophyllacea	44.3	44.3	-	-	-	-	-	-	8.6	8.6



Percent of mangrove trees (live trees >1-inch DBH) by species in FSM states.

Percent of dead mangrove trees by species in FSM states and overall.

	FSM		Kosrae		Pohnpei		Chuuk		Yap	
Mangrove Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Bruguiera gymnorrhiza	8.7	6.3	42.9	97.0	10.2	7.4	--	–	3.7	3.7
Rhizophora stylosa	6.3	6.3	–	–	9.5	9.5	--	–	–	–
Sonneratia alba	42.8	22.6	42.9	69.0	62.2	21.0	--	–	1.9	4.3
Rhizophora apiculata	7.0	6.1	–	–	7.2	8.0	--	–	7.9	10.8
Rhizophora mucronata	0.5	1.3	14.3	14.3	0.3	0.3	--	–	–	–
Xylocarpus granatum	7.0	4.8	–	–	10.5	7.5	--	–	–	–
Lumnitzera littorea	2.7	2.7	–	–	–	–	100.0	100.0	–	–
Scyphiphora hydrophyllacea	24.8	24.8	–	–	–	–	--	–	86.5	86.5

Percent of mangrove trees by damage type in FSM states and overall

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Tree Damage Type	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Stem Decay	50.8	10.3	47.7	56.0	27.3	7.6	5.4	5.9	32.8	8.6
Root Disease	1.0	0.6	4.4	4.4	7.8	4.0	2.1	2.1	5.7	2.9
Broken Top	0.6	0.4	6.2	6.5	7.6	2.3	0.4	1.0	5.6	1.9
Dead Top	0.5	0.5	2.2	2.2	7.5	2.4	--	--	5.0	1.9
Open Wound	15.7	3.0	5.5	5.5	0.5	0.5	--	--	4.0	2.6
Human Activities	--	--	28.1	28.1	--	--	--	--	3.3	3.3
Phellinous noxious	--	--	--	--	0.6	0.6	--	--	0.4	0.4
Foliage Disease	1.0	1.0	--	--	--	--	--	--	0.2	0.2
Cankers	--	--	--	--	0.2	0.2	--	--	0.2	0.2
Defoliators	--	--	--	--	0.2	0.2	--	--	0.1	0.1
Wind	0.5	0.5	--	--	--	--	--	--	0.1	0.1
Any Damage	53.3	10.5	52.7	61.4	35.0	10.8	5.8	6.2	38.7	10.0

Percent of mangrove tree species by damage type in FSM

	Sonneratia alba		*Bruguiera gymnorrhiza*		*Rhizophora stylosa*		*Rhizophora apiculata*		*Rhizophora mucronata*		*Xylocarpus granatum*		*Lumnitzera littorea*	
Tree Damage Type	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Stem Decay	39.9	9.9	6.8	3.1	44.1	7.4	1.1	1.2	9.5	8.1	48.6	17.1	92.2	8.9
Open Wound	1.2	1.2	2.7	1.2	--	--	--	--	--	--	2.4	2.4	9.4	6.5
Broken Top	17.3	7.2	0.7	0.6	9.4	1.3	0.5	1.0	4.6	2.5	13.0	7.3	--	--
Root Disease	3.5	1.3	0.6	0.6	19.4	3.3	2.0	2.4	2.7	2.7	3.0	2.3	2.2	2.2
Cankers	--	--	0.6	0.6	--	--	--	--	--	--	--	--	--	--
Human Activities	--	--	0.5	0.5	0.6	0.6	--	--	4.1	4.1	14.4	14.4	42.6	42.6
Defoliators	--	--	0.5	0.5	--	--	--	--	--	--	--	--	--	--
Dead Top	17.2	7.2	0.4	0.4	9.3	1.5	--	--	4.3	2.6	5.6	5.6	--	--
Phellinous noxious	2.9	2.9	--	--	--	--	--	--	--	--	--	--	--	--
Foliage Disease	--	--	--	--	--	--	--	--	--	--	--	--	4.3	4.3
Wind	--	--	--	--	--	--	0.8	0.8	--	--	--	--	--	--
Any Damage	41.9	8.6	8.9	3.4	62.8	10.0	3.5	3.6	15.4	11.2	49.0	17.0	96.6	5.4

Number of mangrove trees by growth, removals and mortality in FSM states and overall

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
GRM Category	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Time 1	1,976,179	2,267,303	598,988	574,290	3,299,667	1,272,392	105,356	109,074	5,980,189	2,664,836
Time 2	1,472,437	1,689,353	584,292	560,200	4,689,197	2,029,616	1,724,196	1,684,957	8,470,123	3,182,162
Gross Growth	246,915	283,290	--	--	1,863,251	1,417,680	1,632,010	1,689,609	3,742,175	2,223,702
Mortality	-750,656	861,241	--	--	-473,720	232,113	--	--	-1,224,377	891,971
Net Change	-503,741	577,951	-14,696	14,090	1,389,530	1,345,224	1,618,840	1,690,713	2,489,933	2,236,596
Removals	--	--	-14,696	14,090	--	--	-13,169	13,634	-27,866	19,607

Volume (net cubic feet) of mangrove trees by growth, removals and mortality in FSM states and overall

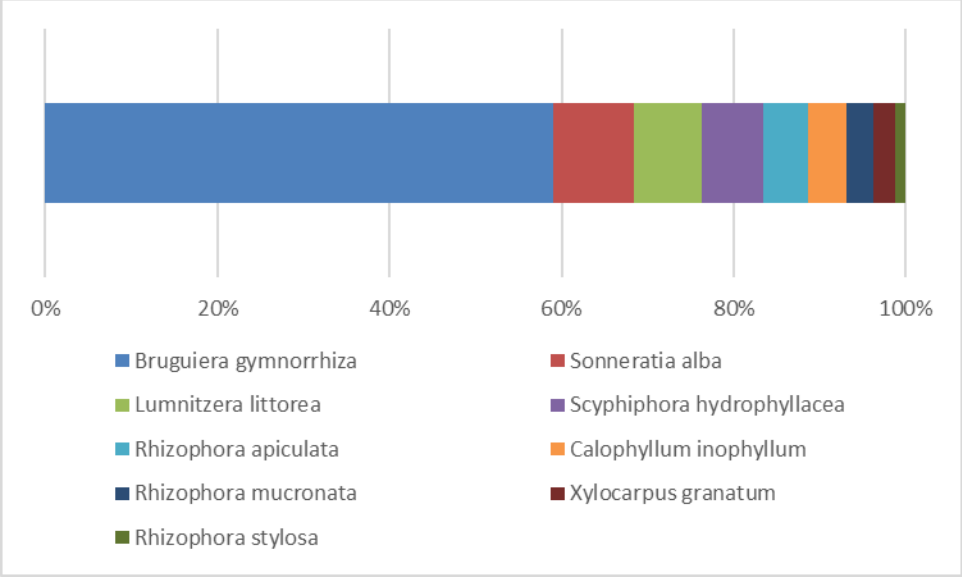
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
GRM Category	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Time 1	1,104,334	1,267,021	565,537	542,218	105,194,342	43,755,759	8,502,605	8,802,691	115,366,817	44,653,703
Time 2	1,544,538	1,772,074	684,785	656,550	85,091,145	41,351,641	9,503,223	9,838,625	96,823,690	42,547,950
Gross Growth	454,989	522,016	162,813	156,100	9,379,766	7,992,061	1,200,720	1,243,098	11,198,289	8,106,491
Mortality	-14,785	16,963	--	--	-7,949,729	6,240,491	--	--	-7,964,514	6,240,514
Net Change	440,204	505,053	119,249	114,332	-20,103,198	22,376,786	1,000,618	1,035,933	-18,543,127	22,406,737
Removals	--	--	-43,565	41,768	-21,533,235	19,900,224	-200,102	207,164	-21,776,902	19,901,346

Percent of mangrove area covered by dominant tree species in FSM states and overall, with mangrove tree species highlighted in gray

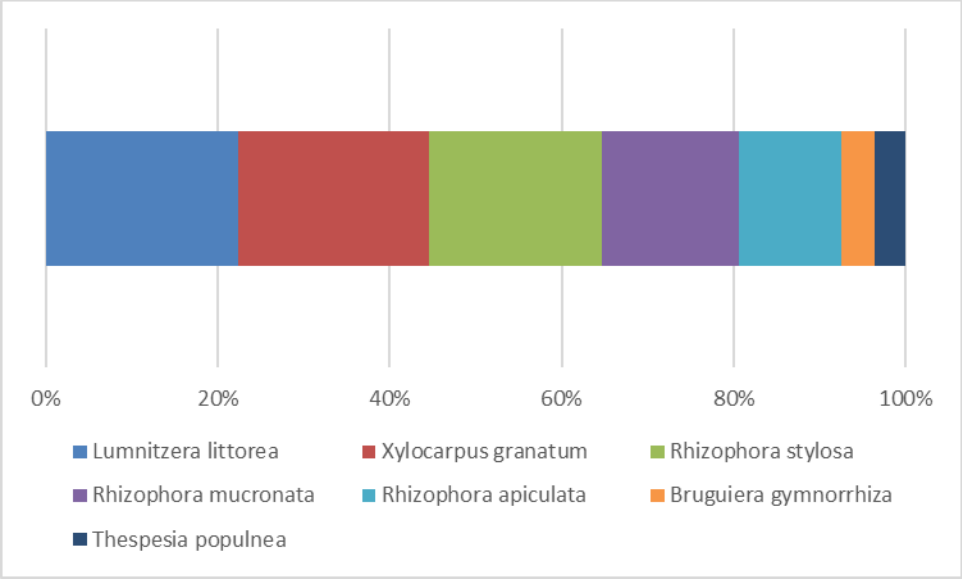
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Dominant Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Sonneratia alba	--	--	--	--	40.9	15.5	65.2	31.6	36.4	12.4
Bruguiera gymnorrhiza	63.4	31.5	--	--	15.1	11.2	17.7	29.6	19.3	10.4
Rhizophora mucronata	--	--	--	--	15.6	12.0	4.1	4.1	10.8	8.4
Xylocarpus granatum	--	--	--	--	14.5	14.5	1.4	1.4	9.7	7.8
Rhizophora stylosa	16.0	16.0	11.6	11.6	7.3	7.3	--	--	7.5	5.8
Rhizophora apiculata	20.5	26.5	20.2	43.5	4.7	5.1	--	--	7.1	6.1
Rhizophora	--	--	68.2	68.2	0.9	0.9	--	--	6.7	5.9
Nypa fruticans	--	--	--	--	--	--	10.2	24.2	1.5	3.6
Rhizophora lamarckii	--	--	--	--	1.1	1.1	--	--	0.7	0.7
Hibiscua tiliaceus	--	--	--	--	--	--	1.4	1.4	0.2	0.2

Relative dominance (percent of total basal area) of mangrove tree species by FSM state and overall

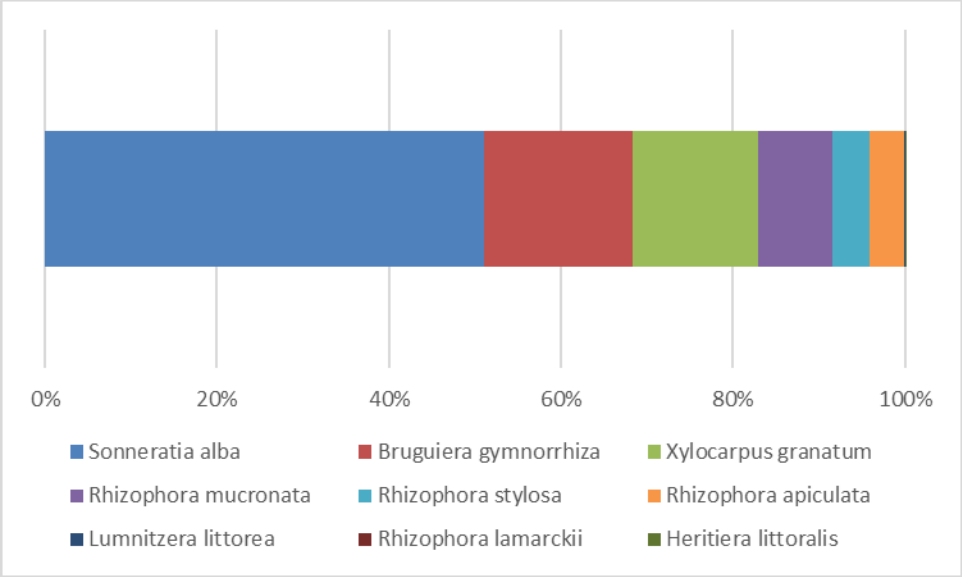
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Mangrove Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Sonneratia alba	9.5	18.4	--	--	51.0	6.6	83.7	20.9	52.2	7.3
Bruguiera gymnorrhiza	59.0	13.7	3.8	3.7	17.3	5.1	12.3	19.1	18.2	5.2
Xylocarpus granatum	2.5	2.5	21.3	21.3	14.7	5.2	0.6	0.6	12.4	4.5
Rhizophora mucronata	3.1	6.6	15.3	8.4	8.5	4.2	1.1	2.6	7.4	3.4
Rhizophora stylosa	1.2	1.2	19.5	35.8	4.3	3.9	0.0	0.0	4.0	3.3
Rhizophora apiculata	5.2	2.6	11.5	30.2	4.1	2.6	1.6	3.6	4.0	2.3
Lumnitzera littorea	7.9	7.9	21.7	21.7	0.1	0.1	--	--	1.0	0.7
Scyphiphora hydrophyllacea	7.1	7.1	--	--	--	--	--	--	0.3	0.3
Calophyllum inophyllum	4.5	4.5	--	--	--	--	--	--	0.2	0.2
Thespesia populnea	--	--	3.5	3.5	--	--	--	--	0.1	0.1
Pemphis acidula	--	--	--	--	--	--	0.4	0.4	0.1	0.1
Barringtonia racemosa	--	--	--	--	--	--	0.1	0.1	0.0	0.0
Pandanus dilatatus	--	--	--	--	--	--	0.1	0.1	0.0	0.0
Rhizophora lamarckii	--	--	--	--	0.0	0.0	0.0	0.0	0.0	0.0
Heritiera littoralis	--	--	--	--	0.0	0.0	--	--	0.0	0.0



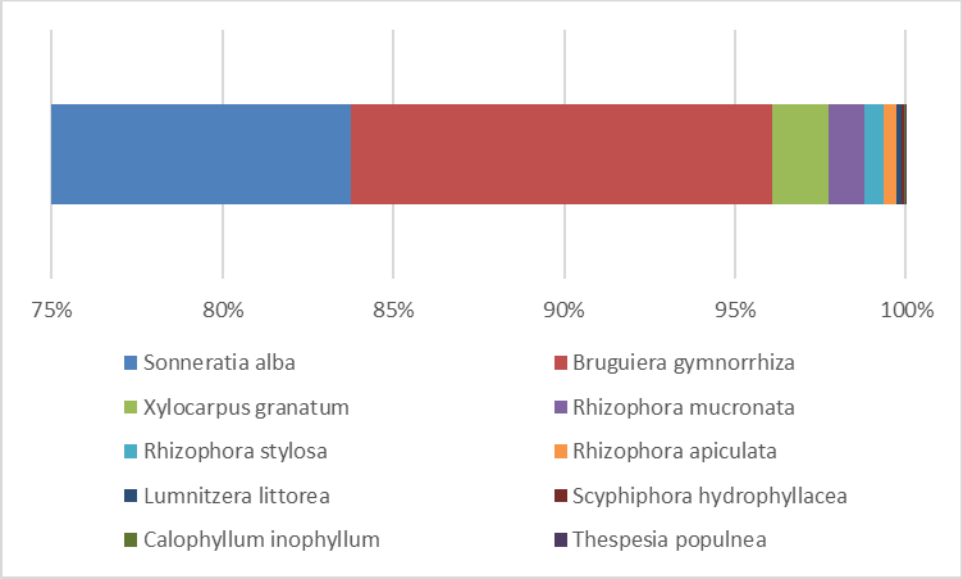
Relative dominance of mangrove tree species in Yap



Relative dominance of mangrove tree species in Chuuk



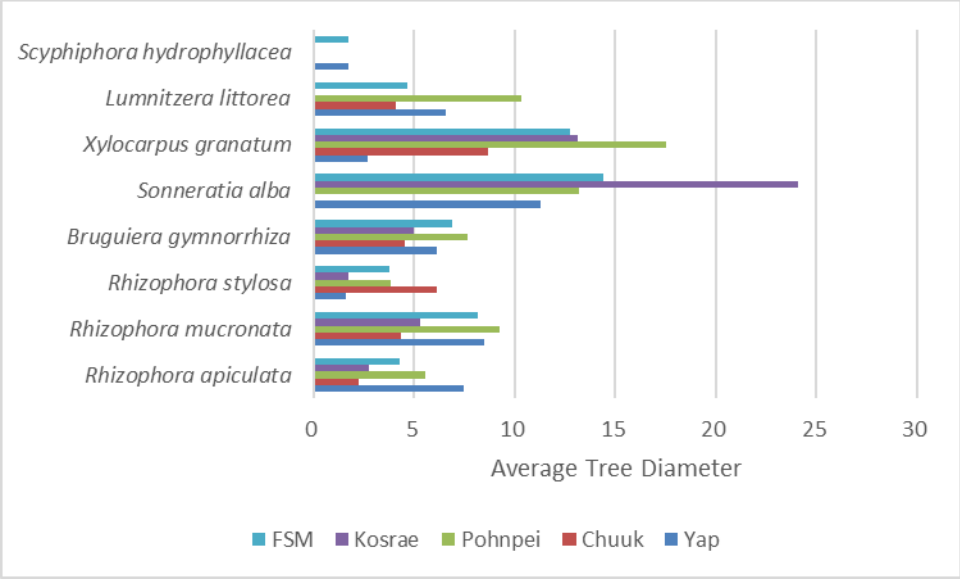
Relative dominance of mangrove tree species in Pohnpei



Relative dominance of mangrove tree species in Kosrae. Note the different starting percentage at the left side of x-axis.

Average diameter (in inches) of mangrove tree species in FSM states and overall

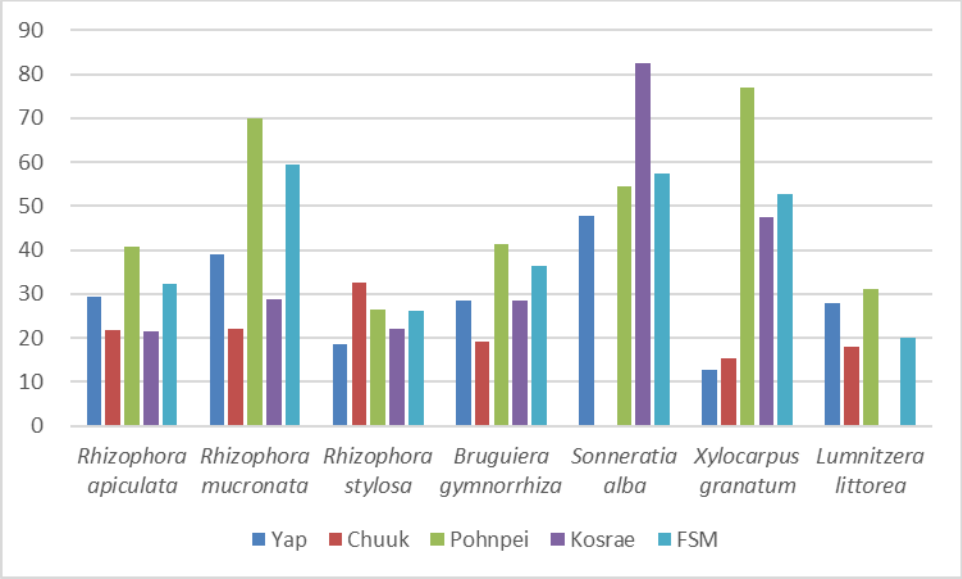
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Mangrove Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Sonneratia alba	11.3	2.5	--	--	13.2	2.9	24.1	10.7	14.4	3.2
Xylocarpus granatum	2.7	2.7	8.7	8.7	17.6	2.1	13.1	13.1	12.7	3.2
Rhizophora mucronata	8.5	0.3	4.3	3.9	9.2	1.1	5.3	7.9	8.2	1.9
Bruguiera gymnorrhiza	6.1	0.4	4.5	2.6	7.7	1.6	5.0	5.9	6.9	1.3
Lumnitzera littorea	6.5	6.5	4.1	4.1	10.3	10.3	--	--	4.6	0.6
Rhizophora apiculata	7.5	0.9	2.2	3.5	5.5	1.9	2.7	2.8	4.3	3.0
Rhizophora stylosa	1.6	1.6	6.1	0.8	3.8	0.0	1.7	1.7	3.8	0.3
Scyphiphora hydrophyllacea	1.7	1.7	--	--	--	--	--	--	1.7	1.7



Average diameter (in inches) of mangrove tree species in FSM states and overall

Average height (in feet) of mangrove tree species in FSM states and overall

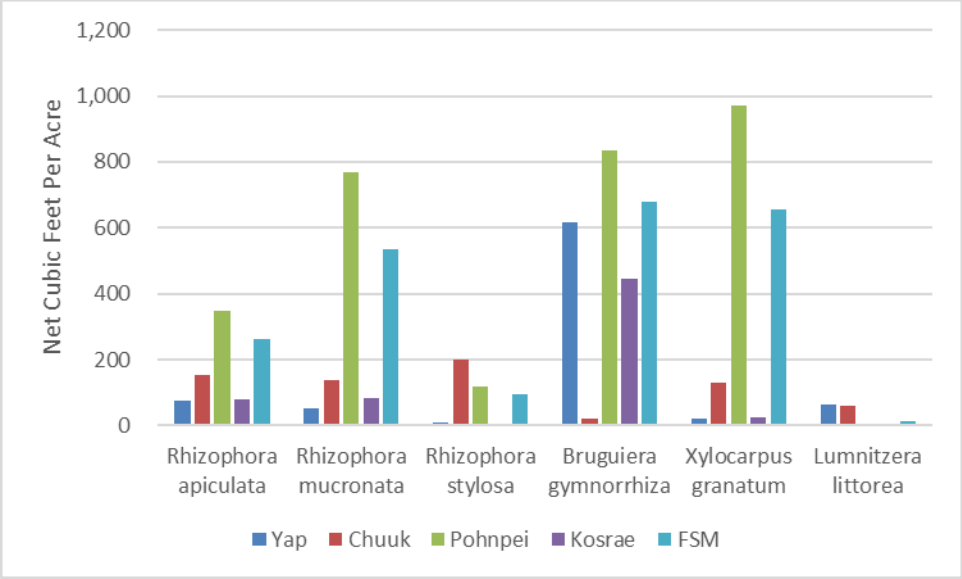
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Mangrove Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Rhizophora mucronata	38.9	8.7	22.1	9.1	70.1	8.8	28.9	20.5	59.3	13.7
Sonneratia alba	47.7	2.7	--	--	54.4	6.5	82.5	26.5	57.3	7.4
Xylocarpus granatum	12.6	12.6	15.3	15.3	77.1	11.9	47.3	47.3	52.7	14.9
Bruguiera gymnorrhiza	28.5	2.1	19.2	8.0	41.3	7.7	28.6	20.3	36.3	5.8
Rhizophora apiculata	29.5	7.8	21.6	15.9	40.7	15.2	21.4	11.7	32.4	16.2
Rhizophora stylosa	18.4	18.4	32.5	11.0	26.5	0.1	22.0	22.0	26.1	1.5
Lumnitzera littorea	27.9	27.9	18.0	18.0	31.0	31.0	--	--	20.1	2.3
Scyphiphora hydrophyllacea	10.6	10.6	--	--	--	--	--	--	10.6	10.6



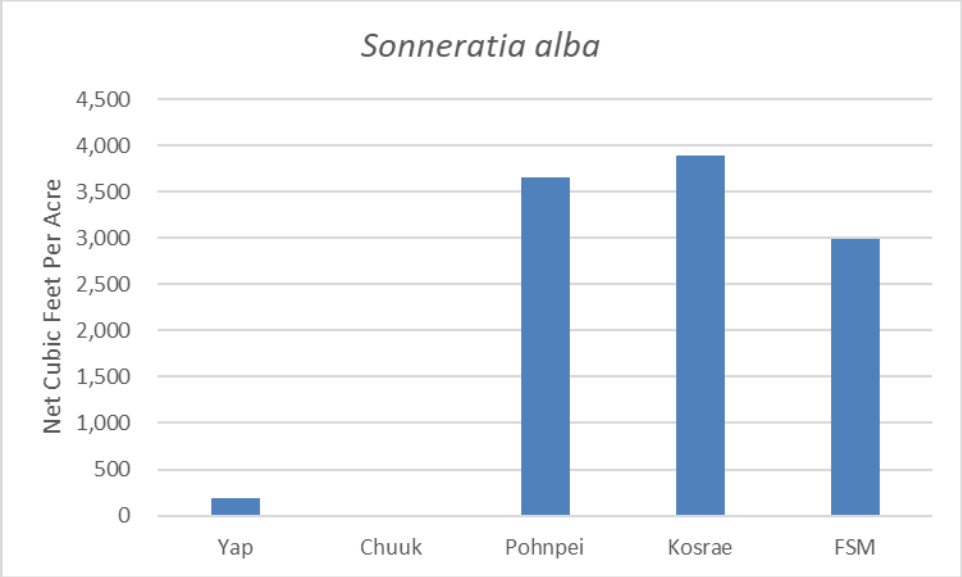
Average height (in feet) of mangrove tree species in FSM states and overall

Mean volume (net cubic feet per acre) of mangrove tree species in FSM states and overall

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Mangrove Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Sonneratia alba	193	387	-	-	3651	955	3886	1512	2987	764
Bruguiera gymnorrhiza	615	163	21	21	833	265	444	698	680	212
Xylocarpus granatum	21	21	128	128	971	446	26	26	655	314
Rhizophora mucronata	51	115	139	71	767	325	82	192	534	232
Rhizophora apiculata	76	47	154	529	350	299	78	256	263	208
Rhizophora stylosa	11	11	198	511	118	101	-	-	97	81
Lumnitzera littorea	63	63	61	61	3	3	-	-	14	11
Scyphiphora hyrdrophyllacea	18	18	--	--	--	--	--	--	2	2



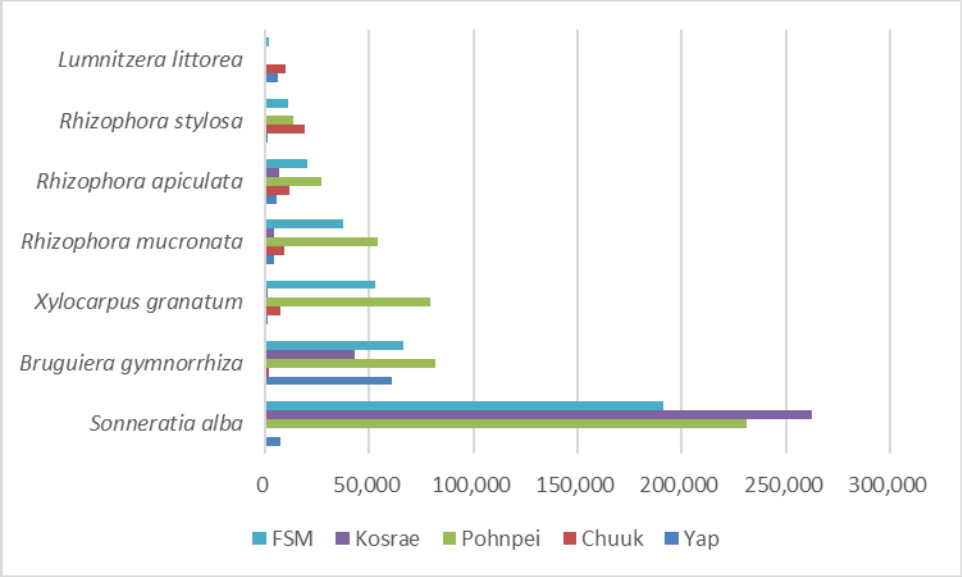
Mean volume (net cubic feet per acre) of mangrove tree species in FSM states and overall. *Sonneratia alba* is not included to show detail of other species here.



Volume (net cubic feet per acre) of *Sonneratia alba* trees in FSM states and overall

Biomass (pounds per acre) of mangrove tree species in FSM states and overall.

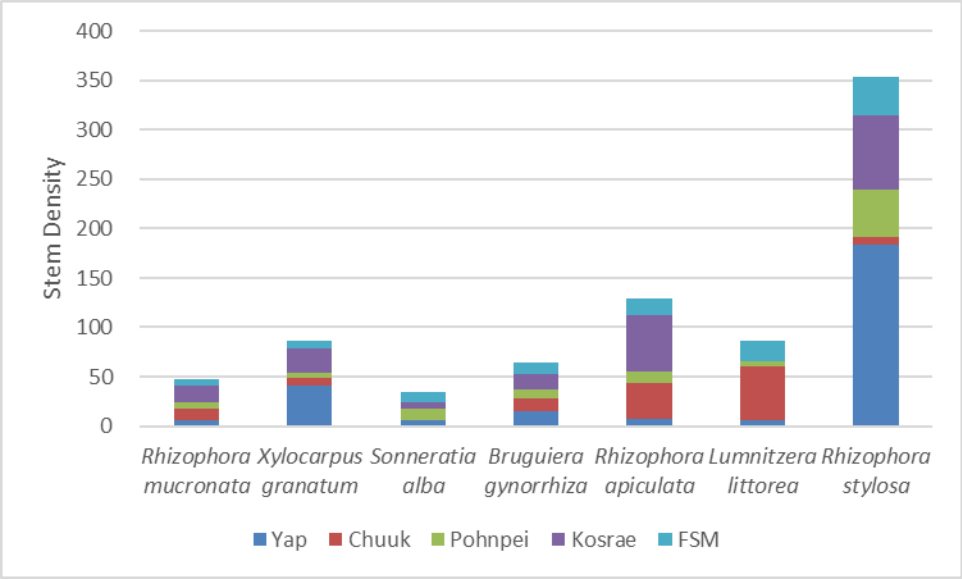
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Mangrove Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Sonneratia alba	7,480	15,046	--	--	231,027	63,861	262,532	96,793	190,912	50,672
Bruguiera gymnorrhiza	60,798	19,601	1,848	2,399	81,736	22,156	42,769	67,853	66,627	18,851
Xylocarpus granatum	1,178	1,178	7,194	7,194	79,262	37,233	1,463	1,463	53,039	26,149
Rhizophora mucronata	4,022	9,443	9,394	4,668	54,368	22,847	4,507	10,363	37,638	16,289
Rhizophora apiculata	5,647	3,887	11,383	34,579	26,878	24,434	6,516	17,608	20,231	16,738
Rhizophora stylosa	938	938	19,066	46,045	13,632	11,632	58	58	10,771	8,744
Lumnitzera littorea	6,253	6,253	10,129	10,129	193	193	--	--	1,706	1,122
Scyphiphora hydrophyllacea	2,847	2,847	--	--	--	--	--	--	306	306



Biomass (pounds per acre) of mangrove tree species in FSM states and overall

Stem density of mangrove trees (live trees >1 inch DBH per acre) by species in FSM states and overall

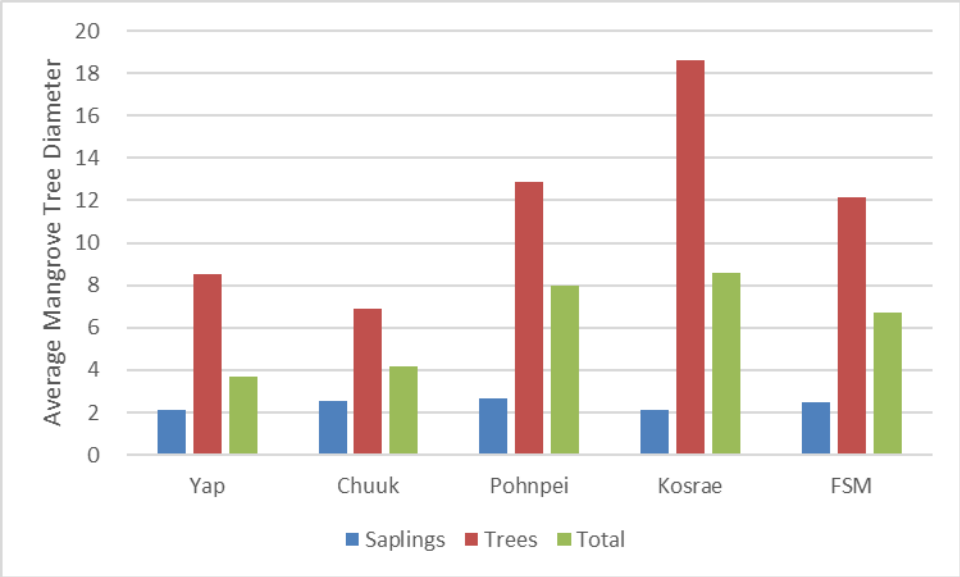
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Mangrove Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Rhizophora mucronata	6.0	--	11.5	12.4	6.3	0.9	16.9	24.2	7.1	1.8
Xylocarpus granatum	40.5	40.5	8.0	8.0	6.0	--	24.1	24.1	8.0	1.8
Sonneratia alba	6.0	--	--	--	11.3	1.8	7.0	2.8	10.4	1.8
Bruguiera gymnorrhiza	15.1	4.6	12.5	11.5	9.8	2.1	15.9	21.7	11.3	2.5
Rhizophora apiculata	7.3	2.0	36.3	81.3	12.2	5.1	57.0	82.1	16.7	13.6
Lumnitzera littorea	6.0	6.0	54.0	54.0	6.0	6.0	--	--	20.3	13.9
Rhizophora stylosa	183.8	183.8	8.1	0.2	47.2	1.5	75.0	75.0	39.1	18.7



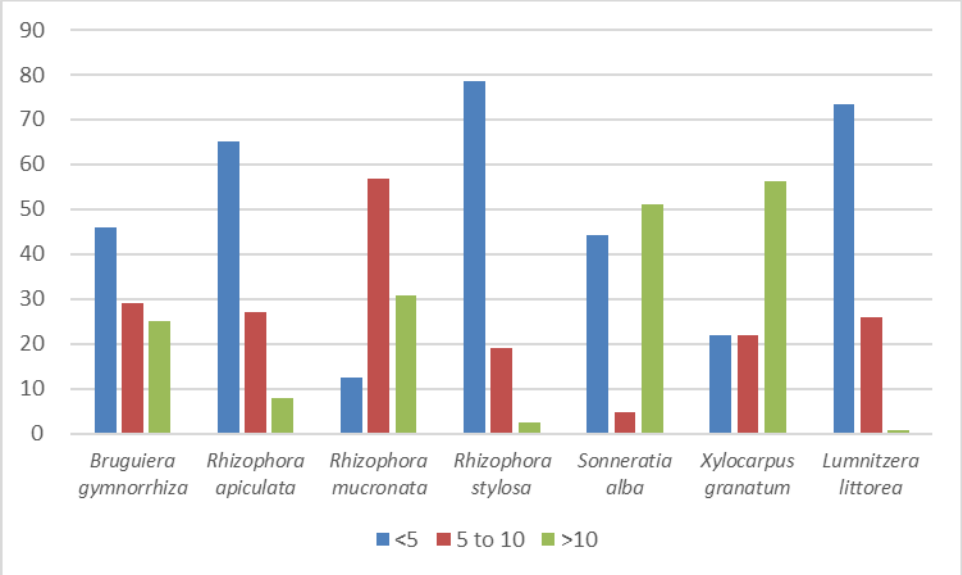
Stem density of mangrove trees (live trees>1-inch DBH per acre) by species in FSM states and overall

Mean diameter (in inches) of mangrove trees in FSM states and overall

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
	Diameter	SE	Diameter	SE	Diameter	SE	Diameter	SE	Diameter	SE
Saplings	2.1	0.1	2.6	2.1	2.7	0.3	2.1	1.4	2.5	0.4
Trees	8.5	0.3	6.9	0.4	12.9	1.3	18.6	4.2	12.1	1.1
Total	3.7	0.7	4.2	3.4	8.0	1.4	8.6	6.9	6.7	1.3



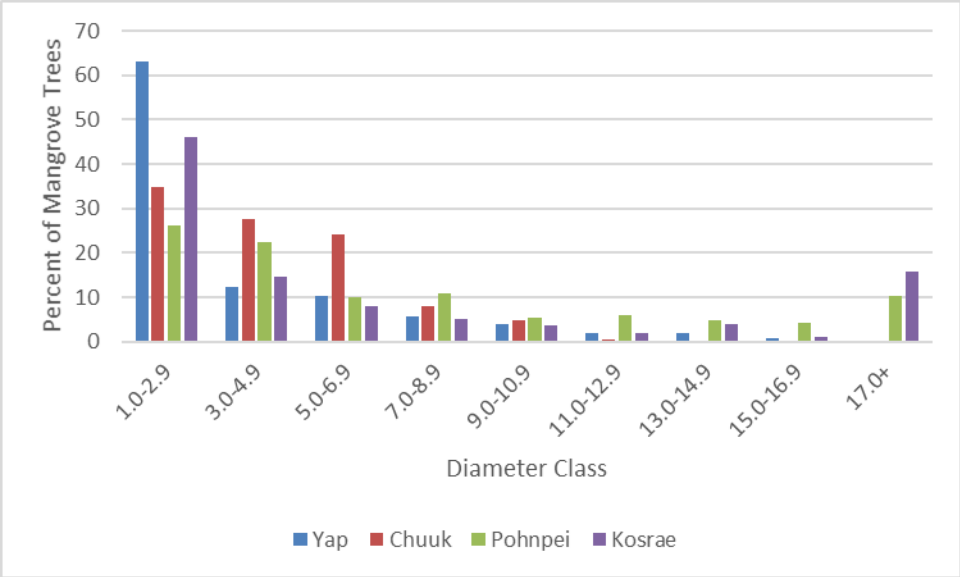
Mean diameter (in inches) of mangrove trees in FSM states and overall



Percent of mangrove trees by species and abbreviated diameter class (in inches) in FSM

Percent of mangrove trees by diameter class (in inches) per FSM state

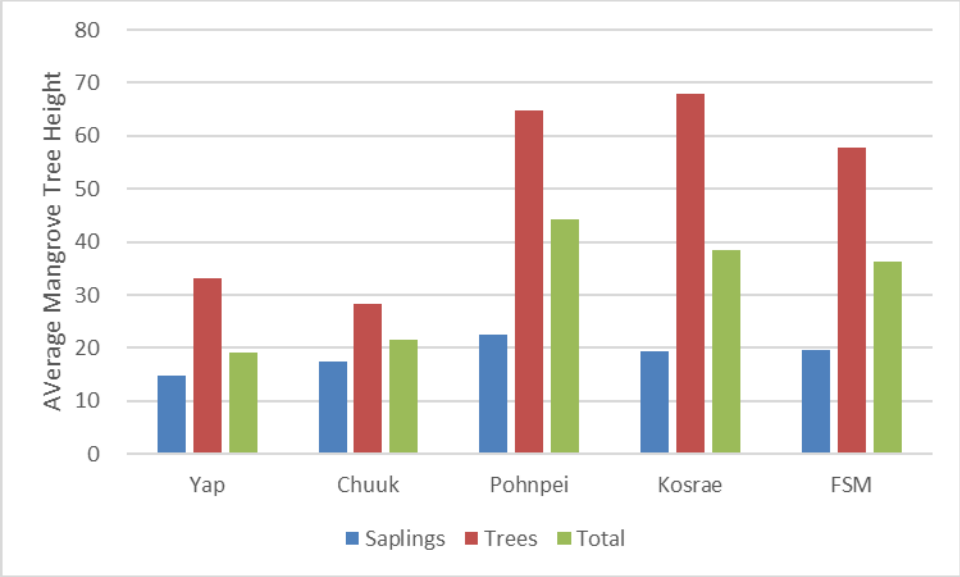
Diameter Class	Yap	SE	Chuuk	SE	Pohnpei	SE	Kosrae	SE
1.0-2.9	63.1	9.3	34.9	78.2	26.0	7.3	46.2	52.9
3.0-4.9	12.2	12.2	27.5	27.5	22.3	8.8	14.6	25.0
5.0-6.9	10.2	4.8	24.2	28.1	10.0	2.8	8.0	7.7
7.0-8.9	5.7	2.6	8.0	11.7	11.0	2.8	5.1	5.5
9.0-10.9	4.0	2.2	4.8	7.0	5.4	1.6	3.7	6.2
11.0-12.9	2.0	1.1	0.6	1.7	5.9	2.0	2.0	3.5
13.0-14.9	1.9	1.1	--	--	4.7	1.6	3.9	3.6
15.0-16.9	0.7	0.4	--	--	4.3	1.8	1.0	1.7
17.0+	0.1	0.1	--	--	10.3	3.7	15.7	16.8



Percent of mangrove trees by diameter class (in inches) per FSM state

Mean height (in feet) of mangrove trees in FSM states and overall

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
	Height	SE	Height	SE	Height	SE	Height	SE	Height	SE
Saplings	14.7	0.5	17.4	1.0	22.5	1.8	19.4	5.1	19.6	2.1
Trees	33.1	4.4	28.2	9.2	64.7	6.5	67.8	13.5	57.8	6.0
Total	19.2	3.2	21.5	6.7	44.3	6.5	38.4	19.6	36.4	5.7



Mean height (in feet) of mangrove trees in FSM states and overall

Agroforest

The native forests across Micronesia have been heavily altered over the millennia since human beings first established themselves there (Muller-Dombois & Fosberg, 1998). On the high islands this change has taken place primarily in the coastal lowlands, where the lowland rainforest was cleared or altered to make way for culturally important tree species that produce food and/or other valuable materials. On smaller islands and atolls, essentially the entire forest ecosystem was at least partially altered. In addition to patches of taro which are often cultivated wherever possible, a human controlled tree garden, or agroforest, has developed in Micronesia over millenia which is quite a sensible, diverse, and efficient system for growing food in the humid tropics (Raynor & Fownes, 1989, Falanruw, 1993, Manner, 1993).

As such, agroforests are especially important to food security across Micronesia. Agroforests can be newly developed or relatively old, as tree gardens studied in Pohnpei ranged from 2 to over 100 years old (Raynor & Fownes, 1989). While composed of mostly introduced plant species, they have mostly been established in Micronesia for centuries, although the number of varieties and cultivars seems to have increased (at least in Pohnpei) since German colonial times (some are also known to have been lost) (Raynor & Fownes,1989). They often include a fair proportion of native species, and many native species have uses within agroforest, like sources of medicines or mulch. There are undoubtedly many uses of native species in agroforest which have not yet been recorded. Some native species are planted intentionally, and which species of native and introduced plants and trees are incorporated into the agroforest may depend on which stage of development it is in, as well as where it is.

Several species highlighted as agroforest species in the tables and figures are also native, and there are varieties selected for various uses grown in agroforests which may be different from those growing wild (ie *Pandanus tectorius*). However, agroforests are usually located close to houses for convenience, efficiency and security, which unfortunately sometimes means that those forests are not sampled by the FIA inventory since they may not meet minimum canopy cover or size requirements. That could also mean that agroforests that do get sampled may be less regularly visited, managed and maintained, and/or have different species or different dominant species than so-called backyard or kitchen gardens.

For the most part, the agroforest summary from the FIA inventory is what you might expect given that it is a human managed forest type. It was the forest community with the most human disturbance, lowest average canopy cover, highest overall tree damage (other than stem decay), and highest invasive species presence/coverage.

There appear to be substantial differences in agroforest among states. Chuuk had by far the largest proportion of forest area under agroforest (61%, SE=15), which was dominated by breadfruit. Breadfruit was also dominant in Pohnpei agroforest, but much less so than in Chuuk. Chuuk had the most breadfruit, pandanus, coconut and mango trees, suggesting that agroforest is particularly widespread and important there. Yap had the most agroforest trees in diameter size classes > 1-3 inches, but this could be due to it also having the most betel nut trees. Incredibly, betelnut made up over a third of agroforest basal area in Yap, and over half of forest area by dominant tree species (with high sample error). Yap also had the most native species, and by far the highest relative dominance of native species in agroforest. Pohnpei had the highest proportion of endemic and invasive tree species in agroforest. Kosrae agroforest was dominated by *Morinda citrifolia* (noni) and had one invasive tree species,

Adenanthera pavonina, was inventoried there. Despite not being included in the inasive species list for FSM, *Adenanthera* was already listed as an agroforest weed in Raynor and Fownes study on Pohnpei, but both invasive tree species (*Spathodea* and *Adenanthera*) in FSM agroforest have documented uses (1989). Yap had by far the lowest percent of agroforest with invasive species present and had the highest agroforest understory coverage with food species, suggesting that it perhaps has the best managed agroforest in FSM.

Merremia peltata (an invasive vine) was the most common invasive species in agroforest across FSM, and damage to agroforest trees from vines was the largest damage type overall and in Chuuk. Damaged and broken treetops were also common, which can also result from vine damage. Chuuk and Kosrae had much higher agroforest tree damage than Yap and Pohnpei. All states except for Chuuk had high relative dominance from *Hibiscus tiliaceus* in agroforest and overall, which is often an indicator of recovery after disturbance, and *Hibiscus* is often used (and sometimes planted intentionally) as tree cover in agroforest areas during fallow intervals. The low coverage of *Hibiscus* in Chuuk could indicate a lack of area for growing agroforest, with inability to leave areas fallow to regenerate soil fertility. The high invasive species cover, vine damage, and damaged/broken treetops in Chuuk agroforest suggests disturbance from the typhoon and/or general human disturbance, perhaps a lack of maintenance, or a combination of all the above.

By species, breadfruit (*Artocarpus altilis*) was by far the most common agroforest tree, but about two thirds of all trees are estimated for the smallest diameter class, which could be from suckers from larger trees, and/or could suggest that most estimated trees are not yet productive. Breadfruit height can also be an indicator of productivity, since trees managed for fruit will generally be kept relatively short, whereas trees destined for canoes or wood will be allowed to grow much taller. The average height across FSM and most states was around 20 to 25 feet, which seems like around the right size for productive fruit harvesting, whereas in Kosrae the trees were much taller, around 50 feet tall. The average height of coconut palms (in any forest community) across FSM was 50 feet. Kosrae had the tallest average coconut trees, but that (and taller breadfruit trees) may be an effect of typhoon frequency which seems to affect differential tree height of all nearly all tree species across FSM. Coconut trees had the highest damage by far from human activities, which makes sense since they are usually climbed to harvest, and notches are often cut into the trunk to facilitate climbing.

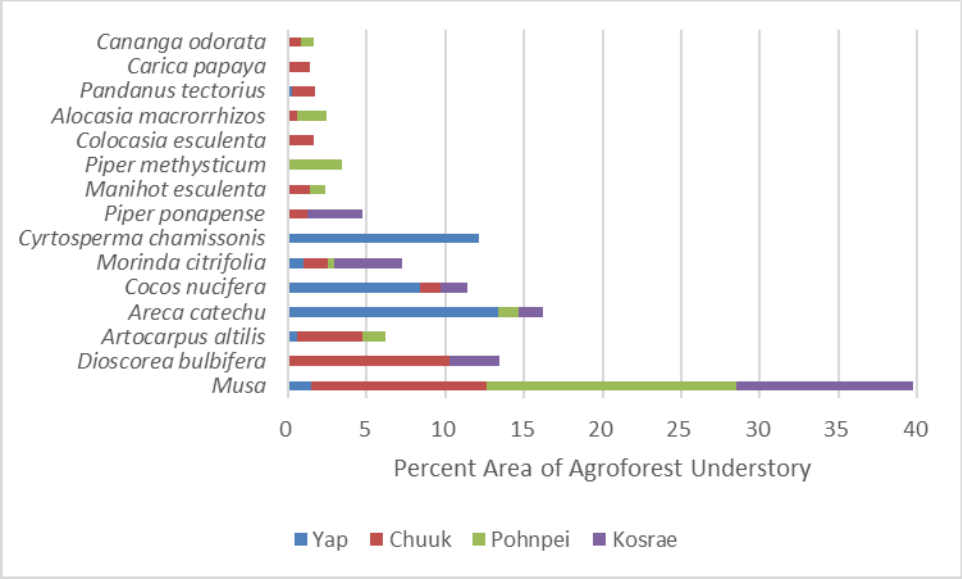
There were at least 28 species of edible plants inventoried in FSM agroforest understory, including tree seedlings. Banana (*Musa*) covered the most agroforest understory among food species overall and in Chuuk, Pohnpei and Kosrae. In Yap betelnut (*Areca catechu*) seedlings and swamp taro (*Crytosperma chamissonis*) covered the most agroforest understory area, and Yap was the only state with more than about 1% agroforest covered in any of the taro species. In Chuuk, air yams (Dioscorea bulbifera) covered the most understory after banana, followed by breadfruit seedlings. In Pohnpei, sakau (*Piper methysticum*) covered the most agroforest understory after banana (with high sample error), but surprisingly black pepper (*Piper ponapense)* plants (and air yams) were only inventoried in Chuuk and Kosrae agroforest. Overall, about a third of agroforest understory area was covered by edible/valuable agroforest plants across FSM, with closer to 40% coverage in Yap and Chuuk agroforest.

Percent of agroforest understory area covered by edible or common agroforest plant species in FSM states and overall

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Understory Food Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Musa	1.5	1.2	11.1	3.2	15.8	7.1	11.2	4.9	11.4	2.6
Dioscorea bulbifera	--	--	10.3	3.3	--	--	3.2	3.2	5.4	1.9
Artocarpus altilis	0.6	0.6	4.2	1.1	1.4	0.3	--	--	2.4	0.6
Areca catechu	13.4	7.3	--	--	1.3	1.3	1.5	1.5	2.0	1.1
Cocos nucifera	8.4	4.7	1.3	0.5	--	--	1.7	1.1	1.8	0.7
Morinda citrifolia	1.0	3.1	1.6	0.6	0.4	0.4	4.4	2.6	1.7	0.7
Cyrtosperma chamissonis	12.1	6.9	--	--	--	--	--	--	1.2	1.0
Piper ponapense	--	--	1.3	1.0	--	--	3.4	0.6	1.2	0.5
Manihot esculenta	--	--	1.4	0.8	1.0	1.0	--	--	0.9	0.4
Piper methysticum	--	--	--	--	3.4	3.4	--	--	0.9	0.9
Colocasia esculenta	--	--	1.6	1.6	--	--	--	--	0.8	0.8
Alocasia macrorrhizos	--	--	0.6	0.6	1.8	1.0	--	--	0.8	0.4
Pandanus tectorius	0.3	0.3	1.4	1.4	--	--	--	--	0.7	0.6
Carica papaya	--	--	1.4	0.9	--	--	--	--	0.7	0.5
Cananga odorata	--	--	0.9	0.5	0.8	0.5	--	--	0.6	0.3
Mangifera indica	0.1	0.1	0.4	0.2	--	--	1.3	1.3	0.4	0.2
Momordica charantia	--	--	0.8	0.8	--	--	--	--	0.4	0.4
Citrus	--	--	0.2	0.2	0.3	0.3	--	--	0.1	0.1
Averrhoa bilimbi	1.4	1.4	--	--	--	--	--	--	0.1	0.1
Cyrtosperma merkusii	0.3	0.3	--	--	--	--	0.5	0.5	0.1	0.1
Abelmoschus moschatus	--	--	0.2	0.2	--	--	--	--	0.1	0.1
Saccharum	--	--	0.2	0.2	--	--	--	--	0.1	0.1
Citrus reticulata	--	--	--	--	--	--	0.5	0.5	0.1	0.1
Citrus x limon	0.6	0.6	--	--	--	--	--	--	0.1	0.1
Inocarpus fagifer	0.6	0.6	--	--	--	--	--	--	0.1	0.1
Ananas comosus	0.4	0.4	--	--	--	--	--	--	0.0	0.0
Annona muricata	0.3	0.3	--	--	--	--	--	--	0.0	0.0
Artocarpus mariannensis	0.2	0.2	--	--	--	--	--	--	0.0	0.0
All Food Species	41.0	14.0	39.0	6.0	26.2	4.8	27.7	3.1	34.1	3.6

Acreage of agroforest understory by edible or common agroforest plant species in FSM states and overall

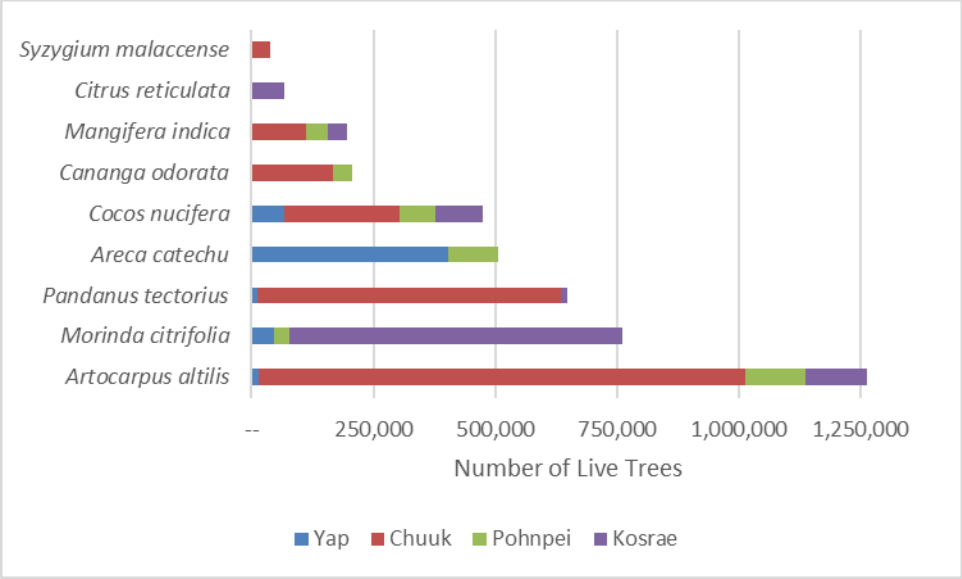
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Understory Food Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Musa	41	42	1,418	551	1,086	644	494	373	3,039	927
Dioscorea bulbifera	--	--	1,309	534	--	--	140	123	1,449	548
Artocarpus altilis	15	16	535	195	99	50	--	--	649	202
Areca catechu	366	297	--	--	91	77	67	59	525	312
Cocos nucifera	229	180	171	79	--	--	74	64	475	206
Morinda citrifolia	27	91	197	90	24	92	192	165	441	228
Cyrtosperma chamissonis	331	285	--	--	--	--	--	--	331	285
Piper ponapense	--	--	161	130	--	--	151	90	312	158
Manihot esculenta	--	--	177	110	67	56	--	--	244	124
Piper methysticum	--	--	--	--	232	220	--	--	232	220
Colocasia esculenta	--	--	208	193	--	--	--	--	208	193
Alocasia macrorrhizos	--	--	78	72	124	93	--	--	202	117
Pandanus tectorius	8	25	182	169	--	--	--	--	190	170
Carica papaya	--	--	182	125	--	--	--	--	182	125
Cananga odorata	--	--	109	75	53	36	--	--	162	83
Mangifera indica	3	8	52	33	--	--	56	49	110	60
Momordica charantia	--	--	104	96	--	--	--	--	104	96
Citrus	--	--	21	19	18	15	--	--	39	25
Averrhoa bilimbi	38	41	--	--	--	--	--	--	38	41
Cyrtosperma merkusii	9	30	--	--	--	--	22	20	32	36
Abelmoschus moschatus	--	--	31	29	--	--	--	--	31	29
Saccharum	--	--	31	29	--	--	--	--	31	29
Citrus reticulata	--	--	--	--	--	--	22	20	22	20
Citrus x limon	15	16	--	--	--	--	--	--	15	16
Inocarpus fagifer	15	16	--	--	--	--	--	--	15	16
Ananas comosus	11	12	--	--	--	--	--	--	11	12
Annona muricata	8	44	--	--	--	--	--	--	8	44
Artocarpus mariannensis	4	13	--	--	--	--	--	--	4	13
All Species	1,123	798	4,967	1,483	1,795	845	1,220	733	9,104	2,022



Food species covering at least 1% of agroforest understory area in FSM states

Number of agroforest trees (live trees>1-inch DBH) by species in FSM states and overall.

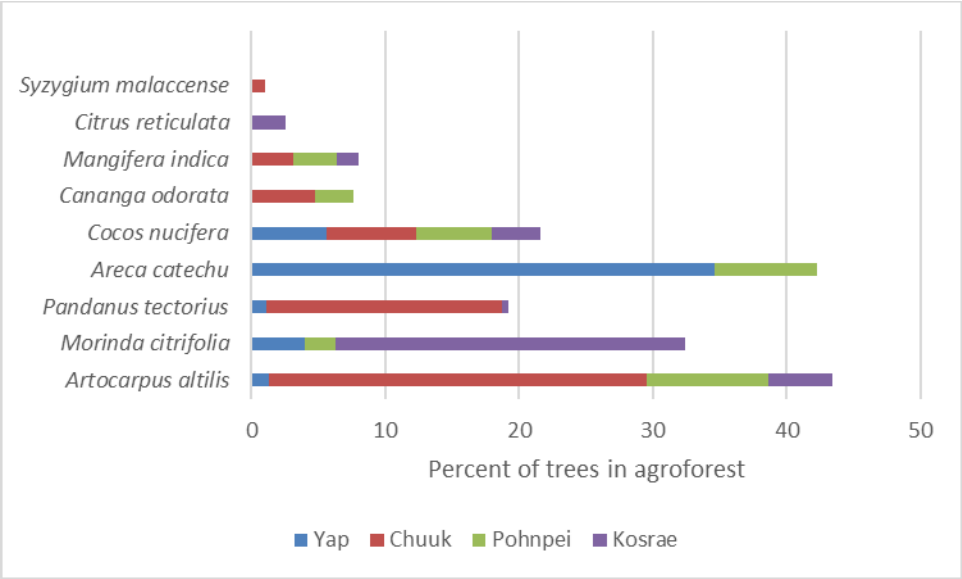
	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Agroforest Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Artocarpus altilis	15,451	49,588	998,859	519,309	123,531	70,831	126,168	78,301	1,264,008	532,249
Morinda citrifolia	46,352	83,599	--	--	30,679	115,812	684,601	455,834	761,631	477,688
Pandanus tectorius	12,929	13,216	623,160	577,881	--	--	13,469	11,861	649,557	578,154
Areca catechu	403,811	393,203	--	--	102,467	86,333	--	--	506,278	402,569
Cocos nucifera	65,883	94,670	237,623	79,001	75,313	43,721	95,521	71,101	474,340	148,898
Cananga odorata	--	--	168,296	143,774	38,439	25,686	--	--	206,736	146,051
Mangifera indica	--	--	112,558	82,172	43,915	37,000	40,408	25,438	196,881	93,640
Citrus reticulata	--	--	--	--	--	--	67,346	59,304	67,346	59,304
Syzygium malaccense	--	--	37,519	34,793	--	--	--	--	37,519	34,793
Artocarpus mariannensis	2,481	7,963	--	--	--	--	--	--	2,481	7,963



Number of agroforest trees (live trees>1-inch DBH) by species in FSM states.

Percent of agroforest trees (live trees >1 inch-DBH) by species in FSM states and overall. Non-agroforest species occurring in agroforest are not shown.

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Agroforest Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Artocarpus altilis	1.3	1.3	28.2	14.6	9.1	5.6	4.8	2.7	14.6	6.4
Morinda citrifolia	4.0	7.2	0.0	0.0	2.3	2.3	26.1	0.8	8.8	4.1
Pandanus tectorius	1.1	1.4	17.6	17.6	--	--	0.5	0.5	7.5	6.4
Areca catechu	34.7	11.9	--	--	7.6	7.6	--	--	5.8	4.3
Cocos nucifera	5.7	7.9	6.7	2.3	5.6	3.4	3.6	0.5	5.5	1.5
Cananga odorata	--	--	4.7	3.4	2.8	1.9	0.0	0.0	2.4	1.6
Mangifera indica	--	--	3.2	1.9	3.2	3.2	1.5	0.2	2.3	0.9
Citrus reticulata	--	--	--	--	--	--	2.6	2.6	0.8	0.8
Syzygium malaccense	--	--	1.1	1.1	--	--	--	--	0.4	0.4
Artocarpus mariannensis	0.2	0.2	--	--	--	--	--	--	--	--



Percent of agroforest trees (live trees >1 inch-DBH) by species in FSM states

Percent of agroforest trees by damage type in FSM states and overall

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Tree Damage Type	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Vine Damage	–	–	27.4	14.7	2.2	2.2	1.0	0.3	11.8	7.0
Broken Top	0.1	0.1	20.4	14.7	0.9	0.9	9.5	2.4	11.3	6.6
Stem Decay	4.4	1.6	11.1	3.9	10.3	6.5	14.7	4.0	11.2	2.7
Human Activities	1.8	3.7	6.0	3.0	7.3	5.4	5.1	0.3	5.4	1.6
Dead Top	–	–	10.2	7.7	2.0	1.1	0.6	0.5	4.6	3.6
Wind	–	–	–	–	--	–	12.8	12.8	3.9	3.9
Open Wound	0.8	0.8	4.7	3.9	2.2	2.2	0.5	0.5	2.5	1.7
Competition	–	–	4.4	4.4	--	–	--	--	1.8	1.8
Broken Branches	–	–	0.7	0.7	--	–	--	--	0.3	0.3
Parasitic/Epiphytic Plants	–	–	–	–	--	–	0.2	0.2	0.1	0.1
General Insects	0.1	0.1	–	–	--	–	--	--	0.0	0.0
Any Damage	6.4	3.5	47.2	11.6	11.3	7.1	39.8	9.9	33.9	7.3

Percent of agroforest tree species by damage type

	Cocos nucifera		*Artocarpus altilis*		*Pandanus tectorius*		*Mangifera indica*		*Areca catechu*	
Damage Type	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Human Activities	41.3	12.5	3.1	1.9	2.1	2.1	6.4	6.4	--	--
Stem Decay	29.6	11.4	4.0	2.5	1.4	1.4	--	--	2.1	1.2
Open Wound	2.8	2.8	13.3	8.1	--	--	--	--	--	--
Parasitic/Epiphytic Plants	--	--	0.4	0.4	--	--	--	--	--	--
Vine Damage	--	--	1.1	1.1	95.9	95.9	6.4	6.4	--	--
Broken Top	--	--	5.1	2.5	95.9	95.9	19.5	7.1	--	--
Dead Top	--	--	2.1	1.5	48.0	48.0	6.4	6.4	--	--
Broken Branches	--	--	1.0	1.0	--	--	--	--	--	--
Any Damage	49.8	11.7	22.8	6.3	99.4	1.4	25.9	6.6	2.1	1.2

Percent of agroforest area covered by dominant tree species in FSM states and overall. Agroforest species are highlighted in orange and invasive species in yellow.

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Artocarpus altilis	--	--	51.0	19.8	41.4	18.2	54.3	31.7	43.9	12.3
Cocos nucifera	29.0	31.0	49.0	19.8	--	--	--	--	26.3	11.0
Hibiscus tiliaceous	7.5	23.9	--	--	14.4	14.4	45.0	45.0	11.9	7.2
Spathodea campanulata	--	--	--	--	27.1	27.1	--	--	7.0	7.0
Areca catechu	50.3	36.2	--	--	--	--	--	--	5.2	4.9
Hererospathe elata	7.5	7.5	--	--	--	--	--	--	0.8	0.8
Morinda citrifolica	--	--	--	--	2.6	2.6	--	--	0.7	0.7
Commersonia bartramia	5.6	5.6	--	--	--	--	--	--	0.6	0.6
Nypa fruticans	--	--	--	--	--	--	0.7	0.7	0.1	0.1

Relative dominance of tree species in Yap agroforest, with agroforest species highlighted in orange.

Tree Species	Total	SE
Cocos nucifera	22.3	25.7
Areca catechu	22.0	12.2
Calophyllum inophyllum	21.0	12.2
Hibiscus tiliaceus	11.1	6.4
Glochidion ramiflorum	7.0	5.4
Averrhoa bilimbi	3.9	3.9
Artocarpus mariannensis	2.2	2.2
Premna obtusifolia	2.1	1.1
Macaranga carolinensis	1.5	1.9
Rhus taitensis	1.2	1.2
Pandanus tectorius	1.1	1.4
Commersonia bartramia	0.8	0.8
Morinda citrifolia	0.6	1.6
Premna serratifolia	0.5	1.6
Ficus tinctoria	0.5	0.5
Ficus copiosa	0.3	0.8
Campnosperma brevipetiolata	0.3	0.3
Heterospathe elata	0.2	0.2
Pongamia pinnata	0.2	0.2
Kleinhovia hospita	0.2	0.2
Artocarpus altilis	0.1	0.1
Pandanus dilatatus	0.1	0.1
Guettarda speciosa	0.1	0.1

Relative dominance of tree species in Chuuk agroforest, with agroforest species highlighted in orange.

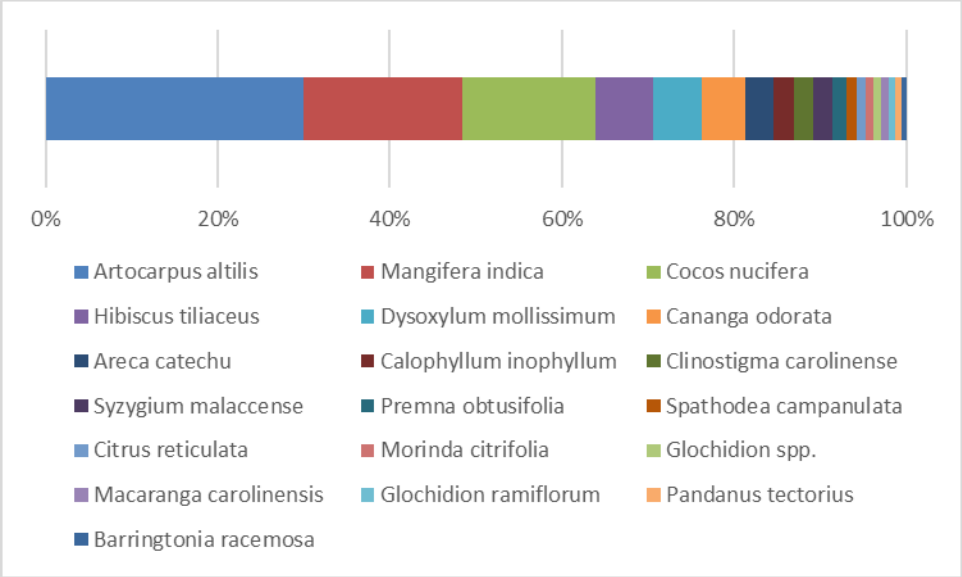
Tree Species	Total	SE
Artocarpus altilis	34.1	7.7
Mangifera indica	23.3	7.5
Cocos nucifera	15.0	6.1
Dysoxylum mollissimum	11.3	11.3
Clinostigma carolinense	4.4	4.4
Syzygium malaccense	4.3	4.3
Cananga odorata	2.3	2.1
Glochidion spp.	1.7	1.1
Hibiscus tiliaceus	1.4	1.4
Macaranga carolinensis	1.0	1.0
Pandanus tectorius	0.9	0.9
Premna serratifolia	0.2	0.2
Tree unknown	0.1	0.1

Relative dominance of tree species in Pohnpei agroforest, with agroforest species highlighted in orange and invasive species in yellow.

Tree Species	Total	SE
Cananga odorata	22.3	10.7
Mangifera indica	21.3	21.3
Artocarpus altilis	16.8	7.0
Cocos nucifera	11.7	4.6
Hibiscus tiliaceus	10.9	10.9
Spathodea campanulata	7.1	7.1
Areca catechu	5.3	5.3
Morinda citrifolia	1.2	1.2
Macaranga carolinensis	0.9	0.9
Aglaia ponapensis	0.8	0.8
Albizia spp.	0.6	0.6
Acacia auriculiformis	0.5	0.5
Adenanthera pavonina	0.3	0.3
Campnosperma brevipetiolata	0.3	0.3

Relative dominance of tree species in Kosrae agroforest, with agroforest species highlighted in orange and invasive species in yellow.

Tree Species	Total	SE
Artocarpus altilis	41.9	9.8
Cocos nucifera	14.5	2.6
Mangifera indica	13.1	2.6
Hibiscus tiliaceus	11.7	11.7
Premna obtusifolia	6.1	1.0
Citrus reticulata	4.2	4.2
Morinda citrifolia	3.0	0.3
Barringtonia racemosa	2.3	2.3
Antidesma kusaiense	1.5	1.0
Pandanus tectorius	0.7	0.7
Horsfieldia nunu	0.4	0.4
Allophylus timorensis	0.3	0.3
Adenanthera pavonina	0.1	0.1
Ficus tinctoria	0.1	0.1



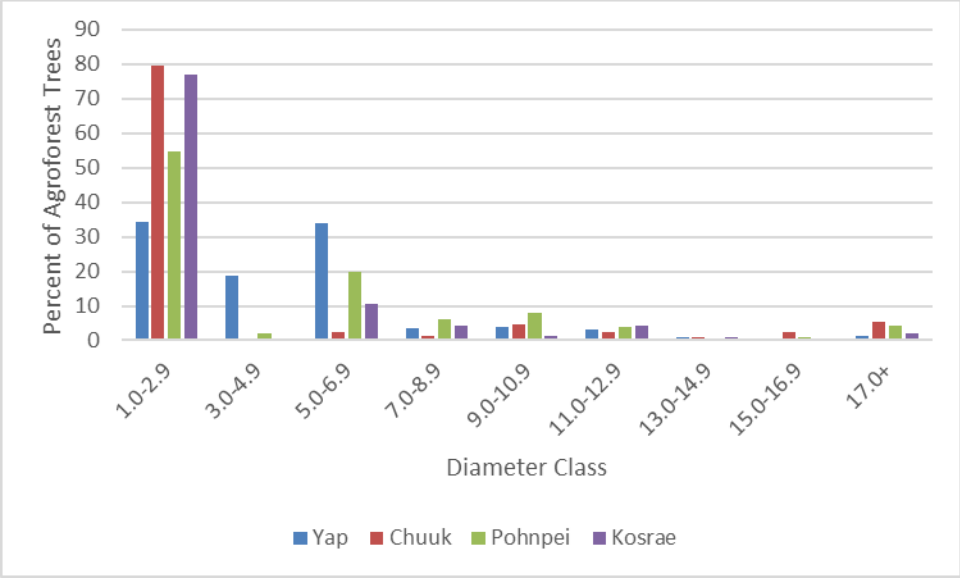
Relative dominance of tree species in FSM agroforest

Relative dominance of tree species in FSM agroforest, with agroforest species highlighted in orange and invasive species in yellow.

Tree Species	Total	SE
Artocarpus altilis	29.3	5.1
Mangifera indica	18.1	5.2
Cocos nucifera	15.1	4.3
Hibiscus tiliaceus	6.4	2.6
Dysoxylum mollissimum	5.6	5.6
Cananga odorata	4.9	2.7
Areca catechu	3.3	2.3
Calophyllum inophyllum	2.3	2.3
Clinostigma carolinense	2.2	2.2
Syzygium malaccense	2.1	2.1
Premna obtusifolia	1.6	0.7
Spathodea campanulata	1.2	1.2
Citrus reticulata	1.0	1.0
Morinda citrifolia	1.0	0.9
Glochidion spp.	0.9	0.6
Macaranga carolinensis	0.8	0.6
Glochidion ramiflorum	0.8	0.8
Pandanus tectorius	0.7	0.4
Barringtonia racemosa	0.5	0.5
Averrhoa bilimbi	0.4	0.4
Antidesma kusaiense	0.3	0.2
Artocarpus mariannensis	0.2	0.2
Premna serratifolia	0.2	0.2
Rhus taitensis	0.1	0.1
Aglaia ponapensis	0.1	0.1
Horsfieldia nunu	0.1	0.1
Albizia spp.	0.1	0.1
Adenanthera pavonina	0.1	0.1
Campnosperma brevipetiolata	0.1	0.1
Commersonia bartramia	0.1	0.1
Acacia auriculiformis	0.1	0.1
Allophylus timorensis	0.1	0.1
Ficus tinctoria	0.1	0.2
Tree unknown	0.1	0.1

Percent of agroforest trees by diameter class (in inches) per FSM state

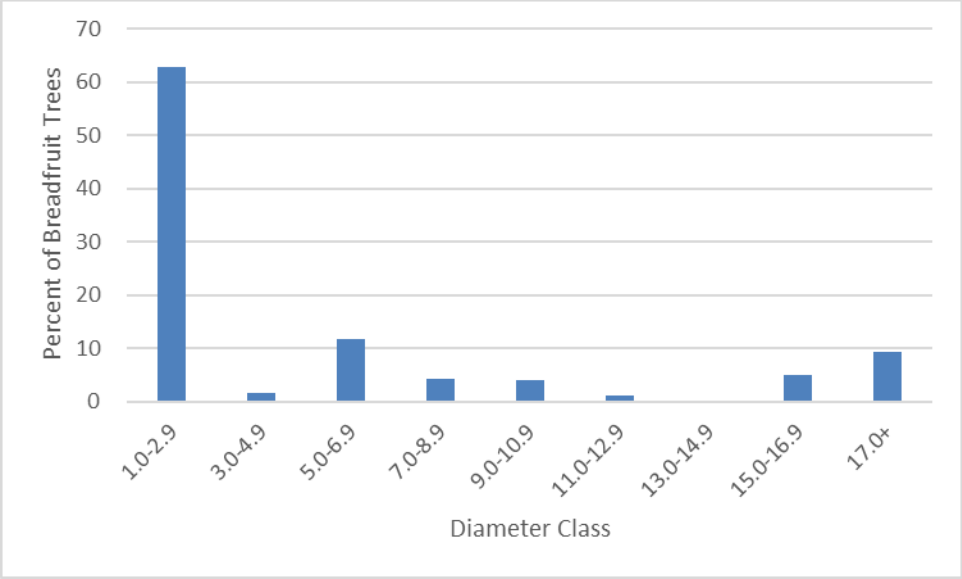
Diameter Class	Yap	SE	Chuuk	SE	Pohnpei	SE	Kosrae	SE
1.0-2.9	34.3	11.4	79.7	4.4	54.8	22.2	76.8	1.6
3.0-4.9	18.7	10.5	0.6	0.6	2.0	2.0	--	--
5.0-6.9	34.0	12.2	2.5	0.8	19.8	11.0	10.4	0.3
7.0-8.9	3.7	0.8	1.4	0.6	6.2	3.0	4.2	0.6
9.0-10.9	3.9	3.3	4.6	2.1	8.1	4.1	1.2	0.6
11.0-12.9	3.0	3.3	2.5	1.4	3.9	2.2	4.2	0.7
13.0-14.9	0.9	1.7	1.1	0.2	0.1	0.1	1.1	0.3
15.0-16.9	0.3	0.8	2.5	0.9	0.9	0.9	0.0	0.0
17.0+	1.3	1.0	5.3	1.6	4.2	2.1	2.2	0.3



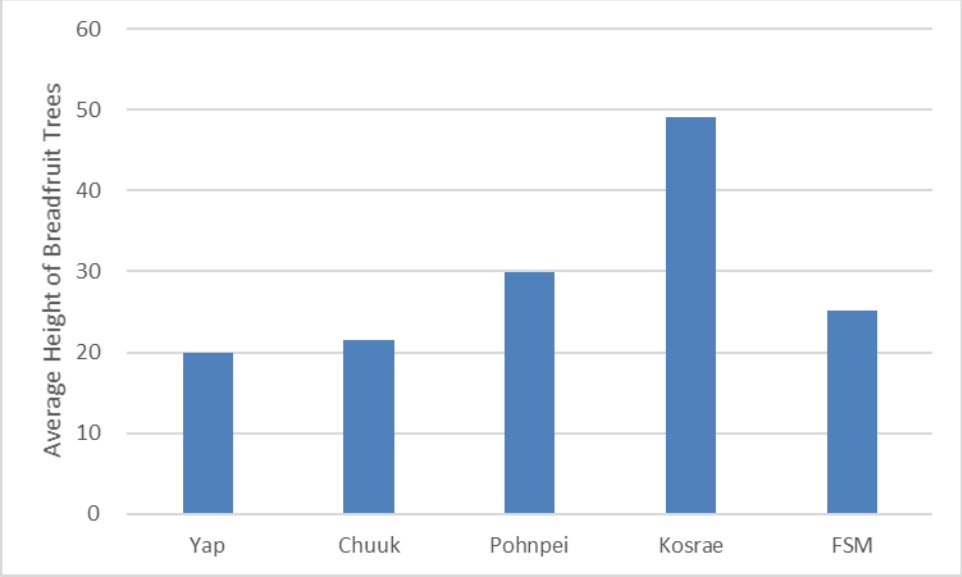
Percent of agroforest trees by diameter class (in inches) per FSM state

Percent of agroforest tree species by abbreviated diameter class (in inches) in FSM

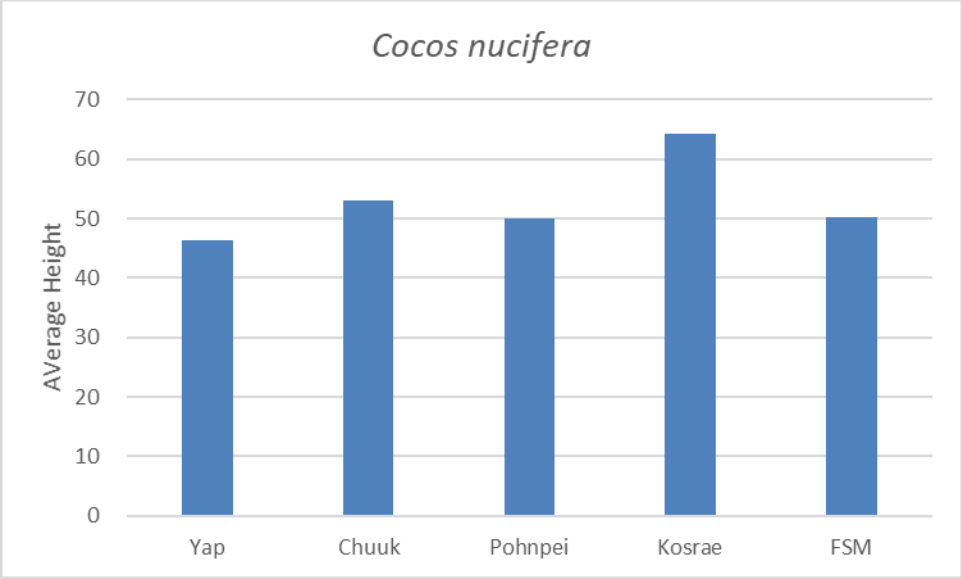
	Artocarpus altilis		*Mangifera indica*		*Cocos nucifera*		*Cananga odorata*		*Areca catechu*		*Syzygium malaccense*		*Morinda citrifolia*		*Pandanus tectorius*	
Diameter Classes	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
<5	64.4	14.9	--	--	--	--	75.4	75.4	31.8	18.4	--	--	97.7	2.5	95.9	95.9
5 to 10	18.3	10.1	26.5	8.5	35.3	9.5	--	--	68.2	18.4	33.3	33.3	2.3	2.5	4.1	4.5
>10	17.3	6.9	73.5	8.5	64.7	9.5	24.6	20.4	--	--	66.7	66.7	--	--	--	--



Percent of *Artocarpus altilis* (breadfruit) trees by diameter class (in inches) in FSM agroforest



Average height (in feet) of *Artocarpus altilis* (breadfruit) in agroforest by FSM state and overall



Mean height (in feet) of live *Cocos nucifera* trees in FSM states and overall.

Percent of trees (live trees>1-inch DBH) in agroforest that are endemic to Micronesia in FSM state MC areas, Non-MC areas, and overall.

	MC Areas	SE	Non-MC Areas	SE	Total	SE
Yap	0.6	0.6	--	--	0.2	0.2
Chuuk	--	--	1.1	1.1	1.1	--
Pohnpei	--	--	11.3	11.3	11.0	11.0
Kosrae	--	--	--	--	--	--
FSM	0.5	0.5	2.3	1.8	2.2	1.7

Percent of trees (live trees>1-inch DBH) in agroforest that are invasive in Micronesia in FSM state MC areas, Non-MC areas, and overall.

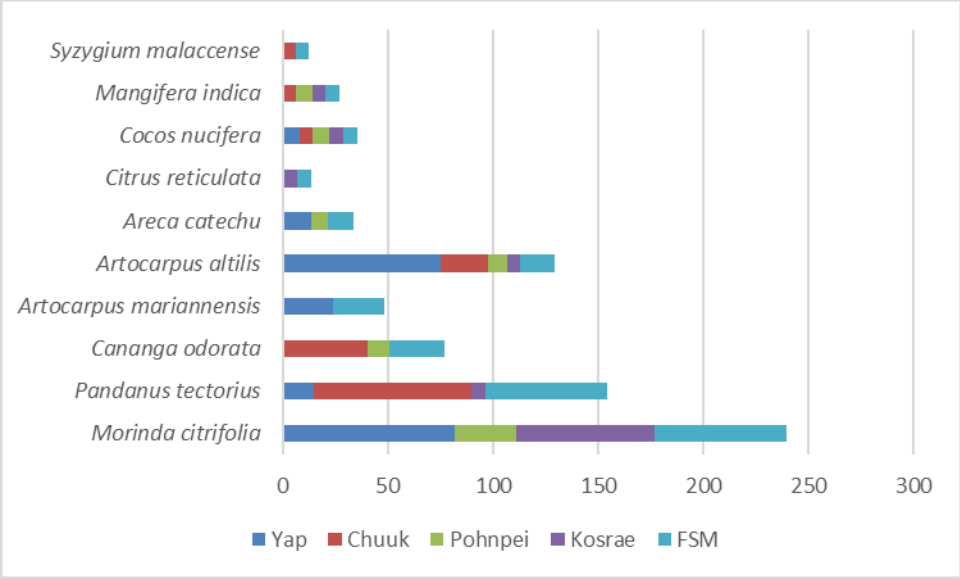
	MC Areas	SE	Non-MC Areas	SE	Total	SE
Yap	--	--	--	--	--	--
Chuuk	--	--	--	--	--	--
Pohnpei	--	--	16.8	5.7	16.4	5.8
Kosrae	8.3	8.3	--	--	0.0	0.0
FSM	0.2	0.2	2.7	1.8	2.6	1.7

Percent of agroforest covered by endemic understory species (tree seedlings and non-trees) in FSM state MC areas, Non-MC areas, and overall. There were no endemic species inentoried in Kosrae agroforest understory.

	Endemic Trees		Endemic Non-Trees		Total	
	Total	SE	Total	SE	Total	SE
FSM MC Area	0.7	1.5	0.2	0.2	1.0	1.6
Non-MC Area	0.5	0.2	--	--	0.5	0.2
Total	0.6	0.2	0.0	0.0	0.6	0.2
Yap MC Area	1.1	2.2	0.3	0.3	1.4	2.2
Non-MC Area	--	--	--	--	--	--
Total	0.5	1.0	0.2	0.2	0.7	1.1
Chuuk MC	--	--	--	--	--	--
Non-MC Area	0.4	0.4	--	--	0.4	0.4
Total	0.4	0.4	--	--	0.4	0.4
Pohnpei MC	--	--	--	--	--	--
Non-MC Area	1.2	0.5	--	--	1.2	0.5
Total	1.2	0.5	--	--	1.2	0.5

Stem density (live trees >1 cm DBH per acre) of agroforest tree species in FSM states and overall

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Agroforest Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Morinda citrifolia	81.8	19.7	--	--	29.0	29.0	65.7	14.2	63.3	17.0
Pandanus tectorius	14.4	10.2	75.0	75.0	--	--	6.8	6.8	58.1	15.1
Cananga odorata	--	--	40.5	23.7	10.1	1.3	--	--	26.0	14.1
Artocarpus mariannensis	24.1	24.1	--	--	--	--	--	--	24.1	24.1
Artocarpus altilis	74.9	74.9	22.8	8.2	8.9	0.8	6.3	0.3	16.2	5.3
Areca catechu	13.7	2.2	--	--	7.9	7.9	--	--	11.9	2.2
Citrus reticulata	--	--	--	--	--	--	6.8	6.8	6.8	6.8
Cocos nucifera	7.9	3.4	6.0	--	8.0	0.4	6.7	0.1	6.6	0.3
Mangifera indica	--	--	6.0	--	7.9	7.9	6.5	0.2	6.5	0.3
Syzygium malaccense	--	--	6.0	6.0	--	--	--	--	6.0	6.0



Stem density (live trees> 1cm DBH per acre) of agroforest tree species in FSM states and overall

Percent of agroforest with invasive plant species present or absent in FSM states and overall.

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Invasives Present	0.9	0.9	100.0	0.0	84.7	8.4	99.3	2.4	85.8	6.6
Invasives Absent	85.5	9.8	–	–	11.7	6.7	0.7	0.7	11.9	5.9

Percent of agroforest area covered by invasive plant species in FSM states and overall.

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Invasive Plant Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Merremia peltata	--	--	16.8	3.6	8.3	4.3	10.8	4.2	11.9	2.4
Costus speciosus	--	--	--	--	8.6	4.4	9.4	3.2	3.8	1.6
Chromolaena odorata	--	--	2.6	1.3	1.2	0.8	--	--	1.6	0.7
Spathodea campanulata	--	--	--	--	2.5	2.5	--	--	0.6	0.6
Sphagneticola trilobata	--	--	0.2	0.1	--	--	2.7	1.9	0.6	0.4
Momordica charantia	--	--	1.1	0.8	--	--	--	--	0.5	0.4
Dieffenbachia seguine	--	--	0.7	0.7	--	--	--	--	0.3	0.3
Falcataria moluccana	--	--	--	--	1.3	1.3	--	--	0.3	0.3
Coccinia grandis	--	--	0.7	0.7	--	--	--	--	0.3	0.3
Hedychium coronarium	--	--	0.3	0.2	0.1	0.1	0.7	0.6	0.3	0.1
Clerodendrum quadriloculare	--	--	0.3	0.3	0.6	0.6	--	--	0.3	0.2
Lantana camara	--	--	0.4	0.2	--	--	--	--	0.2	0.1
Saccharum	--	--	0.2	0.2	--	--	--	--	0.1	0.1
Mimosa diplotricha	--	--	--	--	0.2	0.2	--	--	0.0	0.0
Leucaena leucocephala	0.1	0.1	--	--	--	--	--	--	0.0	0.0
Total	0.1	0.1	23.4	2.9	22.8	3.4	23.7	5.4	20.9	2.4

Acreage of agroforest in FSM covered by invasive plant species.

Invasive Species	Total	SE
Merremia peltata	3,183	925
Costus speciosus	1,003	489
Chromolaena odorata	415	210
Spathodea campanulata	170	143
Sphagneticola trilobata	151	106
Momordica charantia	145	110
Dieffenbachia seguine	94	87
Falcataria moluccana	91	77
Coccinia grandis	83	77
Hedychium coronarium	81	42
Clerodendrum quadriloculare	79	49
Lantana camara	47	24
Saccharum	31	29
Mimosa diplotricha	12	10
Leucaena leucocephala	2	10
Total	5,589	1,356

Strand Forest

Strand vegetation is common along coastlines across much of the tropical Pacific, especially in Micronesia (Mueller-Dombois & Fosberg, 1998). On smaller islands and atolls, the forest vegetation is strand like even in island interiors, but on larger/high islands, strand forest covers the thin strip of land exposed to salt spray, and buffers the interior forests (lowland rainforest and/or agroforest) from wind and salt. As such, strand forests play an important role in coastal stabilization, but are limited in tree species diversity compared to lowland rainforest, because not all tree species can survive living next to the ocean.

Due to their topographical position and normal width, strand forest was not heavily sampled in the base FIA inventory (only one strand forest plot was sampled, in Pohnpei). The MC added 25 strand forests plots (5 in Pohnpei, 2 in Kosrae, and 18 in Yap), and most of those were on outer islands of Yap, so the summary of FSM strand forest is weighted towards outer Yap. All tree species other than coconut trees had relative dominance values with high SE in strand forest, which indicates that other than the presence of coconut trees, strand forest tree species composition was highly variable, even within Yap state. Given that 14 different outer islands were sampled in Yap, the high variation is less surprising, although there were many non-strand specific tree species sampled, probably due to some overlap in some plots between strand and lowland rainforest. The strand plots in Kosrae must have overlapped with swamp forest, since the most dominant species there were the swamp denizens *Terminalia carolinensis* (an endemic) and *Horsfieldia nunu*. This was also the reason for the high rate of tree species endemism in Kosrae strannd forest.

The presence of coconut trees and various other agroforest species in strand forest, particularly on small islands and atolls, makes it almost more of a subtype of agroforest than strand forest per se, although there is also undoubtedly overlap of strand forest and strictly defined agroforest as well. Only in Pohnpei strand forest was the most dominant tree species a common strand forest tree species (with high SE), while in Yap and FSM overall coconut was by far the most dominant species. Coconut height among all forest communities is summarized in the agroforest section, but coconuts were 7.5 feet (SE=4.8) taller in agroforest than in strand forest (53.6 vs. 46.1).The stem density of coconuts was slightly (but not significantly) higher in FSM strand forest than agroforest, and despite accounting for about 6 times less total forest area, strand forests had about 85% of the number of of coconut trees in agroforests (and lowland rainforest had almost 40%). While also home to much smaller numbers of other common agroforest trees, it appears that strand forest is the natural habitat of the endemic wild seeded breadfruit, *Artocarpus mariannensis*. Surprisingly, *Scaveola taccada,*which is one of the most, if not the most common strand species, wasn't sampled at all except in Pohnpei.

Number of common agroforest tree species in strand forest, lowland rainforest agroforest and overall in FSM

	Strand Forest		Lowland Rainforest		Agroforest		Total	
Agroforest Tree Species	Total	SE	Total	SE	Total	SE	Total	SE
Cananga odorata	--	--	2,203,812	1,253,217	206,736	146,051	2,410,547	1,250,402
Artocarpus altilis	20,413	61,557	547,332	252,860	1,264,008	532,249	1,831,753	575,200
Morinda citrifolia	30,790	73,177	711,380	424,625	761,631	477,688	1,503,801	638,448
Pandanus tectorius	46,963	66,449	691,625	481,289	649,557	578,154	1,388,146	754,397
Cocos nucifera	403,024	292,504	169,573	79,305	474,340	148,898	1,046,937	323,660
Areca catechu	--	--	275,096	380,945	506,278	402,569	781,374	543,640
Mangifera indica	--	--	104,950	64,140	196,881	93,640	301,830	107,590
Artocarpus mariannensis	97,486	305,441	17,524	62,218	2,481	7,963	117,491	311,489

Percent of trees (live trees>1-inch DBH) in strand forest that are endemic to Micronesia in FSM state MC areas, and overall. There were no strand forest plots sampled in Chuuk, no endemic species sampled in Non-MC Area strand forest, and no invasive tree species sampled in strand forest in FSM.

	MC-Area	SE	Total	SE
Yap	12.7	35.4	12.7	35.4
Pohnpei	0.7	0.7	0.1	0.1
Kosrae	23.1	23.1	23.1	23.1
FSM	11.8	27.5	6.1	15.1

Percent of strand forest covered by endemic understory species (tree seedlings and non-trees) in FSM state MC areas, Non-MC areas, and overall. There was no strand forest sampled in Chuuk, and no endemic non-tree species were sampled in FSM strand forest.

	Endemic Trees		Endemic Non-Trees		Total	
	Total	SE	Total	SE	Total	SE
FSM MC Area	1.5	2.8	--	--	1.5	2.8
Non-MC Area	--	--	--	--	--	--
Total	1.3	2.4	--	--	1.3	2.4
Yap MC Area	1.2	2.9	--	--	1.2	2.9
Non-MC Area	--	--	--	--	--	--
Total	1.2	2.9	--	--	1.2	2.9
Pohnpei MC	0.6	0.6	--	--	0.6	0.6
Non-MC Area	--	--	--	--	--	--
Total	0.3	0.3	--	--	0.3	0.3
Kosrae MC	5.7	5.7	--	--	5.7	5.7
Non-MC Area	--	--	--	--	--	--
Total	5.7	5.7	--	--	5.7	5.7

Percent of strand forest area by dominant tree species, with agroforest species highlighted in orange, and strand species in blue.

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Cocos nucifera	75.8	35.2	--	--	12.6	33.6	--	--	53.4	30.3
Barringtonia asiatica	3.7	3.7	--	--	62.2	51.6	42.9	42.9	21.8	20.9
Eugenia malaccensis	7.4	7.4	--	--	--	--	--	--	4.9	4.9
Guettarda speciosa	7.4	7.4	--	--	--	--	--	--	4.9	4.9
Horsfieldia nunu	--	--	--	--	--	--	57.1	57.1	4.9	4.9
Pandanus tectorius	5.6	5.6	--	--	--	--	--	--	3.7	3.7
Ficus tinctoria	--	--	--	--	12.6	12.6	--	--	3.2	3.2
Premna serratifolia	--	--	--	--	12.6	12.6	--	--	3.2	3.2

Relative dominance of tree species in Yap strand forest, with agroforest species highlighted in orange, and strand species in blue.

Strand Forest Tree Species	Total	SE
Cocos nucifera	57.1	29.2
Calophyllum inophyllum	7.8	7.8
Guettarda speciosa	7.2	9.7
Eugenia malaccensis	5.5	10.0
Barringtonia asiatica	5.2	5.2
Premna obtusifolia	3.3	8.8
Pisonia grandis	3.1	6.0
Hibiscus tiliaceus	1.6	1.6
Artocarpus mariannensis	1.4	3.2
Ficus prolixa	1.3	3.3
Pandanus tectorius	1.3	1.9
Hernandia sonora	1.1	1.1
Artocarpus altilis	0.9	2.0
Tree unknown	0.9	2.6
Pipturus argenteus	0.7	2.2
Tournefortia argentea	0.5	0.5
Glochidion ramiflorum	0.3	0.3
Pandanus dilatatus	0.2	0.2
Syzygium spp.	0.2	0.2
Terminalia catappa	0.1	0.1
Ficus tinctoria	0.1	0.1
Premna serratifolia	0.1	0.1

Relative dominance of tree species in Pohnpei strand forest, with strand species highlighted in blue and agroforest species in orange.

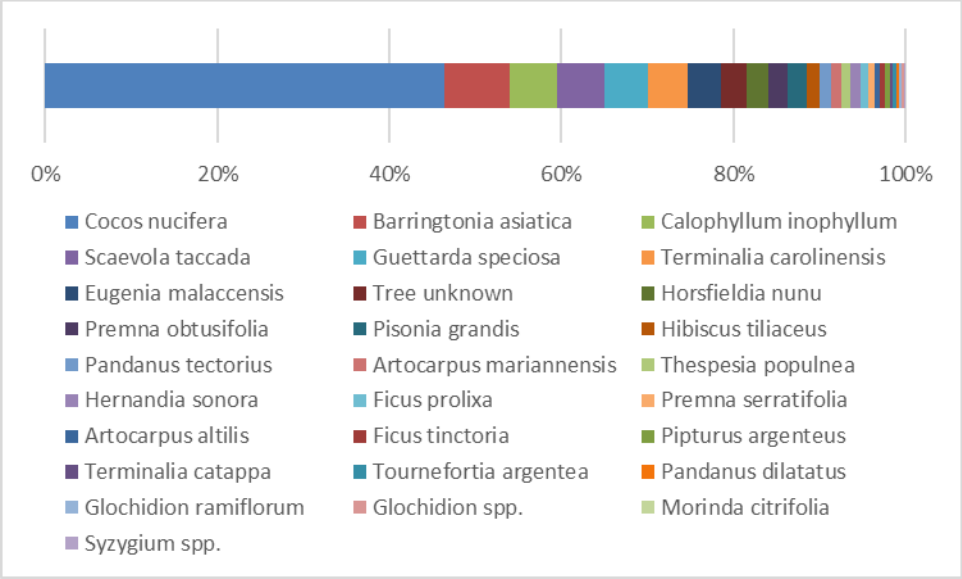
Strand Forest Tree Species	Total	SE
Scaevola taccada	31.3	31.3
Cocos nucifera	30.0	42.4
Tree unknown	13.5	13.2
Barringtonia asiatica	8.0	16.9
Premna serratifolia	3.8	12.9
Ficus tinctoria	3.1	8.2
Pandanus tectorius	2.3	5.2
Hernandia sonora	2.0	2.0
Hibiscus tiliaceus	1.7	1.7
Glochidion spp.	1.1	1.1
Pandanus dilatatus	1.0	2.4
Glochidion ramiflorum	0.8	0.8
Artocarpus mariannensis	0.7	0.7
Morinda citrifolia	0.7	1.6

Relative dominance of tree species in Kosrae strand forest, with strand species highlighted in blue and agroforest species highlighted in orange.

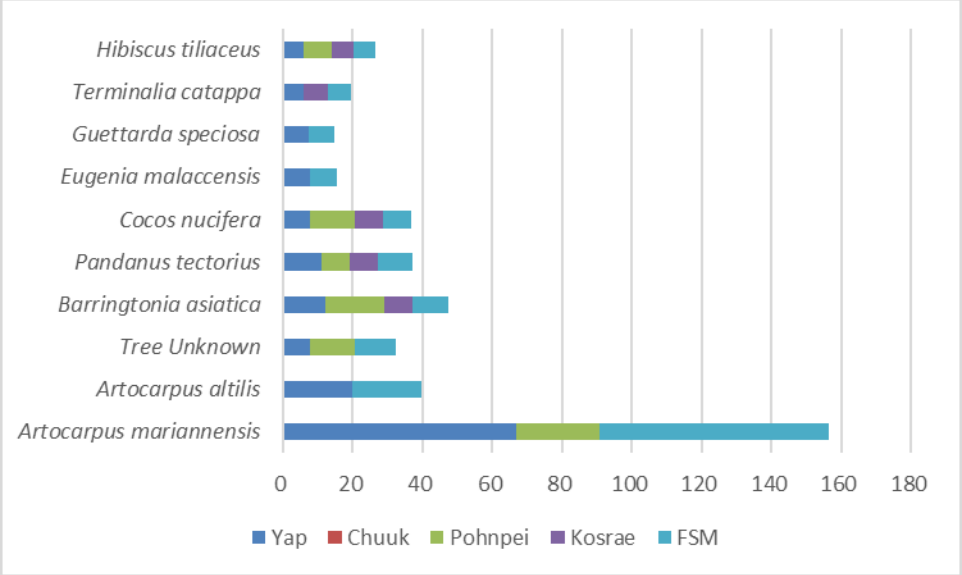
Strand Forest Tree Species	Total	SE
Terminalia carolinensis	38.8	38.8
Horsfieldia nunu	21.3	21.3
Barringtonia asiatica	21.1	21.1
Thespesia populnea	9.6	9.6
Cocos nucifera	4.9	4.9
Terminalia catappa	2.7	6.6
Pandanus tectorius	0.9	0.9
Hibiscus tiliaceus	0.2	0.2

Relative dominance of tree species in FSM strand forest, with agroforest species highlighted in orange and strand species highlighted in blue.

Strand Forest Tree Species	Total	SE
Cocos nucifera	46.3	24.8
Barringtonia asiatica	7.6	14.0
Calophyllum inophyllum	5.5	5.5
Scaevola taccada	5.4	5.4
Guettarda speciosa	5.2	7.0
Terminalia carolinensis	4.5	4.5
Eugenia malaccensis	3.9	7.4
Tree unknown	3.0	4.0
Horsfieldia nunu	2.5	2.5
Premna obtusifolia	2.4	6.3
Pisonia grandis	2.2	4.3
Hibiscus tiliaceus	1.4	3.8
Pandanus tectorius	1.4	1.7
Artocarpus mariannensis	1.1	2.3
Thespesia populnea	1.1	1.1
Hernandia sonora	1.1	2.5
Ficus prolixa	0.9	2.4
Premna serratifolia	0.7	2.4
Artocarpus altilis	0.6	1.5
Ficus tinctoria	0.6	1.6
Pipturus argenteus	0.5	1.5
Terminalia catappa	0.4	0.9
Tournefortia argentea	0.3	0.3
Pandanus dilatatus	0.3	0.7
Glochidion ramiflorum	0.3	0.8
Glochidion spp.	0.2	0.2
Morinda citrifolia	0.1	0.3
Syzygium spp.	0.1	0.1



Relative dominance of tree species in FSM strand forest



Stem density (live trees>1-inch DBH per acre) of tree species in strand forest in FSM states and overall

Stem density (live trees>1 cm per acre) of tree species in strand forest in FSM states and overall, with agroforest species highlighted in orange and strand species in blue.

	Yap		Pohnpei		Kosrae		FSM	
Strand Forest Tree Species	Total	SE	Total	SE	Total	SE	Total	SE
Scaevola taccada	--	--	350.7	350.7	--	--	350.7	350.7
Artocarpus mariannensis	66.8	39.9	24.1	24.1	--	--	65.6	41.1
Morinda citrifolia	74.9	74.9	38.7	56.1	--	--	51.1	44.7
Artocarpus altilis	19.8	12.7	--	--	--	--	19.8	12.7
Hernandia sonora	6.0	6.0	28.2	28.2	--	--	16.1	18.2
Horsfieldia nunu	--	--	--	--	12.3	12.3	12.3	12.3
Tournefortia argentea	12.0	12.0	--	--	--	--	12.0	12.0
Pisonia grandis	11.8	18.8	--	--	--	--	11.8	18.8
Tree Unknown	7.8	3.5	13.0	19.4	--	--	11.7	14.4
Barringtonia asiatica	12.0	12.0	16.9	19.2	8.0	8.0	10.6	6.3
Pandanus tectorius	11.2	16.0	8.0	--	8.0	8.0	10.0	9.9
Cocos nucifera	7.7	1.9	13.0	4.6	8.0	8.0	8.1	2.0
Thespesia populnea	--	--	--	--	8.0	8.0	8.0	8.0
Eugenia malaccensis	7.8	3.4	--	--	--	--	7.8	3.4
Guettarda speciosa	7.4	2.7	--	--	--	--	7.4	2.7
Terminalia catappa	6.0	6.0	--	--	6.9	2.5	6.6	1.7
Hibiscus tiliaceus	6.0	6.0	8.0	8.0	6.0	6.0	6.4	1.5
Terminalia carolinensis	--	--	--	--	6.0	6.0	6.0	6.0
Calophyllum inophyllum	6.0	6.0	--	--	--	--	6.0	6.0
Premna obtusifolia	6.0	--	--	--	--	--	6.0	--

Percent of strand forest trees by damage type in FSM states and overall

	Yap		Pohnpei		Kosrae		FSM	
Damage Type	Total	SE	Total	SE	Total	SE	Total	SE
Stem Decay	2.1	2.4	16.4	4.1	1.3	1.3	10.1	4.9
Human Activities	5.5	7.1	--	--	--	--	2.1	2.7
Defoliators	--	--	1.3	1.3	--	--	0.7	0.7
Broken Top	0.5	0.9	0.2	0.5	--	--	0.3	0.4
Dead Top	0.3	0.8	--	--	--	--	0.1	0.3
Any Damage	7.9	7.8	17.9	4.3	1.3	1.3	13.2	5.4

Lowland Rainforest

On all of the high islands of FSM, most of the lowland rainforest below a few hundred meters elevation has been profoundly altered by human activity, and the highest islands of Pohnpei and Kosrae probably contain the most original native lowland rainforest vegetation, mostly on mountain slopes below montane rainforest (Muller-Dombois & Fosberg, 1998). As such any remaining areas of intact lowland rainforest across FSM are recommended for conservation. Lowland rainforest had by far the highest number of endemic tree species among forest communities in FSM, with only two of the twenty-eight endemic tree species inventoried limited to another forest community (montane rainforest, with only 4 plots). Kosrae had the highest rate of tree endemism overall in lowland rainforest, while Pohnpei had the highest rate among MC Areas. The high rate of invasive trees in Chuuk lowland rainforest is the main reason the percent of invasive trees in lowland rainforest is higher on average than in agroforest in FSM.

Yap has the most seasonal rainfall pattern, the most frequent and largest wildfires, and the most extensive non-forest vegetation (savanna), but nevertheless still had the highest tree species richness in FSM. The most dominant tree in Yap was *Calophyllum inophyllum*, followed by *Hibiscus tiliaceous* (indicating recovery from disturbance) and an endemic tree (unfortunately for the Yapese, the poison tree *Semecarpus venenosus*). Yap had the lowest overall proportion of invasive tree species.

Chuuk is dominated by agroforest with less than 30% of total forest area in lowland rainforest, most of which is located on the low mountaintops which remain forested. Even what was classified as lowland rainforest in the Chuuk inventory was dominated by three agroforest species (mango, coconut, and ilang-ilang). Chuuk had by far the highest percent of invasive trees in lowland rainforest (with high SE), due to *Adenanthera pavonina* (the third most dominant species in Kosrae*)*, and by far the lowest percentage of endemic trees. All these observations suggest that some reforestation of lowland rainforest with native tree species could be beneficial in Chuuk.

The lowland rainforest in Pohnpei was dominated by *Campnosperma brevipetiolata*, considered by some to be the most characteristic dominant tree species of lowland rainforest in the Caroline Islands. Pohnpei had four endemic tree species but also two invasive species in the top ten most dominant species, and *Hibiscus tiliaceous* was the fourth most dominant species, suggesting that forests are in good condition overall but somewhat disturbed and recovering as well. The Pohnpei Watershed Reserve probably contains most of the best remaining lowland rainforest in Pohnpei, as well as all of the montane rainforest, and as such is of the utmost importance, in addition to ensuring a fresh, clean and consistent water supply to the island.

In Kosrae, the most dominant tree species *Horsfieldia nunu* composed a third of lowland rainforest wood, which suggests that relatively large swamp forest trees comprise a substantial proportion of lowland rainforest tree volume there, although unfortunately the magnificent and endemic swamp forest species *Terminalia carolinensis* barely showed up in the inventory. *H. nunu* was previously considered an endemic species but has been reabsorbed into the broader-ranged *H. irya (*Costion & Lorence, 2012*)*. Kosrae was the only state with a higher endemism rate of non-tree species in the understory compared to tree seedlings. Kosrae is the only island in FSM besides Pohnpei with high mountains and montane rainforest and would be well advised to create their own central watershed reserve, especially since Kosrae had the highest overall rate of tree species endemism and understory plant species endemism among FSM lowland rainforest areas.

Percent of live trees in FSM states, communities and overall, that are endemic or invasive to Micronesia

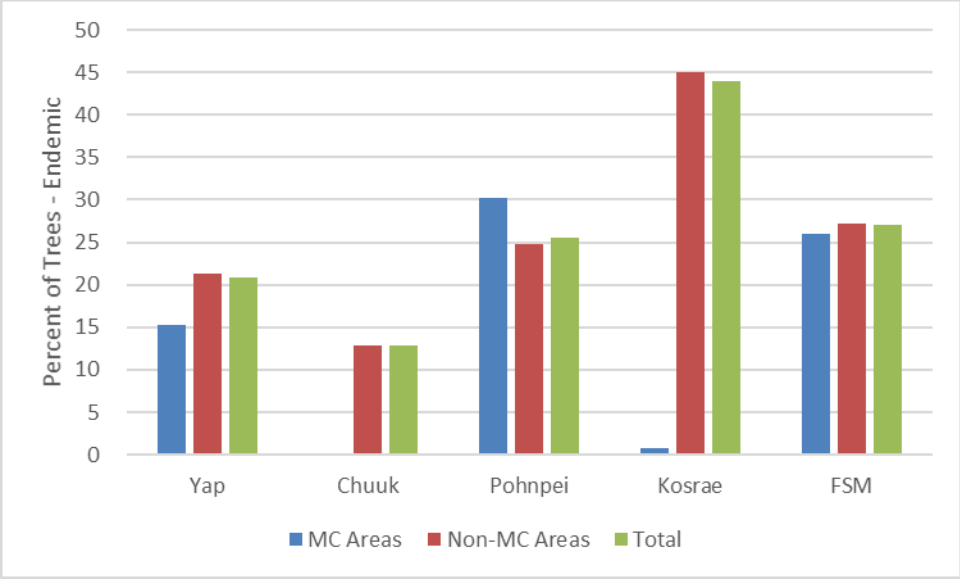
	FSM		Yap		Chuuk		Pohnpei		Kosrae		Strand		Lowland		Montane		Agroforest	
Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Endemic Species	23.6	3.3	17.1	7.0	7.1	3.8	25.7	4.5	35.0	9.3	6.1	15.1	27.1	3.7	63.4	14.5	2.2	1.7
Invasive Species	5.4	2.6	0.1	0.1	22.6	22.6	4.9	2.9	2.5	0.9	--	--	7.2	3.5	--	--	2.6	1.7

Number of endemic trees by species and forest community in FSM

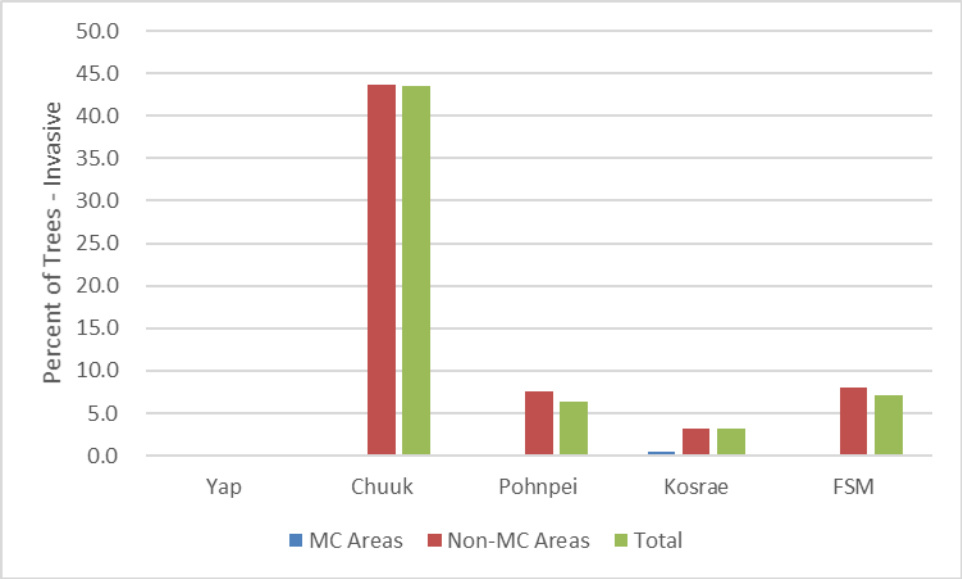
	Montane Rainforest		Strand Forest		Lowland Rainforest		Agroforest		All Forest	
Endemic Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Eugenia stelecantha	--	--	15,398	54,572	6,165,230	2,082,008	--	--	6,180,628	2,082,723
Exorrhiza ponapensis	2,228,821	1,497,388	--	--	2,198,483	900,887	--	--	4,427,304	1,707,712
Aglaia ponapensis	572,433	341,356	--	--	3,654,213	1,022,620	148,242	140,330	4,374,888	1,034,997
Elaeocarpus carolinensis	195,844	185,392	--	--	599,238	218,180	--	--	795,082	274,275
Garcinia rumiyo	--	--	--	--	695,488	506,344	--	--	695,488	506,344
Trichospermum ikutai	--	--	--	--	662,500	531,762	--	--	662,500	531,762
Trukia carolinensis	--	--	--	--	623,160	442,937	--	--	623,160	442,937
Semecarpus venenosa	--	--	--	--	556,476	394,770	--	--	556,476	394,770
Claoxylon carolinianum	--	--	--	--	478,828	319,958	--	--	478,828	319,958
Pandanus japensis	--	--	--	--	458,749	379,009	--	--	458,749	379,009
Timonius albus	--	--	--	--	344,061	265,830	--	--	344,061	265,830
Garcinia ponapensis	296,483	193,674	--	--	11,901	11,265	--	--	308,384	193,224
Ponapea ledermanniana	--	--	--	--	222,829	146,890	--	--	222,829	146,890
Elaeocarpus kusanoi	--	--	1,241	3,982	189,419	153,589	--	--	190,659	153,641
Glochidion marianum	--	--	--	--	183,657	173,816	--	--	183,657	173,816
Cinnamomum carolinense	148,242	140,330	--	--	25,370	16,358	--	--	173,611	140,747
Buchanania engleriana	--	--	--	--	142,308	142,004	--	--	142,308	142,004
Drypetes yapensis	--	--	--	--	142,308	142,004	--	--	142,308	142,004
Artocarpus mariannensis	--	--	97,486	305,441	17,524	62,218	2,481	7,963	117,491	311,489
Meryta senfftiana	--	--	--	--	114,687	122,719	--	--	114,687	122,719
Sterculia ponapensis	--	--	--	--	83,304	78,858	--	--	83,304	78,858
Palaquium karrak	--	--	--	--	41,177	20,374	--	--	41,177	20,374
Ponapea hosinoi	35,702	33,796	--	--	--	--	--	--	35,702	33,796
Pittosporum spp.	--	--	--	--	29,276	24,667	--	--	29,276	24,667
Metroxylon amicarum	11,901	11,265	--	--	--	--	--	--	11,901	11,265
Terminalia carolinensis	--	--	7,417	26,285	1,236	4,381	--	--	8,653	26,392
Cycas circinalis	--	--	--	--	1,241	3,982	--	--	1,241	3,982
Cyathea nigricans	--	--	--	--	1,236	4,381	--	--	1,236	4,381

Percent of lowland rainforest trees endemic or invasive to Micronesia in FSM state MC areas, Non-MC areas and overall.

	FSM						Yap						Chuuk						Pohnpei						Kosrae					
	MC Area		Non-MC Area		Total		MC Area		Non-MC Area		Total		MC Area		Non-MC Area		Total		MC Area		Non-MC Area		Total		MC Area		Non-MC Area		Total	
Percent of Trees	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Endemic Species	26.0	5.4	27.2	4.1	27.1	3.7	15.3	20.7	21.3	8.4	20.8	7.9	--	--	12.9	6.0	12.9	6.0	30.2	3.4	24.7	5.2	25.6	4.4	0.8	0.8	45.1	8.8	44.0	8.9
Invasive Species	0.0	0.0	8.0	3.9	7.2	3.5	--	--	0.2	0.2	0.2	0.2	--	--	43.6	43.6	43.5	43.5	--	--	7.5	4.7	6.3	4.0	0.4	0.4	3.3	1.0	3.2	1.0



Percent of lowland rainforest trees (live trees>1-inch DBH) that are endemic species to Micronesia in FSM state MC areas, Non-MC areas, and overall.



Percent of trees (live trees>1-inch DBH) that are invasive species in Micronesia among all trees in lowland rainforest in FSM state MC areas, Non-MC areas, and overall.

Percent of lowland rainforest trees by damage type in FSM states and overall.

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
Damage Type	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Stem Decay	17.3	2.7	15.9	8.1	8.6	1.8	10.8	3.5	11.6	1.4
Broken Top	4.0	1.7	14.5	8.1	5.6	1.2	6.3	2.8	6.1	1.1
Vine Damage	3.9	2.4	12.3	9.0	0.1	0.1	7.9	6.7	3.5	1.6
Dead Top	3.7	2.6	3.6	2.5	2.1	1.0	6.2	3.0	3.4	1.0
Root Disease	2.5	1.8	0.7	0.7	2.0	1.0	0.3	0.2	1.7	0.6
Open Wound	5.6	2.0	--	--	0.3	0.1	0.5	0.2	1.6	0.6
Human Activities	1.5	0.8	4.1	4.1	0.9	0.9	1.3	1.3	1.4	0.6
Competition	--	--	6.2	0.7	1.1	0.6	1.3	1.3	1.3	0.4
Defoliators	--	--	--	--	1.6	0.8	--	--	0.8	0.4
General Insects	3.4	1.4	--	--	--	--	--	--	0.8	0.3
Dieback	2.5	1.2	--	--	--	--	0.3	0.2	0.6	0.3
Decline/Dieback/Wilt	2.0	1.6	--	--	--	--	--	--	0.5	0.4
Fire	0.9	0.8	--	--	0.0	0.0	--	--	0.2	0.2
Broken Branches	0.0	0.0	0.2	0.2	0.2	0.1	--	--	0.1	0.0
Wind	0.1	0.1	0.5	0.5	--	--	--	--	0.1	0.0
Phellinous noxious	0.1	0.1	--	--	--	--	0.1	0.1	0.0	0.0
Foliage Disease	0.1	0.1	0.2	0.2	--	--	--	--	0.0	0.0
Crook or Sweep	0.1	0.1	--	--	--	--	--	--	0.0	0.0
Any Damage	33.7	4.4	33.3	16.3	17.5	2.3	20.2	6.1	23.0	2.4

Percent of lowland rainforest area by dominant tree species in FSM states and overall, with endemic species highlighted in pink, invasive species in yellow, agroforest species in orange, and planted mahogany in brown.

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Hibiscus tiliaceus	22.9	13.9	29.5	24.8	13.6	6.5	7.7	5.3	15.2	4.8
Horsfieldia nunu	--	--	--	--	--	--	66.3	13.6	14.0	3.6
Campnospera brevipetiolata	9.6	9.6	--	--	21.5	8.0	0.1	0.1	13.3	4.8
Exorrhiza ponapensis	--	--	--	--	18.3	7.7	--	--	9.8	4.2
Adenathera pavonina	--	--	34.8	34.8	--	--	24.7	14.0	7.6	3.7
Myristica insularis	--	--	--	--	13.0	6.6	--	--	6.9	3.6
Semecarpus venenosa	29.8	15.9	--	--	--	--	--	--	5.5	3.1
Spathodea campanulata	--	--	--	--	8.6	5.3	--	--	4.6	2.9
Pandanus tectorius	18.9	13.1	--	--	--	--	--	--	3.5	2.5
Cananga odorata	--	--	--	--	5.7	4.2	--	--	3.0	2.3
Elaeocarpus carolinensis	--	--	--	--	5.3	5.3	--	--	2.8	2.8
Artocarpus altilis	--	--	34.8	34.8	--	--	1.1	1.1	2.7	2.4
Cynometra ramiflora	--	--	--	--	4.3	4.3	--	--	2.3	2.3
Inocarpus fagifer	0.9	0.9	--	--	4.0	4.0	--	--	2.3	2.0
Swietenia macrophylla	--	--	--	--	3.9	3.9	--	--	2.1	2.1
Cocos nucifera	7.2	7.2	--	--	--	--	--	--	1.3	1.3
Calophyllum inophyllum	5.4	5.5	--	--	--	--	--	--	1.0	1.0
Pangium edule	--	--	--	--	1.1	1.1	--	--	0.6	0.6
Areca catechu	2.0	5.6	--	--	--	--	--	--	0.4	1.0
Garcinia rumiyo	1.3	1.3	--	--	--	--	--	--	0.2	0.2
Heterospathe elata	1.3	1.3	--	--	--	--	--	--	0.2	0.2
Artocarpus mariannensis	--	--	--	--	0.4	0.4	--	--	0.2	0.2
Pterocarpus indicus	--	--	--	--	0.4	0.4	--	--	0.2	0.2
Ficus prolixa	0.6	0.6	1.0	1.0	--	--	--	--	0.2	0.4
Tarenna sambucina	0.2	0.2	--	--	--	--	--	--	0.0	0.0

Relative dominance of tree species in Yap lowland rainforest, with endemic species highlighted in pink, agroforest species in orange, planted mahogany species in brown, invasive species in yellow and strand species in blue

Tree Species	Total	SE	Tree Species Continued	Total	SE
Calophyllum inophyllum	17.8	12.5	*Pandanus dubius*	0.3	0.3
Hibiscus tiliaceus	12.7	5.1	*Premna spp.*	0.3	0.3
Semecarpus venenosa	8.5	4.5	*Morinda citrifolia*	0.3	0.3
Pandanus tectorius	5.7	3.7	*Diospyros ferrea*	0.3	0.2
Cocos nucifera	4.9	2.9	*Tree unknown*	0.3	0.4
Campnosperma brevipetiolata	4.2	4.3	*Anacardium occidentale*	0.3	0.3
Pterocarpus indicus	4.1	4.3	*Leucaena leucocephala*	0.3	0.3
Commersonia bartramia	3.7	3.5	*Terminalia catappa*	0.3	0.3
Trichospermum ikutai	3.6	2.6	*Rinorea carolinensis*	0.2	0.2
Inocarpus fagifer	3.3	2.1	*Pouteria obovata*	0.2	0.1
Pericopsis mooniana	2.6	2.6	*Timonius spp.*	0.2	0.2
Glochidion spp.	2.5	1.1	*Heterospathe elata*	0.2	0.2
Ficus copiosa	2.3	1.9	*Maranthes corymbosa*	0.2	0.2
Macaranga carolinensis	2.3	1.3	*Atuna racemosa*	0.2	0.2
Rhus taitensis	1.9	1.0	*Ficus spp.*	0.2	0.2
Pangium edule	1.6	1.8	*Swietenia spp.*	0.2	0.2
Swietenia macrophylla	1.4	1.4	*Melochia spp.*	0.2	0.2
Garcinia rumiyo	1.4	1.6	*Eugenia spp.*	0.2	0.2
Celtis paniculata	1.3	1.0	*Averrhoa bilimbi*	0.2	0.2
Premna obtusifolia	1.2	0.7	*Barringtonia racemosa*	0.1	0.1
Artocarpus altilis	1.0	1.1	*Macaranga spp.*	0.1	0.1
Areca catechu	0.9	1.7	*Acacia auriculiformis*	0.1	0.1
Glochidion ramiflorum	0.9	1.3	*Artocarpus mariannensis*	0.1	0.3
Drypetes yapensis	0.7	0.5	*Meryta senfftiana*	0.1	0.1
Neisosperma oppositifolia	0.7	0.7	*Euphoria longana*	0.1	0.1
Cerbera manghas	0.7	0.7	*Swietenia mahagoni*	0.1	0.1
Heritiera littoralis	0.5	0.3	*Mangifera indica*	0.1	0.1
Aidia cochinchinensis	0.5	0.4	*Premna serratifolia*	0.0	0.1
Buchanania engleriana	0.5	0.4	*Pandanus cominsii*	0.0	0.1
Timonius albus	0.4	0.4	*Glochidion marianum*	0.0	0.1
Pandanus japensis	0.4	0.3	*Cycas circinalis*	0.0	0.0
Ficus prolixa	0.4	0.4	*Ficus tinctoria*	0.0	0.0
Tarenna sambucina	0.3	0.5	*Citrus mitis*	0.0	0.0

Relative dominance of tree species in Chuuk lowland rainforest, with agroforest species highlighted in orange, invasive species in yellow, and endemic species in pink.

Tree Species	Total	SE
Mangifera indica	21.6	21.6
Artocarpus altilis	18.0	11.1
Cananga odorata	16.7	16.7
Dysoxylum mollissimum	12.7	12.7
Glochidion spp.	5.4	5.4
Ficus prolixa	4.9	3.3
Macaranga carolinensis	4.7	4.7
Adenanthera pavonina	4.6	4.6
Hibiscus tiliaceus	4.2	2.6
Clinostigma carolinense	3.4	3.4
Trukia carolinensis	1.5	0.6
Celtis paniculata	1.2	1.2
Premna serratifolia	0.7	0.7
Pandanus cominsii	0.5	0.5

Relative dominance of tree species in Pohnpei lowland rainforest, with endemic species highlighted in pink, invasive species in yellow, agroforest species in orange, mangrove species in gray, and planted mahogany in brown.

Tree Species	Total	SE	Tree Species Continued	Total	SE
Campnosperma brevipetiolata	16.6	4.0	*Bruguiera gymnorrhiza*	0.5	0.5
Exorrhiza ponapensis	16.0	5.6	*Rhizophora apiculata*	0.5	0.5
Myristica insularis	10.5	3.0	*Sterculia ponapensis*	0.4	0.4
Hibiscus tiliaceus	7.0	2.1	*Timonius ponapensis*	0.4	0.4
Spathodea campanulata	5.6	3.0	*Swietenia macrophylla*	0.4	0.4
Elaeocarpus carolinensis	5.6	2.2	*Tree unknown*	0.3	0.2
Cyathea spp.	5.4	1.1	*Claoxylon carolinianum*	0.3	0.2
Inocarpus fagifer	4.8	4.8	*Aidia cochinchinensis*	0.3	0.2
Palaquium karrak	3.4	1.5	*Glochidion ramiflorum*	0.3	0.2
Adenanthera pavonina	3.2	2.4	*Atuna racemosa*	0.3	0.1
Cananga odorata	2.2	1.0	*Premna spp.*	0.2	0.2
Syzygium carolinense	1.6	0.7	*Pittosporum spp.*	0.2	0.2
Mangifera indica	1.3	1.0	*Ponapea ledermanniana*	0.2	0.2
Aglaia ponapensis	1.3	0.4	*Glochidion marianum*	0.2	0.2
Pandanus cominsii	1.2	0.5	*Cyclophyllum barbatum*	0.1	0.1
Commersonia bartramia	1.1	1.1	*Parinari laurina*	0.1	0.1
Barringtonia racemosa	1.0	0.4	*Premna obtusifolia*	0.1	0.1
Artocarpus altilis	0.9	0.6	*Cinnamomum carolinense*	0.1	0.1
Cynometra ramiflora	0.7	0.7	*Morinda citrifolia*	0.1	0.1
Cocos nucifera	0.7	0.5	*Premna serratifolia*	0.1	0.0
Pangium edule	0.6	0.3	*Artocarpus mariannensis*	0.1	0.1
Pterocarpus indicus	0.5	0.5	*Timonius spp.*	0.0	0.0
Elaeocarpus kusanoi	0.5	0.3	*Fagraea berteroana*	0.0	0.0
Macaranga carolinensis	0.5	0.3	*Garcinia ponapensis*	0.0	0.0
Ficus tinctoria	0.5	0.3			

Relative dominance of trees in Kosrae lowland rainforest, with invasive species highlighted in yellow, endemic species in pink, and agroforest species in orange.

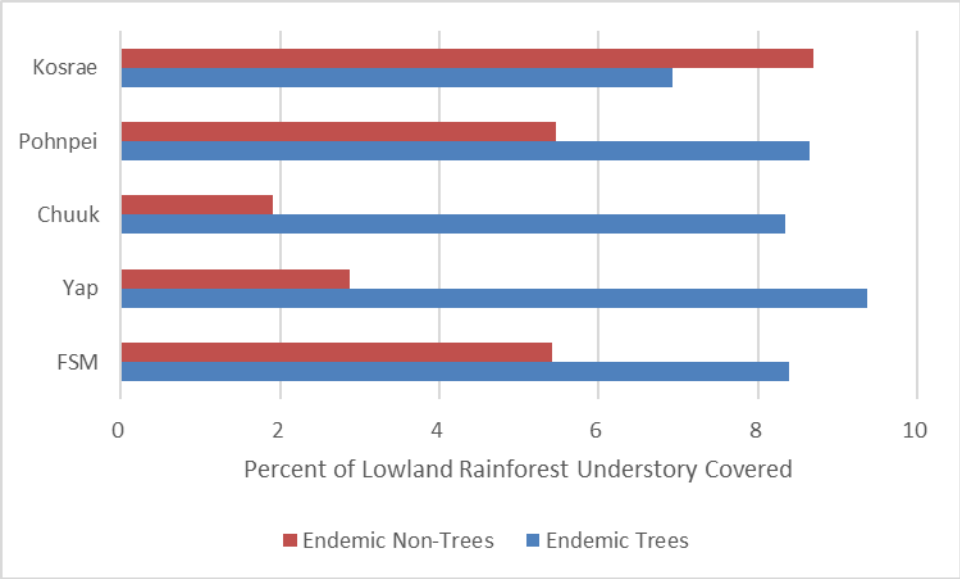
Tree Species	Total	SE
Horsfieldia nunu	33.7	9.5
Ficus prolixa	22.3	8.2
Adenanthera pavonina	17.6	7.5
Campnosperma brevipetiolata	5.6	2.0
Cyathea spp.	4.0	1.4
Elaeocarpus carolinensis	2.8	1.4
Hibiscus tiliaceus	2.1	1.4
Atuna racemosa	1.9	1.6
Dendrocnide latifolia	1.8	1.2
Neuburgia celebica	1.0	0.7
Antidesma kusaiense	0.8	0.4
Cananga odorata	0.5	0.8
Antidesma spp.	0.4	0.4
Artocarpus altilis	0.3	0.3
Ponapea ledermanniana	0.3	0.2
Pandanus tectorius	0.3	0.1
Morinda citrifolia	0.2	0.1
Cerbera manghas	0.2	0.2
Ficus tinctoria	0.1	0.1
Cinnamomum carolinense	0.1	0.1
Terminalia carolinensis	0.1	0.1
Syzygium spp.	0.0	0.0
Aidia cochinchinensis	0.0	0.0
Pandanus dilatatus	0.0	0.0
Premna serratifolia	0.0	0.0
Cyathea nigricans	0.0	0.0

Relative dominance of tree species in FSM lowland rainforest, with endemic species highlighted in pink, invasive species in yellow, agroforest species in orange, planted mahogany species in brown, mangrove species in gray, and strand species in blue.

Tree Species	Total	SE	Tree Species Continued	Total	SE	Tree Species Continued	Total	SE
Campnosperma brevipetiolata	10.9	2.5	*Ficus copiosa*	0.3	0.3	*Parinari laurina*	0.1	0.1
Horsfieldia nunu	9.6	2.5	*Ficus tinctoria*	0.3	0.1	*Timonius spp.*	0.1	0.0
Exorrhiza ponapensis	8.4	3.3	*Elaeocarpus kusanoi*	0.3	0.2	*Pandanus japensis*	0.1	0.0
Adenanthera pavonina	6.9	3.1	*Rhus taitensis*	0.3	0.1	*Artocarpus mariannensis*	0.0	0.1
Ficus prolixa	6.6	3.4	*Neuburgia celebica*	0.3	0.2	*Tarenna sambucina*	0.0	0.1
Hibiscus tiliaceus	6.3	1.4	*Glochidion ramiflorum*	0.3	0.2	*Pandanus dubius*	0.0	0.0
Myristica insularis	5.5	1.7	*Bruguiera gymnorrhiza*	0.3	0.3	*Diospyros ferrea*	0.0	0.0
Cyathea spp.	4.0	0.8	*Rhizophora apiculata*	0.3	0.3	*Anacardium occidentale*	0.0	0.0
Elaeocarpus carolinensis	3.7	1.2	*Celtis paniculata*	0.2	0.2	*Leucaena leucocephala*	0.0	0.0
Inocarpus fagifer	3.0	2.1	*Premna obtusifolia*	0.2	0.1	*Terminalia catappa*	0.0	0.0
Spathodea campanulata	2.9	1.6	*Sterculia ponapensis*	0.2	0.2	*Rinorea carolinensis*	0.0	0.0
Calophyllum inophyllum	2.6	2.1	*Tree unknown*	0.2	0.1	*Pouteria obovata*	0.0	0.0
Cananga odorata	2.1	0.9	*Antidesma kusaiense*	0.2	0.1	*Heterospathe elata*	0.0	0.0
Palaquium karrak	1.8	0.9	*Aidia cochinchinensis*	0.2	0.1	*Maranthes corymbosa*	0.0	0.0
Mangifera indica	1.7	1.1	*Timonius ponapensis*	0.2	0.2	*Ficus spp.*	0.0	0.0
Artocarpus altilis	1.6	0.8	*Garcinia rumiyo*	0.2	0.2	*Swietenia spp.*	0.0	0.0
Semecarpus venenosa	1.2	0.7	*Ponapea ledermanniana*	0.2	0.1	*Melochia spp.*	0.0	0.0
Commersonia bartramia	1.1	0.8	*Claoxylon carolinianum*	0.2	0.1	*Eugenia spp.*	0.0	0.0
Cocos nucifera	1.0	0.5	*Premna spp.*	0.2	0.1	*Fagraea berteroana*	0.0	0.0
Pandanus tectorius	0.9	0.5	*Clinostigma carolinense*	0.2	0.2	*Averrhoa bilimbi*	0.0	0.0
Pterocarpus indicus	0.9	0.7	*Cerbera manghas*	0.1	0.1	*Macaranga spp.*	0.0	0.0
Syzygium carolinense	0.8	0.4	*Morinda citrifolia*	0.1	0.1	*Acacia auriculiformis*	0.0	0.0
Macaranga carolinensis	0.8	0.3	*Areca catechu*	0.1	0.2	*Terminalia carolinensis*	0.0	0.0
Atuna racemosa	0.7	0.4	*Pittosporum spp.*	0.1	0.1	*Garcinia ponapensis*	0.0	0.0
Aglaia ponapensis	0.7	0.2	*Antidesma spp.*	0.1	0.1	*Meryta senfftiana*	0.0	0.0
Pandanus cominsii	0.7	0.2	*Drypetes yapensis*	0.1	0.1	*Euphoria longana*	0.0	0.0
Glochidion spp.	0.6	0.3	*Neisosperma oppositifolia*	0.1	0.1	*Swietenia mahagoni*	0.0	0.0
Dysoxylum mollissimum	0.6	0.6	*Glochidion marianum*	0.1	0.1	*Syzygium spp.*	0.0	0.0
Barringtonia racemosa	0.5	0.2	*Premna serratifolia*	0.1	0.0	*Cycas circinalis*	0.0	0.0
Pangium edule	0.5	0.3	*Heritiera littoralis*	0.1	0.1	*Pandanus dilatatus*	0.0	0.0
Trichospermum ikutai	0.5	0.4	*Cyclophyllum barbatum*	0.1	0.1	*Cyathea nigricans*	0.0	0.0
Dendrocnide latifolia	0.5	0.3	*Trukia carolinensis*	0.1	0.0	*Citrus mitis*	0.0	0.0
Swietenia macrophylla	0.4	0.3	*Buchanania engleriana*	0.1	0.1			
Pericopsis mooniana	0.4	0.4	*Timonius albus*	0.1	0.1			
Cynometra ramiflora	0.4	0.4	*Cinnamomum carolinense*	0.1	0.0			

Percent of lowland rainforest covered by endemic understory species (tree seedlings and non-trees) in FSM state MC areas, Non-MC areas, and overall. No endemic understory species were sampled in Chuuk or Kosrae lowland rainforest.

	Endemic Trees		Endemic Non-Trees		Total	
	Total	SE	Total	SE	Total	SE
FSM MC Area	4.0	2.3	7.1	1.7	11.1	3.1
Non-MC Area	9.0	1.4	5.2	0.8	14.2	1.7
Total	8.4	1.3	5.4	0.7	13.8	1.5
Yap MC Area	5.4	13.0	0.5	0.5	5.9	12.8
Non-MC Area	9.9	3.4	3.2	1.4	13.0	4.6
Total	9.4	3.3	2.9	1.3	12.2	4.3
Chuuk MC	--	--	--	--	--	--
Non-MC Area	8.7	1.7	2.0	2.0	10.7	3.2
Total	8.3	2.1	1.9	1.9	10.3	3.5
Pohnpei MC	4.1	0.7	9.5	1.2	13.6	1.9
Non-MC Area	9.6	2.1	4.6	1.1	14.2	2.3
Total	8.6	1.8	5.5	1.0	14.1	1.9
Kosrae MC	--	--	--	--	--	--
Non-MC Area	7.2	3.0	9.1	1.8	16.3	3.7
Total	6.9	2.9	8.7	1.8	15.6	3.7



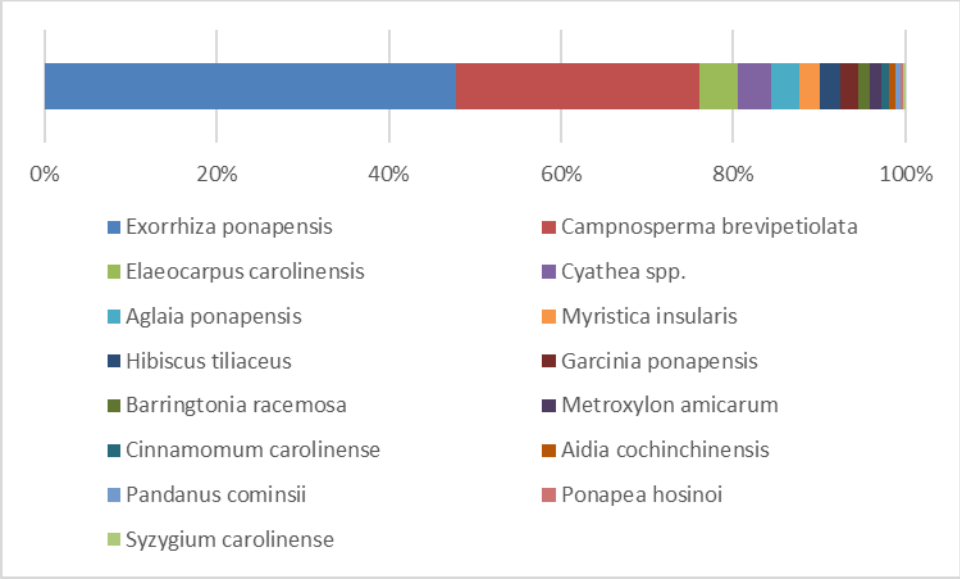
Percent of lowland rainforest covered by endemic understory species (tree seedlings and non-trees) in FSM states and overall.

Montane Rainforest

The montane rainforest, which is sometimes called cloud forest, is determined by rugged topography, fog and almost continuous rain or fog drip, and contains greater variation in vegetation composition than almost any other general vegetation type (Muller-Dombois & Fosberg, 1998). Cloud forests are often characterized by floristic uniqueness resulting from isolation due to geographic remoteness or broken terrain, and island montane vegetation is even more isolated, resulting in the highest species endemism rates of any forest or vegetation community in FSM. While only four plots of montane rainforest were sampled (in Pohnpei), the dominance of endemic species there was clear, with the most dominant species, *Exorrhiza ponapensis*, being endemic and comprising nearly half of all wood. 8 out of 15 tree species inventoried in montane rainforest were endemic, and it had by far the highest rate of tree species endemism among forest communities. However, the endemism rate of understory plants was considerably (about 10%) lower than in lowland rainforest.

Relative dominance of tree species in Pohnpei montane rainforest, with endemic species highlighted in pink.

Tree Species	Total	SE
Exorrhiza ponapensis	45.4	17.3
Campnosperma brevipetiolata	26.7	13.5
Elaeocarpus carolinensis	4.3	4.3
Cyathea spp.	3.7	1.8
Aglaia ponapensis	3.1	1.8
Myristica insularis	2.3	1.5
Hibiscus tiliaceus	2.2	1.4
Garcinia ponapensis	2.0	1.2
Barringtonia racemosa	1.3	0.6
Metroxylon amicarum	1.2	1.2
Cinnamomum carolinense	1.0	1.0
Aidia cochinchinensis	0.7	0.7
Pandanus cominsii	0.5	0.3
Ponapea hosinoi	0.3	0.3
Syzygium carolinense	0.2	0.2



Relative dominance of tree species in Pohnpei montane rainforest

Percent of trees (live trees>1-inch DBH) that are endemic to Micronesia among all trees in montane rainforest in MC areas, Non-MC Areas, and overall. There was no montane rainforest sampled outside of Pohnpei, and there were no invasive tree species sampled in montane rainforest in Pohnpei.

	MC Area	SE	Non-MC Area	SE	Total	SE
Pohnpei	63.4	14.5	--		63.4	14.5
FSM	63.4	14.5	--		63.4	14.5

Percent of forest covered by understory plant (tree seedlings and non-trees) species endemic to Micronesia in montane rainforest in Pohnpei. There was no montane rainforest sampled outside of Pohnpeii.

Understory Species	Total	SE
Endemic Trees	2.9	0.3
Endemic Non-Trees	0.7	0.3
Total	3.5	0.6

Public/Private Forest Ownership

One would expect to find significant differences between forests managed privately and forests managed publicly by government, given the expected differences in management style and intensity. However, there appears to be large differences in ownership patterns across FSM, with almost all forest owned privately in Yap and Chuuk, more than twice as many public than private forest plots in Pohnpei, and about 60% of plots on public forest in Kosrae. There are also large differences in ownership by forest community, with more than three quarters of mangrove plots and less than 40% of lowland rainforest on public land, and more than 85% of agroforest and strand forest plots on private land. So, even though there were 8.5% (SE=6.7) more endemic trees and 8.3% (SE=4.9) fewer invasive trees on public land than on private land in forest overall across FSM, the comparison gives unequal weight to public mangrove and lowland rainforest in Pohnpei and Kosrae, and to private strand and agroforest in Yap and Chuuk. As such, a comparison by land ownership in lowland rainforest is more straightforward, even though more than 60% of plots were on private land. There was about 4% higher but nonsignificant percentage of endemic trees in public lowland rainforest and 11.4 % (SE=6.2) fewer invasive trees than in private lowland rainforest across FSM.

Number of forest plots (or conditions where there are multiple conditions per plot) inventoried by land ownership and forest community in FSM

	Private	State/Local Government
Total Forest Plots (Conditions)	102	66
Lowland Rainforest	45	28
Agroforest	25	4
Mangrove	8	28
Strand Forest	24	2
Montane	0	4
Yap	59	2
Chuuk	14	2
Pohnpei	18	43
Kosrae	13	19

Percent of tree species endemic and invasive to Micronesia by land ownership in all forest and lowland rainforest in FSM

	Total Forest Area				Lowland Rainforest			
	Private		State or Local Government		Private		State or Local Government	
Live Trees	Total	SE	Total	SE	Total	SE	Total	SE
Endemic Species	19.4	4.7	27.9	4.8	25.2	5.5	29.3	5.0
Invasive Species	9.4	4.9	1.1	0.6	12.4	6.2	1.0	0.7

Growth, Removals, Mortality, and Net Change

Repeated measurements of FIA plots over time allow for estimation of growth, removals, mortality and net change of tree species by numbers of trees, volume, or biomass. The reader should keep in mind though, that this means only data from the base FIA plots was used, since the MC plots have only been measured once so far (in 2016), so for this section the relevant sample sizes of plots is in the first table in the document. While the FIA framework allows for calculation of net change for most tree species, the sample error values tend to be high, so for interpretation of trends only species with sample error/estimate ratios of less than 0.9 were used. Total GRM values with all forest communities was high, so a summary volume GRM in lowland rainforest by state is shown here, which indicates that lowland rainforest volume declined significantly in Chuuk, Pohnpei and FSM overall, while significantly increasing in Kosrae and insignificantly in Yap.

The most reliable net change species estimate for FSM overall was for *Hibiscus tiliaceus*, which declined in volume by about 7 million cubic feet of wood and was the species with most significant loss of volume in Pohnpei, Kosrae and Yap. In Chuuk, it had the most significant net gain by number of trees, but still had significant loss of volume. Hopefully, this implies forest recovery since most of the loss of volume was due to mortality rather than removals.

As for food species, the number and volume of coconut trees significantly decreased in every state and was the species with most significant loss of volume in Chuuk, and fourth most significant loss in FSM overall. This appears to be largely due to mortality and is hopefully just a result of aging coconut trees. Breadfruit had the most significant increase in volume in Pohnpei, the most significant decrease in number of trees in Kosrae, and the third most significant decline in volume in Yap. The number of mango trees declined significantly in Chuuk, but the volume increased so much in Pohnpei that mango trees had the largest significant increase in volume of any species in the FSM.

At the state level the net change in mangrove species only showed up in Pohnpei, where *S. alba, B. gymnorrhiza*, *R. mucronata*, and *X. granatum* all declined in numbers, and *R. apiculata* increased massively in volume. At the national level *R. stylosa* and *R. apiculata* both significantly increased in volume, while *L. littorea* declined slightly.

In Yap, three endemic species significantly increased in number (*Timonius albus, Pandanus japensis, Garcinia rumiyo*) but the endemic *Semecarpus venenosa* was the only tree species that significantly (and massively) increased in volume. In Chuuk one of the two endemic tree species inventoried there significantly increased in numbers (*Trukia carolinensis*), while the other significantly decreased in volume (*Clinostigma carolinense*). In Pohnpei, the endemic *Aglaia ponapensis* had by far the largest significant increase in numbers, and *Pittosporum sp*. declined slightly, while *Exorrhiza ponapensis* declined in volume so much that it was the second most significant decline in FSM. *Pittosporum* also declined in volume, and so did *Cyathea sp*. tree ferns and *Aglaia ponapensis*. *Cyathea sp*. tree ferns also declined in volume in Kosrae, and *Elaeocarpus carolinensis* significantly declined in numbers.

Volume of lowland rainforest by growth, mortality, removals and net change in FSM states and overall

	Yap		Chuuk		Pohnpei		Kosrae		FSM	
GRM Category	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Time 1	13,259,829	5,135,874	21,775,267	16,955,207	122,900,583	29,689,264	59,356,595	32,971,305	217,292,274	47,774,633
Time 2	14,872,319	5,063,139	10,578,484	7,315,219	103,399,703	24,874,226	67,147,209	36,023,018	195,997,715	44,671,386
Gross Growth	3,868,142	3,976,782	1,514,961	1,079,748	9,118,832	10,312,623	17,361,787	5,767,330	31,863,722	12,513,711
Mortality	-1,767,212	575,262	-12,643,312	10,744,923	-27,029,911	5,995,279	-9,571,174	3,702,768	-51,011,610	12,862,276
Removals	-488,439	389,862	-68,432	65,610	-1,589,800	798,194	--	--	-2,146,671	890,736
Net Change	1,612,490	3,846,838	-11,196,783	9,943,480	-19,500,880	13,026,007	7,790,614	4,529,290	-21,294,559	17,431,646

Volume of tree species in FSM by growth,mortality, removals and net change between the inventories in 2005 and 2016, in order of smallest to largest ratio of SE/estimate (only showing species with values <0.9), with endemic species in pink, agroforest species in orange, and mangrove species in gray.

	Time 1		Time 2		Gross Growth		Mortality		Removals		Net Change	
Tree Species	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE	Total	SE
Hibiscus tiliaceus	11,126,502	2,301,018	4,075,598	1,169,146	631,153	638,856	-6,262,896	1,472,363	-1,419,160	792,108	-7,050,903	1,856,820
Exorrhiza ponapensis	51,286,657	19,421,681	41,555,771	17,116,964	-3,058,729	2,250,912	-6,120,215	2,481,685	-551,943	404,813	-9,730,887	4,460,969
Cyathea spp.	3,267,787	1,068,505	2,099,241	622,943	202,896	211,627	-1,315,893	464,664	-55,549	58,534	-1,168,546	539,480
Cocos nucifera	12,298,198	4,042,452	7,703,172	2,290,419	-182,195	655,754	-3,734,351	1,741,116	-678,480	702,426	-4,595,026	2,341,318
Neuburgia celebica	197,794	145,063	471,511	277,693	273,717	153,708	--	--	--	--	273,717	153,708
Mangifera indica	10,057,567	5,086,204	14,839,946	5,716,512	6,208,964	2,723,752	-1,345,552	1,226,216	-81,033	77,692	4,782,379	2,781,911
Pandanus spp.	126,402	81,358	--	--	--	--	-77,921	61,361	-48,481	55,623	-126,402	81,358
Clinostigma carolinense	2,705,137	1,843,724	1,831,985	1,379,922	-801,714	513,920	-71,438	68,492	--	--	-873,152	565,317
Horsfieldia nunu	18,886,590	6,720,468	22,354,804	8,697,520	6,920,714	2,881,973	-3,452,500	1,718,902	--	--	3,468,214	2,298,393
Aglaia ponapensis	878,559	626,337	452,654	383,617	-47,702	76,682	-378,204	231,761	--	--	-425,906	284,647
Morinda citrifolia	52,214	29,480	14,253	14,756	-1,443	1,494	-36,518	26,448	--	--	-37,962	26,326
Semecarpus venenosa	1,707,060	1,156,386	2,911,559	2,005,363	1,316,487	895,086	-111,987	79,473	--	--	1,204,499	852,637
Rhizophora stylosa	1,652,270	1,455,329	1,771,769	1,535,171	360,778	302,761	-241,279	222,981	--	--	119,499	84,894
Ficus tinctoria	247,896	189,871	106,302	98,240	-45,441	41,995	-96,154	72,930	--	--	-141,594	101,962
Dendrocnide latifolia	196,065	155,029	214,541	164,896	40,603	35,537	-22,127	22,908	--	--	18,476	13,701
Rhizophora apiculata	15,095,074	11,242,879	18,908,845	14,064,793	4,340,199	3,065,373	-326,326	217,790	-200,102	207,164	3,813,771	2,858,001
Averrhoa bilimbi	48,447	41,243	28,417	26,425	-20,030	15,788	--	--	--	--	-20,030	15,788
Commersonia bartramia	549,885	389,966	4,555,533	3,547,100	4,242,258	3,296,604	-181,736	157,084	-54,873	62,957	4,005,648	3,163,589
Pittosporum spp.	1,329,757	1,080,076	114,476	105,795	72,488	66,991	-1,287,770	1,041,891	--	--	-1,215,281	976,082
Areca catechu	605,868	543,887	395,737	454,036	226,182	259,502	-334,606	335,679	-101,707	116,690	-210,131	176,657
Ponapea ledermanniana	285,818	246,329	343,004	295,355	57,187	49,027	--	--	--	--	57,187	49,027
Lumnitzera littorea	178,384	134,464	158,115	122,528	38,081	28,384	-14,785	16,963	-43,565	41,768	-20,269	17,527
Atuna racemosa	250,641	182,435	90,843	95,724	-29,145	30,711	-130,653	137,674	--	--	-159,798	139,623

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APPENDIX 2

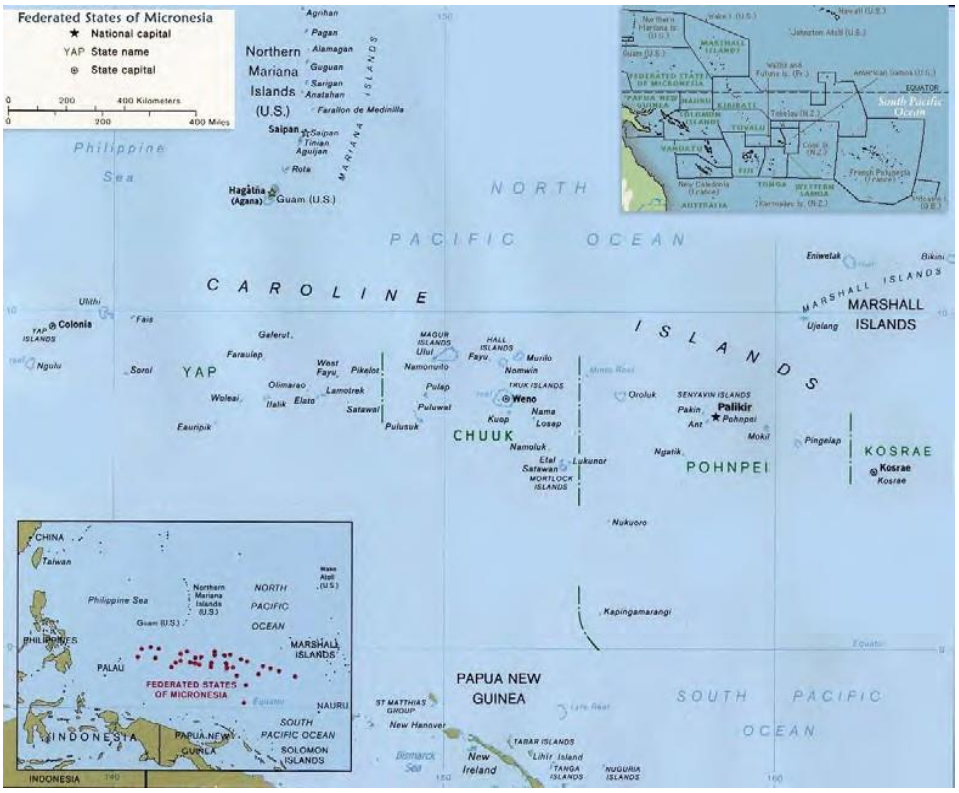
FSM FAP Assessment of Need (AON) 2010

FSM FOREST LEGACY – ASSESSMENT OF NEED (AON)
2010

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.

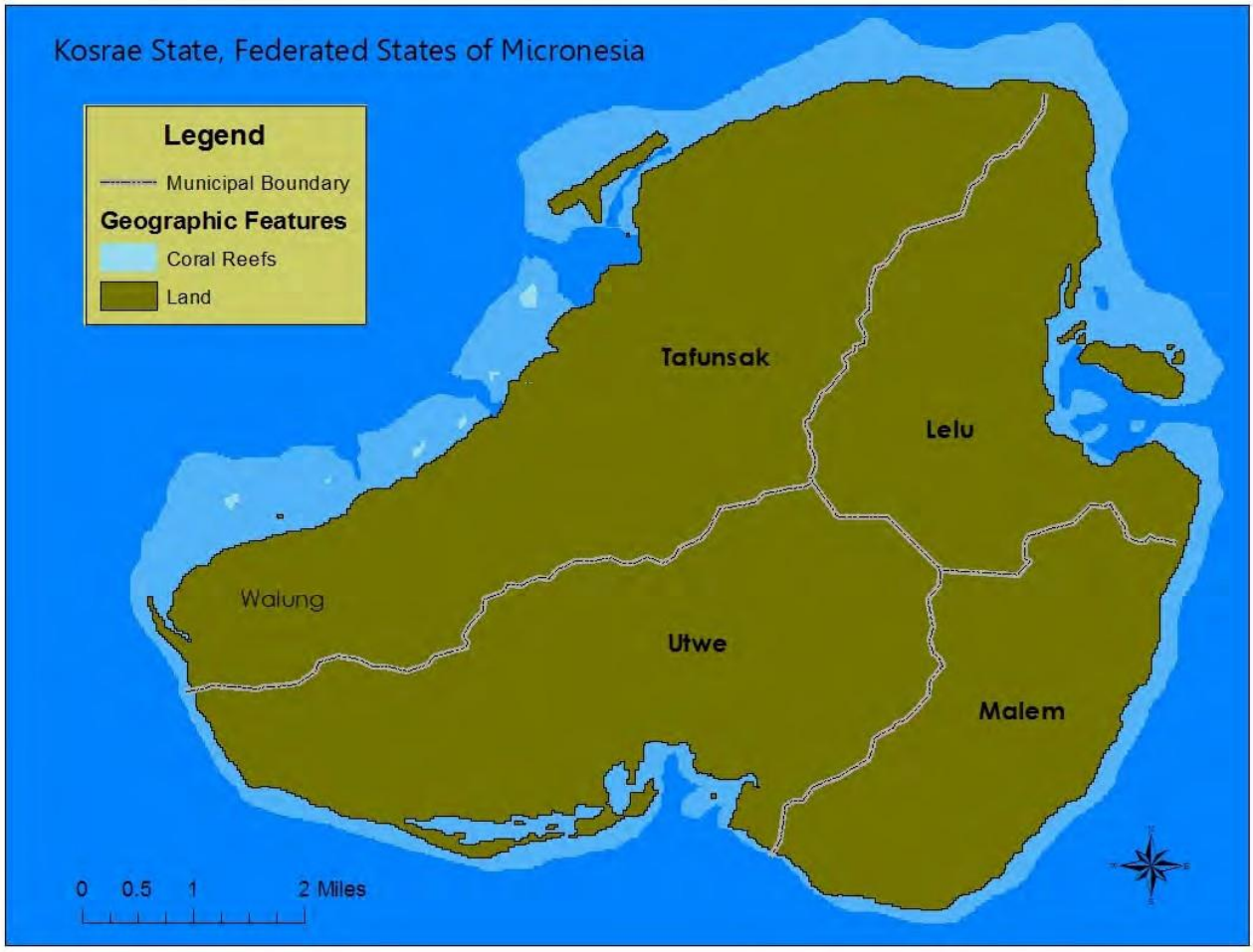
I. Kosrae State

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.

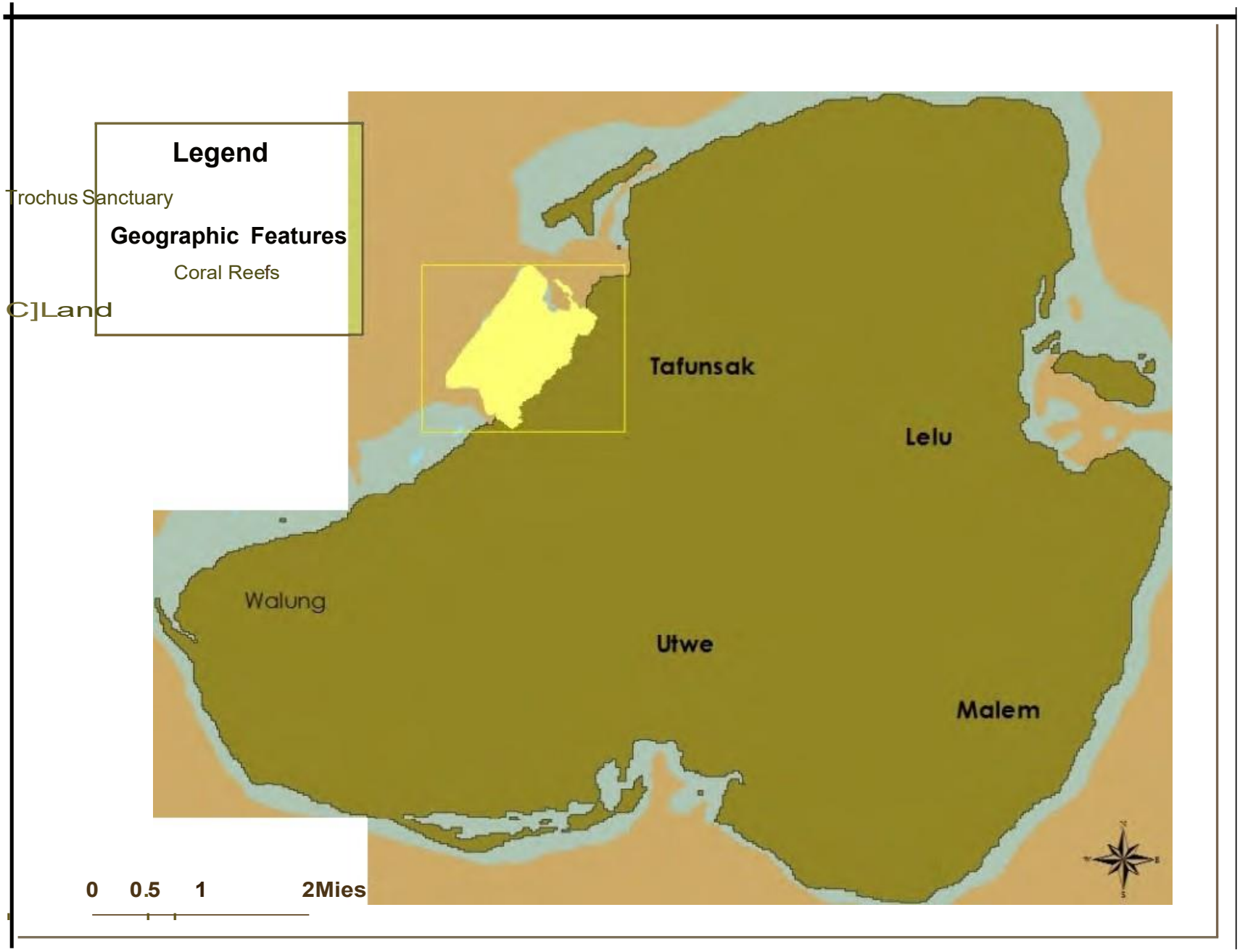
Kosraean is the native and primary language spoken here. English is widely spoken and used, but is only secondary.

D. Marine Environment

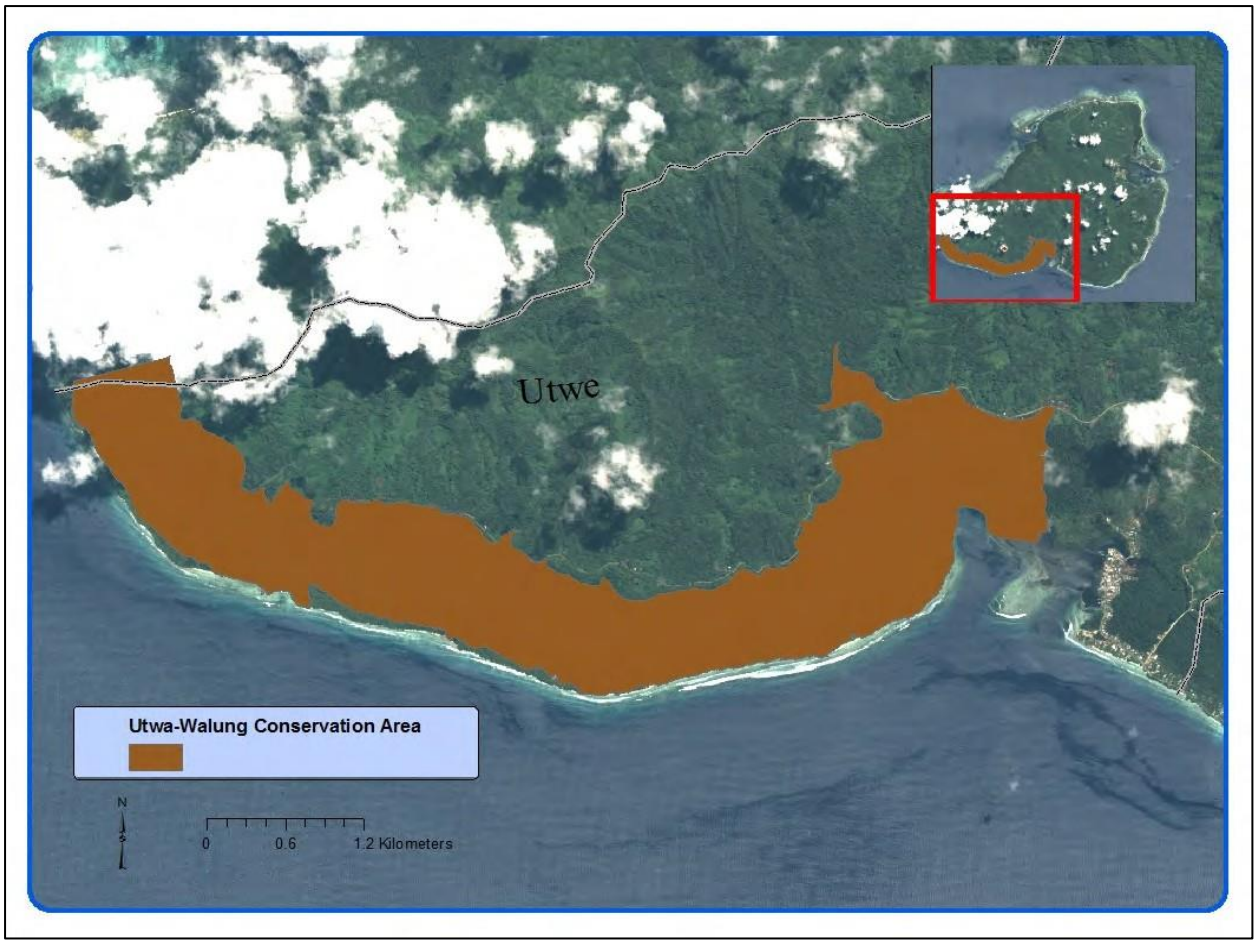
The marine environment of Kosrae is typical of tropical volcanic islands. Habitats include channels, passes, fringing reefs, shallow reef flats, terraces, submerged reefs, slopes, reef holes, embayment, quasi estuaries, sea grass beds, mangroves, and mud and sand flats. Four main harbors nestle along 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.

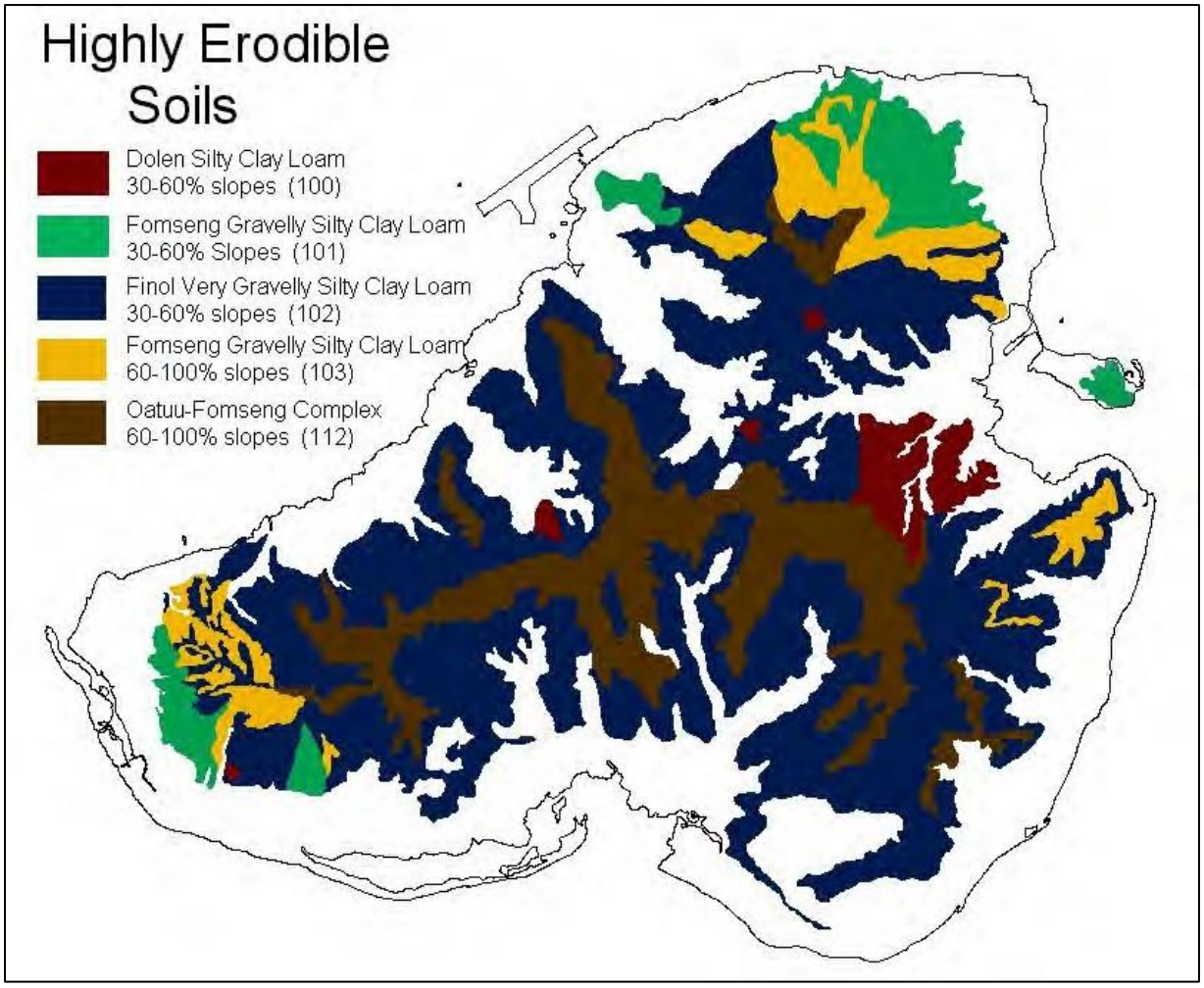
Kosrae exports citrus, banana, and taro to neighboring islands harvested from its agricultural and agroforest areas. Citrus, palm trees, banana, breadfruit trees, and taro plants have always been precious to the people of Kosrae; other plants provide medicine and are used to build shelter and canoes. 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.

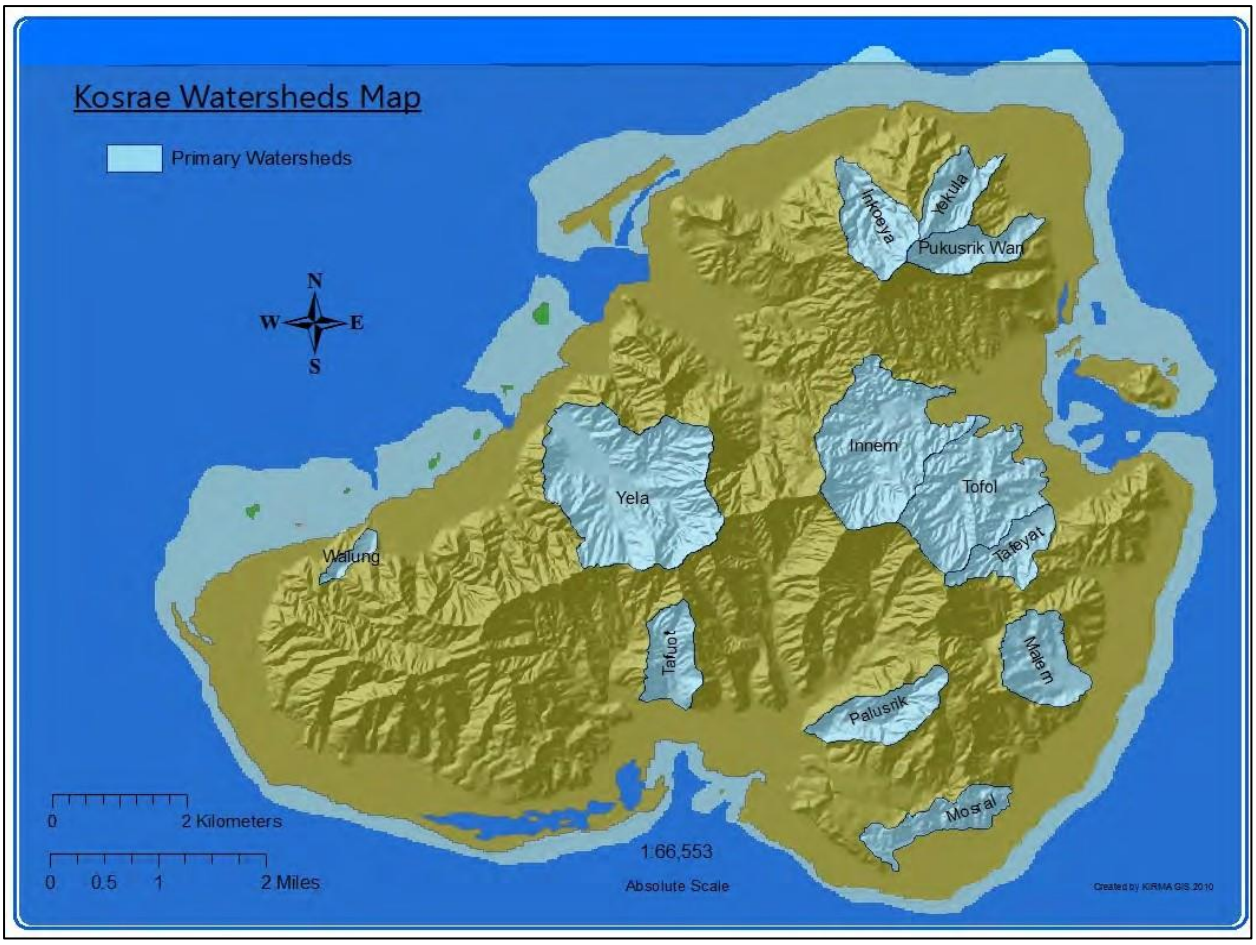
H. Water Resources

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

See Figure 6 on the following page, for the locations of the watersheds / river basins within which these dams and their drainages are found.



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.

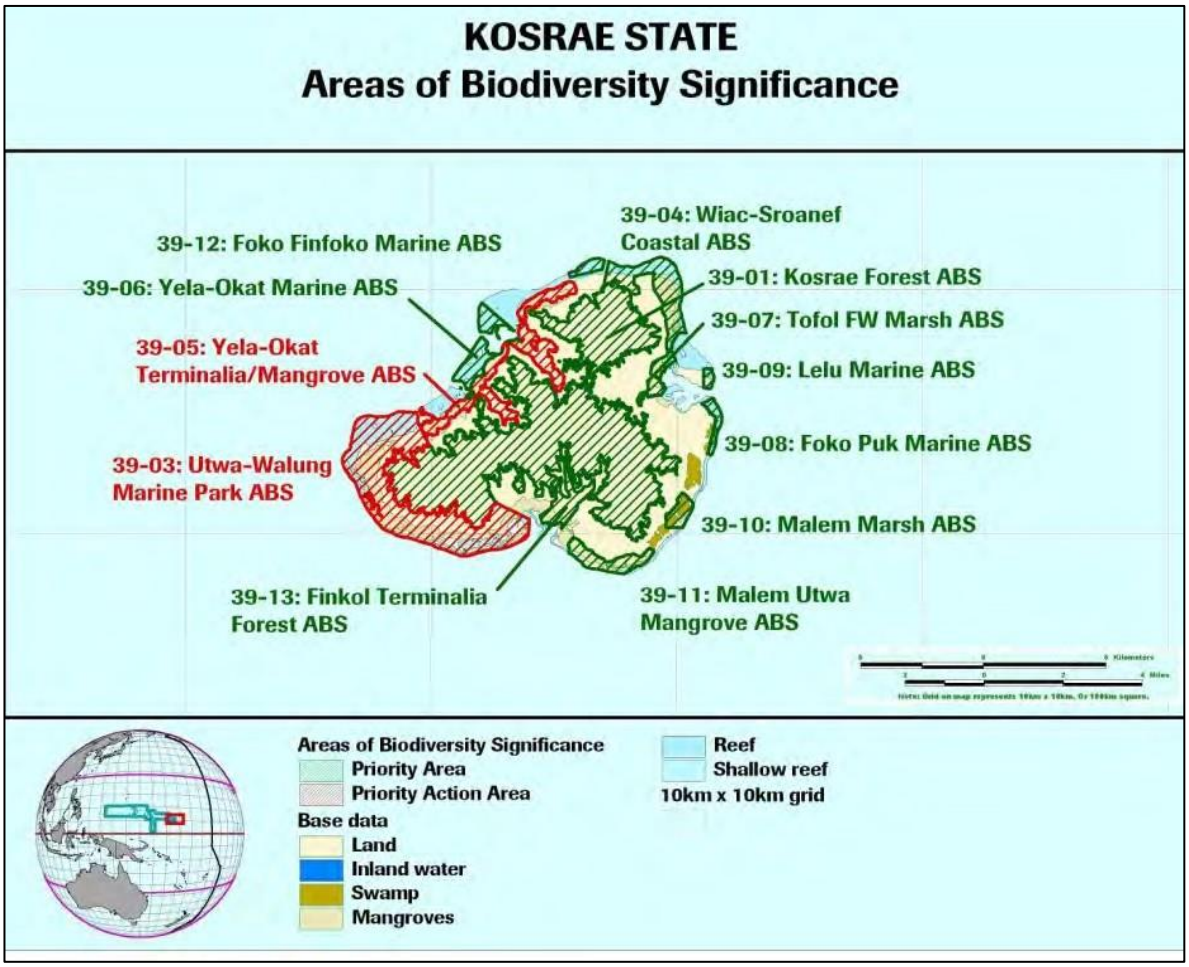
The FSM Conservation Blueprint was produced to identify species, natural communities, and ecological systems that represent the biodiversity of FSM; to record the best remaining examples of where these species, natural communities, and ecological systems occur; and to define, delineate, and prioritize "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).

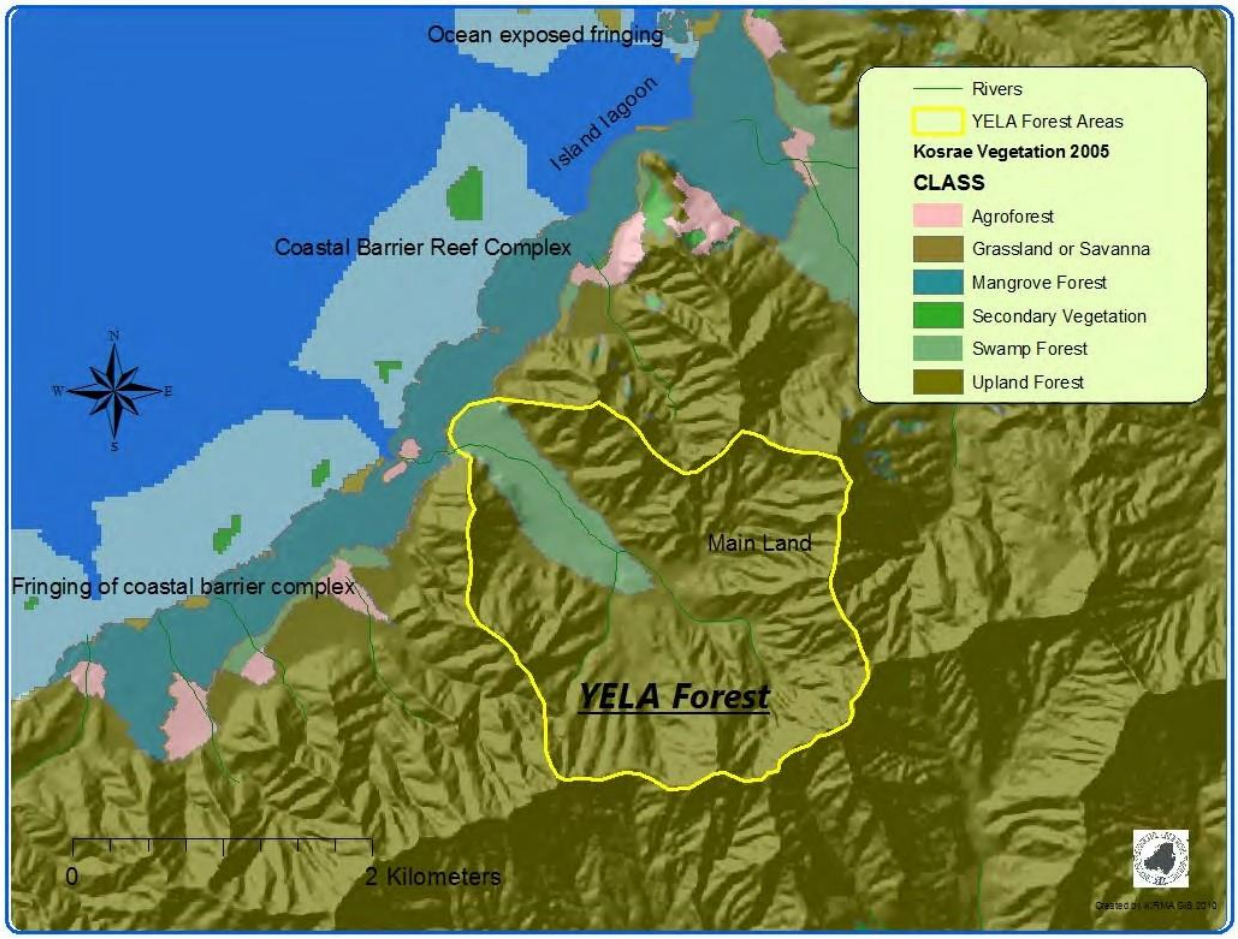
5. Littoral Plant Communities

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

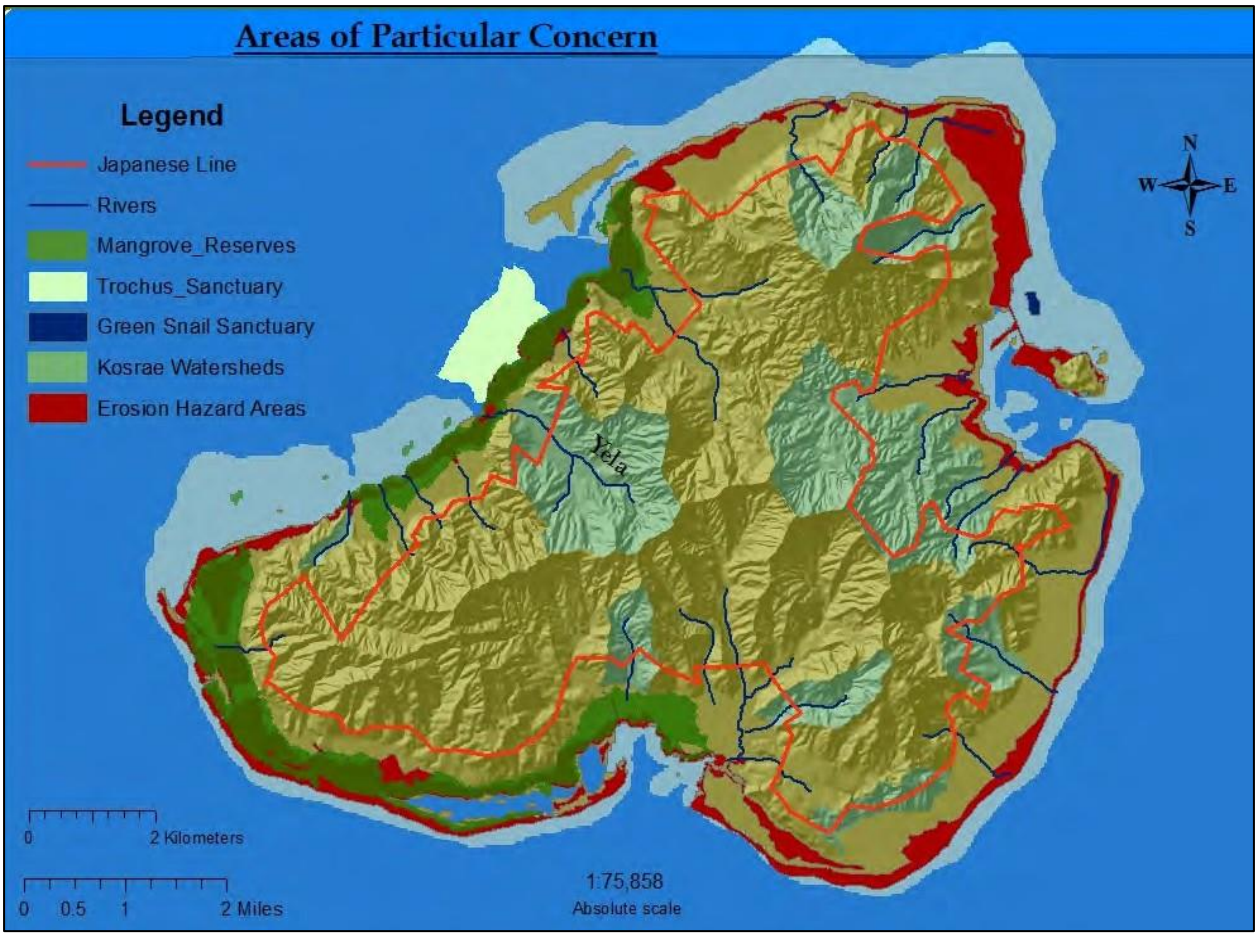
According to the Kosrae State Land Use Plan (KIRMA 2003), the land above the Japanese line includes approximately 67 percent of the total land area of Kosrae, and most of this land is still under the control of the Kosrae State Government. As much as 50 percent of this area is too steep for development 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.

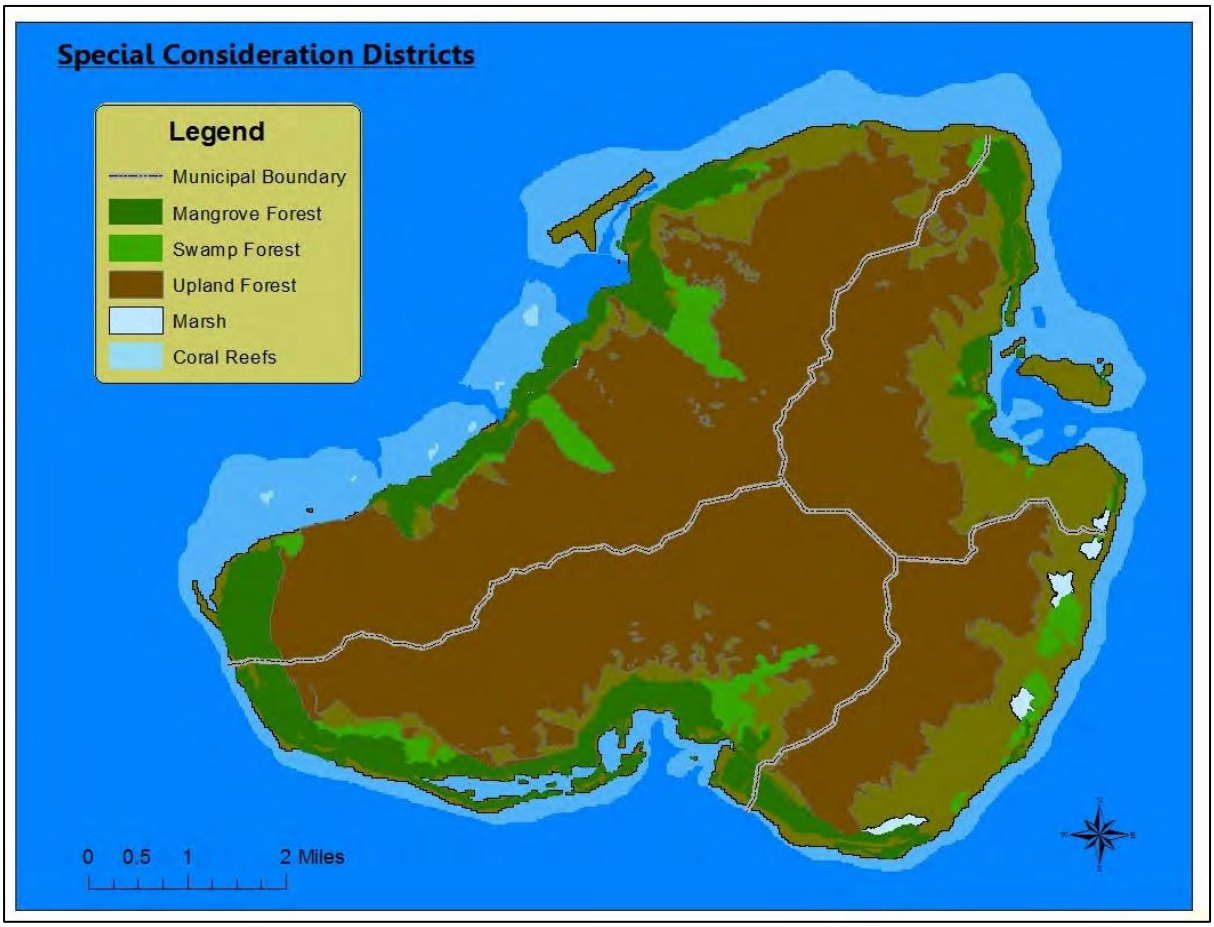
The Division of Survey and Mapping is in the process of surveying all private property boundary lines. Currently, 94 percent of the total area of private property boundary lines has been finalized: 96% in Lelu, 87% in Malem, 94% in Tafunsak and 100% in Utwa Municipalities (not including land above the 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 project applications. 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 3

FSM FAP Stakeholder Consultations

The FSM Department of Resources and Development would like to acknowledge and sincerely thank community, municipal, State and National Government representatives, and the following organizations for their contribution to the development of this updated FSM 2020-2030 Forest Action Plan, and the original version:

- FSM Department of Environment, Climate Change and Emergency Management
    - GIS unit
    - UNDP GEF-5 (FSM Ridge to Reef project)
- College of Micronesia – FSM
- College of Micronesia – FSM, Cooperative Research & Extension
- Micronesia Conservation Trust
- The Nature Conservancy
- Chuuk State Department of Agriculture
    - Division of Forestry
- Division of Land Management, Chuuk State
- Chuuk Conservation Society
- Chuuk State Environmental Protection Agency
- Chuuk State Department of Marine Resources
- Chuuk State Weather Station
- Chuuk Women's Council
- Kosrae Island Resource Management Authority
    - Division of Forestry
- Kosrae Conservation and Safety Organization
- Kosrae Department of Resource and Economic Affairs
- Kosrae Department of Transport and Infrastructure
- Kosrae Historic Preservation Office
- Women in Farming Kosrae
- Pohnpei State Department of Resources and Development
    - Division of Natural Resources and Marine
    - Division of Forestry
- Pohnpei Department of Land
- Pohnpei Division of Fish and Wildlife
- Pohnpei Environmental ProtectionAgency
- Pohnpei Office of Fisheries and Aquaculture
- Pohnpei Historic Preservation Office
- Pohnpei Farmers Association
- Conservation Society of Pohnpei
- Invasive Species Taskforce of Pohnpei (iSTOP)
- Yap State Department of Resources and Development
    - Division of Agriculture and Forestry
    - Division of Land Resources
- Yap State Environmental Protection Agency
- Yap Historic Preservation Office
- Yap Institute of Natural Science
- Yap Community Action Program
- Dr. Reed Perkins, Colleagues, and Students of Queens University – North Carolina
- Secretariat of the Pacific Community
- United States Forest Service
- United States Department of Agriculture Nature Resource and Conservation Service
- United States Geological Survey
- USAID Climate Ready

DEPARTMENT OF RESOURCES & DEVELOPMENT
Federated States of Micronesia
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November 14, 2019

Honorable Henry Falan
Governor
Yap, State Governor
P.O. Box 39
Colonia, Yap FM 96944

SUBJECT: Workshop for the update of the FSM State with Assessment and Resources Strategy/Forestry Action Plan (SWARS/FAP)

Dear Governor Falan

In 2010, the FSM Department of Resources and Development and the United States Forest Service (USFS) developed the first Statewide Forest Resource Assessment and Strategy (or SWARS/Forest Action Plan) for the Federated States of Micronesia. The SWARS/FAP is 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 USFS. The SWARS is important in that it is directly linked to funding opportunities while identifying state and national priorities for forest and terrestrial conservation, protection and use. As an amendment to the FAP, the Assessment of Needs (AON) identifies and prioritizes private forest land to become Forest Legacy Areas (FLA). In the FSM, the current AON was only completed for Kosrae and lead to the YELA Conservation Easement.

At this time, FSM R&D with the support of the Micronesia Conservation Trust (MCT), the Department of Environment, Climate Change and Emergency Management (DECEM) and the Nature Conservancy (TNC) are hosting state workshops to update the SWARS/FAP and the AON (to now include Yap and Pohnpei) for 2020-2030.

As such, the team requests the attendance of all appropriate stakeholders at their workshop on **Monday November 25th, Tuesday November 26th and Wednesday November 27th.** The proposed agenda is attached. In this regard, we would like to seek the assistance of your office to facilitate this visit. Further, we would like to request that an appropriate official be designated to liaise directly with the team point of contact Ms. Tamara Greenstone-Alefaio (MCT) at conservation@ourmicronesia.org.

We look forward to the outcome of these consultations and the final development of the updated plan for the FSM.

Thank you,

Hubert K. Yamada

Acting Secretary, Department of Resources and Development

CC: Department of Resources and Development, Yap State
Division of Agriculture and Forestry

Workshop for the update of the Federated States of Micronesia State-Wide Assessment and Resource Strategy/Forest Action Plan (SWARS/FAP)

Yap
November 25th, 26th and 27th
Location: TBD

DAY 1 (Monday November 25th):

9:00 – 9:15	**Introduction**	
	Introductions/Meeting Purpose	Marlyter
9:15 – 12:00	**Setting the Scene**	
	What is the SWARS/FAP	Marlyter
	USFS Programs and Funds	Marlyter
	Other Funding Opportunities	Tam
	International/National Plans	Tam
	Regional: Micronesia Challenge	Roseo
	• Yap Forest Inventory and Analysis	
	• Categorizing Yap State Priorities Activity	
	Membership of State Forest Stewardship Coordinating Committee	Marlyter
12:00 – 1:00	Lunch	
1:00 - 5:00	**Assessment of Forests**	
	SWARS/FAP - National Themes and Objectives	Tam
	SWOT Analysis Intro	Roseo
	SWOT Analysis by Theme	Groups

DAY 2 (Tuesday November 26th):

9:00 – 10:30	**Assessment of Forests (cont'd)**	
	Report Back on SWOT analysis	Groups
10:30 – 11:00	Coffee Break	
10:30 – 12:00	Report Back on SWOT analysis	Groups
12:00 – 1:00	Lunch	

1:00 – 2:00	**Mapping and Spatial Analysis** National Spatial Framework Mapping by Theme	Snyther
2:00 – 5:00	Assessment of Need (AON)	Liz

DAY 3 (Wednesday November 27th):

9:00 – 10:30	**Strategy/Actions** Review Current SWARS Progress Add actions	All
10:30 – 11:00	Coffee Break	
11:00 – 12:00	Review Current SWARS Progress Add actions	All
12:00 – 1:00	Lunch	
1:00 – 4:00	Review Current SWARS Progress Add actions	All

Yap State FAP Workshop Attendence November 25th -27th, 2019

	Name	Title	Organization	Email	25-Nov	26-Nov	27-Nov
1	Francis Ruegorong	Tech	DAF	ydafwildife@gmail.com	x	x	x
2	Marlyter Silbanuz	PM	FSM R&D	mslbanuz@fsmrd.fm	x	x	
3	Valentino Orhaitil	Technician	DAF	yapucf@gmail.com	x	x	x
4	Christina Fillmed	Executive Director	Yap EPA	epayap@mail.fm	x	x	x
5	Martina Fichog	Nursery	DAF		x	x	x
6	Raphaela Tinngin	Coordinator of Volunteers	DAF	raphaelatinngin@gmail.com	x	x	x
7	Tamdad Sulog	Chief	DAF	agricultureyap@mail.fm	x	x	
8	Cyril Yinnifel	member	COP	cyinnifel@gmail.com	x	x	
9	Snyther Biza	GIS officer	FSM DECEM	sbiza78@gmail.com	x	x	x
10	Michelle Chugen	Grant Manager	YSHPO	mchugen@yapstategov.org	x	x	x
11	Antonia R. Defan	Grant Accountant	DAF	aruerus@yahoo.com	x	x	x
12	Ernie Y Guswel	Invasive Tehnician	DAF		x	x	x
13	Berna Gorong	Conservation Planner	TNC	berna.gorong@tnc.org	x	x	
14	Roseo Marquez	MC/Grants Officer	MCT	sgo@ourmicroneisa.org	x	x	
15	Liz Terk	Director of Conservation Science and Planning	TNC	eterk@tnc.org	x	x	
16	Rachael Nash	Independent contractor		nash.rachael@gmail.com	x	x	x
17	Tamara Greenstone-Alefaio	Conservation Program Manager	MCT	conservation@ourmicronesia.org	x	x	x
18	Andrew Yinnifel	Invasive Species Spray Tech	DAF		x	x	
19	Joseph Tutuw	Invasive Species Tech	DAF		x		
20	Pius Liyagel	Forestry	DAF		x	x	x
21	Ezekial Kefathlee	Coordinator-Watershed	TRCT	ekenfathlee@gmail.com		x	x
22	Debra Laan	State Coordinator	R2R	debra.laan@gmail.com		x	x
23	Barth Yarofaishie	Nursery tech	DAF	barthyarofaishi@gmail.com		x	
24	Sabino Sauchomal	Executive Director	Yap CAP	yapcap@mail.fm			x

Workshop for the update of the Federated States of Micronesia State-Wide Assessment and Resource Strategy/Forest Action Plan (SWARS/FAP)

Chuuk
Monday October 28th and Tuesday October 29th
L5 Conference Room

DAY 1:

10:00 – 10:15	**Introduction**	
	Introductions/Meeting Purpose	Marlyter
10: 15 – 12:00	**Setting the Scene**	
	What is the SWARS/FAP	Marlyter
	USFS Programs and Funds	Marlyter
	Other Funding Opportunities	Tam
	International/National Plans	Tam
	Regional: Micronesia Challenge	Roseo
	• Chuuk Forest Inventory and Analysis	
	• Categorizing Chuuk State Priorities Activity	
12:00 – 1:00	Lunch	
1:00 - 1:20	Membership of State Forest Stewardship Coordinating Committee	Marlyter
1:20 - 3:30	**Assessment of Forests**	
	National Themes and Objectives	Tam
	SWOT Analysis Intro	Roseo
	SWOT Analysis by Theme	Groups
3:30 – 5:00	Report back on Thematic SWOT Analysis	All

DAY 2:

9:00 – 10:30	**Mapping and Spatial Analysis**	
	National Spatial Framework	Snyder
	Mapping by Theme	
10:30 – 11:00	Coffee Break	
11:00 – 12:00	Review of SWOT Themes/Assessment	Tam

12:00 – 1:00	Lunch	
1:00 – 4:00	**Strategy/Actions** Review Current SWARS Progress Additional Actions Funding	All
4:00 – 5:00	Next Steps	All

Chuuk State FAP Workshop Attendence October 28th – 31st, 2019

	Name	Title	Organization	Email	28-Oct	29-Oct	31-Oct
1	Kantito Kanas	Chief	Chuuk AG	kanaskantito@yahoo.com>	x	x	x
2	Joakim Wassan	Technician	Chuuk AG	Joakim Wassan	x	x	
3	Brad Mori	Deputy Director	Chuuk EPA	brad_mori@hotmail.com>	x	x	x
4	Marcellus Akapito	Executive Director	CCS	markapito@gmail.com	x	x	x
5	Clarice Graham	Finance Officer	CCS	clarice.etop@gmail.com	x	x	
6	Curtis Graham	Director	DMR	abcpenia@gmail.com>	x	x	x
7	Maryrose Nakayama	Project Manager	CWC	nakayama.cwc@gmail.com	x	x	
8	Wisney Nakayam	Member of Chuuk State Legislator	Government	wisneynakayama@gmail.com>	x		
9	Snyther Biza	GIS officer	FSM DECEM	sbiza78@gmail.com	x	x	
10	Marlyter Silbanuz	PM	FSM R&D	mslbanuz@fsmrd.fm	x	x	
11	Roseo Marquez	MC/Grants Officer	MCT	sgo@ourmicroneisa.org	x	x	x
12	Tamara Greenstone-Alefaio	Conservation Program Manager	MCT	conservation@ourmicronesia.org	x	x	
13	Beverly Fred	Chuuk State PAN Coordinator	DMR	fanesu03@gmail.com	x		x
14	Roseo Marquez	MC/Grants Officer	MCT	sgo@ourmicroneisa.org	x	x	
15	Justin Fritz	Chuuk C4Life Coordinator	MCT	fritzjustin5@gmail.com	x	x	x
16	Kris Kanemeto	Chuuk State Ridge to Reef Coordinator	DMR	krizk66@gmail.com		x	
17	Tamara Greenstone-Alefaio	Conservation Program Manager	MCT	conservation@ourmicronesia.org	x	x	x
18	Boyd Mackenzie	Chuuk State Weather Service	NOAA	boyd.mackenzie@noaa.gov	x	x	

Workshop for the update of the Federated States of Micronesia State-Wide Assessment and Resource Strategy/Forest Action Plan (SWARS/FAP)

Kosrae
December 10, 11 and 12th
Location: TBD

DAY 1 (Tuesday December 10th)

9:00 – 9:15	**Introduction**	
	Introductions/Meeting Purpose	Marlyter
9:15 – 12:00	**Setting the Scene**	
	What is the SWARS/FAP	Marlyter
	USFS Programs and Funds	Marlyter
	Other Funding Opportunities	Tam
	International/National Plans	Tam
	Regional: Micronesia Challenge	Roseo
	• Kosrae Forest Inventory and Analysis	
	• Categorizing Kosrae State Priorities Activity	
	Membership of State Forest Stewardship Coordinating Committee	Marlyter
12:00 – 1:00	Lunch	
1:00 - 3:00	**Assessment of Forests**	
	SWARS/FAP - National Themes and Objectives	Tam
	SWOT Analysis Intro	Roseo
	SWOT Analysis by Theme	Groups

DAY 2 (Wednesday December 11th)

9:00 – 10:30	**Assessment of Forests (cont'd)**	
	SWOT Analysis by Theme	Groups
10:30 – 11:00	Coffee Break	
10:30 – 12:00	Report Back on SWOT analysis	Groups
12:00 – 1:00	Lunch	

1:00 – 2:00	**Mapping and Spatial Analysis** National Spatial Framework Mapping by Theme	Snyther
2:00 – 3:00	**Strategy/Actions** Review Current SWARS Progress Add actions	All

DAY 3 (Thursday December 12th):

9:00 – 10:30	**Strategy/Actions** Review Current SWARS Progress Add actions	All
10:30 – 11:00	Coffee Break	
11:00 – 12:00	Review Current SWARS Progress Add actions	All
12:00 – 1:00	Lunch	
1:00 – 3:00	Review Current SWARS Progress Add actions	All

Kosrae State FAP Workshop Attendence December 10th – 13th, 2019

	Name	Title	Organization	Email	10-Dec	11-Dec	12-Dec	13-Dec
1	Blair Charley	KIRMA	Director	charleyblair@gmail.com	x	x	x	x
2	Marlyter Silbanuz	PM	FSM R&D	mslbanuz@fsmrd.fm	x	x	x	x
3	Roseo Marquez	MC/Grants Officer	MCT	sgo@ourmicroneisa.org	x	x	x	x
4	Tamara Greenstone-Alefaio	Conservation Program Manager	MCT	conservation@ourmicronesia.org	x	x	x	x
5	Snyther Biza	GIS officer	FSM DECEM	sbiza78@gmail.com	x	x	x	x
6	Faith Siba	FSM IWR R2R Project Manager	DECEM/KCSO	faithsiba@gmail.com	x	x	x	x
7	Maxson Nithian	State Forester	Kosrae	kosraeforestry@gmail.com	x			
8	Hiroki Tanaka	Environmental Educator	KIRMA	hiroki.tanaka031220@gmail.com	x	x	x	x
9	Iliziva Lonno	Assistant Forester	KIRMA	ilizivamyfred@gmail.com	x	x	x	
10	Onniel Nena	Environmental Educator	KCSO	onnena12@gmail.com	x	x	x	
11	Likiak Melander	Administrator	DT&I	likiakmelander@gmail.com	x			
12	Erica Waguk	Education Assistant	KIRMA	erwagugga@gmail.com	x	x	x	x
13	Sam Isaac	Fisheries	DREA	sam.isac00@gmail.com	x	x		
14	Larry Alik	UBR			x	x		
15	Marston Luckymis	R2R Project Coordinator	KIRMA	mluckymis@gmail.com	x		x	x
16	Leonard Sigrah	IS Cooridinator	KIRMA	lsigrah2016@gmail.com	x	x	x	x
17	Gibson Jone		KUB	gibjo5013@gmail.com	x	x	x	
18	Julie Kun		KUB	julie.nuk@hotmail.com	x	x		
19	Austin Albert	Archaelogical Survey Aid	KHPO/KIRMA	siklava@gmail.com	x	x	x	
20	Kenye Livae	President	WIFK	klivae@hotmail.com	x	x	x	x
21	Swenson Thomson	Archaelogical Survey Aid	KHPO/KIRMA	swanthom@gmail.com	x			
22	Ezikiel Nena	Agriculture Extension	DREA	eislander622@yahoo.com	x		x	
23	Jason Livae	Member	UMG					

Workshop for the update of the Federated States of Micronesia State-Wide Assessment and Resource Strategy/Forest Action Plan (SWARS/FAP)

Pohnpei
Location: Island Palm Hotel
January 8th, 9th, 10th

DAY 1 (Wednesday, January 8th)

9:00 – 9:15	**Introduction** Introductions/Meeting Purpose	Marlyter
9:15 – 10:30	**Setting the Scene** USFS Programs and Funds Other Funding Opportunities International/National Plans Micronesia Challenge Pohnpei FIA	Marlyter Tam Roseo
10:30 – 11:00	**Coffee Break**	
11:00 – 11:45	**What is the SWARS/FAP?** SWARS/FAP-National Themes Overview of the Pohnpei State FAP	Rachael
11:45 – 12:00	**State Forest Stewardship Coordinating Committee** Membership	Marlyter
11:00 – 12:00	**Lunch**	
1:00 – 2:00	**Mapping and Spatial Analysis** National Spatial Framework Mapping by Theme	Snyther
2:00 – 2:15	**Coffee Break**	
2:15 – 5:00	**Assessment of Forests** SWOT Analysis Intro SWOT Analysis by Theme	 Roseo Groups

DAY 2 (Thursday, January 9th):

9:00 – 10:30	**Assessment of Forests (cont'd)** Report Back on SWOT analysis	Groups
10:30 – 11:00	**Coffee Break**	
11:00 – 12:00	**Assessment of Forests (cont'd)** Report Back on SWOT analysis	Groups
12:00 – 1:00	**Lunch**	
1:00 – 4:00	**Assessment of Forests (cont'd)** Report Back on SWOT analysis	Groups
4:00 – 5:00	Assessment of Need (AON)	Liz

DAY 3 (Friday, January 10th):

9:00 – 10:30	**Strategy/Actions** Review Current SWARS Progress Add actions	All
10:30 – 11:00	Coffee Break	
11:00 – 12:00	Review Current SWARS Cont'd	All
12:00 – 1:00	Lunch	
1:00 – 4:00	Review Current SWARS Cont'd	All
4:00 – 5:00	Recap and prioritize Natl themes	All

Pohnpei Forest Action Plan Workshop January 8th to 10th, 2020

	Name	Title	Organization	Email	Date 8-Jan	9-Jan	10-Jan
1	Regina Moya	Assistant Coordinator	U&CF	xiexanmoya@gmail.com	x		
2	Santiago Joab	Project Manager	MCT	livelihoods@ourmicronesia.org	x	x	x
3	Jackson Phillip	CRE-COM FSM-Coordinator	Cooperative Research Extension	jphillip1127@gmail.com	x		x
4	Kanio Torres	Agriculture Agent	CRE-COM-FSM	kaniotorres95@gmail.com	x	x	x
5	Bryan Wichep	Agriculture Agent	CRE-COM-FSM	bw.pnicre@gmail.com	x	x	x
6	Francisca Obispo	Terrestrial Program Manager	CSP	fransohl@gmail.com	x	x	x
7	Mark Kostka	Chief of Agriculture	R&D Pohnpei	mkostka1771@gmail.com	x	x	x
8	Smithy Clark	Mayor of Pingelap	Pingelap Government	smithybclark@gmail.com	x	x	x
9	Engly Ioanis	Administrative Assistant	COM Land Grant program	microneisa.fsm@yahoo.com	x	x	
10	Konrad Englberger	consultant	self	ppmicroneisa@mail.fm	x	x	x
11	Tobias Tamerlan	Extension Agent CRE	CRE-COM-FSM	tobias@comfsm.fm	x	x	x
12	Eugene Eperiam	State Forester	NRM	eeperiam@yahoo.com	x	x	x
13	Pelson Moses	Specialist	OFA	ofa.state.gov@gmail.com	x		
14	Clay Hedson	fisheries specialist	OFA	ofa.state.gov@gmail.com	x		
15	Winfred Mudong	SEM Coordinator	MCT	winfredmudong@gmail.com	x		
16	Jorg Anson	Coordinator	EPA-R2R	jorgyanson@gmil.com	x		
17	Liz Terk	Director, Conservation Science and Planning	TNC	eterk@tnc.org	x		
18	Brad Soram	Environment Specialist	EPA	bradsoram@gmail.com	x	x	x
19	Stephen Boland	Senior Policy and Finance Advisor	USAID Climate Ready	sboland@pacificclimateready.org	x		
20	Patterson Shed	Regional Coordinator	USAID Climate Ready	pshed@pacificclimateready.org	x		
21	Snyther Biza	GIS	FSM Decem	sbiza75@gmail.com	x	x	
22	Saimon Lihpai	PNI NRM Chief	FSM Decem	saimonlihpai@rocketmail.com	x		x
23	Marlyter Silbanuz		FSM R&D	marlyterpohnpei@gmail.com	x		x
24	Tamara Greenstone-Alefaio	MCT Conservation Program Manager	MCT	conservation@ourmicronesia.org	x	x	x
25	Roseo Marquez	MCT MC	MCT	sgo@ourmicronesia.org	x	x	x
26	Willian Kostka	Exectutive Director	MCT	director@ourmicronesia.org	x		x
27	Douglas Kusto	R&D PAN	PAN	pnistatepan@gmail.com	x	x	x
28	Rosaleen Alanzo	Secretary MMG	MMG	alanberts84@gmail.com	x		x

29	Welbert Perez	MMG Police	MMG		x	x	x
30	Lucille Apis-Overhoff	Volunteer		lu.overhoff@gmail.co	x	x	x
31	Rachael Nash	independent contractor	self	nash.rachael@gmail.com	x	x	x
32	Marciano Imar	FSM SAPS?	FSM R&D	ramsimar18@gmail.com		x	x
33	Justin Lemuel		CSP	justinlemuel415@gmail.com		x	x
34	Senard Leopold	Mayor	Nukuoro			x	x
35	Rodasio Samuel	Conservation Director	USDA NRCS	rodasio.samuel@usda.gov		x	x
36	Angel Jonathan	educator	CSP	angejonathan@gmail.com		x	x
37	Eugene Joseph	Director	CSP	eujoseph925@gmail.com		x	x
38	Gyrone Samuel	Agriculture Agent II	CRE-COM-FSM	gs.pnicre@gmail.com		x	
39	Bejay Obispo	Terrestrial	CSP	bejayobispo81@gmail.com		x	
40	Kohsak Keller Jr	Extension Agent CRE	CRE-COM-FSM	kjr.pnicre@gmail.com		x	